From: Barbara Ritchie <BARBARA.RITCHIE@fmc.com>
Sent: Tuesday, June 10, 2014 12:39 PM
To: Rochlin, Kevin
Cc: Williams, Jonathan
Subject: RE: Groundwater Sampling Issue
Attachments: 2013-10-31 FMC Responses to EPA DEQ and SBT Comments on Hydro Study Work....pdf; 2014-01-10 FMC transmittal Extraction Zone Hydrogeologic Study Work Plan....pdf; 2014-01-10 FMC Extraction Zone Hydrogeologic Study Work Plan.pdf; EPA Approval Extraction Zone Study February 6 2014.pdf; Appendix G Interim CERCLA GW Monitoring Plan.pdf

Kevin –

First – I need to ask if you've seen any results from the SBT collecting split samples at FMC CERCLA groundwater wells in the 4Q13 monitoring event? I haven't.

Second - Helping with history and document retrieval. If Jonathan is a new reviewer, he might find this helpful too. While file size prevents me from emailing the Groundwater Current Conditions Report (GWCCR) – it is on EPA's website http://www.epa.gov/region10/pdf/sites/emichaud/fmc_gwccr_report.pdf. Read Section 3 - déjà vu all over again.

Additionally, attached are:

- The Interim CERCLA Groundwater monitoring plan (originally Appendix G to the SFS) – incorporated by reference into the RDRA UAO via Item 30.c.7.hh
- FMC's 10/31/13 response to comments on the draft Extraction Zone Hydrogeologic Work Plan (EZHGWP)
- FMC's revised 1/10/14 EZHGWP with transmittal and additional response to comments
- Your 2/6/14 approval of the EZHGWP

I call your attention to the comment received from the SBT on the 2013 draft, and FMC's response from the 10/31/13 letter – extracted below.

Table 3-2 - The Tribes request total metals and radionuclides be analyzed for. The Tribes request this information prior to discharge of any water within the FMC OU. Pumping at a low flow may be more representative of actual groundwater conditions, at least for the initial first 10 minutes prior to sampling.

FMC Response: The laboratory analytical methods specified for the metals listed on Table 3-2 of the Work Plan are for total metals. No field or laboratory filtration of the groundwater samples for dissolved constituent analyses is proposed. As summarized in Section 8.1 of the EPA-approved GWCCR:

> Supplemental sampling events for expanded metals, organic compound and radionuclide analytical parameters have provided further evidence supporting the findings of the EMF RI that the following constituents are not FMC-related contaminants in groundwater:
> ☐ Metals: aluminum, antimony, beryllium, cadmium, copper, lead, molybdenum, mercury, silver, thallium and zinc;
> ☐ Organic Compounds; and
> ☐ Radionuclides.

The existing groundwater sampling and analytical data demonstrates there is no justification to add any additional metals or radionuclides to the groundwater analyses for the samples collected during the extraction zone hydrogeologic study. No revision to the Work Plan is warranted.

Call me after you've reviewed and/or have any questions.

From: Rochlin, Kevin [mailto:rochlin.kevin@epa.gov]
Sent: Tuesday, June 10, 2014 1:07 PM
To: Barbara Ritchie
Cc: Williams, Jonathan
Subject: Groundwater Sampling Issue

Barbara,

Again, I am sending piecemeal issues to attempt to avoid an issue.

It is unclear whether or not the groundwater has been sampled only for 8 RCRA metals or the extended suite of metals and radionuclides as had been previously discussed. This is a major issue for the Tribes who wanted to do full suite groundwater sampling themselves. EPA assured the Tribes that it would be done. If the full suite has not been done, it will have to be done prior to completion of the groundwater design, and any results of significance addressed in the design.

Kevin

From:

Kevin Rochlin | **Superfund Remedial Project Manager**
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From: Rochlin, Kevin
Sent: Monday, June 09, 2014 3:11 PM
To: Zavala, Bernie
Cc: Williams, Jonathan
Subject: FW: EPA responses to FMC's responses on the Hydro study comments and my discussion & resolution with Rob

Bernie,

I am trying to follow up on a request from the Tribe at the beginning of the year. They wanted to sample radionuclide and other COCs during the aquifer test. The discussion seems to indicate that FMC was doing their expanded list, but in the end I think they only did 8 metals.

Can you look at the discussion below and see what you remember. I am probably going to require FMC get the information the Tribe wants, but need to be reminded of where this discussion went.

Kevin

From:

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From: Zavala, Bernie
Sent: Friday, December 20, 2013 1:13 PM
To: Rochlin, Kevin; Douglas.Tanner; Scott Miller; Greutert, Ed [USA]
Subject: EPA responses to FMC's responses on the Hydro study comments and my discussion & resolution with Rob

To all:
During our FMC team conference call (12/12/2013) Kevin asked for me to put together a short couple of paragraphs regarding two items: (1) The list of analytes which will be sampled in the groundwater prior to the aquifer testing and (2) how that data will be used to support the disposal of the purge water during the aquifer testing. The work plan for the hydrogeologic study doesn't include the groundwater sampling for all of the COC's (Table 8: COC's in Groundwater and cleanup levels for the FMC OU) for the three newly installed extraction wells (EW-01, 02 and 03).

The list of analytes that should be sampled for prior to the aquifer test can be found on *Table 8: Contaminants of Concern in*

Groundwater and Cleanup for the FMC OU from the EPA Final Interim ROD Amendment August 2012. Also, EPA had FMC conduct a groundwater sampling of COCs in the spring of 2008 call a special sampling event. The data from this sampling event April 2008 will provide us a snap shot of the water quality that is moving through the FMC facility. EPA will also request FMC to sample the new installed extraction well (3) and have the results available prior to the disposal of the groundwater from the aquifer test at the facility. Kevin mentioned that Rob Hartman, MWH for FMC and I would discuss closure on the comments that FMC needed additional clarification regarding the FMC Hydrogeologic Study work plan.

On Tuesday December 17th Rob Hartman, MWH for FMC sent me an email and wanted to discuss some of the comments to gain better clarification on what is needed. The email list two comments:

Specific comments
Comment #1
The FMC response is correct that the text did give a general description on the number of samples being collected but the QA samples were not included. A table similar to the table below (Field Sampling Summary) shall be included in section 3 after 3.5.2. This would address the comment. The table below would be an example of what EPA's is expecting.
Resolution: Add the required table.
Clarification / discussion: The example table includes field qc samples; however, due to the relatively limited number of samples, no field qc samples are proposed in the work plan.
Comment #12 (two parts)
Part 2:
EPA is still not clear on the logistics on how the purge water will be managed during the 72-aquifer test. EPA agrees based on the water quality from the monitoring wells the purge water is non-hazardous. EPA is expecting a short description of the handling of the water and where it will be stored until it can be used for dust control. Sampling may be required depending on how FMC intends to store water prior to spreading.
Resolution: Amend the document to more fully describe water disposal. Sampling per EPA requirements if EPA determines that it is necessary.
Clarification / discussion: Would like to understand what sampling might be "necessary" in addition to the sampling/analyses included in the work plan up front so if determined to be necessary it can be included in the plan (and QAPP).
I am available this afternoon other than 3 to 4 MST (2 to 3 PST) and any time tomorrow to discuss. Thanks, Rob

Rob and I had the call on Wednesday (12/18) and we had a good discussion and came to an agreement regarding these two comments and he (FMC) will revised the work plan and we should get this revised work plan either prior to or on January 10, 2014. The following is the resolution on these comments:

Comment #1:
FMC will include one QA sample to meet the requirements for collection of QA samples, 1 per 10 field samples (duplicate sample for extraction well EW-1). FMC will also collect a MS/MSD from the extraction well EW-02. The COCs will be from Table 8 of the EPA interim ROD amendment August 2012 or the same parameters they collected during the special sampling event that occurred in 2Q 2008. Rob also mentioned that same list of parameters were also collected in the groundwater sampling event in 2012. Rob said that FMC was planning on collecting water samples after well development from the three extraction wells and send them to lab for analysis using the COCs list from 2008 &2012.
I believe this information on the water quality will inform us on how to disposal of the groundwater during the 72-hour aquifer test and the QA requirement will also be met with the new updated work plan for comment #1.

Comment #12:
Rob said that the revised work plan will fully describe the disposal of the groundwater during the 72-hour aquifer test and as mentioned above in comment #1 there will be enough water quality information from 2008, 2012 and the current sampling that will take place for EW-1, 2 &3 after well development to make a decision on the disposal of the groundwater.
I concur with this approach.

Please let me know if you have any questions.

Bernie Zavala

****
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****

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INTERIM CERCLA GROUNDWATER MONITORING PLAN

FMC PLANT OPERABLE UNIT

Prepared for:

FMC Idaho, LLC
P.O. Box 4111
Pocatello, ID 83202

MARCH 2010

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INTERIM CERCLA GROUNDWATER MONITORING PLAN

1.0 INTRODUCTION

1.1 BACKGROUND

The FMC plant is included within the Eastern Michaud Flats (EMF) Superfund site, which was placed on the National Priorities List (NPL) on August 30, 1990. FMC has been conducting CERCLA groundwater monitoring in conjunction with its ongoing RCRA groundwater monitoring program and Calciner Pond Remedial Action groundwater monitoring program. The RCRA groundwater monitoring program began in 1991 at essentially the same time as the EMF site CERCLA Preliminary Site Characterization Study (PSCS) and Remedial Investigation (RI) groundwater investigations and monitoring. The Calciner Pond Remedial Action groundwater monitoring commenced during the second quarter of 2003 under the IDEQ-FMC voluntary consent order (VCO) for remedial action at the calciner ponds. FMC has been conducting its CERCLA groundwater monitoring program voluntarily since the EMF Site ROD was issued in 1998. Due to the fact that a Remedial Design / Remedial Action (RD/RA) Consent Decree to implement the FMC Plant OU groundwater remedy, including the long-term groundwater monitoring specified in the 1998 ROD, was never entered, an EPA-approved CECLA groundwater monitoring plan has not been required nor prepared.

Following permanent shut-down of the FMC plant in December 2001, EPA and FMC entered into an AOC for a Supplemental Remedial Investigation and Feasibility Study SRI/SFS) at the FMC Plant Operable Unit (OU). Although the AOC and Statement of Work (SOW) for the FMC SRI/SFS did not require a supplemental groundwater investigation(s) at the FMC Plant OU, FMC recognizes the need to address groundwater (both EMF impacts identified during the EMF RI and the potential for future impacts) during the SFS for the FMC Plant OU. FMC prepared a Groundwater Current Conditions Report (GWCCR) for the FMC Plant OU (FMC, June 2009) as a compendium of the extensive EMF RI and post-RI groundwater investigations, results and evaluations to support the SFS for the FMC Plant OU. One of EPA's comments on the draft GWCCR was "FMC's voluntary CERCLA ground water monitoring program must make a transition as soon as possible into an interim ground water monitoring program that must be approved by EPA with the development of site specific DQO's. This interim program will continue until an amended ROD has been signed for FMC. Then a long-term ground water monitoring program will be developed once a remedy is selected." (EPA, February 2009).

During a series of EPA-FMC meetings during February, March and May 2009, FMC and EPA began moving forward toward development of both an interim and long-term CERCLA groundwater monitoring program for the FMC Plant OU. FMC recently finalized the Groundwater Current Conditions Report (GWCCR) for the FMC Plant OU (FMC, June 2009) and EPA approved the GWCCR by letter dated July 20, 2009. Consistent with EPA's direction, this interim CERCLA Groundwater Monitoring Plan is being submitted as an appendix to the SFS Report for the FMC Plant OU.

1.2 GROUNDWATER MONITORING OBJECTIVES

The objective of the interim CERCLA groundwater monitoring program is to collect sufficient data of known quality to, in conjunction with the RCRA and Calciner Pond remedial action groundwater monitoring programs, evaluate potential changes and/or trends in site-related groundwater constituents and evaluate groundwater conditions on an OU-wide basis.

Although the 1998 ROD selected source controls for the old phossy ponds area, calciner sediment storage area and the railroad swale, no Remedial Design and Remedial Action Consent Decree (RD/RA CD) was entered to implement those remedies. Therefore, those CERCLA remedial actions have not been implemented as of 2010. The SFS for the FMC Plant OU is evaluating various soil and groundwater remedial alternatives that include source control actions and long-term monitoring. At such time that EPA selects the soil and groundwater remedies for the FMC Plant OU in a ROD amendment and makes those remedies implementable through a RD/RA Consent Decree, a long-term groundwater monitoring plan will be prepared that will include evaluation of the effectiveness of the CERCLA source control actions and groundwater remedy.

1.3 PLAN ORGANIZATION

Section 2 presents a summary of the current RCRA, Calciner Pond Remedial Action and voluntary CERCLA groundwater monitoring programs and the current groundwater quality at the FMC Plant OU. Section 3 presents a summary of the monitoring plan components. Section 4 describes the data evaluation methods and procedures. Reporting procedures are described in Section 5. The Field Sampling Plan is presented in Attachment A and the Quality Assurance Project Plan is presented in Attachment B. The Data Verification and Data Validation Protocol is presented in Attachment C.

2.0 SUMMARY OF FMC GROUNDWATER MONITORING PROGRAMS

The EMF remedial investigation/feasibility study (RI/FS) that included substantial hydrogeologic and groundwater quality and transport investigations was initiated in 1992, and was completed at the EMF site in 1996 (Bechtel, 1996). The EMF Site ROD was issued in 1998 and FMC has been conducting its voluntary CERCLA groundwater monitoring program since that time.

Following permanent shut-down of the FMC plant in December 2001, EPA and FMC entered into an AOC for a Supplemental Remedial Investigation and Feasibility Study SRI/SFS) at the FMC Plant OU. Although the AOC and Statement of Work (SOW) for the FMC SRI/SFS did not require a supplemental groundwater investigation(s) at the FMC Plant OU, FMC recognizes the need to address groundwater (both EMF impacts identified during the EMF RI and the potential for future impacts) during the SFS for the FMC Plant OU.

In 2008, FMC assembled the substantial post-RI groundwater information developed under multiple regulatory programs and agencies into a single compendium for the purpose of the Administrative Record for the FMC Plant OU. The Groundwater Current Conditions Report for the FMC Plant Operable Unit ("GWCCR," MWH, 2009) provides a summary of the extensive groundwater investigations undertaken during the Eastern Michaud Flats (EMF) Remedial Investigation (RI) [Bechtel, 1996] and presents a comprehensive update of the groundwater studies and monitoring performed at the FMC Plant OU subsequent to the EMF RI up through FMC's May 2008 groundwater monitoring event. The groundwater monitoring program summaries presented below are described in greater detail in the GWCCR.

2.1 SUMMARY OF RCRA AND CALCINER POND GROUNDWATER MONITORING PROGRAMS

2.1.1 RCRA Groundwater Monitoring

In 1991, FMC began RCRA groundwater monitoring of the Waste Management Units (WMUs) that FMC listed on its March 1991 Part B permit application for the FMC Pocatello facility. At that time, there were six WMUs subject to the RCRA quarterly groundwater monitoring requirements. FMC's RCRA groundwater monitoring analytical parameter list was consistent with the CERCLA inorganic and radiological parameter list (34 inorganic and 4 radiological parameters).

In parallel with FMC's and Simplot's request to reduce the CERCLA groundwater monitoring program, FMC in 1995 also requested a reduction in its RCRA groundwater monitoring program. In a letter dated June 13, 1995, EPA agreed with FMC's request to reduce the RCRA groundwater monitoring. Specifically, the RCRA analytical parameter list was reduced from 34 inorganic and 4 radiological parameters to 10 inorganic parameters, including cadmium that was retained at EPA's request. The RCRA groundwater monitoring well network was also modified in 1995, 1997 and 1998 as described in Section 3.2.1.1 of the GWCCR.

During EPA's review of the Pond 8S and Slag Pit Sump Closure Plans and associated Groundwater Monitoring Plans, EPA requested and FMC agreed to add two additional inorganic parameters to the groundwater monitoring for those WMUs: total phosphorus (quarterly) and elemental phosphorus (semi-annually).

As a result of the EPA-approved reduction in parameters, well network modifications, and addition of total phosphorus and elemental phosphorus to the Pond 8S and Slag Pit Sump groundwater monitoring plans, FMC's current RCRA groundwater monitoring program consists of the following:

- Quarterly groundwater monitoring;
- Field parameters: water level (groundwater elevation), pH, specific conductance (SC), temperature and turbidity;
- Laboratory parameters: arsenic, cadmium, selenium, potassium, chloride, fluoride, ammonia, nitrate, orthophosphate, and sulfate. In addition, at the Pond 8S and Slag Pit Sump, total phosphorus is analyzed quarterly and elemental phosphorus (P4) is analyzed semi-annually; and,
- The RCRA groundwater monitoring well network consists of 33 wells and Batiste Spring (surface water station) as listed on Table 2-1 and shown on Figure 2-1.

The RCRA groundwater monitoring is currently being conducted during the post-closure period per the RCRA Groundwater Monitoring Plans for each of the monitored RCRA WMUs (FMC, 1999). The RCRA groundwater monitoring plans are incorporated in and a part of the EPA-approved post-closure plans for these WMUs. For example, the Post-Closure Plan for Pond 18 Cell A includes the RCRA Sampling and Analysis Plans for Post-Closure Monitoring at RCRA Pond 18 Cell A. The RCRA Sampling and Analysis Plan (SAP) for post-closure groundwater monitoring consist of the Quality Assurance Project Plan (QAPjP) (Attachment 10-1 of the Pond 18 Cell A Post-Closure SAP) and the Field Sampling Plan (FSP) for RCRA Groundwater Monitoring (Attachment 10-2a of the Pond 18 Cell A Post-Closure SAP). Other than the monitoring well network associated with each WMU, the post-closure groundwater monitoring SAPs (QAPjP and FSP) are substantively the same for each of the WMUs suject to RCRA groundwater monitoring requirements. FMC reports the results of the RCRA groundwater monitoring for each of the WMUs subject to the groundwater monitoring requirements to EPA annually (calendar year basis) in the RCRA Annual Groundwater Monitoring Assessment Reports.

2.1.2 Calciner Pond Remedial Action Groundwater Monitoring

Pursuant to the Consent Order between the Idaho Department of Environmental Quality (IDEQ) and FMC for remediation of the calciner ponds, FMC submitted a Calciner Pond Remedial Action Groundwater Monitoring Plan to IDEQ. The Calciner Pond Remedial Action Groundwater Monitoring Plan (FMC, November 2008) was approved by IDEQ by letter dated

December 3, 2008. As described in the Monitoring Plan, monitoring wells upgradient and downgradient of the calciner ponds are sampled on a routine basis to evaluate the effectiveness of the remedial action in preventing the release of constituents from the calciner ponds to groundwater. The groundwater monitoring program commenced during the second quarter of 2003 with scheduled sampling of then existing wells 142, 161, 164, 136 and 143. New wells 189 and 190 were installed, developed and sampling began during the third quarter of 2003. The Calciner Pond Groundwater Monitoring Plan network of wells is listed on Table 2-1 and shown on Figure 2-1.

The Calciner Pond Remedial Action Groundwater Monitoring Plan is consistent with the reduced, focused EMF RI CERCLA groundwater monitoring program, as follows:

- Semi-annual groundwater monitoring;
- Field parameters: water level (groundwater elevation), pH, specific conductance (SC), temperature and turbidity;
- Laboratory parameters: arsenic, selenium, potassium, chloride, fluoride, ammonia, nitrate, total phosphorus (orthophosphate until 2008), and sulfate; and,
- Upgradient wells 142, 161, and 164; and downgradient wells 136, 143, 189 and 190 as listed on Table 2-1 and shown on Figure 2-1.

Calciner ponds groundwater monitoring was performed during implementation of the Calciner Pond Remedial Action (2003 through 2005) and is currently continuing during the post-remedial monitoring and maintenance period per the IDEQ Consent Order. FMC reports the results of the calciner ponds groundwater monitoring annually (calendar year reporting period) to IDEQ in a Calciner Pond Remedial Action Groundwater Monitoring Annual Report.

2.2 SUMMARY OF FMC'S VOLUNTARY CERCLA MONITORING PROGRAM

As described in Section 3.1.1 of the GWCCR, the reduced, focused EMF RI CERCLA groundwater monitoring program was implemented in 1994. FMC continued the reduced, focused EMF RI groundwater monitoring until EPA issued the ROD for the EMF Site in 1998. Upon issuance of the ROD, the requirement for EMF RI groundwater monitoring expired pursuant to the terms of the 1991 AOC for the EMF RI/FS.

After the 1998 ROD, FMC voluntarily continued monitoring of the CERCLA groundwater well network primarily to preserve spatial and temporal continuity of the groundwater database in anticipation of a Remedial Design and Remedial Action (RD/RA) Consent Decree for the FMC Plant OU. At that time, the FMC CERCLA groundwater monitoring program remained consistent with the reduced EMF RI CERCLA groundwater monitoring as follows:

- Semi-annual groundwater monitoring;

- Field parameters: water level (groundwater elevation), pH, specific conductance (SC), temperature and turbidity;

- Laboratory parameters: arsenic, selenium, potassium, chloride, fluoride, ammonia, nitrate, orthophosphate and/or total phosphorus, and sulfate; and,

- Twenty-three site-wide wells: 101, 110, 111, 134, 136, 139, 140, 142, 143, 146, 151, 159, 161, 164, 502, 515, 523, 524, 525, Old Pilot, TW-9S, TW-11S and TW-12S as listed on Table 2-1 and shown on Figure 2-1.

A RD/RA Consent Decree to implement the FMC Plant OU groundwater remedy was never entered. FMC has continued the semi-annual groundwater monitoring frequency and the same field and analytical parameters as specified in the 1998 ROD, and periodically made adjustments to better focus the network of wells that were routinely monitored. This interim CERCLA groundwater monitoring plan was developed to formalize the CERCLA groundwater monitoring program until such time that EPA issues a ROD amendment for the FMC Plant OU and a RD/RA Consent Decree is entered to implement the soil and groundwater remedies. FMC expects that a long-term groundwater monitoring plan will be a component of the EPA selected remedy and that plan will be developed as part of the RD/RA.

2.3 SUMMARY OF GROUNDWATER QUALITY CONDITONS THROUGH 2008

The GWCCR (MWH, 2009) provides a summary of the extensive groundwater investigations undertaken during the Eastern Michaud Flats (EMF) Remedial Investigation (RI) [Bechtel, 1996] and presents a comprehensive update of the groundwater studies and monitoring performed at the FMC Plant OU subsequent to the EMF RI up through FMC's May 2008 groundwater monitoring event. The monitoring wells associated with this monitoring program have been sampled at a quarterly to semi-annual frequency over a period of up to 17 years. A summary of the groundwater quality, primarily based on average results from 2006 to 2008, at the interim CERCLA program wells is presented in Table 2-2.

2.3.1 Groundwater Quality and Trends

The current (2009) spatial extent of the FMC-related groundwater impacts is comparable to that defined during the EMF RI (1993-1994). Concentrations of FMC-related groundwater impacts in the western ponds area, central plant area and downgradient portions of the joint fenceline / calciner ponds area have decreased (groundwater beneath the FMC Plant Site has improved) and are expected to continue to improve due to the lack of sustained hydraulic head on any identified or potential source areas at the site.

Increasing trends of sulfate, orthophosphate, potassium and arsenic in wells upgradient of the calciner ponds area (identified in the GWCCR as Remediation Unit [RU] 14) indicate that the Simplot gypstack is contributing increasing levels of these constituents to groundwater upgradient of RU 14 over time. There is consequently a potential for these constituents to

increase in concentration over time and potentially reverse the currently stable or decreasing concentration trends in the downgradient portions of the joint fenceline / calciner ponds area.

2.3.2 Source Area Evaluation

The following are the primary FMC-related source areas and source-distinguishable constituents contributing to groundwater impacts at the FMC Plant Site:

- Pond 8S within RU 22a (RCRA Ponds) - Potassium, chloride, sulfate, ammonia, nitrate, total phosphorus / orthophosphate, fluoride, arsenic, manganese, boron, selenium and total cyanide.

- Old "Phossy" Ponds (RU 22b) and portions of RU 13 with identified "phossy" pond solids in fill materials - Potassium, chloride, sulfate, ammonia, nitrate, total phosphorus / orthophosphate, fluoride, arsenic, manganese, boron, selenium and total cyanide.

- Furnace Building, Phos Dock and Secondary Condenser (RU 1) and Slag Pit (RU 2) – Elemental phosphorus.

- Former Kiln Scrubber Ponds and Calciners (RU 8) and Former Kiln Scrubber Overflow Pond (RU 9) - Ammonia, nitrate, fluoride, selenium, vanadium and total cyanide.

- Former Unlined Calciner Ponds, Calciner Sediment Storage Area 'A', Calciner Ponds (RU 14) - Potassium, chloride, fluoride, arsenic, manganese, boron and selenium.

- Calciner Solids Storage Area (RU 16) – Potassium, chloride, sulfate and selenium.

- Slag Pile (RU 19) – Potassium and sulfate.

Due to the migration of site-impacted groundwater from the western ponds area through the central plant area and multiple sources in the joint fenceline / calciner ponds area including the Simplot gypstack, the evaluation of groundwater constituents attributable to the source areas listed above focuses on the contaminants that can be distinguished from other sources—based on their higher concentrations compared to upgradient groundwater, or based on the fact that the constituents are unique in groundwater at that source area.

Because the IWW pond and ditch (RU 10) and the Railroad Swale (RU 22c) had a sustained hydraulic head, liquid from these areas likely migrated to groundwater to some extent. These areas thus may have been past sources of constituents to groundwater. However, there is currently no discernable contribution to site-impacted groundwater from these areas.

Based on the collective EMF RI and SRI investigations and post-RI groundwater monitoring, there is no evidence that the other RUs (or portions of those RUs not identified as source areas) are sources of groundwater impacts at the FMC Plant OU.

2.3.3 Groundwater Fate and Transport

The major groundwater flow characteristics of the EMF study area that includes the FMC and Simplot plant sites, as shown by the potentiometric contours and inferred flowpaths on Figure 2-2, can be summarized as follows:

- Northward flow from the western and central portions of the FMC Plant Site is limited to the area south of I-86 by converging flow of groundwater from the west and northwest.

- Groundwater from the western and central portions of the FMC Plant Site is swept eastward, south of I-86, and joins groundwater from the joint fenceline / calciner ponds area and from the Simplot plant.

- In the joint fenceline / calciner ponds area, groundwater from the western part of the Simplot gypsum stack flows in a northwesterly sweeping arc across the Simplot property boundary, flows beneath FMC property, where it commingles with flows from the eastern portions of FMC, and exits from the plant boundaries to the northeast near well 110.

- EMF facility-impacted groundwater migrates from the EMF facilities and discharges to the Portneuf River as bank seeps / springs and baseflow to the river at Swanson Road Spring (aka the Spring at Batiste Road), Batiste Spring, and the reach bounded by these two springs.

The most significant factor in the reduction of groundwater constituent concentrations is advective mixing. Mixing of small volumes of EMF-affected groundwater with large volumes of unaffected groundwater within the EMF aquifer system substantially reduces the concentration of all constituents, including conservative, non-attenuating solutes such as sulfate, along the groundwater flowpath.

2.3.4 Summary

The interim CERCLA groundwater monitoring program, in conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs, provides appropriate spatial and temporal coverage of the FMC Plant OU. As described in greater detail in Section 3, the interim CERCLA groundwater monitoring field and analytical parameters are appropriately focused on key parameters that define the extent of FMC-impacted groundwater and are consistent with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs. The groundwater monitoring results obtained under these monitoring programs will be used to evaluate any changes and/or trends in groundwater conditions as described in Section 4.

TABLE 2-1. FMC'S ROUTINE GROUNDWATER MONITORING PROGRAM WELL NETWORKS (2009)

Area	Well Numbers	Up / Downgradient	Program [1]
Pond 18 Cell A	174	U	RCRA
	154, 177, 178	D	RCRA
Pond 17	173	U	RCRA
	171, 172, 180	D	RCRA
Pond 16S	154	U	RCRA
	147,148, 149	D	RCRA
Pond 15S	165	U	RCRA
	113, 115, 166	D	RCRA
Phase IV ponds	167	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 9E	124, 113	U	RCRA
	126, 127, 128	D	RCRA
Pond 8E	167	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 8S	158, 183	U	RCRA
	155, 156, 157	D	RCRA
Slag Pit Sump	121	U	RCRA
	108, 122, 123	D	RCRA
Batiste Spring	Batiste Spring	D	RCRA
Calciner Ponds	164, 161, 142	U	IDEQ
	136, 143, 189, 190	D	IDEQ
On-Plant Site	134, 139, 159, 145	D	CERCLA
Downgradient from Plant Site	111, 146, 110, TW-9S	D	CERCLA
Downgradient from FMC and Simplot Plant Sites	517, TW-12S	D	CERCLA
Northern Perimeter of EMF Groundwater Impact [2]	523, 515, 502, TW-11S, 524, 525	Cross	CERCLA

Note: This table only includes the monitoring well networks for sampling and analysis. The list of wells designated for water level monitoring is presented in Section 3.1 of the ICGMP.
[1] Program: RCRA = RCRA groundwater monitoring plans, IDEQ = Calciner Pond groundwater monitoring plan, CERCLA = Interim CERCLA groundwater monitoring plan.
[2] Impact is in reference to detection of arsenic, nitrate or selenium above representative levels.

TABLE 2-2. SUMMARY OF GROUNDWATER QUALITY AT THE INTERIM CERCLA GROUNDWATER MONITORING PROGRAM WELLS

Parameters	**134**	**139**	**145**	**159**	**110**	**111**	**146**	**523**
Field Measurements								
pH (Field)	6.73	6.92	5.44	6.87	6.86	7.1	7.11	7.38
SC (UMHOS/CM)	2805	4643	5600	2180	1429	1513	1294	893
Turbidity (NTU)	1.2	0.45	4.5	.9	0.4	0.5	0.35	0.2
Water Temperature (°C)	16.9	12.8	15.3	16.8	17.1	14.8	16.9	13.4
General WQP (mg/L)								
Potassium	153	38.5	37.7	36.9	25.4	49.5	46.3	8.49
Sulfate	325	1051	2400	166	215	157	128	59.6
Chloride	287	886	154	210	89.8	170	132	108
Fluoride	0.2	0.583	0.5	NA	0.435	0.105	0.378	0.5
Ammonia	0.5	0.175	2.5	1.9	0.15	0.15	0.15	0.2
Nitrate	21.2	35.5	4.5	<0.1	3.8	8.98	6.13	4.5
Orthophosphate/ Total P	19.80	0.74	57.3	14.1	3.09	3.95	1.33	0.30
Metals (mg/L)								
Arsenic	0.098	0.039	0.298	0.093	0.048	0.024	0.029	0.004
Selenium	0.05	0.038	0.061	<0.005	0.029	0.005	0.003	0.003

NA means parameter not analyzed.

Results are average for four sampling events (4Q06 to 2Q08) except for well 145 and 159 that are results for May 2008 and November 2001, respectively, due to the lack of sufficient data points to calculate a current average value for these wells.

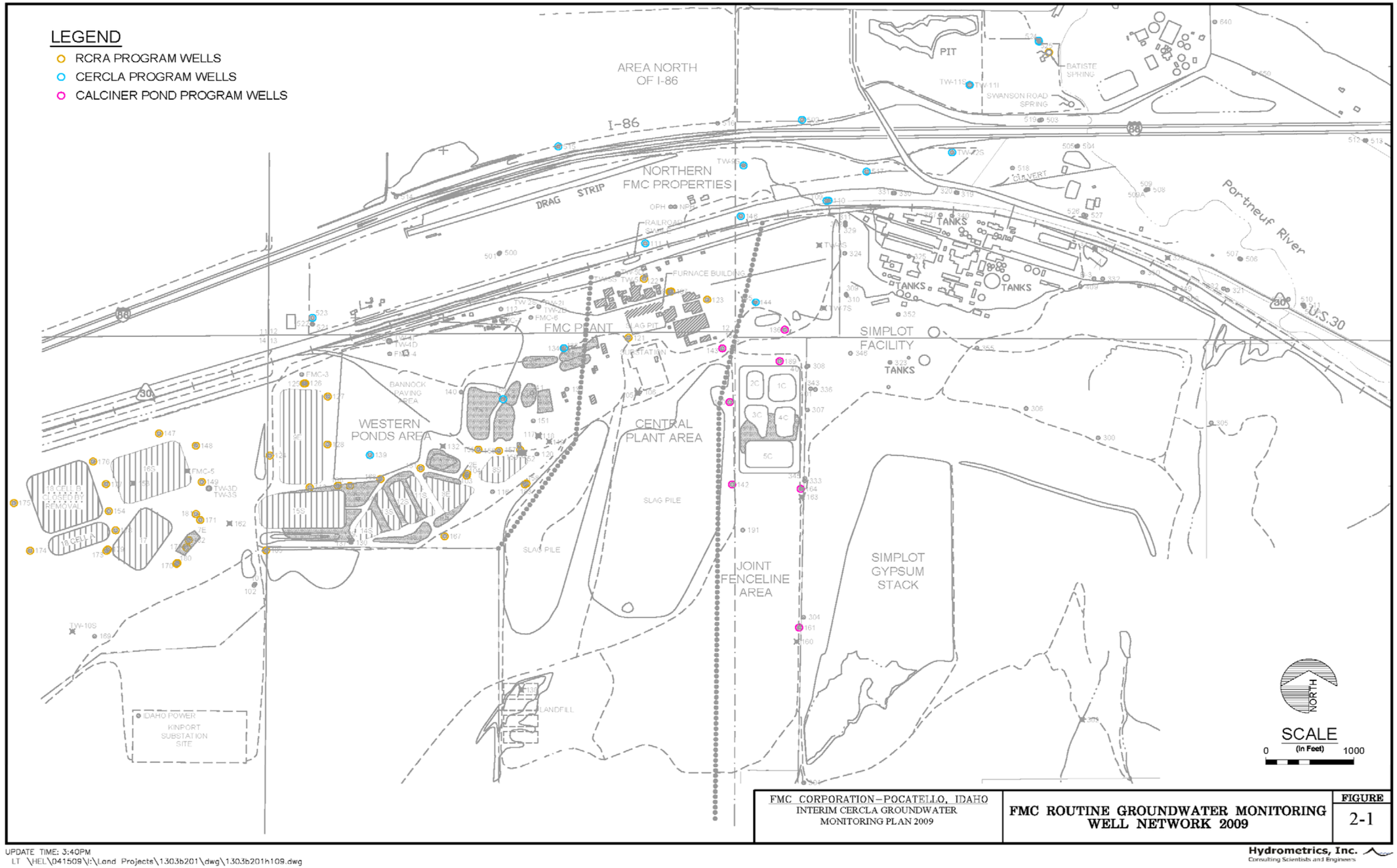
Non-detect results were included as equal to the detection limit for calculation of averages.

TABLE 2-2 (CONTINUED). SUMMARY OF GROUNDWATER QUALITY AT THE INTERIM CERCLA GROUNDWATER MONITORING PROGRAM WELLS

Parameters	TW-9S	502	517	TW-12S	515	TW-11S	524	525
Field Measurements								
pH (Field)	7.06	7.28	6.93	6.5	7.37	7.18	7.55	7.52
SC (UMHOS/CM)	1842	1036	2575	1125	1260	845	517	524
Turbidity (NTU)	8	0.2	0.3	8.5	0.475	9.5	0.325	0.35
Water Temperature (°C)	14.4	12.6	15.9	14.4	13.3	12.4	12.4	12.1
General WQP (mg/L)								
Potassium	58.4	5.4	100	15.7	8.85	3.8	4.21	4.15
Sulfate	161	64.9	189	132	132	49.7	42.9	44.6
Chloride	187	44.3	198	46.2	197	19.9	18.5	19.2
Fluoride	0.1	0.9	0.6	1.1	0.683	0.8	0.675	0.718
Ammonia	0.2	>0.2	0.2	0.7	0.15	<0.2	0.15	0.133
Nitrate	9.95	1.6	11.1	6.1	2.75	1.6	1.88	1.95
Orthophosphate/ Total P	3.21	<0.5	0.92	16.90	0.20	<0.5	0.20	0.25
Metals (mg/L)								
Arsenic	0.027	0.003	0.047	0.017	0.005	0.002	0.004	0.006
Selenium	0.005	>0.005	0.014	0.006	0.003	<0.005	0.005	0.005

Results are average for four sampling events (4Q06 to 2Q08) except for wells 502, 517 and TW-11S that are results for May 2008 only due to the lack of sufficient data points to calculate a current average value for these wells.

Non-detect results were included as equal to the detection limit for calculation of averages.


LEGEND
RCRA PROGRAM WELLS
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CALCINER POND PROGRAM WELLS
AREA NORTH OF I-86
I-86
DRAG STRIP
NORTHERN FMC PROPERTIES
PIT
BATISTE SPRING
SWANSON ROAD SPRING
CULVERT
Portneuf River
TANKS
U.S.30
FURNACE BUILDING
FMC PLANT
SIMPLOT FACILITY
BANNOCK PAVING AREA
WESTERN PONDS AREA
CENTRAL PLANT AREA
SLAG PILE
JOINT FENCELINE AREA
SIMPLOT GYPSUM STACK
LANDFILL
IDAHO POWER KINPORT SUBSTATION SITE
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FMC CORPORATION–POCATELLO, IDAHO
INTERIM CERCLA GROUNDWATER MONITORING PLAN 2009
FMC ROUTINE GROUNDWATER MONITORING WELL NETWORK 2009
FIGURE
2-1
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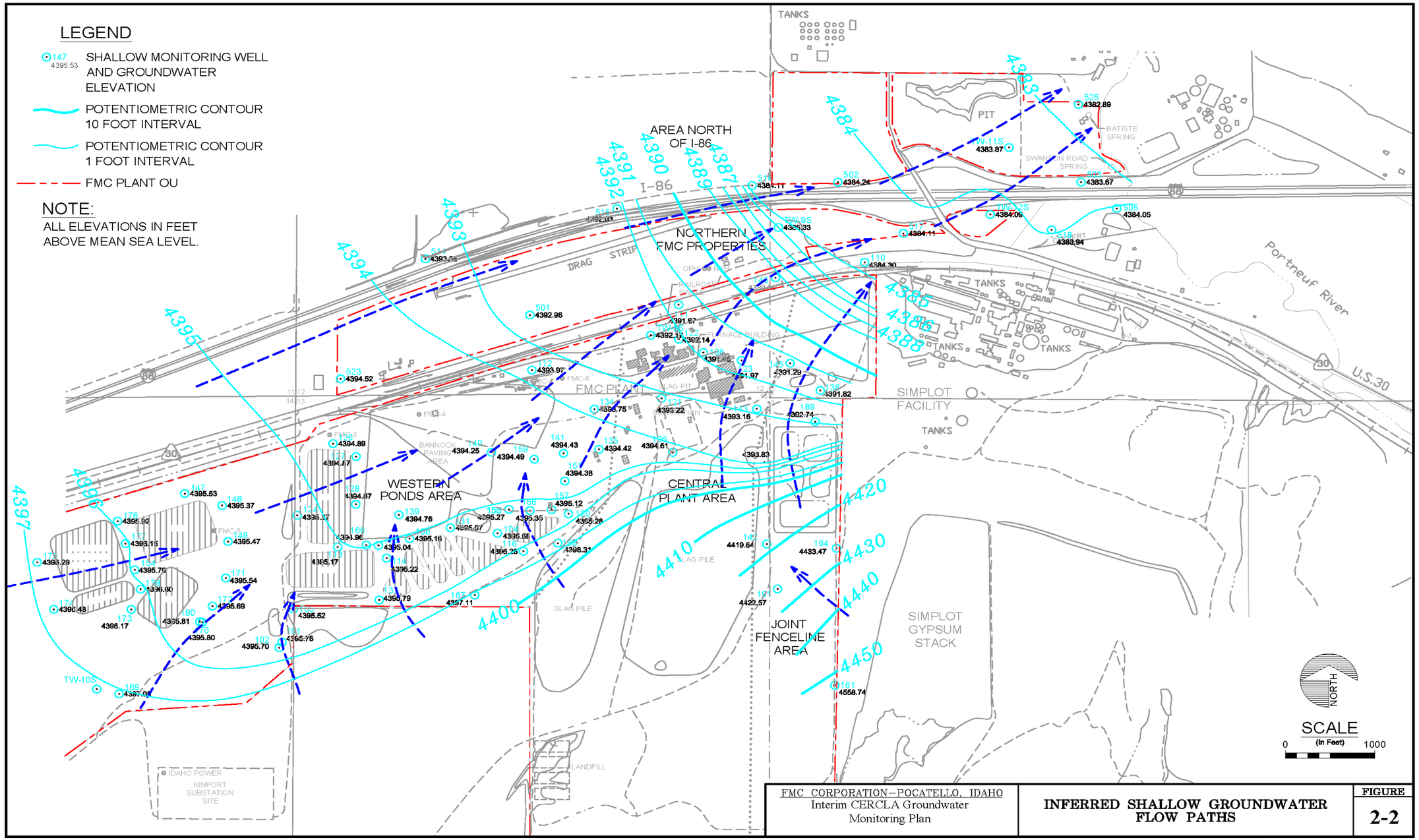
Hydrometrics, Inc.
Consulting Scientists and Engineers



FMC CORPORATION–POCATELLO, IDAHO
Interim CERCLA Groundwater Monitoring Plan

INFERRED SHALLOW GROUNDWATER FLOW PATHS

FIGURE 2-2

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Hydrometrics, Inc.
Consulting Scientists and Engineers

3.0 SUMMARY OF MONITORING PLAN COMPONENTS

The interim CERCLA groundwater monitoring program is designed to provide adequate and appropriate data to address the groundwater monitoring objectives. This monitoring program was developed following the approach described in EPA's *Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan Development and Implementation* (EPA, 2004). The data acquisition activities are described in this section and the Field Sampling Plan ("FSP,"Attachment A) and the Quality Assurance Project Plan ("QAPP," Attachment B). The data evaluation methods and procedures are described in Section 4.

3.1 WATER LEVEL MONITORING

FMC performs quarterly groundwater level (elevation) measurements at numerous monitoring wells that provide uniform coverage across the entire FMC Plant OU. The results of the site-wide water level monitoring have been and will be collected and utilized under FMC's CERCLA, RCRA and Calciner Pond groundwater monitoring programs. During each groundwater monitoring event, water level measurements will be taken in accordance with the Field Sampling Plan at the following list of wells:

- Wells 101 through 191 inclusive consisting of 73 shallow and deep wells within the FMC "100-series" wells;
- TW-5S, TW-5I, TW-5D, TW-9S, TW-11S and TW-12S; and,
- 501, 502, 503, 505, 514, 515, 516, 517, 518, 523, 524 and 525.

In addition to the 91 wells listed above, the surface water elevation will be measured in the Batiste Spring channel immediately below the overflow weir from the springhouse cistern and in the Swanson Road Spring (aka the Spring at Batiste Road) basin.

3.2 INTERIM CERCLA MONITORING WELL NETWORK

Groundwater monitoring will be conducted in accordance with the FSP (Attachment A) and QAPP (Attachment B) presented in this document. Field parameters will be measured and samples for laboratory analyses will be collected at the following groundwater monitoring wells during each semiannual monitoring event:

- On-Plant Site wells: 134, 139, 159 and 145 (in the joint fenceline area)
- Plant Site downgradient wells: 111, 146, 110 and TW-9S
- Wells downgradient from the FMC and Simplot Plant sites: 517 and TW-12S
- Northern perimeter wells: 523, 515, 502, TW-11S, 524 and 525

Because the three groundwater monitoring programs (CERCLA, RCRA and Calciner Pond) are coordinated, the CERCLA groundwater monitoring well network is shown along with the RCRA and Calciner Pond groundwater monitoring well networks that are sampled for field and laboratory analyses in Table 2-1 and on Figure 2-1.

During the series of EPA-FMC meetings (February, March and May 2009) that led to agreement for the development of this interim monitoring plan, EPA also expressed its position that a new groundwater monitoring well is needed on the FMC Plant Site in the joint fenceline area and in the vicinity of abandoned well TW-8S (refer to Figure 2-1). Based on further EPA-FMC discussions, EPA's objective for the new well would be to refine the extent of the Simplot gypstack influence in the joint fenceline area toward the northern FMC Plant Site boundary. Further discussion between EPA and FMC will be necessary to detail the specific objective, location, well installation and construction techniques prior to installation of the well. Therefore,a separate work plan will be prepared that will describe location, installation / construction, development, and initial monitoring / sampling of the new groundwater monitoring well (tentatively designated well 192). Following installation and initial sampling of the new monitoring well, the well will be added to the interim CERCLA monitoring well network described in this section and the FSP and QAPP.

3.3 FIELD PARAMETERS

Groundwater monitoring will be conducted in accordance with the FSP and QAPP presented in this document. The following field parameters will be measured in the monitoring wells during each semiannual monitoring event:

- Dissolved oxygen,
- Oxidation-reduction potential (ORP),
- pH,
- Turbidity,
- Temperature, and
- Specific conductance.

3.4 LABORATORY ANALYTICAL PARAMETERS

As described in detail in the GWCCR, the original EMF Remedial Investigation (RI) groundwater investigation analytical parameter list included a lengthy list of general minerals, nutrients and fluoride, metals and radionuclides. Based on the EMF RI results, FMC and Simplot requested and EPA agreed to a significant reduction in the groundwater analytical laboratory parameter list for the CERCLA groundwater monitoring at the site. The reduced CERCLA parameter list has been used for FMC's routine CERCLA groundwater monitoring program since 1994 following EPA's approval of the reduction.

As further described in the GWCCR, EPA has periodically requested and FMC has performed groundwater monitoring events with "expanded" analytical parameter lists that revisited many of the original CERCLA groundwater investigation long-list parameters and several groundwater

analytical parameters that were not analyzed during the EMF RI. EPA most recently requested that FMC perform an expanded analytical parameter list during the second quarter 2008 (2Q08) CERCLA ground water monitoring event. Prior to finalizing the analytical parameter list for the 2Q08 event, FMC submitted a rationale for the routine and proposed expanded laboratory parameter list. A copy of FMC's proposed 2Q08 CERCLA monitoring event, April 25, 2008 is included as Appendix A.

The results from the 2Q08 CERCLA and all previous expanded groundwater monitoring event are presented and discussed in the GWCCR. The FMC-related constituents in groundwater are identified in the GWCCR and reprinted below:

> "The supplemental sampling events provided additional results, consistent with the EMF RI, that the following constituents are FMC-related contaminants in groundwater:
>
> - Common Ions: Potassium, chloride and sulfate
> - Nutrients and Fluoride: Ammonia, nitrate, total phosphorus / orthophosphate and fluoride;
> - Metals: Arsenic, boron, manganese, selenium, and, in the eastern central plant and joint fenceline areas, vanadium.
>
> Supplemental post-RI sampling events identified the additional FMC-related groundwater contaminants as total cyanide and elemental phosphorus. These inorganic constituents were not evaluated as potential groundwater COPCs during the EMF RI.
>
> Supplemental sampling events for expanded metals, organic compound and radionuclide analytical parameters have provided further evidence supporting the findings of the EMF RI that the following constituents are not FMC-related contaminants in groundwater:
>
> - Metals: aluminum, antimony, beryllium, cadmium, copper, lead, molybdenum, mercury, silver, thallium and zinc;
> - Organic Compounds; and
> - Radionuclides.
>
> Supplemental sampling did not indicate that total uranium is a FMC-related constituent in groundwater. Elevated uranium (and gross alpha activity associated with the uranium 238 and 234 isotopes) in joint-fenceline area wells are more likely associated with naturally-occurring uranium in volcanic bedrock units within which these wells are screened."

Consistent with the recommendations in the GWCCR, the routine groundwater monitoring for the FMC Plant OU focuses on arsenic as the risk-driving groundwater constituent of concern

(COC), the additional groundwater COCs fluoride, nitrate and selenium, and the site-related indicator parameters potassium, total phosphorus / orthophosphate, chloride and sulfate with the broadest FMC-related groundwater impact.

Additionally, periodic expanded monitoring events will include the other FMC Plant OU groundwater COCs manganese and vanadium that are localized within the broader FMC-related impact and the FMC Plant OU source related constituents ammonia, boron and total cyanide that are not significant risk-drivers. Elemental phosphorus is identified as a FMC Plant OU groundwater COC, but is localized and only consistently detected above its CV in monitoring wells 108 and 122. As these wells are already routinely (semiannually) sampled and analyzed for elemental phosphorus under FMC's RCRA groundwater monitoring program, elemental phosphorus is not separately specified as a parameter under the interim CERCLA groundwater monitoring program.

The routine CERCLA groundwater monitoring laboratory analytical parameters are presented in Section 3.4.1 and periodic expanded groundwater parameters are presented in Section 3.4.2.

3.4.1 Routine Groundwater Monitoring Laboratory Analytical Parameters

Groundwater monitoring will be conducted in accordance with the FSP and QAPP presented as Attachments A and B in this document. The wells will be sampled and analyzed during each semiannual monitoring event for:

- Common ions – chloride, potassium, and sulfate.
- Metals – arsenic and selenium.
- General water quality –fluoride, nitrate, and total phosphorus.

3.4.2 Expanded Groundwater Monitoring Laboratory Analytical Parameters

Groundwater monitoring will be conducted in accordance with the FSP and QAPP presented in Attachments A and B in this document. The wells will be sampled and analyzed for an expanded laboratory parameter list every five years during the second quarter monitoring event, beginning with the second quarter 2012 [2Q12] monitoring event. The laboratory parameter list for these expanded monitoring events will include the routine and additional parameters (underlined below), as follows:

- Common ions – chloride, potassium, and sulfate.
- Metals – arsenic, selenium, <u>manganese</u>, <u>boron</u>, and <u>vanadium</u>.
- General water quality – <u>total ammonia</u>, fluoride, nitrate, and total phosphorus.
- Other parameters - <u>total cyanide</u>.

4.0 EVALUATION OF DATA

This section provides a description of the data evaluations that will be performed annually for the groundwater chemistry results from the CERCLA groundwater monitoring well network. Section 4.1 describes the evaluation of water level (potentiometric) data. Section 4.2 describes the qualitative evaluation of field and laboratory parameter results. Section 4.3 describes the quantitative (statistical) evaluation that will be performed annually for specific indicator parameter results from the CERCLA groundwater monitoring well network. Section 4.4 summarizes the data evaluation methodologies utilized for the RCRA and Calciner Pond Remedial Action monitoring programs and integration of those programs in evaluating the results from the CERCLA monitoring program on an FMC Plant OU-wide basis. The CERCLA groundwater monitoring program results and evaluations will be reported annually to EPA as described in Section 5.

4.1 WATER LEVEL MEASUREMENTS

As described in the GWCCR, groundwater levels and flow direction at the site are very stable and have not changed significantly over the 18 years of site-wide groundwater monitoring initiated during the EMF RI. There are seasonal water level fluctuations in the Michaud Flats, typically on the order of 2 to 4 feet, which may be associated with irrigation withdrawal and recharge patterns. Overall, the water levels indicate no long-term decrease in water levels at the site. Water levels in the shallow and deep wells have typically fluctuated within 4 to 8 feet between maximum and minimum measured levels over the 15 to 18 year period of monitoring for most of the wells. Maximum water levels were generally observed in the mid- to late 1990s during a cycle of average and above average regional precipitation during the monitoring period for most wells. Minimum water levels were typically observed in the 2001 and 2002 period that coincided with several years of significantly below average precipitation in the region.

Although there have been no significant changes observed since the Simplot extraction system began operation in 2003 and has expanded from 2003 to 2009, the final operating configuration and flows may create localized changes to the flow direction and gradient in the Joint Fenceline Area. In addition, Simplot's management of the gypstack (expansion of the upper gypstack toward the south) has led to changes in groundwater levels in certain wells located at the joint fenceline and, although not dramatic, has altered the groundwater flow direction and gradient in the southern portion of the Joint Fenceline Area. Simplot has recently submitted a Remedial Action Plan (Simplot, July 2009) that, among other actions, includes lining the gypsum stack over a mutli-year period with a target completion in 2015. This project also has the potential to change groundwater flow direction and gradient in the Joint Fenceline Area over time.

Cumulative hydrographs will be prepared (updated annually) with the quarterly water level data for each of the interim CERCLA groundwater wells (hydrographs are also prepared and presented in the annual RCRA Groundwater Monitoring Assessment and the annual Calciner Pond Remedial Action Groundwater Monitoring Report for those programs). The quarterly site-wide groundwater level data (collected collectively for the CERCLA, RCRA and Calciner Pond

Remedial Action groundwater monitoring programs) will be used to generate quarterly potentiometric maps. The hydrographs and potentiometric maps will be compared to prior years water levels to evaluate potential changes in site-wide groundwater levels that may be related to multi-year precipitation patterns and/or potential localized changes in flow direction related to Simplot's groundwater extraction system and management of the gypstack.

4.2 QUALITATIVE EVALUATION OF FIELD AND LABORATORY PARAMETER RESULTS

The field parameters and laboratory analytical results for each monitoring event will be evaluated to determine whether the data are generally consistent with historical results or if the data indicate potential outliers or temporal or spatial trend. The qualitative evaluation of the results is described below.

Field Parameters

Historically the dissolved oxygen, oxidation-reduction potential (ORP), turbidity and temperature results for the interim CERCLA well network, while valuable for interpreting the hydrogeochemistry at the site, have been relatively consistent and are not particularly useful for evaluating changes in the spacial extent of FMC-impacted groundwater. Thus, these parameters will only be qualitatively reviewed against prior data for comparability.

The pH and specific conductance (SC) results are valuable for interpretation of FMC and non-FMC impacts to groundwater. Time series graphs for pH and SC will be prepared for each of the CERCLA wells to visually assess potential trends and evaluate potential data inconsistencies or outliers. In the event that a potential trend is visually apparent, the data for the parameter and well may be statistically tested for trend using the same methodology described in Section 4.2.

Laboratory Analytical Constituents

Historically the water quality constituents chloride, fluoride and nitrate results for the interim CERCLA well network, while valuable for interpreting the hydrogeochemistry at the site, have been relatively consistent and are not particularly useful for evaluating changes in the spatial extent of FMC-impacted groundwater. Thus, these constituents will only be qualitatively reviewed against prior data for comparability.

Potassium, sulfate, total phosphorus (and historic orthophosphate results), arsenic and selenium results are valuable indicator parameters for interpretation of FMC and non-FMC impacts to groundwater. Time series graphs for these constituents will be prepared for each of the CERCLA wells to assess potential trends and evaluate potential data inconsistencies or outliers.

The results for the northern perimeter monitoring wells 515, TW-11S, 524 and 525 and downgradient monitoring well 502 that historically have shown minimal or no impact from FMC sources to groundwater will be compared to the representative (or background) concentrations and comparative values (CVs) for the FMC Plant OU. The groundwater representative concentrations and CVs were assembled and presented in Table 4.2-1 of the GWCCR. The

representative concentrations and CVs for the interim CERCLA groundwater monitoring routine and expanded parameters are shown on Table 4-1. The comparison of monitoring results to the representative concentrations and CVs will be used to assess the status of these wells (e.g., remain unimpacted or indication of impact).

In addition to this qualitative review of the time series graphs, the potassium, sulfate, total phosphorus (and historic orthophosphate results), arsenic and selenium results from each of the interim CERCLA wells will be tested for trend annually as described below in Section 4.2.

4.3 QUANTITATIVE (STATISTICAL) EVALUATION OF RESULTS

As described in Section 1, this interim CERCLA groundwater monitoring plan is not (and cannot be) designed to evaluate the performance of CERCLA remedial action(s) at the FMC Plant OU. Rather, one of the objectives of the interim CERCLA monitoring program is to evaluate potential changes and/or trends in site-related groundwater constituents. In order to meet this objective, in addition to the qualitative evaluations described above in section 4.2, this section describes the quantitative (statistical) evaluation of the CERCLA monitoring program results for potential trends.

Selection of the statistical method was based on the following factors: 1) the CERCLA well network does not monitor a "single" unit or source area so comparison of upgradient (background) to downgradient wells (inter-well comparison) is not appropriate, 2) the majority of the CERCLA monitoring network wells have been site impacted and, as described in the GWCCR, trends may be present, and 3) the unimpacted wells (523, 515, 502, TW-11S, 524 and 525) within the network should not be presumed not to show a trend and the data sets for unimpacted wells contain a relatively high proportion of undetected results.

As stated in "*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance*" (EPA, March 2009), the Mann-Kendall Test for Trend is summarized as follows:

> **"Basic purpose:** Method for detection monitoring and diagnostic tool. It is used to identify the presence of a significant (upward) trend at a compliance point or any trend in background data.
> **Hypothesis tested:** H_0 — No discernible linear trend exists in the concentration data over time. H_A — A non-zero, (upward) linear component to the trend does exist.
> **Underlying assumptions:** Since the Mann-Kendall trend test is a non-parametric method, the underlying data need not be normal or follow any particular distribution. No special adjustment for ties is needed.
> **When to use:** Use a test for trend when 1) interwell tests are inappropriate so that intrawell tests are called for, and 2) a control chart or intrawell prediction limit cannot be used because of possible trends in intrawell background. A trend test can be particularly helpful at sites with recent or historical contamination where it is uncertain if intrawell background is already contaminated. An upward trend in these cases documents changing concentration levels more accurately than either a control chart or intrawell prediction limit, both of which assume a stationary background mean concentration.

Steps involved: 1) Sort the data values by time of sampling/collection; 2) consider all possible pairs of measurements from different sampling events; 3) score each pair depending on whether the later data point is higher or lower in concentration than the earlier one, and sum the scores to get Mann-Kendall statistic; 4) compare this statistic against an α-level critical point; and 5) if the statistic exceeds the critical point, conclude that a significant upward trend exists. If not, conclude there is insufficient evidence for identifying a significant, non-zero trend.
Advantages/Disadvantages: The Mann-Kendall test does not require any special treatment for nondetects, only that all non-detects can be set to a common value lower than any of the detects. The test is easy to compute and reasonably efficient for detecting (upward) trends. Exact critical points are provided in the Unified Guidance for $n <= 20$; a normal approximation can be used for $n > 20$)."

In consideration of the factors described above, the arsenic, potassium, total phosphorus / orthophosphate, sulfate and selenium results from the interim CERCLA wells will be quantitatively evaluated using the Mann-Kendall test for trend. The Mann-Kendall test for trend will be performed at the 95% confidence level ($\alpha = 0.05$). The test for trend will be performed on the CERCLA well network to evaluate whether there are upward trends in individual wells within these areas on the site:

- On-Plant Site wells: 134, 139, 159 and 145 (in the joint fenceline area);
- Plant Site downgradient wells: 111, 146, 110 and TW-9S;
- Wells downgradient from the FMC and Simplot Plant sites: 517 and TW-12S; and,
- Northern perimeter wells: 523, 515, 502, TW-11S, 524 and 525.

The test for trend results for the CERCLA well network will be utilized in conjunction with the evaluations of the RCRA and Calciner Pond Remedial Action groundwater monitoring programs to assess the FMC Plant OU-wide groundwater conditions and any quality trends as described in Section 4.4 below.

4.4 INTEGRATION WITH OTHER FMC GROUNDWATER MONITORING PROGRAMS

The CERCLA groundwater monitoring program results will be evaluated on a well-specific basis and as groups for specific areas of the site as described in Sections 4.2 and 4.3 above; however, in order to assess the results on an FMC Plant OU-wide basis, output from FMC's RCRA and Calciner Pond Remedial Action monitoring programs will be utilized as inputs to the CERCLA groundwater monitoring evaluations. The RCRA and Calciner Pond Remedial Action groundwater monitoring program results are evaluated pursuant to their respective groundwater monitoring plans. A brief description of the data evaluations performed pursuant to the RCRA (FMC, 1999 and updates) and Calciner Pond Remedial Action (FMC, November, 2008) groundwater monitoring plans is provided in Sections 4.4.1 and 4.4.2, respectively.

While the interim CERCLA groundwater monitoring data evaluations and assessment will utilize data and results of the evaluations from the Calciner Pond and RCRA programs, this plan is not intended to modify or replace the requirements under the Calciner Pond Groundwater Monitoring Plan or RCRA post-closure sampling and analysis plans, including the reporting requirements under those plans respectively. Figure 4-1 shows a flow chart that illustrates the procedure for integration of the Calciner Pond Remedial Action and RCRA groundwater monitoring program output with the interim CERCLA monitoring evaluations. In addition to the FMC groundwater monitoring program data, the Simplot groundwater monitoring data will be reviewed and evaluated as part of the overall assessment of FMC Plant OU-wide groundwater quality and any trends, primarily in the joint fenceline area and in the area downgradient from both FMC's and Simplot's plant sites.

4.4.1 Summary of RCRA Annual Groundwater Assessment

The annual results from the RCRA monitoring well network are evaluated qualitatively and quantitatively. The field parameters and laboratory analytical results for the quarterly monitoring events within the calendar year are evaluated to determine whether the data are generally consistent with historical results or if the data indicate potential outliers or temporal or spatial trends. In addition to the qualitative data evaluations, the arsenic, fluoride and selenium results are quantitatively (statistically) evaluated on a WMU-by-WMU basis to determine the status of each WMU for the monitoring year.

As recommended by the EPA (James Brown, Office of Solid Waste, May 5, 1993), and consistent with the EPA's guidance documents for Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA, 1989, 1992, March 2009), the indicator constituent (arsenic, fluoride and selenium) concentrations are analyzed using a defined set of statistical procedures: the non-parametric Mann-Whitney U-test (rank-sum test) to compare the central tendency (median) of two data sets, and a comparison of mean concentrations. Details of the Mann-Whitney method are provided in the "RCRA Interim Status Groundwater Monitoring Assessment Report" (FMC, August 1993). Statistical testing procedures are as follows:

Test 1) For each WMU, the arsenic, fluoride, and selenium concentrations in upgradient wells are compared to those in the downgradient wells using the Mann-Whitney U-test (also known as the Wilcoxon rank-sum test). The test is performed using a significance level $\alpha = 0.05$ (i.e., if the test yields a p-value less than 0.05, the null hypothesis is rejected and the median concentrations of upgradient and downgradient wells is considered to be significantly different). The α-value of 0.05 sets the Type I error rate at 5%; that is, the risk that the medians will be considered significantly different through statistical testing, even though they are not is 5%. In many cases, constituent concentrations are expected to be higher in the downgradient wells because of the presence of former unlined ponds (the old phossy ponds [Remediation Unit 22b as defined in the SRI Report, MWH, 2009]) underlying or adjacent to certain WMUs. Results showing statistically higher downgradient concentrations using this analysis do not necessarily indicate current impacts from the WMUs, and in certain cases may instead be

attributable to prior practices at the former ponds. Consequently, an additional test (Test 2) is also conducted for downgradient wells for each WMU.

Test 2) For each downgradient well, the current monitoring year mean concentrations of arsenic, fluoride, and selenium are compared to pre-monitoring year mean concentrations. If the current monitoring year mean concentrations are less than or equal to pre-monitoring year mean concentrations, the concentrations of the measured constituent are not increasing at that well, therefore presumably no leakage of contaminants from the WMU is occurring. If the results of Test 1 indicate that concentrations in downgradient wells are significantly higher than those of upgradient wells, and the results of Test 2 indicate that the current monitoring year mean is higher than the pre-monitoring year mean for any individual downgradient well, then Test 3 is conducted.

Test 3) The Mann-Whitney U-test is performed for downgradient wells in the given WMU to compare concentrations observed in the current monitoring year with concentrations observed in previous years (pre-monitoring year). This test is intended to determine if data for a constituent shows a statistically significant increase through time by comparing the median concentrations of the current monitoring year and previous year data sets. As with Test 1, Test 3 is performed using a significance level $\alpha = 0.05$.

The RCRA annual assessment reports include quarterly groundwater water level data and contour maps, cumulative hydrographs for wells associated with each monitored WMU, overall (qualitative) assessment of the field and laboratory results, the results of the statistical tests and time series graphs for arsenic, fluoride and selenium for each monitored WMU, and an assessment of the status of the monitored WMUs.

4.4.2 Summary of Calciner Pond Remedial Action Groundwater Annual Evaluation

The annual results from the Calciner Pond monitoring well network are evaluated qualitatively and quantitatively as described in the Calciner Pond Remedial Action Groundwater Monitoring Plan (FMC, November 2008). A brief summary of those evaluations is presented below.

The field parameters and laboratory analytical results for the semi-annual monitoring events within the calendar year are evaluated to determine whether the data are generally consistent with historical results or if the data indicate potential outliers or temporal or spatial trends. In addition to the qualitative data evaluations, the arsenic, potassium, total phosphorus / orthophosphate, sulfate and selenium results are quantitatively (statistically) evaluated for the monitoring year.

The Mann-Kendall Trend Analysis procedure (see Section 4.3 for description) is used to assess the presence of trends in the constituent levels for the Calciner Pond Remedial Action groundwater monitoring wells (161, 164, 142, 190, 189, 143 and 136). The test is suitable for data that do not follow a normal distribution, and supports multiple observations per time period. Comparisons are made at the 95% confidence level.

In addition to the test for trend results, a source area evaluation is performed that includes evaluation of the sulfate to chloride ratio (SO4:Cl) and potassium to chloride ratio (K:Cl) in the Calciner Pond wells in comparison to the ratios determined for the major sources identified in the joint fenceline area, namely the calciner ponds area subject to the Calciner Pond Remedial Action and the Simplot gypsum stack.

The Calciner Pond Remedial Action annual groundwater monitoring reports include quarterly groundwater water level data and contour maps, cumulative hydrographs for the Calciner Pond groundwater well network, overall (qualitative) assessment of the field and laboratory results, the results of the statistical tests and time series graphs for arsenic, potassium, total phosphorus / orthophosphate, sulfate and selenium, and the source evaluation (ion ratios), and an assessment of the status of the Calciner Pond Remedial Action area.

4.4.3 Integration of RCRA / Calciner Pond Program Results with CERCLA Evaluations

As stated in Section 1, one of the objectives of the interim CERCLA monitoring program is to evaluate any changes and/or trends in groundwater conditions on an OU-wide basis. The results of the statistical analysis of the interim CERCLA groundwater monitoring data will be further evaluated consistent with the project data quality objectives step 5 - development of decision rules as described in the Quality Assurance Project Plan (QAPP, Attachment B). The evaluations (or decision rules) for the CERCLA program results are designed as a series of logical steps that include consideration of the results from the RCRA, Calciner Pond and Simplot groundwater monitoring programs.

As described in Section 4.3, the Mann-Kendall test for trend will be used to determine if there are upward trends in arsenic, potassium, total phosphorus / orthophosphate, sulfate and selenium concentrations in samples collected from the CERCLA well network:

- On-Plant Site wells: 134, 139, 159 and 145 (in the joint fenceline area);
- Plant Site downgradient wells: 111, 146, 110 and TW-9S;
- Wells downgradient from the FMC and Simplot Plant sites: 517 and TW-12S; and,
- Northern perimeter wells: 523, 515, 502, TW-11S, 524 and 525.

If upward trends are detected for any parameter and well(s), additional evaluation will be performed to assess the cause and source of the upward trend(s). The additional evaluation(s) will rely on the qualitative and quantitative data evaluations from all of the groundwater monitoring programs, including Simplot's, as follows:

On-Plant Site wells: Any upward trend(s) at well 139, 134 and/or 159 will be compared to the results from the RCRA annual assessment report to assess whether the tends are related to releases from the closed RCRA ponds or more likely related to the former unlined phossy ponds in the western ponds area. Any upward trend(s) at well 145 will be compared to the results from the Calciner Pond annual groundwater monitoring report to assess whether the trend(s) is consistent with trends observed at the other wells in the joint fenceline area.

Plant Site downgradient wells: Any upward trend(s) at well 111 and/or 146 will be compared to the results from the RCRA annual assessment report to assess whether the tends are related to releases from the closed RCRA ponds or more likely related to the former unlined phossy ponds in the western ponds area. Any upward trend(s) at well 110 will be compared to the results from the Calciner Pond annual groundwater monitoring report to assess whether the trend(s) is consistent with trends observed at the other wells in the joint fenceline area.

Wells downgradient from the FMC and Simplot Plant sites: Any upward trend(s) at well 517 and/or TW-12S will be compared to the results from the RCRA, Calciner Pond and Simplot groundwater monitoring results to assess the likely cause and source of the increasing trend.

Northern perimeter wells: Any upward trend(s) at well 523, 515, 502, TW-11S, 524 and 525 will first be assessed to determine if the trends are related to undetected results at higher detection limits. If the trends are not related to elevated undetected results, the current year concentrations will be compared to the comparative value (CV) per Table 4-1 of the GMP to determine whether there is an indication that the well could be impacted by the EMF Site or other non-EMF source(s). If the result(s) exceed the CV, the results will be compared to the concentration and trend(s) observed at the nearest cross-gradient well(s) within the EMF-impacted area to assess whether the changes are EMF related or more likely related to non-EMF sources.

Depending trend test results for the CERCLA wells and the integrated evaluation method described above. Additional action(s) may be undertaken including:

1. Re-sampling monitoring well(s) within the CERCLA, RCRA and/or Calciner Pond Remedial Action groundwater monitoring well networks may be performed to confirm parameter concentration that may have resulted in a false positive outcome.

2. If the upward trend(s) is confirmed and is likely attributable to the closed RCRA ponds or Calciner Pond Remedial Action area, further evaluation and potential mitigation plan(s) will be performed under those programs.

3. If the upward trend(s) is likely attributable to Simplot sources, the EPA and Simplot will be responsible for identifying appropriate actions.

4. If the upward trend(s) is likely attributable to FMC source areas identified for CERCLA remedial action, ensure the remedial design addresses mitigation of identified and

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potential future sources of groundwater impacts that could exceed the CVs (MCLs, secondary standards or RBCs).

TABLE 4-1. Interim CERCLA Groundwater Monitoring Parameter Representative Concentrations and Comparative Values

ANALYTE	Michaud 95th Percentile (a)	Bannock 95th Percentile (a)	Groundwater Comparative Values (CVs) (b)	Source of Groundwater CV (c)
COMMON IONS (mg/l)				
Chloride	192.90	52.42	250	Secondary Standard
Potassium	12.72	10.52		
Sulfate	72.57	43.40	250	Secondary Standard
PHYSICAL PARAMETERS				
Spec.Conductivity (umhos/cm)	1136	569		
pH	(d)	(d)	6.5 to 8.5	Secondary Standard
Temperature (degrees Celcius)	(d)	(d)		
Redox (mV)	(d)	(d)		
NUTRIENTS AND FLUORIDE (mg/l)				
Ammonia (NH3 as N)	0.50	0.50		
Nitrate (NO3 as N)	5.52	1.60	10	MCL
Orthophosphate (PO4 as P)	0.06	0.13		
Phosphorous	0.33	0.31		
Fluoride	0.80	0.60	4	MCL
METALS (mg/l)				
Arsenic	0.0141	0.0170	0.01	MCL
Boron	0.2935	0.3078	7.3	PRG
Manganese	0.0518	0.0201	0.05	Secondary Standard
Selenium	0.0057	0.0055	0.05	MCL
Vanadium	0.0745	0.1000	0.18	PRG
Other Inorganics				
Total Cyanide	(e)	(e)	0.2	MCL

(a) The Bannock and Michaud representative concentrations are 95th percentile values for pre-1994 data as presented in Table 4.4-1 in the EMF RI Report with the exception of the representative arsenic concentration that is a 95% Upper Prediction Limit as described in Section 4.4 of the Groundwater Current Conditions Report for the FMC Plant OU.

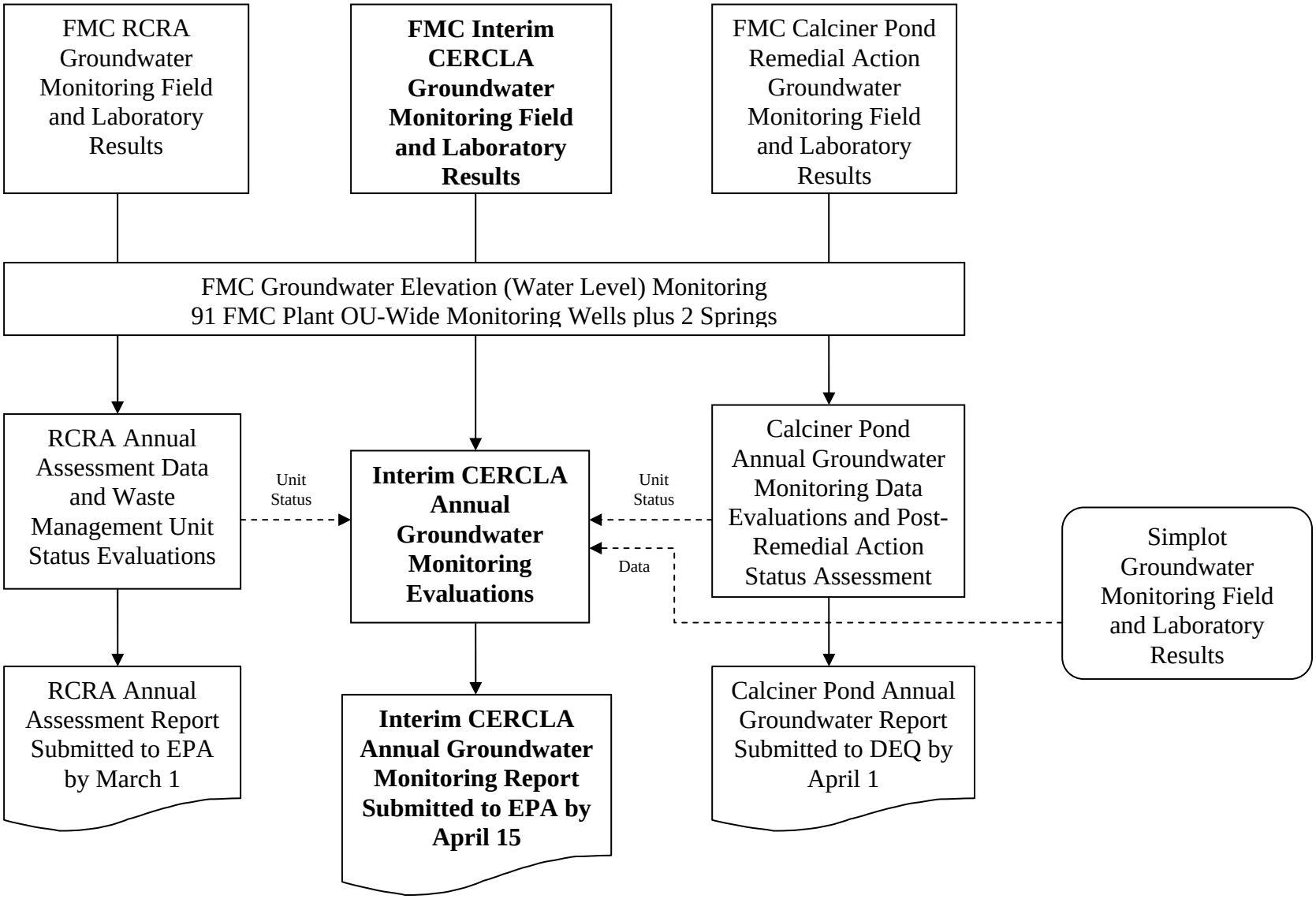
(b) All values are in milligrams per liter (mg/l) unless the units are otherwise specified.

(c) Secondary Standard per National Secondary Drinking Water Regulations; MCL means Maximum Contaminant Level per National Primary Drinking Water Regulations; PRG means Preliminary Remedial Goal for Tap Water per EPA Region VI PRG Table (3/8/2008).

(d) Representative values were not calculated for pH, temperature and redox during the EMF RI.

(e) These parameters were not analyzed or detected during the EMF RI so no representative concentrations were calculated during the EMF RI.

FIGURE 4-1. FLOW CHART ILLUSTRATING INTEGRATION OF THE FMC GROUNDWATER MONITORING PROGRAMS INTO THE INTERIM CERCLA GROUNDWATER MONITORING EVALUATION FOR THE FMC PLANT OU



5.0 REPORTING PROCEDURES

Annual reports will be submitted to EPA by April 15 of the year following the monitoring calendar year (e.g., the 2010 Interim CERCLA Groundwater Monitoring Report will be submitted to EPA by April 15, 2011). These annual reports will contain the following information:

- A compilation of field sampling (e.g. water elevation levels) and laboratory analytical results for the groundwater monitoring program described in this plan.
- FMC Plant OU-wide groundwater elevations displayed on contours maps and updated hydrographs for the interim CERCLA monitoring well network as described in Section 4.1.
- An assessment of data quality and usability.
- An evaluation of groundwater quality that will include:
    - A summary of general chemistry results as described in Section 4.2;
    - Results of trend tests for arsenic, potassium, total phosphorus / orthophosphate, sulfate and selenium as described in Section 4.3; and
- An assessment of the CERCLA groundwater monitoring results including results and output from FMC's RCRA and Calciner Pond Remedial Action groundwater monitoring programs and Simplot's groundwater monitoring data in a comprehensive manner that evaluates potential changes and/or trends in site-wide groundwater at the FMC Plant OU as described in Section 4.4.3.

The annual report will also include the monitoring year's groundwater levels, field parameter and laboratory analytical results in an electronic format (e.g., Microsoft Excel spreadsheet). The data validation and usability reports for the monitoring year will be attached in an electronic format (e.g., Adobe Acrobat).

6.0 REFERENCES

Bechtel Environmental Inc. (BEI), 1996. "Remedial Investigation Report for the Eastern Michaud Flats," prepared for the FMC Corporation and the J.R. Simplot Company. Initially submitted to EPA Region 10 September 1995 and revised August 1996.

Bechtel Environmental Inc. (BEI), 2002. "Revisions to RCRA Corrective Action Environmental Indicators. FMC Idaho LLC, Pocatello, Idaho." June 2002.

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EPA, July 2002. "EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" July 2002.

EPA, November 2002. "Guidance on Environmental Data Verification and Data Validation" EPA QA/G-8, November 2002.

EPA, January 2004. "Guidance for Monitoring at Hazardous Waste Sites: Framework for Monitoring Plan Development and Implementation," OSWER Directive No. 9355.4-28, January 2004.

EPA, February 2009. "Review comments on the G*roundwater Current Conditions Report – FMC Plant OU*, MWH, October 31, 2008," draft Memorandum from Bernie Zavala to Kira Lynch, February 20, 2009.

EPA, March 2009. "Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance" EPA 530-R-09-007, Office of Resource Conservation and Recovery, Program Implementation and Information Division, March 2009.

FMC, August 1993. "RCRA Interim Status Groundwater Monitoring Assessment Report" August 1993.

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FMC Idaho LLC (FMC), November 2008. "Calciner Pond Remedial Action Groundwater Monitoring Plan," May 2008, Revised November 2008.

FMC, 1999. "RCRA Interim Status Groundwater Monitoring Plan", Bechtel Environmental, August 1999; as updated in the RCRA Post-Closure Plans as follows:

- Pond 9E post-closure plan, January 2000;
- Slag Pit Sump post-closure plan, September 2001;
- Pond 8E, Phase IV Ponds and Pond 15S post-closure plans, May 2002;
- Pond 16S post-closure plan, July 2003; and,
- Pond 17 and Pond 18 Cell A post-closure plans, August 2004.

FMC, February 2009. "RCRA Interim Status 2008 Groundwater Monitoring Assessment" February 2009.

FMC, June 2009. "Groundwater Current Conditions Report for the FMC Plant Operable Unit" June 2009 Final.

MWH, 2009. Supplemental Remedial Investigation Report for the FMC Plant Operable Unit-Final. May 2009.

Simplot, July 2009. "Remedial Action Plan" Simplot Don Plant, Pocatello, Idaho, July 15, 2009 Draft.

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APPENDIX A

FMC CERCLA GROUNDWATER MONITORING PROGRAM

2Q2008 SPECIAL SAMPLING AND ANALYSIS EVENT

MARCH 28, 2008, REVISED APRIL 25, 2008

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FMC Idaho LLC
P.O. Box 4111
Pocatello, ID 83205

208.235.8212 phone
208.235.8200 fax

FMC Corporation

Via email and first class mail

April 25, 2008

Ms. Kira Lynch
Remedial Program Manager (M/S ECL-113)
U.S. Environmental Protection Agency Region 10
1600 Sixth Avenue
Seattle, Washington 98101

Subject: FMC Groundwater Monitoring Program, 2Q2008 CERCLA Special Sampling and Analysis Event
FMC Idaho LLC, Pocatello, Idaho

Dear Ms. Lynch:

On March 28, 2008 FMC submitted a proposal to conduct a "special" CERCLA groundwater monitoring event to be conducted concurrently with the routine second quarter 2008 (2Q2008) groundwater monitoring programs at the FMC Plant OU. FMC's proposal presented the results of an evaluation of the groundwater database for the FMC Plant OU that focused on the ROD-specified groundwater chemicals of concern (COCs), recommended supplemental analytical parameters and an additional set of groundwater wells that will be included in the 2Q2008 groundwater monitoring event at FMC.

Based on the April 14 and 18, 2008 teleconferences between FMC and the Agencies during which FMC's March 28 proposal was discussed, FMC has revised the 2Q2008 CERCLA groundwater monitoring special event to: 1) add ORP as a field parameter, 2) add mercury as a laboratory parameter, and 3) replace orthophosphate with total phosphorus as a laboratory parameter for the 2Q2008 event. The enclosed 2Q2008 Special Sampling and Analysis Event summary including Tables 1 and 2, and the SAP Addendum (April 2008) Table 3-4a, Table 3-5a, Table 5-1a, Table 5-5a, Table 7-1a, and Figure 1 represent an the addendum to the EMF RI Sampling and Analysis Plan (SAP) for this 2Q2008 special groundwater monitoring and analysis event.

FMC's groundwater sampling contractor is currently scheduled to conduct the 2Q2008 groundwater monitoring event at FMC during the week of May 19, 2008. Therefore, we request EPA approval of the 2Q2008 Special Sampling and Analysis Event SAP

FMC

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addendum by May 12, 2008 so that the logistics for the special event can be finalized one week in advance of initiating the field work.

As stated in the summary, the results of this event will be added to the cumulative groundwater database and reported to EPA in a groundwater current conditions report for the FMC Plant OU that will be provided in mid-August 2008.

Please feel free to contact me at (215) 299-6700 should you have questions regarding this information.

Sincerely,

Barbara Ritchie
FMC Corporation

Enclosures

cc: Groundwater Working Group 3 Route List (email only)

FMC CERCLA Groundwater Monitoring Program
2Q2008 Special Sampling and Analysis Event
March 28, 2008
Revised April 25, 2008

In response to EPA questions regarding FMC's voluntary CERCLA groundwater monitoring program analytical list, FMC has proposed a "special" groundwater monitoring event that will be conducted concurrently with the routine second quarter 2008 (2Q2008) RCRA, Calciner Ponds and FMC voluntary CERCLA groundwater monitoring programs. This summary presents the results of an evaluation of the groundwater database for the FMC Plant OU that focuses on the ROD-specified groundwater chemicals of concern (COCs), recommended supplemental analytical parameters and an additional set of groundwater wells that are proposed to be included in the 2Q2008 groundwater monitoring event at FMC.

This summary has been revised to add ORP as a field parameter, mercury as a laboratory parameter, and total phosphorus will replace orthophosphate as a laboratory parameter for the 2Q2008 event based on the April 14 and 18, 2008 teleconferences between FMC and the Agencies as described in more detail below. This summary and the attached tables and figure represent an addendum to the EMF RI Sampling and Analysis Plan (SAP) for this 2Q2008 special groundwater monitoring and analysis event. The attached SAP Addenda (April 2008) specific to the 2Q2008 event are: Table 3-4a, Table 3-5a, Table 5-1a, Table 5-5a, Table 7-1a, and Figure 1.

The results of this event will be added to the cumulative groundwater database and reported to EPA in a groundwater current conditions report for the FMC Plant OU that will be provided in mid-August 2008.

Evaluation of Existing Groundwater Data

As FMC has stated in the past, the routine analytical parameters, especially arsenic and potassium, remain the most valuable indicator parameters for monitoring the extent and any trends in groundwater quality related to the identified groundwater impacts at the FMC Plant OU. As documented in Section 4.4 of the Remedial Investigation (RI) Report, arsenic concentrations above representative concentrations essentially define the outermost extent of the EMF Site groundwater impact, whereas groundwater COCs such as boron, fluoride, manganese, nitrate and selenium above representative concentrations have been identified in smaller "subareas" within the larger arsenic groundwater impact. Thus, routine groundwater monitoring for arsenic appropriately focuses on the indicator parameter that delineates the broadest impact.

FMC performed a detailed review of the historic groundwater database focused on the EMF Site ROD-identified groundwater chemicals of concern (COCs) to develop a supplemental analytical parameter list for the 2Q2008 special event. The evaluation

was performed on groundwater data from FMC's monitoring wells (100-series and TW- wells), RI "off-site" wells (500-series wells), and Batiste Springs for all years through the second quarter 2007 from the FEDS database. This evaluation did not include any EPA, IDEQ or Shoshone-Bannock Tribes data from their collocated sampling as described in "Summary of FMC'S Post-Remedial Investigation (1995-2007) Groundwater Monitoring Programs and Supplemental Groundwater Sampling and Analysis Events," February 2008. FMC's evaluation of the groundwater parameters is summarized in the attached Table 1 Summary of FMC's Evaluation of Groundwater Chemicals of Concern.

The supplemental analytical parameters for the 2Q2008 event were selected based on a review of the findings of the RI and review of the cumulative database utilizing the following criteria:

1. The groundwater COC was detected above representative concentrations in monitoring wells located downgradient from FMC source areas (e.g. beryllium was not detected above representative concentrations in any FMC or 500-series well downgradient from FMC source areas, but was detected in Simplot well 318).
2. The groundwater COC was detected at concentrations greater than the Maximum Contaminant Limit (MCL) or EPA-calculated groundwater Risk-Based Concentration (RBC) in greater than 5% of the sample results and the detection limits for those COC results were routinely below the MCL/RBC.
3. The groundwater COC was detected at concentrations greater than the surface water comparative value (e.g., Water Quality Criteria) in greater than 5% of the sample results and the detection limits for those COC results were routinely below the comparative criteria.
4. The radiological parameters radium-226 and radium-228 were selected based on the second criteria above, and gross alpha is included to supplement the database particularly for wells upgradient and downgradient from the FMC Plant OU.
5. The groundwater parameter was not analyzed during the RI and has been subsequently detected above its comparative value in groundwater at the FMC Plant OU (elemental phosphorus at wells 108 and 122 and total cyanide at wells 131 and 168).
6. No groundwater data is available for total uranium for the FMC Plant OU and downgradient wells so it has been included to fill a perceived data gap.

Due to the size of Table 1, the results of the evaluation are presented on the far right-hand column entitled "Selected for 2Q2008 'Special' GW Monitoring" on pages 3 and 4 of Table 1.

Discussion during April 14, 2008 FMC-Agencies Teleconference

During the teleconference between FMC and the Agencies on April 14, 2008 to discuss comments on FMC's March 28, 2008 proposed 2Q2008 special groundwater monitoring event, EPA requested that FMC include one additional field parameter, four additional laboratory parameters (metals), and to include analysis for total phosphorus (rather than orthophosphate) for the 2Q08 event. A summary of the discussion and resolution of EPA's requested additional parameters follows:

Additional field parameter: EPA requested inclusion of ORP as a field parameter. EPA acknowledged that dissolved oxygen is appropriate as an indicator of oxidation conditions and stability of well-purge / formation water prior to sampling, but also requested ORP to provide additional information on reducing conditions for those wells where dissolved oxygen is low or undetectable. FMC agreed to include ORP as a field parameter for the 2Q08 event.

Additional laboratory parameters: EPA requested inclusion of four metals – beryllium, chromium, nickel and mercury – to the laboratory parameter list. FMC pointed out the results of its evaluation, as documented on Table 1, show that none of the groundwater results for beryllium and nickel exceeded the MCL or RBC in the FMC (100-series and TW- wells) and downgradient 500-series wells, and only 2 of over 1,200 (0.2%) results exceeded the MCL for chromium. As shown on EPA's evaluation of EMF groundwater results (documented in the file entitled "mls-GW-Screen with Eco.xls," "GW Screen Alpha" worksheet, dated 2/6/08 attached to K. Lynch, EPA electronic message dated 2/6/2008, subject: Fw: GW table w/ eco benchmarks), beryllium, chromium and nickel were significantly elevated in RI groundwater samples from well 318, downgradient from Simplot's former east overflow pond, but not in the other wells presented in the evaluation. Following the discussion, the Agencies did not further pursue inclusion of these parameters in the 2Q08 event.

FMC also pointed out its evaluation results for mercury show that less than 2% of over 900 results exceeded the MCL; that 8 of the 11 results which exceeded the MCL were from well 144 that is screened in weathered volcanic lithology and the mercury in well 144 is likely naturally occurring; and that no post-RI results (from 1997 – 2001) exceeded the MCL. EPA commented that the Tribes have raised concerns regarding some of the mercury data in the EMF RI being flagged by the laboratory and asked the Tribal representatives if their collocated groundwater results indicated different results than FMC's results and evaluation. The Tribal representative indicated that they would need to review their data before responding to EPA's question. Mercury as an analytical parameter for the 2Q2008 event was taken under advisement pending additional justification and/or Tribes' data review by EPA.

Following the April 14, 2008 conference call, FMC reviewed the Tribes collocated groundwater sample results for mercury from 2001, 2004, 2005 and 2006. The Tribes groundwater results were provided by EPA in an Excel spreadsheet following the

February 12 and 13, 2008 EMF meetings. Although the spreadsheet forwarded by EPA does not include any information with which to assess the quality, validity or usability of the Tribes data, on its face, the Tribes data does not contradict but rather supports FMC's results that demonstrate mercury is not an FMC-related COC in groundwater. The Tribes results from the EPA-forwarded spreadsheet are summarized as follows:

Year	Total # Samples	# Results > MCL (Value)	Well w/ Result > MCL	FMC Result for Primary Sample	Comment
2000	20	1 (0.0021 mg/l)	168	0.0002 **U**	FMC analyzed for the same parameter list as Tribes for the 2000 collocated samples; most Tribes mercury results were not detected or near detection limit, but there appear to be data quality issues with the Tribes 2000 mercury data.
2004	14	0	None	NA	Tribes data: 11/14 < 0.0001, 3/14 values = 0.0001.
2005	20	0	None	NA	Repeated same wells as 2000, Tribes' result for well 168 = 0.0002 **U,** overall Tribes data: 19/20 = 0.0002 **U**, 1/20 = 0.0002.
2006	8	0	None	NA	Tribes data: 8/8 < 0.0002.

Following the Working Group #4 (Simplot) topics during the teleconference on April 18, 2008, FMC asked if EPA had any further information to support its rationale to include mercury as a parameter for the 2Q2008 event. EPA did not present any new information but maintained the position that since mercury is identified as a groundwater COC in the 1998 ROD it should be included to provide "current" data and could not be eliminated from further consideration without "current" data. Rather than further argue the point, FMC agreed to include mercury as a laboratory parameter for the 2Q08 event.

Total phosphorus analysis: EPA questioned the detection limit for laboratory analysis for orthophosphate of 0.1 mg/l (Table 5-1a) and suggested that a lower detection limit would be preferable. Based on the fact that the Portnuef River TMDL is based on total phosphorus and Simplot's groundwater monitoring includes total phosphorus using method 365.2 with a detection limit of 0.01 mg/l but not orthophosphate analysis, EPA requested that FMC include total phosphorus analysis in the 2Q08 event for consistence with the TMDL and Simplot. FMC noted that total phosphorus and orthophosphate data have been comparable historically (i.e., analytical results show that total phosphorus is essentially all in the orthophosphate form in groundwater wells). Based on the discussion, FMC proposed to replace orthophosphate analysis with total phosphorus analysis and would contact its laboratory to confirm method and detection limit. FMC asked if the EPA RCRA program would take issue with the substitution with respect to the RCRA groundwater program wells for this quarter. EPA's RCRA program representative accepted the

substitution. FMC will include total phosphorus for the 2Q08 event using method 6020 with a detection limit of 0.019 mg/l as indicated on the attached addendum to the EMF RI Sampling and Analysis Plan (SAP) entitled "Addendum April 2008, Table 5-1a, III. Groundwater, Analytical Methods for 2Q2008 Groundwater Monitoring Event."

Analytical Parameters for the 2Q2008 Groundwater Monitoring Event

Based on FMC's evaluation, the Agencies review and comments on FMC's proposal and in conjunction with FMC's routine groundwater monitoring program, the analytical parameters for the 2Q2008 event will include:

Routine Analytical Parameters:			
Field parameters:	General Mineral:	Metals:	Additional Parameters:
Dissolved Oxygen pH Temperature Turbidity Specific Conductance	Ammonia Chloride Fluoride Nitrate Total phosphorus [1] Sulfate	Potassium Arsenic Selenium Cadmium (RCRA only)	Elemental phosphorus (Slag Pit Sump and Pond 8S only)

Special Analytical Parameters:			
Field parameters:	Metals:	Radionuclides:	Additional Parameters:
ORP	Antimony Boron Manganese Mercury Vanadium	Gross alpha Ra-226 Ra-228	Elemental phosphorus[2] Total cyanide Total uranium

Notes:
[1] Based on March 14, 2008 conference call between FMC and the Agencies, total phosphorus analysis will replace orthophosphate analysis for the 2Q2008 event including the routine RCRA and Calciner Pond groundwater monitoring programs.
[2] Elemental phosphorus will be included as a 2Q2008 special event analyte for the following wells: 110, 111, 146, TW-9S, 502, 517, TW-11S, TW-12S, and Batiste Spring.

The analytical parameters, analytical methods and detection limits for the 2Q2008 special groundwater monitoring event are provided in the attached addendum to the EMF RI SAP Table 5-1a.

Groundwater Monitoring Wells for the 2Q2008 Event

The routine FMC groundwater programs consist of a well network that includes upgradient wells to the west and south of potential FMC sources, FMC source area specific wells, downgradient wells from the FMC plant site to Batiste Spring and wells outside the northern extent of EMF-impacted groundwater. FMC evaluated the

groundwater monitoring well network associated with its routine monitoring programs and the monitoring wells that were installed during the RI and post-RI that are not currently included in one of the routine programs. Based on the evaluation, FMC is proposing to analyze samples from 25 (of 52 total) routine wells and an additional 14 monitoring wells for the special analytical parameter list during the 2Q2008 monitoring event. The 25 routine wells were selected to include upgradient wells and source area specific wells in the western ponds area, former process areas and calciner ponds / joint fenceline area. The additional 14 wells were selected to include additional wells upgradient of potential FMC source areas (background wells), “sentry” wells historically outside the northern limit of EMF groundwater impacts, and downgradient wells between the EMF plant sites and Batiste Spring that have not been sampled within the last several years. The routine program and additional special event wells are enumerated in Table 2 and shown on the attached Figure 1 Well Locations FMC2Q2008 Monitoring Event.

TABLE 2. FMC'S ROUTINE GROUNDWATER MONITORING AND ADDITIONAL WELLS FOR THE 2Q2008 "SPECIAL" GROUNDWATER MONITORING EVENT

Area	Well Numbers [1]	Up / Downgradient	Program [2]
Pond 18 (Cell A and Cell B)	**174, 175**	U	RCRA
	154, 176, 177, 178	D	RCRA
Pond 17	**173**	U	RCRA
	171, 172, 180	D	RCRA
Pond 16S	154	U	RCRA
	147,148, **149**	D	RCRA
Pond 15S	165	U	RCRA
	113, 115, 166	D	RCRA
Phase IV ponds	**167**	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 9E	124, 113	U	RCRA
	126, **127**, 128	D	RCRA
Pond 8E	**167**	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 8S	158, **183**	U	RCRA
	155, **156**, 157	D	RCRA
Slag Pit Sump	121	U	RCRA
	108, 122, 123	D	RCRA
Batiste Spring	**Batiste Spring**	D	RCRA
Calciner Ponds	**164, 161**, 142	U	IDEQ
	136, 143, 189, 190	D	IDEQ
Upgradient FMC Plant	**101, 102, 169**	U	CERCLA
Within FMC plant	**139, 134, 145**	D	CERCLA
Northern edge FMC plant	**111, 146, 110, 112, 523, 501**	D	CERCLA
Downgradient from FMC plant toward Batiste Spring	**TW-9S, 517, 502, TW-12S, TW-11S**	D	
Outside EMF impact [3] - northern perimeter	**515, 524, 525, 516**	Cross	CERCLA

[1] Wells in red-colored BOLD font are routine wells that will be analyzed for the 2Q2008 special analytical parameter list in addition to the routine parameter list. Wells in red-colored BOLD and UNDERLINE font are the 14 additional wells for the 2Q2008 special sampling event (both routine and special parameter list).
[2] Program: RCRA = RCRA groundwater monitoring plans, IDEQ = Calciner Pond groundwater monitoring plan, CERCLA = FMC continuation of monitoring at "key" CERCLA wells.
[3] Impact is in reference to detection of arsenic, nitrate or selenium above representative levels.

TABLE 1. SUMMARY OF FMC'S EVALUATION OF GROUNDWATER CHEMICALS OF CONCERN FROM RI AND POST-RI DATA FROM FMC 100-SERIES AND TW- WELLS, 500-SERIES WELLS AND BATISTE SPRING MONITORING LOCATIONS

Remedial Investigation ANALYTES	Basis for EPA approval to eliminate from CERCLA GW monitoring [a]	Current CERCLA Monitoring [b] ANALYTES	Current RCRA Monitoring [b] ANALYTES	Post-RI "Special" GW Event [c] ANALYTES	EPA 2008 Table [d] "Yellow or Red"	ROD Table 14 GW COPCs	ROD Table 36 GW COCs	ROD GW COCs MCL or RBC [e]
COMMON IONS								
Alkalinity, bicarbonate	K and SO4 better indicators			1998, 2002				
Calcium	K and SO4 better indicators			1998, 2002				
Chloride	K and SO4 better indicators	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Magnesium	K and SO4 better indicators			1998, 2002				
Potassium	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Sodium	K and SO4 better indicators			1998, 2002				
Sulfate	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
PHYSICAL PARAMETERS								
Spec.Conductivity	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
pH	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Temperature	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Total Dissolved Solids	K and SO4 better indicators			1997, 1998				
Redox	Results consistent, no longer needed			1998				
NUTRIENTS AND FLUORIDE								
Ammonia (NH3 as N)	Limited areas, correlated w/ NO3	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Nitrate (NO3 as N)	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**	**X**	**X**	**X**	**10**
Orthophosphate (PO4 as P)	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**				
Phosphorous (Total P)	PO4 correlated w/ TP		**RETAINED (8S and SPS)**	1998, 2002	**X**			
Fluoride	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**	**X**	**X**	**X**	**4**
METALS								
Aluminum	Correlated to turbidity not site sources			1998, 2000, 2001				
Antimony	No samples > representative levels			1997, 2000, 2001	**X**		X	0.006
Arsenic	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**	**X**	**X**	**X**	**0.01**
Barium	Sporatic detects > rep levels, highest detects in unimpacted wells			1997, 1998, 2000, 2001, 2002				
Beryllium	No samples > representative levels (except well 318 and once each at wells 311, PEI-3 and PEI-5)			1997	**X**	X	X	0.004
Boron	Detected within the same areas as detects for As and Se [retained] but less frequently than As and Se, no MCL			1998, 2000, 2001, 2002			X	1.36
Cadmium	Sporatic detects > rep levels and at only 2 or 3 wells that are within broader area of impact		**RETAINED**	Added for CERCLA wells 2000, 2001, 2002, 2003	**X**		X	0.005
Chromium	Sporatic detects > rep levels and at only 2 or 3 wells that are within broader area of impact			1997, 1998, 2000, 2001, 2002, 2003	**X (well 318 only)**		X	0.1
Cobalt	Less frequent detects but within same areas as detects for As and Se [retained], no MCL			1997, 1998, 2001				
Copper	Sporatic detects > rep levels			1997, 2000, 2001				
Iron	Correlated to turbidity not site sources			1998				
Lead	No samples > representative levels			1997, 1998, 2000, 2001, 2003		X		
Lithium	Less frequent detects but within same areas as detects for As and Se [retained], no MCL			1998, 2000, 2001, 2002				
Manganese	**RETAINED**			1998, 2001, 2002		X	X	0.077
Mercury	Sporatic detects (less than 3% of results) > rep levels, correlated to volcanic lithology (well 144)			1997, 1998, 2000, 2001	**X**	X	X	0.002
Molybdenum	No samples > representative levels			2000, 2001				
Nickel	Less frequent detects but within same areas as detects for As and Se [retained], no MCL			1997, 1998, 2000, 2001, 2003		X	X	0.1
Selenium	**RETAINED**	**RETAINED**	**RETAINED**	**NA - routine analyte**	**X**	**X**	**X**	**0.05**
Silver	No samples > representative levels			1997, 1998, 2000, 2001, 2003				
Thallium	No samples (except well 318) > representative levels			1997, 2000, 2001	**X**		X	0.002
Vanadium	Less frequent detects but within same areas as detects for As and Se [retained], no MCL			1997, 2000, 2001		X	X	0.108
Zinc	No samples (except well 318) > representative levels			1997, 2000, 2001, 2003		X	X	3.92

TABLE 1. SUMMARY OF FMC'S EVALUATION OF GROUNDWATER CHEMICALS OF CONCERN FROM RI AND POST-RI DATA FROM FMC 100-SERIES AND TW- WELLS, 500-SERIES WELLS AND BATISTE SPRING MONITORING LOCATIONS

Remedial Investigation ANALYTES	Basis for EPA approval to eliminate from CERCLA GW monitoring [a]	Current CERCLA Monitoring [b] ANALYTES	Current RCRA Monitoring [b] ANALYTES	Post-RI "Special" GW Event [c] ANALYTES	EPA 2008 Table [d] "Yellow or Red"	ROD Table 14 GW COPCs	ROD Table 36 GW COCs	ROD GW COCs MCL or RBC [e]
RADIOLOGICAL			EPA agreed to eliminate from RCRA					
Gross alpha	**RETAINED**			1998, 2000, 2001	**X**	X	X	15 PCi/l
Gross beta	Correlated to K-40/K natural ratio			1998, 2000, 2001		X	X	4 mrem/year
Radium-226	83 to 98% samples < MDA			1998, 2000, 2001	**X**	X	X	
Radium-228	75 to 82% samples < MDA			1998, 2000, 2001	**X**	X	X	5 PCi/l combined
Speciated Rad Study			Not in RCRA Monitoring					
Lead-210	No samples detected > MDA						X	Individual radionuclides responsible for gross alpha and gross beta - no MCL or RBCs established for these radionuclides
Polonium-210	No samples detected > MDA					X	X	
Potassium-40	Correlated to K-40/K natural ratio					X	X	
Thorium-230	No samples detected > MDA					X	X	
Thorium-232	No samples detected > MDA							
Uranium 233/234	Correlated to volcanic lithology					X	X	
Uranium 238 (alpha)	Correlated to volcanic lithology					X	X	
ORGANICS								
Volatile Organics	Low level detects of few parameters not temporaly or spatially consistent, probably lab artifacts			1997, 2003, 2005		TCE	TCE	0.005
						PCE	PCE	0.005
Semi-volatile Organics	Low level detects of few parameters not temporaly or spatially consistent, probably lab artifacts			1997, 1998, 2003, 2005				
Non-RI Analytes								
Elemental Phosphorus	No EPA method during RI		**ADDED after 1998 (8S and SPS)**	1998 (Initial sampling/analysis)				0.00073 [h]
Total Cyanide	Not required per RI Workplan			1997, 2000, 2001, 2003				0.2
Cesium-137	Not required per RI Workplan			2000, 2001				
Uranium	Not required per RI Workplan				**X**			0.03

TABLE 1. SUMMARY OF FMC'S EVALUATION OF GROUNDWATER CHEMICALS OF CONCERN FROM RI AND POST-RI DATA FROM FMC 100-SERIES AND TW- WELLS, 500-SERIES WELLS AND BATISTE SPRING MONITORING LOCATIONS

Remedial Investigation ANALYTES	Number of Results for GW COCs	Average Detection Limit GW COCs [f]	Number of Results > MCL or RBC GW COCs	Percentage Results >MCL or RBC	Wells with Results > MCL or RBC GW COCs	Period of Data > MCL or RBC GW COCs	Period of Data for GW Results Evaluated		Surface Water Comparative Value [g]	Is SurfaceWater Criteria < GW MCL or RBC	Number of Results > Comparative Value	Percent Results > Comparative Value	Selected for 2Q2008 "Special" GW Monitoring
COMMON IONS													
Alkalinity, bicarbonate													No
Calcium													No
Chloride													**Yes (Routine)**
Magnesium													No
Potassium													**Yes (Routine)**
Sodium													No
Sulfate													**Yes (Routine)**
PHYSICAL PARAMETERS													
Spec.Conductivity													**Yes (Routine)**
pH													**Yes (Routine)**
Temperature													**Yes (Routine)**
Total Dissolved Solids													No
Redox													No
NUTRIENTS AND FLUORIDE													
Ammonia (NH3 as N)													**Yes (Routine)**
Nitrate (NO3 as N)	**3,192**	**0.33**	**536**	**16.8%**	**Refer to RI Figure 4.4-22**	**1Q1990 - 2Q2007**	**1Q1990**	**2Q2007**	**0.3 [i]**	**Y**	**2,812**	**88.1%**	**Yes (Routine)**
Orthophosphate (PO4 as P)													**Yes (Routine)**
Phosphorous (Total P)													No
Fluoride	**2,715**	**0.33**	**180**	**6.6%**	**Refer to RI Figure 4.4-24**	**1Q1990 - 2Q2007**	**1Q1990**	**2Q2007**	**7 [j]**	**N**	**NA**	**NA**	**Yes (Routine)**
METALS													
Aluminum													No
Antimony	845	0.0567	12	1.4%	107, 124, 128, 137, 145, 147, 154, 503, 504	2Q1992 - 1Q1995	2Q1992	4Q2001	0.03 [k]	N	NA	NA	**Yes [r]**
Arsenic	**3,875**	**0.0078**	**2,619**	**67.6%**	**Refer to RI Figure 4.4-14**	**1Q1990 - 2Q2007**	**1Q1990**	**2Q2007**	**0.15 [l]**	**N**	**NA**	**NA**	**Yes (Routine)**
Barium													No
Beryllium	765	0.0011	0	0.0%	None	NA	4Q1990	4Q1997	0.00053 [m]	Y	11	1.4%	No
Boron	875	0.2203	161	18.4%	150, 152, 155, 156, 157, 115, 131, 132, 168, 104, 159, 114, 143, 140, 141, 116, 134	3Q1992 - 4Q2001	3Q1992	4Q2001	0.0016 [n]	Y	707	80.8%	**Yes [s]**
Cadmium	3,063	0.0012	10	0.3%	136, 143, 151, TW-12S	2Q1992 - 4Q1997	4Q1990	2Q2007	0.00046 [o]	Y	60	2.0%	**Yes (Routine RCRA only)**
Chromium	1,229	0.0046	2	0.2%	158	3Q1993	4Q1990	2Q2003	0.16 [o]	N	NA	NA	No
Cobalt													No
Copper													No
Iron													No
Lead													No
Lithium													No
Manganese	1,334	0.0043	546	40.9%	Refer to RI Figure 4.4-19	4Q1990 - 2Q2002	4Q1990	2Q2002	No CV	NA	NA	NA	**Yes [s]**
Mercury	922	0.0002	11	1.2%	121, 144 (8 of 11 results > MCL), TW-2S, TW-5S, 506	3Q1991 - 3Q1994	1Q1991	4Q2001	0.00077 [l]	Y	21	2.3%	No
Molybdenum													No
Nickel	871	0.0154	0	0.0%	None	NA	4Q1990	2Q2003	0.11 [o]	N	NA	NA	No
Selenium	**3,835**	**0.0070**	**186**	**4.9%**	**Refer to RI Figure 4.4-20**	**4Q1990 - 2Q2007**	**4Q1990**	**2Q2007**	**0.005 [l]**	**Y**	**1106**	**28.8%**	**Yes (Routine)**
Silver													No
Thallium	845	0.0037	16	1.9%	108, 121, 123, 131, 135, 139, 147, 150, 152, 156, 510	2Q1992 - 3Q2000	2Q1992	4Q2001	0.004 [m]	N	NA	NA	No
Vanadium	1,139	0.0167	33	2.9%	123 (25 of 33 results > RBC), 143, TW-2I, TW-2S, TW-9S	4Q1990 - 4Q2001 (Well 123) 2Q1991-4Q1997 (other wells)	4Q1990	4Q2001	0.012 [m]	Y	192	16.9%	**Yes [t]**
Zinc	1,159	0.0210	0	0.0%	None	NA	4Q1990	2Q2003	0.26 [o]	Y	0	0%	No

TABLE 1. SUMMARY OF FMC'S EVALUATION OF GROUNDWATER CHEMICALS OF CONCERN FROM RI AND POST-RI DATA FROM FMC 100-SERIES AND TW- WELLS, 500-SERIES WELLS AND BATISTE SPRING MONITORING LOCATIONS

Remedial Investigation ANALYTES	Number of Results for GW COCs	Average Detection Limit GW COCs [f]	Number of Results > MCL or RBC GW COCs	Percentage Results >MCL or RBC	Wells with Results > MCL or RBC GW COCs	Period of Data > MCL or RBC GW COCs	Period of Data for GW Results Evaluated	Surface Water Comparative Value [g]	Is SurfaceWater Criteria < GW MCL or RBC	Number of Results > Comparative Value	Percent Results > Comparative Value	Selected for 2Q2008 "Special" GW Monitoring
RADIOLOGICAL												
Gross alpha	816		27	3.3%	110, 111, 108, 117, 122, 140, 150, 152, 142, 146, 161, TW-12S, 515, 521	2Q1992 - 4Q1994	1Q1990 3Q2000	No CV	NA	NA	NA	**Yes [u]**
Gross beta	765		0	0.0%		NA	1Q1990 3Q2000	No CV	NA	NA	NA	No
Radium-226	622		32	5.1%	TW-10S, 128, 119, 144, 122, 110, 146, TW-12S, 154, 102, 127, TW-3D, 135, 139, 103, 112, 159, 107, 116, 118, 106, TW-11I, 136, 508, 511, 513, 517, Batiste Spring	3Q1992 - 1Q1994	3Q1992 3Q2000	No CV	NA	NA	NA	**Yes**
Radium-228	623							No CV	NA	NA	NA	**Yes [s]**
Speciated Rad Study												
Lead-210								NA	NA	NA	NA	No
Polonium-210								NA	NA	NA	NA	No
Potassium-40								NA	NA	NA	NA	No
Thorium-230								NA	NA	NA	NA	No
Thorium-232								NA	NA	NA	NA	No
Uranium 233/234								NA	NA	NA	NA	No
Uranium 238 (alpha)								NA	NA	NA	NA	No
ORGANICS												
Volatile Organics	TCE 127	0.0048	5	3.9%	121	3Q1992 - 2Q1993	3Q1992 2Q2005	0.047 [p]	N	NA	NA	No
	PCE 127	0.0048	1	0.8%	111 (3Q1992 sample only)	3Q1992	3Q1992 2Q2005	0.045 [p]	N	NA	NA	No
Semi-volatile Organics												No
Non-RI Analytes												
Elemental Phosphorus	236	0.0004	36	15.3%	108, 122, 123 (4Q2003 only)	1Q1998 - 2Q2007	1Q1998 2Q2007	0.0001 [n]	Y	NC [q]	NC	**Yes [v]**
Total Cyanide	51	0.01	4	7.8%	131, 168	3Q2000 - 4Q2001	4Q1997 2Q2003	0.0052 [l]	Y	NC	NC	**Yes [v]**
Cesium-137												No
Uranium	0	NA	NA	NC				0.0026 [k]	Y	NC	NC	**Yes [w]**

NOTES:
[a] Details are provided in the Remedial Investigation Report for the Eastern Michaud Flats Site, Bechtel Environmental, Inc., [Final RI Report] August 1996.
[b] Current FMC groundwater monitoring program analytical lists as of 4th quarter 2007.
[c] The FMC special groundwater monitoring events are detailed in “Summary of FMC’S Post-Remedial Investigation (1995-2007) Groundwater Monitoring Programs and Supplemental Groundwater Sampling and Analysis Events,” February 2008.
[d] File entitled "mls-GW-Screen with Eco.xls," "GW Screen Alpha" worksheet, dated 2/6/08 attached to K. Lynch, EPA electronic message dated 2/6/2008, subject: Fw: GW table w/ eco benchmarks.
[e] EMF ROD Maximum Contaminant Level (MCL) or Risk-Based Concentration (RBC) from ROD Table 36, except Arsenic MCL is current 2008 MCL. All values in mg/l except as otherwise indicated.
[f] All values in mg/l except as otherwise indicated.
[g] All values in mg/l except as otherwise indicated, see additional notes for source of comparative value.
[h] 2004 EPA Region IX Preliminary Remediation Goal (PRG) for tap water.
[i] Value is IDEQ Portnuef River TMDL target for Total inorganic Nitrogen.
[j] Value is derived from Camargo fluoride paper, provided to FMC by EPA at the EMF meetings on February 12 and 13, 2008, and assuming the average water hardness at Batiste Spring of 250 mg/L.
[k] Tier II Secondary Chronic Value (SCV) surface water screening benchmark from Oak Ridge National Laboratory's Risk Assessment Information System (RAIS).
[l] EPA National Ambient Water Quality Criteria CCC.
[m] EPA Region IV chronic surface water screening benchmark from RAIS.
[n] EPA Region VI freshwater screening benchmark from RAIS.
[o] EPA National Ambient Water Quality Criteria CCC for hardness-dependent parameter calculated for Batiste Spring average hardness of 250 mg/l.
[p] EPA Region V Ecological Screening Level (ESL) for surface water from RAIS.
[q] NC means Not Calculated
[r] Selected due to COC detection limit not routinely less than MCL or RBC.
[s] Selected due to COC detected greater than MCL or RBC in greater than 5-percent of results.
[t] Selected due to COC detected greater than surface water CV in greater than 5-percent of results.
[u] Gross alpha selected to supplement the database for wells upgradient and downgradient from the FMC Plant OU.
[v] Selected because the groundwater parameter was not analyzed during the RI and has been subsequently detected above its comparative value in groundwater at the FMC Plant OU.
[w] Selected because no groundwater data is available for total uranium for the FMC Plant OU and downgradient wells.

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Addendum (April 2008)
Table 3-4a
Groundwater Sampling Locations 2Q2008 Event

Location	Well Numbers [a]
FMC Facility	101, 102, 108, 110, 111, 112, 122, 123, 127, 134, 136, 139, 143, 145, 146, 147, 149, 156, 161, 164, 167, 169, 173, 174, 175, 183, 189
Outside FMC Facility Boundary	501, 502, 515, 516, 517, 523, 524, 525, TW-9S, TW-11S, TW-12S
Batiste Spring	Batiste Spring

[a] Elemental phosphorus will be included as a 2Q2008 special event analyte for the following wells: 110, 111, 146, TW-9S, 502, 517, TW-11S, TW-12S, and Batiste Spring.

Follows A-16

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Addendum (April 2008)
Table 3-5a
Summary of Groundwater Sampling and Analyses for 2Q2008 Event

Type of Analysis	Number of Primary Analyses [a, b]
Field Analyses	
pH	39
Temperature	39
Specific Conductance	39
Turbidity	39
Dissolved Oxygen	39
ORP	39
Laboratory Radiological Analyses	
Gross Alpha	39 [c]
Radium-226	39 [c]
Radium-228	39 [c]
Laboratory Chemical Analyses	
Metals	39 [c]
Water Quality Parameters	39 [c]
Total Cyanide	39 [c]
Elemental Phosphorus	9 [c, d]
Total Uranium	39 [c]

[a] Number of primary analyses, QC samples not included.

[b] Field QC samples will be collected at a rate of 1 per 20 primary samples or 1 per sample delivery group (SDG) whichever number of primary samples is less.

[c] Field QC samples to be collected include duplicate, MS/MSD and rinseate blank samples.

[d] Elemental phosphorus will be included as a 2Q2008 special event analyte for the following wells: 110, 111, 146, TW-9S, 502, 517, TW-11S, TW-12S, and Batiste Spring.

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Addendum (April 2008)
Table 5-1a, III. GROUNDWATER
Analytical Methods for 2Q2008 Groundwater Monitoring Event

Parameter	Method	Detection Limit	Units
Routine Analytes			
General WQP			
Ammonia	EPA 350.3	0.2	mg/l
Chloride	EPA 300.0	1	mg/l
Fluoride	EPA 300.0	0.1	mg/l
Nitrate	EPA 300.0	0.1	mg/l
Total Phosphorus	SW6020	0.019	mg/l
Sulfate	EPA 300.0	1	mg/l
Metals			
Arsenic	SW6020	0.0019	mg/l
Cadmium (RCRA wells only)	SW6020	0.0005	mg/l
Potassium	SW6020	0.1	mg/l
Selenium	SW6020	0.00048	mg/l
2Q2008 Special Parameters			
Metals			
Antimony	SW6020	0.00068	mg/l
Boron	SW6020	0.018	mg/l
Manganese	SW6020	0.0006	mg/l
Mercury	SW7470A	0.0002	mg/l
Vanadium	SW6020	0.0021	mg/l
Radionuclides			
Gross alpha	EPA 900	3	pCi/l
Radium 226	EPA 903	1	pCi/l
Radium 228	EPA 904 mod	1	pCi/l
OTHER			
Total Cyanide	EPA 335.4	0.01	mg/l
Total Uranium	SW6020	0.001	mg/l
Elemental Phosphorus	SW7580	0.00008	mg/l

Follows Page A-36

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Addendum (April 2008)
Table 5-5a, III. GROUNDWATER

Analytical Parameters for 2Q2008 Groundwater Monitoring Event

Parameter
Routine Analytes
General WQP
Ammonia
Chloride
Fluoride
Nitrate
Total Phosphorus
Sulfate
Metals
Arsenic
Cadmium (RCRA wells only)
Potassium
Selenium
2Q2008 Special Parameters
Metals
Antimony
Boron
Manganese
Mercury
Vanadium
Radionuclides
Gross alpha
Radium 226
Radium 228
OTHER
Total Cyanide
Total Uranium
Elemental Phosphorus [a]

[a] Elemental phosphorus will be included as a 2Q2008 special event analyte for the following wells: 110, 111, 146, TW-9S, 502, 517, TW-11S, TW-12S, and Batiste Spring.

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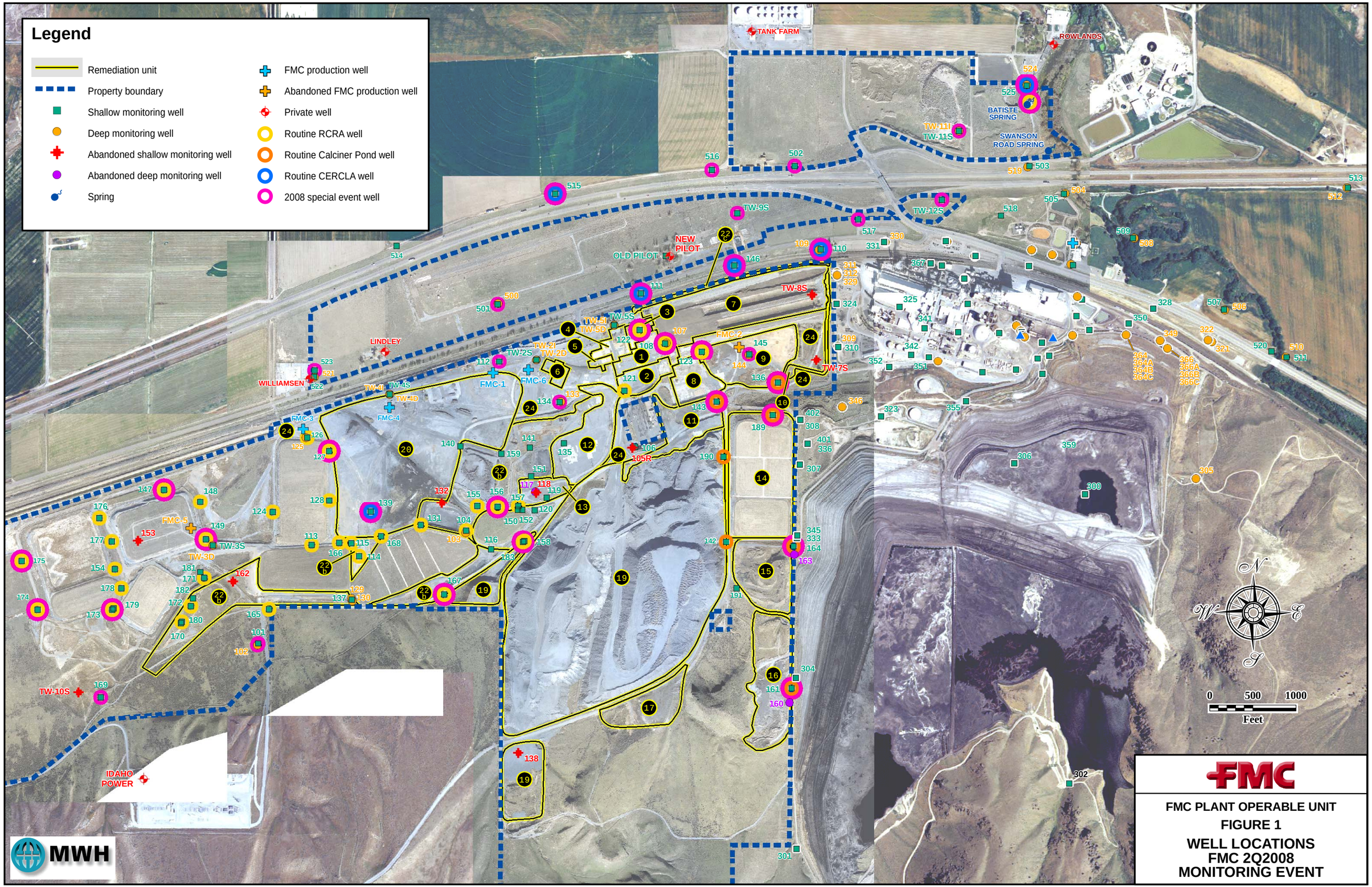
Addendum (April 2008)
Table 7-1a, III. GROUNDWATER
Sample Containers, Preservatives and Holding Times
for 2Q2008 Groundwater Monitoring Event

Parameter	Container	Preservative	Holding Time
Routine Analytes			
General WQP			
Ammonia	Polyethylene	H2SO4 to pH < 2; cool to 4°C	28 days
Chloride	Polyethylene	None	28 days
Fluoride	Polyethylene	None	28 days
Nitrate	Polyethylene	Cool to 4°C	48 hours
Total Phosphorus	Polyethylene	HNO3 to pH < 2; cool to 4°C	28 days
Sulfate	Polyethylene	Cool to 4°C	28 days
Metals			
Arsenic	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Cadmium (RCRA wells only)	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Potassium	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Selenium	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
2Q2008 Special Parameters			
Metals			
Antimony	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Boron	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Manganese	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Mercury	Polyethylene	HNO3 to pH < 2; cool to 4°C	28 days
Vanadium	Polyethylene	HNO3 to pH < 2; cool to 4°C	6 months
Radionuclides			
Gross alpha	Polyethylene	HNO3 to pH < 2	6 months
Radium 226	Polyethylene	HNO3 to pH < 2	6 months
Radium 228	Polyethylene	HNO3 to pH < 2	6 months
OTHER			
Total Cyanide	Polyethylene	NaOH to pH > 12; cool to 4°C	14 days
Total Uranium	Polyethylene	HNO3 to pH < 2	6 months
Elemental Phosphorus	Amber glass, PTFE-lined cap	Cool to 4°C	Extracted: 5 days Analyzed: 30 days

Follows Page A-20



FILE Fig 1_FMC_WellLocations_2008Monitoring_3_27_08.mxd 3/28/08

ATTACHMENT A

INTERIM CERCLA GROUNDWATER MONITORING

FIELD SAMPLING PLAN

Appendix G Interim CERCLA GW Monitoring Plan.pdf

INTERIM CERCLA GROUNDWATER MONITORING FIELD SAMPLING PLAN

Prepared for:

FMC Idaho, LLC

Pocatello, Idaho

March 2010

Appendix G Interim CERCLA GW Monitoring Plan.pdf

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INTERIM CERCLA GROUNDWATER MONITORING FIELD SAMPLING PLAN

1.0 INTRODUCTION

1.1 BACKGROUND

This Field Sampling Plan (FSP) provides sampling and analysis procedures for groundwater samples collected under the Interim CERCLA Groundwater Monitoring Program at the FMC Idaho, LLC (FMC) property in Pocatello, Idaho. The FSP has been prepared as Attachment A to the Interim CERCLA Groundwater Monitoring Plan (GMP).

The FSP contains procedures for sample collection, labeling, storage, shipment, chain-of-custody protocols, and quality assurance/quality control (QA/QC). The plan also specifies the analytical parameters, test methods, and threshold concentrations. Implementation of these procedures will also ensure that sampling equipment and supplies have been properly decontaminated.

1.2 PREVIOUS RESULTS

In accordance with the Eastern Michaud Flats Superfund Site remedial investigation and FMC's subsequent voluntary CERCLA groundwater quality monitoring program, the monitoring wells associated with this monitoring program have been sampled at a quarterly to semi-annual frequency over a period of up to 17 years. A summary of the groundwater quality, primarily based on average results from 2006 to 2008, at the interim CERCLA program wells is presented in Table A-1. Additional review of recent groundwater quality data is presented in Section 2.2 of the GMP. A detailed description of groundwater quality at the site is presented in the Groundwater Current Conditions Report (GWCCR) for the FMC Plant OU (FMC, June 2009).

TABLE A-1. SUMMARY OF GROUNDWATER QUALITY AT THE INTERIM CERCLA GROUNDWATER MONITORING PROGRAM WELLS

Parameters	**134**	**139**	**145**	**159**	**110**	**111**	**146**	**523**
Field Measurements								
pH (Field)	6.73	6.92	5.44	6.87	6.86	7.1	7.11	7.38
SC (UMHOS/CM)	2805	4643	5600	2180	1429	1513	1294	893
Turbidity (NTU)	1.2	0.45	4.5	.9	0.4	0.5	0.35	0.2
Water Temperature (°C)	16.9	12.8	15.3	16.8	17.1	14.8	16.9	13.4
General WQP (mg/L)								
Potassium	153	38.5	37.7	36.9	25.4	49.5	46.3	8.49
Sulfate	325	1051	2400	166	215	157	128	59.6
Chloride	287	886	154	210	89.8	170	132	108
Fluoride	0.2	0.583	0.5	NA	0.435	0.105	0.378	0.5
Ammonia	0.5	0.175	2.5	1.9	0.15	0.15	0.15	0.2
Nitrate	21.2	35.5	4.5	<0.1	3.8	8.98	6.13	4.5
Orthophosphate/ Total P	19.80	0.74	57.3	14.1	3.09	3.95	1.33	0.30
Metals (mg/L)								
Arsenic	0.098	0.039	0.298	0.093	0.048	0.024	0.029	0.004
Selenium	0.05	0.038	0.061	<0.005	0.029	0.005	0.003	0.003

NA means parameter not analyzed.

Results are average for four sampling events (4Q06 to 2Q08) except for well 145 and 159 that are results for May 2008 and November 2001, respectively, due to the lack of sufficient data points to calculate a current average value for these wells.

Non-detect results were included as equal to the detection limit for calculation of averages.

TABLE A-1 (CONTINUED). SUMMARY OF GROUNDWATER QUALITY AT THE INTERIM CERCLA GROUNDWATER MONITORING PROGRAM WELLS

Parameters	TW-9S	502	517	TW-12S	515	TW-11S	524	525
Field Measurements								
pH (Field)	7.06	7.28	6.93	6.5	7.37	7.18	7.55	7.52
SC (UMHOS/CM)	1842	1036	2575	1125	1260	845	517	524
Turbidity (NTU)	8	0.2	0.3	8.5	0.475	9.5	0.325	0.35
Water Temperature (°C)	14.4	12.6	15.9	14.4	13.3	12.4	12.4	12.1
General WQP (mg/L)								
Potassium	58.4	5.4	100	15.7	8.85	3.8	4.21	4.15
Sulfate	161	64.9	189	132	132	49.7	42.9	44.6
Chloride	187	44.3	198	46.2	197	19.9	18.5	19.2
Fluoride	0.1	0.9	0.6	1.1	0.683	0.8	0.675	0.718
Ammonia	0.2	>0.2	0.2	0.7	0.15	<0.2	0.15	0.133
Nitrate	9.95	1.6	11.1	6.1	2.75	1.6	1.88	1.95
Orthophosphate/ Total P	3.21	<0.5	0.92	16.90	0.20	<0.5	0.20	0.25
Metals (mg/L)								
Arsenic	0.027	0.003	0.047	0.017	0.005	0.002	0.004	0.006
Selenium	0.005	>0.005	0.014	0.006	0.003	<0.005	0.005	0.005

Results are average for four sampling events (4Q06 to 2Q08) except for wells 502, 517 and TW-11S that are results for May 2008 only due to the lack of sufficient data points to calculate a current average value for these wells.

Non-detect results were included as equal to the detection limit for calculation of averages.

2.0 SAMPLING OBJECTIVES

The objectives of sampling monitoring wells associated with the Interim CERCLA Groundwater Monitoring Program are to:

- Collect samples representative of groundwater flowing beneath the FMC Plant OU.
- Generate data (field measurements and laboratory analytical results) that meets data quality objectives.
- In conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs, evaluate potential changes and/or trends in groundwater conditions on an OU-wide basis.

3.0 SAMPLING LOCATIONS AND FREQUENCY

The interim CERCLA program monitoring well locations are shown in Figure A-1. Table A-2 presents a summary of well construction details. Well construction logs appear in Appendix A-A of this FSP.

3.1 GROUNDWATER MONITORING WELL SAMPLES

Groundwater monitoring well samples will be collected semi-annually from each of the interim CERCLA program wells in accordance with the procedures specified in Section 5. Consistent with prior practice, the semi-annual CERCLA groundwater monitoring events will typically be performed during May and November each year. All of these wells will typically be sampled within a one week period during each sampling event. Each sample will then be submitted to the laboratory in accordance with the procedures specified in Section 6. As described in the GMP and specified in Section 6, in addition to the routine semi-annual groundwater monitoring events, groundwater monitoring for an expanded laboratory parameter list will be performed every five years during the second quarter monitoring event, beginning with the second quarter 2012 [2Q12] monitoring event.

3.2 FIELD DUPLICATE GROUNDWATER MONITORING WELL SAMPLES

Field duplicate groundwater samples will be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well designated for a field duplicate sample will be randomly selected during each monitoring event from one of the sixteen interim CERCLA program monitoring wells.

3.3 MATRIX SPIKE / MATRIX SPIKE DUPLICATE QUALITY CONTROL SAMPLES

Matrix spike / matrix spike duplicate (MS/MSD) quality control samples will also be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well designated for a MS/MSD quality control sample will be randomly selected during each monitoring event from one of the sixteen interim CERCLA program monitoring wells.

3.4 FIELD BLANK QUALITY CONTROL SAMPLES

During each CERCLA monitoring event, field blank samples will be collected as follows:

Rinsate blank - Rinsate blanks are collected by pumping purified (distilled or deionized) water through the submersible pump setup to evaluate the effectiveness of field decontamination of sampling equipment. The blank is analyzed for the same analytical parameters as the groundwater samples. Rinsate blanks will be collected after decontamination and at a minimum frequency of one per sample delivery group or one per twenty samples collected.

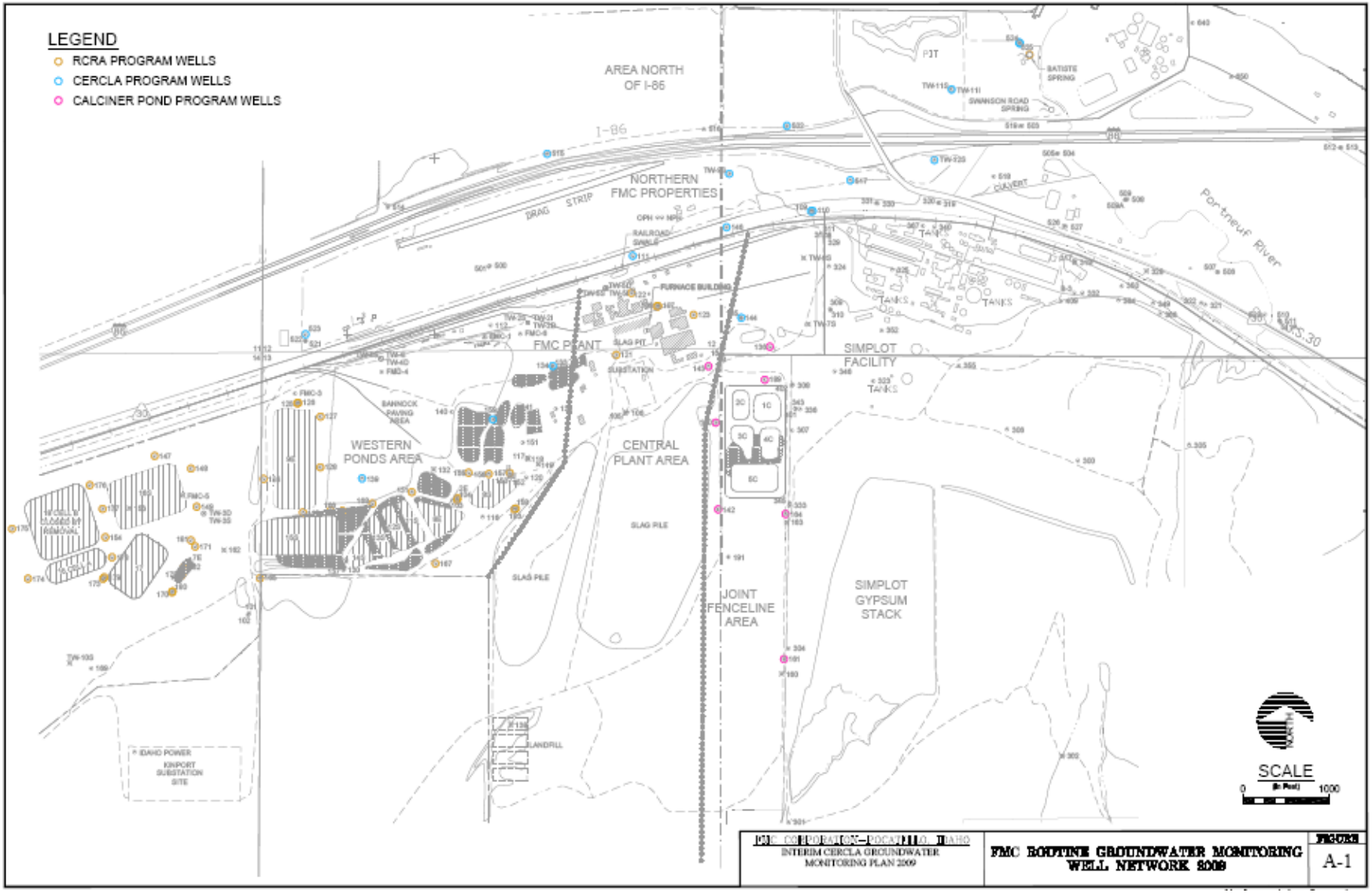
Distilled or De-ionized water blank – Distilled or de-ionized water blanks are aliquots of water collected directly from the field supply container and analyzed to determine distilled or de-ionized water quality. The blanks are collected at a frequency of one per sampling event in

conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs (i.e., one distilled or de-ionized water blank per sampling event concurrently satisfies requirement for all three monitoring programs).

TABLE A-2. WELL CONSTRUCTION SUMMARY AND MAY 2008 WATER LEVELS

WELL	Easting	Northing	"Top of Casing" Measuring Point Elevation *	Top of Screen Elevation*	Bottom of Screen Elevation*	Well Bottom Elevation*	Borehole Total Depth Elevation*	Depth to Water May 2008	Water Elevation May 2008
110	558378.9	453398.7	4450.57	4364.30	4354.30	4351.80	4347.80	66.27	4384.30
111	556296.9	452890.2	4468.04	4374.00	4364.60	4361.80	4356.30	76.37	4391.67
134	555354.2	451636.8	4478.93	4374.50	4365.00	4362.20	4361.00	85.18	4393.75
139	553167	450368.1	4467.66	4377.90	4373.70	4370.30	4303.30	72.90	4394.76
145	557552.3	452188.7	4478.26	4347.00	4337.00	4334.50	4327.00	86.97	4391.29
146	557382.2	453214.1	4459.30	4367.90	4352.90	4350.40	4349.40	70.24	4389.06
159	554680.1	451036	4491.79	4381.30	4371.30	4368.30	4364.00	97.30	4394.49
502	558079.5	454363.3	4441.30	4375.10	4370.10	4367.30	4365.30	57.06	4384.24
515	555307.3	454045.1	4450.35	4379.10	4369.10	4366.10	4364.30	58.32	4392.03
517	558812.8	453747	4444.45	4377.10	4367.10	4364.10	4363.00	60.34	4384.11
523	552513.7	452001.4	4452.98	4375.80	4365.80	4365.30	4360.80	58.46	4394.52
524	560768	455307	4399.92	4348.90	4338.90	4338.40	4275.40	17.06	4382.86
525	560772.1	455296.9	4399.61	4379.30	4369.30	4368.80	4368.60	16.72	4382.89
TW-11S	559985	454775	4426.24	4377.00	4367.00	4367.00	4367.00	42.37	4383.87
TW-12S	559785	453975	4436.28	4381.00	4373.00	4373.00	4373.00	52.19	4384.09
TW-9S	557413.1	453819.7	4450.23	4373.00	4369.00	4369.00	4269.00	64.90	4385.33

* - Elevations are in Feet Above Mean Sea Level


LEGEND
RCRA PROGRAM WELLS
CERCLA PROGRAM WELLS
CALCINER POND PROGRAM WELLS
AREA NORTH OF I-86
I-86
NORTHERN FMC PROPERTIES
DRAG STRIP
FMC PLANT
WESTERN PONDS AREA
CENTRAL PLANT AREA
SLAG PILE
JOINT FENCELINE AREA
SIMPLOT FACILITY
TANKS
SIMPLOT GYPSUM STACK
Portneuf River
SCALE
0
1000
FMC CORPORATION–POCATELLO, IDAHO
INTERIM CERCLA GROUNDWATER MONITORING PLAN 2009
FMC ROUTINE GROUNDWATER MONITORING WELL NETWORK 2009
FIGURE
A-1

4.0 SAMPLE DESIGNATION

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique ID numbers. At a minimum, the sample labels will contain the following information:

- Facility name.
- Sample number.
- Date of collection.
- Time of collection.
- Analytical parameter.
- Method of preservation.

Each sample will be assigned a unique sample number. The same unique number will be used to identify all containers associated with that sample. The sample coding convention used for the Interim CERCLA monitoring program (which is also consistent with the RCRA, and Calciner Pond Remedial Action groundwater programs sample coding) is described in Section 5.1.1 below.

5.0 SAMPLING EQUIPMENT AND PROCEDURES

This section describes the procedures to be used to collect groundwater samples. All samples will be collected in accordance with the procedures presented in this section and handled in accordance with the procedures presented in Section 6.

5.1 FIELD LOGBOOKS

Field logbooks will document where, when, how, and from whom any vital project information was obtained. Logbook entries will be complete and accurate enough to permit reconstruction of field activities. At a minimum, the following sampling information will be recorded:

- Sample location, station location, and description.
- Sample number.
- Sampler's name(s).
- Date and time of sample collection.
- Type of sample (e.g., regular, QA sample designation).
- Type of sampling equipment used.
- Onsite measurement data (e.g. temperature, pH, conductivity).
- Field observations and details important to analysis or integrity of samples (e.g., heavy rains, odors, colors).
- Type of preservation used.

In addition, the following will be kept in a Field Data Report:

- Chain-of-custody forms.
- Shipping arrangements (i.e., Federal Express air bill number).
- Recipient laboratory(ies).

5.1.1 Sample Coding in Field Logbooks

The station location will be described in the logbook as follows, in a manner consistent with the conventions used during the remedial investigation.

A one-digit number will be used to indicate the year in which the sample was collected, for example “3” indicates a sample was collected in 2003. This digit will be followed by two others indicating the month in which the sample was collected, for example “11” indicates a sample was collected in November. Finally, additional digits or letters will identify the well from which the sample was collected. The location description, 311136, indicates a sample collected from Well 136 in November 2003.

Samples collected for field QC will be identified by a three-digit or descriptive letter combination. Numbers for well locations and field QC will be grouped as follows:

- CERCLA Groundwater Monitoring Wells: 100, TW and 500 series numbers.
- Field Duplicate: 600 series starting with 600 for each sampling event and continuing consecutively during the event for duplicates collected.
- Rinsate: 700 series numbers starting with 700 for each sampling event and continuing consecutively during the event for rinsates collected.
- Distilled/deionized water blank: FDI.

Samples collected for laboratory QC will be identified on bottles and field paperwork using an A, B, or C designation as a suffix to the sample identifier code. These QC codes will be designated as follows:

- A - Original unspiked sample
- B - Matrix spike
- C - Matrix spike duplicate

The date of collection will be indicated in mm/dd/yy format, and the time will be indicated in accordance with the military convention. The analytical parameter and method of preservation will be indicated in unambiguous shorthand, such as K for potassium and HCl for hydrochloric acid.

Logbooks will be bound with consecutively numbered pages. Each page will be dated and the time of entry noted in military time. All entries will be legible, written in ink, and signed by the individual making the entries. Language will be factual, objective, and free of personal opinions or inappropriate terminology. In addition to the sampling information, the following specifics will also be recorded in the field logbook:

- Team members.
- Time of site arrival/entry on site and time of site departure.
- Other personnel on site.
- Any deviations from sampling plans, site safety plans, and QAPP procedures.
- Any changes in personnel and responsibilities as well as reasons for the changes.
- Equipment calibration and equipment model and serial number.

5.2 GROUNDWATER MONITORING WELL SAMPLE COLLECTION

5.2.1 Water Level Measurements

FMC performs quarterly groundwater level (elevation) measurements at numerous monitoring wells that provide uniform coverage across the entire FMC Plant OU such that the water level measurements are coordinated among FMC's RCRA, Calciner Pond Remedial Action and interim CERCLA groundwater monitoring programs. Routine quarterly water level measurements will be taken at the following list of wells:

- Wells 101 through 191 inclusive (i.e., includes all shallow and deep wells within the FMC "100-series" wells);
- TW-5S, TW-5I, TW-5D, TW-9S, TW-11S and TW-12S; and,
- 501, 502, 503, 505, 514, 515, 516, 517, 518, 523, 524 and 525.
- In addition, the surface water elevation will be measured in the Batiste Spring channel immediately below the overflow weir from the springhouse cistern and in the Swanson Road Spring (aka the Spring at Batiste Road) basin.

Water levels will be established, generally in a single day, prior to purging and sampling the wells. Wells will be purged and sampled on subsequent days within the sampling event. An electronic sounder, accurate to the nearest (+/–) 0.01 feet, will be used to measure depth to water in each well. When using an electronic sounder, the probe is lowered down the casing to the top of the water column. The graduated markings on the probe wire are used to measure the depth to water from the surveyed point on the rim of the well casing. Typically, the measuring device emits a constant tone when the probe is submerged in standing water, and most electronic water level sounders have a visual indicator consisting of a small light bulb or diode that turns on when the probe encounters water. Water level sounding equipment will be decontaminated by rinsing with de-ionized or distilled water before and after use in each well.

The long-history of groundwater monitoring indicates that there is no significant sediment entering the groundwater monitoring wells. Consequently, it is unnecessary to measure total

well depth on a routine basis. However, FMC's groundwater sampling contractor will measure total well depth at any wells that, based on the sampling contractors experience and historic monitoring of the wells, are suspected to have significant (e.g., above the screened interval) sediment accumulation. In the event significant sediment accumulation is found based on measured total depth compared to the well construction details for the well, the groundwater sampling contractor will notify FMC. FMC will determine whether the well will be sampled prior to or after actions to remove the excessive sediment (e.g., well redevelopment).

5.2.2 Well Purging

All wells will be purged prior to sampling. Three to five casing volumes of water will be purged using an electric submersible pump. Clean flexible plastic or Teflon tubes connected to pumps will be used for groundwater extraction. All tubes will be decontaminated before and after use in each well. Pumps will typically be placed approximately 10 feet below the water level in the well to permit reasonable drawdown but to prevent cascading conditions. Pumps may need to be placed lower in the water column at certain wells to avoid lowering the water level to the pump inlet horizon due to the poor yield characteristics of these monitoring wells. If necessary, purge water will be collected into a measured container to record the purge volume.

Casing volumes will be calculated based on total well depth and static water level; casing diameter will be based on the well construction details. Monitoring well construction details are summarized in Table A-2 along with water elevations measured during May 2008.
One casing volume will be calculated as:

$$V = \pi R^2 h / 19.25$$

where:

V is the volume of one well casing of water (in gallons, 1 gallon = 0.134 ft^3);

R is one-half the inner diameter of the well casing (in inches); and

h is the total depth of water in the well (in feet).

Prior to the start of sampling and after each well casing volume is purged, water temperature, pH, specific conductance, dissolved oxygen (DO) and oxidation-reduction potential (ORP) will be measured using in-line flow-through meters installed in a manifold off the pump system. A separate grab sample will be obtained to measure turbidity the same time interval as other field parameters. The flow-through cell and associated tubing will be emptied prior to sampling a subsequent well. During operation, the flow-through cell and tubing are flushed with purge water at approximately one gpm for five to ten minutes before field parameters are recorded. This flushing action and the non-absorptive nature of this sampling equipment makes it unnecessary to otherwise decontaminate the tubing and in-line meters between uses using the equipment decontamination methods presented in Section 5.6 of this FSP. The tubing and in-line flow-through meter system will not be used to collect regular groundwater sample that are analyzed for the parameters listed in Table 3-2 of the GMP. The final measurements will be recorded after these parameters have stabilized, indicating representative formation water is entering the well.

Three consecutive measurements which display consistent values of all parameters will be taken prior to sampling. Samples will be collected after three well casing volumes if parameters have stabilized. Typically, the temperature should not vary by more than (+/–)1°C, pH by more than 0.1 pH units, DO by no more than 0.3 mg/L and specific conductance by more than 10 percent from reading to reading. No water that has been tested with a field meter probe will be collected for chemical analysis. If these parameters have not stabilized after five casing volumes have been purged, purging will cease, a notation will be recorded in the field logbook, and samples will be collected. In accordance with Section 5.1, depth-to-water measurements, field measurements of parameters, and purge volumes will be recorded in the field logbook. The in-line flow meter used to estimate the volume of removed purged water will be field-checked for volumetric accuracy once during a sampling event by recording the time needed to obtain a known volume of purge water in a bucket.

If a monitoring well dewaters during purging and three casing volumes are not purged, that well will be allowed to recharge up to 80 percent of static water column, and dewatered once more. After water levels have recharged to 80 percent of the static water column, groundwater samples will be collected.

All field meters will be calibrated according to manufacturers' guidelines and specifications prior to beginning field work every day.

5.2.3 Well Sampling

Groundwater samples will be collected from the interim CERCLA monitoring wells specified in Table A-3 and illustrated in Figure A-1. Prior to sampling, the water level in the well will be measured as described in Section 5.2.1 and wells will be purged as described in Section 5.2.2. All wells will be sampled within 24 hours after purging. Clean nitrile or latex gloves will be worn while collecting samples. Groundwater samples will be collected directly from the pump tubing into the appropriate sample container, preserved as described in Section 6, and chilled and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the discharge tubing to the sample container.

Section 6 gives detailed procedures for sample packaging, labeling, and shipping. All groundwater sampling equipment will be decontaminated before and after each sample is collected using procedures outlined in Section 5.6.

TABLE A-3. FMC'S ROUTINE GROUNDWATER MONITORING PROGRAM WELL NETWORKS (2009)

Area	Well Numbers	Up / Downgradient	Program [1]
Pond 18 Cell A	174	U	RCRA
	154, 177, 178	D	RCRA
Pond 17	173	U	RCRA
	171, 172, 180	D	RCRA
Pond 16S	154	U	RCRA
	147,148, 149	D	RCRA
Pond 15S	165	U	RCRA
	113, 115, 166	D	RCRA
Phase IV ponds	167	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 9E	124, 113	U	RCRA
	126, 127, 128	D	RCRA
Pond 8E	167	U	RCRA
	104, 114, 131, 168	D	RCRA
Pond 8S	158, 183	U	RCRA
	155, 156, 157	D	RCRA
Slag Pit Sump	121	U	RCRA
	108, 122, 123	D	RCRA
Batiste Spring	Batiste Spring	D	RCRA
Calciner Ponds	164, 161, 142	U	IDEQ
	136, 143, 189, 190	D	IDEQ
On-Plant Site	134, 139, 159, 145	D	CERCLA
Downgradient from Plant Site	111, 146, 110, TW-9S	D	CERCLA
Downgradient from FMC and Simplot Plant Sites	517, TW-12S	D	CERCLA
Northern Perimeter of EMF Groundwater Impact [2]	523, 515, 502, TW-11S, 524, 525	Cross	CERCLA

Note: This table only includes the monitoring well networks for sampling and analysis. The list of wells designated for water level monitoring is presented in Section 3.1 of the ICGMP and 5.2.1 of this FSP.
[1] Program: RCRA = RCRA groundwater monitoring plans, IDEQ = Calciner Pond groundwater monitoring plan, CERCLA = Interim CERCLA groundwater monitoring plan.
[2] Impact is in reference to detection of arsenic, nitrate or selenium above representative levels.

5.3 FIELD DUPLICATE GROUNDWATER MONITORING WELL SAMPLE COLLECTION

When collecting duplicate groundwater samples, bottles with two different sample designations will be alternated in the filling sequence.

5.4 MATRIX SPIKE / MATRIX SPIKE DUPLICATE QC SAMPLE COLLECTION

When collecting MS/MSD QC samples, a single sample designation, followed with "A," "B" and "C" suffixes for the primary, MS and MSD sample volumes respectively, will be assigned to a triple-volume sample.

5.5 FIELD BLANK QC SAMPLE COLLECTION

Rinsate blanks will be collected by pumping purified (distilled or deionized) water through the submersible pump setup after decontamination. Distilled or de-ionized water blanks will be collected directly from the field supply container.

5.6 FIELD PARAMETER MEASUREMENTS

Electrical conductivity, water temperature, turbidity and pH measurements will be made in the field during purging and immediately before collection of the water sample. Field parameter measurements are collected using an in-line flow through system as described in Section 5.2.2. A field pH meter with a combination electrode or equivalent will be used for pH measurement. A field conductivity meter will be used for specific conductance measurements. A nephelometer-type turbidimeter will be used for turbidity measurements. Temperature measurements will be performed using standard thermometers or equivalent temperature meters. A combined field meter or individual meters will be used for dissolved oxygen and ORP measurements. Combination instruments capable of measuring multiple parameters may also be used. All instruments will be calibrated in accordance with manufacturers' recommendations. Conductivity standards and pH buffers used in the calibration will be recorded on daily calibration forms associated with each monitoring event. The field parameter measurement, calibration and accuracy requirements are summarized below:

Field Parameter	**Instrument / Method**	**Calibration**	**Estimated Accuracy***
Water Level Survey	Electrical Water Probe Steel Tape	Reference to Steel Tape Reference to New Tape	0.01 ft 0.01 ft
Specific Conductance	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	± 0.5% or 1 µmhos/cm
Dissolved Oxygen	Dissolved oxygen meter	Daily, based on local barometric pressure and water-saturated air	± 2% or 0.2 mg/L

ORP	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	± 20 mV
Temperature	Temperature meter	Factory calibration only	0.15 °C
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	± 2%
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	± 0.2 pH unit

*Based on manufacturer specifications for YSI 556 MPS system and HACH 2100P turbidity meter currently used for FMC groundwater monitoring. Alternate instrumentation should have comparable estimated accuracies.

5.7 EQUIPMENT DECONTAMINATION PROCEDURE

Decontamination of sampling equipment will be consistently conducted in a manner to minimize potential cross-contamination and to ensure the quality of samples collected. The resulting decontamination fluids and residual material will be handled in the manner described in Section 7 to minimize potential recontamination of sampling equipment.

All equipment that comes into contact with potentially contaminated water will be decontaminated. Sampling equipment will be washed with a non-phosphate detergent scrub, followed by fresh water and de-ionized water rinses prior to each use. Equipment will be decontaminated in plastic containers, on pallets or plastic sheeting, and clean equipment will be used immediately. Clean equipment that is stored more than a few hours will be decontaminated again prior to use.

Sampling equipment will either be cleaned at the sampling location using non-phosphate detergent followed by fresh water and deionized water rinse, or will be steam-cleaned along with other equipment at a decontamination station.

Sampling equipment will be decontaminated as follows:

1. The exterior surfaces and accessible interior portions of submersible and hand pumps will be steam-cleaned or cleaned with sequential rinses of non-phosphate detergent solution, tap water, and de-ionized water prior to each use. Inaccessible interior portions of the pumps will be cleaned prior to each use by purging the same rinse water sequence through the pump and discharge lines. An effort will be made to sample the wells in the order of least to most contaminated to further minimize the risk of sample cross-contamination.

2. Bailers and tubing used for collection of the groundwater samples will be precleaned and disposed after one use or cleaned at the start of the job and between wells by steam cleaning or with a non-phosphate detergent wash followed by a tap water, and finally, a de-ionized water rinse.

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3. Steel tapes, water probes, water level indicators, and transducers will be rinsed in de-ionized water or cleaned in a detergent solution and rinsed once in fresh water after each use.

4. Rinsate blanks will be collected from the submersible pump setup at the frequency specified in Section 3.4.

6.0 SAMPLING HANDLING AND ANALYSIS

This section describes sample handling procedures including sample containers, sample preservation, shipping requirements and holding times, and sample analysis. These procedures are designed to ensure that samples are preserved and transported to the laboratory in a manner that is consistent and maintains sample integrity. Table A-4 summarizes sample containers, preservatives, volume, and holding times for the routine semi-annual groundwater monitoring events, and Table A-5 summarizes the same information for the expanded 5-year monitoring events.

TABLE A-4. SAMPLE HANDLING AND PRESERVATION PROCEDURES FOR ROUTINE SEMIANNUAL MONITORING EVENTS

Parameter	Recommended Container	Preservative	Maximum Holding Time
Water Quality (Cl^-, F^-, NO_3^-, and SO_4^{2-})	0.5-liter polyethylene bottle	Cool to 4°C	28 days
Metals (As, K, Se, and Total phosphorus)	0.25-liter polyethylene bottles	HNO_3 to pH<2, Cool to 4°C	6 months

TABLE A-5. SAMPLE HANDLING AND PRESERVATION PROCEDURES FOR EXPANDED 5-YEAR MONITORING EVENTS

Parameter	Recommended Container	Preservative	Maximum Holding Time
Water Quality (Cl^-, F^-, NO_3^-, and SO_4^{2-})	0.5-liter polyethylene bottle	Cool to 4°C	28 days
Metals (As, K, Se, Mn, B, V and Total phosphorus)	0.25-liter polyethylene bottles	HNO_3 to pH<2[a], Cool to 4°C	6 months
Total Ammonia	0.5-liter polyethylene bottle	H_2SO_4 to pH<2; Cool to 4°C	28 days
Total cyanide	0.5-liter polyethylene bottle	NaOH to pH > 12; Cool to 4°C	14 days

6.1 SAMPLE HANDLING

Sample containers will be pre-cleaned. Preservatives, if required, will be added to the containers prior to shipment of the sample containers to the laboratory or added to the samples(s) in the field as needed to meet sample preservation requirements.

6.2 SAMPLE SHIPMENT

All sample containers will be placed in a strong, rigid-walled shipping container such as a heavy plastic cooler. The following outlines the packaging procedures that will be followed.

1. When ice is used, secure the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler.
2. Line the cooler with bubble wrap, as needed, to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Custody-seal all container tops.
5. Affix sample labels onto the containers and write sample number on container with indelible ink.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.

All samples will be placed in coolers with the appropriate chain-of-custody form. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap or Styrofoam peanuts to prevent movement and breakage during shipment. Ice used to cool samples will be placed on top and around the samples to chill them to the correct temperature. Both samples and ice will be double-bagged in large plastic bags. Each ice chest will be securely taped shut with strapping tape; and custody seals will be affixed to the front and back of each cooler.

6.3 SAMPLE ANALYSIS

Required sample analyses and methods for the routine semi-annual groundwater monitoring events are summarized in Table A-6.

TABLE A-6. SUMMARY OF REQUIRED ANALYSES

ROUTINE SEMIANNUAL GROUNDWATER MONITORING EVENTS

Parameter	Method Number	Method Type	Reporting Limit (ppm)
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.1
Chloride	9056 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1
Fluoride	9056 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1
Metals (As, Se)	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002 (As), 0.0005 (Se)
Nitrate	9056 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1
Total Phosphorus	6010B (a) or 365.2 (c)	Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid)	0.02
Sulfate	9056 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1

(a) Analysis may also be performed using method 6020, both 6010B and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for the Chemical Analysis of Water and Wastes (MCAWW) (EPA/600/4-79/020).

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

The required sample analyses and methods for the expanded 5-year monitoring events are summarized in Table A-7.

TABLE A-7. SUMMARY OF REQUIRED ANALYSES

EXPANDED 5-YEAR GROUNDWATER MONITORING EVENTS

Parameter	Method Number	Method Type	Reporting Limit (ppm)
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.1
Chloride	9056 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1
Fluoride	9056 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1
Metals (As, Se, Mn, B and V)	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002 (As), 0.0005 (Se), 0.0006 (Mn), 0.018 (B), 0.002 (V)
Nitrate	9056 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1
Total Phosphorus	6010B (a) or 365.2 (c)	Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid)	0.02
Sulfate	9056 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1
Total Ammonia (NH_3 + NH_4 as N)	350.3 (d)	Potentiometric, Ion Selective Electrode	0.2
Total Cyanide	335.4 (d)	Colorimetric	0.01

(a) Analysis may also be performed using method 6020, both 6010B and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for the Chemical Analysis of Water and Wastes (MCAWW) (EPA/600/4-79/020).

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

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7.0 DISPOSAL OF WASTE

In the process of collecting groundwater samples, different types of potentially contaminated wastes will be generated. The expected wastes are:

- Used personal protective equipment (PPE).
- Disposable sampling equipment.
- Decontamination fluids.
- Purged groundwater.

This section describes the procedures that will be followed to handle these wastes. The procedures have enough flexibility to allow the sampling team to use its professional judgment on the proper method for the disposal of each type of waste generated at each sampling location.

7.1 USED PPE AND DISPOSABLE SAMPLING EQUIPMENT

Used PPE and disposable equipment will be bagged and accumulated in a dumpster onsite for disposal in the onsite landfill or an appropriate off-site landfill. Any PPE and disposable equipment that could be considered reusable will be rendered inoperable before disposal.

7.2 DISPOSAL OF DECONTAMINATION FLUIDS AND PURGED GROUNDWATER

Due to the low levels of contaminants in groundwater (i.e., analytical results of previous groundwater samples have not exceeded the Toxicity Criteria presented in 40 C.F.R. Part 261 Subpart C), the decontamination fluids and groundwater will be managed as non-hazardous water.

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APPENDIX A-A

INTERIM CERCLA GROUNDWATER MONITORING PLAN

WELL COMPLETION DIAGRAMS

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	110

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Northeastern corner of site	N 453,398.7 E 558,378.9	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-3-90	10-3-90	Layne Environmental	AP-1000	10"	101.5	0.0	101.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
3.0/67		2	4450.57	4449.3	64.8/4384.5 12-01-90	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140-lbs / 30-in	4-in / 97.5-ft	Curtis Obi

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4449.3				0 - 5 FT. **GRAVELLY SILT WITH SAND (ML)**: Dark yellowish brown (10 YR 4/2), slightly moist, stiff, with 20% coarse-grained sand and 30% subrounded gravel (diameter ≤ 3 in.).	Dual-wall percussion drilling with reverse air circulation.
SS	1.5	1.5	2 4 14					4444.3	5			5 - 101.5 ft. **GRAVEL WITH SAND (GW)**: Moderate yellowish brown (10 YR 5/4) to pale yellowish brown (10 YR 6/2), dry to wet, loose to medium-dense, well-graded, angular-to-subrounded gravel and cobbles (diameter ≤ 8 in.), with sand.	Air-water mist (<1 gpm) used where needed to restore circulation.
									10				Logged from drill cuttings and from split-spoon samples using the Unified Soil Classification System (ASTM D 2488-84) and the GSA Rock Color Chart.
									15				
									20			Purple quartzite boulder fragments at 18 ft.	
									25				
SS	1.5	0.0	16 22 19						30				
									35				
									40				
									45				
									50				
									55				
									60				
									65				Encountered ground water during drilling at approximately 67 ft below the ground surface.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
EMF POCATELLO, ID	8-12-92	110

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	110

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								75				
								80				
								85				
								90			Bleached shell fragments below 90 ft.	Moderate ground-water discharge from gravel (approx. 10 gpm).
								95				
SS	1.5	1.5	5 8 8				4347.8	100			Silt fraction increases at 100 ft.	
											TOTAL DEPTH: 101.5 FT.	Boring converted to well on 10-3-90.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
EMF POCATELLO, ID	8-12-92	110

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	111

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Northern edge of site	N 452,890.2 E 556,296.9	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-11-90	10-11-90	Layne Environmental	AP-1000	10"	110.0	0.0	110.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
1.3/43		1	4468.04	4466.3	▽ 71.7/4394.7 12-01-90 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140-lbs / 30-in	4-in / 104.5-ft	Garrett Day

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4466.3				0 - 5 ft. **SILT WITH SAND (ML)**: Grayish brown (5 YR 3/2), dry, with 20% well-graded subrounded sand.	Dual-wall percussion drilling with reverse air circulation.
SS	1.5	1.0	8 11 8				4461.3	5			5 - 15 ft. **SILT (ML)**: moderate brown (5 YR 4/4), slightly moist, slightly plastic, calcareous.	Air-water mist (<1 gpm) used where needed to restore circulation.
							4451.3	10, 15			15 - 25 ft. **SILT (MH)**: Moderate brown (5 YR 4/4), slightly moist, plastic, calcareous.	Logged from drill cuttings and from split-spoon samples using the Unified Soil Classification System (ASTN D 2488-84) and the GSA Rock Color Chart.
							4441.3	20, 25			25 - 58 ft. **SILTY SAND WITH GRAVEL (SM)**: Moderate brown (5 YR 4/4), dense, 40% well-graded subangular sand, 30% clayey silt, 30% subangular gravel (diameter ≤ 2 in.).	
SS	1.5	0.3	35 48 50					30, 35, 40, 45, 50, 55				
							4408.3	60			58 - 62 ft. **GRAVEL WITH SAND (GW)**: Dusky brown (5 YR 2/2), 70% well-graded gravel of metamorphic and volcanic lithologies, 30% angular-to-subangular coarse-grained sand, with trace fine-to-medium sand.	
							4404.3				62 - 82 ft. **CLAY (CL)**: Dark yellowish brown (10 YR 4/4), moist to wet, slightly plastic, calcareous, silty clay with 10% subrounded medium to coarse-grained sand and trace gravel.	
SS	1.5	1.3	20 25 19					65				

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
EMF POCATELLO, ID	8-12-92	111

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	111

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								75				Encountered ground water during drilling at approximately 75 ft below the ground surface.
								80				
							4384.3				82 - 107 ft. **GRAVEL WITH SAND (GW)**: Brownish gray (5 YR 4/1), well-graded subrounded gravel (diameter ≤ 2 in.) with 40-50% well-graded subangular sand, and trace clay.	
								85				85-107 ft: Abundant ground-water discharge.
								90				
								95				
								100				
								105				
							4359.3				107 - 110 ft. **CLAYEY SAND (SC)**: Dark yellowish brown (10 YR 4/4), 60% subangular fine to medium-grained sand with 30% clay, 10% gravel, and trace coarse sand.	
							4356.3	110			TOTAL DEPTH: 110.0 FT.	Boring converted to well on 10-12-90.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: EMF POCATELLO, ID

Last Update: 8-12-92

HOLE NO. 111

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	134

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
North of former Pond 2S	N 451,636.8 E 555,354.2	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-29-90	10-29-90	Layne Environmental	AP-1000	10"	116.0	0.0	116.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/		0	4478.93	4477.0	80.6/4396.4 12-01-90 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
No samples collected.	4-in / 114.8-ft	Garrett Day

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4477.0					
							4474.0				0 - 3 ft. **SLAG GRAVEL (FILL)**: Medium gray (5N5).	Dual-wall percussion drilling with reverse air circulation.
								5, 10, 15, 20, 25, 30, 35, 40, 45			3 - 48 ft. **SILT (ML)**: Dark yellowish brown (10 YR 4/2), dry, 90% low-plasticity calcareous silt, 10% subangular-to-rounded well-graded sand, with trace gravel.	Air-water mist (<1 gpm) used where needed to restore circulation. Logged from drill cuttings using the Unified Soil Classification System and the GSA Rock Color Chart.
							4429.0	50, 55, 60			48 - 62 ft. **SILTY GRAVEL WITH SAND (GM)** Moderate brown (5 YR 3/4), dry, calcareous, 40% subangular-to-subrounded well-graded gravel (diameter ≤ 3 in.), 40% silt, 40% subangular-to-rounded well-graded sand, with trace boulders.	
							4415.0	65			62 - 95 ft. **SILT (ML)**: Dark yellowish brown (5 YR 4/2), slightly moist, moderately plastic, calcareous, clayey silt with trace sand, gravel, and boulders.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
EMF POCATELLO, ID	8-12-92	134

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	134

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								75				
								80				
								85				
								90				
							4382.0	95			95 - 113 ft. **GRAVEL WITH SAND (GW)**: Blackish red (5 R 2/2), wet, 80% angular-to-rounded, well-graded gravel (diameter ≤ 3 in.) of metamorphic and volcanic lithologies, 20% subangular-to-subrounded, well-graded sand, with trace silt and clay.	Encountered ground water during drilling at approximately 95 ft below the ground surface. 100-113 ft: Moderate ground-water discharge.
								100				
								105				
								110				
							4364.0				113 - 116 ft. **CLAY (CL)**: Moderate brown (5 YR 3/4), wet, moderately plastic, moderately calcareous, silty clay with trace sand and gravel.	113-116 ft: Minimal ground-water discharge.
							4361.0	115			TOTAL DEPTH: 116 FT.	
												Boring converted to well on 10-29-90.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: EMF POCATELLO, ID

Last Update: 8-12-92

HOLE NO. 134

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BECHTEL

GEOLOGIC DRILL LOG

PROJECT: EMF POCATELLO, ID	JOB NO. 21372	SHEET NO. 1 OF 3	HOLE NO. 139		
SITE: FMC Corporation	COORDINATES and/or STATIONINGS: N 450,368.1 E 553,167.0	ANGLE FROM HORIZ: Vertical	BEARING: ------		
BEGUN: 5-12-92	COMPLETED: 5-13-92	DRILLER: Layne Environmental	DRILL MAKE AND MODEL: AP-1000	SIZE: 10"	OVERBURDEN: 161.0
ROCK (FT.): 2.0	TOTAL DEPTH: 163.0	CORE RECOVERY (FT./%): /	CORE BOXES	SAMPLES	EL. TOP CASING: 4467.7
GROUND EL.: 4466.3	DEPTH/EL. GROUND WATER: 72.2/4394.1 6-26-92	DEPTH/EL. TOP OF ROCK: 161.0/4305.3			
SAMPLE HAMMER WEIGHT/FALL: 140 lbs. / 30 in.	CASING LEFT IN HOLE: DIA./LENGTH: 4" Sch. 40 PVC / 96.0	LOGGED BY: Garrett Day			

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4466.3				0 - 8 ft. **SLAG GRAVEL FILL**: Grayish black (N2); 40% angular, 1/4 to 2" gravel; 40% medium to coarse subangular sand; 20% silty material; dry.	Dual-wall percussion drilling with reverse air circulation. Inner pipe = 6" Outer pipe = 9 3/4" diameter Air-water mist (<1 gpm) used when needed to assist with circulation. Logged from drill cuttings using Unified Soil Classification System and GSA Rock Color Chart.
								4458.3	5			8 - 25 ft. **SILT (ML)**: Dark yellowish brown (10 YR 4/2); 100% clayey silt; trace of gravel; calcareous; moderately plastic; moist	
									10, 15, 20			At 20 feet: Moist to wet.	
								4441.3	25			25 - 46 ft. **SANDY GRAVEL (GW)**: Dark yellowish brown (10 YR 4/2); well graded; 40% angular to subrounded fine gravel to 2" cobbles, metamorphic and quartzitic; 40% fine to coarse angular to subangular sand; 20% silt; dry. At 30-46 feet: Up to 5" broken and non-broken metamorphic and volcanic cobbles.	
									30, 35, 40				
								4420.3	45			46 - 67 ft. **GRAVELLY SILT (ML-GM)**: Dark yellowish brown (10 YR 4/2); 80% calcareous, moderately plastic silt; 20% subrounded, metamorphic and volcanic gravels to 3" cobbles; dry.	
									50, 55, 60			At 55 feet: Gravel layer; 40% angular rhyolitic and andesitic gravels to 1" diameter.	
								4399.3	65			67 - 78 ft. **CLAYEY SILT (ML-MH)**: Moderate brown (5 YR 3/4); 90% clayey silt to sandy silt; 10% coarse sand, to fine subangular	67 feet: Wet

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation | Last Update: 11-10-93 | HOLE NO. 139

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 3	139

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
												gravel; calcareous; moderately plastic; wet.	
								4388.3	75				
									80			78 - 86 ft. **SILTY CLAY (CL-CH)**: Pale yellowish brown (10 YR 6/2) mottled with dark yellowish brown (10 YR 4/2); Possible limonite staining; calcareous; moderately plastic; wet.	
								4380.3	85				
									90			86 - 95 ft. **SANDY GRAVEL (GP-GW)**: Dark yellowish brown (10 YR 4/2); 40% 1" to 4" subangular, volcanic and metamorphic gravel; 40% mostly fine sand, some subangular to subrounded medium to coarse sand; 20% clayey silt; wet.	86-93 feet: Abundant ground water discharge.
								4371.3	95			At 93 feet: Clay stringer.	
												At 93-95 feet: Mostly volcanic gravels (rhyolitic, basaltic, andesitic, etc.).	
									100			95 - 130 ft. **SANDY CLAY (CL-SC)**: Dark yellowish brown (10 YR 4/2); 50% silty calcareous clay; 30% fine to coarse subangular sand; 20% fine angular volcanic gravel; wet.	
									105				
									110			At 110 feet: Some hard siltstone with possibly some tuffaceous material; calcareous; gravels are volcanic, olive black (5 Y 2/1) to very dusky red (10 R 2/2); wet.	
									115				
									120			At 120-130 feet: Black manganese oxides present in cuttings.	
									125				
								4336.3	130			130 - 143 ft. **SILT (ML) TO SILTSTONE**: Moderate brown (5 YR 4/4 to 5 YR 3/4); hard; calcareous; with white elongated filling; 10% coarse metamorphic sand to fine subrounded gravel (Possibly very weathered tuff or volcanic ash). Water flow suggests fractured material.	130-143 feet: Abundant ground water discharge.
									135				
									140				
								4323.3	145			143 - 157 ft. **WEATHERED ASH FLOW TUFFS TO CLAY (CL)**: Pale yellowish brown (10 YR 6/2); porphyritic rhyolitic tuff; dark red inclusions; hard; some calcareous; in a dark yellow brown (10 YR 4/2) clay.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 139

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	3 OF 3	139

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								155				
							4309.3					
								160			157 - 161 ft. **VOLCANIC GRAVEL (GP)**: Black (N1); 60% volcanic gravel of mainly basalt, rhyolite, some trachyandesite; 25% black basaltic sand, medium to coarse angular grains; 15% porphyritic tuff and minor pitchstone; welded tuff with glass shards and flame structures (fiamme); wet.	157-161 feet: Abundant ground water discharge.
							4305.3					
							4303.3				161 - 163 ft. **BASALT PORPHYRY**: Black (N1), with abundant white, fresh plagioclase phenocrysts up to 3 mm; hard with fresh and weathered cuttings (possibly fractured).	161-163 feet: Hard drilling. Backfilled bottom of hole with cement-bentonite grout (-99 to 163 feet).
											TOTAL DEPTH: 163.0 FT.	Installed 4" monitoring well on 5-13-92.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 139

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	145

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
FMC Corporation	N 452,188.7 E 557,552.3	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
4-30-92	4-30-92	Layne Environmental	AP-1000	10"	149.0	1.0	150.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
1.5/100		1	4478.3	4477.0	84.6/4392.4 6-26-92	149.0/4328.0

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 in.	4" Sch 40 PVC / 142.5	H. Feng

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4477.0				0 - 14 ft. **SANDY GRAVEL (FILL)**: Gray; 50% fine gravel, 50% medium to coarse sand.	Dual-wall percussion drilling with reverse air circulation. Inner pipe = 6" Outer pipe = 9 3/4" diameter. Air-water mist (<1 gpm) used when needed to assist with circulation.
							4463.0	5, 10				
							4461.0	15			14 - 16 ft. **SANDY GRAVEL (GW)**: 50% well rounded black gravel, 50% brown medium to coarse grained sand.	Logged from split spoon sample and drill cuttings using the Unified Soil Classification System and the GSA Rock Color Chart.
								20, 25, 30, 35, 40, 45			16 - 47 ft. **SANDY SILT (ML)**: Brown (10 YR 5/3); 90% very stiff silt, 10% fine sand. At 16 - 40 feet: Moist. At 40 - 47 feet: Significant increase in moisture.	
							4430.0				47 - 50 ft. **SILTY SAND WITH GRAVEL (SM)**: Grayish brown (10 YR 5/2); 50% medium sand, 30% silt, 20% well rounded coarse gravel.	
							4427.0	50			50 - 57 ft. **SILTY SAND (SM)**: Brown (10 YR 5/3); 70% coarse sand, some fine to medium sand, 20% silt.	
							4420.0	55, 60, 65			57 - 75 ft. **SAND (SW)**: Reddish gray (5 YR 5/2), subrounded; wet at 75 feet.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
FMC Corporation	11-10-93	145

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	145

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6" N	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME MIN.	ELEV.	DEPTH	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4402.0	75	75 - 84 ft. **CLAY (CH)**: Yellowish brown (10 YR 5/4); more than 90% very soft, high plastic clay, less than 10% silt, trace of gravel.	At 73 feet: Wet soil.
SS	1.5	1.5	4/6/10						80		
								4393.0	85	84 - 88 ft. **GRAVELLY CLAY (CH)**: Yellowish brown (10 YR 5/4); 70% clay, 20% gravel, 10% silt; wet.	
								4389.0			
								4388.0	90	88 - 89 ft. **VOLCANIC GRAVEL (GW)**: Dark gray to black angular gravels; no fines; moist.	At 88 feet: Moist to wet but no ground water discharge.
									95	89 - 101 ft. **CLAYEY VOLCANIC GRAVEL (GC)**: 50% angular, purple and dark gray to black gravel; 20 - 40% grayish brown clay; 10 - 20% silt to fine sand.	
								4376.0	100	101 - 116 ft. **SILTY VOLCANIC GRAVEL (GM)**: 50% dark purple and black angular gravels; 40% silt, clay and fine sand mixture.	At 101 feet: Encountered ground water; discharge not significant from 101-116 ft.; drill cuttings are a muddy slurry.
									105		
									110		
								4361.0	115	116 - 129 ft. **GRAVELLY SILT (ML)**: More than 70% of soil cuttings are silt; 10 - 30% dark colored angular gravel (Interval from 89-129 ft. may be volcanic mud flow or agglomerate).	At 116-129 feet: Little or no ground water encountered; cuttings are a muddy slurry.
									120		
									125		
								4348.0	130	129 - 140 ft. **SANDY GRAVEL (GW)**: 80% dark colored fine to coarse angular gravels; 10-20% medium to coarse grained sand; no fines.	At 129 - 140 feet: Abundant discharge of ground water.
									135		At 140 - 141 feet: No ground water discharged.
								4337.0	140	140 - 144 ft. **SANDY TO SILTY VOLCANIC GRAVEL**: Dark purple to black angular, volcanic gravel in silty, sandy matrix. At 140-141 ft.: Light gray, fractured tuff; possible boulder.	At 141 - 144 feet: Abundant discharge of ground water.
								4336.0			
								4333.0	145	144 - 150 ft. **GRAVELLY SILT (ML)**: 10-20% volcanic gravel; some clay. At 149-150 ft.:Light gray tuff.	At 144 - 149 feet: Minor ground water discharge
								4328.0			Installed 4" PVC monitoring well on 5-5-92.
								4327.0		TOTAL DEPTH: 150 FT.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 145

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	146

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
FMC Corporation	N 453,214.1 E 557,382.2	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
4-21-92	4-22-92	Layne Environmental	AP-1000	10"	108.5	0.0	108.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
2.5/83		2	4459.3	4457.9	68.6/4389.3 6-26-92 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 in.	4" Sch. 40 PVC / 107.5	H. Feng

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4457.9				0 - 5 ft. **CLAYEY SILT (ML)**: Brown.	Dual-wall air percussion drilling with reverse air circulation.
								4452.9	5			5 - 10 ft. **CLAYEY GRAVEL (GC)**: With cobbles of 3" or greater.	Inner pipe = 6"
								4447.9	10			10 - 20 ft. **GRAVELLY SILT (GM-ML)**: 60% silt, 30% gravel, 10% clay.	Outer pipe = 9 3/4" diameter.
									15				Air-water mist (<1 gpm) used when needed to assist with circulation.
								4437.9	20			20 - 30 ft. **SILTY GRAVEL (GM)**: 70% gravel, 20% silt, 10% sand, < 5% clay.	Logged from drill cuttings and from split-spoon samples using the Unified Soil Classification System and GSA Rock Color Chart.
									25				
								4427.9	30			30 - 35 ft. **GRAVEL WITH COBBLES (GP)**: 70% gravel, 20% boulders and cobbles.	
								4422.9	35			35 - 60 ft. **SILTY GRAVEL (GM)**: 60% angular gravel, 20% fine-grained sand, 20% silt, trace of cobbles of 3" or greater.	
									40				
									45				
									50				
									55				
								4397.9	60			60 - 71 ft. **CLAYEY SILT (ML)**: Light yellowish brown (10 YR 6/4); 70% silt, 20% clay, some fine-grained sand; very moist.	
									65				

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
FMC Corporation	11-10-93	146

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	146

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	1.5	1.0	16-26-37				4386.9					
											71 - 76 ft. **SANDY GRAVEL (GP)**: Light brown (7.5 YR 6/2); 60% gravel, 30% coarse-grained sand, <10% clay.	At 70 feet: Observed saturation in drill cuttings.
							4381.9	75			76 - 80 ft. **SILTY CLAY (CL)**: Gray (N6).	At 76 - 80 feet: Cuttings returned as slurry.
SS	1.5	1.5	4-12-40				4377.9	80			80 - 101 ft. **GRAVEL AND SAND (GP)**: Light brownish gray (2.5YR 6/2), roughly 50% gravel, 50% sand, traces of cobbles.	At 80 - 101 feet: Abundant ground water discharge.
								85				
								90				
								95				
							4356.9	100				
											101 - 105 ft. **SANDY GRAVEL (GP)**: 80% reddish brown (5YR 4/4) gravel, 20% brownish gray (2.5YR 6/2) sand.	At 101 - 105 feet: Abundant ground water discharge.
							4352.9	105			105 - 108.5 ft. **SANDY SILT (ML)**: Grayish brown (2.5Y 5/2) with clay pockets.	
							4349.4				TOTAL DEPTH: 108.5 FT.	Installed 4" monitoring well on 4-22-92.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 146

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	159

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
FMC Corporation	N 451,036.0 E 554,680.1	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
6-26-93	6-26-93	Layne Environmental	AP-1000	10"	126.0		126.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/		1	4491.79	4490.0	95.2/4394.8 6-26-93 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 in.	4" PVC / 123.5 ft.	Dave Kyllonen

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4490.0					
							4489.5				0 - 0.5 ft. **SLAG GRAVEL (Fill)**: Medium light gray (N6).	Dual-wall percussion drilling with reverse air circulation
								5			0.5 - 12 ft. **GRAVELLY SILT (ML)**: Dark yellowish brown (10 YR 4/2), floury, with 20-30% volcanic gravel to 1/2", subangular to subrounded; dry.	Inner pipe = 6" I.D.
								10				Outer pipe = 9 3/4" O.D.
							4478.0				12 - 48 ft. **SILT (ML)**: Moderate yellowish brown (10 YR 5/4), floury, dry.	
								15				
								20				
								25				
								30				
								35			At 35 feet, trace fine gravel.	
								40				
								45				
							4442.0				48 - 52 ft. **CLAYEY SILT (CL-ML)**: Moderate yellowish brown (10 YR 5/4), slightly plastic, floury, slightly moist.	
								50				
							4438.0				52 - 72 ft. **SILTY SANDY GRAVEL (GW-GM)**: Multicolored quartzite gravel, moderate yellowish brown (10 YR 5/4), silt and sand; well graded gravel up to 6" diameter, subrounded to subangular cobbles, some particles flat and elongated; with fine grained sand and 15-20% silt; slightly moist.	
								55				
								60			At 60 feet, silt content decreases to 5-10%, gravels become finer, few large gravel or cobbles.	
								65				

Logged from split-spoon samples

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 159

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	159

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6" / % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4418.0					and drill cuttings using Unified Soil Classification System and GSA Rock Color Chart At 68 feet, discharge pipe plugged with cobble fragment.
								75			72 - 89 ft. **CLAYEY SILT (CL-ML)**: Moderate yellowish brown (10 YR 5/4), slightly plastic, slightly moist.	
								80				
								85				
							4401.0					
								90			89 - 105 ft. **SILTY CLAY (ML-CL)**: Moderate yellowish brown (10 YR 5/4), 10-20% silt, medium plasticity, moist to wet.	At 88 feet, discharge pipe plugged by 6" rubble.
SS	1.5	1.5	11 17 20					95			At 95 feet, some 2" gravel.	At 95 feet, wet.
												At 96 feet, took split spoon sample at top of water bearing interval.
								100			At 102 feet, becomes pale yellowish brown (10 YR 6/2) and highly plastic, 10% silt.	
							4385.0	105			105 - 110 ft. **SILTY SANDY GRAVEL (GP-GM)**: Multicolored quartzite sand and gravel with moderate yellowish brown (10 YR 5/4) silt; gravel is 1/2" - 3/4" and subangular to subrounded; with 10-15% fine grained sand and 10% silt; saturated.	
							4380.0	110			110 - 124 ft. **SANDY GRAVEL (GW)**: Multicolored quartzite, gravels 1/2" - 2", mostly 1/2" - 1", 10-20% coarse sand, 5-10% fine to medium sand; saturated.	At 109 feet, started to produce some water. Volume increasing with depth.
								115				
								120				
							4366.0					
							4364.0	125			124 - 126 ft. **SANDY CLAY (CL)**: Pale yellowish brown (10 YR 6/2), 10-15% fine grained sand, < 5% gravel, gravel is 1/4" and subangular to subrounded; wet.	At 124 feet, stopped producing water. Installed 4" monitoring well on 6-26-93.
											TOTAL DEPTH: 126 FT.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: FMC Corporation

Last Update: 11-10-93

HOLE NO. 159

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	502

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
North of Highway 30	N 454,363.3 E 558,079.5	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
5-18-92	5-18-92	Boyles Brothers	Schramm T685	9"	74'	0'	74.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/			4441.3	4439.3	55.6/4383.7 6-26-92 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
	4" PVC / 72 feet	D. B. McCullar

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4439.3					
								4435.3				0 - 4 ft. **SANDY GRAVEL (GW)**: Pale yellowish brown (10 YR 6/2), angular to subround, medium to very coarse sand, granules and pebbles to 1 cm, quartzite and occasional (< 5%) basalt; roots near surface.	Drilling with compressed air, using 7-1/2" Halco down-hole hammer and 9" outer casing.
								4434.3	5			4 - 5 ft. **SILT (ML)**: Pale yellowish brown (10 YR 6/2), very calcareous, floury, dry (loess).	
								4430.3	10			5 - 9 ft. **SILTY GRAVEL (GM)**: Pale yellowish brown (10 YR 6/2), calcareous silt, very coarse sand, gravel granules and pebbles, cobbles and boulders, angular to round.	Very slow drilling, boulders (12" diameter) visible in open hole.
									15			9 - 36 ft. **GRAVEL (GW)**: Multicolored granules and pebbles to 2 cm, angular to subround, consisting of quartzite with 20% basalt. Cobbles and boulders probably present.	Very slow drilling.
									20				Description and classification are from logging of cuttings blown from hole; logged using Unified Soil Classification System and GSA Rock Color Chart.
									25				
									30				
								4403.3	35			36 - 60 ft. **SANDY GRAVEL (GW)**: Various colors, subangular to subround quartzite and 10% basalt granules and pebbles to 2 cm; with medium to very coarse sand, subangular to subround, quartzose; dry.	
									40				
									45			From 43 to 45 feet, gravels are coated with dark yellowish brown (10 YR 4/2) silt; granules and pebbles slightly moist. At 46 feet, silty sandy gravel, 20% silty sand, gravel granules and pebbles to 2 cm; dry.	
									50				
									55				
								4379.3	60			60 - 62 ft. **GRAVEL (GW)**: Various colors, angular to subround, granules and pebbles to 2 cm, composed of quartzite and < 10% basalt.	Making water.
								4377.3	65			62 - 71 ft. **SANDY GRAVEL (GW)**: Pale yellowish brown (10 YR 6/2) subangular to subround, silty coating, medium to very coarse sand granules and pebbles to 1 cm, wet.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
EMF POCATELLO, ID	11-12-92	502

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	502

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4368.3					
							4365.3				71 - 74 ft. **SILTY CLAY (CL)**: Pale yellowish brown (10 YR 6/2) to moderate yellowish brown (10 YR 5/4), moist, firm, slightly sandy.	
											Bottom of Hole = 74 ft.	Installed 4" PVC monitoring well to a depth of 72 ft. on 5-19-92.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: EMF POCATELLO, ID

Last Update: 11-12-92

HOLE NO. 502

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 2	515

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
Offsite	N 454,045.1 E 555,307.3	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
7-21-93	7-21-93	Layne Environmental	AP-1000	10"	86.0		86.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/		1	4450.0	4450.3	51.0/4399.3 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs. / 30 in.	4" PVC / 84.2 ft.	D. B. McCullar

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4450.3					
							4447.3				0 - 3 ft. **SANDY GRAVEL (GW)**: Dark yellowish brown (10 YR 4/2), coarse sand, granules and pebbles to 1 inch, round to subround, quartzite, very moist to wet.	Dual wall percussion drilling with reverse air circulation. Diameter of inner pipe is 6"; outer pipe is 9 3/4".
								5			3 - 8 ft. **SILT (ML)**: Moderate yellowish brown (10 YR 5/4) wet, slightly sandy.	
							4442.3				8 - 46 ft. **GRAVEL (GW)**: Various colors, granules and pebbles to 1 1/2 inches, subangular to subround, 10% coarse sand, moderate yellowish brown. Below 10 feet, cobble size increases to 5 inches, quartzite with occasional basalt. Below 30 feet, cobbles increases to 6 inches. Slightly silty at 42 feet, grading siltier.	Lithologic descriptions logged from split spoon samples and cuttings using the Unified Soil Classification System, and the GSA Rock Color Chart.
								10				
								15				
								20				
								25				
								30				
								35				
								40				
							4404.3	45				
								50			46 - 53 ft. **SILTY GRAVEL (GM)**: Moderate yellowish brown , silt covered gravels, mixture of quartzite and basalt granules and pebbles to 2 1/2 inches. Becomes wet at 50 feet and saturated below 51 feet, large cobbles to 6 inches.	Ground water at approximately at 51 feet.
							4397.3					
SS	1.5	1.5	45 5 10 9					55			53 - 67 ft. **CLAY (CH)**: Olive gray (5 Y 4/1) changing to dusky brown (5 YR 2/2) at 55.2 feet then changes to gravelly clay (CH), dark yellowish brown (10 YR 4/2) with wood pieces 1 inch long, blackened on outside. Changes back to clay (CH), light olive gray (5 Y 5/2) at 55.8 feet, firm, very moist, moderate to high plasticity, changes color to yellowish gray (5 Y 7/2) at 56.1 feet, siltier, firm. Below 65 feet, clay cuttings are massive 8 inches across, very firm.	
								60				
								65				
							4383.3					
							4380.3				67 - 70 ft. **SAND (SP)**: Moderate yellowish brown (10 YR 5/4), fine to medium, moist to wet.	Ground water at approximately at 67 feet.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
Offsite	11-10-93	515

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 2	515

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								75 80 85			70 - 86 ft. **SANDY GRAVEL (GW)**: Moderate yellowish brown (10 YR 5/4), 25% medium to coarse sand, quartzite granules and pebbles to 1 inch, increasing to 2 inches below 73 feet.	
							4364.3				TOTAL DEPTH : 86 FT.	Water very dark (dusky brown)

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: Offsite

Last Update: 11-10-93

HOLE NO. 515

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 of 2	517

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
North of Highway 30	N 453,747.0 E 558,812.8	-90	N00.0E

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
7-7-93	7-7-93	Layne Environmental	AP-1000	10"	79.5		79.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	ELEV. TOP CASING	GROUND ELEV.	DEPTH / ELEVATION GROUND WATER	DEPTH / ELEVATION TOP OF ROCK
/		0	4444.45	4442.5	58.5/4384 7-7-93 /	/

SAMPLE HAMMER WEIGHT / FALL	CASING LEFT IN HOLE: DIAMETER / LENGTH	LOGGED BY:
	4" PVC / 78.4 ft.	Dave Kyllonen

SAMP. TYPE AND DIAM.	SAMP. ADV. / LEN CORE	SAMPLE REC. / CORE REC.	SAMPLE BLOWS "N" / % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								5, 10, 15			0 - 16 ft. **SILTY GRAVEL with SAND (GM):** Multicolored quartzite and volcanics, moderate yellowish brown (10 YR 5/4) silt, gravel to 1 1/2", mostly < 1/2", sand is fine to coarse grained, mostly coarse grained, 20% silt; particles subrounded to subangular; slightly moist near surface, becomes dry at depth. At 10 feet, silt content decreases to 10-20%.	Dual wall percussion drilling with reverse air circulation. Inner pipe = 6" ID. Outer pipe = 9 3/4" OD. Logged from split spoon samples and drill cuttings using the Unified Soil Classification System and the GSA Rock Color chart.
							4426.5	20, 25, 30, 35			16 - 38 ft. **GRAVEL (GP):** Multicolored quartzite and volcanics, gravel to 3", cobbles to 6", sand is fine to coarse grained, gravel mostly < 3/4", < 5% silt; particles subangular to subrounded; dry. At 36 feet, silt content increases to 5-10%.	
							4404.5	40, 45, 50, 55, 60, 65			38 - 79.5 ft. **GRAVELLY SAND (SP):** Multicolored quartzite an volcanics, fine to coarse grained sand, mostly coarse grained, gravel to 3", some 4" cobbles, 5-10% silt; particles subangular to rounded; dry. At 50 feet, a 6" vesicular basalt cobble along with other 4"-5" volcanic and quartzite cobbles. At 65 feet, gravel mostly 1/4" - 1/2", very little sand.	At 60 ft., gravel is wet. Blew some water after adding more casing at 60 feet.

SS = Split Spoon; ST = Shelby Tube; D = Dennison; P = Pitcher; O = Other

SITE	Last Update:	HOLE NO.
North of Highway 30	8/19/93	517

Report Form: EMF_IDAHO

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 of 2	517

SAMP. TYPE AND DIAM.	SAMP. ADV. / LEN CORE	SAMPLE REC. / CORE REC.	SAMPLE BLOWS "N" / % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								75				Not producing any water
							4363.0					At 75 ft., after clearing plugged discharge line, began to produce 5-10 gpm.
											TOTAL DEPTH : 79.5 FEET. **TOTAL DEPTH = 79.5 FEET**	Installed 4" monitoring well on 7-7-93.

SS = Split Spoon; ST = Shelby Tube; D = Dennison; P = Pitcher; O = Other

SITE	Last Update:	HOLE NO.
North of Highway 30	8/19/93	517

Report Form: EMF_IDAHO

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 3	523

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
OFF SITE	N 452,001.4 E 552,513.7	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
6-12-94	6-12-94	Layne Environmental	AP-1000	10"	90.0	0.0	90.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/na	0	0	4452.98	4450.8	▽ 55.0/4395.8 /	na/na

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
na	4 in / 85.5 ft	C. Obi

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4450.8				0 - 5 ft. **SANDY SILT (ML):** Grayish orange (5 YR 7/2); 20% fine to coarse grained sand; soft, dry.	Borehole drilled with dual-wall percussion-hammer drill rig. Cuttings expelled from boring using reverse-air circulation.
							4445.8	5			5 - 15 ft. **SILTY GRAVEL (GM):** Grayish orange (5 YR 7/2); angular to rounded gravel to 3 inches; 20-40% silt; loose, dry.	Soil descriptions based on visual observations of cuttings following the Unified Soil Classification System (USCS) and the Geological Society of America (GSA) Rock Color Chart.
								10				
							4435.8	15			15 - 44 ft. **SANDY GRAVEL (GP):** Grayish orange (5 YR 7/2); angular to rounded gravel to 6 inches; 30% fine to coarse grained sand; 10% silt; loose, dry.	
								20				
								25				
								30			Moist below 31 ft.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
OFF SITE	7-11-94	523

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 3	523

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								40				
							4406.8	45			44 - 68 ft. **SILT (ML):** Moderate yellowish brown (10 YR 5/4); medium plasticity, soft, wet.	
								50				
								55				
								60				
								65				
							4382.8	70			68 - 89 ft. **SANDY GRAVEL (GP):** Subangular to rounded multicolored gravel; 20% fine to coarse grained sand; loose, wet, abundant muddy water.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: OFF SITE

Last Update: 7-11-94

HOLE NO. 523

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	3 OF 3	523

(Template: BCHTLLS)

SAMP AND TYPE DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6" / % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								80				
								85				
							4361.8					
							4360.8	90			89 - 90 ft. **CLAY (CL):** Moderate yellowish brown (10 YR 5/4); 10% fine to coarse grained sand; medium plasticity, soft to stiff, wet.	
											TOTAL DEPTH: 90 FT.	Borehole 523 completed as monitoring well 523 on 6-13-94 using 4" Sch 40 PVC and screened between depths of 75 and 85 ft. See well construction diagram for completion details.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: OFF SITE

Last Update: 7-11-94

HOLE NO. 523

Appendix G Interim CERCLA GW Monitoring Plan.pdf

BECHTEL

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 4	524

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
OFF SITE	N 455,307.0 E 560,768.0	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
6-14-94	6-14-94	Layne Environmental	AP-1000	10"	120.0	2.0	122.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/na	0	0	4399.92	4397.4	20.0/4377.4 /	120.0'/4277.4'

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
na	4 in / 59 ft	C. Obi

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4397.4				0 - 8 ft. **GRAVELLY SILT (ML):** Moderate yellowishbrown (10 YR 7/4); 20% subangular to rounded gravel to 3 inches; 0-20% fine to coarse grained sand; soft, dry.	Borehole drilled with dual-wall percussion-hammer drill rig. Cuttings expelled from boring using reverse-air circulation. Soil descriptions based on visual observations of cuttings following the Unified Soil Classification System (USCS) and the Geological Society of America (GSA) Rock Color Chart.
							4389.4	5			8 - 112 ft. **SILTY GRAVEL (GM):** Moderate yellowish brown (10 YR 7/4); relatively uniform deposit of multicolored angular fragments to rounded cobbles to 6 inches; 10-20% fine to coarse grained sand; 20-30% silt; loose, dry.	
								10				
								15				
								20			Wet below 20 ft., abundant muddy water.	
								25				
								30				

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
OFF SITE	7-11-94	524

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	2 OF 4	524

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								40				
								45				
								50				
								55				
								60				
								65				
								70				

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: OFF SITE

Last Update: 7-11-94

HOLE NO. 524

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	3 OF 4	524

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								80				
								85				
								90				
								95				
								100				
								105				
								110				
							4285.4				112 - 120 ft. CLAY (CH): Grayish orange pink (5 YR 7/2) to moderate brown (5 YR 4/4); 0-20% fine to coarse grained sand; high plasticity; stiff, moist to wet.	

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE: OFF SITE

Last Update: 7-11-94

HOLE NO. 524

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	4 OF 4	524

(Template: BCHTLLS)

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS 6"	% CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
								4277.4	120				
								4276.4				120 - 121 ft. **FRACTURED BASALT:** Black vesicular basalt, hard, with calcite and mud-encrusted fractures.	
								4275.4				121 - 122 **BASALT:** Black vesicular basalt, very hard.	
												TOTAL DEPTH: 122 FT.	
													Borehole 524 was allowed to cave from 122 to 59 ft then completed as monitoring well 524 on 6-14-94 using 4" Sch 40 PVC and screened between depths of 48.5 to 58.5 ft. See Well construction diagram for completion details.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
OFF SITE	7-11-94	524

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GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
EMF POCATELLO, ID	21372	1 OF 1	525

SITE	COORDINATES and/or STATIONINGS	ANGLE FROM HORIZ	BEARING
OFF SITE	N 455,296.9 E 560,772.1	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
6-15-94	6-15-94	Layne Environmental	AP-1000	10"	28.5	0.0	28.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
/na	0	1	4399.61	4397.1	15.0/4382.1 /	na/na

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lb / 30 in	4 in / 28.3 ft	C. Obi

(Template: BCHTLLS)

SAMP TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
							4397.1				0 - 4 ft **GRAVELLY SILT (ML):** Moderate yellowish brown (10 YR 7/4); 20% subangular to rounded gravel to 3 inches; 0-20% fine to coarse grained sand; soft, dry.	Borehole drilled with dual-wall percussion-hammer drill rig. Cuttings expelled from boring using reverse-air circulation.
							4393.1				4 - 28.5 ft. **SILTY GRAVEL (GM):** Moderate yellowish brown (10 YR 7/4); angular to rounded multicolored gravel to 6 inches; 10-20% fine to coarse grained sand; 20-30% silt; loose, dry.	Soil descriptions based on visual observations of cuttings following the Unified Soil Classification System (USCS) and the Geological Society of America (GSA) Rock Color Chart.
								5				
								10				
SS	1.5	0.4	15-25-32					15			Wet below 15 ft., abundant muddy water.	
								20				
								25				
							4368.6				TOTAL DEPTH: 28.5 FT.	Borehole 525 completed as monitoring well 525 on 6-15-94 using 4" Sch 40 PVC and screened between depths of 17.8 and 27.8 ft. See well construction diagram for completion details.

SS = SPLIT SPOON; ST = SHELBY TUBE
D= DENNISON P = PITCHER O = OTHER

SITE	Last Update:	HOLE NO.
OFF SITE	7-11-94	525

Appendix G Interim CERCLA GW Monitoring Plan.pdf

GEOLOGIST'S LOG

(An interpretative combination of the sample, core, driller, and geophysical logs)

Well 9S Project FMC - Pocatello Page ____ of ____

Date/ Time	Lithologic Unit Description	Lithologic Unit Depth Below Land Surface from (ft)	to (ft)
12/13/80	Alluvium	0	9
	Boulders and gravel	9	52
	Volcanic ash flow	52	55
	Gravel, medium and subrounded	55	62
	Volcanic ash flow	62	66
	Gravel and light brown clay	66	75
	Gravel, larger grain size, no clay present.		
	Water bearing zone.	75	80

Appendix G Interim CERCLA GW Monitoring Plan.pdf

(An interpretative combination of the sample, core, driller, and geophysical logs)

Well 11I Project FMC - Pocatello Page ____ of ____

Date/ Time	Lithologic Unit Description	Lithologic Unit Depth Below Land Surface from (ft)	to (ft)
3/81	Light brown silt with small to large gravel	0	5.0
	Boulder	5.0	6.0
	Gravel, small to large, multicolored, with light brown silt	6.0	11.3
	Boulder	11.3	13.0
	Gravel, small to large with cobbles and light brown silt	13.0	28.0
	Boulder	28.0	29.0
	Gravel, small to large, cobbles small boulders and light brown silt	29.0	102.0
	Light brown clayey silt with medium sized gravel	102.0	115.0
	Gravel with medium to coarse sand and clayey silt. Gravel is subrounded and angular, Sample resembles tallus	115.0	118.0
	Rhyolite, gray porphoritic cavity between 121 and 123 feet	118.0	135 TD
	Note: Open hole 5-5/8-inch diameter between 126 and 135 ft. below land surface. Static water level 37.91 ft. below land surface		

Appendix G Interim CERCLA GW Monitoring Plan.pdf

(An interpretative combination of the sample, core, driller, and geophysical logs)

Well 12S Project FMC-Pocatello Page ____ of ____

Date/ Time	Lithologic Unit Description	Lithologic Unit Depth Below Land Surface from (ft)	to (ft)
11/9/81	Light brown silt and gravel	0	3
	Gravel, small to large with cobbles, boulders and light brown silt	3	62 TD
	Note: Water encountered at 52 feet while drilling. Screened with a 6-inch diameter 20 slot stainless steel well screen		

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	110

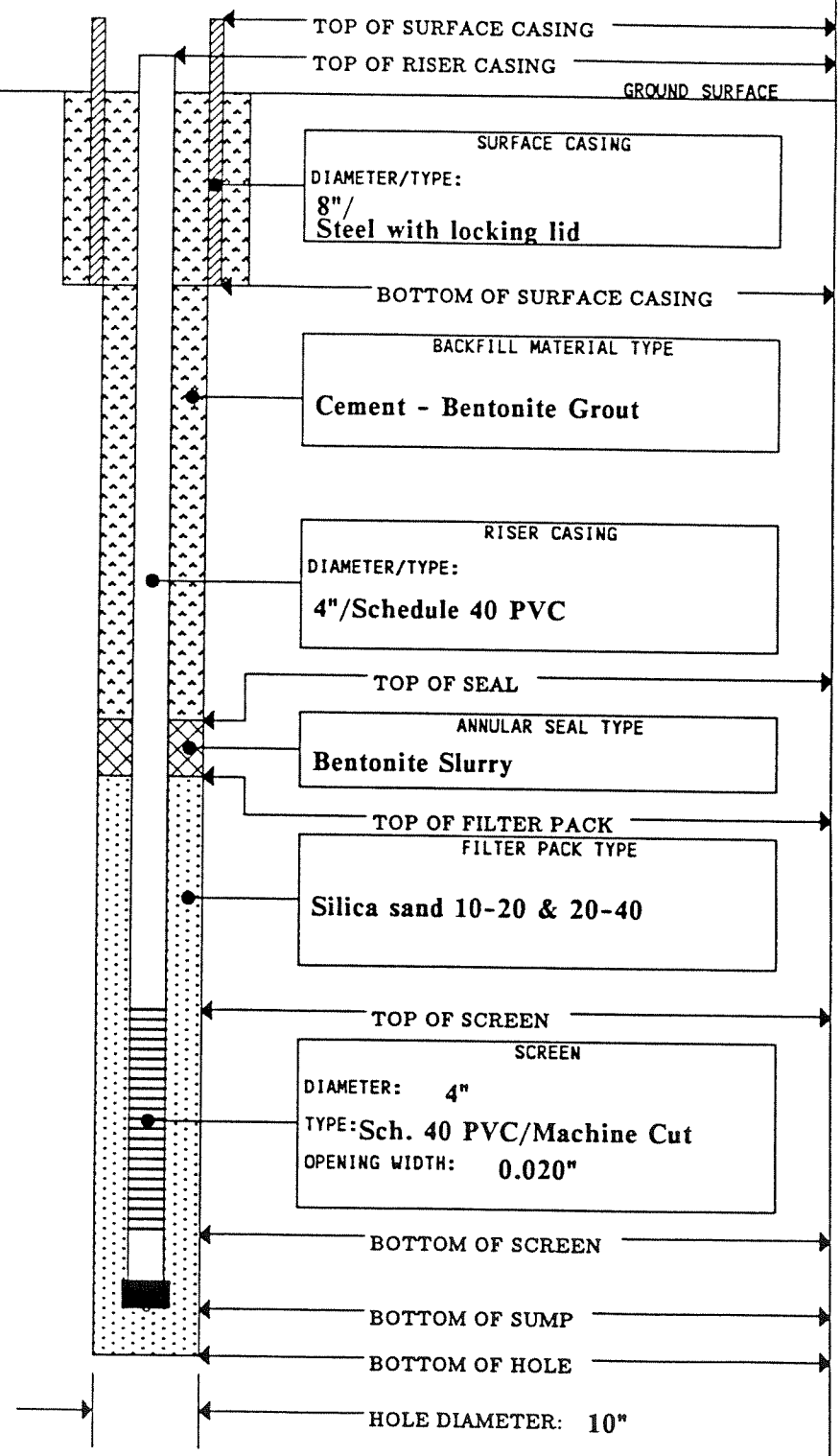
JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	Northeastern corner of site	N 453,398.7 E 558,378.9

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-3-90	10-3-90	Curtis Obi	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	1.7	4451.0
TOP OF RISER CASING	1.3	4450.6
GROUND SURFACE	0.0	4449.3
BOTTOM OF SURFACE CASING	3.3	4446.0
TOP OF SEAL	69.0	4380.3
TOP OF FILTER PACK	73.0	4376.3
TOP OF SCREEN	85.0	4364.3
BOTTOM OF SCREEN	95.0	4354.3
BOTTOM OF SUMP	97.5	4351.8
BOTTOM OF HOLE	101.5	4347.8

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	111

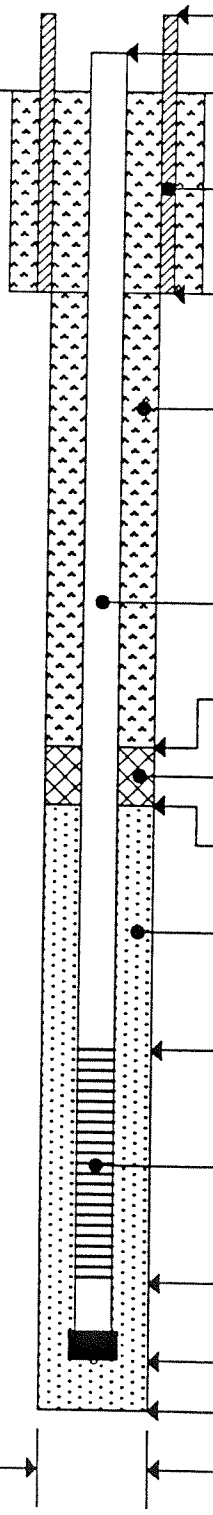
JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	Northern edge of site	N 452,890.2 E 556,296.9

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-11-90	10-12-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4468.4
TOP OF RISER CASING	1.7	4468.0
GROUND SURFACE	0.0	4466.3
BOTTOM OF SURFACE CASING	2.9	4463.4
TOP OF SEAL	84.0	4382.3
TOP OF FILTER PACK	88.0	4378.3
TOP OF SCREEN	92.3	4374.0
BOTTOM OF SCREEN	101.7	4364.6
BOTTOM OF SUMP	104.5	4361.8
BOTTOM OF HOLE	110.0	4356.3

SURFACE CASING
DIAMETER/TYPE:
8"/
Steel with locking lid

BACKFILL MATERIAL TYPE
Cement - Bentonite Grout

RISER CASING
DIAMETER/TYPE:
4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite Slurry

FILTER PACK TYPE
Silica sand 10-20 & 20-40

SCREEN
DIAMETER: 4"
TYPE: Sch. 40 PVC/Machine Cut
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	134

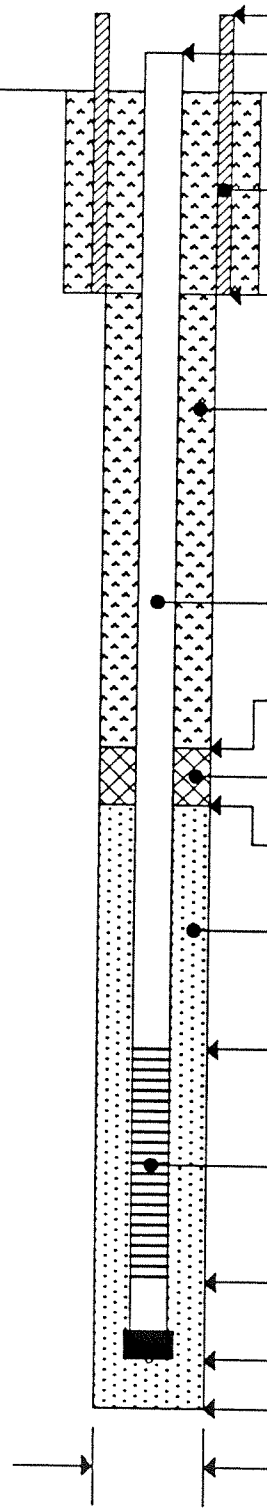
JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	North of former Pond 2S	N 451,636.8 E 555,354.2

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
10-29-90	10-29-90	Garrett Day	Top of PVC casing(Water level)

(GENERALIZED GEOLOGIC LOG)

See Boring Logs.

NOT TO SCALE



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.2	4479.2
TOP OF RISER CASING	1.9	4478.9
GROUND SURFACE	0.0	4477.0
BOTTOM OF SURFACE CASING	2.8	4474.2
TOP OF SEAL	94.0	4383.0
TOP OF FILTER PACK	98.0	4379.0
TOP OF SCREEN	102.5	4374.5
BOTTOM OF SCREEN	112.0	4365.0
BOTTOM OF SUMP	114.8	4362.2
BOTTOM OF HOLE	116.0	4361.0

SURFACE CASING
DIAMETER/TYPE: 8"/ Steel with locking lid

BACKFILL MATERIAL TYPE
Cement - Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite Slurry

FILTER PACK TYPE
Silica sand 10-20 & 20-40

SCREEN
DIAMETER: 4"
TYPE: Sch. 40 PVC/Machine Cut
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 8-12-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	139

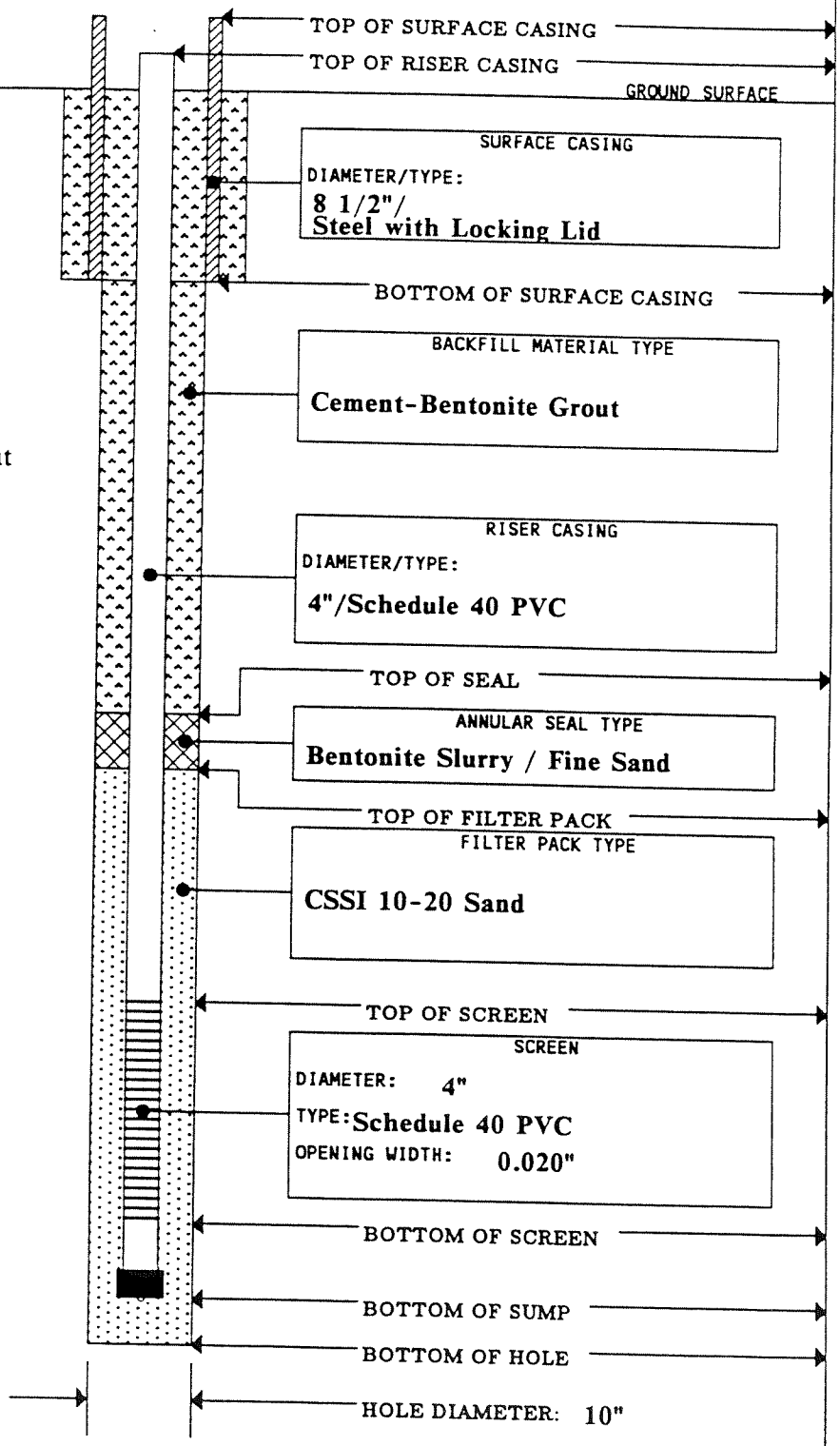
JOB NO.	SITE	COORDINATES and/or STATIONINGS
20906	FMC Corporation	N 450,368.1 E 553,167.0

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5-13-92	5-13-92	Garrett Day	Top of PVC Casing-Water Level

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details

At 99-163 ft.: Backfill with C-B Grout



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	1.6	4467.9
TOP OF RISER CASING	1.4	4467.7
GROUND SURFACE	0.0	4466.3
BOTTOM OF SURFACE CASING	3.4	4462.9
TOP OF SEAL	78.0	4388.3
TOP OF FILTER PACK	83.0	4383.3
TOP OF SCREEN	88.4	4377.9
BOTTOM OF SCREEN	92.6	4373.7
BOTTOM OF SUMP	96.0	4370.3
BOTTOM OF HOLE	163.0	4303.3

Update: 7-28-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	145

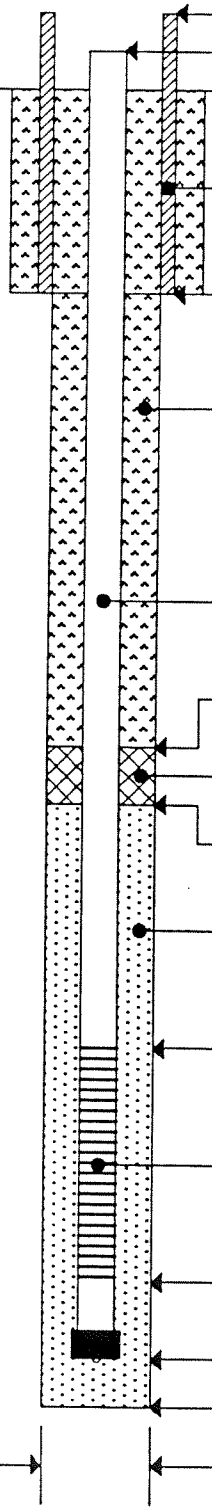
JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	FMC Corporation	N 452,188.7 E 557,552.3

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
4-30-92	5-5-92	H. Feng	Top of PVC Casing-Water Level

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details

At 143-150 ft.: Bentonite well plug



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	1.6	4478.6
TOP OF RISER CASING	1.3	4478.3
GROUND SURFACE	0.0	4477.0
BOTTOM OF SURFACE CASING	3.4	4473.6
TOP OF SEAL	120.0	4357.0
TOP OF FILTER PACK	122.0	4355.0
TOP OF SCREEN	130.0	4347.0
BOTTOM OF SCREEN	140.0	4337.0
BOTTOM OF SUMP	142.5	4334.5
BOTTOM OF HOLE	150.0	4327.0

SURFACE CASING
DIAMETER/TYPE: 8 1/2"/ Steel with Locking Lid

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite / Fine Sands

FILTER PACK TYPE
CSSI 10-20 Sand

SCREEN
DIAMETER: 4"
TYPE: Schedule 40 PVC
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 11-10-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

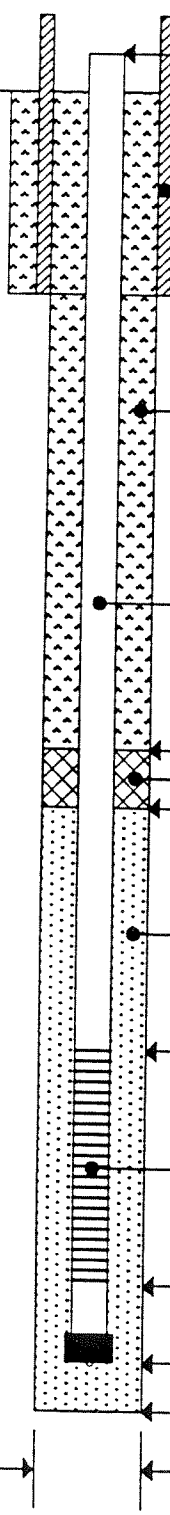
PROJECT	WELL NO.
EMF POCATELLO, ID	146

JOB NO.	SITE	COORDINATES and/or STATIONINGS
20906	FMC Corporation	N 453,214.1 E 557,382.2

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
4-21-92	4-22-92	H. Feng	Top of PVC Casing-Water Level

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.1	4460.0
TOP OF RISER CASING	1.4	4459.3
GROUND SURFACE	0.0	4457.9
BOTTOM OF SURFACE CASING	2.9	4455.0
TOP OF SEAL	76.5	4381.4
TOP OF FILTER PACK	81.5	4376.4
TOP OF SCREEN	90.0	4367.9
BOTTOM OF SCREEN	105.0	4352.9
BOTTOM OF SUMP	107.5	4350.4
BOTTOM OF HOLE	108.5	4349.4

SURFACE CASING
DIAMETER/TYPE: 8 1/2"/ Steel with Locking Lid

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite

FILTER PACK TYPE
CSSI 10-20 Sand

SCREEN
DIAMETER: 4"
TYPE: Schedule 40 PVC
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 7-28-92
Template: 2WELLOG

NOT TO SCALE

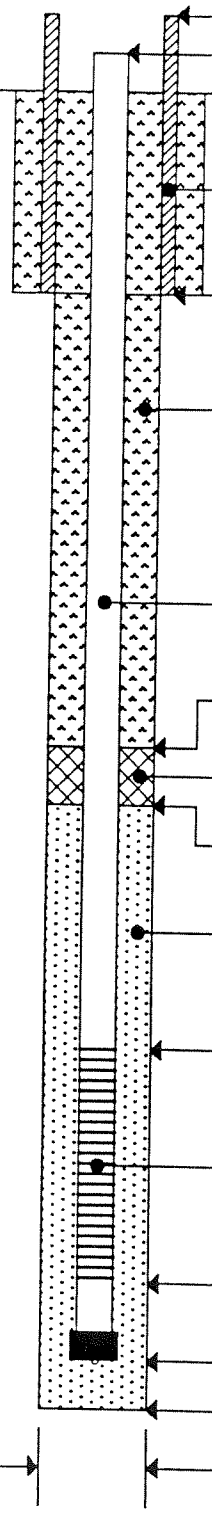
Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

PROJECT: *EMF POCATELLO, ID*		WELL NO. 159
JOB NO. 21372	SITE: FMC Corporation	COORDINATES and/or STATIONINGS: N 451,036.0 E 554,680.1
BEGUN 6-26-93	COMPLETED 6-26-93	PREPARED BY: Dave Kyllonen
REFERENCE POINT FOR MEASUREMENTS: Top of PVC - Water levels		

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.8	4494.6
TOP OF RISER CASING	2.0	4493.8
GROUND SURFACE	0.0	4490.0
BOTTOM OF SURFACE CASING	2.2	4479.6
TOP OF SEAL	100.0	4391.8
TOP OF FILTER PACK	105.0	4386.8
TOP OF SCREEN	110.5	4381.3
BOTTOM OF SCREEN	120.5	4371.3
BOTTOM OF SUMP	123.5	4368.3
BOTTOM OF HOLE	126.0	4364.0

SURFACE CASING
DIAMETER/TYPE: 8 5/8"/ Steel

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite Slurry

FILTER PACK TYPE
CSSI 10-20 Silica Sand

SCREEN
DIAMETER: 4"
TYPE: Schedule 40 PVC Slotted
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 9-8-93
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

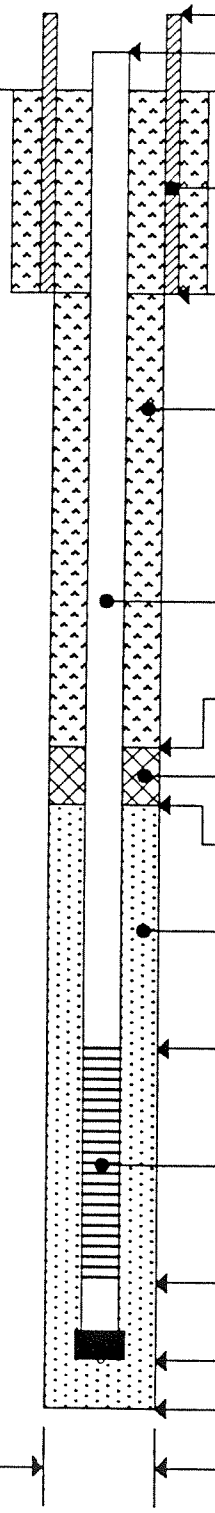
PROJECT	WELL NO.
EMF POCATELLO, ID	502

JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	North of Highway 30	N 454,363.3 E 558,079.5

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
5-18-92	5-19-92	D. B. McCullar	Top of PVC Casing-Water Level

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.5	4441.8
TOP OF RISER CASING	2.0	4441.3
GROUND SURFACE	0.0	4439.3
BOTTOM OF SURFACE CASING	3.5	4435.8
TOP OF SEAL	55.0	4384.3
TOP OF FILTER PACK	58.0	4381.3
TOP OF SCREEN	64.2	4375.1
BOTTOM OF SCREEN	69.2	4370.1
BOTTOM OF SUMP	72.0	4367.3
BOTTOM OF HOLE	74.0	4365.3

SURFACE CASING
DIAMETER/TYPE: 8"/ Steel with locking lid

BACKFILL MATERIAL TYPE
C-B Grout/Well Plug

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Volclay 1/4" Bentonite Pellets

FILTER PACK TYPE
CSSI 10-20 Sand

SCREEN
DIAMETER: 4"
TYPE: Schedule 40 PVC
OPENING WIDTH: 0.020"

HOLE DIAMETER: 9"

Update: 11-11-92
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

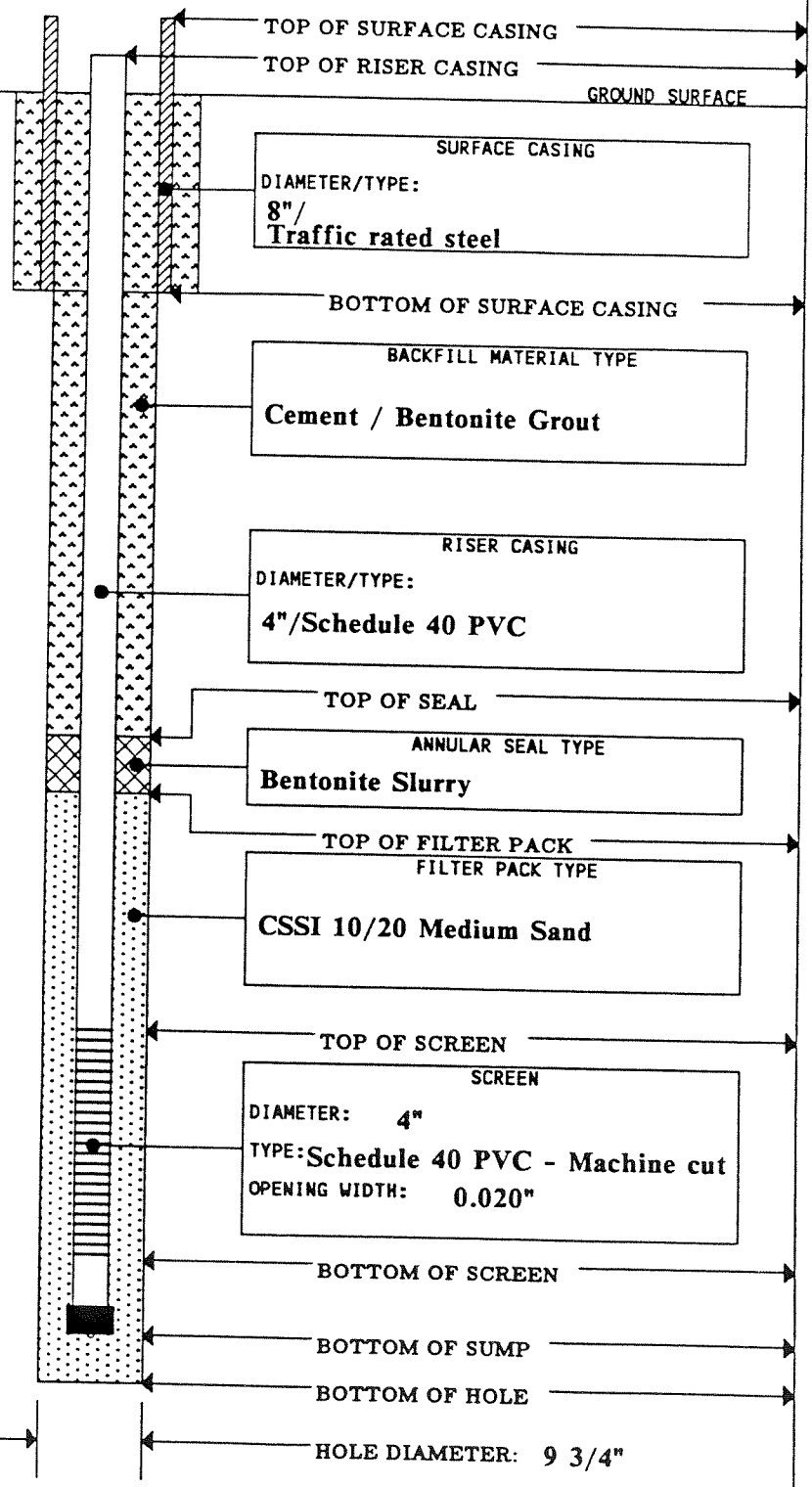
PROJECT	WELL NO.
EMF POCATELLO, ID	515

JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	Offsite	N 454,045.1 E 555,307.3

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7-21-93	7-21-93	D. B. McCullar	Ground surface

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF RISER CASING	0.3	4450.0
GROUND SURFACE	0.0	4450.3
BOTTOM OF SURFACE CASING	1.0	4449.3
TOP OF SEAL	63.0	4387.3
TOP OF FILTER PACK	67.0	4383.3
TOP OF SCREEN	71.2	4379.1
BOTTOM OF SCREEN	81.2	4369.1
BOTTOM OF SUMP	84.2	4366.1
BOTTOM OF HOLE	86.0	4364.3

Update: 10-4-93
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

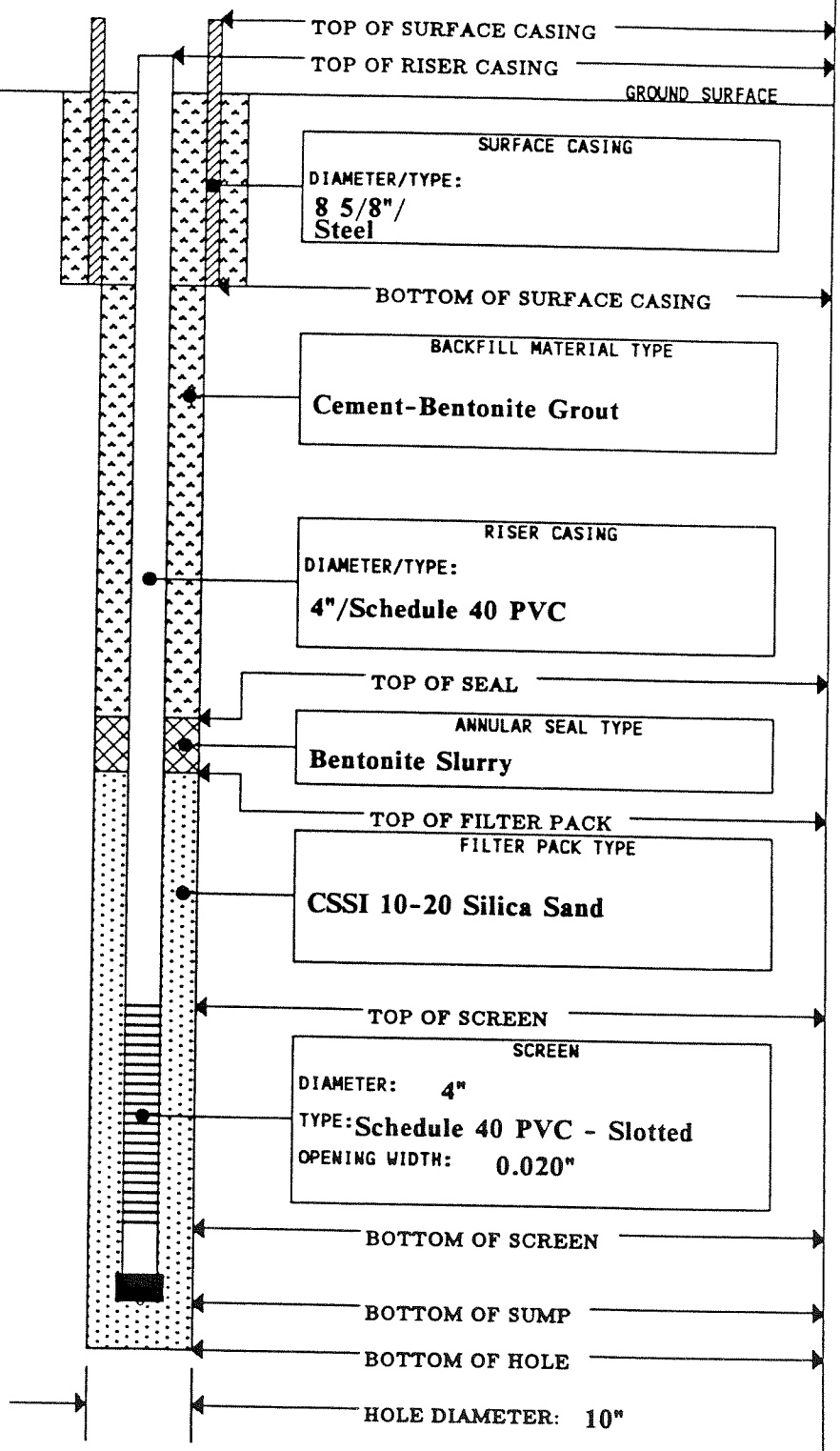
MONITORING WELL

PROJECT	WELL NO.
EMF POCATELLO, ID	517

JOB NO.	SITE	COORDINATES and/or STATIONINGS
21372	North of Highway 30	N 453,747.0 E 558,812.8

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
7-7-93	7-7-93	Dave Kyllonen	Top of PVC - Water levels

(GENERALIZED GEOLOGIC LOG)



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.7	4445.2
TOP OF RISER CASING	2.1	4444.6
GROUND SURFACE	0.0	4442.5
BOTTOM OF SURFACE CASING	3.3	4439.2
TOP OF SEAL	53.0	4389.5
TOP OF FILTER PACK	60.0	4382.5
TOP OF SCREEN	65.4	4377.1
BOTTOM OF SCREEN	75.4	4367.1
BOTTOM OF SUMP	78.4	4364.1
BOTTOM OF HOLE	79.5	4363.0

HOLE DIAMETER: 10"

Update: 8-19-93
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

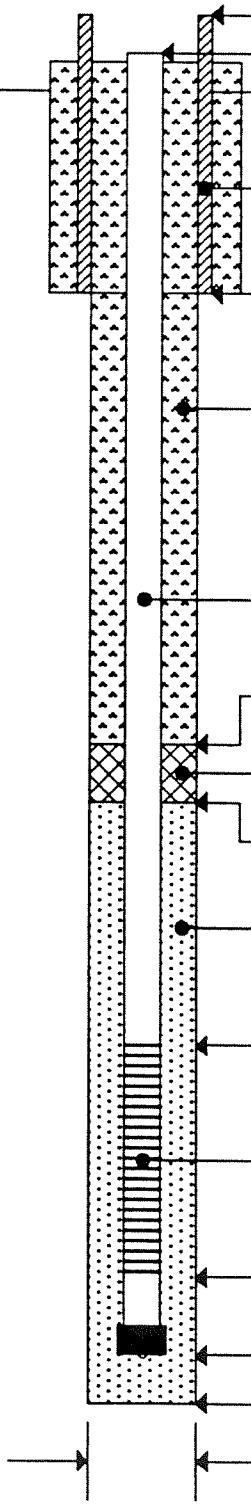
PROJECT	WELL NO.
EMF POCATELLO, ID	523

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	OFF SITE	N 452,001 E 552,514

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6-12-94	6-12-94	C. Obi	Notch at top of PVC: 4452.98'

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	3.0	4453.8
TOP OF RISER CASING	2.2	4453.0
GROUND SURFACE	0.0	4450.8
BOTTOM OF SURFACE CASING	2.0	4448.8
TOP OF SEAL	66.5	4384.3
TOP OF FILTER PACK	69.0	4381.8
TOP OF SCREEN	75.0	4375.8
BOTTOM OF SCREEN	85.0	4365.8
BOTTOM OF SUMP	85.5	4365.3
BOTTOM OF HOLE	90.0	4360.8

SURFACE CASING
DIAMETER/TYPE: 8"/ Steel Monument

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Enviroplug Bentonite Tablets

FILTER PACK TYPE
10-20 CSSI Silica Sand

SCREEN
DIAMETER: 4"
TYPE: Sch. 40 PVC Machine-Cut Slots
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 7-11-94
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

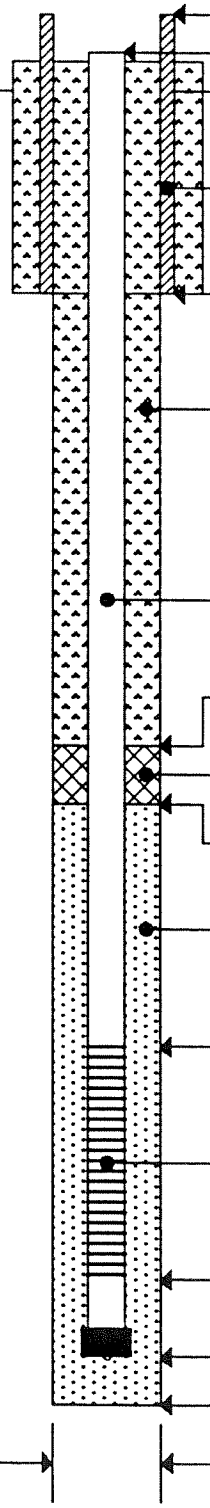
PROJECT	WELL NO.
EMF POCATELLO, ID	524

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	OFF SITE	N 455,307 E 560,768

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6-14-94	6-14-94	C. Obi	Notch at top of PVC: 4399.92'

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	3.0	4400.4
TOP OF RISER CASING	2.5	4399.9
GROUND SURFACE	0.0	4397.4
BOTTOM OF SURFACE CASING	2.0	4395.4
TOP OF SEAL	40.0	4.
TOP OF FILTER PACK	46.0	4351.4
TOP OF SCREEN	48.5	4348.9
BOTTOM OF SCREEN	58.5	4338.9
BOTTOM OF SUMP	59.0	4338.4
BOTTOM OF HOLE	122.0	4275.4

SURFACE CASING
DIAMETER/TYPE: 8"/ Steel Monument

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite Slurry / Fine Sand

FILTER PACK TYPE
10-20 CSSI Silica Sand

SCREEN
DIAMETER: 4"
TYPE: Sch. 40 PVC Machine-Cut Slots
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 7-11-94
Template: 2WELLOG

NOT TO SCALE

Appendix G Interim CERCLA GW Monitoring Plan.pdf

MONITORING WELL

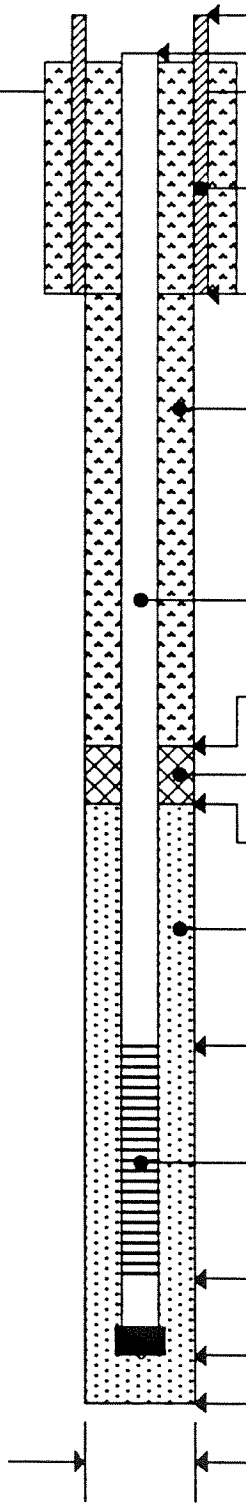
PROJECT	WELL NO.
EMF POCATELLO, ID	525

JOB NO.	SITE	COORDINATES and/or STATIONING
21372	OFF SITE	N 455,297 E 560,772

BEGUN	COMPLETED	PREPARED BY	REFERENCE POINT FOR MEASUREMENTS
6-15-94	6-15-94	C. Obi	Notch at top of PVC: 4399.61'

(GENERALIZED GEOLOGIC LOG)

See Geologic Drill Log for Details.



	DEPTH (FT)	ELEV. (FTMSL)
TOP OF SURFACE CASING	2.9	4400.0
TOP OF RISER CASING	2.5	4399.6
GROUND SURFACE	0.0	4397.1
BOTTOM OF SURFACE CASING	2.1	4395.0
TOP OF SEAL	3.0	4394.1
TOP OF FILTER PACK	15.5	4381.6
TOP OF SCREEN	17.8	4379.3
BOTTOM OF SCREEN	27.8	4369.3
BOTTOM OF SUMP	28.3	4368.8
BOTTOM OF HOLE	28.5	4368.6

SURFACE CASING
DIAMETER/TYPE: 8"/ Steel Monument

BACKFILL MATERIAL TYPE
Cement-Bentonite Grout

RISER CASING
DIAMETER/TYPE: 4"/Schedule 40 PVC

ANNULAR SEAL TYPE
Bentonite Tablets and Granules

FILTER PACK TYPE
10-20 CSSI Silica Sand

SCREEN
DIAMETER: 4"
TYPE: Sch. 40 PVC Machine-Cut Slots
OPENING WIDTH: 0.020"

HOLE DIAMETER: 10"

Update: 7-11-94
Template: 2WELLOG

NOT TO SCALE

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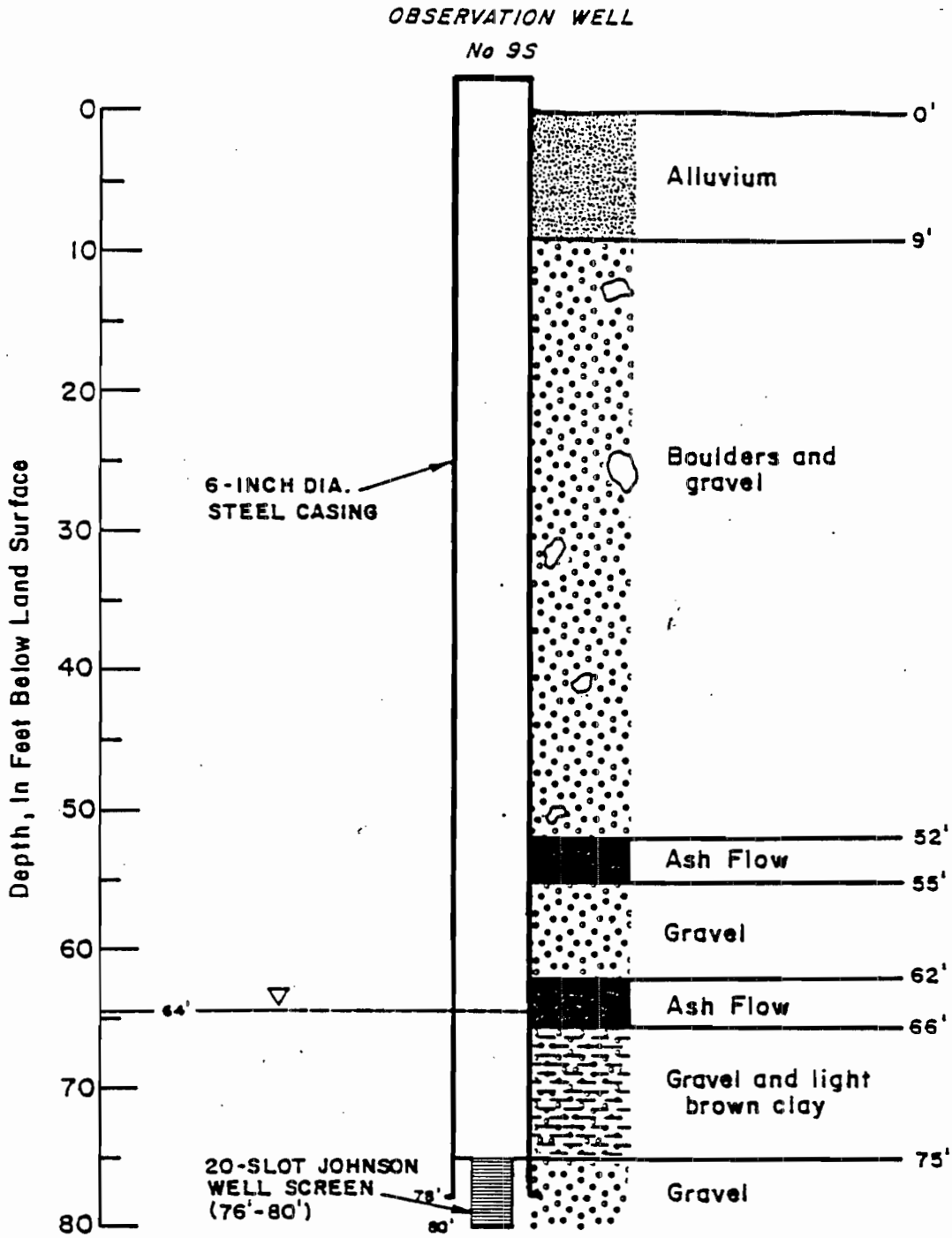

PREPARED FOR FMC CORPORATION POCATELLO, IDAHO		
TITLE WELL CONSTRUCTION DIAGRAM AND GEOLOGY OF SITE 9		
COMPILED BY Chris Creed	Geraghty & Miller, Inc. Syosset, N.Y	DATE 4/81
DRAWN BY C. Robertson		REVISED
CHECKED BY E. Koch	SCALE	Nº A-9

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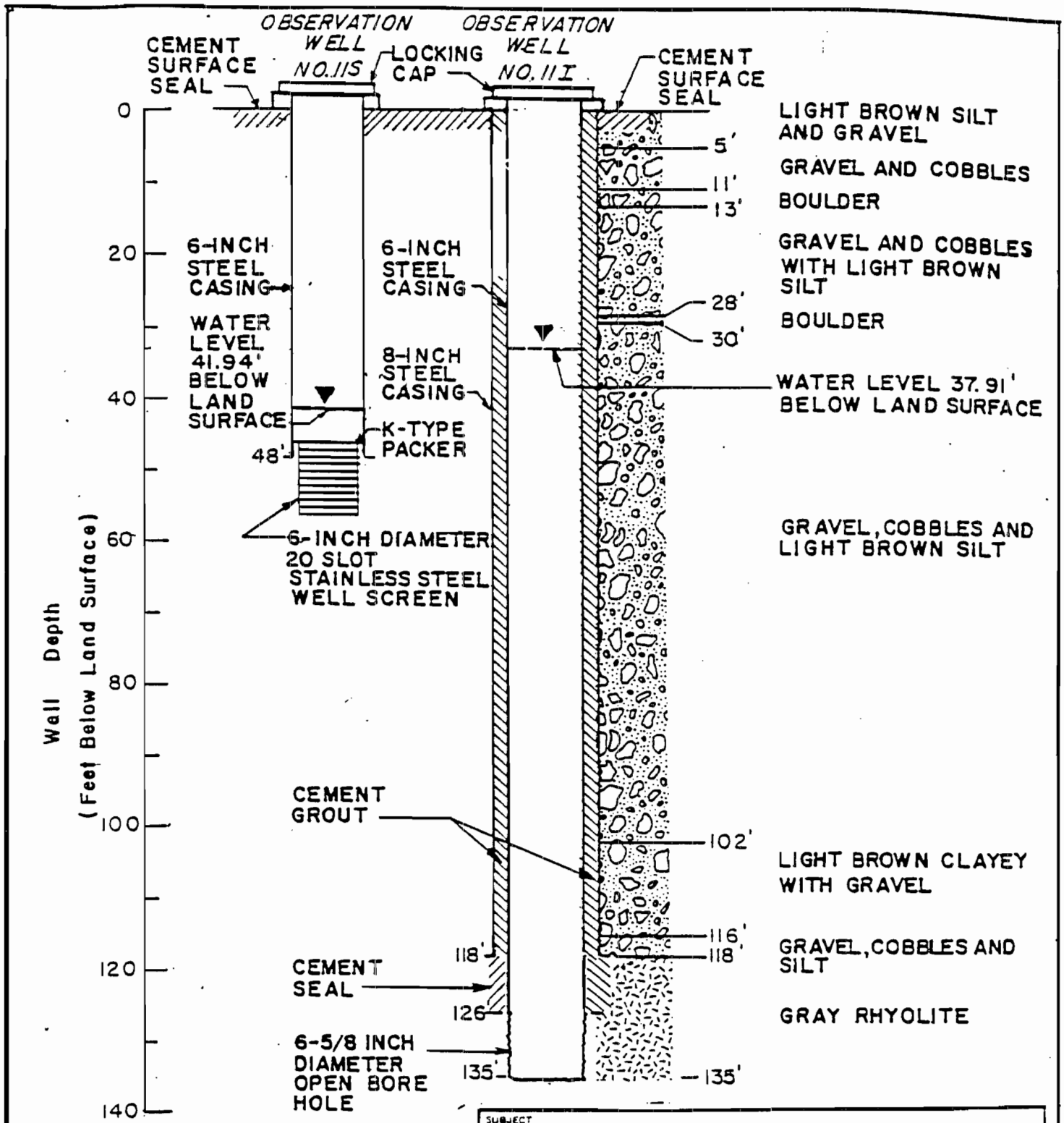

SUBJECT

WELL CONSTRUCTION DIAGRAM AND GEOLOGY OF SITE 11

PREPARED FOR

FMC CORPORATION
POCATELLO, IDAHO

Geraghty & Miller, Inc.	COMPILED BY CHRISTOPHER CREED	SCALE SHOWN	FIGURE A-11
	PREPARED BY D. MONTANINO	DATE 3/82	
	PROJECT MGR ELLIS KOCH		

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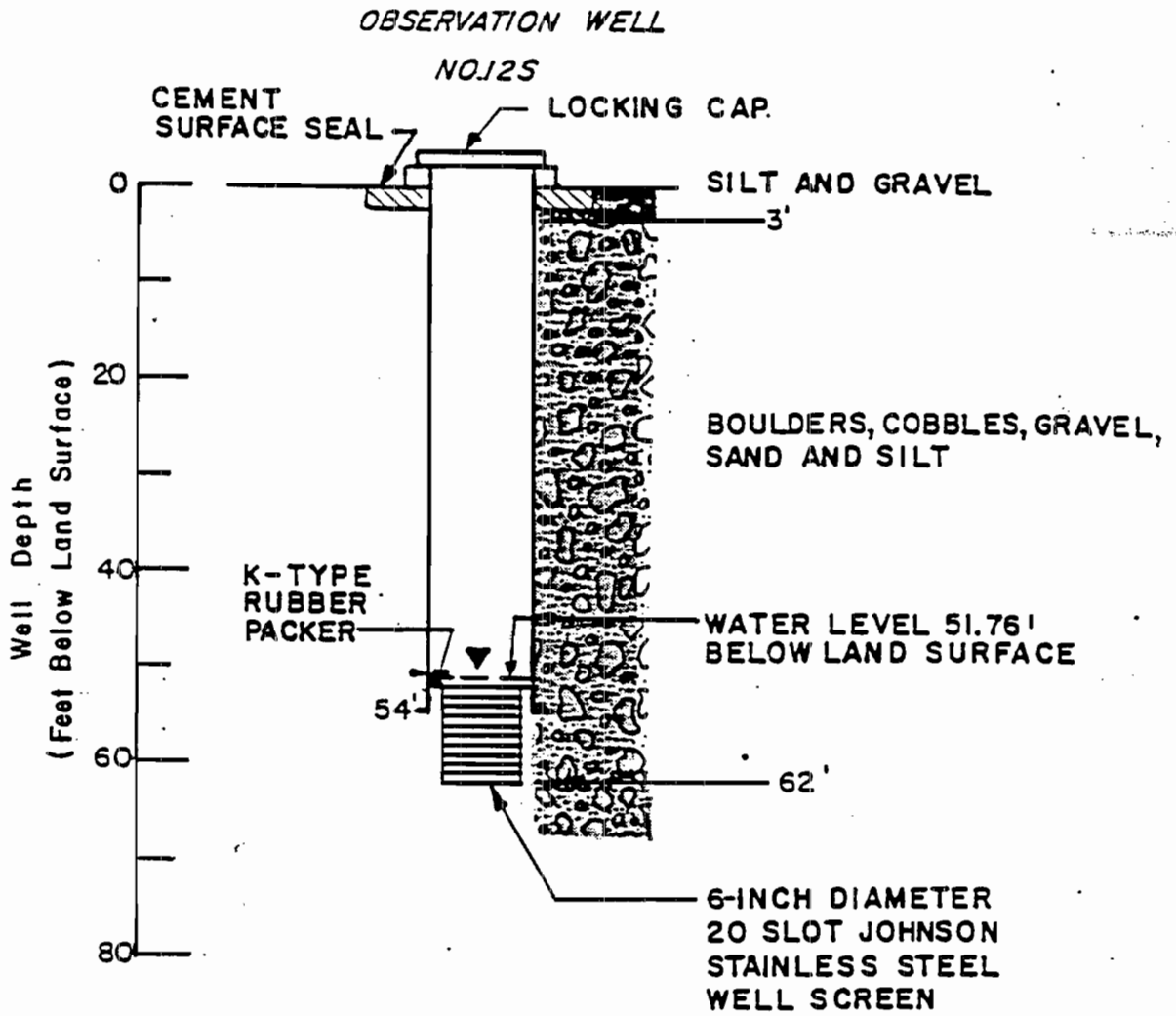

SUBJECT

WELL CONSTRUCTION DIAGRAM
AND GEOLOGY OF SITE 12

PREPARED FOR

FMC CORPORATION
POCATELLO, IDAHO

Geraghty & Miller, Inc.	COMPILED BY CHRISTOPHER CRECO	SCALE SHOWN	FIGURE A-12
	PREPARED BY D. MONTANINO	DATE 3/82	
	PROJECT MGR. ELLIS KOCH		

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ATTACHMENT B

INTERIM CERCLA GROUNDWATER MONITORING

QUALITY ASSURANCE PROJECT PLAN

Appendix G Interim CERCLA GW Monitoring Plan.pdf

INTERIM CERCLA GROUNDWATER MONITORING QUALITY ASSURANCE PROJECT PLAN

Prepared for:

FMC Idaho, LLC

Pocatello, Idaho

MARCH 2010

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INTERIM CERCLA GROUNDWATER MONITORING QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPP) describes the quality assurance and quality control requirements for the Interim CERCLA Groundwater Monitoring Program. These requirements have been established using the procedures recommended by EPA in *Quality Assurance Project Plans for Environmental Data Operations* (EPA, 2001). The QAPP has been prepared as Attachment B of the Interim CERCLA Groundwater Monitoring Plan (GMP) for the FMC site. QAPP requirements are implemented through the field sampling plan (FSP) presented in Attachment A of the GMP. The FSP provides the detailed field procedures that will be used to conduct groundwater monitoring.

This document is organized as follows: Section 1 presents project management information and requirements; Section 2 provides study design and implementation requirements ensuring that appropriate methods for sampling, analysis, data handling and quality control are employed and properly documented; Section 3 addresses the requirements for assessing the effectiveness of the quality control measures described in this plan; and Section 4 provides requirements for data validation and assurance of data usability.

1.0 PROJECT MANAGEMENT

1.1 PROJECT ORGANIZATION

The project organization is shown in Figure B-1. The responsibilities of key project personnel are as follows:

- FMC Project Manager - responsible for review, monitoring, auditing, and evaluation of performance of sampling and analytical contractors. Also responsible for assembly, organization and maintenance of all information collected during field activities.

- FMC Groundwater Sampling Contractor - responsible for collection of samples in accordance with project guidance documents, the representativeness of samples collected, and reporting of field data relevant to groundwater monitoring and data management. Also responsible for maintenance of groundwater monitoring database.

- FMC Analytical Laboratory Contractor QA Officer - responsible for ensuring laboratory compliance with relevant provisions of the GMP/FSP/QAPP, and the accuracy and precision of data resulting from analysis of groundwater monitoring samples.

- FMC Data Validation Contractor - responsible for data validation.

All personnel are responsible for identifying problems that may arise in the collection and reporting of project data and overseeing the implementation of the necessary corrective actions. The FMC Project Manager will track, review, and verify the effectiveness of corrective actions.

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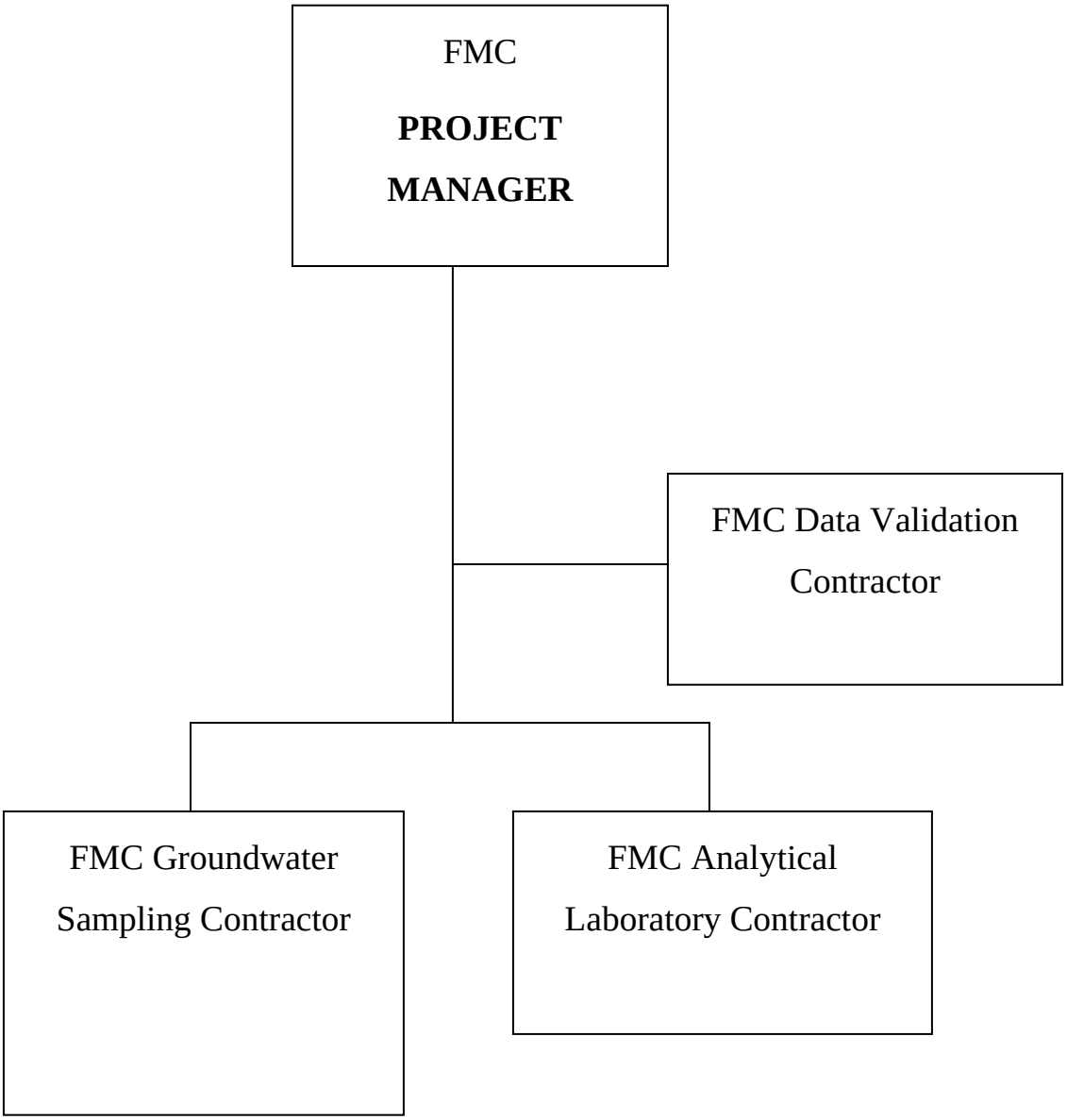
FIGURE B-1. PROJECT ORGANIZATION



1.2 BACKGROUND

FMC has been conducting a voluntary CERCLA groundwater monitoring program in conjunction with its ongoing RCRA groundwater monitoring program and Calciner Pond Remedial Action groundwater monitoring program. The RCRA groundwater monitoring program began in 1991 at essentially the same time as the CERCLA Preliminary Site Characterization Study (PSCS) and Remedial Investigation (RI) groundwater investigations and monitoring. The Calciner Pond Remedial Action groundwater monitoring commenced during the second quarter of 2003 under the IDEQ-FMC voluntary consent order (VCO) for remedial action at the calciner ponds. FMC has been conducting its voluntary CERCLA groundwater monitoring program since the EMF Site ROD was issued in 1998. Due to the fact that a Remedial Design / Remedial Action (RD/RA) Consent Decree to implement the FMC Plant OU groundwater remedy, including the long-term groundwater monitoring specified in the 1998 ROD, was never entered, an EPA-approved CECLA groundwater monitoring plan has not been required nor prepared.

Following permanent shut-down of the FMC plant in December 2001, EPA and FMC entered into an AOC for a Supplemental Remedial Investigation and Feasibility Study SRI/SFS) at the FMC Plant Operable Unit (OU). Although the AOC and Statement of Work (SOW) for the FMC SRI/SFS did not require a supplemental groundwater investigation(s) at the FMC Plant OU, FMC recognizes the need to address groundwater (both EMF impacts identified during the EMF RI and the potential for future impacts) during the SFS for the FMC Plant OU. FMC prepared a Groundwater Current Conditions Report (GWCCR) for the FMC Plant OU as a compendium of the extensive EMF RI and post-RI groundwater investigations, results and evaluations to support the SFS for the FMC Plant OU. One of EPA's comments on the draft GWCCR was "FMC's voluntary CERCLA ground water monitoring program must make a transition as soon as possible into an interim ground water monitoring program that must be approved by EPA with the development of site specific DQO's. This interim program will continue until an amended ROD has been signed for FMC. Then a long-term ground water monitoring program will be developed once a remedy is selected."

During a series of EPA-FMC meetings during February, March and May 2009, FMC and EPA began moving forward toward development of both an interim and long-term CERCLA groundwater monitoring program for the FMC Plant OU. FMC recently finalized the *Groundwater Current Conditions Report* (GWCCR) *for the FMC Plant OU* (FMC, June 2009) and EPA approved the GWCCR by letter dated July 20, 2009. Consistent with EPA's direction, this interim CERCLA Groundwater Monitoring Plan is being submitted as an appendix to the SFS Report for the FMC Plant OU.

A detailed understanding of the sources, nature and extent of groundwater contamination is needed to effectively interpret monitoring results. The interim CERCLA groundwater monitoring plan provides a summary of the groundwater conditions at the site; however, the GWCCR provides a detailed description of the sources, nature and extent of groundwater contamination at the FMC Plant OU.

1.3 PROJECT DESCRIPTION

The interim CERCLA groundwater monitoring program wells to be sampled are listed in Table B-1. These wells will be sampled semi-annually and targeted for the fall (normally November) and spring (normally May) of each year.

TABLE B-1. INTERIM CERCLA PROGRAM MONITORING WELLS

Area	Well Numbers	Up / Downgradient [1]
On-Plant Site	134, 139, 159, 145	D
Downgradient from Plant Site	111, 146, 110, TW-9S	D
Downgradient from FMC and Simplot Plant Sites	517, TW-12S	D
Northern Perimeter of EMF Groundwater Impact [2]	523, 515, 502, TW-11S, 524, 525	Cross

[1] Up / Downgradient refers to the wells hydrologic relationship to identified FMC and Simplot source areas.

[2] Impact is in reference to detection of arsenic, nitrate or selenium above representative levels.

1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The overall objective of the groundwater monitoring program is to collect samples representative of the groundwater conditions at the FMC Plant OU. Data Quality Objectives for this groundwater-monitoring program are presented in Table B-2.

To meet these objectives, data of known quality will be collected and analyzed. To facilitate the required statistical analyses, discussed below, analytical methods with the lowest

TABLE B-2. DATA QUALITY OBJECTIVES FOR THE INTERIM CERCLA GROUNDWATER MONITORING PROGRAM

#	DQO Step	Data Quality Objectives
1	State the problem	An objective process is needed to evaluate groundwater flow patterns and potential changes and/or trends in site-related groundwater constituents on a FMC Plant OU-wide basis.
2	Identify the decision	Are concentrations of site-related groundwater constituents stable or decreasing in wells 1) downgradient from identified FMC source areas, 2) downgradient from the joint fenceline area and both EMF facility sites, and 3) along the northern perimeter and not site-impacted to date. If increasing concentration trends are identified, evaluate / identify likely cause and mitigation plan if related to FMC source(s).
3	Identify inputs to the decision	• FMC-Plant OU-wide groundwater elevation (water level) data. • Monitoring data from the interim CERCLA groundwater monitoring wells. • Results (output) from the annual assessments / evaluations specified under the RCRA and Calciner Pond Remedial Action groundwater monitoring programs annual reports.. • JR Simplot Company gypstack groundwater monitoring data will also be used to evaluate potential changes in flow patterns and source contributions in the joint fenceline area and downgradient from both EMF facility sites.
4	Define the study boundaries	**Spatial** • Downgradient of the FMC Plant Site groundwater impact source areas (as identified in the GWCCR and summarized in the Interim CERCLA Groundwater Monitoring Plan); • Downgradient of the FMC Plant Site and JR Simplot Plant Site in the area of EMF groundwater discharge to the Portneuf River between and including Swanson Road Spring (aka the Spring at Batiste Road) and Batiste Spring. • Cross-gradient wells to the northwest and northeast of the FMC Plant Site that have not previously / currently been impacted by FMC-impacts to groundwater. • Groundwater in the underlying uppermost aquifer zone. **Temporal** • EMF Remedial Investigation groundwater monitoring data (1991 to 1995). • FMC's on-going RCRA and Calciner Pond Remedial Action groundwater monitoring programs annual assessments. • FMC's post-RI voluntary and interim CERCLA groundwater monitoring program data (1996 to current). • JR Simplot Company gypstack groundwater monitoring data (currently reported quarterly and annually).

TABLE B-2. DATA QUALITY OBJECTIVES FOR THE CALCINER POND REMEDIAL ACTION GROUNDWATER MONITORING PROGRAM (CONTINUED)

#	DQO Step	Data Quality Objectives
5	Develop a decision rule	• Using the Mann-Kendall Trend Analysis, are there upward trends in arsenic, potassium, total phosphorus / orthophosphate, selenium and sulfate concentrations in samples collected from: o On-Plant Site wells: 134, 139, 159 and 145 (in the joint fenceline area) o Plant Site downgradient wells: 111, 146, 110 and TW-9S o Wells downgradient from the FMC and Simplot Plant sites: 517 and TW-12S o Northern perimeter wells: 523, 515, 502, TW-11S, 524 and 525 • If so, are the upward trends attributable to EMF sources as follows: o On-Plant Site wells: Are trends at well 139, 134 and/or 159 related to releases from the closed RCRA ponds, per RCRA annual assessment report, or are the changes more likely related to the former unlined phossy ponds in the western ponds area? Is trend at well 145 consistent with trends observed at the other wells in the joint fenceline area per annual Calciner Pond Remedial Action groundwater monitoring report? o Plant Site downgradient wells: Are trends at well 111 and/or 146 related to releases from the closed RCRA ponds or the closed RCRA slag pit sump, per RCRA annual assessment report, or are the changes more likely related to the former unlined phossy ponds in the western ponds area? Is trend at well 110 consistent with trends observed at the other wells in the joint fenceline area per annual Calciner Pond Remedial Action groundwater monitoring report? o Wells downgradient from the FMC and Simplot Plant sites: Are trends at well 517 and/or TW-12S related to releases from FMC sources, per annual RCRA and Calciner Pond groundwater reports, or are the changes more likely related to Simplot sources based on review of Simplot groundwater monitoring results? o Northern perimeter wells: Are trends related to undetected results at higher detection limit? If not, are results higher than relevant comparative value (CV) per Table 4-1 of the GMP? If so, are the trends consistent with trends observed at the nearest cross-gradient well(s) within the EMF-impacted area or are the changes more likely related to non-EMF sources? • If the upward trend(s) are attributable to the closed RCRA ponds or Calciner Pond Remedial Action, further evaluation and potential mitigation plan(s) will be performed under those programs. If the upward trend(s) are attributable to Simplot sources, Simplot retains responsibility for the performance of Simplot's remedial actions. If the upward trends are attributable to FMC source areas identified for CERCLA remedial action, ensure remedial design addresses mitigation of identified and potential future sources of groundwater impacts that could exceed the CVs (MCLs, secondary standards or RBCs).

TABLE B-2. DATA QUALITY OBJECTIVES FOR THE CALCINER POND REMEDIAL ACTION GROUNDWATER MONITORING PROGRAM (CONTINUED)

6	Specify limits on decision errors	The Mann-Kendall Trend Analysis will be performed at the 95% confidence level (i.e., $\alpha = 0.05$).
7	Optimize the design for obtaining data	Groundwater monitoring and data evaluation activities will be conducted as specified in the Interim CERCLA Groundwater Monitoring Plan, FSP and QAPP.

routinely achievable detection limits will be used. This will assure that the required statistical analyses are performed using as many positively detected values as possible.

The objective of the interim CERCLA groundwater monitoring program is to collect sufficient data of known quality to, in conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs, evaluate potential changes and/or trends in site-related groundwater constituents and evaluate groundwater conditions on an OU-wide basis. To meet this objective, groundwater samples from the monitoring wells listed in Table B-1 will be analyzed for the parameters specified in Table B-3 for the routine semiannual monitoring events and in Table B-4 for the expanded 5-year monitoring events. The acceptable level of uncertainty is included in Tables B-3 and B-4 as precision and accuracy goals. Samples will be handled in accordance with the requirements specified in the Field Sampling Plan and submitted for analysis in accordance with the requirements specified in Tables B-3 and B-4. Data generated from analysis of groundwater samples will be reviewed in accordance with the requirements specified in Section 4.

1.5 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

All personnel directly involved in sample collection, handling, analysis, and data evaluation will be provided with a copy of this QAPP and the applicable FSP. Personnel will be trained in the requirements specified herein, or provided ample time to read and become familiar with the requirements prior to beginning data collection activities.

1.6 DOCUMENTATION AND RECORDS

Records of the analyses and evaluations required by this plan will be maintained by FMC at the Pocatello plant or at another FMC corporate office. Laboratory documentation and records requirements are specified in the laboratory QAPP. Required field documentation is specified in the companion Field Sampling Plan. Data reporting requirements to EPA are specified in Section 5 of the Groundwater Monitoring Plan.

2.0 MEASUREMENT/DATA ACQUISITION

This section provides requirements for sampling program design, sample collection, handling, analysis, and data management. These requirements ensure that appropriate methods for sampling, analysis, data handling, and quality control are employed and documented.

TABLE B-3. SUMMARY OF REQUIRED ANALYSES
ROUTINE SEMIANNUAL GROUNDWATER MONITORING EVENTS

Parameter	Method Number	Method Type	Reporting Limit (mg/l)	Accuracy*	Precision**
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.1	75% - 125%	± 30%
Chloride	9056 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1	75% - 125%	± 30%
Fluoride	9056 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1	75% - 125%	± 30%
Arsenic, selenium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002 (As), 0.0005 (Se)	75% - 125%	± 30%
Nitrate	9056 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1	75% - 125%	± 35%
Total Phosphorus	6010B (a) or 365.2 (c)	Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid)	0.02	75% - 125%	± 30%
Sulfate	9056 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1	75% - 125%	± 30%

(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983.

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

* percent recovery

** relative percent difference

TABLE B-4. SUMMARY OF REQUIRED ANALYSES
EXPANDED 5-YEAR GROUNDWATER MONITORING EVENTS

Parameter	Method Number	Method Type	Reporting Limit (mg/l)	Accuracy*	Precision**
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.1	75% - 125%	± 30%
Chloride	9056 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1	75% - 125%	± 30%
Fluoride	9056 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1	75% - 125%	± 30%
Arsenic, selenium, manganese, boron and vanadium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002 (As), 0.0005 (Se), 0.0006 (Mn), 0.018 (B), 0.002 (V)	75% - 125%	± 30%
Nitrate	9056 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1	75% - 125%	± 35%
Total Phosphorus	6010B (a) or 365.2 (c)	Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid)	0.02	75% - 125%	± 30%
Sulfate	9056 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1	75% - 125%	± 30%
Total Ammonia (NH_3 + NH_4 as N)	350.3 (d)	Potentiometric, Ion Selective Electrode	0.2	75% - 125%	± 30%
Total Cyanide	335.4 (d)	Colorimetric	0.01	75% - 125%	± 30%

(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983.

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

* percent recovery

** relative percent difference

2.1 SAMPLING METHODS REQUIREMENTS

The groundwater monitoring wells associated with the Interim CERCLA Groundwater Monitoring Plan will be sampled in accordance with the detailed procedures presented in the FSP (Attachment A to the Groundwater Monitoring Plan).

2.2 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

The groundwater samples will be handled and custody will be maintained in accordance with the detailed procedures presented in the FSP.

2.3 ANALYTICAL METHODS REQUIREMENTS

The analytical methods that will be used on groundwater monitoring samples are summarized in Tables B-3 and B-4. The tables specify the method number, method type, and method detection limit ranges. Reporting limits presented on Tables B-3 and B-4 for each analysis represent the best reporting limits that can be attained by the specified methodology. Data from multiple dilutions will be used, as necessary, to quantify target components within the calibrated range. Actual reporting and detection limits obtained during analysis will be reported by the laboratory for each parameter in each sample.

The laboratory performing the analyses will have an established quality assurance/quality control (QA/QC) plan and all analyses will be performed in accordance standard operating procedures consistent with the QA/QC plan. Where analytical or QA/QC procedures presented in the QAPP are different from those presented in the laboratory QA/QC plan, procedures presented in this QAPP will govern.

2.4 QUALITY CONTROL REQUIREMENTS

Both field and laboratory QC checks will be employed to evaluate field contamination, the variability of field techniques and the performance of laboratory analytical procedures. QC checks will take the form of samples introduced into the analytical stream to enable evaluation of sampling and analytical accuracy and precision. Such QC samples will be regularly prepared in the field and laboratory so that all phases of the sampling process are monitored.

The well sampling schedule for the Interim CERCLA groundwater monitoring program will be coordinated with FMC's Calciner Pond Remedial Action groundwater monitoring, which includes similar analytical requirements. This will enable concurrent collection of field duplicates and samples used to evaluate sampling and analytical quality, as noted below.

2.4.1 Field Quality Control Samples

Field Duplicates - Field duplicate samples will be collected for use as a measure of the precision of the sample collection and analysis process. The duplicate will be submitted with minimal indication of the site it was taken from. Duplicates will be prepared following standard sampling and preparation techniques as described in the FSP and submitted to the laboratory at a minimum frequency of one per sample delivery group or every 20 samples.

Rinsate Blanks - Rinsate blanks are collected by pouring reagent grade purified water over or through submersible pump setups to evaluate the effectiveness of field decontamination of sampling equipment. The blank is analyzed for the same analytical parameters as the groundwater samples. Rinsate blanks will be collected after decontamination and at a minimum frequency of one per sample delivery group or every 20 samples.

Distilled or De-ionized Water Blank – Distilled or de-ionized water blanks are aliquots of water collected directly from the field supply container and analyzed to determine distilled / de-ionized water quality. The blanks are collected at a frequency of one per semi-annual sampling event and are analyzed for the same parameters as the groundwater samples. The distilled or de-ionized blanks are collected in conjunction with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs (i.e., one distilled or de-ionized water blank per sampling event concurrently satisfies requirement for all three monitoring programs).

2.4.2 Matrix Spike / Matrix Spike Duplicate Quality Control Samples

Matrix spike / matrix spike duplicate (MS/MSD) quality control samples will also be collected at a frequency of one per sample delivery group or one per twenty samples collected. The well designated for a MS/MSD quality control sample will be randomly selected during each monitoring event from one of the sixteen interim CERCLA program monitoring wells.

2.4.3 Laboratory QA/QC Samples

Laboratory QC samples consist of laboratory method blanks, laboratory control samples, matrix spike, and laboratory duplicates or matrix spike duplicates. Requirements for laboratory QC samples are specified in the Laboratory's Quality Assurance Project Plan.

For method-specific QC criteria and samples (e.g. calibration blanks or initial calibrations), the criteria specified in the methods will be used. The methods will be performed as written. Any deviations, if allowed, must be approved by the FMC Environmental Manager in writing prior to implementation by the laboratory. Procedures will be in place for demonstrating that the laboratory is in control during each analytical measurement.

Laboratory Control Samples - The laboratory will be considered in control when data generated by analysis of control samples fall within laboratory prescribed limits. Data generated by analysis of control samples that falls outside the established control limits are judged to be generated during an "out-of-control" situation. These data are considered suspect and shall be repeated or reported with qualifiers. Laboratory control samples shall be analyzed for each analytical method when appropriate for the method. A laboratory control sample consists of either a control matrix spiked with the analytes of interest for this program or a certified reference material that contains the analytes of interest. Laboratory control sample(s) shall be analyzed with each batch of samples processed to verify that the precision and bias of the analytical process are within control limits. The results of the laboratory

control sample(s) will be compared to control limits established by the laboratory for both precision and bias to determine usability of the data.

Method Blank - A method blank shall be analyzed with each batch of samples processed to assess contamination levels in the laboratory. The laboratory shall have guidelines in place for accepting or rejecting data based on the level of contamination in the blank. For a method blank to be acceptable for use with the accompanying samples, the concentration in the blank of any analyte of concern shall not be higher than the highest of either:

- The MDL, or
- Five percent of the regulatory limit for that analyte, or
- Five percent of the measured concentration in the sample.

Matrix Spike/Matrix Spike Duplicates for Matrix Duplicate Samples - Procedures shall be in place for documenting the effect of the matrix on method performance. When appropriate for the method, there shall be at least one matrix spike (MS) and either one matrix duplicate (MD) or one matrix spike duplicate (MSD) per analytical batch. These procedures shall include preparation and analysis of matrix spikes and the method of standard additions for metal and inorganic methods. When the concentration of the analyte in the sample is greater than 0.1% (1,000 ppm), no spike is necessary. Procedures shall be in place for determining the precision of the method for a specific matrix. These procedures shall include analysis of matrix duplicates and/or matrix spike duplicates.

If the concentration of a specific analyte in the sample is being checked against a regulatory concentration limit or action level, the spike shall be at or below the limit, or 10 times the background concentration (if historical data are available), whichever concentration is higher.

If the concentration of a specific analyte in a sample is not being checked against a limit specific for that analyte, then the analyst may spike the sample at the same concentration as the reference sample, at 20 times the estimated quantitation limit (EQL) in the matrix of interest, or at a concentration near the middle of the calibration range.

2.5 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

All equipment used in the conduct of this work will receive routine maintenance checks in order to minimize equipment breakdowns. Maintenance checks will generally coincide with calibration checks. Any equipment found to be operating improperly will be taken out of use, and a notation stating the time and date of this action will be made in a log book. The equipment will be repaired, replaced or recalibrated, as necessary, and the time and date of its return to service will also be recorded. Groundwater monitoring equipment will be inspected and maintained as noted in Table B-5.

TABLE B-5. GROUNDWATER MONITORING EQUIPMENT INSPECTION AND MAINTENANCE ACTIVITIES

Inspection Item	Inspection Frequency	Maintenance Action
Field equipment	Semiannual	Repair or replace defective/damaged equipment
Laboratory equipment	Semiannual	Recalibrate; repair or replace defective equipment in accordance with Laboratory QA/QC Plan

2.6 INSTRUMENT CALIBRATION AND FREQUENCY

The requirements in this section pertain to the calibration of field equipment. Laboratory equipment will be calibrated in accordance with an established QA/QC plan and all calibrations will be performed in accordance standard operating procedures consistent with the QA/QC plan. Additional requirements related to laboratory instrument calibrations and frequency requirements are specified in the laboratory QA/QC plan. All calibrations of field equipment will be recorded in appropriate logbooks. Table B-6 provides a summary of field equipment calibration requirements.

TABLE B-6. SUMMARY OF FIELD EQUIPMENT CALIBRATION REQUIREMENTS

Field Parameter	Instrument / Method	Calibration	Calibration Frequency	Estimated Accuracy*
Water Level Survey	Electrical Water Probe Steel Tape	Reference to Steel Tape Reference to New Tape	Periodically Periodically	0.1 ft 0.01 ft
Specific Conductance	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	Daily	± 0.5% or 1 µmhos/cm
Dissolved Oxygen	Dissolved oxygen meter	Daily, based on local barometric pressure and water-saturated air	Daily	± 2% or 0.2 mg/L
ORP	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	Daily	± 20 mV
Temperature	Temperature meter	Factory calibration only	Factory only	0.15 °C
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	Daily	± 2%
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	Daily	± 0.2 pH unit

*Based on manufacturer specifications for YSI 556 MPS system and HACH 2100P turbidity meter currently used for FMC groundwater monitoring. Alternate instrumentation should have comparable estimated accuracies.

2.7 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

Groundwater sample containers will be new or pre-cleaned and supplied by the laboratory performing sample analysis along with any required preservatives. All other consumables will be decontaminated prior to use in accordance with the equipment decontamination procedure presented in the FSP.

2.8 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

To meet groundwater-monitoring objectives at the FMC Facility, no data from non-direct measurements are required, other than that collected during groundwater sampling and sample analysis.

2.9 DATA MANAGEMENT

Data from both the field and the laboratory will be managed during this project. Field data will consist of field notebooks, field sampling forms, daily calibration forms, and chain of custody forms. Sampling forms, calibration forms, and chain of custody forms will be retained by the groundwater-sampling contractor until the end of each semiannual sampling event, then forwarded to the FMC Project Manager for retention. Original field notebooks will be maintained by the sampling contractor, with copies provided to the FMC Project Manager on a semiannual basis.

The laboratory documentation required for each sample delivery group depends on the anticipated level of review. The documentation requirements of data validation and data review are presented below. The Groundwater Sampling Contractor will maintain the analytical database.

<u>Laboratory Documentation for Data Validation</u>

The following documentation will be provided by the laboratory for each sample delivery group scheduled for validation:

1. Case Narrative
2. Chain of Custody Documentation
3. Summary of Results
4. QA/QC Result Summaries
5. Raw Data.

The format and detailed content of the laboratory documents will support validation of the data in accordance with *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, July 2002). An electronic data deliverable will be provided by the laboratory in a file format specified by FMC that is compatible with Excel, Access, or dBase III software. The deliverable will contain the fields specified in Table B-7. Data packages for full validation will be forwarded by the laboratory to the data validation

contractor. At the same time, a copy of items 1 through 4 will be forwarded to the FMC Project Manager for retention.

Laboratory Documentation for Data Review

Each sample delivery group of laboratory data not planned for validation will include items 1 through 4 described above in the same level of detail as required if the data were to be validated. Item 5, Raw Data, is not required. An electronic data deliverable will be provided by the laboratory in a file format specified by FMC. The deliverable will contain the fields specified in Table B-7. Items 1 though 4 will be forwarded to the FMC Project Manager for retention.

TABLE B-7. DATABASE FIELD ACRONYMS AND DESCRIPTIONS

DATABASE FIELD NAME	Type	Size	FULL NAME	DESCRIPTION
STA_ID	Text	12	Station ID:	well number, etc. (i.e., F308300 or S308108)
AGENCY	Text	8	Agency	investigating party (EPA)
SAMP_DATE	Date/Time	8	Sample Date	date sample was taken
SAMP_ID	Text	8	Sample ID	unique identification number given to each sample
WTR_DEP	Number (Double)	8	Water Depth	depth to where water is found from casing reference notch (in ft.)
WTR_ELEV	Number (Double)	8	Water Elevation	elevation above mean sea level of groundwater (in ft.)
CHEM_NAME	Text	36	Chemical Name	name of chemical
CAS_NO	Text	12	Chemical Abstract Service Number	number that is given to identify a unique chemical by the Chemical Abstract Service
CONC_DET	Number (Double)	8	Concentration Detection	chemical concentration that was detected
QUAL	Text	4	Qualifier	laboratory qualifier given to each sample
UNITS	Text	12	Units	units of measurement
QUAL_VAL	Text	4	Validation Qualifier	qualifier assigned as a result of data validation
QUAL_CODE	Text	6	Code Qualifier	code used by validation to indicate why a qualifier was assigned
VAL_LVL	Text	4	Validation Level	level or extent of validation done
CHEM_NO	Number (Double)	8	Chemical Number	chemical number given by FMC for database sorting

TABLE B-7. DATABASE FIELD ACRONYMS AND DESCRIPTIONS (CONTINUED)

DATABASE FIELD NAME	Type	Size	FULL NAME	DESCRIPTION
SAMP_TYPE	Text	4	Sample Type	e.g., groundwater (GW), surface water (SW) or potential source (PS) sample
LAB_NAME	Text	12	Laboratory Name	name of laboratory that performed the analyses
LAB_ID	Text	12	Laboratory Identification	identification number given to a sample by laboratory
QUAL_ANAL	Text	4	Analysis Qualifier	lab-assigned qualifier (see Qualifier Description)
QUAL_SAM	Text	8	Qualifying Sample	sample qualifier indicating that sample is not representative (see Qualifier Description)
AN_DATE	Date/Time	8	Analytical Date	date sample was analyzed for constituents
AN_METHOD	Text	20	Analytical Method	method used for analyzing chemicals
PKG_NAME	Text	9	Package Name	laboratory sample delivery group (SDG)
ACTUAL_VAL	Number (Double)	8	Actual Value	actual value shown for accuracy, used only for radiological
ACCURACY	Number (Double)	8	Accuracy	± accuracy (for rad samples)
RPT_LIM	Number (Double)	8	Reporting Limit	laboratory required reporting limit
FILE_NAME	Text	8	File Name	chronological name of an event

3.0 ASSESSMENT/OVERSIGHT

Periodic surveillance of sampling activities will be conducted. The surveillance will be conducted by the FMC Project Manager or designee. The field surveillance will focus on adherence to procedures outlined in the FSP and will include field observation of sampling procedures and selected documentation (e.g. field log books). Laboratory audits will be conducted in accordance with the laboratory quality assurance plan. Field surveillance reports and laboratory audit reports will be forwarded to the FMC Environmental Manager. Audit findings which require corrective action and follow-up will be documented and tracked and will have resolution verified by the FMC Project Manager.

3.1 ASSESSMENTS AND RESPONSE ACTIONS

If it appears that field or laboratory data are in error, the error(s) or potential error(s) will be documented and appropriate corrective action(s) will be taken. Corrective actions may include one or more of the following:

- Measurements may be repeated to check the error
- Calibrations may be checked and/or repeated
- Instrument or measuring device(s) may be replaced or repaired
- New samples may be collected, and/or samples may be reanalyzed.

All field and laboratory personnel will be responsible for identification of problems and implementation of corrective actions. During field and laboratory activities, problem descriptions and corrective actions taken will be thoroughly detailed and entered into notebooks. If the FMC Project Manager, FMC Sampling Contractors, FMC Data Validation Contractor, Analytical Laboratory Contractors, or other project personnel become aware of any problems in sample collection or analysis that cannot be corrected in the field or laboratory, they will initiate formal corrective action and notify the FMC Project Manager and prepare a Corrective Action Report. The FMC Project Manager will also be notified of problems identified and corrective actions taken during field activities. Appropriate corrective actions will be determined on a case-by-case basis.

3.2 REPORTS TO MANAGEMENT

The surveillance and audit findings will be included in the corresponding groundwater monitoring results and data validation report. Each report, as appropriate, will include a section that provides an overall assessment of the performance of the field and laboratory programs based on the audits.

4.0 DATA VALIDATION AND USABILITY

The following subsection present requirements for activities that occur after the data collection phase of the project is complete.

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

All data generated by this project will be reviewed by the FMC Environmental Manager or designee to ensure they are consistent with previous results and previously observed data trends. The data verification and validation activities will be in accordance with those used by FMC for its CERCLA and RCRA groundwater monitoring data over the past several years. These data verification and validation efforts are based on procedures recommended in *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G-8, November 2002*)*. A Data Verification and Data Validation Protocol for FMC's Interim CERCLA, RCRA and Calciner Pond Remedial Action groundwater programs is included as Attachment C to the Groundwater Monitoring Plan that describes how FMC has routinely adapted the specifications set forth in the National Functional Guidelines to non-CLP methods, the personnel that have been involved, the inputs to the process, sources of the inputs, how the process has been implemented, and the outputs of the process.

4.2 VALIDATION AND VERIFICATION METHODS

The required data review will be conducted during report preparation; it will include a comparison of the current and previous results for water levels and chemical parameters measured at each well sampled. The data verification and validation methods will be in accordance with those used by FMC for its CERCLA, Calciner Pond and RCRA groundwater monitoring data over the past several years. These data verification and validation efforts are based on procedures recommended in *Guidance on Environmental Data Verification and Data Validation* (EPA QA/G-8. EPA/240/R-02/004, November 2002*)*.

4.3 RECONCILIATION WITH USER REQUIREMENTS

EPA recommends that the QAPP "[d]escribe how the results obtained from the project or task will be reconciled with the requirements defined by the data user or decision maker. Outline the proposed methods to analyze the data and determine possible anomalies or departures from assumptions established in the planning phase of data collection. Describe how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers." (QA/R-5, EPA 2001, Section 3.5.3). As noted in QA/R-5, this corresponds to Step 7 of the DQO process.

The process to be followed in reviewing groundwater-monitoring data against user requirements is described below. Figure B-2 illustrates the steps described in these sections.

Review of Analytical Data

Once analytical data for samples collected during a groundwater-sampling event have been reviewed by the analyst and the Analytical Laboratory QA Officer and are determined to be useable, they are reported to the Groundwater Sampling Contractor (GSC), who then forwards a copy of the data to the Data Validation Contractor (DVC). The DVC will review the analytical data reported by the laboratory as well as field sampling and sample handling records submitted by the GSC.

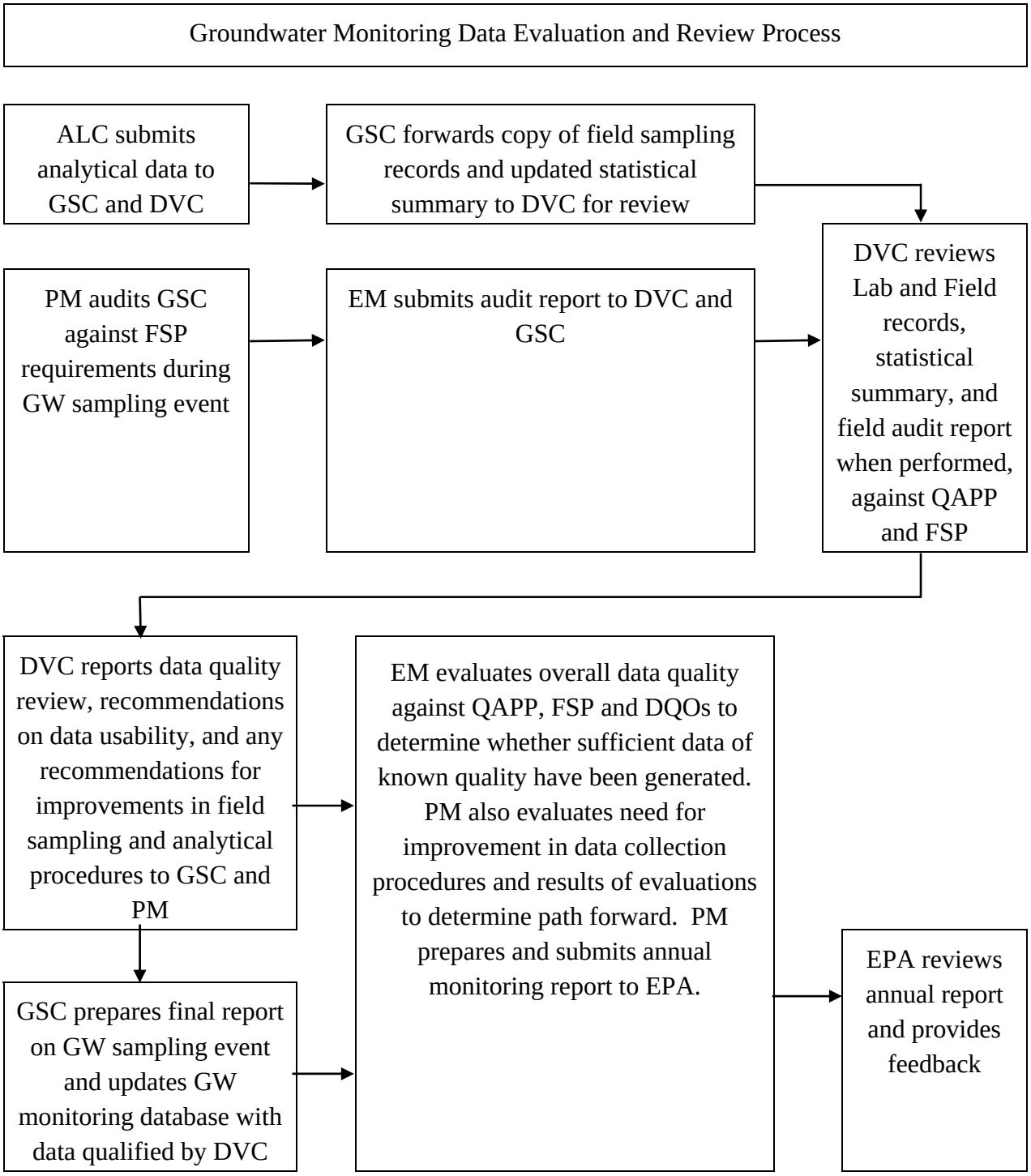
In addition, the FMC Project Manager (or designee) will perform periodic audits of the performance of the GSC against the requirements of the Field Sampling Plan (Attachment A to the Groundwater Monitoring Plan).

The FMC Project Manager will prepare an audit report and submit this to the DVC and the GSC. The DVC will review the audit report and evaluate these findings as part of the review of data provided by the analytical laboratory and GSC. Based on these inputs, the DVC will determine the quality of the data and assign appropriate data qualification flags in accordance with EPA's Functional Guidelines and this QAPP.

The DVC will submit a report to the FMC Project Manager and the GSC containing the results of the data review process, recommendations on data usability, and any recommendations for improvements in field sampling and analytical procedures.

The GSC will then prepare a report containing field-sampling data; a figure displaying groundwater elevation contours for wells sampled during the monitoring event, analytical reports submitted by the Analytical Laboratory and the DVC. The Groundwater Sampling Contractor will also add the field measurements, analytical data, and data validation flags to the project groundwater-monitoring database. This compilation report and updated database will be submitted to the FMC Project Manager for further review and reconciliation with user requirements.

FIGURE B-2. DATA VALIDATION AND USABILITY PROCESS



NOTES:
ALC = Analytical Laboratory Contractor, DVC = Data Validation Contractor, PM = FMC Project Manager, FSP = Field Sampling Plan, GSC = Groundwater Sampling Contractor, QAPP = Quality Assurance Project Plan.

Data Usability Determination

Reconciliation with DQOs determines the usability and limitation of the analytical data with respect to its intended purpose. Attainment of DQOs in fulfillment of program objectives described in this QAPP and the Field Sampling Plan (Attachment A to the Groundwater Monitoring Plan) is partly determined by a qualitative and quantitative assessment of the data collection and measurement process.

The principal DQO for the Interim CERCLA Groundwater Monitoring Plan from Step 2 of the DQO process is:

> *Are concentrations of site-related groundwater constituents stable or decreasing in wells 1) downgradient from identified FMC source areas, 2) downgradient from the joint fenceline area and both EMF facility sites, and 3) along the northern perimeter and not site-impacted to date. If increasing concentration trends are identified, evaluate / identify likely cause and mitigation plan if related to FMC source(s).*

The qualitative assessment of accumulated data against this DQO is the responsibility of the FMC Project Manager. Groundwater monitoring data are evaluated for conformance with required sample collection procedures, sampling handling, and analytical requirements and procedures. The data are also evaluated for previously unknown spatial or temporal variations that may affect sample representativeness. This evaluation is based on surveillance activities conducted by the EM and quantitative assessment of data quality by the DVC, as noted earlier in this section.

The FMC Project Manager evaluates overall data quality against QAPP, FSP, and DQOs to determine whether sufficient data of known quality have been generated. The EM also evaluates any need(s) for improvement in data collection procedures and then determines a path forward.

The FMC Project Manager determines if the data are adequate for the quantitative assessments described in Step 5 of the DQO process, as listed below. For groundwater monitoring data, a statistical analysis of the groundwater quality data using the Mann-Kendall Trend Test at the 95% confidence level is performed for arsenic, potassium, total phosphorus / orthophosphate, selenium and sulfate. The results of the statistical analyses of the interim CERCLA groundwater monitoring program data, in coordination with the RCRA and Calciner Pond Remedial Action groundwater monitoring programs and Simplot's remedial action groundwater monitoring data, will be used to evaluate groundwater conditions on a FMC Plant OU-wide basis.

DQO Step 5 Decision Rules

- Using the Mann-Kendall Trend Analysis, are there upward trends in arsenic, potassium, total phosphorus / orthophosphate, selenium and sulfate concentrations in samples collected from:
    - On-Plant Site wells: 139, 134, 159 and 145 (in the joint fenceline area)
    - Plant Site downgradient wells: 111, 146, 110 and TW-9S
    - Wells downgradient from the FMC and Simplot Plant sites: 517 and TW-12S
    - Northern perimeter wells: 523, 515, 502, TW-11S, 524 and 525
- If so, are the upward trends attributable to EMF sources as follows:
    - On-Plant Site wells: Are trends at well 139, 134 and/or 159 related to releases from the closed RCRA ponds, per results of evaluations (output) from RCRA annual assessment report, or are the changes more likely related to the former unlined phossy ponds in the western ponds area? Is trend at well 145 consistent with trends observed at the other wells in the joint fenceline area per annual Calciner Pond Remedial Action groundwater monitoring report?
    - Plant Site downgradient wells: Are trends at well 111 and/or 146 related to releases from the closed RCRA ponds or the closed RCRA slag pit sump, per output from RCRA annual assessment report, or are the changes more likely related to the former unlined phossy ponds in the western ponds area? Is trend at well 110 consistent with trends observed at the other wells in the joint fenceline area per output from annual Calciner Pond Remedial Action groundwater monitoring report?
    - Wells downgradient from the FMC and Simplot Plant sites: Are trends at well 517 and/or TW-12S related to releases from FMC sources, per output from annual RCRA and Calciner Pond groundwater reports, or are the changes more likely related to Simplot sources based on review of Simplot groundwater monitoring results?
    - Northern perimeter wells: Are trends related to undetected results at higher detection limit? If not, are results higher than relevant comparative value (CV) per Table 4-1 of the GMP. If so, are the trends consistent with trends observed at the nearest cross-gradient well(s) within the EMF-impacted area or are the changes more likely related to non-EMF sources?
- If the upward trend(s) are attributed to the closed RCRA ponds or Calciner Pond Remedial Action based on the evaluations / assessments under those programs, further evaluation and potential mitigation plan(s) will be performed under those

programs. If the upward trend(s) are attributable to Simplot sources, Simplot retains responsibility for the performance of Simplot's remedial actions. If the upward trends are attributable to FMC source areas identified for CERCLA remedial action, ensure remedial design addresses mitigation of identified and potential future sources of groundwater impacts that could exceed the CVs (MCLs, secondary standards or RBCs).

Appendix G Interim CERCLA GW Monitoring Plan.pdf

REFERENCES

EPA, 2001. "Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA QA/R-5, March 2001.

EPA, July 2002. "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Final", EPA 540-R-01-008, July 2002.

EPA, November 2002. "Guidance on Environmental Data Verification and Data Validation" EPA QA/G-8, November 2002.

FMC, June 2009. "Groundwater Current Conditions Report (GWCCR) for the FMC Plant Operable Unit," June 2009.

ATTACHMENT C

DATA VERIFICATION AND DATA VALIDATION PROTOCOL

DATA VERIFICATION AND VALIDATION PROTOCOL FMC POCATELLO, IDAHO RCRA, CERCLA, AND CALCINER POND GROUNDWATER MONITORING PROGRAMS

Rev March 2010

1. INTRODUCTION

This protocol describes the procedures used by FMC Idaho, LLC for verification and validation of analytical data obtained from groundwater samples collected for the RCRA, CERCLA and Calciner Pond Remedial Action groundwater monitoring programs for the FMC plant site located in Pocatello, Idaho. The groundwater monitoring programs are performed pursuant to the RCRA Interim Status Groundwater Monitoring Plan as updated in the RCRA Post Closure Plans (FMC, 1999), the Calciner Pond Remedial Action Groundwater Monitoring Plan (FMC, November 2008) and the Interim CERCLA Groundwater Monitoring Plan (FMC, March 2010). The verification and validation procedures are in accordance with EPA's *Guidance on Environmental Data Verification and Data Validation*, EPA QA/G-8, (EPA, November 2002).

To reduce the potential for real or perceived conflicts of interest, FMC engages a third party data validation contractor (DVC) to perform the functions described in this protocol. Figure C-1 is a flow chart providing a general overview of the FMC project team and contractors role and flow of the data review and evaluation process used by FMC for the RCRA, CERCLA, and Calciner Pond Remedial Action groundwater monitoring programs. A list of the analytical parameters and analytical methods associated with the RCRA, CERCLA and Calciner Pond Remedial Action groundwater monitoring programs is provided in Table C-1. For all parameters except ammonia RCRA methods provided in the SW-846 Manual are selected for the appropriate parameters. For ammonia a RCRA method is not provided in the SW-846 Manual, therefore, a method listed in Methods for Chemical Analysis of Water and Wastewater approved for NPDES monitoring has been utilized.

Data Verification

The data verification process is an adaptation of the guidance set forth in the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA July 2002), revisions contemporary with the activity (Guidelines), as well as to the specifications of the non-CLP methods and , as well as program-specific performance goals. As indicated in the QAPP, the DVC performs a Level III data verification for these programs. Level III verification involves a review of all administrative documents, including field and laboratory chain-of-custody documents, sample preservation records, and sample preparation logs. For all precision and accuracy evaluations, laboratory summary information and forms are evaluated as indicated for the individual methods. Any observation from this process that may have potential impact on data utility or defensibility is narrated in the verification summary. Any actions or qualifications are also narrated and tabulated in the verification summary. The data verification reports are appended to the data usability summary.

Data Validation

The data validation process involves a review of all verification information, as well as other available site-chemistry information including statistical trend analysis focused on the potential impact of non-compliances on the ability to make the decision. The product of this effort is a data usability summary narrating all outliers and their potential impacts on the ability to address the regulatory standards as well as a tabular presentation for easy reference. A definition of all data qualifiers used by the DVC, as indicated in the Guidelines, is presented in Table C-2. The data verification reports are appended to the data usability summary.

2. TECHNICAL REVIEW OF METHOD 6010B AND 6020

For Method 6010B and 6020 the following items are evaluated by the DVC:

- Calibration
- Blanks
- ICP Interference Check Sample (ICS)
- Laboratory Control Sample (LCS)
- Duplicate Sample Analysis
- Spike Sample Analysis
- ICP Serial Dilution
- Field Duplicates
- Detection Limits
- Overall Assessment

If all criteria, as defined below, are met for the indicated item, it is noted with an asterisk and so defined in the narrative.

PRESERVATION AND HOLDING TIMES:

The DVC reviews the chain-of-custody documentation, sample receipt logs, and sample preparation and analysis logs. If the required preservation conditions are violated, the data reported ≥ Reporting Limit (RL) are will be flagged by the DVC as estimated low (J-) and non-detected values are will be qualified as unusable (R).

CALIBRATION:

a. Initial Calibration:

The DVC reviews the initial calibration summary. If an initial calibration was not performed, quality the DVC will qualify the data for all analytes from the samples in the analytical set as unusable (R). If an initial calibration provides recoveries above the upper limit, the data for the non-compliant analyte(s) reported ≥ RL for all samples analyzed with the calibration are will be flagged by the DVC as estimated high (J+). If an initial calibration provides recoveries below the lower limit, the

DVC will qualify the data for the non-compliant analyte(s) as estimated low (J-, UJ-).

b. Continuing calibration.

If a continuing calibration was not performed at the required frequency, the DVC will qualify the data for all analytes from the samples in the analytical set between the continuing calibrations as unusable (R). If a continuing calibration provides recoveries above the upper limit, the data for the non-compliant analyte(s) reported ≥ RL for all samples analyzed before and after the non-compliant calibration will be are flagged by the DVC as estimated high (J+). If a continuing calibration provides recoveries below the lower limit, the DVC will qualify the data for the non-compliant analyte(s) as estimated low (J-, UJ-).

c. Low-level calibration verification.

If the laboratory performs a low-level calibration verification (e.g. at or near the RL), and recoveries are reported below the lower limit, the DVC will qualify the results from non-compliant analyte(s) reported <2RL for the samples associated with the standard as estimated low (J-). If the recoveries are reported above the upper limit, the DVC will qualify the results from non-compliant analyte(s) reported positive but <2RL for the samples associated with the standard as estimated high (J+).

BLANKS:

The DVC will review the results reported for all blanks. These include initial calibration blanks, continuing calibration blanks, preparation blanks, and field blanks. The initial calibration blanks, continuing calibration blanks, and preparation blanks should not be reported with analytes present at concentrations >MDL. If any are reported above the MDL, the DVC will indicate this in the narrative as a method non-conformance. For all blanks, the DVC will calculate the action levels at five times the reported blank concentration. Any associated sample values reported below the action level will be qualified by the DVC as not-detected (U) at the reported value. For blanks reported with negative values, the DVC will determine that whether the RL or reported values above the RL are greater than five times the absolute value of the negative blank. Positive values and RL values less than five times the absolute value of the negative blank will be are flagged by the DVC as estimated low (J-).

ICP INTERFERENCE CHECK SAMPLE:

The DVC will review the results reported for the interference check standard. For values above the upper limit, the DVC will qualify all associated sample data that are reported ≥ RL for the analyte(s) as estimated high (J+). For values below the lower limit, the DVC will qualify all associated sample data for the analyte(s) as estimated low (J-, UJ-).

LABORATORY CONTROL SAMPLE:

The DVC will review the results reported for the laboratory control sample. For values above the upper limit, the DVC will qualify all associated sample data that are reported ≥ RL for the analyte(s) as estimated high (J+). For values below the lower limit, the DVC will qualify all associated sample data for the analyte(s) as estimated low (J-, UJ-). The DVC will indicate in the narrative that non-compliant LCS results without re-digestion and reanalysis are not compliant with method requirements.

DUPLICATE SAMPLE ANALYSIS:

The DVC will review the results reported for the laboratory replicate analysis. For situations where both the sample and replicate sample are reported with concentrations >5 RL of analyte RPD limits will be used and when either one or both are reported with <5 RL of analyte |S-D| limits will be used. The DVC will qualify the results reported for the non-compliant analyte(s) for all samples in the analytical batch as estimated (J, UJ). If a duplicate sample was not analyzed at the required frequency, the DVC will indicate in the narrative as a method non-conformance.

SPIKE SAMPLE ANALYSIS:

The DVC will review the results reported for the matrix spike (MS)/matrix spike duplicate (MSD) analysis. For situations where the native level is greater than four times the spiking level, the matrix spike recoveries are not evaluated. For situations where the native level is less than four times the spiking level, and non-compliant recoveries are reported, the DVC will qualify the results for all samples in the batch as estimated low (J-, UJ-) if below the limit and positive results as estimated high (J+) if above the upper limit. If the RPD of MS/MSD is out of specification, the DVC will qualify the results for the element(s) reported in all samples associated with the batch as estimated (J, UJ). If a matrix spike/matrix spike duplicate sample was not analyzed at the required frequency, the DVC will indicate this in the narrative as a method non-conformance.

ICP SERIAL DILUTION:

The DVC will review the results reported for the serial dilution analysis. For samples reported with >50 MDL of analyte in the undiluted sample providing non-compliant %D, the DVC will qualify the results for the element(s) in all samples associated with the batch as estimated (J, UJ). The DVC will comment in the narrative the indicated bias direction (, e.g. if the diluted value is higher than the undiluted value, low bias is indicated).

FIELD DUPLICATES:

The DVC will review the results reported for the field duplicate analysis. For situations where both the sample and field duplicate sample are reported with concentrations >5 RL of analyte RPD limits will be used and when either one or both are reported with <5 RL of analyte |S-D| limits will be used. The DVC will qualify the results reported for the non-compliant analyte(s) for all samples in the analytical batch as estimated (J, UJ).

DETECTION LIMITS:

The DVC will review the reporting limits regarding their reasonableness with method-stated values and with respect to MDL, if reported in the data package. The DVC will narrate any deviations from method requirements for reporting limits. If the laboratory is required to report values below the method-stated values, the DVC will narrate the statistical implications and qualify values below the statistically valid limit as estimated (J).

OVERALL ASSESSMENT:

In the overall assessment, the DVC will provide a brief summary of all items and QC outliers indicated in the narrative report.

3. TECHNICAL REVIEW OF METHODS 9056, 365.2, 350.3, 7580, 9010C, 9012B AND 7580

For Method 9056, 365.2, 350.3, 7580, 9010C, 9012B and 7580 the following items are evaluated by the DVC:

- Preservation and Holding Times
- Calibration
- Blanks
- Laboratory Control Sample (LCS)
- Duplicate Sample Analysis
- Spike Sample Analysis
- Field Duplicates
- Detection Limits
- Overall Assessment

If all criteria, as defined below, are met for the indicated item, it is noted with an asterisk and so defined in the narrative.

PRESERVATION AND HOLDING TIMES:

The DVC will review the chain-of-custody documentation, sample receipt logs, and sample preparation and analysis logs. If the required preservation conditions are violated and/or the holding time has been exceeded, and where studies have not shown that the exceedence has no significant impact on sample integrity for the parameter, the data reported for the parameter are flagged by The DVC as estimated low (J-). For significant holding time exceedences (e.g. >2 times the published limit) that have not shown that the exceedence has no significant impact on sample integrity for the parameter, associated non-detected values are qualified by the DVC as unusable (R).

CALIBRATION:

a. Initial Calibration:

The DVC will review the initial calibration summary. If an initial calibration was not performed, the DVC will qualify the data for all analytes from the samples in the analytical set as unusable (R). If an initial calibration was performed with fewer than the method-specified number of concentrations, the DVC will narrate the finding as a method deviation and qualify all associated sample results as estimated (J, UJ). The DVC will verify that the method-specified linear regression quantitation model was used to calculate sample concentrations. If it was not, the DVC will narrate the finding as a method deviation and qualify all associated sample results as estimated (J).

b. Continuing calibration.

If a continuing calibration was not performed at the required frequency, quality the DVC will qualify the data for all analytes from the samples in the analytical set between the continuing calibrations as unusable (R). If a continuing calibration provides recoveries above the upper limit, the data for the non-compliant analyte(s) reported ≥ RL for all samples analyzed before and after the non-compliant calibration are will be flagged as estimated high (J+). If a continuing calibration provides recoveries below the lower limit, the DVC will qualify the data for the non-compliant analyte(s) for all samples analyzed before and after the non-compliant calibration as estimated low (J-, UJ-).

BLANKS:

The DVC will review the results reported for all blanks. These include initial calibration blanks, continuing calibration blanks, and field blanks. The initial calibration blanks, and continuing calibration blanks should not be reported with analytes present at concentrations >MDL. If any are reported above the MDL, the DVC will indicate this in the narrative as a method non-conformance. For all blanks, the DVC will calculate the action levels at five times the reported blank concentration. Any associated sample values reported below the action level are will be qualified by the DVC as not-detected (U) at the reported value. For blanks reported with negative values, the DVC will determine that the RL or reported values above the RL are greater than five times the absolute value of the negative blank. Positive values and RL values less than five times the absolute value of the negative blank will be are flagged by the DVC as estimated low (J-).

LABORATORY CONTROL SAMPLE:

The DVC will review the results reported for the laboratory control sample. For values above the upper limit, the DVC will qualify all associated sample data that are reported ≥ RL for the analyte(s) as estimated high (J+). For values below the lower limit, the DVC qualify all associated sample data for the analyte(s) as estimated low (J-, UJ-). The DVC will indicate in

the narrative that non-compliant LCS results without reanalysis are not compliant with method requirements.

DUPLICATE SAMPLE ANALYSIS:

The DVC will review the results reported for the laboratory replicate analysis. For situations where both the sample and replicate sample are reported with concentrations >5 RL of analyte RPD limits will be used and when either one or both are reported with <5 RL of analyte |S-D| limits will be used. The DVC will qualify the results reported for the non-compliant analyte(s) for all samples in the analytical batch as estimated (J, UJ). If a duplicate sample was not analyzed at the required frequency, the DVC will indicate in the narrative as a method non-conformance.

SPIKE SAMPLE ANALYSIS:

The DVC will review the results reported for the matrix spike (MS)/matrix spike duplicate (MSD) analysis. For situations where the native level is greater than four times the spiking level, the DVC will not evaluate the matrix spike recoveries are not evaluated. For situations where the native level is less than four times the spiking level, and non-compliant recoveries are reported, the DVC will qualify the results for all samples in the batch as estimated low (J-, UJ-) if below the limit and positive results as estimated high (J+) if above the upper limit. If the RPD of MS/MSD is out of specification, the DVC will qualify the results for the element(s) reported in all samples associated with the batch as estimated (J, UJ). If a matrix spike/matrix spike duplicate sample was not analyzed at the required frequency, the DVC will indicate this in the narrative as a method non-conformance.

FIELD DUPLICATES:

The DVC will review the results reported for the field duplicate analysis. For situations where both the sample and field duplicate sample are reported with concentrations >5 RL of analyte RPD limits will be used and when either one or both are reported with <5 RL of analyte |S-D| limits will be used. The DVC will qualify the results reported for the non-compliant analyte(s) for all samples in the analytical batch as estimated (J, UJ).

DETECTION LIMITS:

The DVC will review the reporting limits regarding their reasonableness with method-stated values and with respect to MDL, if reported in the data package. The DVC will narrate any deviations from method requirements for reporting limits. If the laboratory is required to report values below the method-stated values, the DVC will narrate the statistical implications and qualify values below the statistically valid limit as estimated (J).

OVERALL ASSESSMENT:

In the overall assessment, the DVC will provide a brief summary of all items and QC outliers indicated in the narrative report.

4. PREPARATION OF DATA VALIDATION/USABILITY REPORT

For each event, a Data Validation/Usability Report (Report) is prepared by the DVC for each groundwater sampling event. The Report will summarize the event, indicate when the samples were collected, attach the reports provided by the laboratory, indicate what analyses were performed, indicate what analytical methods were used, indicate what procedures were used for the technical review, and indicate what guidance and standards were used for the usability assessment.

The data usability issues are also summarized and discussed in the usability narrative of the Report. The data quality indicators assessed by the DVC are precision, accuracy, representativeness, comparability, completeness, and consistency.

PRECISION

The precision of laboratory replicate analysis as well as field duplicate samples is will be discussed in the Report. The impacts of any outliers from method and program document specification will be identified and an assessment will be presented on the potential impact of these outliers on the utility of the datum in question.

ACCURACY

The accuracy (bias) indications resulting from calibrations, spikes, serial dilutions, and standard reference materials are will be discussed in the Report. The impacts of any outliers from method and program document specification will be identified and an assessment will be presented on the potential impact of these outliers on the utility of the datum in question.

REPRESENTATIVENESS

The factors contributing to representativeness (e.g., well preparation prior to collection, collection of collocated samples, container cleanliness, preservation, blank contamination, and time from collection to analysis) will be are discussed in the Report. The impacts of any outliers from method and program document specification will be identified and an assessment will be presented on the potential impact of these outliers on the utility of the datum in question.

COMPARABILITY

The factors contributing to comparability (e.g., consistency of reporting units, QA/QC procedures, sampling techniques, and analytical procedures utilized) will be discussed in the Report. The impacts of any outliers from method and program document specification will be identified and an assessment will be presented on the potential impact of these outliers on the utility of the datum in question.

COMPLETENESS

An assessment of the extent of completeness (e.g., usable data obtained *vs.* usable data program goals) will be discussed in the Report. The potential impact of lack of achievement of completeness goals is will be narrated.

CONSISTENCY

A comparison of the event data with the historical trend is will be performed. The impacts of any outliers from statistical expectations will be addressed as well as the need and extent of further consistency evaluations. The potential impact of lack of consistency with historical trends on the utility of the data is will be narrated in the Report.

REFERENCES:

EPA, 1983. "Methods for Chemical Analysis of Water and Wastes", USEPA 600/4-79-020, March 1983 and subsequent revisions.

EPA, 1986. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846 Third Edition, November 1986 and subsequent revisions.

EPA, 2001. "Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA QA/R-5, March 2001.

EPA, 2002. "Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" July 2002.

EPA, November 2002. "Guidance on Environmental Data Verification and Data Validation" EPA QA/G-8, November 2002.

FMC, 1999. "RCRA Interim Status Groundwater Monitoring Plan", Bechtel Environmental, August 1999; as updated in the RCRA Post-Closure Plans as follows:

- Pond 9E post-closure plan, January 2000;
- Slag Pit Sump post-closure plan, September 2001;
- Pond 8E, Phase IV Ponds and Pond 15S post-closure plans, May 2002;
- Pond 16S post-closure plan, July 2003; and,
- Pond 17 and Pond 18 Cell A post-closure plans, August 2004.

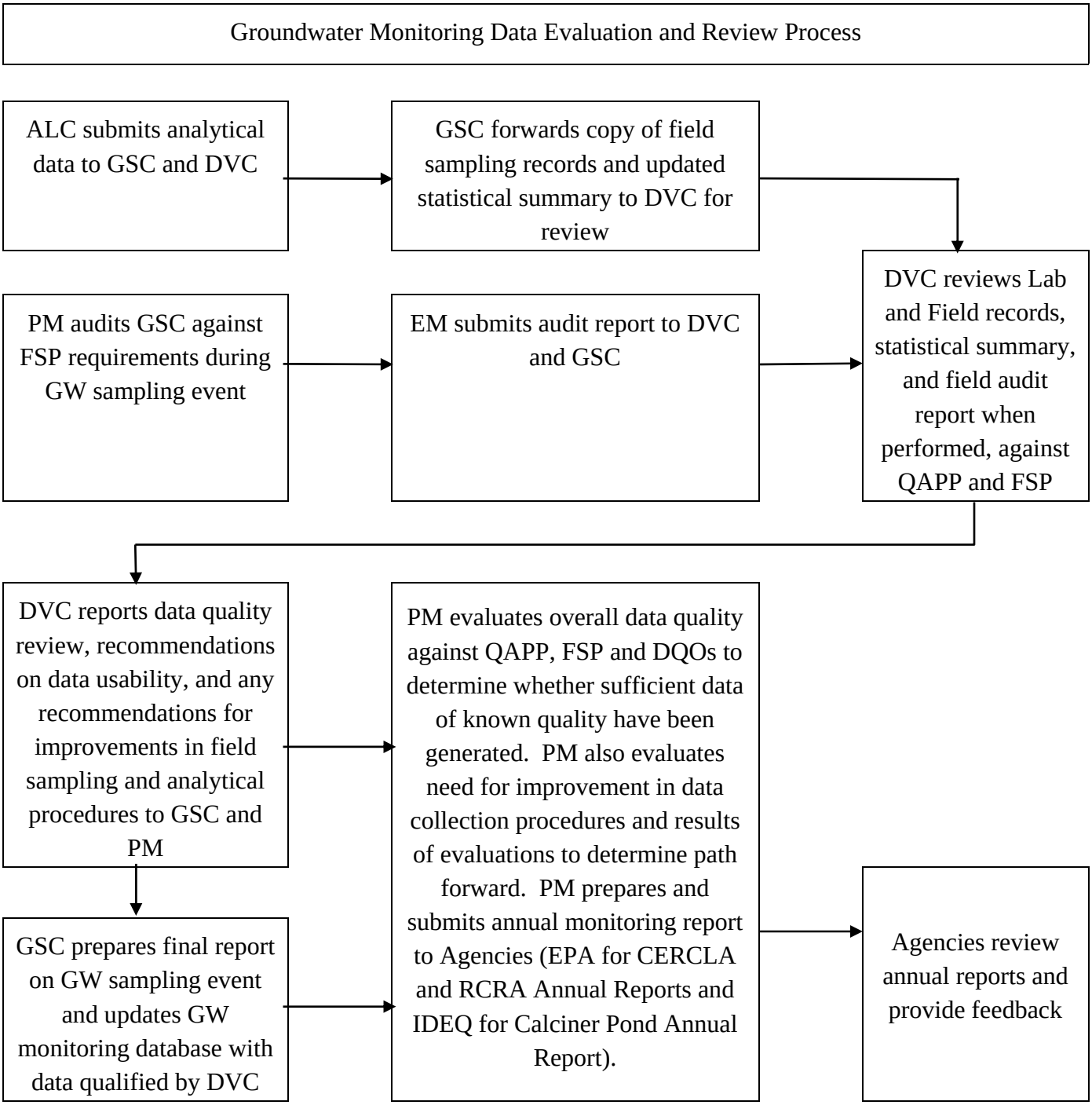
FMC Idaho LLC (FMC), November 2008. "Calciner Pond Remedial Action Groundwater Monitoring Plan," May 2008, Revised November 2008.

FMC, March 2010. "Interim CERCLA Groundwater Monitoring Plan," March 2010.

TABLE C-1 Analytical Parameters and Methods Associated with the FMC Groundwater Monitoring Programs		
Analytical Parameters	**Method**	**Program**
Arsenic	6010 or 6020	All
Potassium	6010 or 6020	All
Total phosphorus	6010 or 6020 or 365.2	All
Selenium	6010 or 6020	All
Cadmium	6010 or 6020	RCRA
Boron	6010 or 6020	CERCLA
Manganese	6010 or 6020	CERCLA
Vanadium	6010 or 6020	CERCLA
Chloride	9056	All
Fluoride	9056	All
Nitrate	9056	All
Orthophosphate	365.2	RCRA
Sulfate	9056	All
Ammonia	350.3	All
Cyanide	9010C or 9012B	CERCLA
Elemental phosphorus	7580	RCRA

TABLE C-2 DATA QUALIFIER DEFINITIONS	
U	The analyte was analyzed for, but was not detected above the level of the sample quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the result may be biased high.
J-	The result is an estimated quantity, but the result may be biased low.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control criteria. The analyte may or may not be present in the sample.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

FIGURE C-1 Data Evaluation and Review Process



NOTES:
ALC = Analytical Laboratory Contractor, DVC = Data Validation Contractor, PM = FMC Project Manager, FSP = Field Sampling Plan, GSC = Groundwater Sampling Contractor, QAPP = Quality Assurance Project Plan.

EPA Approval Extraction Zone Study February 6 2014.pdf

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ENVIRONMENTAL CLEANUP

February 6, 2014

Reply to
Attn. of ECL-111

Ms. Barbara Ritchie
FMC Corporation
1735 Market Street
Philadelphia, Pennsylvania 19103

RE: Unilateral Administrative Order for Remedial Design and Remedial Action
EPA Docket No. CERCLA 10-2013-0116

Extraction Zone Hydrogeologic Study Work Plan, January 2014

Dear Ms. Ritchie:

EPA has reviewed the remaining comment responses on the referenced document. The document is approved. Please provide EPA with your schedule for conducting the work so that we may plan oversight.

Sincerely,

Kevin Rochlin,
Project Manager

Printed on Recycled Paper

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FMC

FMC Idaho LLC, Pocatello, Idaho

FMC OU Remedial Design
EXTRACTION ZONE
HYDROGEOLOGIC STUDY WORK PLAN

January 2014

MWH

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LIST OF ACRONYMS

AFLB	American Falls Lake Beds
amsl	above mean sea level
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/s	centimeters per second
COC	contaminants of concern
DQO	data quality objective
EPA	United States Environmental Protection Agency
EMF	Eastern Michaud Flats
FMC	FMC Corporation
FMC OU	FMC Operable Unit
FSP	Field Sampling Plan
ft	feet
ft/day	feet per day
ft^2/day	square feet per day
gpm	gallons per minute
GPS	global positioning system
GWCCR	Groundwater Current Conditions Report for the FMC Plant OU
HASP	Health and Safety Plan
HCS	Hydraulic Containment System
I-86	Interstate 86
IROD	Interim Record of Decision Amendment
MCL	maximum contaminant level
mg/l	milligrams per liter
MS/MSD	matrix spike / matrix spike duplicate
MWH	MWH Americas, Inc.
NTU	Nephelometric tubidity unit
Plan	Groundwater Extraction Zone Hydrogeologic Study Work Plan
PM	Project Manager
POTW	publically owned treatment works
psi	pounds per square inch
PVC	polyvinyl chloride
QAPP	quality assurance project plan
RA	Remedial Action
RAs	Remediation Areas
RD	Remedial Design
SRI	Supplemental Remedial Investigation
SFS	Supplemental Feasibility Study

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SOP	Standard Operating Procedure
SWHASP	Site-Wide Health and Safety Plan
TOC	top of casing
UAO	Unilateral Administrative Order
USCS	Unified Soil Classification System

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1.0 INTRODUCTION

This Groundwater Extraction Zone Hydrogeologic Study Work Plan (Plan) was prepared to obtain data and information necessary to advance the Remedial Design (RD) for the FMC Operable Unit (FMC OU), Pocatello, Idaho. This Plan details the work and analyses for a detailed hydrogeologic assessment in the extraction zone of the groundwater remedial action Hydraulic Containment System (HCS) located at the northeast boundary of the FMC OU. The HCS is a component of the selected remedy for the FMC OU identified in the Interim Record of Decision Amendment (IROD, EPA 2012) and the Unilateral Administrative Order for Remedial Design and Remedial Action (UAO, EPA 2013). Data collected during this study will be utilized to refine the design of the groundwater remedy selected for the FMC OU. This Plan was prepared pursuant to Section IX., Paragraph 30.d. (Performance Testing) of the UAO and EPA's letter of June 19, 2013 that clarified the intent of the groundwater remedy performance testing.

This study will be performed to obtain more detailed hydrogeologic and water quality data within the groundwater remedy extraction zone preliminarily identified based on the *Supplemental Feasibility Study Report for the FMC Plant OU* (SFS Report, MWH 2010a) groundwater model. More detailed hydrogeologic and groundwater quality data is needed to refine the groundwater model including expected total extraction flow, number and location of extraction wells and combined water quality for purpose of evaluating water management (treatment) options. This Plan describes the collection of groundwater samples from the extraction zone for laboratory analyses and bulk water samples for potential bench-top / jar testing for further evaluation of the water treatment process for extracted groundwater, under either management option A (treatment at the City of Pocatello publically owned treatment works [POTW]) or option B (on-site treatment followed by infiltration in an on-site percolation basin[s]). A subsequent work plan may be recommended for water treatment process evaluation in the event that the bench-top / jar testing (if performed) indicates that a larger scale, on-site evaluation of the water treatment process is necessary to complete the remedial design.

1.1 BACKGROUND

1.1.1 FMC Site Description

A vicinity map of the FMC OU is provided on Figure 1-1 and a site map showing the FMC OU Remediation Areas (RAs) and hydrogeologic study area is provided on Figure 1-2.

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1.1.2 Regulatory Background

The IROD was signed by EPA Region 10 on September 27, 2012. The IROD presents the interim remedy for the Site as selected by the EPA. On June 10, 2013, EPA Region 10 issued a UAO to FMC for Remedial Design and Remedial Action (UAO; EPA 2013), EPA Docket No. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-10-2013-0116. The UAO defines the specific actions FMC will undertake to design and implement the selected remedy at the FMC OU in accordance with the IROD. The selected groundwater remedy requires extraction from the shallow aquifer to provide hydraulic containment of groundwater thereby preventing further downgradient migration of FMC OU COCs.

1.1.3 Summary of Hydrology and Hydrogeologic Setting

The EMF Site, and specifically the FMC OU, has been the subject of many environmental investigations. Most notable are the RI as summarized in the *Remedial Investigation Report for the Eastern Michaud Flats Site* (EMF RI Report; Bechtel, 1996*)*, the *Groundwater Current Conditions Report* (GWCCR) *for the FMC Plant Operable Unit* (MWH, 2009a), and the *Supplemental Remedial Investigation* (SRI) *Report for the FMC Plant Operable Unit* (MWH, 2009b). These reports provide detailed information on the results of the investigations conducted at the FMC OU. This section presents a brief summary of the hydrologic and hydrogeologic investigations, a more detailed discussion is contained in Section 2 of this Plan.

Major surface water features of the region near the FMC OU include the Snake River, Portneuf River, and the American Falls Reservoir. There are no naturally-occurring perennial surface water systems within the FMC OU. Surface water runoff from the FMC OU former operations area from precipitation is infrequent and is entirely contained within the FMC Plant Site property. Surface water runoff will continue to be entirely contained within the FMC Plant Site property during and after implementation of the selected remedy.

Groundwater at the EMF Site flows northward from the western and central portions of the FMC OU and converges with flow of groundwater from the west and northwest. Groundwater from the western and central portions of the FMC OU flows eastward, south of I-86, and joins groundwater from the Joint Fence Line Area and from the Simplot Plant. Virtually all groundwater from beneath the EMF facilities ultimately discharges to the Portneuf River between Batiste Spring and the spring at Batiste Road (aka Swanson Road Springs). Groundwater elevation contours for the shallow aquifer zone and generalized flow direction are shown on Figure 1-3.

Groundwater depths range from more than 150 feet (ft) below ground surface (bgs) in the southern portion of the FMC OU to 45 ft bgs in the northwestern area of the FMC plant area (Figures 1-4a and 1-4b; Cross Section). In the northern portion of the FMC OU, groundwater is

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approximately 60 ft bgs. The SRI sampling encountered groundwater at depths typically greater than 90 ft bgs at the FMC plant area. As presented in Figure 1-3, groundwater flow beneath the former operations area generally flows to the north from the Bannock Range and then to an east-northeasterly flow as the Bannock Range groundwater merges with the Michaud groundwater system. FMC- and Simplot-impacted groundwater discharges and mixes with the Portneuf River in the area between and including Swanson Road Spring and Batiste Spring, and then migrates into the Off-Plant OU as surface water.

1.2 PURPOSE AND OBJECTIVES OF HYDROGEOLOGIC STUDY

This Plan presents the elements for implementing a study to collect additional data that will be evaluated and incorporated in the final design of the HCS. The full-scale HCS will be designed to capture impacted shallow groundwater before it can migrate beyond the FMC Plant Site boundary. The full-scale HCS will be designed to effectively capture upgradient impacted groundwater, thus containing and extracting groundwater before it migrates off-site. The purpose of this Plan is to present the layout for the hydrogeologic study and evaluation criteria, a quality assurance project plan (QAPP) and the processes to be utilized for data reduction, review, and reporting.

The HCS will consist of a network of extraction wells, located along the northeastern boundary of the FMC Plant Site area of the FMC OU that will capture impacted shallow groundwater before it can migrate downgradient beyond the FMC OU boundary (Figure 1-3). Groundwater modeling as described in the *Groundwater Model Report for the FMC Plant Operable Unit*, (MWH, 2010b) indicates that five extraction wells will be sufficient for hydraulic capture (containment) of the remaining contaminants of concern (COC)-contaminated groundwater plume before it leaves the FMC Plant Site. During the full-scale HCS, the extracted groundwater will be treated by one of two management options: A) discharge for treatment at the City of Pocatello POTW, or B) on-site treatment followed by discharge to a percolation/infiltration basin(s) located in the western undeveloped portion of the FMC OU. This Plan details the study that FMC will conduct utilizing three extraction wells to assess the hydrogeological characteristics of soils in the planned extraction zone and the testing, data evaluation, and reporting associated with this study. The study results will be used to develop the final design of the HCS and will assist in selecting between the water management options. The final design will specify additional extraction wells (expected to total five wells) to provide complete capture of COC-contaminated groundwater.

1.3 HYDROGEOLOGIC STUDY GENERAL APPROACH AND PROCESS

Containment (i.e., hydraulic capture) of impacted groundwater near the northeast FMC Plant Site boundary is expected to be achieved by installation of a HCS and subsequent pumping of groundwater with extraction wells (see Figure 1-3). The HCS and its associated monitoring

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network will be designed and installed based on the data collected during this Hydrogeologic Study.

Predictive groundwater modeling indicates that five extraction wells, or possibly fewer, likely will be sufficient for hydraulic capture (containment) of the remaining plume before it migrates beyond the FMC OU downgradient boundary. This Plan presents a phased investigative approach prior to finalizing the design and implementation of a full-scale HCS.

1.3.1 Phase I HCS Installation

The HCS will be installed in two distinct field work phases, as necessary. Phase I will consist of the installation of three extraction wells strategically placed across an area to intercept COC-impacted groundwater (see Figure 1-3) and installation of six piezometers that will be utilized to monitor the overall containment (i.e., capture zone). Field procedures for well installation and other activities are further discussed in Section 3.0 and also detailed in Appendix A.

1.3.2 Phase I HCS Pump Tests

Variable pumping rate step-drawdown tests will be performed for a duration of approximately six hours (two hours for each of the three predetermined discharge rates as shown in Table B-3 of Appendix B, though final rates may be revised based on well development results) at each of the three extraction wells to determine specific capacity and optimal pumping rates for each well. A single 24-hour constant rate aquifer test will be performed on the western extraction well to determine aquifer hydraulic parameters. Following the step-drawdown and 24-hour constant rate pumping tests, all three Phase I extraction wells will then be pumped simultaneously for a 72-hour hydraulic containment test. During the 24- and 72-hour test, the water level from select monitoring wells and piezometers will be measured and recorded. The water level data will be evaluated to determine impacts (groundwater drawdown) on the aquifer and the overall capture zone. These procedures are further described in Section 3.0 and in Appendix B. The extracted groundwater from the testing will be managed as described in Standard Operating Procedure (SOP) number 04 (Investigation Derived Waste) contained in Appendix D. Based on over 20 years of groundwater monitoring results at the site, the extracted water is expected to be non-hazardous and will be utilized for dust-suppression activities on site. Alternatively, if the extracted groundwater is determined to be hazardous, arrangements for off-site disposal in accordance with applicable requirements will be made.

1.3.3 Groundwater Sample Collection

Groundwater quality samples will be collected and analyzed from the newly installed extraction wells for site COCs and potential bench-top / jar testing for further evaluation of water treatment under option A (discharge and treatment at the City of Pocatello POTW) or option B (on-site treatment followed by infiltration/evaporation). A subsequent work plan may be recommended

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for water treatment process evaluation in the event that the bench-top / jar testing (if performed) indicates that a larger scale, on-site evaluation of the water treatment process is necessary to complete the remedial design. The six piezometers and area monitoring wells located proximate to the first three extraction wells will be used to monitor water levels during aquifer tests and to provide water-level drawdown data for capture zone definition and future HCS design. This information will be presented in the Preliminary (30%) RD specified in the UAO. The monitoring and sampling locations are further specified in Section 3.0 of this Plan. Section 4.0 presents the QAPP.

1.4 HYDROGEOLOGIC STUDY WORK PLAN ORGANIZATION

The remainder of this document is organized as follows:

- Section 2.0 – FMC OU Hydrogeology and Groundwater Modeling summary
- Section 3.0 – Hydrogeologic Study design
- Section 4.0 – QAPP
- Section 5.0 – Data Reduction, Review, and Reporting
- Section 6.0 – Health and Safety Plan
- Section 7.0 – Deliverables and Schedule
- Section 8.0 – References
- Appendix A – Extraction Well and Piezometer Installation Field Procedures
- Appendix B –Procedures for Conducting Step Drawdown Tests, Constant Discharge Aquifer Tests, and Multiple Well Containment Tests
- Appendix C –Groundwater Sampling Field Form
- Appendix D – Standard Operating Procedures

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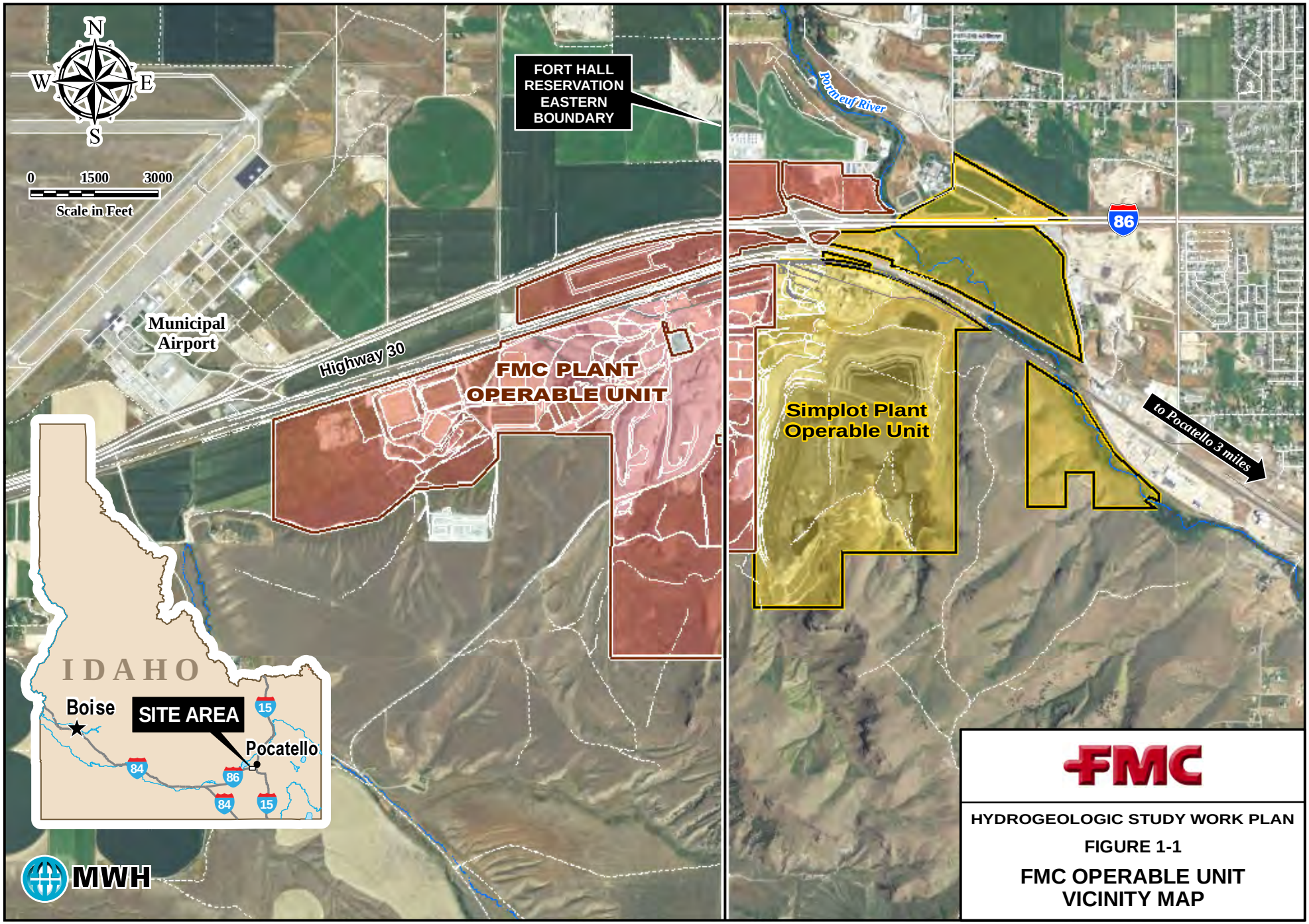

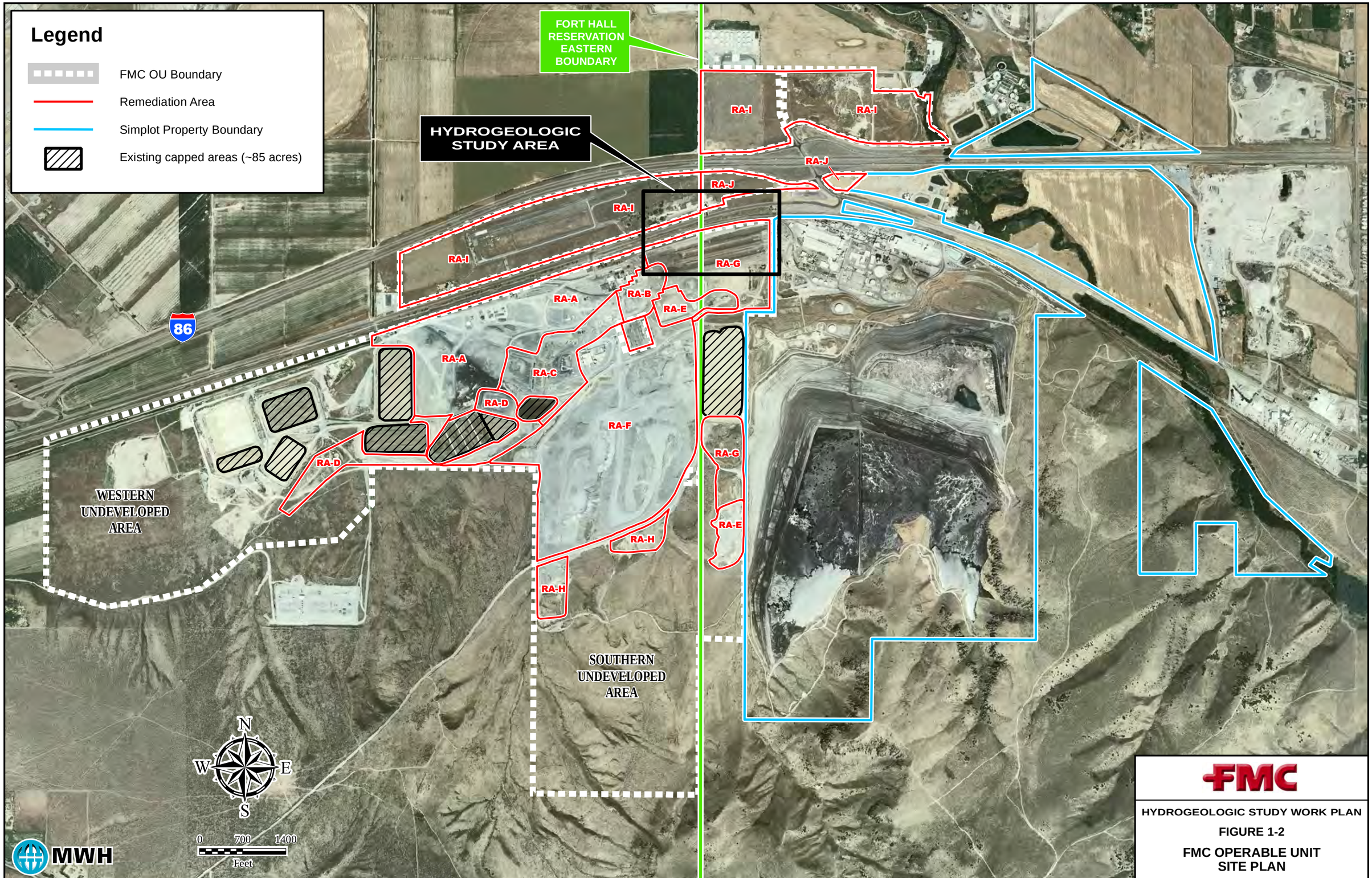

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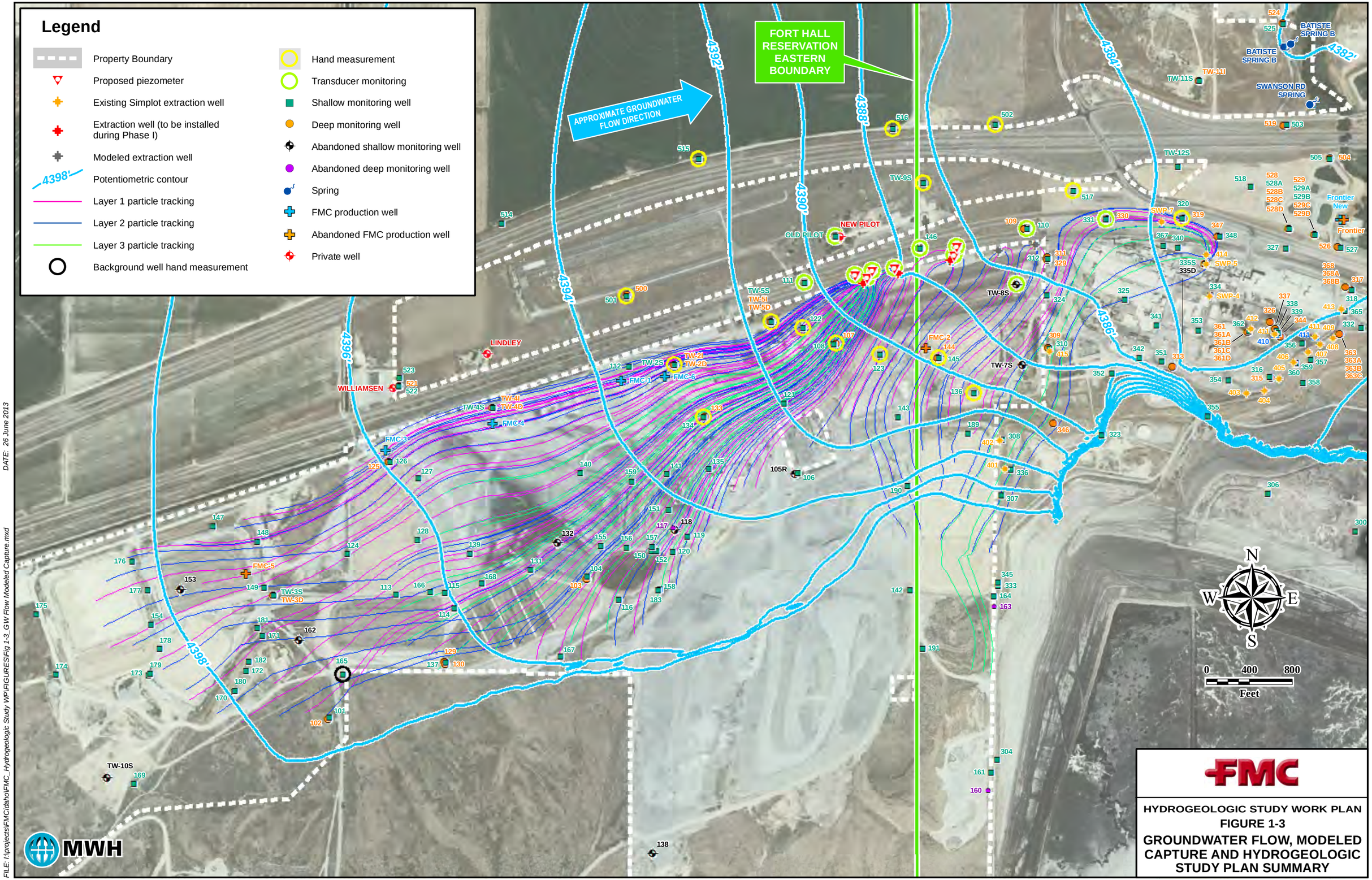

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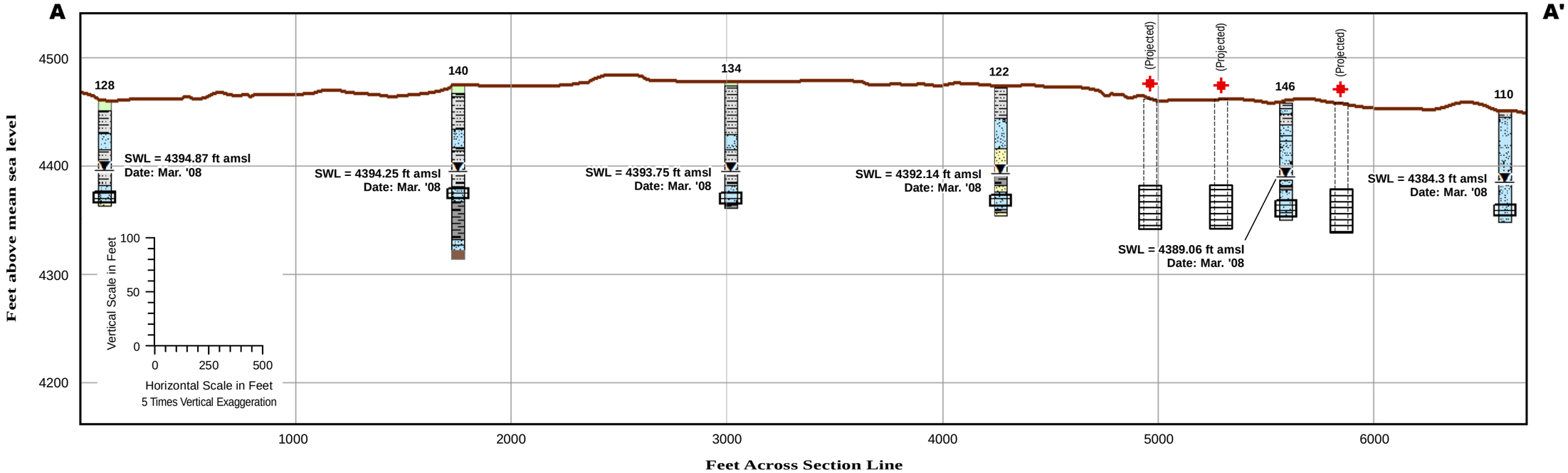

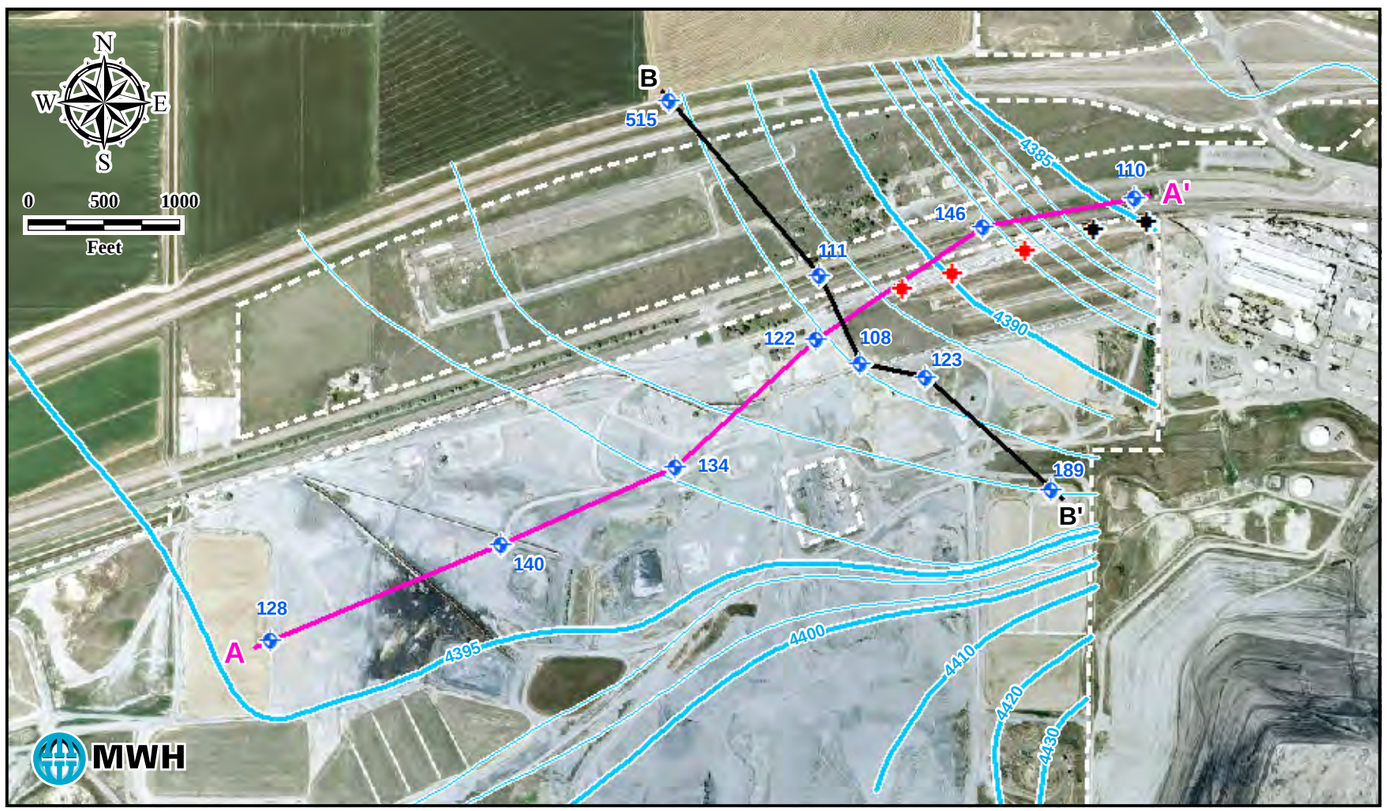

EXPLANATION

▼	Groundwater Level		Cross Section Line
	Well Screen Interval		FMC Property Boundary
	Asphalt/Fill	4394	Potentiometric Surface Contour
	Clay	SWL	Static Water Level
	Silt	ft	Feet
	Sand	amsl	Above Mean Sea Level
	Gravel		
	Bedrock		
	Extraction Well - Phase I		
	Modeled Extraction Well		
	Monitoring well used for cross sections		

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE 1-4a

CROSS SECTION A-A'

DATE: 15 July 2013

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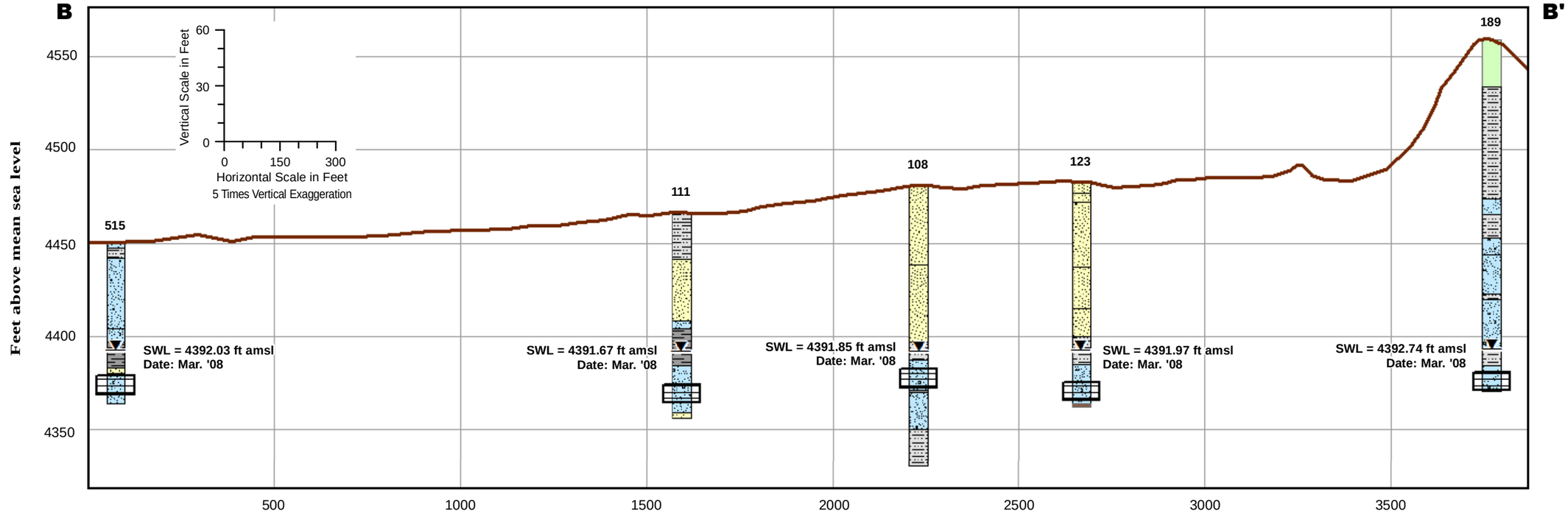

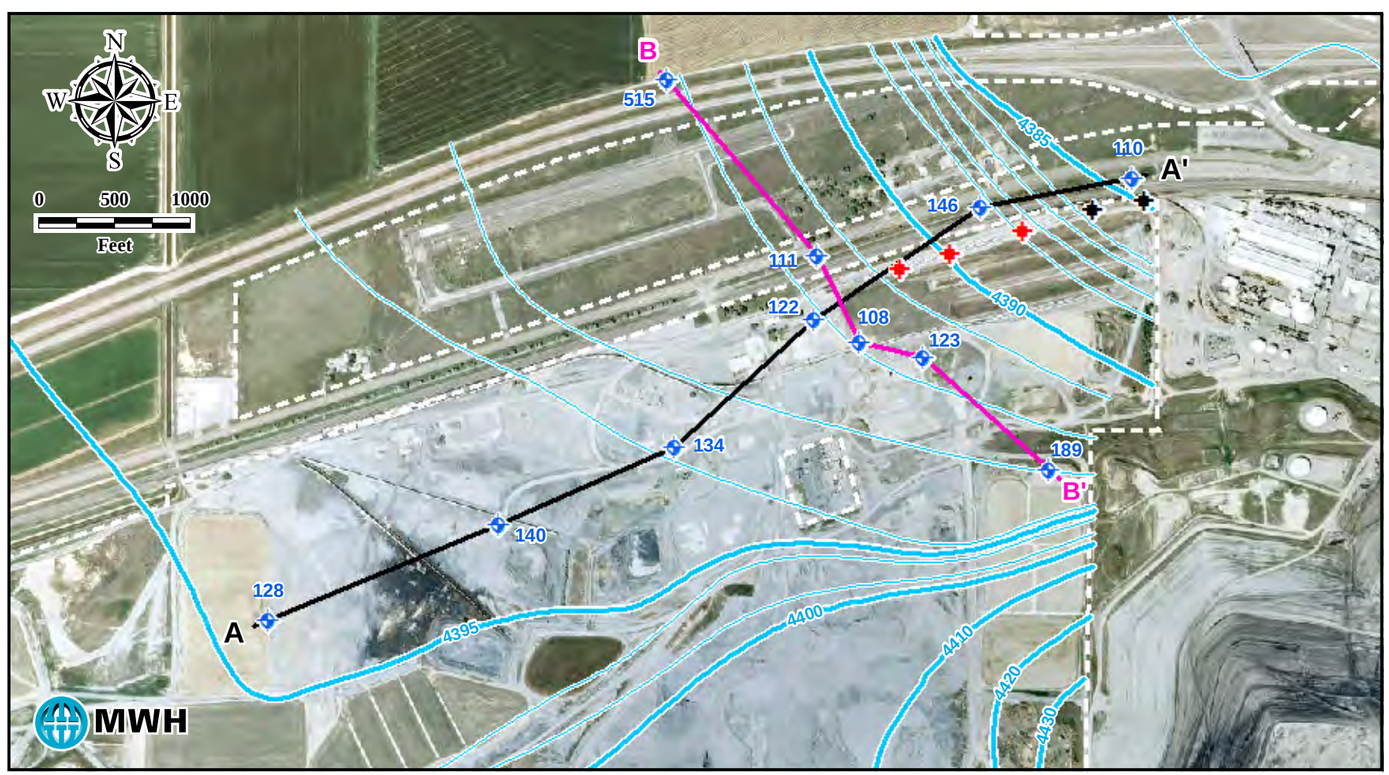

EXPLANATION

▼	Groundwater Level		Cross Section Line
	Well Screen Interval		FMC Property Boundary
	Asphalt/Fill	4394	Potentiometric Surface Contour
	Clay	SWL	Static Water Level
	Silt	ft	Feet
	Sand	amsl	Above Mean Sea Level
	Gravel		
	Bedrock		
	Extraction Well - Phase I		
	Modeled Extraction Well		
	Monitoring well used for cross sections		

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE 1-4b

CROSS SECTION B-B'

DATE: 15 July 2013

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2.0 FMC OU HYDROGEOLOGY AND GROUNDWATER MODELING SUMMARY

This section presents a summary of the site hydrogeology, nature and extent of contamination and groundwater modeling results used to determine the initial HCS extraction well arrangement.

2.1 HYDROGEOLOGY

This section presents the geology and hydrogeology of the FMC OU. For greater detail see the EMF RI Report (Bechtel, 1996) and the GWCCR (MWH, 2009a).

2.1.1 Regional Hydrogeologic Setting

The EMF Site is located at the southern margin of the Eastern Snake River Plain which is underlain by basalt and gravel aquifers that are recharged mostly by underflow from surrounding mountain ranges. Some recharge occurs as irrigation return and deep percolation from precipitation. Several rivers flow onto the Snake River Plain, where surface water infiltrates and ultimately discharges to the Snake River. Groundwater flow through the basalts of the Snake River Plain occurs primarily in thin interflow zones: thin gravel and fracture zones between basalt flows and in the fracture of the basalts (some of the basalts are columnar basalts, with a large interconnected fracture network). Regionally, the Snake River defines the base level for some smaller rivers such as the Blackfoot and Portneuf Rivers. The Portneuf River drains approximately 1,250 square miles, flowing across the Eastern Michaud Flats to the American Falls Reservoir, where it joins the Snake River.

The Michaud Flats are underlain by the same prolific basalt and gravel aquifers. These aquifers are recharged by underflow from the adjoining Bannock and Pocatello mountain ranges and from significant down-valley underflow from the Pocatello Valley aquifer. Smaller drainages also provide underflow to the aquifers (see EMF RI Report Figure 3.3-2, provided in Appendix B of this Plan). Direct infiltration from precipitation and irrigation return are other recharge sources. Within the mountainous areas, there are no regionally continuous hydrostratigraphic units. At the transition between mountainous areas and flatlands, there are alluvial fan deposits where groundwater flow occurs primarily within sand and gravel lenses.

Within the Michaud Flats, the aquifer system can be divided into a shallow and a deeper aquifer. The shallow aquifer is the Michaud Gravel which is typically overlain by a silt aquitard. The aquitard is generally saturated from 10 to 30 feet above the gravel, but is locally unconfined. The deeper aquifer is comprised of the gravel and volcanics of the Sunbeam and Starlight Formations, and the Big Hole Basalt. The deeper aquifer is the primary water-producing aquifer within the Michaud Flats. The deeper aquifer underlies the AFLB, the regional aquitard between the shallow and deeper aquifers (Houser, 1992). Groundwater flow within the regional aquifer

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system discharges to the Portneuf River (via springs and base flow contribution), American Falls Reservoir, or to one of the numerous springs and seeps in the Fort Hall Bottoms. Groundwater discharges to the Portneuf River along the reach from I-86 downstream to the American Falls Reservoir. The river gains significant flow along this reach as groundwater discharges through the riverbed and springs on both the east and west sides of the channel. The Pocatello sewer treatment plant (STP) also contributes some flow along this river reach.

2.1.2 EMF Site Hydrogeology

The EMF Site hydrostratigraphic framework is generally consistent with the regional framework. Three distinct hydrogeologic areas were delineated in the vicinity of the EMF facilities on the basis of lithologic data, stratigraphic relationships, groundwater flow characteristics, and water chemistry. These areas are the Michaud Flats, Bannock Range, and Portneuf River (see EMF RI Report Figure 3.3-3, in Appendix B). Within the Bannock Range area there were no continuous hydrostratigraphic units delineated during the RI. Starlight Formation volcanic flows and interflow units were not correlative, and the distribution of rock types and saturated materials encountered in the RI borings is best described as highly heterogeneous.

The transition zone between the Bannock Range hydrogeologic area and the Michaud Flats is characterized by small coalescing alluvial fans that are also relatively heterogeneous. In the Michaud Flats, distinct shallow aquifer and deeper aquifer zones were identified in the RI (see EMF RI Report Figure 3.3-4, in Appendix B). The shallow aquifer is a 10 to 20-feet thick gravel and sand aquifer that is locally overlain by a silt aquitard (EMF RI Figure 3.3-5, in Appendix B). The deeper aquifer is the gravel unit of the Sunbeam Formation and the underlying basalt and rhyolite. The unconsolidated gravel and the underlying volcanic lithologies do not appear to have a large permeability contrast, nor is there an intervening aquitard between these units. Therefore, both units constitute the deeper aquifer in the Michaud Flats area.

The AFLB form an aquitard that separates the shallow and deeper aquifers within the Michaud Flats area. These lacustrine clays and silts have very low permeability and are regionally extensive, extending from the Bannock Range area to the American Falls Reservoir, where they crop out along the reservoir embankment. As shown on EMF RI Figure 3.3-6 (included in Appendix E), the top of the AFLB is expected to be encountered at an elevation between 4,350 and 4,365 feet above mean sea level (AMSL) in the extraction zone at the northeast property boundary of the FMC Plant site. The range of elevations for the top of the AFLB reported in the EMF RI has been confirmed and refined beneath the Simplot plant site. As shown on Figure 3-1 of Simplot's Supplemental Subsurface Investigation in the Phosphoric Acid Plant Area Report (July 2013), the top of the AFLB was encountered at an elevation between 4,350 and 4,375 feet AMSL (the AFLB was reportedly encountered at 4,381 AMSL in one boring).

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As shown on EMF RI Report Figures 3.1-6A and B and 3.3-4 (included in Appendix E), the AFLB is about 35 to 15 feet thick based on the lithologic logs from wells 139, 140 and 133 (western ponds area), well 330 (east of FMC and Simplot joint north plant property boundary) and well 500 (north of I-86). A review of deep boring logs from well 109 (next to well 110 in the northeast corner of the plant site), 140 (western ponds area) and well 109 (next to well 108 in the central plant area) shows a depth to the top and thickness of the AFLB consistent with EMF RI Figures 3.3-6 and 3.3-4 respectively.

The AFLB are not present along part of the Portneuf River in the area of Batiste Springs and Wells 524/525 south to Well 520 (see EMF RI Figure 3.3-6, in Appendix B). The Bonneville Flood may have scoured the AFLB, consistent with Trimble's (1976) map of boulder deposition patterns that indicate a main flood channel in this area. Elevation contours on the top of the AFLB suggest a slight dip to the north. Just to the south of I-86, there is an elongated, east-west depression in the AFLB surface, which may also be an erosional feature of the flood (see EMF RI Figure 3.3-6, in Appendix B).

In areas immediately adjacent to the Portneuf River, where the AFLB are not present (as discussed above) and in the Bannock Range area, distinct shallow and deeper aquifers cannot be delineated. In the Bannock Range and Portneuf River areas, the monitoring wells in well pairs were classified as shallow and deep without respect to specific hydrostratigraphic units.

2.1.3 Aquifer Test Results

EMF Site pumping test and slug test results are detailed in Section 3.3.2.1 of the EMF RI Report (see EMF RI Table 3.3-1 Hydraulic Conductivities and Transmissivities of EMF Aquifer System, provided in Appendix B) and are summarized below.

In the Bannock Range area, hydraulic conductivity typically ranges from 0.00001 centimeter per sec (cm/s; 0.03 feet per day [ft/day]) to 0.1 cm/s (283 ft/day) in shallow and deeper zones. Although the lithology is highly heterogeneous, the hydraulic conductivity is fairly consistent throughout much of this area as defined by Wells 142, 300, 301, 304, 306, 323, 325, PEI-2, and PEI-5 (Figure 1-3). Hydraulic conductivities are higher at Wells 307, 308, and 333, which are located along the joint fenceline of Simplot and FMC. The higher hydraulic conductivities in this area are associated with a small, narrow, and deep relict sediment-filled stream channel originating within the Bannock Range (see EMF RI Figures 3.3-2 and 3.3-7A, in Appendix B).

Estimated hydraulic conductivity values in the Michaud Flats shallow aquifer range from 0.01 cm/s (30 ft/day) to 0.36 cm/s (1,000 ft/day). The highest values were at Wells 150 (near Pond 8S) and 153 (near Pond 16S). Slightly lower values were associated with the depression in the AFLB, and two of the lowest values were measured in Wells 515 and 516, north of this depression. In the deeper aquifer hydraulic conductivities appear to have an increasing trend to

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the north. Relatively low values were measured in deeper Wells 103 and 107 with slightly higher values at Well 500 and 133.

Transmissivity data from Jacobson (1984) indicate very high hydraulic conductivities in the deeper aquifer throughout the area north of I-86 (see EMF RI Table 3.3-1, in Appendix B). South of I-86, a transmissivity of 227,000 square feet per day (ft^2/day) was calculated at Simplot production well SWP-7. When SWP-5 was installed and developed, 3 feet of drawdown was measured after 48 hours of pumping at 4,100 gpm, indicating it has a higher transmissivity than SWP-7. Irrigation wells tested in the Michaud Flats had transmissivities ranging from 21,900 to 444,000 ft^2/day (Jacobson, 1984).

The bouldery gravel aquifer in the Portneuf River area has the highest hydraulic conductivity in the area. Calculated values ranged from 0.01 cm/s (28 ft/day) to 1.7 cm/s (4,800 ft/day). Most of the slug test results from the Portneuf River area indicate hydraulic conductivities are greater than 0.36 cm/s (1,000 ft/day). Hydraulic conductivities appear to be similar in the shallow and deeper wells throughout the Portneuf River area.

2.1.4 Groundwater Elevations, Flow Patterns and Vertical Gradients

Depth to groundwater in EMF Site wells ranges from over 150 feet in the Bannock Range to less than 10 feet near the Portneuf River (groundwater reaches the ground surface at the springs). The groundwater elevations in the Bannock Range were up to 4,629 feet amsl (above mean sea level), as measured in PEI-1. Approximately 8,500 feet north the groundwater elevations were 4,383 feet amsl at Batiste Spring along the Portneuf River (see EMF RI Figure 3.3-8F, in Appendix B).

There are seasonal water level fluctuations in the Michaud Flats, typically on the order of 2 to 4 feet, which may be associated with irrigation withdrawal and recharge patterns. Overall, the water levels indicate no long-term decrease in water levels at the site. Water levels in the shallow and deep wells have typically fluctuated within 4 to 8 feet between maximum and minimum measured levels over the 15 to 18 year period of monitoring for most of the wells. Maximum water levels were generally observed in the mid- to late 1990s during a cycle of average and above average regional precipitation during the monitoring period for most wells. Minimum water levels were typically observed in the 2001 and 2002 period that coincided with several years of significantly below average precipitation in the region. Water levels have slowly rebounded in recent years but generally have not recovered to levels measured during the 1990s.

Groundwater elevation potentiometric contour plots for the shallow aquifer were prepared for each quarterly sampling event from June 1992 through May 2008. The potentiometric contour map for the shallow aquifer in May 2008 is presented in Figure 1-3. Potentiometric contour

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maps from June 1992 through May 2008 are provided in Appendix B of the GWCCR (MWH, 2009a). These contour patterns are very consistent from quarter to quarter and year to year. Several key features are evident in the contour patterns.

- There are very steep horizontal hydraulic gradients in the Bannock Range.
- Within the western part of the monitoring network, there is a slight northeast-trending trough in the groundwater surface extending through the area of Wells 170, 168, 139 and 140 (northeast of Pond 15S).
- There is a distinct increase in the horizontal hydraulic gradient in the vicinity of Wells 146 and TW-9S, and a decreasing hydraulic gradient further east, in the vicinity of Wells 517, TW-11S and TW-12S.
- Shallow groundwater contour patterns do not appear to be influenced by production wells pumping from the deeper aquifer nor from the dramatic decrease in pumping from production wells FMC-1 and FMC-3 following plant shutdown in December 2001.

General flow patterns described by the hydraulic head contours indicate that groundwater flows north off the Bannock Range based on the steep hydraulic gradients observed in the low permeability materials. When this Bannock Range flow enters the highly permeable aquifer materials beneath Michaud Flats and the Portneuf River, groundwater flow converges sharply, with all shallow Bannock Range groundwater ultimately discharging along a short reach of the Portneuf River at Batiste Spring, the Spring at Batiste Road (aka Swanson Road Springs), and as bank seeps and baseflow to the river in the reach bounded by these springs just north of I-86.

Horizontal groundwater seepage velocities, calculated from hydraulic conductivities, horizontal gradients, and estimated porosity, are up to 12 ft/day in the Portneuf River area, 0.4 ft/day in the Bannock Range area, and from 1 to 11 ft/day in the Michaud Flats area. The variable seepage velocities calculated in the Michaud Flats area illustrate the effects of variable horizontal gradients and the wide range of hydraulic conductivities calculated for this area (see EMF RI Table 3.3-1, in Appendix B). The consistently high seepage velocities in the Portneuf River area are indicative of the very high hydraulic conductivities associated with the Bonneville Flood deposits.

Vertical head differentials were measured in well pairs installed during the EMF RI and during previous investigations. Vertical head differentials are one measure of the flow potential between shallow and deeper saturated zones (the other factor is the vertical hydraulic conductivity). The vertical head differentials also provide indications of the direction of the flow or gradient between shallow and deeper zones.

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The overall pattern of vertical differentials shows that in the area along the flanks of the Bannock Range there is a downward vertical hydraulic gradient. Well pairs 130/137 and 101/102 had persistent downward gradients, and well pair 103/104 had a slight upward gradient (less than 0.10 foot head differential). This pattern is still observed based on the water levels at well pairs 101/102, 130/137 and 103/104 measured during May 2008. Water levels measured in May 2008 for site-wide shallow/deep well pairs are shown on Table 2.2-1 of the GWCCR. Further north, vertical gradients were upward in well pairs 134/133, 117/118 (now abandoned), 107/108, TW-5S/TW-5I, and 500/501 during the EMF RI. During the EMF RI, there was a downward gradient measured in well pair 125/126, located near production well FMC-1, which draws water from the deeper aquifer and may have induced a local downward gradient. However, based on measurements in May 2008, the slight (less than 0.1 foot) downward gradient at well pair 125/126 does not relate to pumping of FMC's production well FMC-1, as this well has not been pumped in over eight years.

From the area along the joint facilities' fenceline out to the Portneuf River, there were relatively large upward vertical head differentials measured in the well pairs 309/310, 329(311)/312, 109/110, 319/320, TW-11I/11S, 504/505, 503/519, and 315/316 during the EMF RI. In these well pairs the water levels in the deeper wells were typically 2 to 6 feet higher than water levels in the shallow wells. The May 2008 water level measurements at well pair 109/110 showed the water level in the deeper well (Well 109) was 4.6 feet higher than the shallow well (Well 110) with a calculated upward vertical gradient of 0.09 feet per foot, consistent with the EMF RI findings in this area of the site.

2.1.5 Summary of Groundwater Hydrogeology

- Hydraulic gradients (and inferred groundwater flow directions) within the EMF study area are very stable and have not changed significantly, as demonstrated by 18 years of quarterly monitoring.

- Migration of site-related constituents from the shallow groundwater zone to the deeper zone is inhibited by upward vertical hydraulic gradients and the presence of confining strata (silt and clay units of the AFLB) throughout large portions of the EMF study area. As described in the GWCCR, during 2002, deep aquifer zone wells within the FMC Plant OU were selected for sampling and analysis for the routine CERCLA and an expanded parameters list. This special program was conducted in response to EPA questions regarding the EMF RI findings that the deep aquifer zone was not impacted in the FMC western ponds area and EMF joint fenceline area. All of the sample results were below the representative (background) levels with the exception of the fluoride result for well 125 (0.98 mg/l) which was slightly higher than the Michaud representative concentration (0.80 mg/l), but was far below the comparative value of 4 mg/l. EPA also requested and FMC agreed to again monitor the deep wells on the FMC OU during 2009 as documented

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in the Summary of Results for the FMC 2Q2009 Groundwater Monitoring Event, submitted to EPA on July 30, 2009. In summary, the results from the 2009 sampling of deep wells located near the FMC Plant Site northern property (wells TW-5D and 109) confirm the EMF RI finding that FMC impacted groundwater is not migrating beyond the Plant Site in the deep groundwater zone. Groundwater underflowing the EMF facilities discharges to the Portneuf River.

- Northward flow of impacted groundwater from the western ponds area (i.e., Pond 8S and the old phossy ponds including Ponds 3E - 6E, now beneath the RCRA lined and capped ponds Pond 15S and Phase IV Ponds) and central plant areas of the FMC Plant Site is limited to the area south of I-86, due to the effects of converging flow of groundwater from the Michaud aquifer to the west and northwest.

- Virtually all groundwater underflowing the EMF facilities discharges to the Portneuf River at Batiste Spring, the Spring at Batiste Road (aka Swanson Road Springs), and as bank seeps and baseflow to the river in the reach bounded by these springs.

2.2 SUMMARY OF GROUNDWATER MODELING

A groundwater model was constructed for the FMC OU and presented in the *Groundwater Model Report for the FMC Plant Operable Unit*, (MWH, 2010b). The final calibrated groundwater flow and transport model and predictive simulations of remedial alternatives (e.g., refinement of the groundwater remedial alternatives such as extraction well locations and flow rates; assumptions regarding the J.R. Simplot Plant OU sources and sinks) were modified based on agency feedback and guidance obtained during these meetings. The groundwater model was constructed and predictive simulations were performed in four general steps as follows:

1. The three-dimensional groundwater flow model was developed and refined during calibration to provide the underlying flow regime for contaminant fate and transport simulations;

2. The contaminant transport model was developed for the site related groundwater constituents arsenic, total phosphorus / orthophosphate, and potassium and refined during calibration (plume matching) to improve estimates of transport parameters;

3. The modeled groundwater remedial alternatives 2 and 3 extraction well configurations and pumping rates were developed and refined to meet appropriate capture and well drawdown criteria; and,

4. The predictive simulations were performed for Alternatives 1, 2 and 3.

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Below is a brief summary of results from the groundwater model report:

- The calibrated steady-state groundwater flow model developed for the site adequately represents flow conditions at the FMC Plant OU, as illustrated by the simulated potentiometric surface contour map and the calibration statistics presented in the model report.

- Plume matching results indicate that the parameters selected for both the groundwater flow and contaminant transport models were reasonable and provided an acceptable match between observed and predicted plume configurations. Overall, the calibrated transport model was most sensitive to changes in sorption coefficients and relatively insensitive to changes in dispersivity and porosity.

- The selected groundwater remedy (Alternative 2 in the model report) requires hydraulic containment of contaminated groundwater at the FMC Plant Site boundary. Many well configurations (alignment and number of wells) and extraction rates were tested, until an optimal configuration was found that minimized extraction rates while still completely capturing on-site contaminated groundwater.

2.3 SELECTED GROUNDWATER REMEDIAL ACTION MODEL RESULTS

The objective of the groundwater remedy selected in the IROD and required under the UAO (Model Groundwater Alternative 2) is to contain contaminated groundwater so that it does not migrate outside the FMC OU boundary. Many well configurations (alignment and number of wells) and extraction rates were modeled, until an optimal configuration was found that minimized extraction rates while still completely capturing on-site contaminated groundwater. Based on the modeling, the final extraction well system is expected to consist of five wells (depths will be range from approximately 120 feet bgs in the western portion of the extraction area to 140 feet bgs in the eastern portion) along the northern FMC Plant Site boundary, with a total extraction rate of 530 gpm. Containment was assessed by placing MODPATH particles within the footprint of the arsenic plume (largest plume) in the three uppermost layers and tracking them forward**.** Figure 1-3 presents the extraction well alignment and particle tracking showing containment of on-site contaminated groundwater for Alternative 2. This simulation also included infiltration of 440 gpm (the estimated infiltration rate for Alternative 2B presented in Appendix C of the Groundwater Model Report; MWH 2010b) to the western undeveloped area of the FMC OU to simulate the disposal of treated, extracted groundwater to a percolation/evaporation pond upgradient (west) of the groundwater contamination.

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3.0 HYDROGEOLOGIC STUDY DESIGN

This section presents a description of the main components of the Hydrogeologic Study. The QAPP for this study and the groundwater sampling procedures are contained in Section 4. Field procedures for the installation of the extraction wells and piezometers and aquifer (pump) tests are contained in Appendices A and B, respectively. Standard operating procedures (SOPs) relevant to the field activities to implement this work plan are contained in Appendix D. The SOPs provided were previously developed for the supplemental remedial investigation for the FMC OU and were modified as needed for the RD field studies.

3.1 PRELIMINARY HYDROGEOLOGIC STUDY DESIGN

This section provides a discussion of the preliminary (Phase I) design of extraction wells and piezometers, including installation, construction, and testing. Design of the HCS including additional extraction wells (a total five based on preliminary modeling), a control/treatment building, and a discharge pipeline to the City of Pocatello POTW (Option A) or on-site infiltration gallery (Option B) will be presented in the RD upon completion of test analyses.

Groundwater model results indicate that installation of five groundwater extraction wells at a spacing of approximately 350 to 500 feet will create hydraulic containment and prevent further migration of the contaminated groundwater plume beyond the FMC Site northern boundary. The approximate locations (final locations to be determined in the field) of the extraction wells and piezometers proposed for this study are shown on Figure 3-1. Extraction wells EW-01, -02 and 03 are located at the western three (3) locations of the preliminary groundwater extraction system design of five (5) extraction wells along the northeast FMC plant property. The eastern two (2) extraction wells from the preliminary design are shown on Figure 3-1 as modeled extraction wells.

The western three (3) wells were selected for this study because, based on the groundwater model, these wells are predicted to capture the majority of the groundwater flow from beneath the FMC plant site and all the flow from the western ponds and central plant areas. Therefore, confirming the hydrogeology and aquifer characteristics at the western extraction wells is considered more critical to finalizing the overall groundwater extraction system than the eastern well locations that are modeled to intercept relatively low groundwater flow from the joint fenceline area. In addition, by including the “center” extraction well (based on the preliminary design), the updated groundwater model can be used to further refine the location(s) and designed extraction rate of well(s) toward the eastern plant property line to capture flow from the joint fenceline area. The design of the extraction wells and piezometers are described below.

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3.1.1 Extraction Wells

Each extraction well will be constructed in a 12-inch diameter borehole drilled to approximately 120 feet bgs (the approximate depth of the bottom of the shallow aquifer zone and the top of the AFLB aquitard), actual depths of each well will likely vary. The intent of the extraction wells is to provide control (i.e., vertical and horizontal) of COC-impacted groundwater. Each extraction well will be constructed using six-inch diameter well material (i.e., well screen and casing). Also, a one-inch diameter piezometer will be co-installed (nested) within the 12-inch borehole, adjacent to the six-inch extraction well material (Figure 3-2).

The boreholes will likely be advanced using a casing advance drilling method that will be specified by the selected drilling subcontractor. Potential methodologies include roto-sonic, triple-wall air-percussion, or ARCH drilling. The extraction wells will consist of six-inch stainless steel wire-wrapped screen extending approximately 30-40 feet above the bottom of the borehole, with six-inch diameter, schedule 80 PVC casing extending from the top of the screen to the ground surface (refer to Figure 3-1). Stainless steel well screen and PVC pipe were selected because of their very low corrosion rates and dielectric compatibility. The sand pack around the extraction well screen will be selected based on screen slot size and lithology, and will consist of a silica sand pack that will prevent the migration of fine soil particles into the well. For the purposes of this preliminary design, it is assumed that 10/20 mesh sand will be used for the filter pack and will extend a minimum of five feet above the well screen. Above this will be a minimum five-foot thick bentonite seal and Portland Type A cement/bentonite grout seal to within eight feet of the ground surface. The area above the concrete seal will be completed with native fill to allow for future installation of the remaining wellhead completion hardware (e.g., power conduit, transmission piping, valves, gauges, etc.). The wells will be constructed following the procedures described in Appendix A.

To facilitate the initial aquifer tests, the top of the well will be temporarily finished with a PVC flanged end and a blind flange cover that can be padlocked for security. Following aquifer tests, this temporary completion will be replaced with a concrete collar, lockable steel protective casing and barriers to protect the wellheads.

3.1.2 Extraction Well Co-Installed Piezometers

Each six-inch diameter extraction well will have a one-inch diameter internal piezometer co-installed within the boring to allow the system operator to determine the water level within the well using a pressure transducer. The internal piezometers will have the same screen length and slot size as the extraction well screen (refer to Figure 3-1). Because each piezometer only needs to be large enough to accommodate a dedicated pressure transducer or a ¾-inch diameter water-level probe, it will be constructed of one-inch diameter, schedule 40 PVC casing. The top of the

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piezometer will be temporarily finished with a lockable watertight cap for security until final extraction well construction is completed.

3.1.3 Extraction Well Surface Completions

A protective metallic casing will be placed over each extraction well. In addition, each extraction well will have an appropriate number of barriers (e.g., Jersey barriers) to protect the wellheads. Each well and protective casing will be constructed to protrude above the ground surface, approximately 24 and 30 inches respectively. Each extraction well will be finished by placing soil around the well and sloped away from the wellhead to prevent surface water from ponding near the well.

3.2 GROUNDWATER PIEZOMETERS

In addition to the piezometers installed at each extraction well (i.e., within the same borehole), independent piezometers will be installed to monitor water levels in the immediate vicinity (within approximately 50- 300 feet) of the HCS extraction wells (Figure 3-1). These piezometers will be installed as the extraction wells are installed. As part of Phase I for the aquifer test and hydraulic containment test, six piezometers will be installed adjacent to the first three extraction wells and used to measure drawdown during the aquifer test and hydraulic containment test (Figure 1-3). Data from these locations will be used to determine hydraulic parameters of the aquifer including hydraulic conductivity, transmissivity, storativity, and specific yield. The piezometer arrangement will allow for the use of distance-drawdown methods as well as time-drawdown methods in the determination of these parameters. Furthermore, the arrangement will allow for delineation of anisotropy and heterogeneities within the subsurface soil strata and aquifer. Water-level data recorded during the hydraulic containment test will assist in siting additional piezometer pairs for design of the HCS system.

3.2.1 Field Procedures

The SOPs for installing extraction wells and piezometers including associated surface completion, development, and soil sampling and classification are presented in Appendix A. In addition, associated field forms that will be used for well installation are included in Appendix A.

3.3 AQUIFER TESTING NETWORK AND PROCEDURES

Variable pumping rate step-drawdown tests (i.e., six-hour step-tests, consisting of three two-hour steps) will be performed at each of the three Phase I extraction wells to determine well specific capacity and optimal pumping rates for each well. A 24-hour constant rate aquifer test will be performed on the western extraction well to determine aquifer hydraulic parameters. All three extraction wells will then be pumped simultaneously for a 72-hour hydraulic containment test.

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The procedures for performing the step-tests, the constant rate pumping, and hydraulic containment test are outlined in Appendix B. Certain of the existing monitoring wells (listed in Table 3-1) will be used to monitor groundwater elevations during the pumping tests.

During the over 20 years of groundwater monitoring at the FMC OU, including sampling from approximately 125 monitoring wells at the FMC OU, over 4,500 samples and over 50,000 individual analytical results, no groundwater sample result has ever exceeded the threshold values for RCRA characteristic waste. The extracted groundwater from the aquifer testing will be managed and characterized as described in SOP 4 (Investigation Derived Waste) contained in Appendix D. As described in greater detail in SOP 4, the pump test purge water will be loaded into water trucks for dust control on the site. For dust control, the approximately 1.5 million gallons of water that will be pumped over an approximately one week period during the aquifer testing would represent a total of about 0.014 inches (or about 0.003 inches per day) of water spread over about a 340 acre area of the plant site (site-wide roadways and areas within RA-A).

3.4 AQUIFER TESTING ANALYSIS AND MODEL UPDATE

Data collected during the hydraulic containment testing will be used to develop hydrologic characteristics of the aquifer in the vicinity of the extraction wells. Water level measurements collected from the Phase I extraction wells, nearby piezometers, and more distant monitoring wells, will be imported into industry standard analytical software (e.g., AQTESOLV®) for analysis. Several different analytical methods (analytical methods may include Cooper-Jacob, Theis, Distance-Drawdown, and others) will be utilized to derive transmissivity, hydraulic conductivity and storage coefficients for the aquifer. Based on the results of the aquifer testing analysis, the capture zone will be evaluated using an analytical model for prediction of long-term performance of the extraction wells as part of the HCS.

Geologic, hydrogeologic and aquifer characteristics derived from the Phase I extraction well installation and aquifer testing (and analysis described above) will subsequently be used to update/refine the existing numerical groundwater flow model of the site. The numerical model will be calibrated to the observed performance of the aquifer during the 24- and 72-hour hydraulic containment test. Calibration of the model in the vicinity of the extraction wells may require grid refinement in order to simulate the measured groundwater drawdown more precisely. The revised numerical model will then be used to assess the potential long-term (100-year) performance (drawdown, hydraulic gradient, and flow net) of the initial three extraction wells. Results from these simulations will be used to predict if the three extraction wells are expected to meet the performance objectives of the HCS design. If the additional two (2) eastern extraction wells (or additional well[s]) are predicted to be necessary, the model results will be used to assist in selecting the appropriate locations of any additional extraction wells predicted to meet the performance objectives of the HCS. Additional simulations may also be performed to

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assess and optimize the pumping distribution among the extraction wells to improve the design of the HCS.

3.5 GROUNDWATER MONITORING AND SAMPLING AND ANALYSIS DURING AQUIFER TESTING

3.5.1 Water Level Measurements

Water level measurements will be collected from select piezometers and monitoring wells during the hydrogeologic study. Table 3-1 and Figure 1-3 provide a description of the piezometers and monitoring wells to be used to collect water level data during the tests. The measurement frequency and monitoring method (i.e., hand measurement or transducer) used at each monitoring point will vary, based on distance from the pumping well. Specifics on measurement frequency and method are provided in Appendix B.

3.5.2 Groundwater Sample Collection

Discrete time-composite and bulk groundwater samples will be collected from the installed extraction wells during the hydrogeologic test. Groundwater samples will be collected from each extraction well via an inline sample port installed in the discharge line. Table 3-2 provides a description of the HCS baseline effluent analytes, analytical test methods, reporting limits, and the precision and accuracy required to refine the expected average extracted groundwater quality to further evaluate the disposal method (i.e., disposal at the Pocatello POTW and/or on-site treatment) during design. Bulk groundwater samples (multiple 5-gallon containers) will also be collected during the aquifer (pump) tests. The bulk samples will be retained for potential utilization by third-party vendors for bench-top treatment testing in the event that an on-site treatment facility is required. Groundwater samples for chemical analysis and bulk bench-scale treatability study will be collected, as applicable, from each extraction well and as a composite of the HCS as follows:

- Six-hour step-test (discrete samples from each extraction well)
    - Start of six hour step test (approximately one hour after start of step one)
    - End of step three (prior to pump shut-down)
- 72-hour pump test (composite and bulk samples)
    - Start of 72-hour pump test (approximately one hour after start)
    - End of 36-hour period
    - End of pump test (72-hour period)

The groundwater sampling program is summarized on Table 3-3. Groundwater sample field and laboratory analytical procedures are described in Section 4.

Table 3-1

SUMMARY OF PIEZOMETRIC SURFACE ELEVATION MEASUREMENTS
Extraction Zone Hydrogeologic Characterization Study for the FMC OU
(Page 1 of 2)

Location Identification Number	Top of screen elevation (ft msl)	Bottom of screen elevation (ft msl)	Baseline piezometric surface elevation (ft msl)	0-20 minute piezometric surface elevation (ft msl)	20-40 minute piezometric surface elevation (ft msl)	40-60 minute piezometric surface elevation (ft msl)	2-12 hour piezometric surface elevation (ft msl)	greater than 24 hour piezometric surface elevation (ft msl)
EW-1	--	--	X	X	X	X	X	X
EW-2	--	--	X	X	X	X	X	X
EW-3	--	--	X	X	X	X	X	X
PZ-01	--	--	X	X	X	X	X	X
PZ-02	--	--	X	X	X	X	X	X
PZ-03	--	--	X	X	X	X	X	X
PZ-04	--	--	X	X	X	X	X	X
PZ-05	--	--	X	X	X	X	X	X
PZ-06	--	--	X	X	X	X	X	X
107	4294.5	4274.5	X	--	X	X	X	X
108	4382.7	4372.7	X	--	X	X	X	X
109	4312.2	4302.7	X	X	X	X	X	X
110	4364.3	4354.3	X	X	X	X	X	X
111	4374.0	4364.6	X	X	X	X	X	X
122	4372.4	4362.4	X	--	X	X	X	X
123	4375.5	4366.0	X	--	--	X	X	X
133	4259.7	4239.7	X	--	--	--	--	X
134	4374.5	4365.0	X	--	--	--	--	X
136	4365.1	4355.1	X	--	--	--	X	X
144	4288.1	4258.1	X	--	--	--	X	X
145	4347.0	4337.0	X	--	--	X	X	X
146	4367.9	4352.9	X	X	X	X	X	X
311*	4319.7	4309.7	X	--	--	--	X	X
312*	4360.8	4352.1	X	--	--	--	X	X
329*	4322.0	4312.0	X	--	--	--	X	X
331*	4378.0	4368.0	X	X	X	X	X	X
500	4323.6	4313.6	X	--	--	--	--	X
501	4376.5	4366.9	X	--	--	--	--	X
502	4375.1	4370.1	X	--	--	--	--	X
515	4379.1	4369.1	X	--	--	--	--	X
516	4375.2	4365.2	X	--	--	--	X	X
517	4377.1	4367.1	X	--	--	--	X	X
TW-9S	4373.0	4369.0	X	--	--	--	X	X
TW-2S	4373.0	4360.0	X	--	--	--	X	X
TW-2I	4285.0	4245.0	X	--	--	--	X	X
TW-2D	4178.0	4158.0	X	--	--	--	X	X
TW-5S	4378.0	4374.0	X	--	--	--	X	X

Table 3-1

SUMMARY OF PIEZOMETRIC SURFACE ELEVATION MEASUREMENTS
Extraction Zone Hydrogeologic Characterization Study for the FMC OU
(Page 2 of 2)

Location Identification Number	Top of screen elevation (ft msl)	Bottom of screen elevation (ft msl)	Baseline piezometric surface elevation (ft msl)	0-20 minute piezometric surface elevation (ft msl)	20-40 minute piezometric surface elevation (ft msl)	40-60 minute piezometric surface elevation (ft msl)	2-12 hour piezometric surface elevation (ft msl)	greater than 24 hour piezometric surface elevation (ft msl)
TW-5I	4341.0	4334.0	X	--	--	--	X	X
TW-5D	4202.0	4191.0	X	--	--	--	X	X
319*	4299.5	4279.5	X	--	--	--	--	X
320*	4384.2	4369.2	X	--	--	--	--	X
Old Pilot**	4371.0	4349.0	X	X	X	X	X	X
TW-11S	4377.0	4367.0	X	--	--	--	X	X
TW-11I	4299.0	4290.0	X	--	--	--	X	X
165 (control well)	4376.7	4366.7	X	--	--	--	X	X

ft msl means feet above mean sea level.
See Table B-1 for measurement frequency.
Highlighted locations will contain pressure transducers; hand-measurements will only be collected as backup as practicable.
* Wells are Simplot wells and may not be accessible during pump tests.
** Old pilot house well has a dedicated pump that may not allow access with a water level probe / transducer.

TABLE 3-2

GROUNDWATER FIELD MEASUREMENT AND LABORATORY ANALYSIS REQUIREMENTS
HYDROGEOLOGIC STUDY WORK PLAN FOR THE FMC OU
Page 1 of 2

Parameter	Instrument / Method	Calibration	Calibration Frequency	Estimated Accuracy*	Average Concentration of Constituent in Groundwater (wells 110, 146, and TW-9S)	Groundwater Cleanup Standards (mg/l)***	Pocatello POTW Pretreatment Limits
Field Measurements							
Depth to Water (feet)	Electrical Water Probe Steel Tape	Reference to Steel Tape Reference to New Tape	Periodically Periodically	0.1 ft 0.01 ft	66.9	NA	NA
Specific Conductance (µmhos/cm)	Conductivity meter	Daily, single standard (typically 1413 µmhos/cm)	Daily	± 0.5% or 1 µmhos/cm	1521.7	NA	NA
Redox (mV)	ORP meter	Daily, using ORP buffer solution; solution temperature must also be recorded	Daily	± 20 mV	-100.0	NA	NA
Temperature (C)	Temperature meter	Factory calibration only	Factory only	0.15 °C	16.1	NA	NA
Nephelometric turbidity (NTU)	Turbidity meter	Daily, check against 2 known standards	Daily	± 2%	2.9	NA	NA
pH	pH meter	Daily, 2- or 3-point with standard buffers (4, 7, 10)	Daily	± 0.2 pH unit	7.01	6.5 to 8.5	6.0 to 10.0

Parameter	Analytical Method Number	Method Type	Reporting Limit (mg/l)	Estimated Accuracy*	Precision **	Average Concentration of Constituent in Groundwater (wells 110, 146, and TW-9S)	Groundwater Cleanup Standards (mg/l)***	Pocatello POTW Pretreatment Limits
WQP								
Fluoride	9056 (b) or 340.2 (c)	Ion Chromatography or Potentiometric, Ion Selective Electrode	0.1	75% - 125%	± 30%	0.30	4	32
Nitrate	9056 (b) or 353.2 (d)	Ion Chromatography or Colorimetric	0.1	75% - 125%	± 35%	6.63	10	NA
Total Phosphorus	6010B (a) or 365.2 (c)	Inductively Coupled Plasma / Mass Spectrometry or Colorimetric (ascorbic acid)	0.02	75% - 125%	± 30%	2.54	NA	7.0
Sulfate	9056 (b) or 375.4 (d)	Ion Chromatography or Turbidimetric	1	75% - 125%	± 30%	168	250	NA
Potassium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.1	75% - 125%	± 30%	43.4	NA	NA
Chloride	9056 (b) or 325.3 (c)	Ion Chromatography or Titrimetric	1	75% - 125%	± 30%	136.3	250	NA
Total Ammonia (NH3 + NH4 as N)	350.3 (d)	Potentiometric, Ion Selective Electrode	0.2	75% - 125%	± 30%	0.17	NA	NA

TABLE 3-2

GROUNDWATER FIELD MEASUREMENT AND LABORATORY ANALYSIS REQUIREMENTS
HYDROGEOLOGIC STUDY WORK PLAN FOR THE FMC OU
Page 2 of 2

Parameter	Analytical Method Number	Method Type	Reporting Limit (mg/l)	Estimated Accuracy*	Precision **	Average Concentration of Constituent in Groundwater (wells 110, 146, and TW-9S)	Groundwater Cleanup Standards (mg/l)***	Pocatello POTW Pretreatment Limits
Metals (mg/l)								
Arsenic	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002	75% - 125%	± 30%	0.03	0.01	0.06
Cadmium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.002	75% - 125%	± 30%	<0.0005	0.01	0.2
Copper	6010B (a)	Inductively Coupled Plasma / Mass Spectrometry	0.01	75% - 125%	± 20%	0	1	0.5
Cyanide	335.4 (d)	Colorimetric	0.01	75% - 125%	± 30%	0.01	0.2	0.2
Lead	6010B (a)	Inductively Coupled Plasma / Mass Spectrometry	0.01	75% - 125%	± 20%	0	0.015	0.3
Mercury	SW 7470A (b)	Cold Vapor Atomic Absorbtion Spectrometry	0.0005	75% - 125%	± 20%	<0.0002	0.002	0.0006
Nickel	6010B (a)	Inductively Coupled Plasma / Mass Spectrometry	0.01	75% - 125%	± 20%	<0.04	0.73	1
Selenium	6010B (a)	Inductively Coupled Plasma Atomic Emission Spectrometry	0.0005	75% - 125%	± 30%	0.012	0.050	NA
Silver	6010B (a)	Inductively Coupled Plasma / Mass Spectrometry	0.01	75% - 125%	± 20%	<0.005	0.1	0.6
Zinc	6010B (a)	Inductively Coupled Plasma / Mass Spectrometry	0.02	75% - 125%	± 20%	0.001	71	1.2

(a) Analysis may also be performed using method 6020, both 6010 and 6020 from Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(b) Test Methods for Evaluating Solid Waste, EPA SW–846, Third Edition, Update IIIB, as revised through 2002.

(c) Methods for Chemical Analysis of Water and Wastes, EPA600/4–79–020, Revision, March 1983.

(d) Methods for the Determination of Inorganic Substances in Environmental Samples (EPA/600/R-93/100).

* percent recovery

** relative percent difference

*** Secondary Standard per National Secondary Drinking Water Regulations; MCL means Maximum Contaminant Level per National Primary Drinking Water Regulations; PRG means Preliminary Remedial Goal for Tap Water per EPA Region VI PRG Table (3/8/2008), except Lithium PRG is from the Region IX PRG Table (2004); TT Action Level means Treatment Technique action level per the National Primary Drinking Water Regulations.

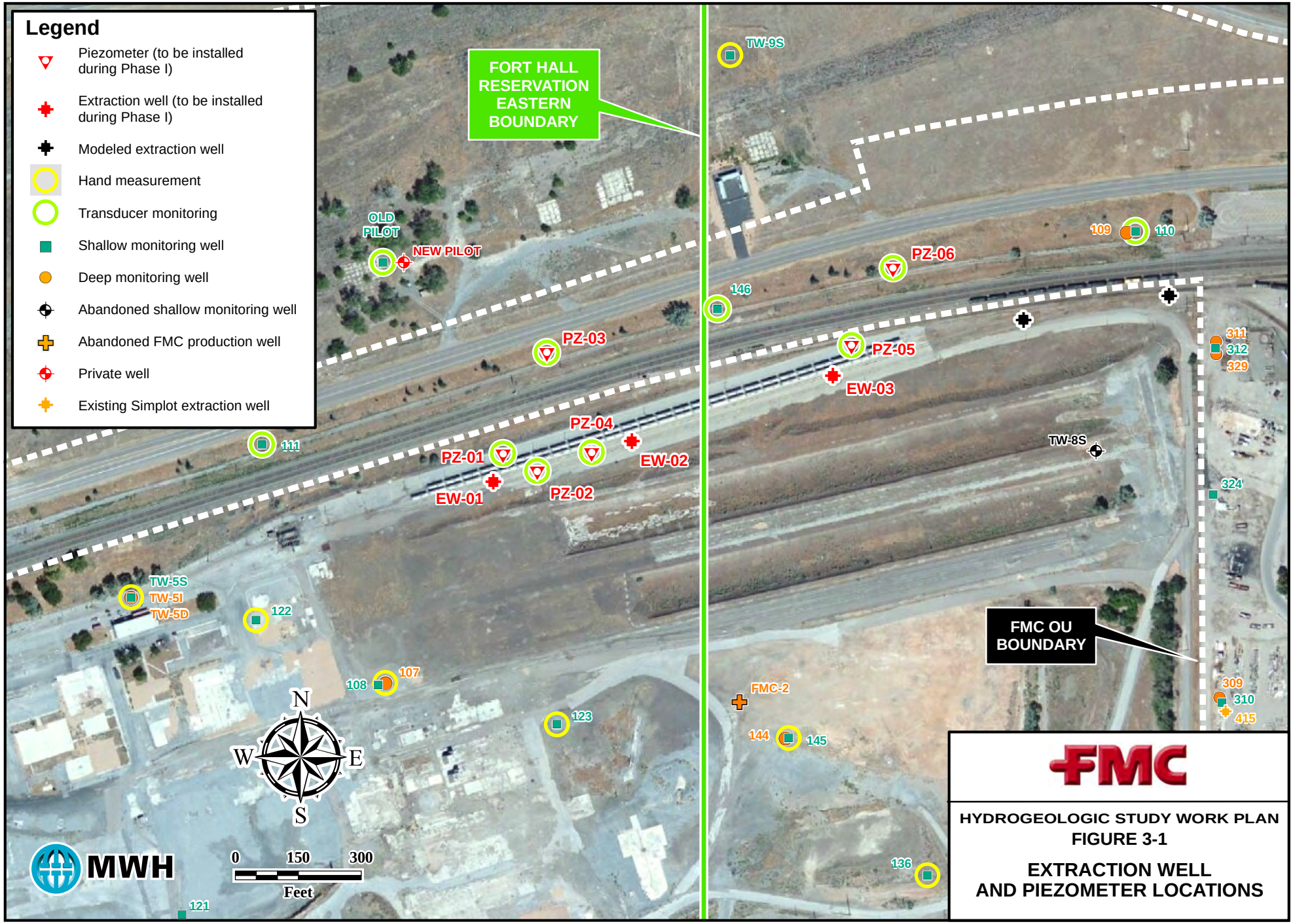
NA Not Applicable; no POTW standard

TABLE 3-3

SUMMARY OF GROUNDWATER SAMPLES
HYDROGEOLOGIC STUDY WORK PLAN FOR THE FMC OU

Well	6-hour Step Test				72-hour Containment Test	
	Primary Samples	**Field Quality Control Samples**			**Composite Sample**	**Bulk Samples**
		Duplicate	**MS / MSD**			
	Analyses per Table 3-2	Analyses per Table 3-2	Analyses per Table 3-2	Total	Analyses per Table 3-2	Hold for potential bench-top treatment testing
EW-01	2	1	0	3	1 flow-weighted composite	Five 5-gallon flow-weighted composites
EW-02	2	0	0	2		
EW-03	2	0	1	3		
Total	**6**	**1**	**1**	**8**	**1**	**5**

FILE: I:\projects\FMCidaho\FMC_Hydrogeologic Study WP\FIGURES\Fig 3-1_Extract Well and Piez Locs.mxd DATE: 15 July 2013



HYDROGEOLOGIC STUDY WORK PLAN
FIGURE 3-1

EXTRACTION WELL AND PIEZOMETER LOCATIONS

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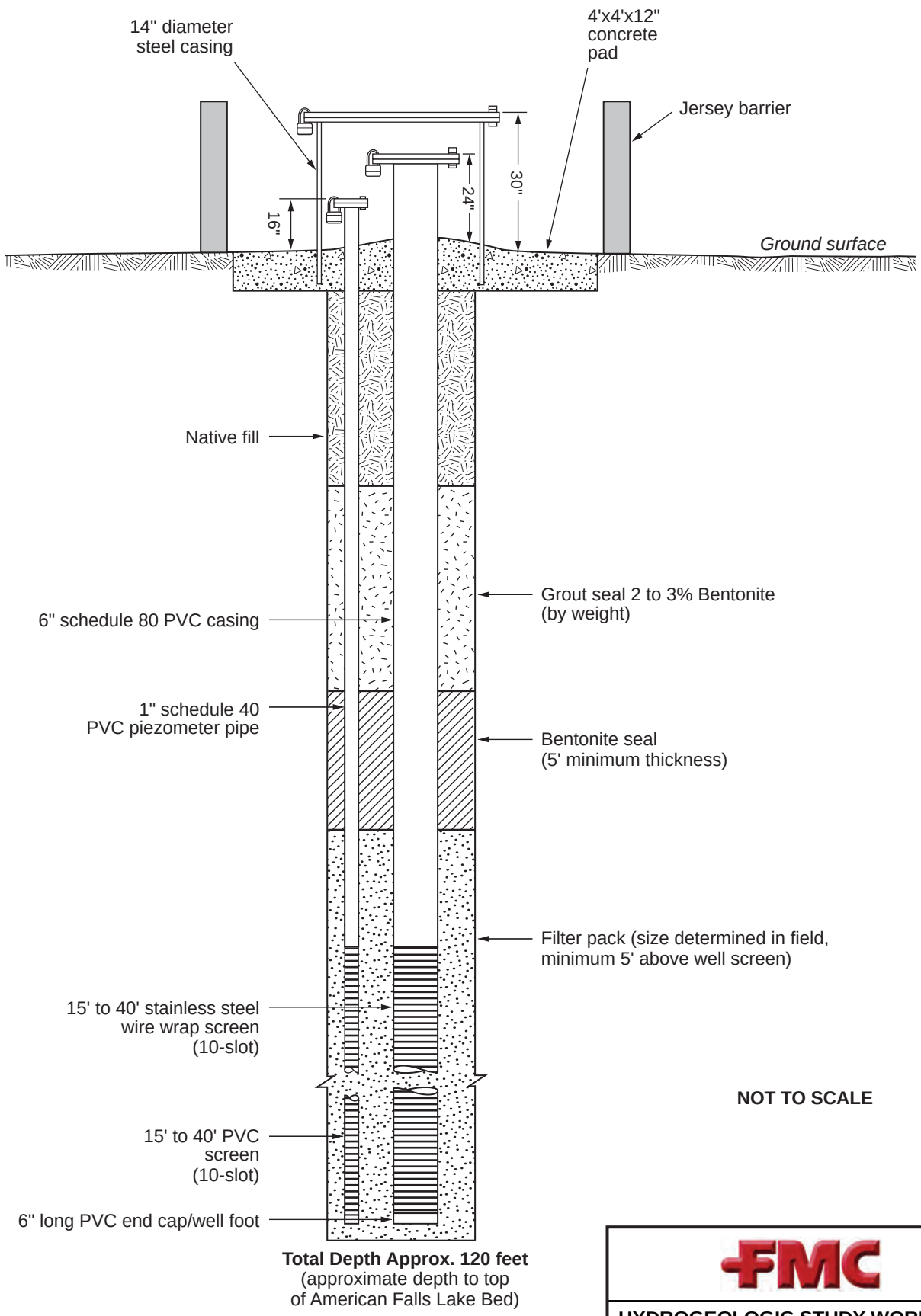

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE 3-2

GENERALIZED EXTRACTION WELL DESIGN

MWH

FILE *Fig 3-2_Generalized Extraction Well Design_mod2.ai* *DATE: 17 Oct 2013*

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4.0 QAPP AND FSP

4.1 INTRODUCTION

This section presents the QAPP and the Field Sampling Plan (FSP) for the Hydrogeologic Study and includes:

- Project team and project organization;
- Data Quality Objectives (DQOs);
- Field measurement and sampling procedures
- Equipment calibration procedures
- Sample preservation and handling procedures; and,
- Personnel training.

4.2 PROJECT TEAM AND ORGANIZATION

The responsibility and authority of each team member in this project organization is presented below.

4.2.1 EPA Remedial Project Manager

The EPA is the lead agency governing the remediation of the FMC OU. The EPA issued the IROD and UAO, and is responsible for approving all plans and reports related to implementing the Selected Remedy, including the Hydrogeological Study. The EPA Remedial Project Manager is Mr. Kevin Rochlin.

4.2.2 FMC Project Coordinator

As the responsible party, FMC is implementing the Selected Remedy in accordance with the UAO. FMC has overall responsibility for procuring consultants and contractors to perform the work, budgeting and securing the necessary funds, and assuring that the requirements of the UAO are met. The FMC Remediation Director is Ms. Barbara Ritchie.

4.2.3 MWH Project Director

Mr. Marc Bowman is the MWH Project Director and main point of contact for MWH Americas, Inc., the Supervising Contractor. Mr. Bowman was the MWH Project Manager (PM) for the FMC Plant OU SRI/SFS and will have overall responsibility for successful completion of the RD and the Hydrogeological Study. He will be responsible for the contractual commitments and for ensuring that the necessary resources are dedicated to the project, will define/clarify the scope of work and objectives for each major activity, and will assure the technical, budget, and schedule requirements are met.

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4.2.4 MWH RD Manager

Mr. Rob Hartman is the MWH RD Manager and will be responsible for day-to-day technical elements of the Hydrogeological Study. Mr. Hartman, along with the MWH Project Director, will be responsible for coordinating with the necessary agencies and authorities to identify any permit requirements associated with implementation of the remedy.

4.2.5 MWH Hydrogeological Manager

Mr. Jesse Stewart will serve as the MWH Hydrogeologic Manager and serve as the primary interface to the MWH Project Director and the RD Manager. He will be responsible for coordinating the necessary resources to accomplish the Study elements and to complete the Hydrogeological Study testing on schedule as well as providing construction quality assurance.

4.3 DATA QUALITY OBJECTIVES

During execution of the Hydrogeologic Study there are three types of data to be collected:

1. Qualitative / semi-quantitative observations associated with drilling the boreholes (e.g., lithologic logging), determination of the well screen interval and screen slot size, and development of the extraction wells and piezometers;

2. Physical measurements (e.g., groundwater elevations) associated with drilling the boreholes (e.g., depth of lithologic samples), construction of the extraction wells and piezometers (e.g., setting bottom of casing), and aquifer pumping tests; and,

3. Physical and chemical analyses of groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

The Data Collection Quality Objectives for the Hydrogeological Study are presented in Table 4-1.

4.3.1 Extraction Well and Piezometer Installation

There is no “problem statement” associated with the installation of the extraction wells and piezometers during the execution of this Plan. Thus, no specific, numeric data quality objectives (DQOs) have been established. However, there will be numerous observation and measurements performed during drilling of the boreholes for the extraction wells that will be utilized to finalize well construction / completion details as summarized below:

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Observation / Measurement during Drilling	Extraction Well Construction Element
Static water level in borehole	Top of screen will extend approximately 5 feet above static water level
Lithologic logging in saturated zone: soil types	Screened casing slot size
Groundwater chemistry profiling	Screen length and bottom of hole / well if SC < 500 umhos/cm and phosphate field analysis < 0.1 mg/l before encountering top of the AFLB
Lithologic logging: top of AFLB	Screen length and bottom of hole / well if SC > 500 umhos/cm and phosphate field analysis > 0.1 mg/l in sample at or above the top of the AFLB

As specified in Section A.2.3 of the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, the screened casing slot size and screened interval for each extraction well will be selected based on stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager. The use of qualified field personnel (geologists/hydrogeologists), adherence to the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, and field documentation will assure the wells/piezometers will be installed properly and will meet the requirements for this hydrogeologic study and completing the design and ultimately the full-scale implementation of the HCS.

4.3.2 Aquifer Pump Test Physical Measurements

The pump test physical measurements that will be collected are direct measurements and there is no “problem statement” or “decisions” associated with the data. Thus, no specific, numeric data quality objectives (DQOs) have been established. As specified in the Procedures for Conducting

Step Drawdown Tests, Drawdown Tests, Constant Discharge Aquifer Tests and Multiple Well Containment (Appendix B) , manual water-level measurements shall be collected using electronic water-level indicators capable of measuring to 0.01-foot accuracy during all segments of the aquifer test. Electronic water-level indicators will be dedicated to specific wells during the test to avoid errors due to slight differences between indicators. Manual water-level measurements shall be collected as a back-up to water-levels measured using pressure transducers and data loggers.

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4.3.3 Groundwater Samples - Field and Laboratory Analyses

Field analyses will be performed on groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

The groundwater field parameters will be measured utilizing calibrated field meters with the calibration frequency and accuracy specified on Table 3-2. Note that during drilling the extraction wells the groundwater chemistry profiling samples will be field analyzed for the parameters listed on Table A.2.3-1. The field meters for those parameters will meet the calibration frequency and accuracy specified on Table 3-2 with the exception of phosphate. Phosphate will be field-analyzed using a Hach portable colorimetric phosphate test kit (Model PO-23 or comparable). The Model PO-23 has two (2) measurement concentration ranges of 0.1 to 5 mg/l and 1 to 50 mg/l which should be adequate for the range of expected groundwater phosphate concentrations at the extraction well locations. Hach does not specify a calibration method / frequency or precision/accuracy information for their portable phosphate test kits.

In addition to the field analyses, groundwater samples will be collected from the extraction wells during the aquifer (pump) testing for laboratory analyses. The groundwater samples from the extraction wells will be analyzed at a NELAP-accredited analytical laboratory for the parameters specified on Table 3-2. The acceptable level of uncertainty is included in Table 3-2 as accuracy and precision goals. Samples will be collected and handled as described in Section 4.4.2 below. The specified reporting limits are below the lower of the groundwater cleanup standard or Pocatello POTW Pretreatment Limit to assure the data are useable.

The laboratory analytical results for the groundwater samples from the extraction wells will be validated consistent with the Data Verification and Validation Protocol for FMC's groundwater monitoring programs (Appendix C of the Interim CERCLA Groundwater Monitoring Plan for the FMC OU [MWH, 2010c]). A Level III data verification will be performed on the sample results. Level III verification involves a review of all administrative documents, including field and laboratory chain-of-custody documents, sample preservation records, and sample preparation logs. For all precision and accuracy evaluations, laboratory summary information and forms will be evaluated for the individual laboratory methods.

4.4 SAMPLING/MEASUREMENT PROCEDURES

4.4.1 Extraction Well and Piezometer Installation Procedures

The methodologies and procedures for installation of the extraction wells and piezometers are presented in Appendix A.

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4.4.2 Aquifer Test Procedures

The methodologies and procedures for performing the aquifer testing program are presented in Appendix B.

4.4.3 Groundwater Sampling Procedures

As described in Section 3, summarized on Table 3-3 and shown on Table 4-1, three types of groundwater samples will be collected during this study:

1. Discrete samples for laboratory analysis collected at the start (approximately one hour after the start) of the six-hour step drawdown test at each extraction well;

2. A composite sample for laboratory analysis that includes aliquots collected at the start (approximately one hour after the start), after 36 hours and at the end of the 72-hour multi-extraction well containment pump test; and

3. Composite ("bulk") samples that include aliquots collected at the start (approximately one hour after the start), after 36 hours and at the end of the 72-hour multi-extraction well containment pump test to be retained for potential bench / jar testing by water treatment equipment / supply vendors.

The procedures for collecting, labeling and handling these samples is described below.

4.4.3.1 Sample Designation

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The station location will be described in the logbook as follows, in a manner consistent with the conventions used during the remedial investigation. A one-digit number will be used to indicate the year in which the sample was collected, for example "3" indicates a sample was collected in 2013. This digit will be followed by two others indicating the month in which the sample was collected, for example "03" indicates a sample was collected in March. Finally, additional digits or letters will identify the well from which the sample was collected. The location description, 403EW01 indicates a sample collected from Well EZ-01 in March 2014.

At a minimum, the sample labels will contain the following information:

- Facility name.
- Sample number.
- Date of collection.
- Time of collection.

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- Analytical parameter.
- Method of preservation.

Samples collected for field QC will be identified by a three-digit or descriptive letter combination.

- Field Duplicate: The well number will be designated as "600."
- Samples collected for laboratory QC will be identified on bottles and field paperwork using an A, B, or C designation as a suffix to the sample identifier code. These QC codes will be designated as follows:
    - A - Original unspiked sample
    - B - Matrix spike (MS)
    - C - Matrix spike duplicate (MSD)

4.4.3.2 Sample Collection

The discrete groundwater samples will be collected directly from the pump tubing (at each extraction well) into the appropriate sample containers, preserved as described below, and chilled and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the discharge tubing to the sample container. As shown on Table 3-3, a duplicate sample will be collected during the collection of the 6-hour step test at well EZ-01 (during second sample near end of 6 hour test) and MS/MSD sample will be collected during the collection of the 6-hour step test at well EZ-03 (during second sample near end of 6 hour test).

The composite sample will initially be collected in an approximately 5-gallon pre-cleaned container. An aliquot from each extraction well will be collected at the time intervals specified above and on Table 4-1. The volume of the aliquot from each well will be in proportion to the pump rates set for each well during the multi-extraction well containment pump test. For example, if well EW-1 is pumping at 120 gpm, well EW-2 at 100 gpm and EW-3 at 80 gpm, then the aliquot volume from EW-1 and EW-3 will be 20 percent greater and lower, respectively than the aliquot from well EW-2. As nine (9) total aliquots will be collected in a 5-gallon container, the "base" aliquot volume will be about 0.5 gallons.

The composite groundwater sample will then be transferred into the appropriate sample containers, preserved as described below, and chilled and processed for shipment to the laboratory. When transferring samples, care will be taken not to touch the 5-gallon composite collection container to the sample container.

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The same procedure described for the initial collection of the composite sample into 5-gallon containers will be used to collect the bulk samples that will be retained. Approximately eight (8) bulk samples will be collected and retained.

For the discrete and composite samples to be submitted for laboratory analysis, a separate pre-cleaned container will be filled and used to measure the field parameters. A field pH meter with a combination electrode or equivalent will be used for pH measurement. A field conductivity meter will be used for specific conductance measurements. A nephelometer-type turbidimeter will be used for turbidity measurements. Temperature measurements will be performed using standard thermometers or equivalent temperature meters. A combined field meter or individual meters will be used for dissolved oxygen and ORP measurements. Combination instruments capable of measuring multiple parameters may also be used. All instruments will be calibrated in accordance with manufacturers' recommendations. The field parameter measurement, calibration and accuracy requirements are provide on Table 3-2.

The recommended sample containers and required sample preservation and holding times for the discrete and composite sample to be submitted for laboratory analysis are summarized in the inset table below.

Sample Preservation and Holding Time Requirements for Laboratory Analyses

Parameter	Recommended Container	Preservative	Maximum Holding Time
Water Quality (Cl^-, F^-, NO_3^-, and SO_4^{2-})	0.5-liter polyethylene bottle	Cool to 4°C	28 days
Metals (Ag, As, Cd, Cu, Hg, K, Pb, Ni, Se, Mn, B, V, Zn and Total phosphorus)	0.25-liter polyethylene bottles	HNO_3 to pH $\leq$ 2, Cool to 4°C	6 months; except Hg is 28 day hold time
Total Ammonia	0.5-liter polyethylene bottle	H_2SO_4 to pH $\leq$ 2; Cool to 4°C	28 days
Total cyanide	0.5-liter polyethylene bottle	NaOH to pH $\geq$ 12; Cool to 4°C	14 days

The sample designation, field parameters and number of containers / preservation for each of the samples to be submitted to the laboratory for analysis will be documented on a groundwater sampling field form (Appendix C).

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4.4.3.3 Sample Handling

All sample containers will be pre-cleaned. Preservatives, if required, will be added to the containers prior to shipment of the sample containers from the laboratory (pre-preserved) or added to the samples(s) in the field as needed to meet sample preservation requirements.

All sample containers for submittal for laboratory analysis will be placed in a strong, rigid-walled shipping container such as a heavy plastic cooler. The following outlines the packaging procedures that will be followed.

1. When ice is used, secure the drain plug of the cooler with tape to prevent melting ice from leaking out of the cooler.
2. Line the cooler with bubble wrap, as needed, to prevent breakage during shipment.
3. Check screw caps for tightness and, if not full, mark the sample volume level of liquid samples on the outside of their sample bottles with indelible ink.
4. Custody-seal all container tops.
5. Affix sample labels onto the containers and write sample number on container with indelible ink.
6. Wrap all glass sample containers in bubble wrap to prevent breakage.

All samples will be placed in coolers with the appropriate chain-of-custody form. All forms will be enclosed in a large plastic bag and affixed to the underside of the cooler lid. Empty space in the cooler will be filled with bubble wrap to prevent movement and breakage during shipment. Ice used to cool samples will be placed on top and around the samples to chill them to the correct temperature. Both samples and ice will be double-bagged in large plastic bags. Each ice chest will be securely taped shut with strapping tape; and custody seals will be affixed to the front and back of each cooler.

The retained bulk groundwater samples will be labeled as described above and stored at a secure location.

4.5 PERSONNEL TRAINING

All personnel directly involved with the Hydrogeological Study will be provided with a copy of this Plan. Personnel will be trained in the requirements specified herein and provided ample time to read and become familiar with these requirements prior to beginning data collection activities. All onsite personnel shall conform to the MWH health and safety plans and the FMC *Site-Wide Health and Safety Plan* (FMC 2013).

Table 4-1

Data Collection Quality Objectives

Groundwater Extraction Zone Hydrogeologic Study Work Plan for the FMC OU

(Page 1 of 2)

#	DQO Step	Extraction Well and Piezometer Installation	HCS Model Prediction Capture Zone Determination	Establish Expected Average HCS Effluent Quality to Refine Evaluation of Disposal Options
1	State the problem	New extraction wells and piezometers need to be installed / constructed properly and will meet the requirements for the HCS.	Verify Model Predictions and determine the alignment and layout for the final design of the full-scale HCS to capture contaminated groundwater before it migrates beyond the FMC Plant Site.	Establish expected average effluent quality to refine evaluation of management/disposal options (i.e., discharge to the Pocatello POTW or on-site treatment and discharge to percolation basin(s)).
2	Identify the decision	Finalize well construction / completion details.	Define hydrogeologic conditions in the extraction well zone identified by the groundwater model.	Expected average HCS effluent quality and total flow are needed to evaluate and determine if discharge to the POTW is viable, and to finalize design for the management/disposal option.
3	Identify inputs to the decision	Numerous observation and measurements performed during drilling of the boreholes for the extraction wells including: • Geologic / lithologic logging – soil types • Static water level in borehole • Groundwater chemistry profiling results – groundwater samples will be collected and filed analyzed for approximately every 10 feet of drill depth within the saturated zone (for extraction wells). Field analyses per Table A.2.3-1 of Appendix A.	Groundwater elevation (water level) data collected from select locations at and near the extraction area (see Table 3-1). Water levels will be measured to an accuracy of 0.01 foot. Groundwater pump test results will be utilized to update the groundwater model.	Groundwater samples for chemical analysis and bulk bench-scale treatability study will be collected, as applicable, from each extraction well and as an composite of the HCS as follows: **Six-hour step-test (discrete samples from each extraction well)** • Start of six hour step test (approximately one hour after start of step one). • End of step three (prior to pump shut-down) **72-hour pump test (composite and bulk samples)** • Start of 72-hour pump test (approximately one hour after start) • End of t 36-hour period • End of pump test (72-hour period)
4	Define the study boundaries	Vertical extent of borehole advanced to construct wells.	Approximate northeast boundary of the FMC Plant OU.	Groundwater in the impacted shallow aquifer zone at the northeast boundary of the FMC Plan OU.

Table 4-1

Data Collection Quality Objectives

Groundwater Extraction Zone Hydrogeologic Study Work Plan for the FMC OU

(Page 2 of 2)

#	DQO Step		HCS Model Prediction Capture Zone Determination	Establish Expected Average HCS Effluent Quality to Refine Evaluation of Disposal Options
5	Develop a decision rule	Screened casing slot size will be determined by saturated zone soil types (grain size). Top of screen will extend approximately 5 feet above static water level. Screen length and bottom of hole based on groundwater chemistry profile: • If SC < 500 umhos/cm and phosphate field analysis < 0.1 mg/l before encountering top of the AFLB, bottom of hole / screen set above American Falls Lake Bed (AFLB) deposits; or • If SC > 500 umhos/cm and phosphate field analysis > 0.1 mg/l in sample at or above the top of the AFLB, bottom of hole / screen set at top of AFLB.	A groundwater model update will be used to determine whether the full-scale HCS can provide long-term groundwater capture at the FMC Site boundary.	The results will be used to refine evaluation of management/disposal options.
6	Specify limits on decision errors	Not applicable.	Based on previous modeling efforts (mean absolute error), differences between simulated and observed head conditions should be less than or equal to an absolute value of 1.1 feet across the model domain.	Not applicable.
7	Optimize the design for obtaining data	The borings and well construction will be conducted as described in this Plan.	Data will be collected as described in Section 3.0 and Appendix B of this Plan.	The field hydrogeologic studies and data evaluation activities will be conducted as described in this Plan.

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5.0 DATA REDUCTION, REVIEW AND REPORTING

5.1 DATA REDUCTION

Data collection for the Hydrogeologic Study will be performed in the field and analytical laboratory. Field data will be used as reported from properly calibrated water level meters and pressure transducers. Analytical data will be provided by the analytical laboratory.

5.2 DATA REVIEW, PERFORMANCE AUDITS AND CORRECTIVE ACTIONS

Prior to use, the MWH RD Manager or designee will review and assess the quality of field data. The data will be reviewed to assess whether the procedures specified in this Work Plan, including the QAPP and FSP, were followed and to identify inconsistencies and/or anomalous values. Any inconsistencies will be resolved immediately, if possible, by seeking clarification from those personnel responsible for data collection. At a minimum, the information contained in field logs/notes, field-sampling forms, instrument outputs, as applicable, will be included in the review process. All changes or corrections to this field documentation will also be reviewed. A narrative will be prepared that describes any deviations from the procedures, explains any qualifications regarding the data quality, and describes any significant problem identified during the review process.

As the field portion of the hydrogeologic study is expected to be completed within three to five weeks, construction quality control measurements will be field audited at least twice during the field effort.

5.3 DOCUMENTATION AND REPORTING

All data collected in direct support of this hydrogeologic study will be retained by FMC and/or its contractors consistent with the records retention requirements under the UAO. All data collected in direct support of this extraction area hydrogeologic characterization study will be reported to EPA in a report entitled *Hydrogeologic Study Report* to be provided within 60 days of completion of the field work or receipt of final validated laboratory analytical reports, whichever is later. This will allow time for data interpretation and processing as well as an update to the groundwater model.

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6.0 HEALTH AND SAFETY PLAN

The FMC Plant OU is covered by the *Site-Wide Health and Safety Plan* ([SWHASP], FMC 2013). The SWHASP provides the Site health and safety organization, specific Site hazards, Site controls, Site evacuation procedures, Site PPE requirements, general health and safety procedures, and emergency procedures. In addition, the SWHASP requires that all Contractors working on the Site will develop their own action-specific Health and Safety Plan (HASP) which will incorporate the general requirements specified in the SWHASP. Each Contractor's action-specific HASPs must provide specific health and safety requirements that are pertinent to the anticipated activities during that action.

Per the requirements of UAO Section IX, Paragraph 30. a., FMC will submit the most recent version of the SWHASP under a separate transmittal. Copies of the SWHASP and all Contractor action-specific HASPs will be maintained on Site during actions performed under this Work Plan.

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7.0 DELIVERABLES AND SCHEDULE

In addition to this Plan and the SWHASP (as described in Section 6.0), a report entitled *Hydrogeologic Study Report* will be provided within 60 days of completion of the field work or receipt of final validated laboratory analytical reports, whichever is later.

The overall hydrogeologic study project schedule is as follows:

Project Activity	**Schedule**
Submittal of the *Site-Wide Health and Safety Plan*	Submitted July 15, 2013; Updated version submitted December 27, 2013
Submittal of *Hydrogeologic Study Work Plan*	Draft submitted July 15, 2013; this revised version submitted on or before January 10, 2014.
Mobilize for implementation of field work	Targeting mid-March 2014 pending final approval of the *Hydrogeologic Study Work Plan.*
Complete field work	75 days after mobilization / implementation of field work.
Submittal of the *Hydrogeologic Study Report*	60 days after completion of field work or receipt of final validated laboratory analytical reports, whichever is later.

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8.0 REFERENCES

Bechtel, 1996. Remedial Investigation Report for the Eastern Michaud Flat Site. Bechtel Environmental, Inc. Draft issued September 1995 and revised August 1996.

EPA, 2012. Interim Amendment to the Record of Decision for the EMF Superfund Site - FMC Operable Unit - Pocatello, Idaho, September 27, 2012.

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Houser, 1992. Quaternary stratigraphy of an area northeast of American Falls Reservoir, eastern Snake River Plan, Idaho, Link, P. K., et al., eds., Regional Geology of Eastern Idaho and Western Wyoming, *Geological Society of America Memoir*, Vol. 179, pp. 269-288.

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MWH, 2009a. Groundwater Current Conditions Report for the FMC Plant Operable Unit, June 2009 - Final.

MWH, 2009b. Supplemental Remedial Investigation Report for the FMC Plant OU, May 2009.

MWH, 2010a. Supplemental Feasibility Study Report for the FMC Plant Operable Unit, July 2010.

MWH, 2010b. Groundwater Model Report for the FMC Plant Operable Unit, July 2010 (Appendix E of the SFS Report).

MWH, 2010c. Interim CERCLA Groundwater Monitoring Plan for the FMC Operable Unit, July 2010.

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APPENDIX A

EXTRACTION WELL AND PIEZOMETER INSTALLATION FIELD PROCEDURES

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A.1 INTRODUCTION

This appendix describes and outlines field procedures for the installation, development, topographic survey, and groundwater elevation measurements of extraction wells, monitoring wells/piezometers for the FMC OU Hydrogeologic Study in support of the FMC OU Boundary Hydraulic Containment System (HCS).

A.2 GENERAL CONSIDERATIONS FOR WELL INSTALLATION

A.2.1 Underground Utility Locating and Digging Permits

Subsurface locations will be cleared by FMC as specified in SOP 1 provided in Appendix D. If any underground utilities are determined to be present at a proposed location, the location will be moved to the nearest area clear of utilities.

A.2.2 Well and Piezometer Designations

For the purposes of this Plan, the extraction wells, monitoring wells, and piezometers are numbered sequentially using "EW" to indicate an extraction well, "and "PZ" to indicate a piezometer (e.g., EW1, EW2 and PZ1, PZ2). As the wells and piezometers are installed during the phased process, they will be given designations that conform to FMC OU guidelines.

A.2.3 Soil Sample Collection and Groundwater Chemistry Profiling Procedures

During drilling activities, soil samples for stratigraphic logging will be collected from the borehole prior to well installation. Soil samples will be collected using a split-spoon sampler or from soil cores (e.g., sonic drill cores). As necessary, a sample catcher will be placed at the end of the sampler so that unconsolidated soils are not lost as the sample device is retrieved from the borehole.

In the event that the HCS extraction wells and piezometers are installed using roto-sonic drilling methods, soil cores for stratigraphic logging will be collected continuously throughout the length of the borehole. However, if the extraction wells and piezometers installation is performed using other drill methods (i.e., air-rotary, etc.,) soil samples will be collected using a split-spoon sampler at 5-foot centers above the water table, and then continuously from approximately 5 feet above the saturated zone to the bottom of the boring. Split-spoon, soil samples for piezometers installed will be collected following the same procedures as for the extraction wells. The screened casing slot size and interval will be selected based on the static water level in the

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borehole, stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager.

Stratigraphic logging will be performed at each well and piezometer location according to the Unified Soil Classification System (USCS). The USCS soil classification is based on grain size, degree of grading, stiffness, plasticity, and density. In addition, the soil description will also include Munsell color (wet), soil particle angularity, and moisture content), if present. All stratigraphic data will be recorded on the Extraction Well/Piezometer Boring Log Form (included in the field forms the end of Appendix A).

Field analyses of groundwater samples for indicator constituents of site-affected groundwater will be performed during drilling of the extraction wells. The field analyses will be performed to supplement the stratigraphic interpretations for the selection of screen intervals.

Groundwater samples will be collected from the saturated zone during drilling. Since the roto-sonic, triple-wall air-percussion, or ARCH drilling methods will maintain an open borehole, groundwater encountered during drilling is most likely to originate in the zone between the end of the advance casing and the drill bit. A submersible pump or hydropunch groundwater sampling tip will be placed near the tip of the advance casing and the groundwater will be pumped to the surface for field analysis. Groundwater quality parameters (pH, temperature, and specific conductance) will be monitored during pumping until a representative sample can be obtained. Once representative conditions are observed, a sample of the discharge will be collected and analyzed in the field for the parameters listed in Table A.2.3-1. One sample will be collected and analyzed for approximately every 10 feet of drill depth within the saturated zone. The results will be used in conjunction with lithologic logging observations to select the interval for placement of the well screen.

Table A.2.3-1: Groundwater analyses conducted during drilling.

Analytical Parameter	**Method**
pH	Multi-probe field meter
Specific Conductance	Multi-probe field meter
Redox	Multi-probe field meter
Temperature	Multi-probe field meter
Nephelometric turbidity (NTU)	Turbidity meter
Phosphate	HACH portable colorimeter

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A.2.4 Decontamination Procedures

All down-hole drilling and sampling equipment will be decontaminated prior to use at each borehole location in accordance with SOP 2 provided in Appendix D. After decontamination, down-hole equipment will be kept off the ground and stored on a clean surface (e.g., plastic) until it is used. All decontamination fluids will be disposed of according to the protocols established in SOP 4 provided in Appendix D.

A.2.5 Documentation

Field activities associated with extraction well and piezometer drilling, soil sampling, construction, completion, and development will be recorded on field forms included as an Attachment to this Appendix. The MWH on-site representative will maintain a field logbook. The field logbook will be a weather resistant, bound, survey-type book, with non-removable pages. Information to be entered in the logbook typically will include the name and location of the job, personnel on site, name and address of the field contact person, the date(s) the borehole was started and completed, weather conditions, sampling methodology, sample depths, decontamination procedures, and any other observations that may be relevant to the field program.

A.2.6 Well and Piezometer Development Procedures

The extraction wells and piezometers will be developed no sooner than 48-hours after grouting and construction are completed. The extraction wells and piezometers will be developed using a combination of a surge block and bailer and either a portable centrifugal pump, a submersible pump, or airlift pump. The depth to groundwater and the total depth of the well will be measured with an electric water-level indicator prior to and immediately after development.

During extraction well and piezometer development, water quality parameters such as pH, specific conductivity, temperature, and turbidity will be monitored. These parameters will be measured with a portable water-quality meter. The parameters will be measured at the beginning of well development and after the evacuation of each borehole volume. A minimum of six rounds of water quality parameter measurements will be made; and well development will continue until the following criteria are met:

- Five borehole volumes (assuming 30 percent porosity in the sand pack) have been removed

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- Three consecutive water-quality measurements must satisfy the following criteria:
  - pH = ± 0.3 pH units
  - Temperature = ± 1°C
  - Specific conductivity = ± 10 percent
  - Turbidity <= 5 nephelometric turbidity units (NTUs).

Piezometer development will continue until the purged water is reasonably free of sediments (as determined by the MWH field representative). The total time devoted to developing each piezometer will not exceed 4 hours.

A.2.6.1 Decontamination Procedures

All down-hole equipment associated with well development will be decontaminated prior to use at each borehole location in accordance with SOP 2 provided in Appendix D. After decontamination, down-hole equipment will be kept off the ground and stored on a clean surface (e.g., plastic) until it is used. All decontamination fluids will be disposed of according to the protocols established in SOP 4 provided in Appendix D.

A.2.6.5 Documentation

All measurements made during monitoring well development will be recorded on the Well Development Form (Attachment 1). Required information includes well identification, date and time of development, field personnel, method of development, meter(s) used to measure water quality parameters, calibration procedures, measured water quality parameters, discharge rates, volume of water evacuated from the well, beginning and ending water level, total well depth measurements, and notes on any discussions to terminate development before compliance with the turbidity criteria.

A.2.7 Investigation-Derived Waste Handling

All cuttings will be stockpiled at each drill location on plastic sheeting. The cuttings will be covered at the completion of drilling activities according to SOP 4 provided in Appendix D.

All groundwater and decontamination water generated during well drilling, development, or pump test / sampling activities will be managed according to SOP 4.

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A.3 GROUNDWATER EXTRACTION WELLS

A.3.1 Extraction Well Drilling Equipment and Procedures

Casing advance drilling methods (e.g., roto-sonic, ARCH, triple-wall percussion) will be used to install the extraction wells and piezometers. It is anticipated that the total depths of the extraction wells will be approximately 120 feet bgs. The boreholes will have an effective diameter of approximately 12 inches. No circulating fluid, drilling muds, or other additives will be used without pre-approval of the Project Managers. Additives are not expected to be required.

A.3.2 Extraction Well Design and Construction

A.3.2.1 Extraction Well Design

The extraction wells will be constructed of six-inch diameter, flush-threaded, Schedule 80, polyvinyl chloride (PVC) casing connected to flush-threaded sections (30-40 feet total) of stainless steel wire-wrapped screen, with a stainless steel end cap. Each extraction well boring shall also contain a co-installed 1-inch diameter, Schedule 40, PVC piezometer pipe. The extraction well and associated piezometer screened sections will consist of 0.010-inch factory slotted screen. The sand pack around the extraction well and associated piezometer screen will be placed as the well is installed, and will consist of a silica sand pack (i.e., 10/20 mesh sand) that will prevent the migration of fine soil particles into the well. The screen in each extraction well and associated piezometer will be placed according to field observations, and extend approximately 40 feet above the bottom of the well.

A.3.2.2 Extraction Well Construction

Extraction well construction will be initiated within 18 hours of completing the borehole. To ensure the stability of the borehole during well construction, the extraction well will be constructed through the drill string. It is anticipated that each extraction well will be constructed with the bottom of the screen located at approximately 120feet bgs. Refer to Figure 3-2 in Section 3.0 for the extraction well design and completion details.

After the well casing and the capped screens have been positioned, and suspended with centralizers, to the desired depth in the borehole (e.g., extraction well and associated piezometer), a sand-pack consisting of clean, , non-carbonate silica sand will be placed in the annulus between the screen and borehole wall as the drill casing or drive pipe are slowly removed. As the drill casing or drill string are pulled upward, and the sand settles out through the bottom, additional sand will be added so that no less than one-foot of sand always remains

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inside the bottom end of the drill string during sand pack construction. The depth of the sand pack inside the annular space between the casings and the borehole wall will be continuously monitored using a weighted probe. The sand pack will be added until it is a minimum of five-feet above the screens. The well will be gently surged during emplacement of the filter pack to enhance settlement and to minimize voids. After the intended sand pack height has been reached, the sand will be allowed to settle for at least 20 minutes, after which the depth of the top of the sand pack will be verified. If additional sand is required, it will be added to the borehole. The sand will once again be allowed to settle and the height of the sand pack will be verified.

After the sand pack is in place, a minimum five-foot thick bentonite seal will be placed on top of the sand pack. Bentonite pellets will be poured from the surface to the top of the sand pack as the drill casing or drill strings are slowly withdrawn. The thickness of the bentonite seal will be monitored with a weighted probe. The depth to the top of the seal will then be verified using the weighted probe. When the desired thickness is reached, clean potable water from an approved water source will be added to the borehole, and the bentonite seal will be allowed to hydrate for 30 minutes. For seals competed below the water table, wax coated bentonite tables (e.g., Pel Plug) will be used. The coated tables sink through the water column to the top of the sand pack and are “time released” during hydration. The bentonite seal will be allowed to hydrate for 30 to 45 minutes.

The remaining open annular space of the extraction well will be grouted to eight-feet bgs through a tremmie pipe positioned at the bottom of the annular space. The PVC risers will extend approximately two-feet above the ground surface.

A.3.2.6 Extraction Well Completion

The above ground PVC well casing will be protected from vehicular damage by using Jersey barriers to cordon-off an approximately 5-foot by 5-foot area around each well head until the final completion is installed. For all extraction wells a 14-inch diameter protective steel casing approximately three-feet in length will be installed to a height of approximately 2.5-feet above the ground surface. The protective casing will have a vented lid that can be secured with a lock. A mortar collar will be placed within the protective casing annulus from the ground surface to 6 inches above the ground surface. A 0.25-inch diameter hole (drainage port) will be drilled in the protective casing, approximately 0.5 inch above the mortar collar. The mortar mix will be composed of one part cement to two parts sand. Minimal water will be used to hydrate the mix. Soil will be placed around the casing that slopes away from the steel casing toward the ground surface. Each well completed above ground will be protected by barriers (e.g., Jersey barriers or bollards). Refer to Figure A-1 for construction details for above-ground well / piezometer completions. The construction and completion details for each well and piezometer will be recorded on a Well Completion Form.

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A.4 PIEZOMETERS

A.4.1 Piezometer Drilling Equipment and Procedures

Piezometers will be installed using the same manner as the extraction wells above. However, smaller diameter casing advance will be utilized (e.g., six to eight inch casing). It is anticipated that the total depths of the piezometers installed for the Hydrogeological Study will be approximately 120 feet bgs.

A.4.2 Piezometer/Monitoring Well Design and Construction

A.4.2.1 Piezometer Design

The piezometers/monitoring wells will be constructed of 2-inch diameter, flush-threaded, Schedule 40 PVC riser connected to 2-inch diameter, flush threaded sections of Schedule 40 PVC screen, with a PVC end or cap. The screened sections of the piezometers/monitoring wells will consist of 0.010-inch factory slotted screen. The sand pack surrounding the piezometer screen will be placed as it is installed, and will consist of a silica sand pack that will prevent the migration of fine soil particles into the piezometer. The depth interval for the screen in each piezometer will be placed according to field observations. The piezometer screen will consist of 10-foot intervals and will be placed to fully penetrate the saturated thickness of the aquifer. The actual completion details will be decided in the field based on the saturated thickness of the target water-bearing zone and the requirements of aquifer tests performed during the Hydrogeological Study.

A.4.2.2 Piezometer Construction

Piezometer construction will be initiated within 18 hours of completing the borehole. To ensure the stability of the borehole during construction, the piezometer will be constructed through the drill pipe.

After the riser and the capped screen have been positioned to the desired depth in the borehole, a sand-pack consisting of clean, non-carbonate silica sand will be placed in the annulus between the screen and borehole wall as the drill string are slowly removed. As the drill string is pulled upward, and the sand settles out through the bottom, additional sand will be added so that no less than one-foot of sand always remains inside the bottom end of the drill string during sand pack construction. The depth of the sand pack inside the annular space between the casing and the borehole wall will be continuously monitored using a weighted probe. The sand pack will be added until it is a minimum of two-feet and no more than three-feet above the top of the screen. The piezometer will be surged during emplacement of the filter material. After the intended sand pack thickness has been reached, the sand will be allowed to settle for at least 20 minutes, after

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which the depth of the top of the sand pack will be verified. If additional sand is required, it will be added to the borehole. The sand will once again be allowed to settle and the thickness of the sand pack will be verified.

After the sand pack is in place, a minimum five-foot thick bentonite seal will be placed on top of the sand pack. Bentonite pellets will be poured from the surface to the top of the sand pack as the drill string is slowly withdrawn. The thickness of the bentonite seal will be monitored with a weighted probe. The depth to the top of the seal will then be verified using the weighted probe. When the desired thickness is reached, clean potable water from an approved water source will be added to the borehole, and the bentonite seal will be allowed to hydrate for 30 minutes. For seals competed below the water table, coated bentonite pellets/tablets will be used. The coated pellets/tablets sink through the water column to the top of the sand pack and is "time released" during hydration. The seal will be allowed to hydrate for 30 to 45 minutes.

A.4.2.3 Piezometer Completion

The piezometers will be completed above ground with a protective steel casing approximately 5 feet in length that will extend to a height of approximately 2.5 feet above the ground surface. The protective casing will have a vented lid that can be secured with a lock. A mortar collar will be placed within the protective casing annulus from the ground surface to approximately 6 inches above the ground surface. Soil will be placed around the casing that slopes away from the steel casing toward the ground surface. Each well / piezometer completed above ground will be protected by barriers (e.g., Jersey barriers or bollards). A stainless steel identification plate stamped with the well designation will be affixed to each well casing or flush-mount lid (if used). Refer to Figure A-1 for construction details for above-ground well / piezometer completions. The construction and completion details for each well and piezometer will be recorded on a Well Completion Form.

A.5 TOPOGRAPHIC SURVEY / GPS

All extraction wells and piezometers will be surveyed for horizontal control with Global Positioning System (GPS) equipment as specified in SOP 3 contained in Appendix D. The elevation measurements for the monitoring wells and piezometers will be made at a specific mark at the top of the riser casing (measuring point), and at the ground surface.

The horizontal control for each GPS measurement will be within $\pm$ 3.0. The vertical control for each survey measurement will be within $\pm$ 0.01 feet.

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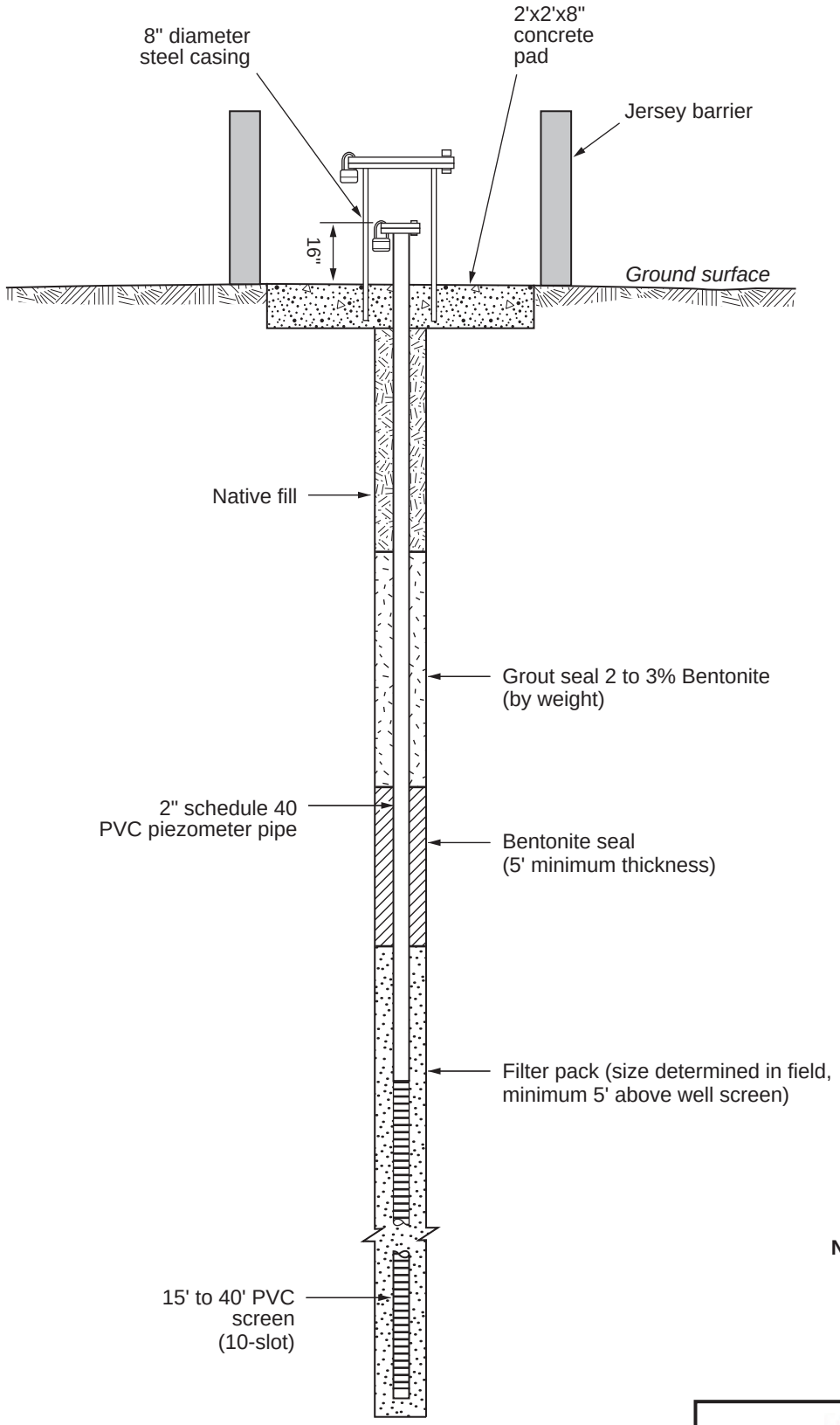

Total Depth Approx. 120 feet
(approximate depth to top
of American Falls Lake Bed)

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE A-1

GENERALIZED PIEZOMETER DESIGN AND ABOVE-GROUND COMPLETION

MWH

FILE *Fig A-1_Generalized Piezometer Design and Above Ground Completion.ai* *DATE: 24 Oct 2013*

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ATTACHMENT 1

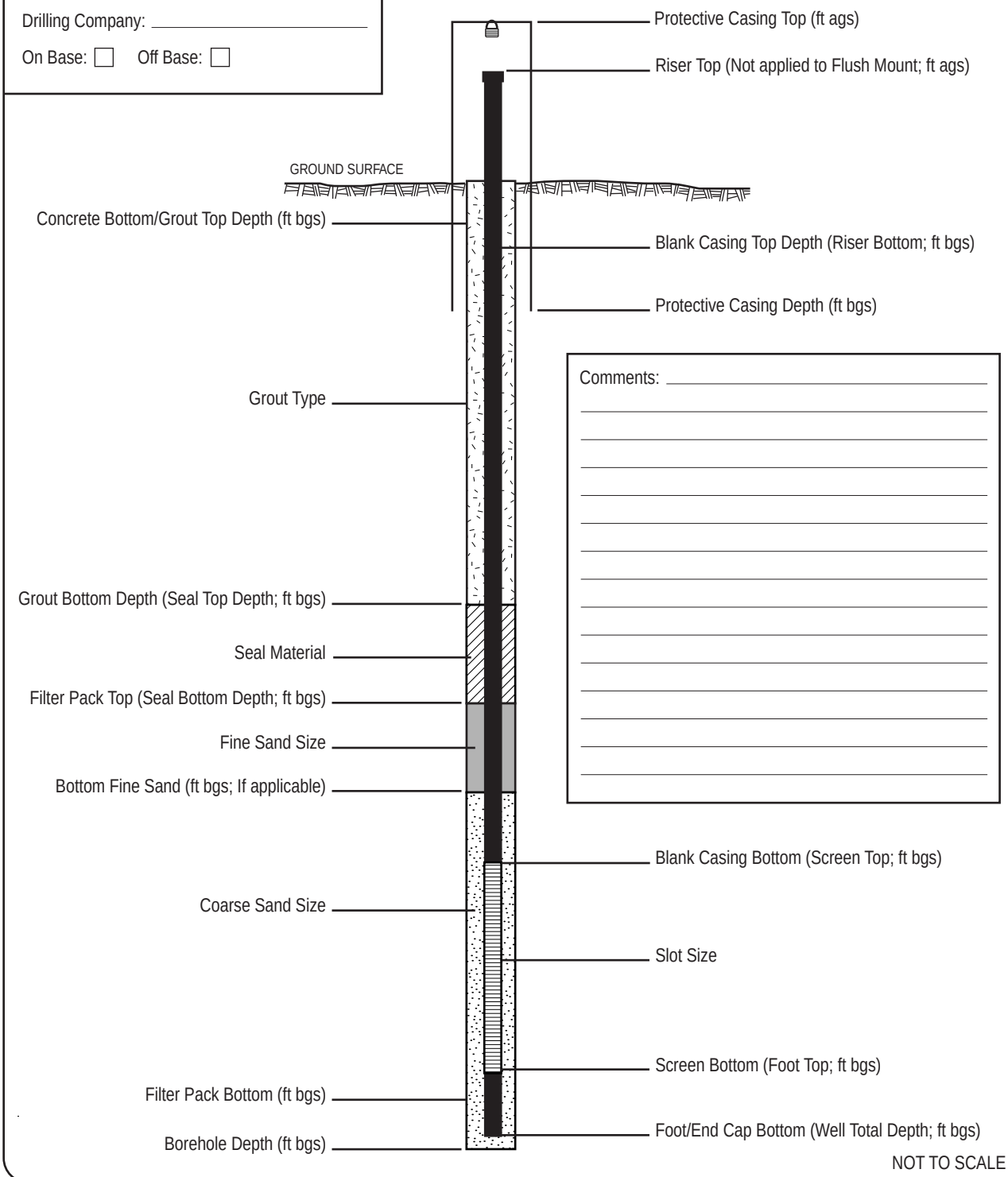
FIELD FORMS

MONITORING WELL COMPLETION FORM

Project No: _____

Drilling Company: _____

On Base: ☐ Off Base: ☐



Comments: _____

Loc ID/Well ID _____

Geologist _____

Date Construction Started _____

Date Construction Completed _____

LOC Type (i.e. Monitoring Well) _____

Riser Material/Diameter _____ / _____

Blank Casing Material/Diameter _____ / _____

Screen Material/Diameter _____ / _____

Protective Casing Type _____

Borehole Diameter _____

Above Ground Completion ☐ Flush Mount ☐

USCS Classification of Screened Interval _____

PROJECT NO. _____

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MONITORING WELL LOG FORM

BORING LOCATION

Project: _____ Project No: _____
Date Drilled: _____ Date Completed: _____
Logged By: _____

Boring ID: _____
Northing:_____ Easting:_____

Ground Surface Elevation (ft.): _____
Measuring Point (MP) Elevation (ft.): _____
MP is Top of PVC Casing Datum: NGVD (1929)

Water Elevation (ft.): _____
Date Measured: _____

Total Depth (ft.): _____
Diameter (in.) _____

Drilling Contractor: _____
Drilling Method: _____

Screen: Diameter _____ Depth _____ Slot Size _____
Casing: Diameter _____ Length _____ Type _____
Sand _____ Bentonite Seal _____ Cement Grout Seal _____

DEPTH (FEET)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICATION	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)

* C California Split Spoon Sampler (2.5" I.D.)
S Standard penetration test sampler
c Cuttings
▼ Elevation of ground water

PROJECT NO. _____

Project: _____ Project No: _____

Boring ID.: _____

DEPTH (FEET)	GRAIN SIZE % GRAVEL	% SAND	% FINES	MAX. PID READING (ppm)	BLOWS (6 IN.)	SAMPLE TYPE*	SAMPLE RECOVERY	USCS/ASTM CLASSIFICAT.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION (USCS name; color; size and angularity of each component or plasticity; density; moisture content; additional facts)	ELEVATION (FEET)

PROJECT NO. _____

PAGE ____ OF _____

MONITORING WELL LOG FORM

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MONITORING WELL DEVELOPMENT

DATE: _____ WEATHER: _____

WELL DESIGNATION: _____ PROJECT NO: _____

FIELD PERSONNEL:_____ SUBCONTRACTOR:_____

WELL SUMMARY:

Depth to NAPL:_____

Depth of water: _____

Total well depth:_____

Construction: _____

_____

Start Time_____(a)

End Time_____(b)

Total Time_____(b-a)

Location Map

INSTRUMENTATION

pH meter (model): _____ Calibrated with buffers: _____4 _____7 _____10

SC meter (model): _____ Calibrated with standard solution: _____ µmhos/cm

Turbidity meter (model): _____ Calibrated with: _____

DEVELOPMENT SUMMARY:

Development method: Bailer_____ Pump (type) _____ Surge Block (type) _____

5 purge volume calculation: _____

Time	pH	SC (µmhos/cm)	Temp (°C)	Turbidity (NTU)	Pumping Rate	Gals. Evacuated	Visual Appearance/Comments

Final

Time	pH	SC (µmhos/cm)	Temp (°C)	Turbidity (NTU)	Pumping Rate	Gals. Evacuated	Visual Appearance/Comments

PROJECT NO. _____

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APPENDIX B

PROCEDURE FOR CONDUCTING STEP DRAWDOWN TESTS, CONSTANT DISCHARGE AQUIFER TESTS, AND MULTIPLE WELL CONTAINMENT TESTS

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B.1 INTRODUCTION

To prevent further downgradient contaminant migration beyond the FMC OU Site boundary, a hydraulic containment system consisting of multiple extraction wells will be installed along the northeast site boundary. Prior to full-scale implementation, a Hydrogeologic Study will be performed to collect additional hydrogeologic data from the site. As part of the Hydrogeologic Study, aquifer testing will be performed to determine aquifer hydraulic properties (e.g., hydraulic conductivity, transmissivity, storativity, specific yield, delayed yield, sustainable pumping rates, anisotropy, etc.) and to determine the potential for lowering the piezometric surface sufficiently to achieve hydraulic containment. This Plan outlines the methods that will be used to 1) perform 6-hour step-drawdown tests at each extraction well installed to determine specific capacities and sustainable pumping rates, 2) a 24-hour test at the western most extraction wells for determining hydraulic properties using a constant rate aquifer test, and, 3) a 72-hour constant rate pump test at the three initial extraction wells pumping simultaneously to determine whether hydraulic containment is being achieved. This work plan addresses the requirements and logistics associated with these aquifer tests.

B.2 OVERVIEW OF PUMPING TESTS

This section details the following elements of pumping tests:

- Aquifer test principles
- Assumptions and limitations
- Test method selection
- Equipment requirements
- Personnel requirements.

B.2.1 Aquifer Test Principles

Several different types of aquifer tests can be conducted to determine aquifer properties, although the fundamental principles of all tests remain similar. An aquifer test is performed by applying stress to an aquifer by extracting groundwater from a pumping/extraction well and measuring the aquifer response to that stress by monitoring drawdown as a function of time in the pumping well, and/or observation wells or piezometers, at known distances from the well. These measurements are then incorporated into an appropriate well-flow equation to calculate the hydraulic properties of the aquifer.

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B.2.2 General Assumptions and Limitations for Pumping Tests

Numerous different types of aquifer tests and well-flow equations exist that may be implemented for a variety of hydrogeologic settings. Each method has a different set of limitations and assumptions. Separate assumptions and limitations exist for confined, semi-confined (leaky), and unconfined (water-table) aquifers. In general, the following assumptions apply to most well-flow equations and hydrogeologic settings:

- The aquifer is of infinite areal extent;
- The aquifer is of uniform thickness;
- The aquifer is approximately horizontal over the area that shall be influenced by the pumping test;
- The aquifer is pumped at a constant discharge rate; and
- The pumping well fully penetrates the entire thickness of the aquifer and thus receives water by horizontal flow.

B.2.3 Aquifer Test Methods

B.2.3.1 Step-Drawdown Tests

A 6-hour step-drawdown test shall be performed at each of the three initial extraction wells to determine specific capacity and optimal pumping rates. The step- drawdown tests will consist of three steps at variable pumping rates.

B.2.3.2 Constant Discharge Aquifer Test

A 24-hour constant discharge aquifer-pumping test shall be used to determine the hydraulic properties of the aquifer at one specific extraction well location(s). This type of test typically involves monitoring the induced groundwater drawdown in several observation wells or piezometers during continuous pumping of the extraction well(s). Longer-term, constant discharge aquifer pumping tests are the most accurate means of evaluating aquifer hydraulic properties of unconfined systems. Additionally, well performance characteristics such as well capacity, well yield, and well efficiency may be determined using a constant discharge aquifer pumping test.

An aquifer recovery test shall be performed to monitor the residual drawdown following the pumping test. An aquifer recovery test provides additional data for calculating aquifer hydraulic properties and allows for an independent check of the pumping test drawdown results. The aquifer recovery test can also be used to evaluate potential borehole storage effects of the pumping well if the pumping test is performed without the use of piezometers or observation

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wells. Furthermore, recovery data are typically more reliable than drawdown measured during pumping due to the difficulties of maintaining constant discharge from a pumping well.

B.2.3.3 Hydraulic Containment Test

A 72-hour hydraulic containment test shall be conducted while pumping groundwater from the three initial Phase I extraction wells. The purpose of this test is to lower the upgradient water table elevations to a level equal or lower than downgradient elevations in order to achieve hydraulic containment. Each of the extraction wells will be tested simultaneously at pumping rates determined from previous 24-hour constant rate aquifer test.

B.2.4 Equipment Requirements and Definitions

B.2.4.1 Electric Submersible Pump

The submersible pump must be capable of pumping for extended periods of time at a constant discharge rate and must be powered by a reliable source. The discharge pipe or hose shall be equipped with a flow adjustment valve used to regulate flow, which is much more desirable than changing the speed of the pump motor because it allows for better control of the discharge rate.

B2.4.2 Flow Gauge

An in-line flow meter shall be used to measure flow from the extraction pump. The discharge rate will be monitored directly on a meter displaying a constant gallons per minute (gpm) reading and also will be calculated by dividing the quantifiable volume of groundwater collected (at various points during the test) by the time required.

B.2.4.3 Electronic Water-Level Indicator

Manual water-level measurements shall be collected using electronic water-level indicators capable of measuring to 0.01-foot accuracy during all segments of the aquifer test. Electronic water-level indicators will be dedicated to specific wells during the test to avoid errors due to slight differences between indicators. Manual water-level measurements shall be collected as a back-up to water-levels measured using pressure transducers and data loggers. All manual water-level measurements shall be recorded on an aquifer test data sheet, an example of these data collection sheets are included as Figures B-1 and B-2.

B.2.4.4 Pressure Transducer

Pressure transducers shall be used to monitor water levels in pumping wells during aquifer testing. The pressure transducer installed in the pumping well shall be located in the associated piezometer and placed above the level of the pump, but below the anticipated drawdown level. Pressure transducers installed in piezometers shall be placed within the screened interval. The pressure transducers shall be connected to a programmable surface data logger (described

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below). Transducers are available in different pressure ranges. A pressure transducer shall never be lowered to a depth that produces a greater pressure than the operating range of the transducer. Operating ranges in feet of water for different pressure transducers can be determined by multiplying the pounds per square inch (psi) of the transducer by 2.3. For example, a 10-psi transducer can operate from water table to a maximum depth of 23 feet; a 50-psi transducer can operate down to 115 feet below the water table.

B.2.4.5 Data Logger

A data logger is a small field computer capable of recording a wide range of physical measurements such as pressures, temperatures, specific conductance, and flow. The data logger converts the pressure value sent by the transducer into feet of water above the transducer, and records the values in its memory. The data can then be downloaded from the logger to a PC computer. Each transducer has specific parameters that must be input to the data logger to make the appropriate conversions from pressure units to feet of water.

B.2.4.6 Timing Device

All project team members shall have an accurate timer, wristwatch, or stop watch. All timing devices must be synchronized prior to starting any aquifer pumping test. The importance of accurate time measurements cannot be overstated.

B.2.4.7 Health and Safety Equipment

The FMC Plant OU is covered by the *Site-Wide Health and Safety Plan* ([SWHASP], FMC 2013). The SWHASP provides the Site health and safety organization, specific Site hazards, Site controls, Site evacuation procedures, Site PPE requirements, general health and safety procedures, and emergency procedures. In addition, the SWHASP requires that all Contractors working on the Site will develop their own action-specific Health and Safety Plan (HASP) which will incorporate the general requirements specified in the SWHASP. Each Contractor's action-specific HASPs must provide specific health and safety requirements that are pertinent to the anticipated activities during that action.

B.2.5 Personnel Requirements

Initially, the aquifer pumping tests shall require a minimum of three people at start up. One person shall be responsible for monitoring the flow gauge and adjusting the discharge rate of the pump. One person shall be responsible for starting the data loggers and ensuring that the data loggers continue operating. All team members shall be responsible for taking manual (back-up) water-level measurements with electronic water-level indicators. As the water levels reach a pseudo-steady state, fewer team members shall be required.

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B.2.6 Responsibilities

B.2.6.1 RD Project Manager

The Project Manager shall select the aquifer testing methods with assistance from the project team. The Project Manager is responsible for the preparation of groundwater pumping subcontracts and for regulatory interaction, appropriate permitting, and potential treatment of contaminated groundwater generated during aquifer testing in areas with contaminated groundwater. Additionally, the Project Manager coordinates the project team and ensures access to necessary staffing and equipment resources. For the purpose of these aquifer tests, Rob Hartman (MWH) is the Project Manager.

B.2.6.2 Project Hydrogeologist

The Project Hydrogeologist is responsible for the successful completion of the testing program in a technically sound manner. The Project Hydrogeologist is responsible for the design of the testing methods, data acquisition methods, and data analysis. The Project Hydrogeologist must have thorough understanding of the site hydrogeology to the extent known and must be have knowledge and extensive experience using field instruments and equipment, such as pressure transducers, data loggers, pumps, flow gauges, and meters. The Project Hydrologeologist must possess knowledge in the areas of well hydraulics and aquifer mechanics and is responsible for data reduction and analysis. The MWH Project Hydrogeologist for these aquifer tests shall be Jesse Stewart.

B.2.6.3 Field Team Leader

The Field Team Leader coordinates logistical aspects of the testing program and is responsible for accurate and precise data collection by all field team members. The Field Team Leader assists in the design of the aquifer testing program and must have working knowledge of equipment and instruments used in testing methods implemented. William Bragdon shall serve as the MWH Field Team Leader.

B.2.6.4 Project Staff

Project Staff assist in data acquisition and data reduction and in the design of the aquifer testing method and with data analysis. Project staff shall be chosen from a pool of qualified hydrogeologists and field technicians, based on program schedule. At least one member of the Project Staff will be on-site at all times during aquifer testing.

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B.3 TEST DESIGN CONSIDERATIONS

The following design components must be evaluated prior to initiation of a pumping test:

- **Extraction wells.** Each of the extraction wells will be designed as part of the Hydrogeologic Study for pumping and must be fully developed and capable of sustained and prolonged pumping. The first three Phase I extraction wells will be located in northeast portion of the Former Operations Area as per Figure 1-3). Nearby observation wells or piezometers are required for distance-drawdown calculations (see Figure 1-3).

- **Choice of piezometers.** Ideally, water levels shall be monitored in as many nearby monitoring wells or piezometers as feasible. Prior to conducting the pumping test, zones of influence may be estimated using well-flow equations to determine which wells likely will show a drawdown response. It is beneficial to use monitoring wells and piezometers located upgradient, downgradient, and cross-gradient from the pumping well to evaluate hydraulic anisotropy and or heterogeneities.

- **Step Tests.** A 6-hour variable rate step-drawdown test shall be performed in each of the three extraction wells to calculate specific capacity and determine the pumping rate for the constant rate test. Step tests will also be performed in any additional extraction wells installed (up to two additional wells) to determine well specific capacity and substantial pumping rates.

- **Constant Discharge Aquifer Test.** A 24-hour constant discharge aquifer test will be performed in the western-most extraction well. This test will be used to determine the hydraulic properties of the aquifer at a single pumping/extraction well location. This type of test typically involves monitoring drawdown in several observation wells and/or piezometers. Long-term, constant discharge aquifer pumping tests are the most accurate means of evaluating aquifer hydraulic properties of unconfined systems. In addition, well performance characteristics such as well capacity, well yield, and well efficiency may be determined using a constant discharge aquifer pumping test.

- **Hydraulic Containment Test.** Once the first three extraction wells are in place and the variable rate step-drawdown and constant rate tests are completed, a hydraulic containment test shall be performed. Each of the extraction wells will be tested simultaneously at pumping rates determined from previous aquifer tests. Pumping rates may need to be varied or tuned during the test due to well interference effects between extraction wells. Water level measurements will be measured in extraction wells, monitoring wells and piezometers. The objective of this test is to lower the

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upgradient water table elevations to a level equal or lower than downgradient elevations in order to achieve hydraulic containment.

- **Duration of Pumping Test - Unconfined Aquifer.** The cone of depression that results from pumping expands much more slowly for unconfined aquifers than for confined aquifers. The generally accepted minimum duration pumping test for an unconfined aquifer is 72 hours. However, the initial constant rate pump test will be performed for 24 hours to primarily establish well yields to be expected during the final 72-hour hydraulic containment pump test.

- **Size of pump.** The size of the pump shall be based on the drawdown requirements and estimated specific capacity of the well. Pumping rates will be determined from evaluation step drawdown tests that will be performed prior to the constant discharge aquifer pumping tests to determine the flow rates from the constant rate tests and the specific capacity.

- **Discharge Rate.** The discharge rate shall be based on the results of a step-drawdown and initial 24-hour constant rate testing program. The specific capacity calculated from the step-drawdown and constant rate tests shall be used to estimate the desired drawdown and pumping rate. Because of the uncertainty in the step test calculations, a level of safety shall be factored into the desired drawdown level to ensure that the water level is not drawn down to the pump. If the water level is lowered to the pump, pumping shall be terminated immediately and collection of recovery data shall be started until the aquifer recovers to static conditions.

- **Pre-Test Water Level Measurements.** One barometric pressure transducer shall be installed in the pumping well, and transducers shall be set into observation wells at least two days prior to the start of pumping to monitor pre-test trends and to correlate changes in water levels to changes in barometric pressure. Measurements shall be recorded every hour with a linear scale set on the data logger.

- **Pumping Test Water Level Measurements.** Water-level measurements during the test shall be collected at various frequencies. Individual water-level indicators can be dedicated to monitoring wells and piezometers. Pressure transducers with data loggers shall be installed in extraction well piezometers and up to ten additional piezometers (i.e., PZ01- PZ-06) and monitoring wells (see Table 3-1) within the anticipated zone of influence. Manual water-level measurements during the constant discharge aquifer pumping test shall be collected at various frequencies depending on the proximity of the monitoring wells and piezometers to the pumping well. Table B-1 lists a suggested measurement frequency schedule that can be followed during constant discharge aquifer pumping tests. The measurement frequency schedule presented in Table B-1 is a suggested frequency and may need to be modified to meet

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specific needs for individual monitoring wells and piezometers. Water-levels measured electronically using pressure transducers and data loggers shall be collected using the logarithmic time interval cycle shown in Table B-2. The logarithmic time interval allows for extremely rapid measurements during the initial portion of the test and then gradually slows the measurement frequency during later segments of the test. Table 3-1 provides a list of all piezometers and wells to be measured during the various pump tests.

- **Aquifer Recovery Test Water Level Measurements.** Water levels shall be measured during the recovery portion of the constant-rate test according to the same schedule as the pumping portion of the test (see Tables B-1 and B-2). That is, water levels shall be collected more frequently immediately after the pump is shut off and less frequently in the later stages of the recovery. The data loggers shall be reset to collect water-level recovery data, using a logarithmic interval. The recovery portion of the constant-rate test often provides some of the best data because, when the pump is shut off, water levels recover without the influence of well loss, erratic pumping, or turbulent flow near the pumping well provided that the check valve in the well functions properly.

- **Collection of Water Samples**. Groundwater samples will be collected as described in Section 3.0 of the Plan and documented on the water sampling form provided in Appendix C.

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TABLE B-1

SUGGESTED MANUAL MEASUREMENT FREQUENCY USING CALIBRATED ELECTRONIC WATER-LEVEL INDICATORS FMC OU, POCATELLO, IDAHO

ELAPSED TIME	MEASUREMENT FREQUENCY
0-20 minutes	30 seconds
20-40minutes	2 minute
40-60 minutes	5 minutes
60-120 minutes	10 minutes
2-12 hours	1 hour
12 hours to 3 days	2 hours

TABLE B-2

TIME INTERVAL SCHEDULE FOR PRESSURE TRANSDUCERS AND DATA LOGGERS FMC OU, POCATELLO, IDAHO

LINEAR CYCLE	MEASUREMENT INTERVAL	TOTAL DATA POINTS PER CYCLE
30 minutes	1 second	1800
30 minutes – 6 hours	10 second	1980
6 hours -72 hours	10 minute	396

- **Discharge Water.** The discharge water from the pumping tests will be collected in portable water containers for appropriate management per SOP 4 (Appendix D).
- **Miscellaneous.** Precipitation events must be recorded in the field notes, including time of onset, and duration. Barometric readings shall be measured by a barometric transducer and data logger. The barometric transducer shall be suspended in the

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pumping well to minimize diurnal variations due to temperature changes. Barometric pressure effects on water levels shall be evaluated during the constant-rate test and factored into the analysis if necessary. For shallow zone wells, the passing of heavy equipment or trains shall be noted on the field logs.

B.4 AQUIFER TESTING PROCEDURES

B.4.0.1. As described in Section B.1, several piezometers will be monitored during the step-drawdown tests, the 24-hour constant rate-pumping test, and the 72-hour hydraulic containment test to determine aquifer characteristics. For each test, Table B-3 outlines the specific design parameters for each test for the pumping wells, piezometers, control point wells, water level measurements and frequency, and collection of water samples. Table B-3 also provides recommendations for the pump size, discharge rate, discharge water/investigation-derived waste (IDW), traffic control, and other miscellaneous items that may influence or need to be considered during the test.

TABLE B-3

SITE-SPECIFIC CHARACTERISTICS AND DESIGN CONSIDERATIONS
FMC OU, POCATELLO, IDAHO

Design Parameter	Step-Drawdown and Constant Rate Extraction Well Test	72-Hour Hydraulic Containment Test
Extraction Wells	Each extraction well will be constructed with 6" diameter casing. The sand filter pack size, screened casing slot size and screened interval for each extraction well will be selected based on the static groundwater level in the borehole, stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager.	Each extraction well will be operated simultaneously at the optimal flow rate determined during step-drawdown tests and the constant rate test.
Observation Points Distant Wells	Each extraction well will be paired with piezometers as detailed in the Plan. The extraction wells and specific piezometers will be monitored using pressure transducers. The monitoring wells listed in Table 3-1 will be used as distant wells during the test, and specific up- and downgradient monitoring wells installed for the system. Data from these wells will be used to determine the extent of drawdown only.	At a minimum, piezometers both up- and downgradient of each extraction well will be monitored to determine water table elevation. Piezometers shall be measured manually using electronic water level indicators. However, the same water level indicator shall be used in piezometer pairs so measurement can be correlated. Additionally, each water level indicator used for the test shall be calibrated against a "master tape." This is completed by measuring three different depths to water in different wells with each tape followed by creating a linear regression for each indicator for determining a correction to apply. The monitoring wells listed in Table 3-1 will be used as distant wells during the test and specific up- and downgradient monitoring wells installed for the system. Water levels in these wells will be recorded manually only. Data from these wells will be used to determine the extent of drawdown only.
Control Point Wells	Well 165 will be designated as the control point well. No drawdown is anticipated at this location during individual well tests. Manual water levels will be collected daily at this well.	Well 165 will be designated as the control point well. No drawdown is anticipated at this location during individual well tests. Manual water levels will be collected daily at this well.
Size Of Pump	A submersible pump shall be used during the test. The pump size will be based on development. A pump controller shall be used to vary the speed and pumping rate of the pump. A throttling valve on the discharge line of the pump shall be used to provide additional flow control.	Dedicated pumps will be used for the test. Pump size for individual wells will be based on results of step-drawdown tests and the constant rate test.
Duration Of Test	Since this test assumes an unconfined aquifer, the constant rate test will last for a total of 24 hours, plus a step drawdown test that shall consist of three steps lasting for approximately 2 hours each. The steps shall be performed at approximately 75, 95, and 115 gpm, but may be greater or lower depending on the well capability (development of the well will assist in determining pumping capability). After the step test has been completed, the system shall be allowed to equilibrate at least overnight, prior to commencing the constant rate aquifer-pumping test.	Since this test assumes an unconfined aquifer, the test shall last for a minimum of 72 hours. Total test duration may be much longer in order to achieve hydraulic containment.
Discharge Rate	This shall be based on the results of the step-drawdown test that will be conducted prior to beginning the aquifer-pumping test. Currently, it is estimated that approximately 90 to 120 gpm of water shall be produced from each extraction well for the duration of the test based on preliminary modeling.	Discharge rates shall be based on the results of the individual extraction well constant rate aquifer tests

TABLE B-3

SITE-SPECIFIC CHARACTERISTICS AND DESIGN CONSIDERATIONS
FMC OU, POCATELLO, IDAHO
(continued)

Design Parameter	Step-Drawdown and Constant Rate Extraction Well Test	72-Hour Hydraulic Containment Test
Pumping Test Water Level Measurements And Frequency	Measurements shall be made using the temporary pressure transducers and dataloggers at frequencies outlined in Table B-2. Backup measurements shall be made using an electronic water-level indicator at frequencies outlined in Table B-1.	Measurements will be made at each of piezometers prior to the test, 10 minutes after start-up, and then hourly for the next 8 hours using an electronic water-level indicator. After 8 hours, water level will be collected on a frequency of every four hours until the end of the test. One measurement will be completed prior to shut down. Measurements will also be made using dedicated pressure transducers in the extraction wells and piezometers, if available.
Aquifer Recovery Test Water Level Measurements	Measurements shall be made using the temporary pressure transducers and dataloggers at frequencies outlined in Table B-2. Backup measurements will also be made using an electronic water-level indicator at frequencies outlined in Table B-1.	A recovery test will not be performed for the hydraulic containment test.
Collection Of Water Samples	Water samples shall be collected from the extraction wells as described in Section 3.5.2 of the Plan. Samples will be sent to the laboratory and analyzed for as provided in Table 3-2. Field parameters will also be monitored when analytical samples are collected.	Water samples shall be collected from the extraction wells as described in Section 3.0 of the Plan and documented on the water sampling form provided in Appendix C. Samples will be sent to the laboratory and analyzed as provided in Table 3-2. Field parameters will also be monitored when analytical samples are collected.
Discharge Water	Discharge water will be managed per SOP 4 (Appendix D).	Discharge water will be managed per SOP 4 (Appendix D).
Traffic Control	None anticipated for this test	None anticipated for this test
Miscellaneous	All meteorological parameters and physical disturbances that could impact the results of the test shall be noted in the field logbook. A pressure transducer for reading barometric fluctuations will be installed in the extraction well during the test.	All meteorological parameters and physical disturbances that could impact the results of the test shall be noted in the field logbook. A pressure transducer for reading barometric fluctuations will be installed in the production well during the test.
	A diesel-fueled portable generator will be used to supply power to all field equipment.	A permanent power supply shall be in place. However if permanent power supply is not available, a portable diesel-fueled generator will be used.

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B.4.1 STEP-DRAWDOWN TEST PROCEDURES

B.4.1.1. Continuous data logging equipment shall be used wherever possible, although manual backup measurements shall also be collected as discussed above. All of the data loggers shall be synchronized to the correct day, date, and time. All project team members must synchronize their watches to the correct time datum.

1. Remove the well head expansion cap from all observation wells and piezometers, as well as the extraction well/associated piezometer. Allow all wells to equilibrate to atmospheric conditions.

2. Record the static water level in all test wells using electronic water-level indicators.

3. The pump shall be set in the well at the desired pumping level, usually within the screened interval. The extracted groundwater from the aquifer testing will be managed and characterized as described in SOP 4 (Investigation Derived Waste) contained in Appendix D. If determined to be non-hazardous, the water will be utilized for dust-suppression activities on site.

4. Determine the appropriate depth of the transducer for the pumping well. The transducer shall be placed at least 3 to 5 feet above the pump if possible to minimize interference with the pump. In some instances, installation of the transducer below the pump may be required. Lower the transducer to the target depth in the pumping well piezometer. Allow the well to equilibrate to static water levels.

5. Install pressure transducers in all of the selected observation wells/piezometers included in the test well in a manner similar to that described above. In typical applications, a 10-psi transducer (highly accurate up to 23 feet below the water table) is adequate for monitoring drawdown in observation wells. Secure transducer cables above ground surface and affix duct tape to each cable to monitor if any slippage occurs.

6. Connect the pressure transducers to the data logger. Enter the required transducers parameters and other test parameters in the data logger and record transducer input parameters on the transducer form shown in Figures B1 and B2. The data logger typically prompts the user to record water levels below the top of casing (TOC) or surface. Surface refers to a static water level datum. The instrument is therefore "referenced" or "zeroed" to either a static water level or to a value input by the operator. Water levels below static water level shall be recorded as negative values. For pumping test purposes, water levels can be recorded relative to either "TOC" or "surface". Note that referencing to "surface mode" minimizes mistakes in the field. An accurate record of all input parameters and field observations must be included in a field log.

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7. "Zero" the pressure transducer/data logger to static water levels (or, alternatively, enter the TOC value for each well). Confirm static levels (or TOC-adjusted values) with an electronic water-level indicator.

8. For the pumping well and for observation wells close by the pumping well, the early time data will be recorded at very frequent intervals. This is best accomplished using the logarithmic data-recording mode shown in Table B-2, where each transducer is pre-set to start recording prior to but as close as possible to when the pump is started. Set the loggers to the "delayed start mode" to begin at a pre-determined time. Ideally the loggers will begin recording one second before pumping begins. Other project team members must be prepared to begin manually measuring and recording water levels on a pre-determined frequency (see Table B-1).

9. *TEST START-UP* — This is the critical step. Once the pump is started, there is no going back. At a pre-determined time that is close to but AFTER the pre-determined time set for the loggers to begin recording data, one person must simultaneously start the pump and quickly stabilize the discharge rate to the discharge rate of the first “step”. The data recorded by the transducers and data loggers can be viewed following completion of the logarithmic data recording cycle (after 10 minutes). Water-levels measured by the transducers shall be similar to the manually measured water levels. After running the test for exactly 2 hours, the discharge rate is quickly “stepped up” to a higher pumping rate, and the frequency of water level measurements are collected at a frequency comparable to that required at the start of a new test. After running the test for exactly 2 hours, the discharge rate is again quickly “stepped up” and the process is repeated.

B.4.2 CONSTANT RATE PUMPING TEST PROCEDURES

B.4.2.1. After completing the step-drawdown tests, the site shall be allowed to recover at least overnight so that equilibrium conditions can be re-attained. During this time, the data from the step test shall be evaluated and the ideal pumping rate for the test will calculated. The following procedure shall then be used to conduct the aquifer pump test:

1. Procedures 1-8 of the step test shall be followed prior to commencing the aquifer pumping test.

2. *TEST START-UP* — This is the critical step. Once the pump is started, there is no going back. At a pre-determined time that is close to but AFTER the pre-determined time set for the loggers to begin recording data, one person must simultaneously start the pump and quickly stabilize the discharge rate to the desired discharge rate (determined from a step test, slug tests, or previous aquifer tests). The data recorded by the transducers and data logger can be viewed following completion of the logarithmic data recording cycle (after 10 minutes). Water-levels measured by the transducers shall be similar to the

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manually measured water levels. It is always beneficial to plot the time and drawdown data in the field to ensure that the pumping rate and the drawdowns are adequate.

B.4.3 Aquifer Recovery Tests

B.4.3.1. An aquifer recovery test shall always be completed following a constant rate pumping test. As stated above, recovery data are often more reliable than drawdown data due to difficulties of maintaining an absolute constant discharge rate from a pump.

1. Complete a constant discharge aquifer pumping test in the manner detailed above.

2. Wait for data logger to record a point (every 200 minutes at this time), then complete a round of water levels.

3. At a pre-determined time (a minimum of 72 hours after pumping begins), simultaneously turn off the pump, and restart the data loggers to measure aquifer recovery using the logarithmic data recording mode (Table B-2). Stop the pump immediately (one second) after restarting the data logger. Manual measurements shall be collected using electronic water-level indicator using the suggested frequency presented in Table B-1. Continue recording the recovery data until the water levels return to static (or at least 90 percent of original static levels). At this time the test is completed.

4. Carefully download the field data from the transducers to a computer. Obtain a hard copy and a master electronic copy to be stored inviolate.

B.4.4 HYDRAULIC CONTAINMENT TEST PROCEDURES

B.4.4.1. Once the constant rate aquifer test has been completed and the wells have returned to static conditions, a hydraulic containment test will be performed. For this test, each of the extraction wells shall be started simultaneously at the optimal pumping rate determined during the constant rate aquifer test. The objective of this test is to determine whether hydraulic containment is being achieved. Therefore, water levels will be collected from the entire extraction well system and associated observation wells, but are not time critical like a constant rate aquifer test. Hydraulic containment will be achieved when upgradient water table elevation is equal or less than downgradient water table elevation. Additionally, pumping rates in wells may need to be adjusted due to super position of drawdown between extraction wells. Water levels in extraction wells will need to be monitored closely so that maximum drawdown will not exceed pump levels. The hydraulic containment test shall be operated for a minimum of 72 hours to determine long-term effects of the extraction system. Specific measurement times are presented in Table B-1 and B-2.

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Figure B-1
AQUIFER TEST DATA SHEET
(PUMPING WELL)

Page ___ of ___

PROJECT NAME: _____ PROJECT NO: _____ WELL NO: _____

DATE: _____ PUMP DEPTH: _____ TEST NO: _____

TYPE OF TEST: _____ PUMPED WELL NO: _____ DISTANCE FROM PUMPING WELL: _____

MEASURING EQUIPMENT: _____ HYDROGEOLOGIST: _____

Time Data	**Water Level Data**	**Water Quality**	
Pump On: Date/Time_____(t) Pump Off: Date/Time_____(t') Duration of Aquifer Test: Pumping:_____ Recovery:_____	Pretest Water Level_____ Static Water Level:_____ Measuring Point:_____ Elevation of Measuring Point:_____		

Date	Time Since Pump Started t (min)	Time Since Pump Stopped t' (min)	Depth to Water (ft)	Pressure Transducer (XD)	Flow Rate (gpm)	pH	Specific Conductivity	Temperature	Comments on factors affecting test data

Conversion Factors: 1 PSI = 2.31 feet **1 cubic foot = 7.48 gallons**

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Figure B-2

AQUIFER TEST DATA SHEET
(OBSERVATION WELLS)

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PROJECT NAME: _____ PROJECT NO: _____ PIEZO NO: _____
DATE: _____ PUMP DEPTH: _____ TEST NO: _____
TYPE OF TEST: _____ PUMPED WELL NO: _____ DISTANCE FROM PUMPING WELL: _____
MEASURING EQUIPMENT: _____ HYDROGEOLOGIST: _____

Time Data	**Water Level Data**	**Time Data Continuation**	**Water Level Data Continuation**
Pump On: Date/Time_____ Pump Off: Date/Time_____ Duration of Aquifer Test: Pumping:_____ Recovery:_____	Pretest Water Level_____ Static Water Level:_____ Measuring Point:_____ Elevation of Measuring Point:_____		

Date	Time	Depth to Water (ft)	Pressure Transducer (XD)	Flow Rate (gpm)	Date	Time	Depth to Water (ft)	Pressure Transducer (XD)	Flow Rate (gpm)

Conversion Factors: 1 PSI = 2.31 feet 1 cubic foot = 7.48 gallons

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APPENDIX C

Groundwater Sampling Field Form

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GROUND-WATER/SURFACE WATER SAMPLING LOG

Project No: _____ Sample Location _____ Surface Water ☐ Ground Water ☐

Sampling Personnel_____ Date_____ Start Time _____ Weather_____

Depth to Water_____ Depth to Product _____ Product Thickness _____ Measuring Point _____

Borehole Dia. _____ Calculated Purge Volume _____ Gallons Total Casing Depth/Dia. _____

Sampling Method: Dedicated Submersible Pump ☐ Portable Submersible Pump ☐

Dedicated Bladder Pump ☐ Portable Bladder Pump ☐ Surge/Bail ☐ Surge Block Type _____

Disposable Bailer ☐ Bailer Type _____

Pump Started _____ Pump Stopped _____ Total Gallons _____ Organic Vapor at Well Head _____

Time (military)	pH	SC (umhos/cm)	Temp (°C)	Eh-ORP (millvolts)	D.O. (mg/L)	Turbidity (NTU)	Vol Evac. (gal.)	Comments/ Flow rate

Final:

Time	pH	SC	Temp	Eh-ORP	D.O.	Turbidity	Ferrous Iron	Vol Evac.	Comments/Flow rate

COMMENTS: _____

HYDROLAB: pH Calibration Buffers: 4 ☐ 7 ☐ 10 ☐ Eh Reference Solution _____

SC Reference Solution _____ umhos/cm Turbidity Reference Solution _____ NTUs

Sample Name _____ TIME _____ VOCs ☐ Sulfide ☐ Anions/Alkalinity/TDS ☐

TOC ☐ Cations ☐ Trace Metals ☐ SVOCs ☐ Perchlorate ☐ Explosive ☐ TPH Gas ☐ Dioxin/Furans ☐

TPH Diesel/Motor Oil ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐

MS/MSD _____ BD _____ BD Name/TIme _____ TB _____

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APPENDIX D

Standard Operating Procedures

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STANDARD OPERATING PROCEDURE 1

SITE ACCESS AND CLEARANCE REQUIREMENTS

This SOP has been revised from SOP No. 1 included in the *SRI Field Sampling Plan for the FMC Plant OU – May 2007*.

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STANDARD OPERATING PROCEDURE 1

SITE ACCESS AND CLEARANCE REQUIREMENTS

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1.0 INTRODUCTION

This standard operating procedure (SOP) defines minimum requirements that shall be fulfilled by all personnel in order to obtain site access and clearance(s) necessary to perform assigned tasks at FMC. It is the Contractor's responsibility to determine necessary clearances. Access and clearances required may include, but are not limited to, the following:

- Site access and clearance: FMC Project Manager
- Digging, Drilling, Excavation: FMC and/or FMC's contractor for FMC-owned property and Idaho Dig Line for off property locations (not anticipated).
- Public Road Closure: Idaho Department of Transportation
- Union Pacific Railroad where digging, drilling, or excavations are near the active Union Pacific Railroad tracks.

Close attention shall be paid to minimum waiting periods required before certain authorizations and clearances can be issued. Proper documentation shall be maintained at all times as evidence that authorization/clearance has been obtained. The minimum requirements for the above list are specified in this SOP. In addition to the minimum requirements outlined in this SOP, all Site contractors must comply with the FMC Site-Wide Health and Safety Plan (SWHASP) and develop their own action-specific Health and Safety Plan (HASP). The Contractor's action-specific HASP must incorporate the general requirements specified in the SWHASP and provide specific health and safety requirements that are pertinent to the anticipated activities during Contractor actions.

2.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved as needed. Project team member information shall be

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included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

RDRA Project Manager: Responsible for ensuring all personnel, including sub-contractors, have the applicable authorization(s) and clearance necessary to perform tasks as assigned. The RDRA Project Manager shall coordinate with other key project staff and FMC personnel to accomplish this task.

Field Team Leader (FTL): Responsible for ensuring access requirements are observed by field personnel at all times, preparing daily logs of field activities, and ensuring that documentation of all appropriate authorization(s) and clearance are at the work site at all times.

Field Technician (or other designated personnel): Assists the FTL with the implementation of field tasks.

3.0 ACCESS TO FMC-OWNED PROPERTY

The entrances to the FMC-owned property will normally be locked at all times. Entry onto the Site will be performed in accordance with the FMC Site-Wide Health and Safety Plan Section 5.1. RDRA contractors and subcontractors will have access to the gate key or code based upon approval and coordination with the RDRA Field Team Leader (FTL) and/or the RDRA Project Manager. All other contractors and/or visitors must obtain approval from FMC and schedule arrival and departure dates/time with FMC at the FMC Pocatello office.

All RDRA contractor and subcontractor employees performing work at the FMC Plant OU will be required to check in and check out with the FTL through the use of a sign-in sheet. A daily field log and sign in sheet will be kept at the work site by the FTL that will

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document all on site personnel and visitors. Persons not meeting the minimum standards as defined in SWHASP will not be allowed access by the FTL.

4.0 HOT WORK CLEARANCE

All cutting, welding, brazing, and other hot work will comply with all safety requirements of FMC SWHASP and the Safety, Fire Prevention and Health (AFOSH) Standard 91-5, OSHA 1910.252, and the National Fire Protection Agency (NFPA) codes.

Under this standard, personnel or contractors involved in RDRA activities that require welding, cutting, brazing, or other "hot work" shall fulfill the following requirements:

1. The RDRA contractor shall contact the FMC and the FTL prior to performing any hot work. This will allow the appropriate review and inspection of the work area prior to cutting, welding, brazing, or other "hot work". As the FMC Plant OU is expected to be fully decommissioned at the time of the RDRA field work, each case will be reviewed for potential hazards or other safety concerns. After such review, written approval (e.g., documented in the site log book) must be obtained from the FTL prior to any RDRA contractor performing hot work on the site.
2. Provide adequate number of portable fire extinguishers and place them as close to the work area as possible.

5.0 UTILITY CLEARANCE ON FMC-OWNED PROPERTY

Underground and aboveground utility clearance will be completed before subsurface investigations commence on FMC-owned property (including obtaining an excavation permit consistent with the requirements of Section 3.2.8 of the SWHASP) or off property (see Section 6 and 7 for requirements pertaining to investigations on lands not owned by FMC). The area within a 5-foot radius of each subsurface sampling location will be cleared using the following protocol:

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1. Review available facility utility maps provided by FMC and/or FMC's contractor, A&E Engineering.
2. Mark the proposed sampling locations and the utility lines in the immediate vicinity using a marker, stake, flags, or paint.
3. Verify proposed sampling locations with FMC plant or A&E employees with knowledge of the utilities to discuss undocumented utilities, potential obstructions, etc.
4. Scan the surface with a magnetic locator according to the manufacturer's directions to search for the presence of buried utilities and other obstructions.
5. Hand auger or push a probe to a depth of 4 to 5 feet below ground surface in areas where historic maps or historic knowledge of subsurface utilities are not available.
6. Overhead telephone and power lines shall also be taken into account when selecting drilling/excavation locations.
7. The RDRA contractor shall notify FMC and A&E in case of any suspicion or confirmation of damage to any underground utilities.

6.0 UTILITY CLEARANCE ON LANDS NOT OWNED BY FMC

Although subsurface investigation is not expected off FMC-owned property as part of the scope of this RDRA, the Idaho Dig Line provides one central location for contractors and the general public to call and notify multiple utility companies of intended excavation (off FMC-owned property). Information, contractor responsibilities, and an online tool to notify Idaho Dig Line of planned work can be found by calling 800-342-1585. Idaho Dig Line shall be notified at least 48 hours, but no more than seven (7) days, prior to drilling or excavation. Notices of drilling or excavation are good for 14 calendar days. Requests for a utility meeting with locators are scheduled through the Idaho Dig Line. If drilling or excavation on a single project lasts more than 14 days, Idaho Dig Line shall be notified prior to the deadline to update clearance permits. To obtain clearance for any drilling or excavation off FMC-owned property, MWH and/or its RDRA subcontractor shall provide Idaho Dig Line with the following information:

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- Company information including company name, address, and telephone number
- The name and telephone number of the caller
- Type of work to be accomplished including information regarding anticipated depth and information regarding horizontal or vertical boring
- Date of proposed work
- Precise location of the proposed drilling/excavation site. This shall be a detailed description including street address, street names and numbers, subdivision lot number if available, direction and distance relative to street or intersection (north, south, east, or west), and any other relevant information. If possible, the site shall be pre-marked with white paint, stakes, or flags
- Provide a location map if requested by Idaho Dig Line
- Marking instructions (e.g., portion of site to be cleared by Idaho Dig Line)
- Field personnel contact name and telephone number

If subsurface investigation is required off FMC-owned property, the RDRA contractor/excavator shall work with MWH to provide this information. MWH shall obtain a Location Request Number from the Idaho Dig Line representative. This is a number that references the caller with the details of the proposed excavation and is helpful when contacting a member utility or Idaho Dig Line for further assistance. MWH and the RDRA subcontractor shall possess this number at all times on job sites to prove compliance with state statutes.

After Idaho Dig Line and local utilities have marked the proposed drilling or excavation site, a minimum clearance of five feet will be maintained between a marked and unexposed underground facility and the cutting edge or point of any power-operated excavating or earth moving equipment. If excavation is required within five feet of any marking, the excavation shall be performed utilizing a hand auger or probe point to check for underground utilities. MWH or the subcontractor shall notify FMC and the Idaho Dig Line in case of any suspicion or confirmation of damage to the underground utilities.

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Underground utilities are marked with paint or pin flags with a color scheme representing different utilities. The way that these lines will be identified by the various utilities are defined by the following legend:

Red = Electric

Yellow = Oil and Gas

Orange = Communications including Cable TV, telephone and fiber optics.

Blue = Water

Green = Sewer

Pink = Temporary Survey Markings

White = Proposed Excavation

7.0 PUBLIC ROAD CLOSURE

Although not expected as part of the scope of this RDRA, the Idaho Department of Transportation (IDOT) requires road/lane closures for all work conducted on designated highways, or shoulder areas of designated highways, within the state of Idaho. This includes, but is not limited to, drilling and excavation and other work to be performed along roadways and shoulders. In such a case, it is the responsibility of MWH to contact IDOT for any authorizations. The following information must be submitted with the application:

- Applicant's name, address and phone
- Reason for permit
- Location of work site, including highway number, city, county, milepost or description
- Anticipated commencement and completion of construction/work
- Instructions for new utility installations
- A map of the work area if possible
- A diagram of the type of road closure signs required
- A name and address of the personnel who will close the lane/road

A performance bond may be required by IDOT prior to commencement of work on IDOT property.

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STANDARD OPERATING PROCEDURE 2

EQUIPMENT DECONTAMINATION

This SOP has been revised from SOP No. 3 included in the *SRI Field Sampling Plan for the FMC Plant OU – May 2007*.

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STANDARD OPERATING PROCEDURES 3

EQUIPMENT DECONTAMINATION

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1.0 INTRODUCTION

Decontamination of drilling, sampling equipment, monitoring/inspection equipment and support vehicles at the FMC site is a necessary and critical aspect of environmental field investigations. Proper decontamination is a key element in reducing the potential for cross-contamination between samples from different locations, ensuring that samples are representative of the sampled materials, as well as health and safety issues associated with elemental phosphorus. Improper decontamination may result in costly re-collection and re-analysis of samples. All equipment used in the sampling process shall be properly decontaminated prior to the collection of each sample and after completion of sampling activities.

The procedures outlined in this standard operating procedure (SOP) shall be followed during decontamination of field equipment used in the sampling process, including drilling, soil/water sample collection, and monitoring/inspection activities. Any deviations from these procedures shall be noted in the field logbooks and approved by the RDRA Project Manager and the Quality Manager. In addition to the minimum requirements outlined in this SOP, all Site contractors must comply with the FMC Site-Wide Health and Safety Plan (SWHASP) and develop their own action-specific Health and Safety Plan (HASP). The Contractor's action-specific HASP must incorporate the general requirements specified in the SWHASP and provide specific health and safety requirements that are pertinent to the anticipated activities during Contractor actions.

Three major categories of field equipment, along with applicable decontamination methods for each, are discussed below.

2.0 DEFINITIONS

Brass Sleeve: Hollow, cylindrical sleeves made of brass and used as liners in split-spoon samplers for collection of undisturbed samples.

Auger Flight: An individual hollow-stem auger section, usually 5 feet in length.

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Continuous Core Barrel: 5-foot long steel barrels that can be joined together to allow continuous cores to be collected during a single run.

Drill Pipe: Hollow metal pipe used for drilling, through which soil and groundwater sampling devices can be advanced for sample collection.

Potable Water: A drilling quality water source that can be used for steam cleaning and decontamination water. This source should be sampled at the beginning of each field program to set baseline concentrations.

Distilled Water: Commercially available or laboratory-grade water that has been distilled. Each batch of distilled water should be analyzed to set baseline concentrations. The distilled water will be used as rinse water during the decontamination of tools, sampling equipment and other small items.

Hand Auger: A sampling tool consisting of a metal tube with two sharpened spiral wings at the tip.

Split-Spoon Sampler: A sampling tool consisting of a thick-walled steel tube with a removable head and drive shoe. The steel tube splits open lengthwise when the head and drive shoe are removed.

Scoop: A sampling hand tool consisting of a small shovel- or trowel-shaped blade.

3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

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RDRA Project Manager: Selects project-specific drilling and sampling methods, and associated decontamination procedures with input from other key project staff and other personnel that are responsible for project quality control.

Quality Manager: Performs project audits. Ensures project-specific data quality objectives are fulfilled.

Field Team Leader (FTL) and/or Geologist, Hydrogeologist, or Engineer: Implements the field program and supervises other sampling personnel. Ensures that proper decontamination procedures are followed. Prepares daily logs of field activities.

Field Sampling Technician (or other designated personnel): Assists the FTL, geologist, hydrogeologist, or engineer in the implementation of tasks and is responsible for the decontamination of sampling equipment.

4.0 DECONTAMINATION PROCEDURES

A decontamination pad designed to collect the rinsate and any associated soil or chemicals will be established in a location at the FMC site. The decontamination pad will be constructed in an area designated by FMC and will be used for the duration of the field activities. The decontamination pad will be large enough to accommodate the drilling equipment components that come into contact with contaminated soils or groundwater that are present at the site. The rinsate collected from the decontamination pad and from other onsite decontamination activities will be stored in labeled containers until the proper disposal protocol is established pending waste characterization.

Soil boring drilling and soil sampling procedures require that decontaminated tools be employed in order to prevent cross-contamination. The decontamination procedures described below shall be followed to ensure that only uncontaminated materials will be introduced to the subsurface during drilling and sampling. For equipment and tools that have come into contact with contaminated soils or groundwater, the equipment

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decontamination process shall be undertaken before and after each use of the equipment and include washing. The flooring of the decontamination pad shall be impermeable to water and have a sump or low area to collect the rinsate to be transferred into the storage containers.

The precise location of the decontamination facility shall be determined based on such factors as ease of access for personnel and proximity to work site and rinsate storage or staging areas.

4.1 DRILLING AND LARGE EQUIPMENT

4.1.1 In Areas with Potential Contact with Contaminated Soil or Groundwater

The following procedures shall be used for decontamination of large pieces of equipment including drilling equipment and support vehicles in areas of the Site in which there is a potential for contact with contaminated soil or groundwater (as determined during the SRI and/or historic groundwater monitoring). This will include percussion hammer drill pipe, hollow-stem auger flights, drill rods for sampling, the drill rig, support vehicles and other equipment and tools that may come in contact with sampling equipment or that may have possible contamination.

- Wash the external surfaces and internal surfaces, as applicable, on equipment using water from an approved water source. If necessary, scrub using a phosphate-free detergent (e.g., Alconox™), or equivalent laboratory-grade detergent until all visible dirt, grime, grease, oil, loose paint, rust, etc., have been removed.
- Rinse with potable water.

4.1.2 In Areas with Little Potential for Contact with Contaminated Soil or Groundwater Contamination

The following procedures shall be used for decontamination of large pieces of equipment including drilling equipment, trenching equipment, construction equipment, and support

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vehicles in areas of the Site in which there is little or no potential for contact with contaminated soil or groundwater (as determined during the SRI and/or historic groundwater monitoring). Note that this procedure will apply to equipment that comes into contact with native soils and/or slag on slag covered roads or surfaces. For example, trenching in the Western Undeveloped Area and/or construction of the test gamma cap will involve drilling, trenching, digging, or construction activities in areas where the large equipment will only contact native soils and slag on roads and/or construction surfaces.

- Equipment will be decontaminated at the completion of the Site work, prior to removal off-Site, by mechanically brushing tires and other surfaces that came into contact with native soils or slag.

4.2 SOIL AND GROUNDWATER SAMPLING/INSPECTION EQUIPMENT

4.2.1 In Areas with Potential Contact with Contaminated Soil or Groundwater

The following procedure will be used to decontaminate sampling/inspection equipment such as split-spoon samplers; brass sleeves; continuous core barrels; scoops; hand augers; metal sampling pans; video equipment and other sampling/inspection equipment and tools that may come into contact with contaminated soils and/or groundwater.

- Wash and scrub equipment with phosphate-free, laboratory-grade detergent (e.g., Alconox™ or equivalent); steam cleaning may also be performed if possible.
- Double or Triple-rinse with potable water.
- Air dry.
- Store in clean plastic bag or designated casing.

Personnel involved in decontamination activities shall wear appropriate protective clothing as defined in the project-specific health and safety plan.

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4.2.2 In Areas with Potential Contact with Elemental Phosphorus

The following procedure will be used to decontaminate sampling/inspection equipment such video equipment and/or sampling equipment and tools that may come into contact with site materials contaminated with elemental phosphorus (P4). The only activity where potential P4 exposure is expected is while video surveying the storm sewers in RA-A. Special health and safety precautions for the storm sewer video survey include:

- Persons involved in the video survey of the RA-A storm sewers should read and be familiar with the hazards of P4 exposure as presented in Section 3.1.3 of the SWHASP. Note that the immediate area around the location where the storm sewer video survey is being performed shall be designated an *Exclusion Zone* as discussed in Section 6.1.1 of the SWHASP.
- Persons involved in the video survey of the RA-A storm sewers, performing decontamination, and within the *Exclusion Zone* shall don ***Modified Level C Protection for Potential Phosphorus Exposure*** as discussed in Section 7.3.3 of the SWHASP.

As the camera and wiring is removed from the storm sewers, the following decontamination procedures will be applied:

- Wash and scrub equipment with water as the camera and wiring is withdrawn from the sewer piping, taking care to only handle the cleaned portion of the equipment (while wearing the ***Modified Level C Protection for Potential Phosphorus Exposure***).
- Double or Triple-rinse with potable water.
- Capture all wash and rinse water in a metal container for later waste determination.
- Air dry the camera and wiring until completely dry. This will allow any remaining P4 to oxidize prior to stowage.

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4.2.3 In Areas with Little Potential for Contact with Contaminated Soil or Groundwater Contamination

The following procedures shall be used for decontamination of sampling equipment including in areas of the Site in which there is little or no potential for contact with contaminated soil or groundwater (as determined during the SRI and/or historic groundwater monitoring).

- Equipment will be decontaminated at the completion of the Site work, prior to removal off-Site, by mechanically brushing surfaces that came into contact with native soils or slag.

4.3 GROUNDWATER MONITORING EQUIPMENT

The following procedure shall be used to decontaminate groundwater monitoring devices such as groundwater elevation meters and free product thickness meters. Spray bottles may be used to store and dispense distilled water.

- Wash equipment with laboratory-grade, phosphate-free detergent (e.g., Alconox™ or equivalent) and water, or steam clean.
- Triple-rinse with distilled water.
- Store in clean plastic bag or storage case.

5.0 PROCEDURE FOR OTHER WASTE DISPOSAL

While the decontamination Investigative Derived Waste (IDW) will be evaluated on a case-by-case basis, the general approach to be followed is detailed in SOP-4. Decontamination fluids (typically washwater) will be contained as generated. The washwater will be segregated from solids to the extent practicable (i.e., solids will be allowed to settle out of the washwater on the decontamination containment pad or within the collection container). Washwater will then be containerized to await waste

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determination. Solids will also be containerized in a separate container to await waste determination.

6.0 REFERENCES

Environmental protection Agency, RCRA Ground-Water Monitoring: Draft Technical Guidance, November 1992. Page 7-17.

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STANDARD OPERATING PROCEDURE 3

LOCATION AND TOPOGRAPHICAL SURVEY

This SOP has been revised from SOP No. 6 included in the *SRI Field Sampling Plan for the FMC Plant OU – May 2007.*

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STANDARD OPERATING PROCEDURE 3

LOCATION AND TOPOGRAPHICAL SURVEY

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1.0 INTRODUCTION

Surveying is the science of making the measurements necessary to determine the relative positions of points above, on, or beneath the surface of the earth, or to establish such points. This standard operating procedure (SOP) provides a description of the general types of surveys and requirements for performing these surveys. This SOP describes the applicability of the Global Positioning System (GPS) surveys, along with precision and accuracy required for each technique. This SOP is intended for the project leader to help develop work plans and manage resources. Note that in addition to the minimum requirements outlined in this SOP, all Site contractors must comply with the FMC Site-Wide Health and Safety Plan (SWHASP) while working on Site.

2.0 DEFINITIONS

Accuracy: Accuracy refers to the closeness between measurements and expectations or true values. The farther a measurement is from its expected value, the less accurate it is. Observations may be accurate but not precise if they are well distributed about the expected value, but are significantly disbursed from one another.

Accuracy is often referred to in terms of its order (i.e., first, second, or third order accuracy). The order of accuracy refers to the error of closure allowed; guidelines for each order of accuracy are as follows:

Order of Accuracy	Maximum Error
1st	1/25,000
2nd	1/10,000
3rd	1/5,000

Benchmarks: Monuments placed by surveyors to serve as permanent reference points. Benchmarks are elevation markers, and their location and elevation are precisely established and recorded on surveyors' level notes. They are set upon some permanent object to ensure they remain undisturbed.

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Global Positioning System (GPS): This system utilizes a network of overhead satellites orbiting the earth to locate objects and/or targets on the surface of the earth. Data from a minimum of three satellites is required to plot (by triangulation) the location of a certain point. Accuracy is dependent on the duration of data collection and the type of receiver/antenna used. All measurements will be referenced to the State Plane Coordinate System, North American Datum 1983 and North American Vertical Datum 1988.

Monuments: Physical objects that serve as landmarks for navigation. Classes of monuments include: natural, artificial, record, or legal. Examples of natural monuments are trees, large stones, or other substantial, naturally occurring objects in place before the survey was made. Artificial monuments can consist of iron pipe or bar driven into the ground, concrete or stone monument with a drill hole, cross, or metal plug marking an exact location (such as a corner). The standard for monumenting public-land surveys, as adopted by the Bureau of Land Management (BLM), is a post made of iron pipe filled with concrete. The lower end of the pipe is split and spread to form a base and the upper end is fitted with a brass cap with identifying marks. A record monument exists because of a reference in a deed or description (e.g., the gutter along a street). A legal monument is one that is controlling in the description (e.g., "to a concrete post").

Precision: Precision pertains to the distribution over a set of repeated observations of a random variable. It is a measure of the reproducibility of a result or measured value. Thus, if observations are closely clustered together, then the observations are said to have been obtained with high precision. Observations may be precise but not accurate if they are closely grouped about a value that is different from the expected or true value.

Station: A station is a 100-foot section of a measurement from a reference point such as a benchmark. For example, a stake placed 1,500 feet from a reference point is at station 15 and is labeled "15+00," and a stake placed 1,325 from a reference point is labeled "13+25."

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3.0 RESPONSIBILITIES

This section presents a brief definition of field roles, and the responsibilities generally associated with them. This list is not intended to be comprehensive and often, additional personnel may be involved. Project team member information shall be included in project specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

RD Project Manager: The RDRA Project Manager has overall responsibility for establishing the specific technical requirements and coordinating the survey services for the project. The RDRA Project Manager shall rely on input from FMC personnel and other key project staff who may have more detailed knowledge of the technical requirements and who would be on site to oversee the surveying. To facilitate the management and administration of surveying services procured for a particular site, the RDRA Project Manager may delegate responsibility to the Field Team Leader (FTL) as the focal point for all matters involving surveying services.

Field Team Leader (FTL) and/or Field Geologist, Hydrogeologist, or Engineer: Responsible for implementation of the actual field activities performed on site including the measurement of sampling locations and to daily check the accuracy of the GPS instrument. In addition, the FTL shall be responsible for scheduling and coordinating field activities, overseeing survey activities, and preparing daily logs of field activities.

Surveyor (Surveying Contractor): In the event a licensed land surveyor is needed, the surveyor will be responsible for assuring that all surveying field operations, office calculations, map preparation, and related surveying activities conform to established guidelines and the specific requirements of the surveying subcontract (including health and safety requirements). All surveying operations shall be performed by, or under the direction of, a State of Idaho Licensed (or Registered) Land Surveyor, who shall sign and seal all final drawings, maps, and reports submitted as deliverables.

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4.0 GUIDELINES

The following sections provide guidelines for the performance of several types of surveys and the precision and accuracy required for each. Emphasis is placed on the application of surveying techniques to environmental investigations.

4.1 PERFORMING SURVEYS

There are many types of surveys that can be performed. This SOP describes the survey that will potentially be used at the FMC site. The survey will be used to establish northing and easting measurements and an elevation (feet above mean sea level). A Sokkia Axis, Trimble GEO Explorer, Trimble Pathfinder GPS or similar unit will be used for mapping test pits, boreholes, PIC and other sampling locations as well as being used for determining the thickness of soil covers. The selected unit must have an accuracy of 1 meter or less and will be checked daily with a known elevation of a benchmark. If the accuracy is greater than 1 meter, than the type of location data will be evaluated as to whether a professional surveyor is required. All measurements will be referenced to a State Plane Coordinate System, North American datum 1983 and the North American Vertical Datum 1988.

Global Positioning System (GPS) Surveying: GPS is a ranging system from known positions of satellites in space to unknown positions on land, sea, and in air or space. GPS uses the triangulation from orbiting satellites to establish the location derived from the broadcast of a satellite signal. The GPS unit measures the distance using the travel time of radio signals. The GPS concept assumes that four or more satellites will be available at any location on earth 24 hours a day.

Establishing Control (Benchmark): Prior to initiating any type of survey, a control shall be established at the site. The control point will be a surveyed benchmark used as a daily check for the accuracy of the GPS unit. If a benchmark is not available at the site or if access is limited, a fixed monument may be established by a licensed surveyor.

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Licensed Surveyor: In the event that a licensed surveyor is required for increased accuracy a State of Idaho Licensed Surveyor will be used at FMC. In the State of Idaho, the Idaho State Government Department of Commerce, Division of Occupational and Professional Licensing, administers licensing and certification programs.

Based on the project requirements, monuments may be set at the site that can be used in future site-surveys as a control point. Care shall be taken when establishing new control points and elevations from other agencies' vertical control points to ensure that all the old control benchmarks are on the same datum or reference plane. The monument shall be stamped with the state planar coordinates and the elevation (feet above mean sea level) such that it shall serve as a reference point for additional surveys. This can save time in future survey work as the surveying contractor will not have to survey new locations from distant established control points.

4.2 REQUIRED ACCURACY AND PRECISION

The required survey accuracy and precision depends on the intended purpose of the survey work. Sampling locations are to be surveyed within 1 meter or less both horizontally and vertically. Higher accuracies may be required for boundary surveys, topographic surveys, etc. The following sections discuss accuracy and precision requirements for specific survey types.

Marking Sampling Locations: The sampling location will be marked in the field using a stake with the corresponding sample number in the event that the location is revisited for additional sampling or surveying.

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STANDARD OPERATING PROCEDURE 4

INVESTIGATION DERIVED WASTE MANAGEMENT

This SOP has been revised from SOP No. 7 included in the *SRI Field Sampling Plan for the FMC Plant OU – May 2007*.

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STANDARD OPERATING PROCEDURE 4

INVESTIGATION DERIVED WASTE (IDW) MANAGEMENT

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1.0 INTRODUCTION

Investigation-derived waste (IDW) may be generated during the field investigation activities conducted under the planned extraction zone hydrogeologic study at the FMC Plant Operable Unit during 2014. The National Contingency Plan (NCP), codified in 40 Code of Federal Regulations (CFR) 300, requires that IDW be handled to attain all the applicable or relevant and appropriate requirements (ARARs) to the extent practicable, considering the urgency of the situation. The purpose of this SOP is to present procedures to be followed in the management of IDW generated during these field activities.

Potential IDW that may be generated during field activities are solid wastes and may include (but are not limited to) the following media and waste types:

Fluids	Solids
Groundwater well development / purge	Soils and soil cuttings
Drilling mud	Plastic tarps or sheeting
Grout	Drill pipe and well casing/screen
Decontamination fluids and wastewater	Decontamination solids
	Disposable equipment (i.e., rope, bailers, sampling equipment, & other consumables)
	Spent personal protective equipment (PPE)
	Used containers, sample bottles
	Packaging materials

The above wastes may or may not be encountered, generated or managed while performing the 2014 field activities. However, all solid waste streams will be characterized to determine if they are hazardous wastes per 40 CFR § 262.11 for the purposes of handling and disposal. Guidance from this document shall be used as part of project planning to estimate total volumes of IDW likely to be generated during the anticipated 2014 field activities as well as how the IDW will be managed and disposed.

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2.0 DEFINITIONS

Area of Contamination (AOC) unit: The AOC unit concept is critical to the IDW management at a CERCLA investigation site. Although EPA has not promulgated a definition of an AOC unit, an AOC unit is generally an area within a CERCLA investigation site with similar characteristics with respect to contamination and the associated risks to human health and the environment. A CERCLA investigation site may contain one or more AOC units. AOC units for the FMC Plant Operable Unit, which may be different from the Remediation Units (RUs) as used in the *SRI Work Plan for the FMC Plant OU* and/or the Remediation Areas (RAs) used in the *SFS Report for the FMC Plant OU*, will be delineated based upon exiting information, information gathered during the SRI, and visual observation as well as consideration of IDW management.

Decontamination fluids: Any fluids, including aqueous wash water, solvents, and contaminants that are used or generated during decontamination procedures.

Decontamination solids: Any solids, including soils and soil cuttings, fill materials, and contaminants that are generated during decontamination procedures.

Grout: A fluid mixture of cement and water (neat cement) of a consistency that can be forced through a pipe and placed as required.

Hazardous waste: A solid waste that meets the definition of a hazardous waste under RCRA as defined in 40 CFR § 261.3.

Hazardous IDW: An investigation derived waste that is also a hazardous waste under RCRA as defined in 40 CFR § 261.3.

Investigation-derived waste (IDW): Solid wastes, as defined in 40 CFR § 261.2, directly generated as result of performing the 2014 field activities at the FMC Plant OU.

Nonhazardous waste: A solid waste that does not meet the definition of a hazardous waste as defined in 40 CFR § 261.3 or is excluded from hazardous waste regulation per 40 CFR § 261.4(b).

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Soils and soil cuttings: Solid material generated from excavation or drilling processes. Soils may include native soils, fill materials, and/or other historical plant waste streams used as fill materials on the site.

Solid waste: Any waste stream (solid, liquid or containerized gas) that meets the definition of solid waste under RCRA as defined in 40 CFR § 261.2.

3.0 RESPONSIBILITIES

This section presents a brief definition of the field team roles and responsibilities for management of IDW generated while conducting the 2014 field activities. This list is not intended to be a comprehensive list as additional personnel may be involved. Project team member information shall be included in project-specific plans (e.g., work plan, field sampling plan, quality assurance plan, etc.), and field personnel shall always consult the appropriate documents to determine project-specific roles and responsibilities. In addition, one person may serve in more than one role on any given project.

RDRA Project Manager: Responsible to ensure that all field team members are properly trained per their responsibilities associated with IDW and that appropriate equipment and facilities are available for appropriate IDW management.

Field Team Leader (FTL): Implements the field program and supervises all field team members in the appropriate management of IDW. Ensures that only properly trained personnel are managing IDW on the site.

Environmental, Health and Safety (EHS) Officer: Assists the Field Team Leader in the supervision of all IDW management on site. The EHS officer shall be responsible for all IDW identification and characterization, on site disposal, off site shipment and disposal, waste accumulation, emergency response and contingency planning, IDW training, and IDW reporting and recordkeeping.

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Project Team Members: Ensure that they are properly trained prior to any IDW management as well as follow the appropriate IDW procedures and training.

4.0 REGULATORY BASIS AND GUIDANCE

IDW encountered, generated, or managed during the 2014 field activities may contain hazardous substances as defined by CERCLA. Some IDW may be hazardous wastes under RCRA while others may be regulated under other federal laws such as TSCA. These regulatory requirements may be applicable or relevant and appropriate requirements (ARARs) which impact how the IDW is managed. Note that hazardous wastes under RCRA and/or wastes regulated under TSCA are not expected to be encountered, generated, or managed as part of the 2014 field activities. However, waste determinations will be performed and documented on all waste streams.

4.1 EPA GUIDANCE ON IDW MANAGEMENT

The management of IDW generated during the 2014 field activities shall be in accordance with EPA Guidance "Management of Investigation-Derived Wastes During Site Inspections", May 1991 (EPA, 1991). This guidance is based upon EPA's strategy for managing IDW based upon the following concepts:

- The National Contingency Plan (NCP) directive that CERCLA site investigations (SI) comply with applicable or relevant and appropriate requirements (ARARs) to the extent practicable.

- The Area of Contamination (AOC) unit concept.

The specific elements of EPA's guidance for IDW management are as follows:

- Characterizing IDW through the use of existing information (manifests, MSDSs, previous test results, knowledge of the waste generation process, and other relevant records) and best professional judgement.

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- Delineating an AOC unit for leaving RCRA hazardous soil cuttings within the unit.

- Containerizing and disposing of RCRA hazardous groundwater, decontamination fluids, PPE, and disposable equipment at RCRA Subtitle C facilities.

- Leaving on-site RCRA nonhazardous soil cuttings, groundwater, and decontamination fluids preferably without containerization and testing.

In general, EPA does not recommend removal of wastes from sites, in particular, from those sites where IDW do not pose any immediate threat to human health or the environment. Actions taken during the 2014 field activities with respect to IDW, that leave conditions essentially unchanged, should not require a detailed analysis of ARARs or assurance that conditions at the site will comply with the ARARs. At the same time, field personnel conducting the 2014 field activities should ensure that their handling of IDW does not create additional hazards at the site.

In brief, compliance with the NCP can generally be assured by:

1) Identifying contaminants, if any, present in the IDW based upon existing information and best professional judgement; testing is not required in most circumstances.

2) Determining ARARs and the extent to which it is practicable to comply with them.

3) Delineating an AOC unit based upon existing information and visual observation if soil cuttings are RCRA hazardous.

4) Burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created. Containerization and testing are not required.

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5) Containerizing RCRA hazardous groundwater and other RCRA hazardous IDW such as PPE, disposable sampling equipment, and decontamination fluids for off-site disposal.

4.2 HAZARDOUS WASTE REGULATION

The RCRA hazardous waste regulations are clearly ARARs for hazardous IDW generated and managed during the 2014 field activities. However, with the application of EPA IDW guidance, RCRA requirements apply to management of IDW in the following manner:

- If RCRA hazardous IDW is stored or disposed off-site, then comply with all RCRA (and other ARAR) requirements.

- If RCRA hazardous IDW is stored on-site, then comply with RCRA (and other ARAR) requirements to the extent practicable.

For the 2014 field activities, the following general guidance is expected to be practicable and therefore followed, recognizing that each situation will be evaluated against EPA IDW guidance (EPA, 1991) as well as RCRA hazardous waste requirements and other ARARs:

- IDW may be assumed not to be a “listed” hazardous waste under RCRA 40 CFR 261 Subpart D, unless available information about the site suggests otherwise.

- IDW characterization to determine if the IDW exhibits RCRA hazardous waste characteristics do not typically require testing if the characterization can be made by “applying knowledge of the hazardous characteristics in light of the materials or processes used” or by historical testing consistent with 40 CFR § 262.11(c).

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- Compliance with the RCRA hazardous waste generator requirements of 40 CFR Part 262 for all RCRA hazardous IDW generated and/or managed (with exception of soil cuttings managed in accordance with the EPA IDW guidance). It is presumed that the RCRA hazardous IDW generated will fall within the large quantity generator (LQG) requirements.

- Land disposal does not occur (and thus the Land Disposal Restrictions [LDR] of 40 CFR Part 268 are not applicable) when IDW soil cutting wastes are:

  - Moved, stored or left in place within a single AOC unit;
  - Capped in place;
  - Treated in situ (without moving the IDW to another AOC unit for treatment); or
  - Processed within the AOC unit to improve structural stability (without placing the IDW into another AOC unit for processing).

- Conversely, land disposal does occur (and the LDR of 40 CFR Part 268 are applicable) when IDW soil cutting wastes are:

  - Moved from one AOC unit to another AOC unit for disposal;
  - Moved outside an AOC unit for treatment or storage and returned to the same AOC unit for disposal;
  - Excavated from an AOC unit and placed in a container, tank, surface impoundment, etc. and then re-deposited back into the same AOC.

5.0 DESCRIPTION OF ANTICIPATED IDW MANAGEMENT

The following subsections provide a description of the anticipated IDW to be encountered, generated, and/or managed at the FMC Plant Operable Unit during the 2014 field activities and the anticipated management of each. It should be noted that this information is provided for planning purposes, and will be evaluated and may need to be revised based upon actual experience and waste determinations while on site.

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5.1 SOIL AND SOIL CUTTINGS

During the 2014 field activities, numerous test pits, trenches, and borings will be performed within the Western Undeveloped Area (WUA) of the FMC Plant Operable Unit to gain access to appropriate depths for soil sampling and to provide a source of clean soil for the test gamma cap. The WUA was determined during the SRI to be un-impacted, therefore, soils from this area will be managed as clean soils. There will also be extraction wells and sampling wells installed at the northeast corner of the FMC Plant OU. In addition to native soils, fill materials including slag and phosphate ore are expected to be encountered. Past analyses of these fill materials have determined that these fill materials do not demonstrate any characteristics of a hazardous waste, and therefore would not be hazardous.

Therefore, all soil and soil cuttings managed during the 2014 field activities will be managed as follows unless field observations are different than expected:

- Leaving on-site RCRA nonhazardous soil cuttings within the AOC where they are generated. Typically, this will involve placing soil cuttings back into the same investigation pit, trench, or bore hole (except finished wells) and in the same order from which the material was removed, to the extent practicable. For example, and effort will be made to segregate fill materials from native soils as soil cuttings are removed from a pit, trench, or bore hole. For finished wells, the soil cuttings will be spread out at the surface near the bore hole. The placement of the soil cuttings back into the pit, trench or bore hole will typically involve placement of the native soils back first, followed by the fill materials. This should ensure that there are not additional hazards created at the site and that site conditions remain essentially unchanged.

5.2 WELL DEVELOPMENT AND PURGE FLUIDS

During the 2014 field activities, groundwater extraction wells and piezometers are anticipated to be installed in the northeast area of the FMC Plant Site. Fluids will be

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generated during the development of the wells and piezometers and purge water will be generated during the planned pump testing of the extraction wells. During the over 20 years of groundwater monitoring at the FMC OU, including sampling from approximately 125 monitoring wells at the FMC OU, over 4,500 samples and over 50,000 individual analytical results, no groundwater sample result has ever exceeded the threshold values for RCRA characteristic waste, and therefore, based upon process knowledge and consistent with the requirements of 40 CFR §262.11, the liquid IDW generated during the development of the wells and piezometers and the pump testing would not be hazardous.

Well development and purge fluids (liquid IDW) generated during the field activities will be managed as follows unless field observations are different than expected:

- Liquid IDW will be characterized based on analysis of development fluids from each extraction well and piezometer which will be separately containerized in a portable container(s) as generated, and held pending waste determination.

- As a confirmation of the extensive existing groundwater data set described above, a sample of well development fluids from each new well and piezometer will be collected and analyzed for pH and the eight RCRA metals.

- Liquid IDW that is determined to be nonhazardous will be transferred from the portable container(s) to a water truck(s) and utilized for dust control on-site.

- Subsequently generated liquid IDW (e.g., well purge [aquifer pump test] fluids) will be characterized through the use of existing information (extensive existing data set described above, well development fluid characterization described above, knowledge of the contaminants present, and other relevant records) and best professional judgment as consistent with the requirements of 40 CFR §262.11. This characterization will be documented and maintained as part of the solid/hazardous waste determination records.

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- Subsequently generated liquid IDW that are determined to be nonhazardous will be loaded directly from the well pump (or booster pump if needed) directly into water trucks for dust control on the site. For dust control, the approximately 1.5 million gallons of water that will be pumped over an approximately one week period during the aquifer testing would represent a total of about 0.014 inches (or about 0.003 inches per day) of water spread over about a 340 acre area of the plant site (site-wide roadways and areas within RA-A).

- Any well which produces liquid IDW that is determined to be hazardous will be managed per the procedures presented in Section 6.0 below and disposed in an off-site RCRA facility.

5.3 SPENT SAMPLING-RELATED EQUIPMENT

During the 2014 field activities, spent sampling-related equipment may be generated. This may include (but not limited to) plastic sheeting/tarps, rope, bailers, sampling equipment, spent PPE, sample bottles, used containers, packaging materials, and other consumables. The spent sampling-related equipment is expected to be nonhazardous, based upon historical and SRI data collected.

While the spent sampling-related equipment will be evaluated on a case-by-case basis, the general approach to be followed for spent sampling-related equipment IDW will follow the EPA guidance for IDW (EPA, 1991) which includes:

- Containerizing the spent sampling-related equipment at the point of generation.

- Characterizing the spent sampling-related equipment IDW through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records) and best professional judgement. This characterization will be documented and maintained as part of the solid/hazardous waste determination records.

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- Those spent sampling-related equipment IDW that are determined to be nonhazardous will be disposed along with other Site non-hazardous solid waste.

- Those spent sampling-related equipment IDW that are determined to be hazardous (although not expected) will be managed per the procedures presented in Section 6.0 below and disposed in an off-site RCRA facility.

5.4 DECONTAMINATION FLUIDS AND SOLIDS

5.4.1 Decontamination Fluids and Solids Associated with Drilling, Digging, and/or Trenching

During the 2014 field activities, decontamination fluids and solids will be generated. Typically, these will be generated at a common decon area, although there may be more than one decon area. Typically, the decontamination IDW will include (but not limited to) washwater from equipment, cleaning agents, cleaning utensils, and spent PPE (along with associated contaminants). Although this decontamination IDW is expected to be nonhazardous, waste determinations will be performed on each waste stream.

5.4.2 Decontamination Fluids and Solids Waste Management

While the decontamination IDW will be evaluated on a case-by-case basis, the general approach to be followed for decontamination IDW will follow the EPA guidance for IDW (EPA, 1991) which includes:

- Containment of decontamination fluids (typically washwater) as generated. The washwater will be segregated from solids to the extent practicable (i.e., solids will be allowed to settle out of the washwater on the decontamination containment pad). Washwater will then be containerized to await waste determination. Solids will also be containerized in a separate container to await waste determination.

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- Other decontamination solids such as cleaning utensils and PPE will also be containerized to await waste determination.

- Characterizing the decontamination IDW through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records) and best professional judgement. This characterization will be documented and maintained as part of the solid/hazardous waste determination records.

- The decontamination solids IDW that are determined to be nonhazardous will be disposed in on-site.

- The decontamination liquids IDW that are determined to be nonhazardous will be disposed as a nonhazardous solid waste, preferably on-site.

- The decontamination IDW (either liquid or solid) that are determined to be hazardous will be managed per the procedures presented in Section 6.0 below and disposed in an off-site RCRA facility.

6.0 PROCEDURES FOR HAZARDOUS IDW MANAGEMENT

Although hazardous IDW is not expected to be generated, the following procedures apply to all IDW that have been determined to be hazardous except for soil cuttings IDW that remain with the AOC unit.

6.1 INTRODUCTION

Once an IDW has been determined to be hazardous, the federal RCRA Subtitle C waste management requirements apply to that waste. The scope of this procedure covers the requirements for large quantity generators of hazardous IDW which manage the hazardous IDW on site such that RCRA permitting is not required.

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6.2 DETERMINE LAND DISPOSAL RESTRICTIONS

The 1984 amendments to the RCRA law included a prohibition of land disposal of certain hazardous wastes without first meeting some treatment standards. For the most part, all listed and characteristic hazardous wastes must be treated according to the treatment levels and technologies outlined in 40 CFR Part 268 to reduce the toxicity and/or mobility of hazardous constituents prior to being disposed of on the land, i.e., landfilled. Therefore, a generator must determine if the waste is a "restricted waste" under the land ban rules, and if so, off site treatment and disposal is limited. Note that these rules apply only to wastes destined for land disposal which is defined as: placement in or on the land including a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or concrete vault or bunker. Wastes which are shipped off site for disposal other than land disposal are not regulated under the land disposal restriction regulations of 40 CFR Part 268.

Generators of hazardous wastes must determine if the waste is restricted from land disposal under 40 CFR Part 268. The following reporting and recordkeeping requirements apply.

- If a generator determines that he is managing a restricted waste and the waste does not meet the applicable treatment standards, with each shipment of waste, the generator must notify the treatment or storage facility in writing of the appropriate treatment standards;
- If the generator determines that he is managing a restricted waste and the waste can be disposed without further treatment, with each shipment of waste, the generator must submit to the treatment, storage or disposal facility a notice and certification stating that the waste meets the applicable treatment standards;
- If the generator determines that he is managing a waste subject to an exemption from a prohibition on the type of land disposal method utilized for

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the waste, with each shipment of waste, the generator must submit to the receiving facility a notice stating that the waste is not prohibited from land disposal;

- If the generator is managing prohibited waste in tanks, containers, or containment buildings regulated under 40 CFR 262.34, and is treating such waste in such tanks, containers, or containment buildings to meet applicable treatment standards, the generator must develop a waste analysis plan which describes the procedures the generator will carry out to comply with the treatment standards; and
- If the generator determines whether the waste is restricted based solely on his knowledge of the waste, all supporting data used to make this determination must be retained on-site in the generator's files.

The generator must retain on-site a copy of all notices, certifications, demonstrations, waste analysis data, and other documentation produced pursuant to these requirements for at least three years from the date the waste was last shipped from the site. It should also be noted that it is prohibited to dilute a hazardous waste in order to circumvent the land disposal prohibitions (40 CFR 268.3). Once a waste is determined to be a "restricted waste", an appropriate Treatment, Storage, and Disposal Facility (TSDF) can be selected to properly treat and dispose of the waste.

6.3 ON-SITE ACCUMULATION

As discussed in Section 5.0 above for each IDW generated, a large quantity generator (LQG) must make the appropriate hazardous waste determination per 40 CFR Part 262.11. If the IDW is determined to be hazardous, then the IDW will typically be stored on-site prior to shipment off-site for disposal. The following requirements apply to all hazardous IDW being stored on-site prior to shipment.

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6.3.1 EPA Identification Number (40 CFR Part 262.12)

Any facility which is a LQG of hazardous wastes must not treat, store, dispose, transport or offer for transportation any hazardous waste without first obtaining a EPA identification number from EPA (or the authorized state). Hazardous wastes cannot be offered to transporters or to treatment, storage or disposal facilities that have not received a EPA identification number. The FMC Plant Operable Unit has an EPA ID number of IDD070929518 which will be used on all manifests for shipments of hazardous IDW for off-site disposal.

6.3.2 On-Site Hazardous Waste Accumulation (Storage) (40 CFR 262.34(d))

Two types of accumulation areas for hazardous waste are permissible for a LQG without RCRA interim status or a Part B permit. These are the "90-day storage area" and the "satellite accumulation station" (SAS). The SAS requirements are discussed below. With regards to a "90-day storage area", a LQG may store hazardous wastes on-site for up to 90 days or less in a storage area, provided that the following conditions are met:

- If the waste is placed in containers, the requirements of 40 CFR Part 265 Subpart I (container requirements) are met. See below for container requirements;
- If the waste is placed in tanks, the requirements of 40 CFR 265 Subpart J (tank requirements) are met. See below for the tank requirements.
- At closure, the generator closes the storage area per the requirements of 40 CFR 265.111 and 40 CFR 265.114;
- The date which the hazardous waste is placed in the storage area is clearly marked on the container, and the container is clearly marked as "Hazardous Waste";
- The facility complies with 40 CFR Part 265 Subpart C, Preparedness and Prevention (See Section 6.3.3 below);
- The facility complies with 40 CFR Part 265 Subpart D, Contingency Plan and Emergency Procedures (See Section 6.3.4);

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- The facility complies with 40 CFR Part 265.16 training requirements (See Section 6.6 below);
- Any hazardous wastes which are stored longer than 90 days must first be granted an extension by EPA (or authorized state).

90-Day Storage Area Container Requirements (40 CFR Part 265 Subpart I)

Hazardous waste stored in containers must meet the following requirements:

- Containers must be in good condition, free of leaks;
- Hazardous wastes must be compatible with container (or liner) material;
- Containers must always be kept closed except to add or remove wastes;
- Containers must be handled in a manner to avoid ruptures;
- The storage area must be inspected at least weekly to check for container deterioration; and
- Incompatible wastes must be stored separately with separate secondary containment.

Incompatible wastes are wastes that are unsuitable for co-mingling because the co-mingling could result in any of the following:

- Extreme heat or pressure generation;
- Fire;
- Explosion or violent reaction;
- Formation of substances that have the potential to react violently;
- Formation of toxic dusts, mists, fumes, gases, or other chemicals; and/or
- Volatization of ignitable or toxic chemicals due to heat generation.

90-Day Storage Area Tank Requirements (40 CFR Subpart J)

LQGs that accumulate or store hazardous wastes in tanks or tank systems must meet the following requirements:

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- For tanks existing prior to July 14, 1986, an assessment of tank must be performed and certified by an independent, qualified, licensed engineer. The written certification must be kept on file at the facility (40 CFR 265.191);
- New tank systems (those built after July 14, 1986) must meet tank technical standards and have been certified by an independent, qualified, licensed engineer. The written certification must be kept on file at the facility (40 CFR 265.192);
- New tank systems must have adequate secondary containment and leak detection systems. Existing tanks must be upgraded to meet these standards by the time the tank is 15 years of age (40 CFR 265.193);
- Tanks must be operated to prevent system failure, overflow and spills. Tanks must be operated with sufficient freeboard to prevent overtopping (40 CFR 265.194);
- Inspect the tanks at least once each operating day for the following:
    - Discharge control equipment;
    - Monitoring equipment and controls;
    - Tank level; and
    - Evidence of leaks or spills. (40 CFR 265.195)
- Inspect the tanks at least weekly for corrosion, erosion or leaks;
    - The tank must meet the closure and post-closure care provisions of 40 CFR 265.197; and
    - Store incompatible wastes separately (40 CFR 265.199).

<u>Satellite Accumulation Station (SAS) Requirements (40 CFR 262.34(c))</u>

A SAS is a container placed at or near the point of waste generation for the purpose of collecting the waste as it is being generated. For example, a container may be placed in the quality control laboratory for collection of hazardous wastes generated in the

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laboratory. This SAS may collect up to 55 gallons of hazardous waste or 1 quart of acute hazardous waste. The SAS does not need to meet the requirements of a storage area, provided the following conditions are met:

- The amount of hazardous waste accumulated at the SAS does not exceed 55 gallons (or 1 quart of acute hazardous waste);
- The SAS is located at or near the point of generation where the waste is initially accumulated and is under the control of the operator of the process generating the waste;
- The container used is in good condition, is compatible with the wastes being accumulated, and is kept closed except to add or remove wastes;
- The container is marked with the words "Hazardous Waste" or other words to identify the contents; and
- Once the 55-gallon limit is reached, the date is marked on the container and the container is moved from the SAS within three days to a proper location. For example, the wastes must either be moved to the storage area or be picked up by a waste transporter and moved off-site.

6.3.3 Preparedness and Prevention (40 CFR Part 265 Subpart C)

The following preparedness and prevention steps must be taken concerning the hazardous waste storage area:

- The storage area must be operated and maintained to minimize the possibility of fire, explosions or releases of hazardous waste;
- The facility must have appropriate communication systems, fire-fighting equipment, spill control equipment and decontamination equipment;
- All emergency response systems and equipment must be tested monthly with documentation and maintained to assure proper operation;
- Persons handling hazardous wastes must have immediate access to alarms and/or communication systems;

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- The storage area shall have adequate aisle space for emergency response activities; and
- The facility must attempt to make arrangements with the local police, fire departments, emergency response teams, and local hospitals to assure readiness for potential emergencies associated with the storage area.

6.3.4 Contingency Plan and Emergency Procedures (40 CFR Subpart D)

A LQG that accumulates or stores hazardous waste on site in a 90-day storage area must develop and keep current a contingency plan for the facility. The purpose of the contingency plan is to provide an organized plan of action and delegation of responsibilities and authority to specific facility personnel to respond to emergency situations that may require both the facility and/or outside resources. The contingency plan is designed to minimize hazards to humans or the environment from fires, explosion or any unplanned sudden or non-sudden release of hazardous waste/hazardous waste constituent to air, soil or surface water in compliance with the requirements of 40 CFR 265 Subpart D. MWH will maintain a Contingency Plan on the site if hazardous IDW are accumulated on-site.

The key components of the contingency plan include the following (40 CFR 265.52):

- A description of the emergency response organization, including designation of the Emergency Coordinator and alternates;
- Response procedures;
- Emergency notification;
- Arrangements with local authorities;
- List of names, addresses and phone numbers of designated emergency personnel and alternates;
- List of emergency response communication equipment and locations;
- Evacuation procedures, routes and alternates; and

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- Procedures for amending the plan.

Copies of the plan must be sent to (40 CFR 265.53):

- The FMC Project Manager;
- Power County Sheriff's department;
- Pocatello fire department; and
- Other agencies as deemed appropriate.

The emergency coordinator (EC) is the key person facilitating emergency preparedness and response. The EC or designated alternate shall be on-site or on-call at all times. The EC and alternates must be trained and thoroughly familiar with the contingency plan, emergency response activities and operation of the facility. The EC must know the locations and characteristics of all waste generated, location of all records within the facility and the facility layout. The EC must have the authority to commit the resources needed to carry out the spill response plan. Any person or department who first discovers any spill of a hazardous waste/material is responsible for notifying the spill response/emergency response coordinator. The EC for the 2014 field activities will be the EHS Officer with the Field Team Leader and the RDRA Project Manager as alternates.

The contingency plan should be reviewed and immediately amended when:

- Changes in applicable regulations occur;
- The plan fails in an emergency;
- Changes are made to emergency procedures;
- Changes occur in emergency personnel list; or
- Changes occur in emergency equipment list.

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6.4 PRE-TRANSPORTATION REQUIREMENTS

Prior to transporting hazardous wastes or offering hazardous wastes for transportation off-site, the generator must comply with the following:

- Package the hazardous wastes in DOT-approved containers per 49 CFR Parts 173, 178 and 179. DOT-approved containers (such as drums) are usually marked as being DOT-approved);
- Label the hazardous wastes according to DOT labeling requirements per 49 CFR Part 172;
- Mark each container (of 110 gallons or less) used in transportation with the following:

  HAZARDOUS WASTE - Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the EPA.

  - Generator's Name and Address
  - Manifest Document Number
- Ensure that the initial transporter placards the transport vehicle with the appropriate placard in accordance with 49 CFR Part 172 Subpart F.

6.5 MANIFESTING OFF-SITE SHIPMENTS OF HAZARDOUS IDW

Any generator which transports or offers for transportation hazardous waste for off-site treatment, storage or disposal must prepare a manifest according to manifest instructions for each shipment of similar hazardous wastes. The manifest must be carefully filled out with each shipment. Take care to follow the instructions and use the terms as listed in the instructions. A generator must designate on the manifest one facility (designated facility) which is permitted to handle the waste described on the manifest (40 CFR 262.20).

The generator must determine if the state to which the wastes are destined (consignment state) requires use of its own manifest. If so, then the consignment state's manifest must be used. If the consignment state does not require use of its manifest, and the state in

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which the waste shipment originates (generator state) does, then the manifest from the generator state must be used. If both states have manifests, use the consignment state manifest, making sure that there are sufficient copies to meet the generator state distribution requirements. If neither state requires use of its manifest, then any uniform hazardous waste manifest may be used (40 CFR 262.21).

The manifest must contain at least enough copies such that the generator gets two copies, the transporter gets one copy and the designated facility gets one copy. Some states require additional copies to be sent to the state. At the time of shipment, the generator must keep one copy (the generator copy) of the completed, signed manifest and give the remaining copies to the transporter. Each copy must have the signature of the generator and the transporter at the time of shipment. The original manifest shall be returned to the generator once the shipment reaches the designated facility and the manifest is signed by the designated facility (40 CFR 262.21).

If the original, signed manifest is not received by the generator within a certain number of days, action by the generator is required. These requirements are discussed in the following sections:

- If, after 35 days from the date of shipment, the original manifest copy is not yet received by the LQG, the LQG must contact the transporter and/or the designated disposal facility to determine the status of the hazardous waste (40 CFR 262.42(a)(1)).
- If after 45 days from the date of shipment, the original manifest copy is not yet received by the LQG, the LQG must submit an exception report to the U.S. EPA (or authorized state). The exception report must include a copy of the manifest along with an explanation of efforts to locate the hazardous wastes and the result of these efforts (40 CFR 262.42(a)(2)).

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6.6 PERSONNEL TRAINING

Any person, and their immediate supervisor(s), involved in waste management at a LQG facility which stores hazardous waste in a 90-day storage area must undergo initial and annual training for hazardous waste management (40 CFR 262.34(a)(4) and 40 CFR 265.16). Facility personnel are required to successfully complete a program of classroom instruction or on-the-job training that teaches them to perform hazardous waste management duties relevant to their jobs. The program must be directed by a person trained in hazardous waste management procedures.

The training must be designed to enable personnel to effectively respond to emergencies by becoming familiar with emergency procedures, emergency equipment and emergency systems, including the following;

- Procedures for using, inspecting, repairing and replacing facility emergency and monitoring equipment;
- Communications or alarm systems;
- Response to fires or explosions; and
- Off-site communication.

Employee training is to be held at regular intervals. Emergency planning information, e.g., the Contingency Plan, also should be provided to state and local emergency response agencies at regular intervals (40 CFR 265.37 and 265.53). Employees required to receive the training cannot work unsupervised until they have completed the training requirements (either classroom or on-the-job training). In addition, facility personnel must take part in an annual review of the initial training.

The following records must be maintained at the facility for employees affected by this training:

- Job title for each position and name of employee filling each job;
- Job descriptions for each position related to hazardous waste management;

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- Written description of type and amount of initial and continuing training that will be given to each person filling the various job positions; and
- Documentation that necessary training has been given and completed by each affected personnel.

Training records are required to be kept on current personnel until closure of the facility. For former employees, training records must be kept for at least three years from the date the employee last worked at the facility and may be transferred if the employee stays within the same company (40 CFR 265.16(e).

6.7 REPORTING AND RECORDKEEPING

The following reports are required of a LQG:

- Manifest exception reports as discussed in Section 6.5 above.
- A LQG must submit a Biennial Report to the EPA (or authorized state) every even numbered year by March 1, e.g., March 1, 2008 for the 2007 reporting year. The Biennial Report is to be submitted on EPA form 8700-13A.

The following records are required to be kept for a minimum of three years by the LQG:

- The signed original manifests;
- Biennial reports;
- Exception reports;
- All records pertaining to hazardous waste determinations; and
- Land disposal determination records, notification and certification records.

7.0 REFERENCES

EPA, 1991. Management of Investigation-Derived Wastes During Site Inspections, EPA May 1991, EPA/540/G-91/009

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APPENDIX E

Referenced EMF RI Table and Figures

TABLE 3.3-1

HYDRAULIC CONDUCTIVITIES AND TRANSMISSIVITIES OF EMF AQUIFER SYSTEM

TABLE 3.3-1

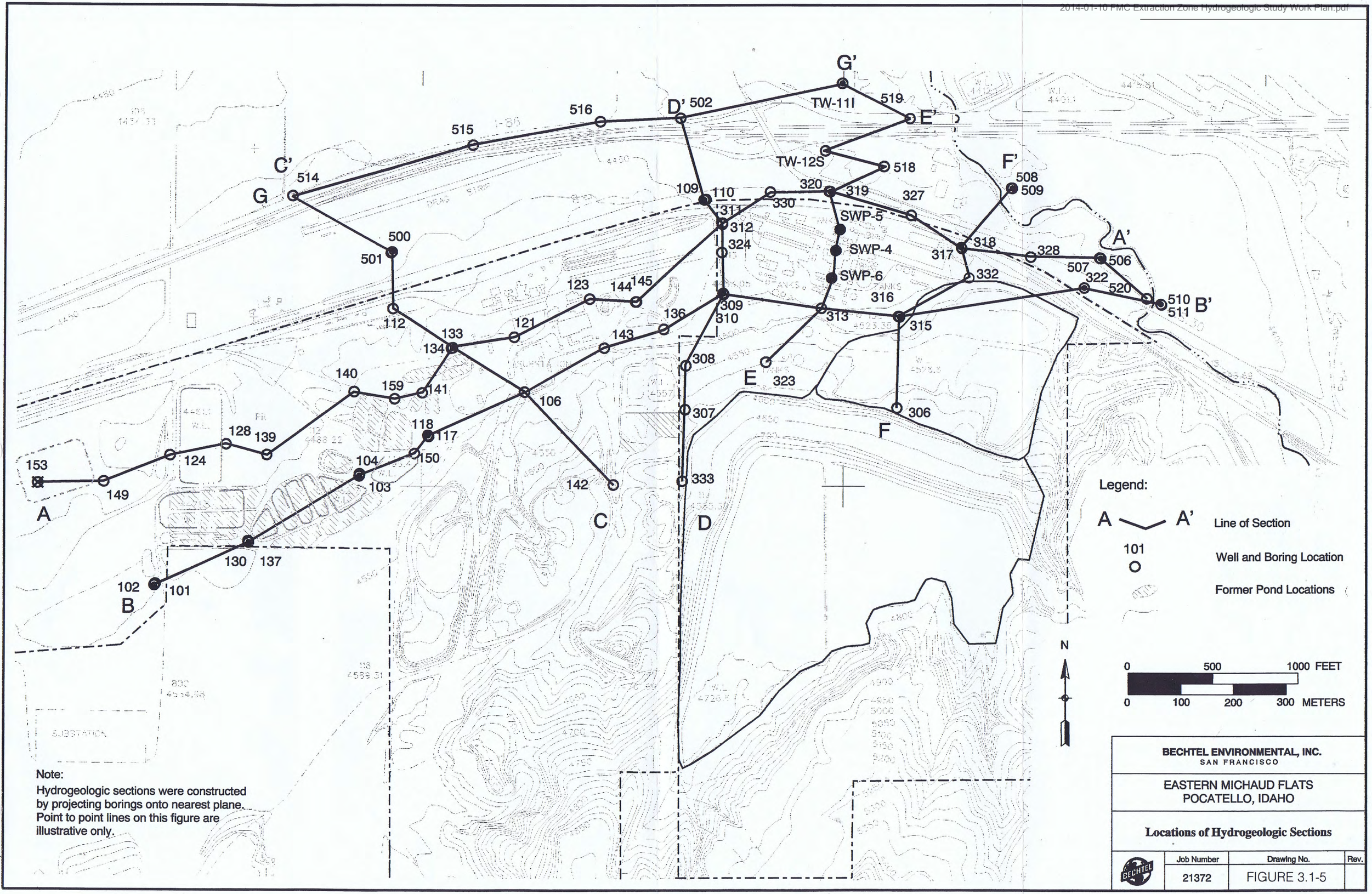
	Shallow Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	104	4.45E-02	126	Slug Test	BEI
	108	1.01E-01	286	Slug Test	BEI
	110	3.80E-02	108	Slug Test	BEI
	111	1.40E-01	397	Slug Test	BEI
	113	1.40E-01	397	Pumping Test	BEI
	126	5.85E-02	166	Slug Test	BEI
	134	1.09E-01	309	Slug Test	BEI
	135	3.15E-02	89.3	Slug Test	BEI
	139	1.90E-02	53.9	Slug Test	BEI
	140	9.70E-02	275	Slug Test	BEI
	146	6.10E-02	173	Slug Test	Hydrometrics
	148	2.45E-02	69.5	Slug Test	Hydrometrics
	150	3.55E-01	1000	Pumping Test	BEI
	153	3.30E-01	935	Slug Test	BEI
	154	1.74E-02	49.3	Slug Test	Hydrometrics
	501	9.05E-02	257	Slug Test	BEI
	514	3.92E-02	111	Slug Test	Hydrometrics
	515	1.05E-02	29.8	Slug Test	Hydrometrics
	516	2.33E-02	66.0	Slug Test	Hydrometrics
BANNOCK RANGE	106	4.30E-03	12.2	Slug Test	Hydrometrics
	142	7.00E-04	1.98	Slug Test	BEI
	300	2.43E-04	0.69	Slug Test	Hydrometrics
	301	1.00E-05	0.03	Slug Test	BEI
	304	4.95E-04	1.41	Slug Test	Hydrometrics
	306	1.17E-03	3.32	Slug Test	Hydrometrics
	307	9.91E-02	281	Slug Test	Hydrometrics
	308	2.51E-02	71.2	Slug Test	Hydrometrics
	313	1.80E-02	51.0	Slug Test	BEI
	316	1.02E-02	28.9	Slug Test	BEI
	323	1.20E-03	3.40	Slug Test	Hydrometrics
	325	5.45E-03	15.5	Slug Test	BEI
	333	9.91E-03	28.1	Slug Test	Hydrometrics
	PEI-2	1.00E-03	2.83	Pumping Test	PEI
	PEI-5	4.50E-04	1.28	Pumping Test	PEI
PORTNEUF RIVER	312	1.40E+00	3970	Pumping Test	BEI
	318	1.40E-03	3.97	Slug Test	BEI
	324	5.45E-02	154	Slug Test	BEI
	327	1.18E-01	334	Slug Test	Hydrometrics
	328	1.84E-01	522	Slug Test	Hydrometrics
	502	1.39E-01	394	Slug Test	Hydrometrics
	503	1.68E+00	4760	Slug Test	BEI
	505	3.66E-01	1038	Slug Test	Hydrometrics
	507	6.40E-01	1810	Slug Test	BEI
	517	7.20E-01	2040	Slug Test	BEI
	518	1.49E-01	422	Slug Test	Hydrometrics

	Deep Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	103	5.20E-03	14.7	Slug Test	BEI
	107	2.20E-02	62.4	Slug Test	BEI
	109	5.15E-03	14.6	Slug Test	BEI
	125	7.22E-02	205	Slug Test	Hydrometrics
	133	1.20E-01	340	Slug Test	BEI
	145	2.15E-01	609	Slug Test	BEI
	500	6.70E-02	190	Slug Test	BEI
BANNOCK RANGE	315	1.19E-02	33.7	Slug Test	BEI
PORTNEUF RIVER	311	8.60E-04	2.44	Slug Test	BEI
	317	9.90E-03	28.1	Slug Test	BEI
	319	1.00E-02	28.4	Slug Test	BEI
	321	1.50E-01	425	Slug Test	BEI
	322	2.80E-01	794.7	Pumping Test	BEI
	329	3.65E-01	1030	Slug Test	BEI
	330	5.64E-02	160	Slug Test	Hydrometrics
	504	7.10E-02	201	Slug Test	Hydrometrics
	506	2.30E-01	652	Slug Test	BEI
	512	5.80E-01	1640	Slug Test	BEI
	519	1.59E-02	45.0	Slug Test	Hydrometrics

	Production Wells	Transmissivity (ft^2/day)	Transmissivity (gpd/ft)	Type of Test	Source
MICHAUD FLATS	FMC-6	7370	55130	Pumping Test	BEI
	32ACD1	35100	262550	Pumping Test	USGS
	32DDC1	135700	1015000	Pumping Test	USGS
	33BAA1	21900	163810	Pumping Test	USGS
	33CCD1	41400	309670	Pumping Test	USGS
	34ADD1	40400	302190	Pumping Test	USGS
	34DCC1	36600	273770	Pumping Test	USGS
	35DDC1	164400	1229700	Pumping Test	USGS
	3ACD1	41200	308176	Pumping Test	USGS
	3BDC1	444000	3321100	Pumping Test	USGS
	4BBA1	38500	287980	Pumping Test	USGS
	5BDA1	36800	275260	Pumping Test	USGS
	8ADA1	27300	204200	Pumping Test	USGS
	9CAC1	199000	1488500	Pumping Test	USGS
	12BBC1	54700	409160	Pumping Test	USGS
PORTNEUF RIVER	SWP-7	227270	1700000	Pumping Test	Simplot

References:
BEI = Bechtel Environmental, Inc., Preliminary Site Characterization Summary for the Eastern Michaud Flats site, January, 1994
PEI = PEI Associates, Inc., Evaluation of Waste Management for Phosphate Processing, April 1985
Hydrometrics = Hydrometrics, Inc., Hydraulic Conductivity Testing of Existing Well Sites at the Eastern Michaud Flats Site, Pocatello, Idaho, April 1994
USGS = United States Geological Survey, Water-Resources Investigations Report 84-4201, Hydrogeology of Eastern Michaud Flats, Fort Hall Indian Reservation, Idaho
Simplot = J.R. Simplot files
FMC = FMC files

Hydraulic conductivity at Well 318 not used in K-zone mapping due to potential precipitation reactions in formation related to mixing of low pH water with groundwater.
Transmissivity at Well 311 not used due to possible grout contamination in filter pack.



Note:
Hydrogeologic sections were constructed by projecting borings onto nearest plane. Point to point lines on this figure are illustrative only.

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EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Locations of Hydrogeologic Sections

Job Number	Drawing No.	Rev.
21372	FIGURE 3.1-5	

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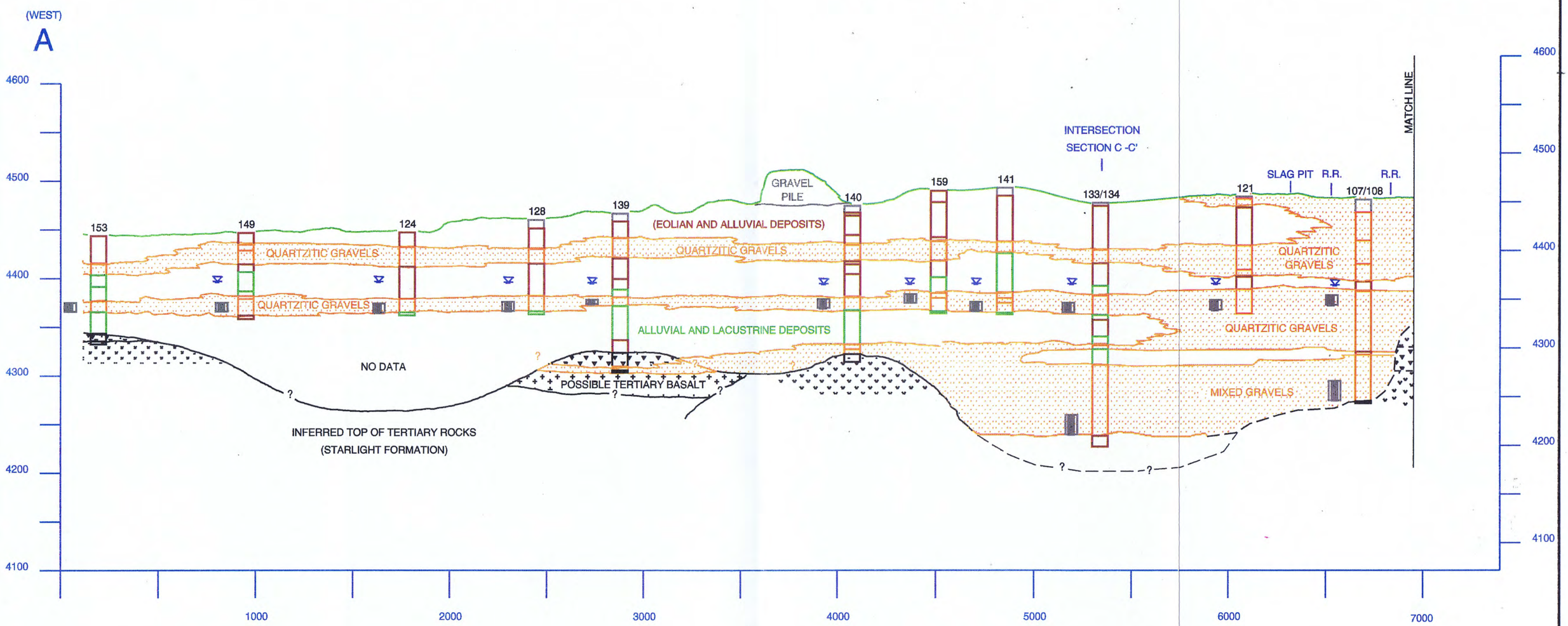

Legend:

- Water level
- Well screen

SAND
GRAVELLY SAND
SILTY SAND
CLAYEY SAND
SANDSTONE
GRAVEL
SAND AND GRAVEL
SILTY, SANDY GRAVEL
SILTY GRAVEL
CLAYEY GRAVEL

SILT
CLAYEY SILT
SANDY SILT
GRAVELLY SILT

CLAY
SILTY CLAY
SANDY CLAY
GRAVELLY CLAY

BASALT
RHYOLITE
TUFF

CALICHE
PEAT

ASPHALT
CONCRETE
FILL

NOTES:

1) Ground surface line is generalized
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.

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Hydrogeologic Cross-Section A-A'
sheet 1 of 2

Job Number	Drawing No.	Rev.
21372	FIGURE 3.1-6A	

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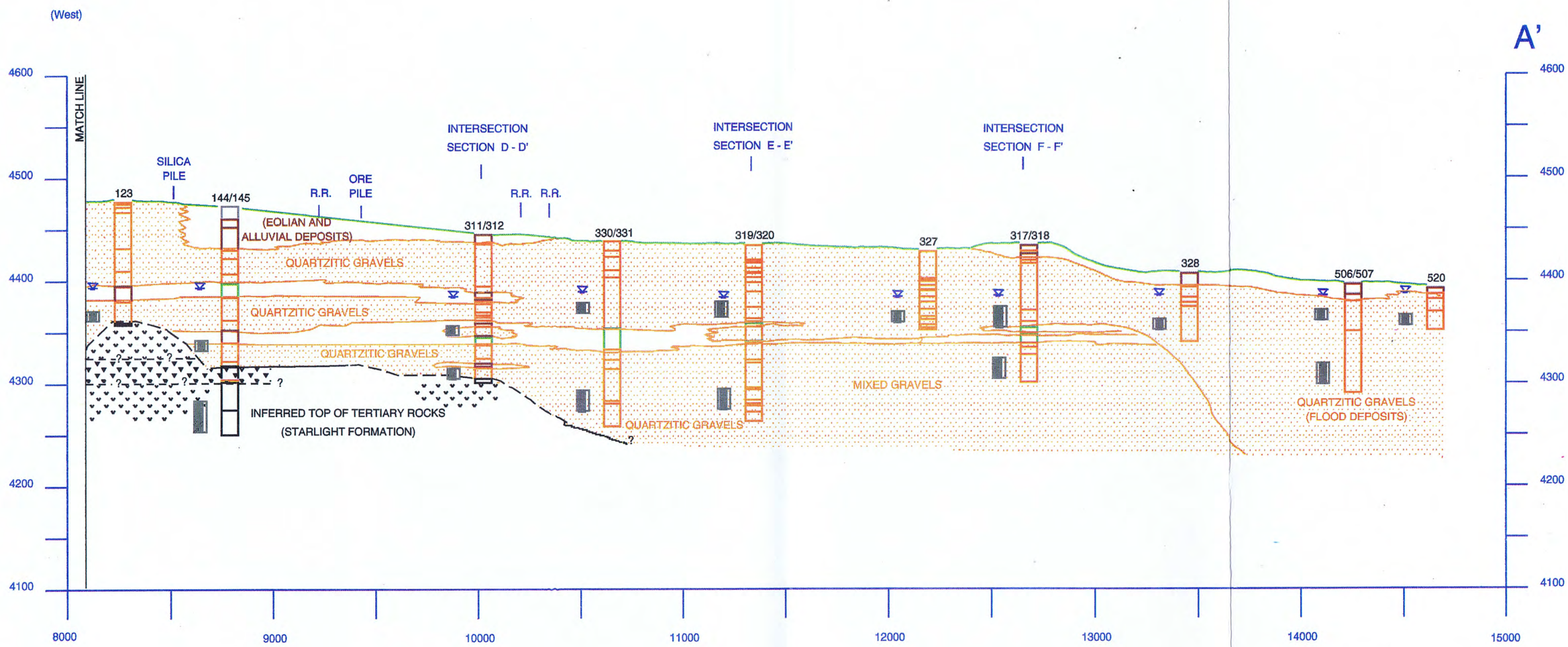

Legend:

- Water Level
- Well Screen

SAND
GRAVELLY SAND
SILTY SAND
CLAYEY SAND
SANDSTONE
GRAVEL
SAND AND GRAVEL
SILTY, SANDY GRAVEL
SILTY GRAVEL
CLAYEY GRAVEL

SILT
CLAYEY SILT
SANDY SILT
GRAVELLY SILT

CLAY
SILTY CLAY
SANDY CLAY
GRAVELLY CLAY

BASALT
RHYOLITE
TUFF

CALICHE
PEAT

ASPHALT
CONCRETE
FILL

NOTES:

1) Ground surface line is generalized
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.

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EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Hydrogeologic Cross-Section A-A'
sheet 2 of 2

Job Number	Drawing No.	Rev.
21372	FIGURE 3.1-6B	

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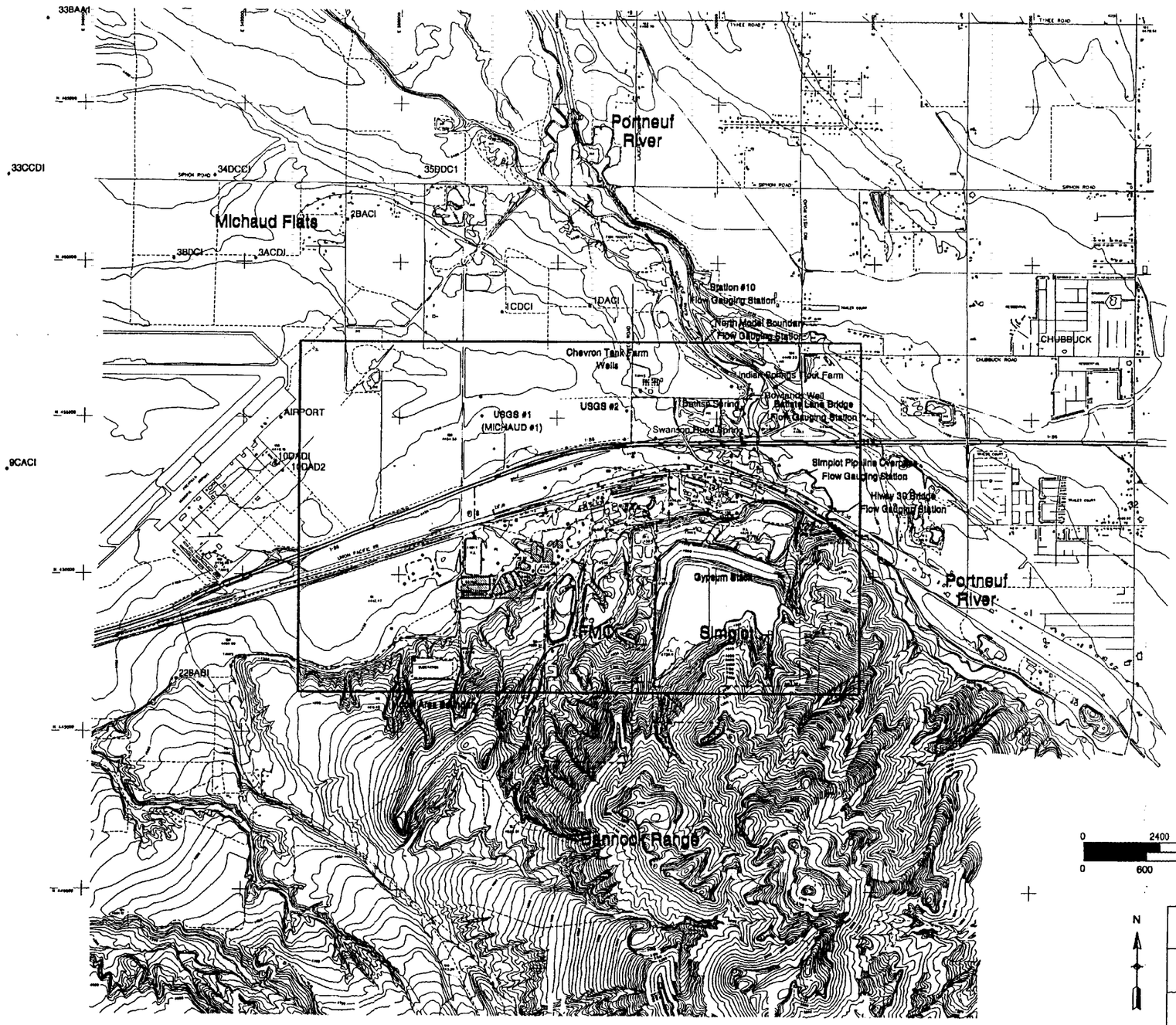

Legend

35DDC1 • Boring and Well Locations
(See Figure 3.3-3 for Base Map & Well Designations Within Model Boundary)

Old Ponds (FMC)

Model Boundary

EMF Property Boundary

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EMF Flow Model Study Area

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-2	

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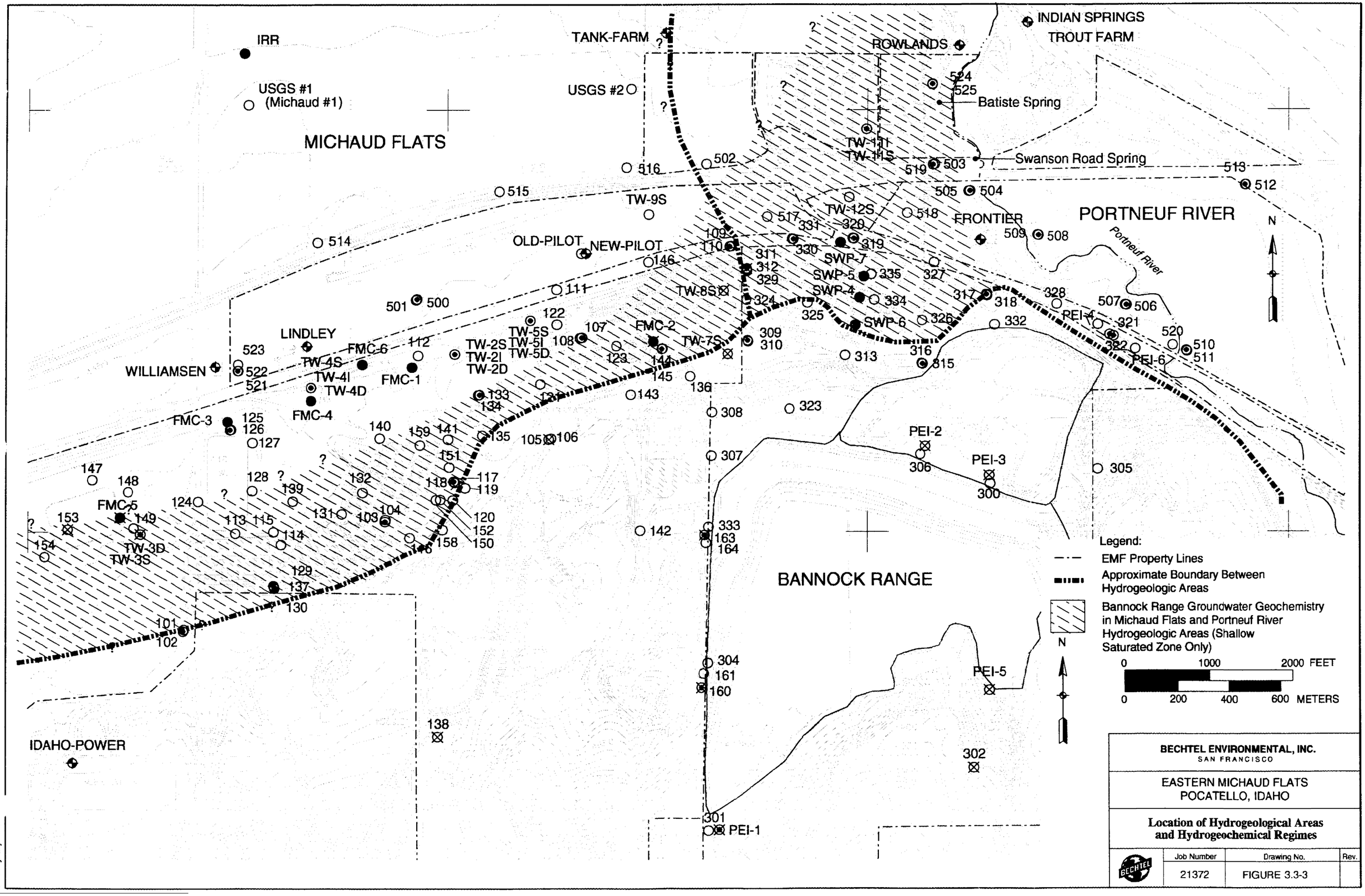

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POCATELLO, IDAHO

Location of Hydrogeological Areas and Hydrogeochemical Regimes

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-3	

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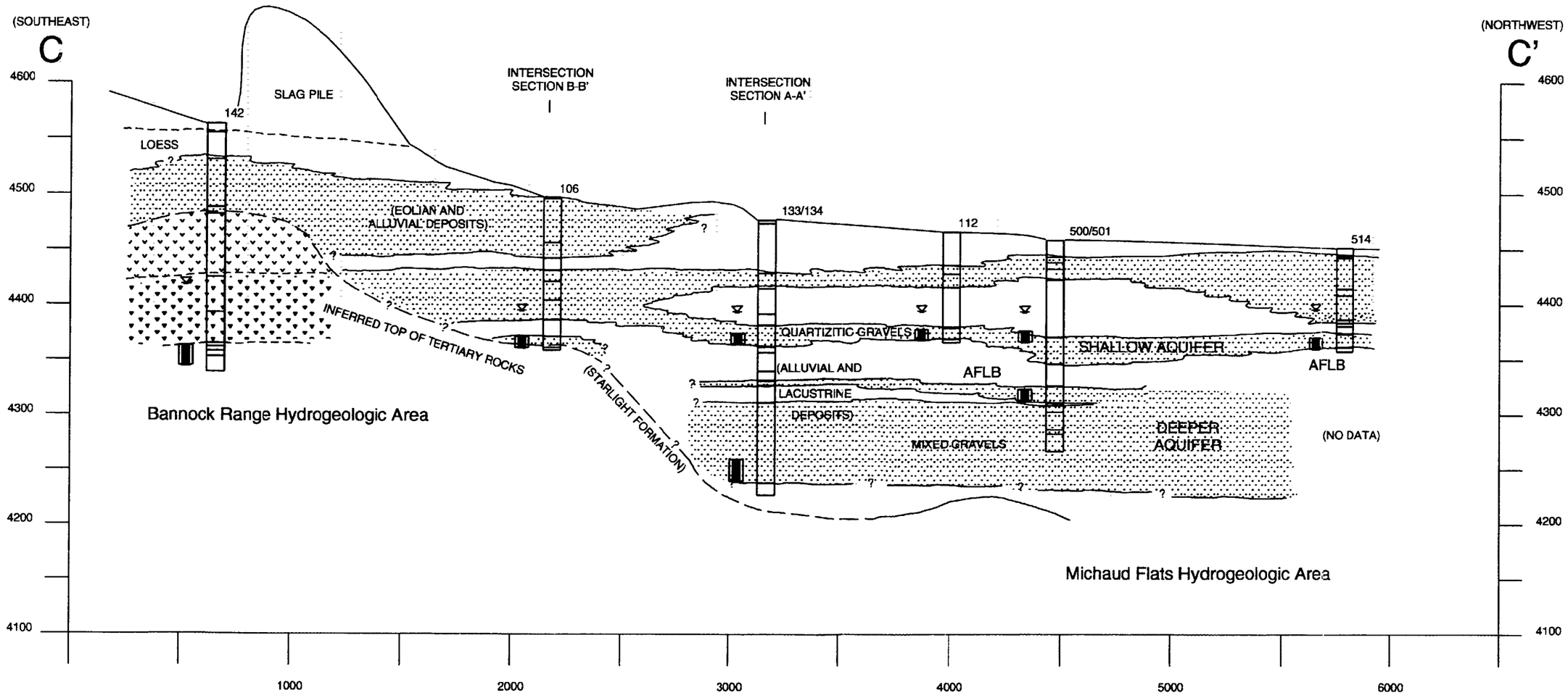

Notes:

1) Ground surface line generalized.
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.
4) Cross-section lines are shown in Figure 3.1-5.
5) AFLB = American Falls Lake Beds

Legend:

- Water level
- Well screen

SAND, GRAVELLY SAND, SILTY SAND, CLAYEY SAND, SANDSTONE, GRAVEL, SAND AND GRAVEL, SILTY, SANDY GRAVEL, SILTY GRAVEL, CLAYEY GRAVEL

SILT, CLAYEY SILT, SANDY SILT, GRAVELLY SILT

CLAY, SILTY CLAY, SANDY CLAY, GRAVELLY CLAY

BASALT, RHYOLITE, TUFF

CALICHE, PEAT

ASPHALT, CONCRETE, FILL

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Hydrogeologic Cross-Section C-C'

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-4	

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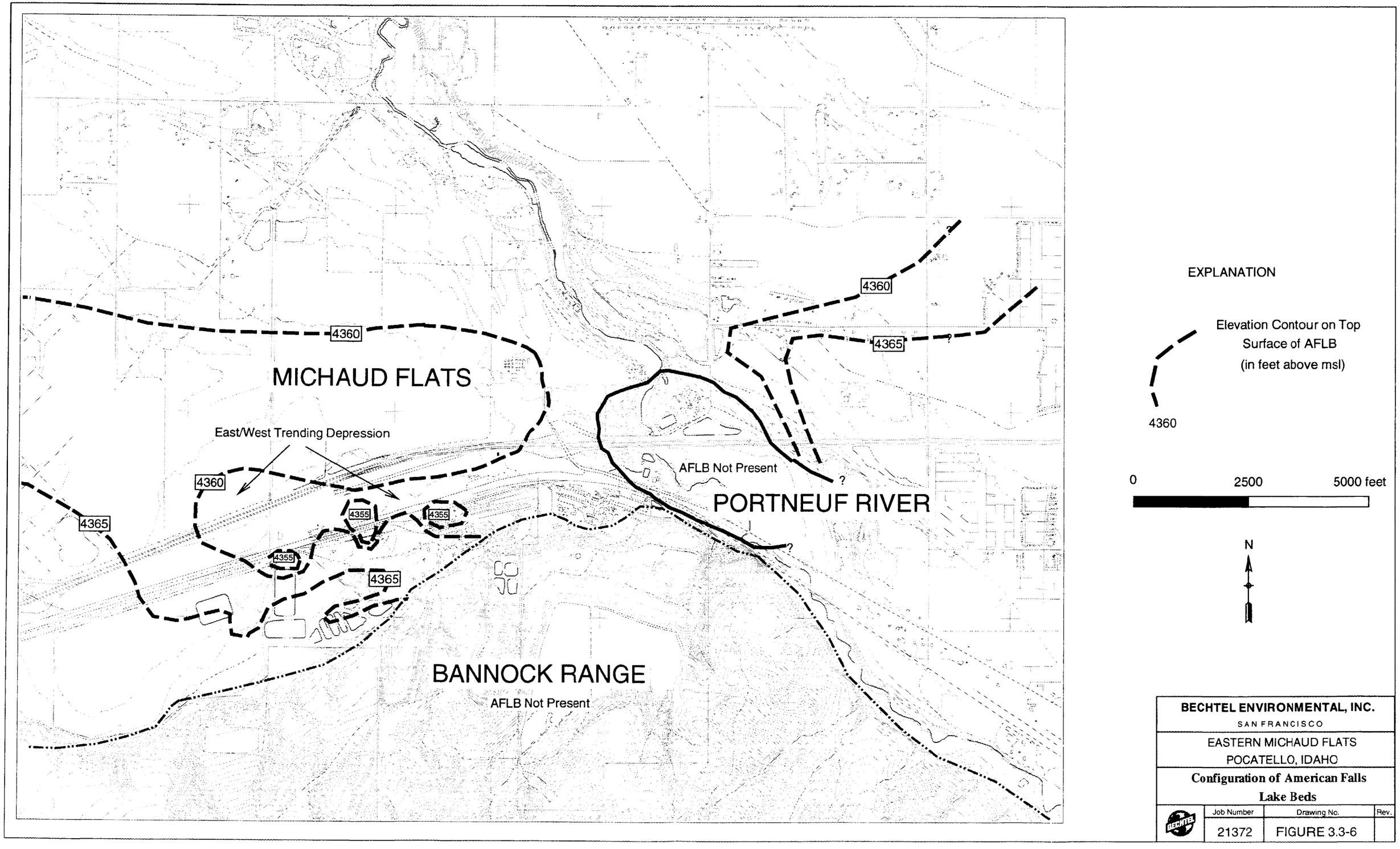

BECHTEL ENVIRONMENTAL, INC. SAN FRANCISCO		
EASTERN MICHAUD FLATS POCATELLO, IDAHO		
Configuration of American Falls Lake Beds		
Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-6	

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APPENDIX F

EPA and Agency Comments on the Hydrogeologic Study Work Plan (July 2013) and FMC Responses/Revisions

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FMC Responses to EPA and SBT Comments, dated and received September 13, 2013, and IDEQ Comments, dated August 13 and received September 16, 2013, on the Extraction Zone Hydrogeologic Study Work Plan submitted July 15, 2013
October 31, 2013

EPA Comments Transmitted
September 13, 2013

Review comments, FMC OU Remedial Design, *Extraction Zone Hydrogeologic Study Work Plan*, MWH, July 2013

General Comments:

1. The above mentioned document has been reviewed and the methods for aquifer testing are appropriate being step test, constant rate pump test and the combined 72-hour constant rate test of the initial three extraction wells. These test results will provide the necessary site specific hydraulic parameters with the water level drawdown to aid in the development of the design for the hydraulic containment system (HCS).

   FMC Response: Comment noted as supportive of the study approach.

2. However, there must be continuous geologic logging and vertical water quality characterization profiling when installing the boreholes for the three extractions well and piezometers from the water table down to the American Fall lake bed (AFLB) or aquitard. This information will be needed when selecting the location for the screen interval of the extraction wells and piezometers.

   FMC Response: As stated in the Extraction Zone Hydrogeologic Study Work Plan (Work Plan), Appendix A, Section A.2.3, soil will be continuously logged from approximately 5 feet above the water table to the bottom of the boring during drilling of the extraction wells to identify specific soil horizons including the American Falls Lake Bed. This section will be revised to specify the same procedure will be followed during installation of the piezometers. The section will also be revised to clarify that the screen lengths will be based on observations made during drilling and after consulting with the MWH Hydrogeological Manager.

   With respect to vertical water quality characterization, Simplot's use of vertical groundwater quality monitoring during drilling appears to have been performed primarily to determine the screened intervals for multiple, nested wells which is not the case for the extraction wells and piezometers proposed in the Work Plan. However, vertical groundwater chemistry profiling during drilling of the extraction wells, similar to the method utilized by Simplot, will be added to the Work Plan. The revisions to Appendix A, Section A.2.3 of the Work Plan to address this comment are provided in underline/strikethrough format below:

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A.2.3 Soil Sample Collection and Groundwater Chemistry Profiling Procedures

During drilling activities, soil samples for stratigraphic logging will be collected from the borehole prior to well installation. Soil samples will be collected either a split-spoon sampler or from soil cores (e.g., sonic drill cores). As necessary, a sample catcher will be placed at the end of the sampler so that unconsolidated soils are not lost as the sample device is retrieved from the borehole.

In the event that the HCS extraction wells and piezometers are installed using roto-sonic drilling methods, soil cores for stratigraphic logging will be collected continuously throughout the length of the borehole. However, if the extraction wells and piezometers installation is performed using other drill methods (i.e., air-rotary, etc.) soil samples will be collected using a split-spoon sampler at 5-foot centers above the water table, and then continuously from approximately 5 feet above the saturated zone to the bottom of the boring. Split-spoon, soil samples for piezometers installed shall ~~not~~ be collected following the same procedures as for the extraction wells. ~~until drilling depths have reached approximately 5 feet above the saturated zone; at which point samples for stratigraphic logging will be collected at five-foot centers to the bottom of the borehole.~~ Screened intervals will be selected based on stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager.

Field analyses of groundwater samples for indicator constituents of site-affected groundwater will be performed during drilling of the extraction wells. The “real-time” analyses will be performed to supplement the stratigraphic interpretations for the selection of screen intervals.

Groundwater samples will be collected from the saturated zone during drilling. Since the roto-sonic, triple-wall air-percussion, or ARCH drilling methods will maintain an open borehole, groundwater encountered during drilling is most likely to originate in the zone between the end of the advance casing and the drill bit. A submersible pump or hydropunch groundwater sampling tip will be placed near the tip of the advance casing and the groundwater will be pumped to the surface for field analysis. Groundwater quality parameters (pH, temperature, and specific conductance) will be monitored during pumping until a representative sample can be obtained. Once representative conditions are observed, a sample of the discharge will be collected and analyzed in the field for the parameters listed in Table A.2.3-1. One sample will be collected and analyzed for approximately every 10 feet of drill depth within the saturated zone. The results will be used in conjunction with lithologic logging observations to select the interval for placement of the well screen.

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Table A.2.3-1: Groundwater analyses conducted during drilling.

Analytical Parameter	Method
pH	Multi-probe field meter
Specific Conductance	Multi-probe field meter
Redox	Multi-probe field meter
Temperature	Multi-probe field meter
Nephelometric turbidity (NTU)	Turbidity meter
Phosphate	HACH portable Colorimeter

3. In order to improve the understanding of groundwater flow, a contour map of the top of the American Falls Lake Bed clay (AFLB) should be included in the work plan. In addition, the work plan should include a table that lists all monitoring and former production wells that have determined the depth of the top of the clay, the depth, and thickness of the AFLB clay if available. The contour map will enhance the conceptual site model for the site and the well information will be used during the selection of potential groundwater data for analysis and to select potential future monitoring well locations for sample collection and analysis.

   FMC Response: Figure 3.3-6 of the EMF RI Report (1996) that presents a contour map of the top of the AFLB was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments. As shown on the figure, the top of the AFLB is expected to be encountered at an elevation between 4,350 and 4,365 feet above mean sea level (AMSL). The range of elevations for the top of the AFLB reported in the EMF RI has been confirmed and refined beneath the Simplot plant site. As shown on Figure 3-1 of Simplot's Supplemental Subsurface Investigation in the Phosphoric Acid Plant Area Report (July 2013), the top of the AFLB was encountered at an elevation between 4,350 and 4,375 feet AMSL (the AFLB was reportedly encountered at 4,381 AMSL in one boring).

   There is no existing table that lists all monitoring and former production wells that have determined the elevation of the top and thickness of the AFLB. As shown on EMF RI Report Figure 3.3-4 (included in Appendix E), the AFLB is about 35 to 15 feet thick based on the lithologic logs from well 133 (western ponds area) and well 500 (north of I-86). A review of deep boring logs from well 109 (next to well 110 in the northeast corner of the plant site), 140 (western ponds area) and well 109 (next to well 108 in the central plant area) shows a depth to the top and thickness of the AFLB consistent with EMF RI Figures 3.3-6 and 3.3-4 respectively. The additional information provided in this response will be added to paragraph 3 in Section 2.1.2 of the Work Plan as follows:

   > The AFLB form an aquitard that separates the shallow and deeper aquifers within the Michaud Flats area. These lacustrine clays and silts have very low permeability and are regionally extensive, extending from the Bannock Range area to the American Falls Reservoir, where they crop out along the reservoir embankment. <u>As shown on EMF RI Figure 3.3-6 (included in Appendix E), the top of the AFLB is expected to be encountered at an elevation between 4,350 and 4,365 feet above mean sea level</u>

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(AMSL) in the extraction zone at the northeast property boundary of the FMC Plant site. The range of elevations for the top of the AFLB reported in the EMF RI has been confirmed and refined beneath the Simplot plant site. As shown on Figure 3-1 of Simplot's Supplemental Subsurface Investigation in the Phosphoric Acid Plant Area Report (July 2013), the top of the AFLB was encountered at an elevation between 4,350 and 4,375 feet AMSL (the AFLB was reportedly encountered at 4,381 AMSL in one boring).

As shown on EMF RI Report Figure 3.3-4 (included in Appendix E), the AFLB is about 35 to 15 feet thick based on the lithologic logs from well 133 (western ponds area) and well 500 (north of I-86). A review of deep boring logs from well 109 (next to well 110 in the northeast corner of the plant site), 140 (western ponds area) and well 109 (next to well 108 in the central plant area) shows a depth to the top and thickness of the AFLB consistent with EMF RI Figures 3.3-6 and 3.3-4 respectively.

The AFLB are not present along part of the Portneuf River in the area of Batiste Springs and Wells 524/525 south to Well 520 (see EMF RI Figure 3.3-6, in Appendix B). The Bonneville Flood may have scoured the AFLB, consistent with Trimble's (1976) map of boulder deposition patterns that indicate a main flood channel in this area. Elevation contours on the top of the AFLB suggest a slight dip to the north. Just to the south of I-86, there is an elongated, east-west depression in the AFLB surface, which may also be an erosional feature of the flood (see EMF RI Figure 3.3-6, in Appendix B).

Specific Comments:

1.0 Introduction,

1. page 1-1. The second paragraph describes the collection of groundwater samples from the extraction zones of wells EW-01-3 for laboratory analyses and a bulk water sample for a potential jar test for the evaluation of a water treatment system for the groundwater. No table could be found in this document which states the number of field samples, duplicates and QA samples. This table should be included in Section 4 or in the QAPP.

   FMC Response: The number and type of groundwater samples that will be collected are described in Section 3.5.2. A table could be added to this section; however, the text is clear that 2 discrete samples will be collected from each well during the six-hour step tests and 1 composite and bulk sample will be collected during the 72-hour combined pump test. Given the type of samples and the purpose of the sampling and analyses, to refine the expected average extracted groundwater quality and further evaluate the disposal method (i.e., disposal at the Pocatello POTW and/or on-site treatment) during design, field quality assurance samples were not deemed to be necessary. No revision to the Work Plan is warranted.

2. 1.3.2 Phase I HCS Pump Tests, page 1-4. The text states that the 24-hour constant rate pump test will only be performed on the western extraction well (EW-01). It is important to stress the aquifer at all three locations. Each of the wells (EW-02 and EW-03) must undergo the 24-hour constant rate pump test.

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FMC Response: The measured drawdown during the proposed step-testing of the individual extraction wells will provide the relevant information on the hydraulic characteristics in the vicinity of each extraction well. Larger scale hydraulic characteristics and aquifer response will be derived from the combined three-well 72-hour testing. The additional 24-hour testing of each individual well is unnecessary at this time because it will provide little additional insight into the operation of the HCS given the context of the 72-hour testing of the entire system. In addition, as noted in EPA Specific Comment 12, the proposed 6-hour step tests at three extraction wells, 24-hour constant rate aquifer test at extraction well EW-01 and 72-hour hydraulic containment test (all three extraction wells) will produce about 1.5 million gallons of water that will be characterized and managed as described in SOP-4 (Investigation Derived Waste). Additional 24-hour pump tests at the other two extraction wells would add about another 300,000 gallons that would need to be managed during this study. No revision to the Work Plan is warranted.

2.0 FMC OU Hydrogeology and Groundwater Modeling Summary

3. Section 2.1.1, second paragraph. The text refers to EMF RI Report Figure 3.3-2 as being located in Appendix B of the plan. The figure could not be located in Appendix B and should be included.

   FMC Response: An appendix to contain the referenced EMF RI figures was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments.

4. Section 2.1.2, third paragraph. The text refers twice to EMF RI Figure 3.3-6 as being located in Appendix B of the plan. The figure could not be located in Appendix B and should be included.

   FMC Response: An appendix to contain the referenced EMF RI figures was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments.

5. 2.1.3 Aquifer Test Results, page 2-3. Include Table 3.3-1 Hydraulic Conductivities and Transmissivities of EMF Aquifer from the EMF RI with this document.

   FMC Response: Table 3.3-1 from the EMF RI has been added to the now designated Appendix E that is attached to this response to comments.

6. Second paragraph, the conversion from 0.1 cm/s to ft/day must be corrected in the text.

   FMC Response: The typographical error will be corrected (i.e., the value will be corrected to 28<u>3</u> ft/day).

3.0 Hydrogeologic Study Design

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7. Section 3**.** Figure 1-3 presents the results of the flow path modeling which shows that the selected wells are likely to capture groundwater from the western plant area but would not capture groundwater from the eastern plant area. The two unnamed wells east of well EW-03 would apparently potentially capture groundwater from the eastern portion of the site, but are not included in this study. Groundwater monitoring results indicate that groundwater quality in wells 123, 145, and 136 is more contaminated than the average concentration of contaminants in wells 110, 146, and TW-9S presented in Table 3-2.

   While it is acknowledged that the source of contamination in wells 123, 136, and 145 may not have originated within the FMC OU, the situation should be acknowledged and discussed in the work plan. This discussion should include an analysis of why EW-01, EW-02, and EW-03 were selected for the study rather than the two locations further east. In addition, the text should describe how the results of the pump test will be used to evaluate the placement of extraction wells that will contain water from the eastern portion of the site as part of the remedy.

   FMC Response: The second paragraph in Section 3.1 (Preliminary Hydrogeologic Study Design) will be revised to include text describing the rationale for proposing to install the western three (3) extraction wells during this study and how the results will inform progressing with the groundwater remedial design (i.e., designing the system to capture groundwater flow from beneath the FMC plant site including the joint fenceline area) as follows:

   > Groundwater model results indicate that installation of five groundwater extraction wells at a spacing of approximately 350 to 500 feet will create hydraulic containment and prevent further migration of the contaminated groundwater plume beyond the FMC Site northern boundary. The approximate locations (final locations to be determined in the field) of the extraction wells and piezometers proposed for this study are shown on Figure 3-1. Extraction wells EW-01, -02 and 03 are located at the western three (3) locations of the preliminary groundwater extraction system design of five (5) extraction wells along the northeast FMC plant property. The eastern two (2) extraction wells from the preliminary design are shown on Figure 3-1 as modeled extraction wells.
   >
   > The western three (3) wells were selected for this study because, based on the groundwater model, these wells are predicted to capture the majority of the groundwater flow from beneath the FMC plant site and all the flow from the western ponds and central plant areas. Therefore, confirming the hydrogeology and aquifer characteristics at the western extraction wells is considered more critical to finalizing the overall groundwater extraction system than the eastern well locations that are modeled to intercept relatively low groundwater flow from the joint fenceline area. In addition, by including the “center” extraction well (based on the preliminary design), the updated groundwater model can be used to further refine the location(s) and designed extraction rate of well(s) toward the eastern plant property line to capture flow from the joint fenceline area. The design of the extraction wells and piezometers are described below.

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8. 3.1.1 Extraction Wells, page 3-1. As mentioned in the general comments, it is important to have a good understanding of the site specific geology and the groundwater quality or the concentrations of the contaminants of concern (COCs). The Simplot OU of the EMF Superfund site used the roto-sonic drilling method and was able to get good recovery of the geology/lithology and was able to collect water quality samples using a field test kits for both phosphate and sulfate to make decisions on the placement of the screen interval and the length of the screen. This information would lead to a more effective extraction system by placing the screen interval through-out the known plume. Also, samples of the geological formation could be collected from the area selected as the screen interval to design a site specific filter pack around the screen. A roto-sonic drilling method is recommended by EPA based on the results from the Simplot design of their extraction system.

   FMC Response: Refer to the response to EPA General Comment #2. Note that FMC contacted Simplot regarding their experience with sonic drilling and they indicated that sonic was initially utilized to drill in the Bonneville flood gravel lithology in order to minimize lost drilling time or potential rejection when large boulders typical of the flood gravels were encountered. The Bonneville flood gravels are not present beneath the FMC plant site and percussion hammer drilling has successfully been used on previous soil boring and well installation programs at FMC. FMC is confident that sonic, air rotary casing hammer (ARCH) or percussion hammer drilling methods will work for the drilling and installation of wells and that the subsurface geology can be accurately characterized by any of the three drilling methods.

9. Figure 3-2. Make the following changes to this figure, after the total depth of 120 feet add (to AFLB). The text in section 3.1.1 must match what was placed on figure 3.2 the text states a minimum of five-foot above the top of the screen for the filter pack and figure has 2-feet. I agree with the text (5-feet). As mentioned above, a field decision will be made on the length of the screen interval and this figure should state an approximate length, like 15 to 30 feet.

   FMC Response: As suggested by the comment, Figure 3-2 will be revised as follows:

   - Filter pack has been changed from a minimum of 2 feet above well screen to a minimum of 5 feet above well screen;
   - Screened interval for both the extraction well and piezometer has been changed from 40 feet to 15 to 40 feet; and
   - Total Depth = 120 feet (approximate) has been changed to Total Depth = 120 feet (approximate of the top of the American Falls Lake Bed deposit).

   The revised Figure 3-2 is attached to this response to comments.

10. 3.1.2 Extraction Well Co-Installed Piezometers, page 3-2. The internal piezometers must have the same length of screen interval as the extraction well screen.

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FMC Response: Section 3.1.2 (Extraction Well Co-Installed Piezometers) will be revised to clarify that the co-installed piezometers will have the same screened interval and screen lengths as the extraction wells as follows:

> Each six-inch diameter extraction well will have a one-inch diameter internal piezometer co-installed within the boring to allow the system operator to determine the water level within the well using a pressure transducer. The internal piezometers will have ~~approximately 40-foot long PVC~~ the same screen ~~of the same~~ length and slot size as the extraction well screen (refer to Figure 3-1).

11. 3.2 Groundwater Piezometers, page 3-2. An additional piezometer is needed down gradient of EW-02 which should be located closer then [sic] MW-146.

    FMC Response: While the downgradient piezometer would preferably be located closer to EW-02, the piezometer cannot be located closer due to the Union Pacific (UP) main line railroad tracks. Locating the piezometer on the south side of the UP tracks is too close to EW-02 to provide data that would add significantly to the piezometer located within EW-02 and the other piezometers to the south of the UP tracks. No revision of the Work Plan is warranted.

12. 3.3 Aquifer Testing Network and Procedures, page 3-3. What was the rationale used for the selection of the locations for EW-01, 02 and 03? Why not place EW-01 or the extraction wells closer to the higher concentrations of the COCs, MW-122 or MW-145?

    FMC Response: The EPA selected groundwater remedy specified in the IRODA is to "install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU, and/or adjoining springs or the Portneuf River." The selected remedy is based on SFS groundwater alternative 2 which was developed and refined during the development of the groundwater flow and transport model for the FMC OU. The groundwater model was developed over an approximately 1 year period (May 2009 through the July 2010 final groundwater model report) with significant review and input from EPA and opportunity for review and input from IDEQ and the Tribes. Appendix A of the Groundwater Model Report for the FMC Plant OU (Appendix E of the SFS Report, July 2010) includes the meeting minutes, presentation materials and follow-up materials from the six (6) meetings, including the July 2009 site visit, that were conducted to obtain review and input on the groundwater model. Multiple iterations of extraction well locations and rates were simulated to capture the shallow groundwater contaminant plume at the northeastern FMC plant site boundary during development of groundwater remedial alternative 2. The optimum configuration and preliminary design (as described in the IRODA) is for five (5) extraction wells located along the northeastern property line extracting a combined total of about 530 gallons per minute (gpm). The Work Plan was developed consistent with the preliminary groundwater remedial design documented in the IRODA, no revision to the Work Plan is warranted.

12. (cont.) Again all three wells (EW-01, 02 & 03) need to undergo a 24-hour constant rate aquifer test.

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FMC Response: Refer to the response to EPA Specific Comment #2 above.

12. (cont.) The text in this section states that the extracted groundwater from phase I aquifer testing will be contained in storage tanks and characterized and cites SOP 4 (Investigation Derived Waste) as the SOP. Upon review of this SOP it looks as the purge water from the aquifer test may not be contained or tested but the rationale that may be used "*Over 20 years of analyses of groundwater from monitoring wells in the proximity of the planned wells /piezometers do not demonstrate any characteristics of a hazardous waste, and therefore would not be hazardous.*" The SOP continues to state that since it is not a hazardous waste it will be treated as a solid waste and can be disposed on site but it does not say where this water will be discharged. It is important not to discharge the purge water near the aquifer test site because it will comprise the results of this test. The location of the where the aquifer test purge water must be known. The approximate volume of water is + 1.2 million gallons. Also, the nearby monitoring wells, MW-123 and 145(based on second quarter 2009 data) shows concentration of arsenic at 205 µg/L and 483 µg/L. These concentrations are above the site standards of 10µg/L. It is not clear on how this purge water or IDW will be handled. More information is needed on how this IDW will be handled. I [sic] final determination of disposal will need to be made by EPA.

    FMC Response: As noted in the comment, Section 3.3 and SOP-4 state that well development and purge fluids will be containerized to await waste determination. SOP-4 states that the well development / purge fluids will be characterized through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records). As re-stated in the EPA comment, "*Over 20 years of analyses of groundwater from monitoring wells in the proximity of the planned wells /piezometers do not demonstrate any characteristics of a hazardous waste, and therefore would not be hazardous*" is an accurate statement and could be expanded to state that during the over 20 years of groundwater monitoring at the FMC OU, including sampling from approximately 125 monitoring wells at the FMC OU, over 4,500 samples and over 50,000 individual analytical results, no groundwater sample result has ever exceeded the threshold values for RCRA characteristic waste. Waste determination using process knowledge is consistent with 40 CFR Part 262.11.

    FMC agrees with the comment to the extend it implies that the purge water should not be managed in a manner that could allow the water to "short-circuit" through the annulus of nearby monitoring wells. As stated in Section 3.3 of the Work Plan, "If determined to be non-hazardous, the water will be utilized for dust-suppression activities on site." After containerization and characterization per SOP-4, FMC intends to load the water into water trucks for dust control on the site. For dust control, the approximately 1.5 million gallons of water that will be pumped over an approximately one week period during this study would represent a total of about 0.014 inches (or about 0.003 inches per day) of water spread over about a 340 acre area of the plant site (site-wide roadways and areas within RA-A). This minor amount of water spread over the site for dust control cannot be considered even a marginal threat to migrate to groundwater.

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Needless to say, FMC does not have a manufacturing plant process to utilize the aquifer test water (unlike Simplot), does not have a sewer or NPDES discharge permit that would allow discharge of the purge water and containerization for off-site disposal would be prohibitively expensive (even at an unrealistically low unit cost of $1.00 per gallon for transportation and disposal). In the event EPA dictates water management / disposal other than use for dust control on-site, the schedule and scope of the study will need to be significantly reviewed and modified as appropriate. No revision to the Work Plan proposed pending further direction from EPA.

13. 3.4 Aquifer Testing Analysis and Model Update, page 3-3. The EPA does not see a need to make prediction of the long-term performance of the capture zone but must develop an evaluation method for determination of the capture zone for all of the extraction wells and to make sure that the contaminant plume is being captured. The EPA has a guidelines document, A *Systematic Approach for Evaluation of Capture Zones at Pump and Treat System*, (EPA 600/R-08/003, January 2008). This document uses a six step process for the evaluation of the extraction network for capture zones through a groundwater monitoring network. The EPA recommends a systematic approach for the evaluation of capture zones using multiple lines of evidence.

FMC Response: As stated in Section 1.2 of the Work Plan, the hydrogeologic study results will be used to develop the final design of the groundwater remedy hydraulic containment system (HCS) and will assist in selecting between the water management options. The refinement of the FMC OU groundwater model and additional groundwater remedial action simulations described in Section 3.4 of the Work Plan is consistent with developing the final design of the HCS. However, the text will be revised to clarify that the model refinement and simulations will be performed to refine the design of the HCS as follows:

> The revised numerical model will then be used to assess the potential long-term (100-year) performance (drawdown, hydraulic gradient, and flow net) of the initial three extraction wells. Results from these simulations will be used to ~~determine~~ predict if the three extraction wells <u>are expected to</u> meet the performance objectives of the HCS design. If <u>the</u> additional <u>two (2) eastern extraction</u> wells (or additional well[s])) are ~~deemed~~ <u>predicted to be</u> necessary, the model results will be used to assist in selecting the appropriate locations of any additional extraction wells <u>predicted</u> to meet the performance objectives of the HCS. Additional simulations may also be performed to assess and optimize the pumping distribution among the extraction wells to improve the <u>design</u> ~~performance~~ of the HCS.

As specified in the UAO, FMC is required to prepare a Final Groundwater Monitoring Plan as a component of the Remedial Action Work Plan (RAWP). The Final Groundwater Monitoring Plan will provide for, among other required elements, "an EPA Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems (EPA 600/R-08/003, 2008) will be used to evaluate the effectiveness of the Pump and Treat System. An evaluation of the groundwater monitoring network will be conducted to confirm that it is adequate to monitor the FMC OU." The Hydrogeologic Study Work Plan was not developed to address that requirement of the UAO. Pursuant to the UAO, the RAWP will be submitted to EPA concurrently with the Pre-final Remedial Design.

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14. 3.5.1 Water Level Measurements, page 3-4. Table 3-1 must include another column next to the column location identification number, being the screen interval (MSL) for each well location. Also, the column 1-2 hour for the collection of water level data is not needed and should be deleted. That information will be covered in the previous column and the column after.

    FMC Response: Table 3-1 will be revised to include elevations for the top and bottom of the screened interval for existing monitoring wells and the 1-2 hour piezometric surface elevation measurement column has been deleted as suggested by the comment.

15. 3.5.2 Groundwater Sample Collection, page 3-4. No information was provided on the number of water quality samples collected during these two aquifer test being the six hour step-test and the 72-hour pump test. Either table 3-2 or another table is needed that identifies the sample location, the parameters, number of samples, duplicates, MS/MSD, blanks etc. No such table could be found in section 4, QAPP. No mentioned is made on how this data will be validated for data use.

    FMC Response: As stated in the response to Specific Comment #1, the number and type of groundwater samples that will be collected are described in Section 3.5.2. A table could be added to this section; however, the text is clear that 2 discrete samples will be collected from each well during the six-hour step tests and 1 composite and bulk sample will be collected during the 72-hour combined pump test. Given the type of samples and the purpose of the sampling and analyses, to refine the expected average extracted groundwater quality and further evaluate the disposal method (i.e., disposal at the Pocatello POTW and/or on-site treatment) during design, field quality assurance samples were not deemed to be necessary.

    The laboratory analytical results for the extraction well groundwater samples will be validated consistent with the Data Verification and Validation Protocol for FMC's groundwater monitoring programs (Appendix C of the Interim CERCLA Groundwater Monitoring Plan, July 2010). A new paragraph will be added to Section 4.3.3 of the Work Plan as follows:

    > The laboratory analytical results for the groundwater samples from the extraction wells will be validated consistent with the Data Verification and Validation Protocol for FMC's groundwater monitoring programs (Appendix C of the Interim CERCLA Groundwater Monitoring Plan, July 2010). A Level III data verification will be performed on the sample results. Level III verification involves a review of all administrative documents, including field and laboratory chain-of-custody documents, sample preservation records, and sample preparation logs. For all precision and accuracy evaluations, laboratory summary information and forms will be evaluated for the individual laboratory methods.

15. (cont.) If a treatability study is going to be conducted was there a work plan for this treatability study?

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FMC Response: As stated in the text, the bulk groundwater samples will collected and retained for potential third-party vendor bench-top testing (emphasis added). There is no specific plan for that testing and thus no work plan.

16. Table 3-2. This table has a column of the average concentration of constituent in groundwater and list wells 110, 146 and TW-9S. Why were these locations selected? These wells are either down-gradient or cross-gradient of the three extraction wells that we undergo testing. If the objective is to show the potential water quality that will be collected from these three extraction wells then up-gradient monitoring wells must be selected and only average the concentration which is within the capture zone of those wells. As an example from figure 1-3, the particle tracking shows EW-01 using TW-5S & 122 the average total phosphorus concentration would be 10 mg/L and arsenic would be 60µg/L.

    FMC Response: EPA previously made essentially the same comment on the SFS Report (March 2010) and FMC responded to the comment in its June 11, 2010 response to those comments. More to the point, Table 3-2 of the Work Plan includes the average concentrations of constituents in groundwater (wells 110, 146, and TW-9S), groundwater cleanup standards and Pocatello POTW pretreatment limits, which were taken from the final SFS Report, for completeness and to show the project-required analytical reporting limits (DQOs) are appropriate (i.e., lower than the relevant comparative values). The actual analytical results from the individual extraction well groundwater samples during the six-hour step tests and the composite groundwater sample that will be collected during the 72-hour combined pump test will be the best representation of the extracted groundwater quality. No revision to the Work Plan is warranted.

    For reference, the EPA comment on the SFS Report and FMC's June 11, 2010 response are provided below.

    > **Excerpted from: FMC Responses to EPA, IDEQ and Shoshone Bannock Tribes Comments on the Draft SFS Report for the FMC Plant OU, March 2010**
    >
    > **EPA Comment (May 2010)**: 7.5.3 Groundwater Alternative 2A- Source and Institutional Controls, Groundwater Extraction for Hydraulic Control at the Plant Site Boundary and Direct Discharge to POTW, page 7-53
    > 6) The third paragraph, picked three monitoring wells and averaged the water quality (MW-110, 146, and TW-9S) as what may be expected regarding the water quality concentrations that will be conveyed to the POTW. These monitoring wells may be outside the influence of the five extraction wells. MW-123, 145,189 should be used instead; these monitoring wells are within the influence of the five extraction wells.
    >
    > **FMC Response (June 2010):** As discussed during the March 30 and 31, 2010 meeting between FMC, EPA, IDEQ and the Tribes, that reviewed preliminary agency comments on the SFS Report, FMC does not agree that the wells suggested in this comment for characterizing the water that would be sent to the POTW are representative of water quality at the Groundwater Alternative 2 extraction wells. Those wells are too distant from the extraction wells under this alternative and do not account for attenuation of groundwater COCs between the suggested wells and the

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FMC northern boundary extraction area. However, FMC did evaluate extracted groundwater concentrations with two different sets of wells located within or very close (well 111) to the alternative 2A and 2B northern boundary extraction area. As shown in the summary table below, the average concentrations for the 3 well sets evaluated are essentially the same. Considering that these estimated average concentrations were developed to evaluate the most appropriate treatment methodology to meet the preliminary treatment targets for the A and B water disposal options, FMC does not believe the SFS Report needs to be revised to present a different or alternative set of wells to support selection of disposal options and/or identification of appropriate treatment technologies.

Parameter	Average Wells 110, 146 and TW-9S	Average Wells 110, 111 and 146	Average Wells 110 and 146
pH (Field)	7.01	7.02	6.99
SC (UMHOS/CM)	1521.7	1412.0	1361.5
Redox (mV)	-100.0	-99.6	-100.0
Potassium	43.4	40.4	35.9
Sulfate	168.0	166.7	171.5
Chloride	136.3	130.6	110.9
Fluoride	0.30	0.31	0.41
Ammonia	0.17	0.15	0.15
Nitrate	6.63	6.30	4.97
Orthophosphate/ Total Phosphorus	2.54	2.79	2.21
Arsenic	0.03	0.03	0.04
Flouride	0.34	0.36	0.47
Selenium	0.012	0.012	0.016

17. QAPP and FSP, page 4-1. A signature page is needed in the QAPP.

FMC Response: While FMC acknowledges that EPA's guidance suggests that QAPPs include a signature page, the relevant approval (i.e., signature) is the EPA RPM's approval of the Work Plan which presumably will be in the form of an EPA letter. A signature page does not appear to add any value to the QAPP contained in the Work Plan. No revision of the Work Plan is warranted.

18. 4.3 Data Quality Objectives, page 4-3. The data quality objectives should be stated in the text of this section and from the Table 4-1 only one data quality objective was stated, "Verify Model Predictions and determine the alignment and layout for the final design of the full-scale HCS to capture contaminated groundwater before it migrates beyond the FMC Plant site". The EPA believes there are three data quality objectives:

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- To installation five extraction wells and associated piezometers which will contain the groundwater that has impacted the shallow aquifer.
- To conduct aquifer testing to obtain site specific hydraulic parameters to design a full-scale HCS
- To collect groundwater samples from the new installed extraction wells to determine the direction of water treatment either option A (discharge and treatment at the City of Pocatello POTW) or option B (on-site treatment followed by infiltration/evaporation).

It is recommended that EPA and FMC discuss the data quality objectives for this hydrogeologic study work plan. Once the agreed upon DQOs have been set then table 4-1 could be finalized.

FMC Response: FMC agrees that the introduction to Section 4.3 and Sections 4.3.1 could be expanded to include the observations (e.g., lithologic logging) and Section 4.3.3 needs to be revised to include the groundwater profiling (per response to EPA General Comment 2) that will be conducted during installation of the extraction wells. However, the first bullet in this comment does not accurately reflect an objective of the proposed extraction zone hydrogeologic study and appears to paraphrase the IRODA selected groundwater remedy that states "Install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River." As stated in the Work Plan, the proposed extraction wells and piezometers and aquifer testing will provide needed inputs to refine the groundwater extraction system remedial design. A "problem statement" to the effect that "there are no existing extraction wells in the identified groundwater extraction zone to implement the IRODA identified groundwater remedy for the FMC OU" that leads to a "decision" to install extraction wells / piezometers seems unnecessary and does not add value to the Work Plan. Similarly, a "problem statement" to the effect that "there is no extraction zone-specific hydrogeologic or aquifer characterization data" that leads to a "decision" to install extraction wells / piezometers in order to perform aquifer (pump) testing seems unnecessary and does not add value to the Work Plan.

The proposed revisions to the introduction to Section 4.3 and Sections 4.3.1 are provided below. If acceptable, conforming revisions will be made to Table 4-1.

4.3 DATA QUALITY OBJECTIVES

During execution of the Hydrogeologic Study there are three types of data to be collected:

- Qualitative / semi-quantitative observations associated with drilling the boreholes (e.g., lithologic logging), determination of the well screen interval and screen slot size, and development of the extraction wells and piezometers;

- Physical measurements (e.g., groundwater elevations) associated with drilling the boreholes (e.g., depth of lithologic samples), construction of the extraction wells and piezometers (e.g., setting bottom of casing), and aquifer pumping tests; and,

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- Physical and chemical analyses of groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

The Data Collection Quality Objectives for the Hydrogeological Study are presented in Table 4-1.

4.3.1 Extraction Well and Piezometer Installation

There is no "problem statement" associated with the installation of the extraction wells and piezometers during the execution of this Plan. Thus, no specific, numeric data quality objectives (DQOs) have been established. However, there will be numerous observation and measurements performed during drilling of the boreholes for the extraction wells that will be utilized to finalize well construction / completion details as summarized below:

Observation / Measurement during Drilling	**Extraction Well Construction Element**
Static water level in borehole	Top of screen will extend approximately 5 feet above static water level
Lithologic logging in saturated zone: soil types	Screened casing slot size
Groundwater chemistry profiling	Screen length and bottom of hole / well if SC < 500 umhos/cm and phosphate field analysis < 0.1 mg/l before encountering top of the AFLB
Lithologic logging: top of AFLB	Screen length and bottom of hole / well if SC > 500 umhos/cm and phosphate field analysis > 0.1 mg/l in sample at or above the top of the AFLB

As specified in Section A.2.3 of the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, the screened interval for each extraction well will be selected based on stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager. The use of qualified field personnel (geologists/hydrogeologists), adherence to the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, and field documentation will assure the wells/piezometers will be installed properly and will meet the requirements for this hydrogeologic study and completing the design and ultimately the full-scale implementation of the HCS.

4.3.3 Groundwater Samples - Field and Laboratory Analyses

Field analyses will be performed on groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

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The groundwater field parameters will be measured utilizing calibrated field meters with the calibration frequency and accuracy specified on Table 3-2. Note that during drilling the extraction wells the groundwater chemistry profiling samples will be field analyzed for the parameters listed on Table A.2.3-1. The field meters for those parameters will meet the calibration frequency and accuracy specified on Table 3-2 with the exception of phosphate. Phosphate will be field-analyzed using a Hach portable colorimetric phosphate test kit (Model PO-23 or comparable). The Model PO-23 has two (2) measurement concentration ranges of 0.1 to 5 mg/l and 1 to 50 mg/l which should be adequate for the range of expected groundwater phosphate concentrations at the extraction well locations. Hach does not specify a calibration method / frequency or precision/accuracy information for their portable phosphate test kits.

In addition to the field analyses, groundwater samples will be collected from the extraction wells during the aquifer (pump) testing for laboratory analyses. The groundwater samples from the extraction wells will be analyzed at a NELAP-accredited analytical laboratory for the parameters specified on Table 3-2. The acceptable level of uncertainty is included in Table 3-2 as accuracy and precision goals. Samples will be collected and handled as described in Section 4.4.2 below. The specified reporting limits are below the lower of the groundwater cleanup standard or Pocatello POTW Pretreatment Limit to assure the data are useable.

19. 4.3.1 Extraction Well and Piezometer Installation, page 4-2. Problem statements and decisions must be identified for each DQO for sections 4.3.1-4.3.3

    FMC Response: Refer to the response to EPA Specific Comment 18.

20. 4.4 Sampling /Measurement Procedures. 4.4.1 Extraction Well and Piezometer Installation Procedures, page 4-3 and Appendix A, a.2.6

    The development of the 2” diameter piezometer should meet the same criteria of the extraction wells.

    FMC Response: The piezometers will be used strictly as observation points for ground water elevations and therefore do not need to be developed to the same extent as the extraction wells. However, as stated in Section A.2.6 of Appendix A (Well and Piezometer Development Procedures), the extraction wells and piezometers will be developed using a combination of a surge block and bailer and either a portable centrifugal pump, a submersible pump, or airlift pump. During extraction well and piezometer development, water quality parameters such as pH, specific conductivity, temperature, and turbidity will be monitored. These parameters will be measured with a portable water-quality meter. The parameters will be measured at the beginning of well development and after the evacuation of each borehole volume. A minimum of six rounds of water quality parameter measurements will be made; and well development will continue until the criteria set forth in Section A.2.6 are met. Specific to the piezometers, development will continue until the purged water is reasonably

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free of sediments (as determined by the MWH field representative). No revision to the Work Plan is warranted.

21. Appendix A, a.5. X and Y coordinates must be reported out in the state of Idaho state plane coordinates northing and eastings.

    FMC Response: Section A.5 references SOP-3 (Location and Topographic Survey) for surveying the extraction well and piezometer locations. As specified in SOP-3, all measurements will be referenced to the State Plane Coordinate System, North American Datum 1983 and North American Vertical Datum 1988. No revision of the Work Plan is warranted.

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Shoshone-Bannock Tribes Comments, Email dated September 5, 2013 and Transmitted to FMC by EPA Email on September 13, 2013

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General comment:
 The Shoshone-Bannock Tribes would like to evaluate the groundwater model
report referenced throughout this document specifically, the parameters
selected for groundwater flow and contaminant transport models, assess the
reasonableness of predicted parameters, gain a better understanding of
sorption coefficients, dispersivity and porosity parameters.
```

FMC Response: As summarized in the response to EPA Specific Comment 12, the groundwater model was developed over an approximately 1 year period (May 2009 through the July 2010 final groundwater model report) with significant review and input from EPA and opportunity for review and input from IDEQ and the Tribes. Appendix A of the Groundwater Model Report for the FMC Plant OU (Appendix E of the SFS Report, July 2010) includes the meeting minutes, presentation materials and follow-up materials from the six (6) meetings, including the July 2009 site visit, that were conducted to obtain review and input on the groundwater model. The Tribes had full opportunity to review and provide input into the development of the groundwater flow and transport model and modeled groundwater remedial action simulations during the development of those models and Groundwater Model Report for the FMC Plant Operable Unit. No revision to the Work Plan warranted.

```
During the Step Drawdown, all production wells at Simplot should have their
pumping rates measured.  All irrigation wells within a determined radius
should be inventoried and identified for pumping rates.
```

FMC Response: The EMF RI Report and the Groundwater Current Conditions Report for the FMC Plant Operable Unit, June 2009 - Final (GWCCR) provide tabulated lists of surrounding production wells. More importantly, as documented in EMF RI Report, GWCCR and FMC's annual RCRA, CERCLA and Calciner Pond Groundwater Monitoring Reports (most recent annual reports for calendar year 2012), production patterns at Simplot or surrounding agricultural or other production wells have no observable influence on the groundwater potentiometric surface or inferred flow direction at the FMC OU. In addition, during FMC plant operation and utilization of production wells at the FMC OU, that pumping had no observable influence on the groundwater potentiometric surface or flow direction in areas surrounding the FMC OU. No revision to the Work Plan is warranted.

```
Section 2.1.1
 second bullet:  migration of site related constituents from shallow
groundwater to the deeper zone is inhibited by upward vertical hydraulic
gradients of confining strata throughout large portions of the EMF study
area.
 Add: however, site related COCs have been measured in wells in the deep
aquifer.  This groundwater discharges to the Portneuf River along both the
east and west side of the river and regionally.
```

FMC Response: The comment apparently is referring to bullet 2 in Section 2.1.4 of the Work Plan (no such statement appears in Section 2.1.1). The bulleted summary in in Section 2.1.4 of

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the Work Plan is accurate and was taken from the EPA-approved GWCCR. No revision to the Work Plan is warranted.

```
Third bullet:  remove limited to the area south of I-86 from this paragraph.
Water from the EMF area discharges to the Portneuf River which flows north of
I-86.
```

FMC Response: The comment apparently is referring to bullet 3 in Section 2.1.4 of the Work Plan (no such statement appears in Section 2.1.1). The bulleted summary in Section 2.1.4 of the Work Plan is accurate and was taken from the EPA-approved GWCCR. No revision to the Work Plan is warranted.

```
SOP 4-  All purged water must be tested for total metals  and meet the
Shoshone-Bannock Tribes soil cleanup standards and other appropriate
requirements prior to discharge on the ground.
```

FMC Response: Standard Operating Procedure (SOP 4) – Investigation-Derived Waste (IDW) Management was taken directly from the EPA-approved SOP No. 7 included in the Supplemental Remedial Investigation Work Plan (May 2007), and modified as appropriate for the Remedial Design field studies. The SOP is consistent with EPA regulations and guidance. No revision to the Work Plan is warranted.

FMC has consistently made its position clear in this CERCLA process that Tribal regulations do not and cannot constitute ARARs. As stated in the IRODA, EPA has not made a determination whether the Tribes' Soil Cleanup Standards for Contaminated Properties (SCS) are ARARs. No change to the Work Plan is warranted.

```
Table 3-2 - The Tribes request total metals and radionuclides be analyzed
for. The Tribes request this information prior to discharge of any water
within the FMC OU.  Pumping at a low flow may be more representative of
actual groundwater conditions, at least for the initial first 10 minutes
.prior to sampling.
```

FMC Response: The laboratory analytical methods specified for the metals listed on Table 3-2 of the Work Plan are for total metals. No field or laboratory filtration of the groundwater samples for dissolved constituent analyses is proposed. As summarized in Section 8.1 of the EPA-approved GWCCR:

> Supplemental sampling events for expanded metals, organic compound and radionuclide analytical parameters have provided further evidence supporting the findings of the EMF RI that the following constituents are not FMC-related contaminants in groundwater:
>
> - Metals: aluminum, antimony, beryllium, cadmium, copper, lead, molybdenum, mercury, silver, thallium and zinc;
> - Organic Compounds; and
> - Radionuclides.

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The existing groundwater sampling and analytical data demonstrates there is no justification to add any additional metals or radionuclides to the groundwater analyses for the samples collected during the extraction zone hydrogeologic study. No revision to the Work Plan is warranted.

We may have additional comments based on the referenced modeling document.

FMC Response: Comment noted; however, as stated in the response to the first Tribes' comment, the Tribes had full participation and opportunity to comment during development of the groundwater model and simulations presented in the EPA-approved Groundwater Model Report for the FMC Plant Operable Unit. No revision to the Work Plan is warranted.

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Idaho Department of Environmental Quality Comments August 13, 2013

FMC OU Remedial Design Extraction Zone Hydrogeologic Study Work Plan July 2013

IDEQ Comments Received by FMC on September 16, 2013

General Comments

1. New well construction must meet standards set in IDAPA 37.03.09.

   FMC Response: The construction and decommissioning of wells associated with the remedial action will comply with the Idaho Department of Water Resources' (IDWR) Well Construction Standards Rules, IDAPA 37.03.09. As-built diagrams and driller reports will be provided to IDWR following completion of each well. However, the wells (and piezometers) installed pursuant to the CERCLA remedial action will not be permitted with IDWR pursuant to the CERCLA section 121(e)(1) permit exemption for removal or remedial action conducted entirely on-site.

2. Extraction wells should be designed to be as efficient as possible without producing large quantities of silt. This may require the collection of borehole cuttings from the targeted aquifer, conducting particle size analyses on the cutting samples, and then designing a well based on particle size distribution. If particle size analysis has been conducted during prior investigations that support the current selected well screen slot size (10 slot), those data should be presented in the work plan.

   FMC Response: The extraction wells have been designed to be efficient while also minimizing potential silt (or TSS) production. As described in the response to EPA General Comment 2, the soil will be continuously logged from approximately 5 feet above the water table to the bottom of the boring during drilling of the extraction wells to identify specific soil horizons including the American Falls Lake Bed. The currently identified extraction well screen slot size (0.010-inch) is potentially conservative (smaller than necessary) given that virtually all of the existing monitoring wells at the FMC OU have 0.020-inch slotted screen casing and only a few of the over 100 wells produce water with turbidity greater than 5 NTU as measured during purging. In addition to the revisions indicated in the response to EPA General Comment 2, Appendix A, Section A.2.3 of the Work Plan will be revised to clarify that the screen lengths and screen slot size will be based on observations made during drilling and after consulting with the MWH Hydrogeological Manager.

Specific Comments

1. **Page 1-4, section 1.3.2, line 5;**
   Delete the second '-hour'.

   FMC Response: The typographical error will be corrected.

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2. **Page 2-2, section 2.1.2, paragraph 1, lines 5 and 6;**
While the statement concerning the delineation of hydrostratigraphic units in the Bannock Range is technically correct it leads the reader to conclude sufficient effort was exerted during the RI to arrive at the conclusion presented here. DEQ does not agree sufficient evidence was provided to support the conclusion and finds the statement misleading. Please rewrite to present as a theory and not a fact, or provide the reader with information concerning the nature and extent of the Bannock Range hydrogeologic investigation.

FMC Response: The text referenced in the comment will be revised to state:

> Within the Bannock Range area there were no continuous hydrostratigraphic units delineated during the RI. Starlight Formation volcanic flows and interflow units ~~are~~ were not correlative, and the ~~overall~~ distribution of rock types and saturated materials encountered in the RI borings is best described as highly heterogeneous.

3. **Page 2-3, section 2.1.3, paragraph 2, line 2:**
Replace '(28 ft/day)' with "(283 ft/day)".

FMC Response: As stated in the response to EPA Specific Comment 6, the typographical error will be corrected (i.e., the value will be corrected to 283 ft/day).

4. **Page 2-3, section 2.1.3, paragraph 3, line 1:**
Replace 'Measured' with "Estimated".

FMC Response: The text will be revised as suggested in the comment.

5. **Page 2-4, section 2.1.3, paragraph 1, line 1;**
The first sentence is incomplete, please correct.

FMC Response: "Groundwater Elevations, Flow Patterns, and Vertical Gradients" was intended to be a subheading not a sentence. The Work Plan will be revised to format as a subheading and subsequent subheadings will be renumbered and the table of contents revised.

6. **Figure 3-2;**
Change filter pack minimum height requirement to correlate with Section A.3.2.2 (page A-5 top of page).

FMC Response: As stated in EPA Specific Comment 9, the filter pack has been changed from a minimum of 2 feet above well screen to a minimum of 5 feet above well screen. This change will be made consistently through the Work Plan and Appendix A.

7. **Page 4-2, section 4.3.1 and 4.3.2;**
See General Comments 1 and 2. Poor well construction and data collection during the aquifer pump tests may result in over or under estimating aquifer parameters and the effectiveness of the

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HCS as a result. DQOs should be set in place to ensure extraction wells are constructed properly and the best possible data is collected during the pump tests.

FMC Response: Refer to the response to EPA Specific Comment 18.

8. **Page 4-4, section 4.4.3, bullet 2;**
   Please include an explanation of how the variable pumping rates between wells will be accounted for in the composite sample.

   FMC Response: Section 4.4.3.2 (Sample Collection) provides a description and example for the composite sampling procedure:

   > "The composite sample will initially be collected in an approximately 5-gallon pre-cleaned container. An aliquot from each extraction well will be collected at the time intervals specified above and on Table 4-1. The volume of the aliquot from each well will be in proportion to the pump rates set for each well during the multi-extraction well containment pump test. For example, if well EW-1 is pumping at 120 gpm, well EW-2 at 100 gpm and EW-3 at 80 gpm, then the aliquot volume from EW-1 and EW-3 will be 20 percent greater and lower, respectively than the aliquot from well EW-2. As nine (9) total aliquots will be collected in a 5-gallon container, the "base" aliquot volume will be about 0.5 gallons."

   No revision to the Work Plan is warranted.

9. **Table 4-1, row 1, column 2 (HCS Model Predicted Capture Zone Determination);**
   Replace 'before if migrates' with "before it migrates".

   FMC Response: The typographical error will be corrected.

10. **Page 5-1, section 5.3 paragraph 1 line 1;**
    Replace 'gamma cap performance evaluation' with "extraction zone hydrogeologic study".

    FMC Response: The typographical/context error will be corrected.

11. **Page A-1, section A.2.3, paragraph 1, line 2;**
    Insert "using" between 'collected' and 'either'.

    FMC Response: The typographical error will be corrected.

12. **Page A-4, section A.3.2.1;**
    Please state how the final borehole depth will be determined, and the determining factors that will be used for selecting the length of the well screen. If the extraction wells are to be designed to extend over the entire aquifer thickness or some other length, please clearly state and provide justification.

    FMC Response: Refer to the response to EPA General Comment 2 and EPA Specific Comment 9.

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13. **Page A-4, section A.3.2.2, paragraph 1, line 4;**
    Refer to Figure 3-2 instead of Figure 3-1.

    FMC Response: The reference will be corrected.

14. **Page A-7, section A.4.2.3, paragraph 2, line 7;**
    Refers to Figure A-3, Figure A-3 could not be located, please correct accordingly.

    FMC Response: A figure showing a typical above-ground completion for the piezometers was inadvertently omitted from Appendix A. Figure A-1 will be included that shows a typical above-ground completion will be included and is attached to this response to comments. In addition, as the piezometers will all be completed above-grade, the text describing flush mounted completions will be deleted from Section A.4.2.3 in Appendix A.

15. **Page B-6, section B.3, 5th bullet, line 5,**
    The replacement of 'superposition of drawdown' with "well interference effects" is recommended.

    FMC Response: The text will be revised as suggested in the comment.

16. **Table B-3, row 1 (Extraction Wells), column 2 (Step-Drawdown and Constant Rate…);**
    Revise to maintain consistency with Appendix A.

    FMC Response: The text that summarizes the extraction well construction (approximate depth and screen slot size and sand pack gradation) in Table B-3for Extraction Wells under Step-Drawdown and Constant Rate Extraction Well Test will be revised consistent with the response to EPA General Comment 2 and EPA Specific Comment 9.

17. **Table B-3 row 10 (Discharge Water), columns 2 and 3;**
    Insert "in" between 'collected' and 'tank(s)'.

    FMC Response: The typographical error will be corrected.

18. **Page B-14, section B.4.1.1, step 9 and section B.4.2.1 step 2;**
    This discussion leads the reader to conclude the data loggers will be set after the start of pumping, resulting in the loss of early time data. Please revise the text to clearly state data loggers are to be set prior to the start of pumping.

    FMC Response: MWH field personnel have successfully performed numerous pump tests following this standard operating procedure (SOP) and disagree that the SOP is ambiguous regarding the fact that the pressure transducers and data loggers are installed and programed to begin logging prior to initiation ("Test Start-Up") of pumping from the test well(s). No revision of the Work Plan is warranted.

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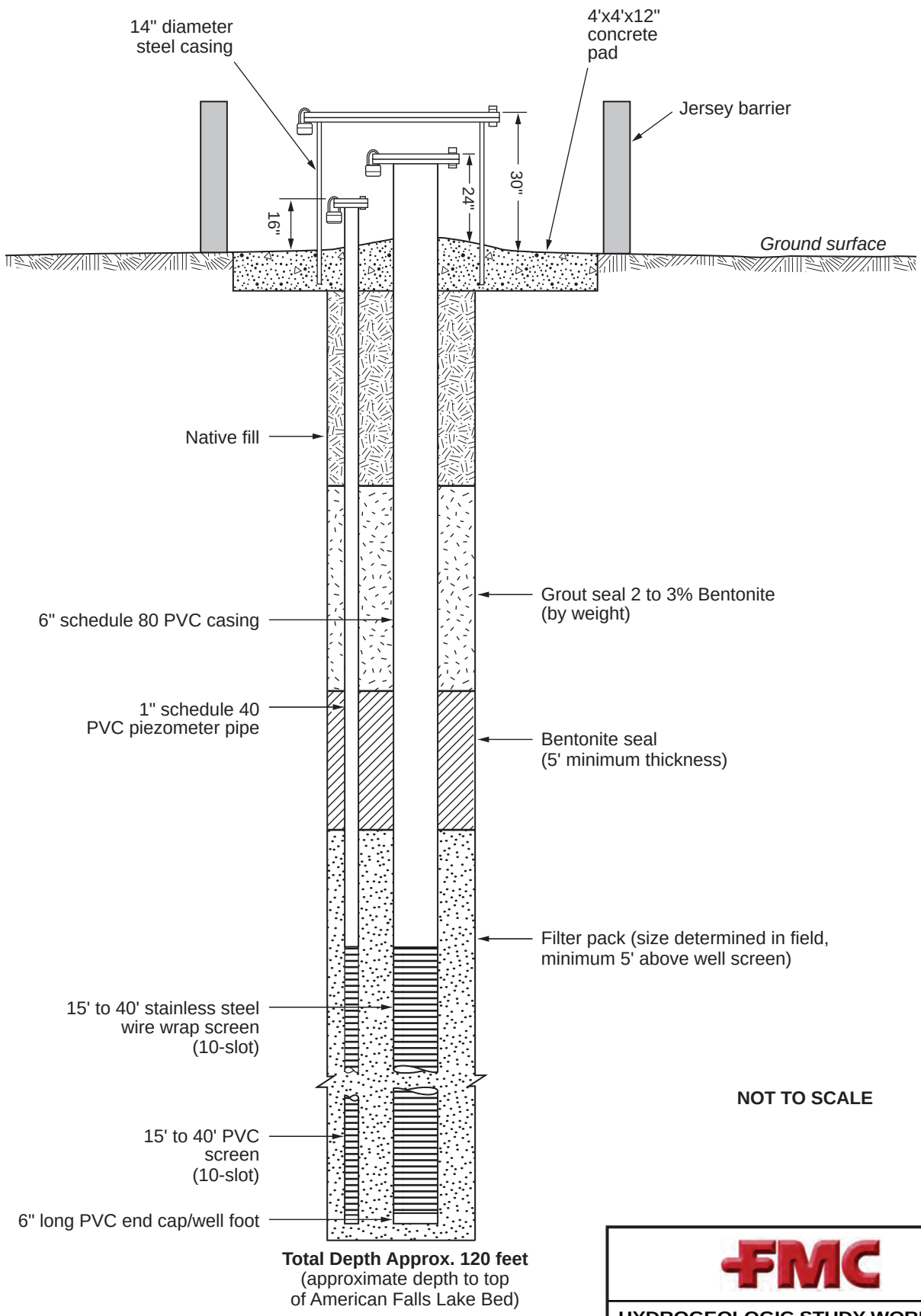

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE 3-2

GENERALIZED EXTRACTION WELL DESIGN

MWH

FILE *Fig 3-2_Generalized Extraction Well Design_mod2.ai* *DATE: 17 Oct 2013*

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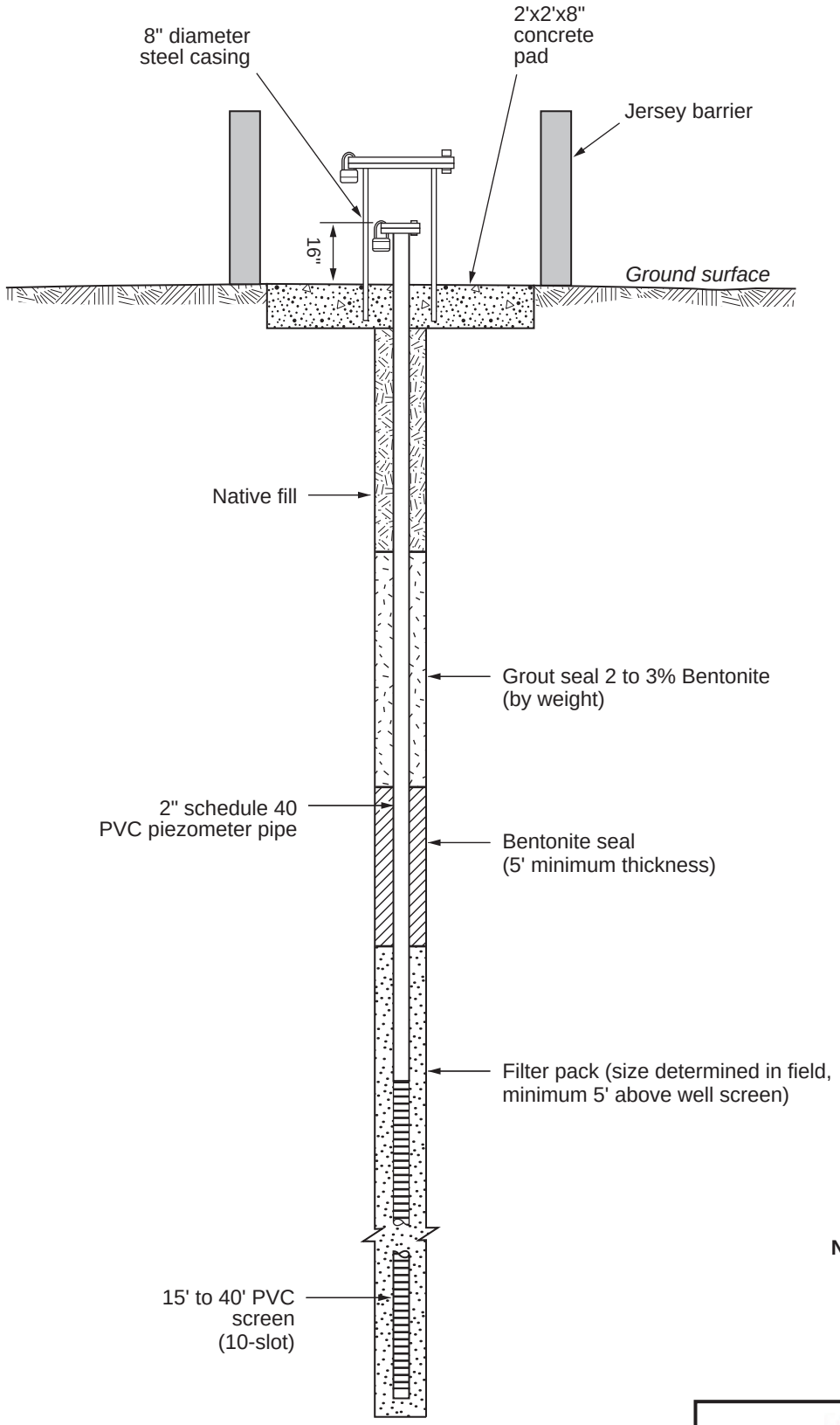


Total Depth Approx. 120 feet
(approximate depth to top
of American Falls Lake Bed)

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE A-1

GENERALIZED PIEZOMETER DESIGN AND ABOVE-GROUND COMPLETION

MWH

FILE *Fig A-1_Generalized Piezometer Design and Above Ground Completion.ai* *DATE: 24 Oct 2013*

2014-01-10 FMC Extraction Zone Hydrogeologic Study Work Plan.pdf

APPENDIX E

Referenced EMF RI Table and Figures

TABLE 3.3-1

HYDRAULIC CONDUCTIVITIES AND TRANSMISSIVITIES OF EMF AQUIFER SYSTEM

TABLE 3.3-1

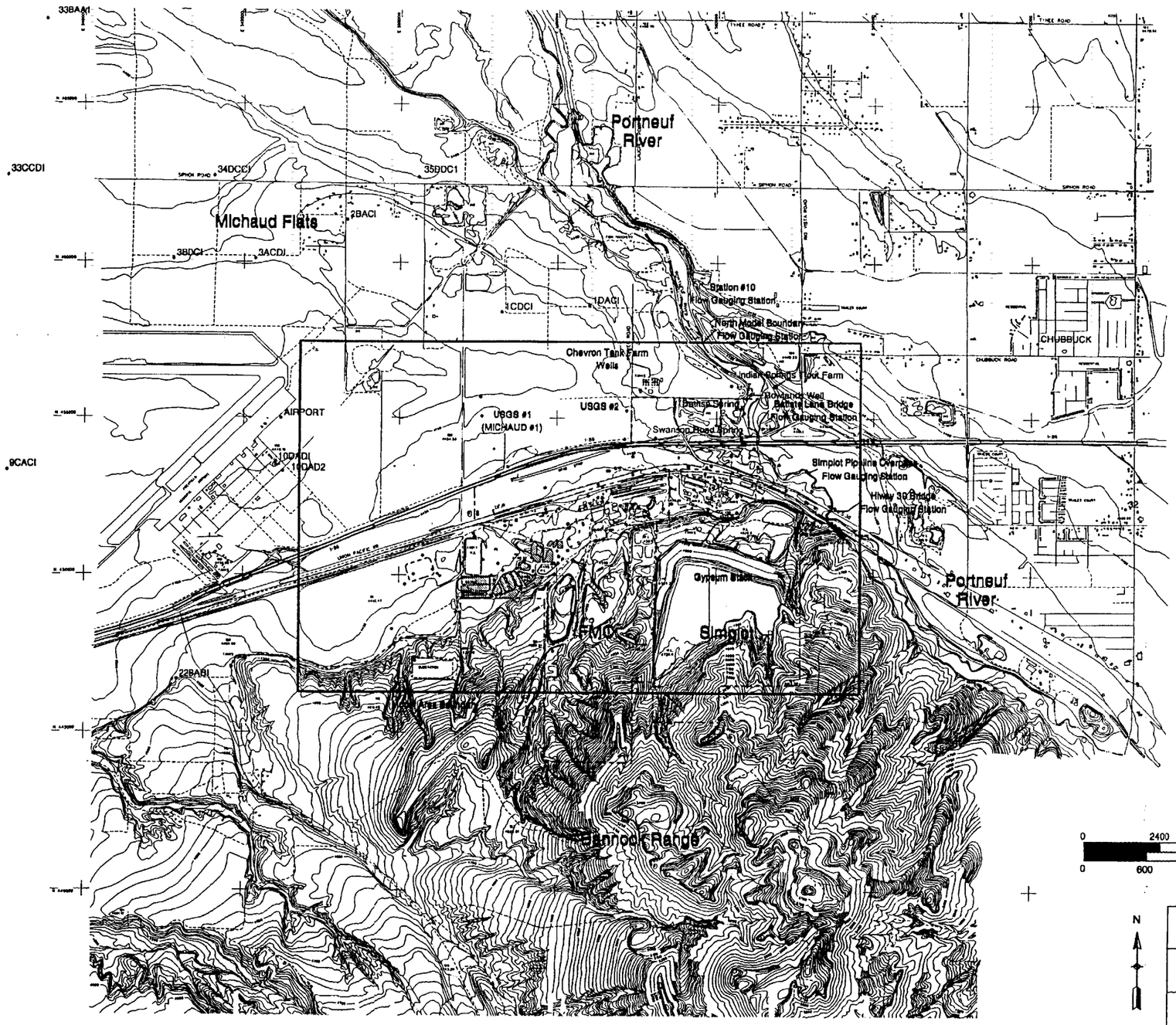
	Shallow Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	104	4.45E-02	126	Slug Test	BEI
	108	1.01E-01	286	Slug Test	BEI
	110	3.80E-02	108	Slug Test	BEI
	111	1.40E-01	397	Slug Test	BEI
	113	1.40E-01	397	Pumping Test	BEI
	126	5.85E-02	166	Slug Test	BEI
	134	1.09E-01	309	Slug Test	BEI
	135	3.15E-02	89.3	Slug Test	BEI
	139	1.90E-02	53.9	Slug Test	BEI
	140	9.70E-02	275	Slug Test	BEI
	146	6.10E-02	173	Slug Test	Hydrometrics
	148	2.45E-02	69.5	Slug Test	Hydrometrics
	150	3.55E-01	1000	Pumping Test	BEI
	153	3.30E-01	935	Slug Test	BEI
	154	1.74E-02	49.3	Slug Test	Hydrometrics
	501	9.05E-02	257	Slug Test	BEI
	514	3.92E-02	111	Slug Test	Hydrometrics
	515	1.05E-02	29.8	Slug Test	Hydrometrics
	516	2.33E-02	66.0	Slug Test	Hydrometrics
BANNOCK RANGE	106	4.30E-03	12.2	Slug Test	Hydrometrics
	142	7.00E-04	1.98	Slug Test	BEI
	300	2.43E-04	0.69	Slug Test	Hydrometrics
	301	1.00E-05	0.03	Slug Test	BEI
	304	4.95E-04	1.41	Slug Test	Hydrometrics
	306	1.17E-03	3.32	Slug Test	Hydrometrics
	307	9.91E-02	281	Slug Test	Hydrometrics
	308	2.51E-02	71.2	Slug Test	Hydrometrics
	313	1.80E-02	51.0	Slug Test	BEI
	316	1.02E-02	28.9	Slug Test	BEI
	323	1.20E-03	3.40	Slug Test	Hydrometrics
	325	5.45E-03	15.5	Slug Test	BEI
	333	9.91E-03	28.1	Slug Test	Hydrometrics
	PEI-2	1.00E-03	2.83	Pumping Test	PEI
	PEI-5	4.50E-04	1.28	Pumping Test	PEI
PORTNEUF RIVER	312	1.40E+00	3970	Pumping Test	BEI
	318	1.40E-03	3.97	Slug Test	BEI
	324	5.45E-02	154	Slug Test	BEI
	327	1.18E-01	334	Slug Test	Hydrometrics
	328	1.84E-01	522	Slug Test	Hydrometrics
	502	1.39E-01	394	Slug Test	Hydrometrics
	503	1.68E+00	4760	Slug Test	BEI
	505	3.66E-01	1038	Slug Test	Hydrometrics
	507	6.40E-01	1810	Slug Test	BEI
	517	7.20E-01	2040	Slug Test	BEI
	518	1.49E-01	422	Slug Test	Hydrometrics

	Deep Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	103	5.20E-03	14.7	Slug Test	BEI
	107	2.20E-02	62.4	Slug Test	BEI
	109	5.15E-03	14.6	Slug Test	BEI
	125	7.22E-02	205	Slug Test	Hydrometrics
	133	1.20E-01	340	Slug Test	BEI
	145	2.15E-01	609	Slug Test	BEI
	500	6.70E-02	190	Slug Test	BEI
BANNOCK RANGE	315	1.19E-02	33.7	Slug Test	BEI
PORTNEUF RIVER	311	8.60E-04	2.44	Slug Test	BEI
	317	9.90E-03	28.1	Slug Test	BEI
	319	1.00E-02	28.4	Slug Test	BEI
	321	1.50E-01	425	Slug Test	BEI
	322	2.80E-01	794.7	Pumping Test	BEI
	329	3.65E-01	1030	Slug Test	BEI
	330	5.64E-02	160	Slug Test	Hydrometrics
	504	7.10E-02	201	Slug Test	Hydrometrics
	506	2.30E-01	652	Slug Test	BEI
	512	5.80E-01	1640	Slug Test	BEI
	519	1.59E-02	45.0	Slug Test	Hydrometrics

	Production Wells	Transmissivity (ft^2/day)	Transmissivity (gpd/ft)	Type of Test	Source
MICHAUD FLATS	FMC-6	7370	55130	Pumping Test	BEI
	32ACD1	35100	262550	Pumping Test	USGS
	32DDC1	135700	1015000	Pumping Test	USGS
	33BAA1	21900	163810	Pumping Test	USGS
	33CCD1	41400	309670	Pumping Test	USGS
	34ADD1	40400	302190	Pumping Test	USGS
	34DCC1	36600	273770	Pumping Test	USGS
	35DDC1	164400	1229700	Pumping Test	USGS
	3ACD1	41200	308176	Pumping Test	USGS
	3BDC1	444000	3321100	Pumping Test	USGS
	4BBA1	38500	287980	Pumping Test	USGS
	5BDA1	36800	275260	Pumping Test	USGS
	8ADA1	27300	204200	Pumping Test	USGS
	9CAC1	199000	1488500	Pumping Test	USGS
	12BBC1	54700	409160	Pumping Test	USGS
PORTNEUF RIVER	SWP-7	227270	1700000	Pumping Test	Simplot

References:
BEI = Bechtel Environmental, Inc., Preliminary Site Characterization Summary for the Eastern Michaud Flats site, January, 1994
PEI = PEI Associates, Inc., Evaluation of Waste Management for Phosphate Processing, April 1985
Hydrometrics = Hydrometrics, Inc., Hydraulic Conductivity Testing of Existing Well Sites at the Eastern Michaud Flats Site, Pocatello, Idaho, April 1994
USGS = United States Geological Survey, Water-Resources Investigations Report 84-4201, Hydrogeology of Eastern Michaud Flats, Fort Hall Indian Reservation, Idaho
Simplot = J.R. Simplot files
FMC = FMC files

Hydraulic conductivity at Well 318 not used in K-zone mapping due to potential precipitation reactions in formation related to mixing of low pH water with groundwater.
Transmissivity at Well 311 not used due to possible grout contamination in filter pack.



Legend

35DDC1 • Boring and Well Locations
(See Figure 3.3-3 for Base Map & Well Designations Within Model Boundary)

Old Ponds (FMC)

Model Boundary

EMF Property Boundary

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

EMF Flow Model Study Area

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-2	

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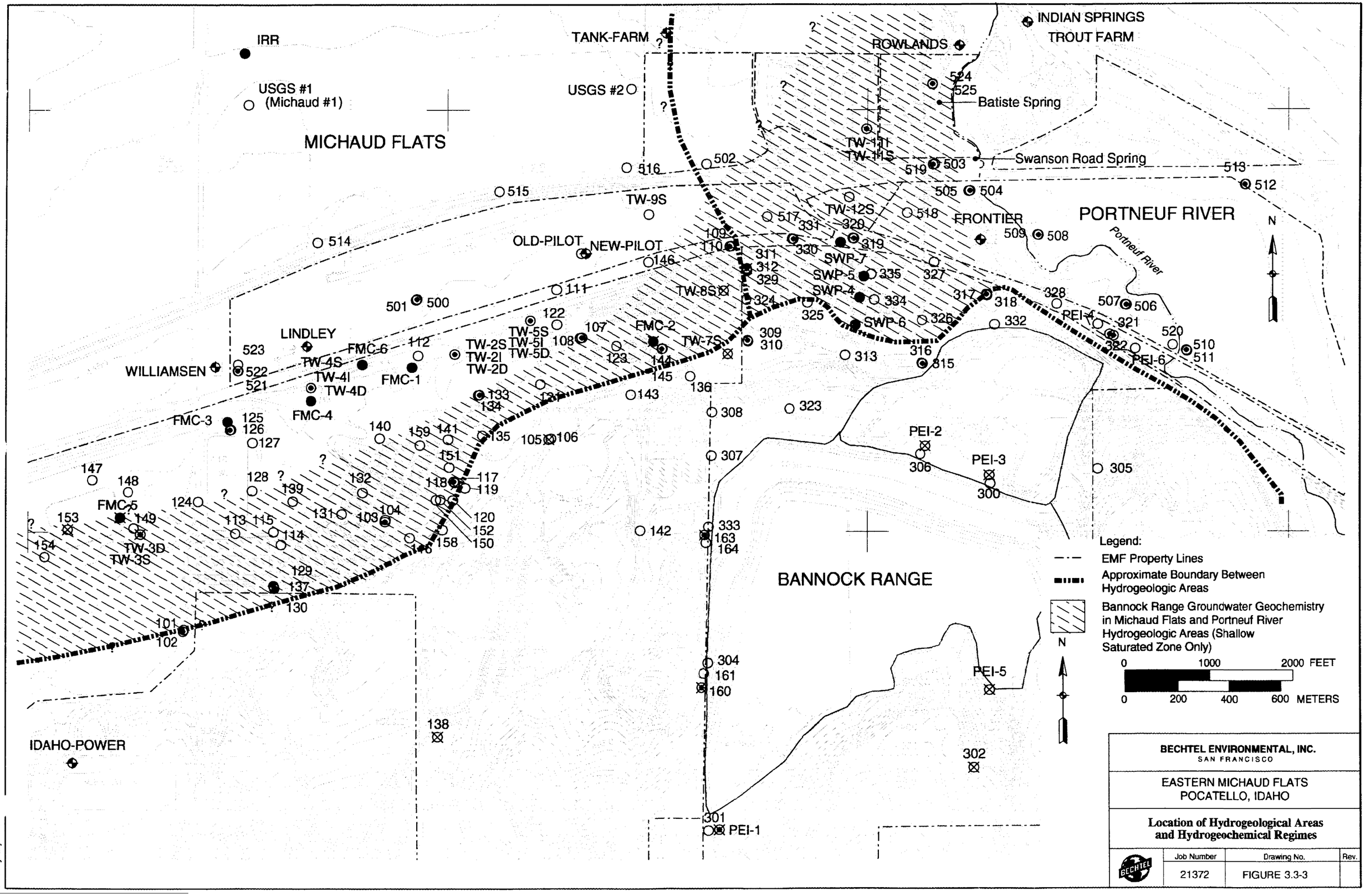

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Location of Hydrogeological Areas and Hydrogeochemical Regimes

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-3	

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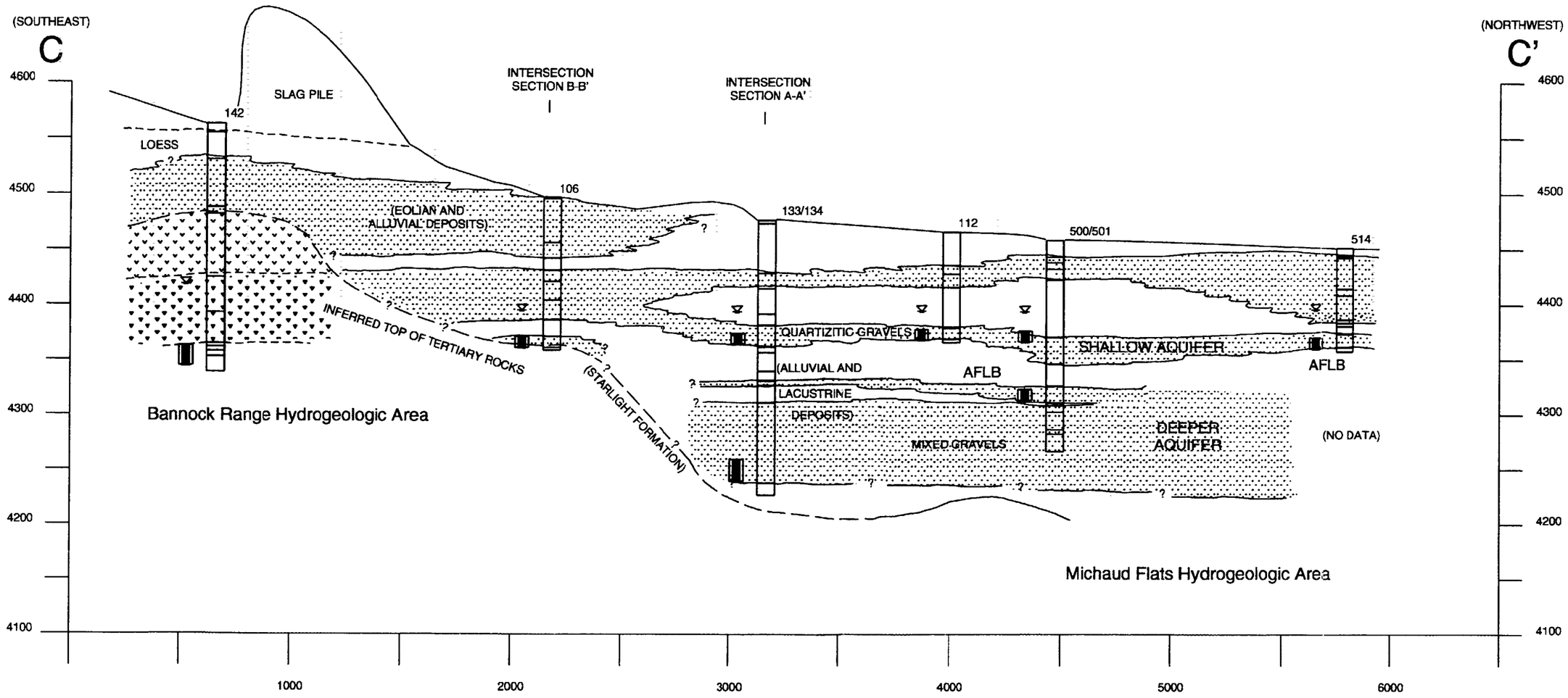

Notes:

1) Ground surface line generalized.
2) Vertical exaggeration = 5x
3) Cross-section is generalized. See boring logs in Appendix for further details.
4) Cross-section lines are shown in Figure 3.1-5.
5) AFLB = American Falls Lake Beds

Legend:

- Water level
- Well screen

SAND, GRAVELLY SAND, SILTY SAND, CLAYEY SAND, SANDSTONE, GRAVEL, SAND AND GRAVEL, SILTY, SANDY GRAVEL, SILTY GRAVEL, CLAYEY GRAVEL

SILT, CLAYEY SILT, SANDY SILT, GRAVELLY SILT

CLAY, SILTY CLAY, SANDY CLAY, GRAVELLY CLAY

BASALT, RHYOLITE, TUFF

CALICHE, PEAT

ASPHALT, CONCRETE, FILL

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Hydrogeologic Cross-Section C-C'

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-4	

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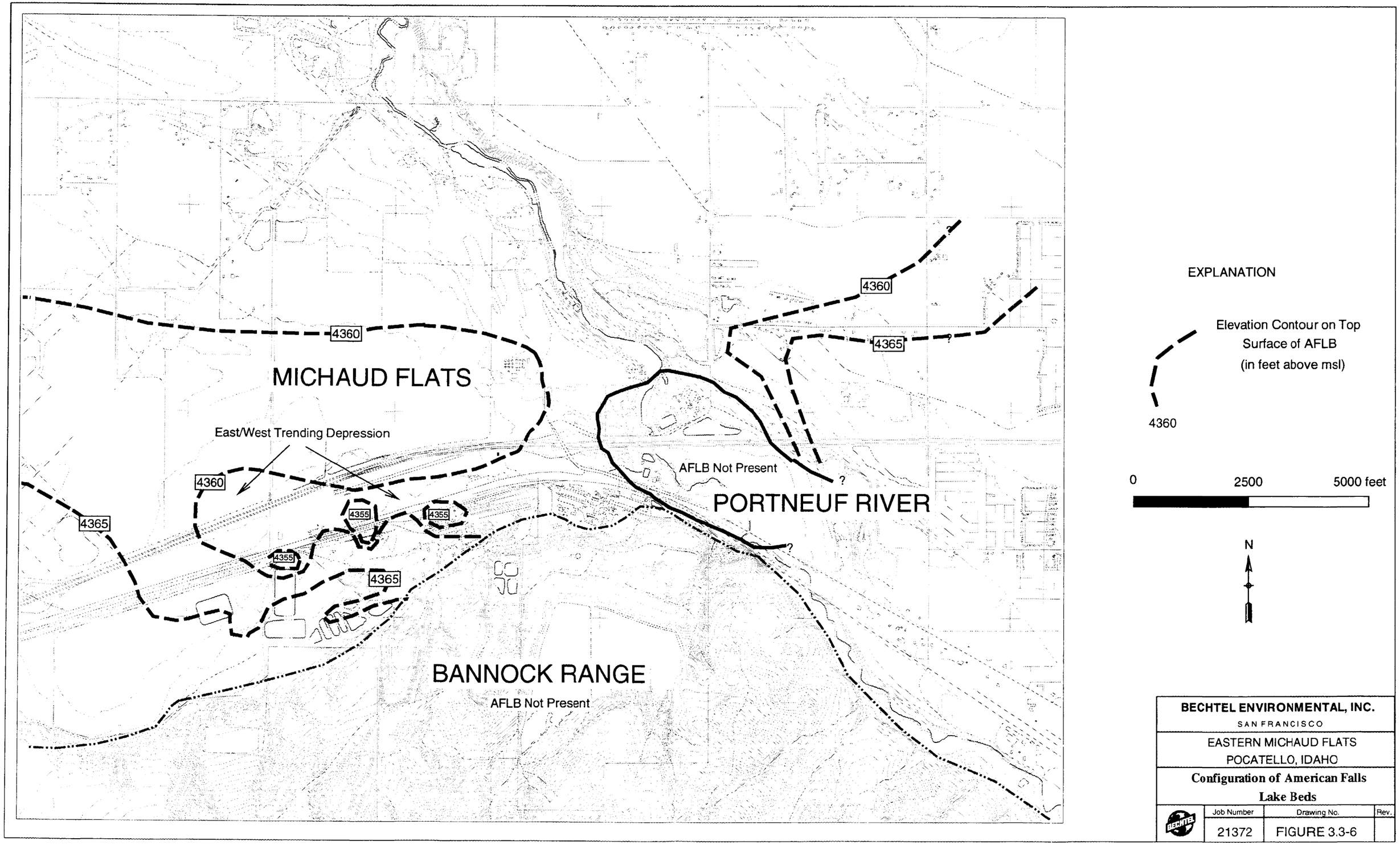

BECHTEL ENVIRONMENTAL, INC. SAN FRANCISCO		
EASTERN MICHAUD FLATS POCATELLO, IDAHO		
Configuration of American Falls Lake Beds		
Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-6	

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FMC Corporation

Transmitted Via E-mail & Federal Express

January 10, 2014

Kevin Rochlin
Project Coordinator
U. S. Environmental Protection Agency
1200 Sixth Avenue, Suite 900
Seattle, WA 98101

Re: FMC Corporation Pocatello, ID
Unilateral Administrative Order for Remedial Design and Remedial Action
EPA Docket No. CERCLA 10-2013-0116
Extraction Zone Hydrogeologic Study Work Plan

Dear Mr. Rochlin,

The purpose of this letter is to transmit the revised Extraction Zone Hydrogeologic Study Work Plan (EZHWP) to EPA for approval. The revised EZHWP incorporates the revisions specified in FMC's October 31, 2013 responses to EPA, IDEQ and SBT comments. EPA replied to those FMC responses in a letter transmitted to FMC via email on December 6, 2013 (noting that the letter was dated October 6, 2013), in which EPA stated that "[t]here are still a few issues that have not been adequately addressed" and listed eight (8) remaining issues and how EPA had determined to resolve them. The following sets forth EPA's resolutions of those issues and describes how the EZHEP has been revised to incorporate them.

EPA General Comment; <u>EPA Resolution: Add the required cross section to the document, and additional requirements per the comment.</u>

EZHWP revision: The EMF RI cross-section A-A' (EMF RI Figures 3.1-6A and 3.1-6B) has been added to Appendix E (Referenced EMF RI Table and Figures) of the EZHWP. As stated in EPA's comment, the conceptual site model will continue to be updated and refined as new information is obtained. Section 3.4 of the EZHWP states that the geologic, hydrogeologic and aquifer characteristics derived from the study will be used to update /refine the groundwater model (e.g., elevation of the top of model layer 3 that corresponds to the AFLB where present within the model domain). The Hydrogeologic Study

2014-01-10 FMC transmittal Extraction Zone Hydrogeologic Study Work Plan....pdf

Report will include an updated contour map of the top of the AFLB consistent with EPA's recommendation.

EPA Specific Comment #1; EPA Resolution: Add the required table.

EZHWP revision: Table 3-3 (Summary of Groundwater Samples) has been added to the EZHWP.

EPA Specific Comment #12; EPA Resolution: Amend the document to more fully describe water disposal. Sampling per EPA requirements if EPA determines that it is necessary.

EZHWP revision: Appendix D, SOP 4 (Investigation-Derived Waste) has been revised to include a more detailed description of the management of extraction well development and aquifer (pump) test water. As described in SOP 4, the well development water will be containerized and characterized prior to determining appropriate disposal and the aquifer test purge water will be characterized based on the results of the development water and managed as appropriate.

As EPA did not specify any sampling requirements in addition to those already specified in the EZHWP, there were no specific revisions to the QAPP and FSP. FMC is prepared to engage in additional discussion with EPA regarding any additional sampling and analysis recommended by EPA, preferably prior to mobilization to execute the EZHWP. Note that the EZHWP groundwater sample field and laboratory analytical program is aligned with the Interim CERCLA Groundwater Monitoring Plan (ICGMP) which reflects the numerous "expanded" groundwater sample analytical programs that FMC has conducted based on EPA requests in the past, including expanded programs during 2008 and 2009. In addition, most recently, the first "expanded" parameter sampling and analysis per the ICGMP during 2Q2012 was consistent with prior results and continued to show that the nature and extent of groundwater constituents and concentrations are very stable and support a non-hazardous waste determination.

Shoshone-Bannock Tribes

1. EPA Resolution: EPA agrees that the Tribes may re-evaluate the groundwater model. No change is required to the document.

   EZHWP revision: No revision required.

2. EPA Resolution: This change needs to be made in the document.

2014-01-10 FMC transmittal Extraction Zone Hydrogeologic Study Work Plan....pdf

EZHWP revision: The second bullet in Section 2.1.5 (formerly Section 2.1.4) has been revised to include a summary of the results of the 2002 and 2009 deep aquifer zone well "special" groundwater sampling and analysis programs performed pursuant to direction from EPA. A sentence was added at the end of this bullet regarding groundwater discharging to the Portneuf River even though it is redundant to the description of groundwater discharge to the Portneuf River already included in the fourth (last) bullet of Section 2.1.5.

3. EPA Resolution: See EPA comment response #12. Sampling may be required prior to discharge.

   EZHWP revision: Refer to response to EPA Specific Comment #12.

IDEQ Comment 1

EPA Resolution: Make the change required in the comment.

EZHWP revision: Appendix B, sections B.4.1 and B.4.2 have been revised to explicitly state that pumping will begin after the pre-determined time set for the water level transducers / loggers to begin recording data.

In addition to the revisions described in FMC's October 31, 2013 letter and those described above, the schedule included in the EZHWP (Section 7) has also been revised to reflect actual submittal dates and a target to mobilize for implementation of field work in mid-March 2014, anticipating timely EPA approval of this EZHWP. Thus, please consider this letter notification pursuant to UAO Paragraph 39 regarding advance notice of any sampling activity. We will provide a firm schedule for mobilization to the field following EPA approval of the EZHWP. The schedule will be based on field conditions, long-range weather forecasts, and subcontractor and equipment availability.

Sincerely,

Barbara E. Ritchie
Associate Director, Environment

Enclosure (4 copies)

cc (as required under the UAO):
Bruce Olenick, Idaho Department of Environmental Quality (2 copies)
Kelly Wright, Shoshone-Bannock Tribes (1 copy)
Susan Hanson, Shoshone-Bannock Tribes (1 copy)

2013-10-31 FMC Responses to EPA DEQ and SBT Comments on Hydro Study Work....pdf

FMC Responses to EPA and SBT Comments, dated and received September 13, 2013, and IDEQ Comments, dated August 13 and received September 16, 2013, on the Extraction Zone Hydrogeologic Study Work Plan submitted July 15, 2013
October 31, 2013

EPA Comments Transmitted
September 13, 2013

Review comments, FMC OU Remedial Design, *Extraction Zone Hydrogeologic Study Work Plan*, MWH, July 2013

General Comments:

1. The above mentioned document has been reviewed and the methods for aquifer testing are appropriate being step test, constant rate pump test and the combined 72-hour constant rate test of the initial three extraction wells. These test results will provide the necessary site specific hydraulic parameters with the water level drawdown to aid in the development of the design for the hydraulic containment system (HCS).

   FMC Response: Comment noted as supportive of the study approach.

2. However, there must be continuous geologic logging and vertical water quality characterization profiling when installing the boreholes for the three extractions well and piezometers from the water table down to the American Fall lake bed (AFLB) or aquitard. This information will be needed when selecting the location for the screen interval of the extraction wells and piezometers.

   FMC Response: As stated in the Extraction Zone Hydrogeologic Study Work Plan (Work Plan), Appendix A, Section A.2.3, soil will be continuously logged from approximately 5 feet above the water table to the bottom of the boring during drilling of the extraction wells to identify specific soil horizons including the American Falls Lake Bed. This section will be revised to specify the same procedure will be followed during installation of the piezometers. The section will also be revised to clarify that the screen lengths will be based on observations made during drilling and after consulting with the MWH Hydrogeological Manager.

   With respect to vertical water quality characterization, Simplot's use of vertical groundwater quality monitoring during drilling appears to have been performed primarily to determine the screened intervals for multiple, nested wells which is not the case for the extraction wells and piezometers proposed in the Work Plan. However, vertical groundwater chemistry profiling during drilling of the extraction wells, similar to the method utilized by Simplot, will be added to the Work Plan. The revisions to Appendix A, Section A.2.3 of the Work Plan to address this comment are provided in underline/strikethrough format below:

2013-10-31 FMC Responses to EPA DEQ and SBT Comments on Hydro Study Work....pdf

A.2.3 Soil Sample Collection and Groundwater Chemistry Profiling Procedures

During drilling activities, soil samples for stratigraphic logging will be collected from the borehole prior to well installation. Soil samples will be collected either a split-spoon sampler or from soil cores (e.g., sonic drill cores). As necessary, a sample catcher will be placed at the end of the sampler so that unconsolidated soils are not lost as the sample device is retrieved from the borehole.

In the event that the HCS extraction wells and piezometers are installed using roto-sonic drilling methods, soil cores for stratigraphic logging will be collected continuously throughout the length of the borehole. However, if the extraction wells and piezometers installation is performed using other drill methods (i.e., air-rotary, etc.) soil samples will be collected using a split-spoon sampler at 5-foot centers above the water table, and then continuously from approximately 5 feet above the saturated zone to the bottom of the boring. Split-spoon, soil samples for piezometers installed shall ~~not~~ be collected following the same procedures as for the extraction wells. ~~until drilling depths have reached approximately 5 feet above the saturated zone; at which point samples for stratigraphic logging will be collected at five-foot centers to the bottom of the borehole.~~ Screened intervals will be selected based on stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager.

Field analyses of groundwater samples for indicator constituents of site-affected groundwater will be performed during drilling of the extraction wells. The “real-time” analyses will be performed to supplement the stratigraphic interpretations for the selection of screen intervals.

Groundwater samples will be collected from the saturated zone during drilling. Since the roto-sonic, triple-wall air-percussion, or ARCH drilling methods will maintain an open borehole, groundwater encountered during drilling is most likely to originate in the zone between the end of the advance casing and the drill bit. A submersible pump or hydropunch groundwater sampling tip will be placed near the tip of the advance casing and the groundwater will be pumped to the surface for field analysis. Groundwater quality parameters (pH, temperature, and specific conductance) will be monitored during pumping until a representative sample can be obtained. Once representative conditions are observed, a sample of the discharge will be collected and analyzed in the field for the parameters listed in Table A.2.3-1. One sample will be collected and analyzed for approximately every 10 feet of drill depth within the saturated zone. The results will be used in conjunction with lithologic logging observations to select the interval for placement of the well screen.

2013-10-31 FMC Responses to EPA DEQ and SBT Comments on Hydro Study Work....pdf

Table A.2.3-1: Groundwater analyses conducted during drilling.

Analytical Parameter	Method
pH	Multi-probe field meter
Specific Conductance	Multi-probe field meter
Redox	Multi-probe field meter
Temperature	Multi-probe field meter
Nephelometric turbidity (NTU)	Turbidity meter
Phosphate	HACH portable Colorimeter

3. In order to improve the understanding of groundwater flow, a contour map of the top of the American Falls Lake Bed clay (AFLB) should be included in the work plan. In addition, the work plan should include a table that lists all monitoring and former production wells that have determined the depth of the top of the clay, the depth, and thickness of the AFLB clay if available. The contour map will enhance the conceptual site model for the site and the well information will be used during the selection of potential groundwater data for analysis and to select potential future monitoring well locations for sample collection and analysis.

   FMC Response: Figure 3.3-6 of the EMF RI Report (1996) that presents a contour map of the top of the AFLB was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments. As shown on the figure, the top of the AFLB is expected to be encountered at an elevation between 4,350 and 4,365 feet above mean sea level (AMSL). The range of elevations for the top of the AFLB reported in the EMF RI has been confirmed and refined beneath the Simplot plant site. As shown on Figure 3-1 of Simplot's Supplemental Subsurface Investigation in the Phosphoric Acid Plant Area Report (July 2013), the top of the AFLB was encountered at an elevation between 4,350 and 4,375 feet AMSL (the AFLB was reportedly encountered at 4,381 AMSL in one boring).

   There is no existing table that lists all monitoring and former production wells that have determined the elevation of the top and thickness of the AFLB. As shown on EMF RI Report Figure 3.3-4 (included in Appendix E), the AFLB is about 35 to 15 feet thick based on the lithologic logs from well 133 (western ponds area) and well 500 (north of I-86). A review of deep boring logs from well 109 (next to well 110 in the northeast corner of the plant site), 140 (western ponds area) and well 109 (next to well 108 in the central plant area) shows a depth to the top and thickness of the AFLB consistent with EMF RI Figures 3.3-6 and 3.3-4 respectively. The additional information provided in this response will be added to paragraph 3 in Section 2.1.2 of the Work Plan as follows:

   > The AFLB form an aquitard that separates the shallow and deeper aquifers within the Michaud Flats area. These lacustrine clays and silts have very low permeability and are regionally extensive, extending from the Bannock Range area to the American Falls Reservoir, where they crop out along the reservoir embankment. <u>As shown on EMF RI Figure 3.3-6 (included in Appendix E), the top of the AFLB is expected to be encountered at an elevation between 4,350 and 4,365 feet above mean sea level</u>

(AMSL) in the extraction zone at the northeast property boundary of the FMC Plant site. The range of elevations for the top of the AFLB reported in the EMF RI has been confirmed and refined beneath the Simplot plant site. As shown on Figure 3-1 of Simplot's Supplemental Subsurface Investigation in the Phosphoric Acid Plant Area Report (July 2013), the top of the AFLB was encountered at an elevation between 4,350 and 4,375 feet AMSL (the AFLB was reportedly encountered at 4,381 AMSL in one boring).

As shown on EMF RI Report Figure 3.3-4 (included in Appendix E), the AFLB is about 35 to 15 feet thick based on the lithologic logs from well 133 (western ponds area) and well 500 (north of I-86). A review of deep boring logs from well 109 (next to well 110 in the northeast corner of the plant site), 140 (western ponds area) and well 109 (next to well 108 in the central plant area) shows a depth to the top and thickness of the AFLB consistent with EMF RI Figures 3.3-6 and 3.3-4 respectively.

The AFLB are not present along part of the Portneuf River in the area of Batiste Springs and Wells 524/525 south to Well 520 (see EMF RI Figure 3.3-6, in Appendix B). The Bonneville Flood may have scoured the AFLB, consistent with Trimble's (1976) map of boulder deposition patterns that indicate a main flood channel in this area. Elevation contours on the top of the AFLB suggest a slight dip to the north. Just to the south of I-86, there is an elongated, east-west depression in the AFLB surface, which may also be an erosional feature of the flood (see EMF RI Figure 3.3-6, in Appendix B).

Specific Comments:

1.0 Introduction,

1. page 1-1. The second paragraph describes the collection of groundwater samples from the extraction zones of wells EW-01-3 for laboratory analyses and a bulk water sample for a potential jar test for the evaluation of a water treatment system for the groundwater. No table could be found in this document which states the number of field samples, duplicates and QA samples. This table should be included in Section 4 or in the QAPP.

   FMC Response: The number and type of groundwater samples that will be collected are described in Section 3.5.2. A table could be added to this section; however, the text is clear that 2 discrete samples will be collected from each well during the six-hour step tests and 1 composite and bulk sample will be collected during the 72-hour combined pump test. Given the type of samples and the purpose of the sampling and analyses, to refine the expected average extracted groundwater quality and further evaluate the disposal method (i.e., disposal at the Pocatello POTW and/or on-site treatment) during design, field quality assurance samples were not deemed to be necessary. No revision to the Work Plan is warranted.

2. 1.3.2 Phase I HCS Pump Tests, page 1-4. The text states that the 24-hour constant rate pump test will only be performed on the western extraction well (EW-01). It is important to stress the aquifer at all three locations. Each of the wells (EW-02 and EW-03) must undergo the 24-hour constant rate pump test.

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FMC Response: The measured drawdown during the proposed step-testing of the individual extraction wells will provide the relevant information on the hydraulic characteristics in the vicinity of each extraction well. Larger scale hydraulic characteristics and aquifer response will be derived from the combined three-well 72-hour testing. The additional 24-hour testing of each individual well is unnecessary at this time because it will provide little additional insight into the operation of the HCS given the context of the 72-hour testing of the entire system. In addition, as noted in EPA Specific Comment 12, the proposed 6-hour step tests at three extraction wells, 24-hour constant rate aquifer test at extraction well EW-01 and 72-hour hydraulic containment test (all three extraction wells) will produce about 1.5 million gallons of water that will be characterized and managed as described in SOP-4 (Investigation Derived Waste). Additional 24-hour pump tests at the other two extraction wells would add about another 300,000 gallons that would need to be managed during this study. No revision to the Work Plan is warranted.

2.0 FMC OU Hydrogeology and Groundwater Modeling Summary

3. Section 2.1.1, second paragraph. The text refers to EMF RI Report Figure 3.3-2 as being located in Appendix B of the plan. The figure could not be located in Appendix B and should be included.

   FMC Response: An appendix to contain the referenced EMF RI figures was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments.

4. Section 2.1.2, third paragraph. The text refers twice to EMF RI Figure 3.3-6 as being located in Appendix B of the plan. The figure could not be located in Appendix B and should be included.

   FMC Response: An appendix to contain the referenced EMF RI figures was inadvertently omitted from the Work Plan. The intended appendix (now designated Appendix E) is attached to this response to comments.

5. 2.1.3 Aquifer Test Results, page 2-3. Include Table 3.3-1 Hydraulic Conductivities and Transmissivities of EMF Aquifer from the EMF RI with this document.

   FMC Response: Table 3.3-1 from the EMF RI has been added to the now designated Appendix E that is attached to this response to comments.

6. Second paragraph, the conversion from 0.1 cm/s to ft/day must be corrected in the text.

   FMC Response: The typographical error will be corrected (i.e., the value will be corrected to 28<u>3</u> ft/day).

3.0 Hydrogeologic Study Design

7. Section 3**.** Figure 1-3 presents the results of the flow path modeling which shows that the selected wells are likely to capture groundwater from the western plant area but would not capture groundwater from the eastern plant area. The two unnamed wells east of well EW-03 would apparently potentially capture groundwater from the eastern portion of the site, but are not included in this study. Groundwater monitoring results indicate that groundwater quality in wells 123, 145, and 136 is more contaminated than the average concentration of contaminants in wells 110, 146, and TW-9S presented in Table 3-2.

   While it is acknowledged that the source of contamination in wells 123, 136, and 145 may not have originated within the FMC OU, the situation should be acknowledged and discussed in the work plan. This discussion should include an analysis of why EW-01, EW-02, and EW-03 were selected for the study rather than the two locations further east. In addition, the text should describe how the results of the pump test will be used to evaluate the placement of extraction wells that will contain water from the eastern portion of the site as part of the remedy.

   FMC Response: The second paragraph in Section 3.1 (Preliminary Hydrogeologic Study Design) will be revised to include text describing the rationale for proposing to install the western three (3) extraction wells during this study and how the results will inform progressing with the groundwater remedial design (i.e., designing the system to capture groundwater flow from beneath the FMC plant site including the joint fenceline area) as follows:

   > Groundwater model results indicate that installation of five groundwater extraction wells at a spacing of approximately 350 to 500 feet will create hydraulic containment and prevent further migration of the contaminated groundwater plume beyond the FMC Site northern boundary. The approximate locations (final locations to be determined in the field) of the extraction wells and piezometers proposed for this study are shown on Figure 3-1. Extraction wells EW-01, -02 and 03 are located at the western three (3) locations of the preliminary groundwater extraction system design of five (5) extraction wells along the northeast FMC plant property. The eastern two (2) extraction wells from the preliminary design are shown on Figure 3-1 as modeled extraction wells.
   >
   > The western three (3) wells were selected for this study because, based on the groundwater model, these wells are predicted to capture the majority of the groundwater flow from beneath the FMC plant site and all the flow from the western ponds and central plant areas. Therefore, confirming the hydrogeology and aquifer characteristics at the western extraction wells is considered more critical to finalizing the overall groundwater extraction system than the eastern well locations that are modeled to intercept relatively low groundwater flow from the joint fenceline area. In addition, by including the “center” extraction well (based on the preliminary design), the updated groundwater model can be used to further refine the location(s) and designed extraction rate of well(s) toward the eastern plant property line to capture flow from the joint fenceline area. The design of the extraction wells and piezometers are described below.

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8. 3.1.1 Extraction Wells, page 3-1. As mentioned in the general comments, it is important to have a good understanding of the site specific geology and the groundwater quality or the concentrations of the contaminants of concern (COCs). The Simplot OU of the EMF Superfund site used the roto-sonic drilling method and was able to get good recovery of the geology/lithology and was able to collect water quality samples using a field test kits for both phosphate and sulfate to make decisions on the placement of the screen interval and the length of the screen. This information would lead to a more effective extraction system by placing the screen interval through-out the known plume. Also, samples of the geological formation could be collected from the area selected as the screen interval to design a site specific filter pack around the screen. A roto-sonic drilling method is recommended by EPA based on the results from the Simplot design of their extraction system.

   FMC Response: Refer to the response to EPA General Comment #2. Note that FMC contacted Simplot regarding their experience with sonic drilling and they indicated that sonic was initially utilized to drill in the Bonneville flood gravel lithology in order to minimize lost drilling time or potential rejection when large boulders typical of the flood gravels were encountered. The Bonneville flood gravels are not present beneath the FMC plant site and percussion hammer drilling has successfully been used on previous soil boring and well installation programs at FMC. FMC is confident that sonic, air rotary casing hammer (ARCH) or percussion hammer drilling methods will work for the drilling and installation of wells and that the subsurface geology can be accurately characterized by any of the three drilling methods.

9. Figure 3-2. Make the following changes to this figure, after the total depth of 120 feet add (to AFLB). The text in section 3.1.1 must match what was placed on figure 3.2 the text states a minimum of five-foot above the top of the screen for the filter pack and figure has 2-feet. I agree with the text (5-feet). As mentioned above, a field decision will be made on the length of the screen interval and this figure should state an approximate length, like 15 to 30 feet.

   FMC Response: As suggested by the comment, Figure 3-2 will be revised as follows:

   - Filter pack has been changed from a minimum of 2 feet above well screen to a minimum of 5 feet above well screen;
   - Screened interval for both the extraction well and piezometer has been changed from 40 feet to 15 to 40 feet; and
   - Total Depth = 120 feet (approximate) has been changed to Total Depth = 120 feet (approximate of the top of the American Falls Lake Bed deposit).

   The revised Figure 3-2 is attached to this response to comments.

10. 3.1.2 Extraction Well Co-Installed Piezometers, page 3-2. The internal piezometers must have the same length of screen interval as the extraction well screen.

FMC Response: Section 3.1.2 (Extraction Well Co-Installed Piezometers) will be revised to clarify that the co-installed piezometers will have the same screened interval and screen lengths as the extraction wells as follows:

> Each six-inch diameter extraction well will have a one-inch diameter internal piezometer co-installed within the boring to allow the system operator to determine the water level within the well using a pressure transducer. The internal piezometers will have ~~approximately 40-foot long PVC~~ the same screen ~~of the same~~ length and slot size as the extraction well screen (refer to Figure 3-1).

11. 3.2 Groundwater Piezometers, page 3-2. An additional piezometer is needed down gradient of EW-02 which should be located closer then [sic] MW-146.

    FMC Response: While the downgradient piezometer would preferably be located closer to EW-02, the piezometer cannot be located closer due to the Union Pacific (UP) main line railroad tracks. Locating the piezometer on the south side of the UP tracks is too close to EW-02 to provide data that would add significantly to the piezometer located within EW-02 and the other piezometers to the south of the UP tracks. No revision of the Work Plan is warranted.

12. 3.3 Aquifer Testing Network and Procedures, page 3-3. What was the rationale used for the selection of the locations for EW-01, 02 and 03? Why not place EW-01 or the extraction wells closer to the higher concentrations of the COCs, MW-122 or MW-145?

    FMC Response: The EPA selected groundwater remedy specified in the IRODA is to "install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU, and/or adjoining springs or the Portneuf River." The selected remedy is based on SFS groundwater alternative 2 which was developed and refined during the development of the groundwater flow and transport model for the FMC OU. The groundwater model was developed over an approximately 1 year period (May 2009 through the July 2010 final groundwater model report) with significant review and input from EPA and opportunity for review and input from IDEQ and the Tribes. Appendix A of the Groundwater Model Report for the FMC Plant OU (Appendix E of the SFS Report, July 2010) includes the meeting minutes, presentation materials and follow-up materials from the six (6) meetings, including the July 2009 site visit, that were conducted to obtain review and input on the groundwater model. Multiple iterations of extraction well locations and rates were simulated to capture the shallow groundwater contaminant plume at the northeastern FMC plant site boundary during development of groundwater remedial alternative 2. The optimum configuration and preliminary design (as described in the IRODA) is for five (5) extraction wells located along the northeastern property line extracting a combined total of about 530 gallons per minute (gpm). The Work Plan was developed consistent with the preliminary groundwater remedial design documented in the IRODA, no revision to the Work Plan is warranted.

12. (cont.) Again all three wells (EW-01, 02 & 03) need to undergo a 24-hour constant rate aquifer test.

FMC Response: Refer to the response to EPA Specific Comment #2 above.

12. (cont.) The text in this section states that the extracted groundwater from phase I aquifer testing will be contained in storage tanks and characterized and cites SOP 4 (Investigation Derived Waste) as the SOP. Upon review of this SOP it looks as the purge water from the aquifer test may not be contained or tested but the rationale that may be used "*Over 20 years of analyses of groundwater from monitoring wells in the proximity of the planned wells /piezometers do not demonstrate any characteristics of a hazardous waste, and therefore would not be hazardous.*" The SOP continues to state that since it is not a hazardous waste it will be treated as a solid waste and can be disposed on site but it does not say where this water will be discharged. It is important not to discharge the purge water near the aquifer test site because it will comprise the results of this test. The location of the where the aquifer test purge water must be known. The approximate volume of water is + 1.2 million gallons. Also, the nearby monitoring wells, MW-123 and 145(based on second quarter 2009 data) shows concentration of arsenic at 205 µg/L and 483 µg/L. These concentrations are above the site standards of 10µg/L. It is not clear on how this purge water or IDW will be handled. More information is needed on how this IDW will be handled. I [sic] final determination of disposal will need to be made by EPA.

FMC Response: As noted in the comment, Section 3.3 and SOP-4 state that well development and purge fluids will be containerized to await waste determination. SOP-4 states that the well development / purge fluids will be characterized through the use of existing information (previous test results, previous waste characterization, knowledge of the contaminants present, and other relevant records). As re-stated in the EPA comment, "*Over 20 years of analyses of groundwater from monitoring wells in the proximity of the planned wells /piezometers do not demonstrate any characteristics of a hazardous waste, and therefore would not be hazardous*" is an accurate statement and could be expanded to state that during the over 20 years of groundwater monitoring at the FMC OU, including sampling from approximately 125 monitoring wells at the FMC OU, over 4,500 samples and over 50,000 individual analytical results, no groundwater sample result has ever exceeded the threshold values for RCRA characteristic waste. Waste determination using process knowledge is consistent with 40 CFR Part 262.11.

FMC agrees with the comment to the extend it implies that the purge water should not be managed in a manner that could allow the water to "short-circuit" through the annulus of nearby monitoring wells. As stated in Section 3.3 of the Work Plan, "If determined to be non-hazardous, the water will be utilized for dust-suppression activities on site." After containerization and characterization per SOP-4, FMC intends to load the water into water trucks for dust control on the site. For dust control, the approximately 1.5 million gallons of water that will be pumped over an approximately one week period during this study would represent a total of about 0.014 inches (or about 0.003 inches per day) of water spread over about a 340 acre area of the plant site (site-wide roadways and areas within RA-A). This minor amount of water spread over the site for dust control cannot be considered even a marginal threat to migrate to groundwater.

Needless to say, FMC does not have a manufacturing plant process to utilize the aquifer test water (unlike Simplot), does not have a sewer or NPDES discharge permit that would allow discharge of the purge water and containerization for off-site disposal would be prohibitively expensive (even at an unrealistically low unit cost of $1.00 per gallon for transportation and disposal). In the event EPA dictates water management / disposal other than use for dust control on-site, the schedule and scope of the study will need to be significantly reviewed and modified as appropriate. No revision to the Work Plan proposed pending further direction from EPA.

13. 3.4 Aquifer Testing Analysis and Model Update, page 3-3. The EPA does not see a need to make prediction of the long-term performance of the capture zone but must develop an evaluation method for determination of the capture zone for all of the extraction wells and to make sure that the contaminant plume is being captured. The EPA has a guidelines document, A *Systematic Approach for Evaluation of Capture Zones at Pump and Treat System*, (EPA 600/R-08/003, January 2008). This document uses a six step process for the evaluation of the extraction network for capture zones through a groundwater monitoring network. The EPA recommends a systematic approach for the evaluation of capture zones using multiple lines of evidence.

FMC Response: As stated in Section 1.2 of the Work Plan, the hydrogeologic study results will be used to develop the final design of the groundwater remedy hydraulic containment system (HCS) and will assist in selecting between the water management options. The refinement of the FMC OU groundwater model and additional groundwater remedial action simulations described in Section 3.4 of the Work Plan is consistent with developing the final design of the HCS. However, the text will be revised to clarify that the model refinement and simulations will be performed to refine the design of the HCS as follows:

> The revised numerical model will then be used to assess the potential long-term (100-year) performance (drawdown, hydraulic gradient, and flow net) of the initial three extraction wells. Results from these simulations will be used to ~~determine~~ predict if the three extraction wells <u>are expected to</u> meet the performance objectives of the HCS design. If <u>the</u> additional <u>two (2) eastern extraction</u> wells (or additional well[s])) are ~~deemed~~ <u>predicted to be</u> necessary, the model results will be used to assist in selecting the appropriate locations of any additional extraction wells <u>predicted</u> to meet the performance objectives of the HCS. Additional simulations may also be performed to assess and optimize the pumping distribution among the extraction wells to improve the <u>design</u> ~~performance~~ of the HCS.

As specified in the UAO, FMC is required to prepare a Final Groundwater Monitoring Plan as a component of the Remedial Action Work Plan (RAWP). The Final Groundwater Monitoring Plan will provide for, among other required elements, "an EPA Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems (EPA 600/R-08/003, 2008) will be used to evaluate the effectiveness of the Pump and Treat System. An evaluation of the groundwater monitoring network will be conducted to confirm that it is adequate to monitor the FMC OU." The Hydrogeologic Study Work Plan was not developed to address that requirement of the UAO. Pursuant to the UAO, the RAWP will be submitted to EPA concurrently with the Pre-final Remedial Design.

14. 3.5.1 Water Level Measurements, page 3-4. Table 3-1 must include another column next to the column location identification number, being the screen interval (MSL) for each well location. Also, the column 1-2 hour for the collection of water level data is not needed and should be deleted. That information will be covered in the previous column and the column after.

    FMC Response: Table 3-1 will be revised to include elevations for the top and bottom of the screened interval for existing monitoring wells and the 1-2 hour piezometric surface elevation measurement column has been deleted as suggested by the comment.

15. 3.5.2 Groundwater Sample Collection, page 3-4. No information was provided on the number of water quality samples collected during these two aquifer test being the six hour step-test and the 72-hour pump test. Either table 3-2 or another table is needed that identifies the sample location, the parameters, number of samples, duplicates, MS/MSD, blanks etc. No such table could be found in section 4, QAPP. No mentioned is made on how this data will be validated for data use.

    FMC Response: As stated in the response to Specific Comment #1, the number and type of groundwater samples that will be collected are described in Section 3.5.2. A table could be added to this section; however, the text is clear that 2 discrete samples will be collected from each well during the six-hour step tests and 1 composite and bulk sample will be collected during the 72-hour combined pump test. Given the type of samples and the purpose of the sampling and analyses, to refine the expected average extracted groundwater quality and further evaluate the disposal method (i.e., disposal at the Pocatello POTW and/or on-site treatment) during design, field quality assurance samples were not deemed to be necessary.

    The laboratory analytical results for the extraction well groundwater samples will be validated consistent with the Data Verification and Validation Protocol for FMC's groundwater monitoring programs (Appendix C of the Interim CERCLA Groundwater Monitoring Plan, July 2010). A new paragraph will be added to Section 4.3.3 of the Work Plan as follows:

    > The laboratory analytical results for the groundwater samples from the extraction wells will be validated consistent with the Data Verification and Validation Protocol for FMC's groundwater monitoring programs (Appendix C of the Interim CERCLA Groundwater Monitoring Plan, July 2010). A Level III data verification will be performed on the sample results. Level III verification involves a review of all administrative documents, including field and laboratory chain-of-custody documents, sample preservation records, and sample preparation logs. For all precision and accuracy evaluations, laboratory summary information and forms will be evaluated for the individual laboratory methods.

15. (cont.) If a treatability study is going to be conducted was there a work plan for this treatability study?

FMC Response: As stated in the text, the bulk groundwater samples will collected and retained for potential third-party vendor bench-top testing (emphasis added). There is no specific plan for that testing and thus no work plan.

16. Table 3-2. This table has a column of the average concentration of constituent in groundwater and list wells 110, 146 and TW-9S. Why were these locations selected? These wells are either down-gradient or cross-gradient of the three extraction wells that we undergo testing. If the objective is to show the potential water quality that will be collected from these three extraction wells then up-gradient monitoring wells must be selected and only average the concentration which is within the capture zone of those wells. As an example from figure 1-3, the particle tracking shows EW-01 using TW-5S & 122 the average total phosphorus concentration would be 10 mg/L and arsenic would be 60µg/L.

    FMC Response: EPA previously made essentially the same comment on the SFS Report (March 2010) and FMC responded to the comment in its June 11, 2010 response to those comments. More to the point, Table 3-2 of the Work Plan includes the average concentrations of constituents in groundwater (wells 110, 146, and TW-9S), groundwater cleanup standards and Pocatello POTW pretreatment limits, which were taken from the final SFS Report, for completeness and to show the project-required analytical reporting limits (DQOs) are appropriate (i.e., lower than the relevant comparative values). The actual analytical results from the individual extraction well groundwater samples during the six-hour step tests and the composite groundwater sample that will be collected during the 72-hour combined pump test will be the best representation of the extracted groundwater quality. No revision to the Work Plan is warranted.

    For reference, the EPA comment on the SFS Report and FMC's June 11, 2010 response are provided below.

    > **Excerpted from: FMC Responses to EPA, IDEQ and Shoshone Bannock Tribes Comments on the Draft SFS Report for the FMC Plant OU, March 2010**
    >
    > **EPA Comment (May 2010)**: 7.5.3 Groundwater Alternative 2A- Source and Institutional Controls, Groundwater Extraction for Hydraulic Control at the Plant Site Boundary and Direct Discharge to POTW, page 7-53
    > 6) The third paragraph, picked three monitoring wells and averaged the water quality (MW-110, 146, and TW-9S) as what may be expected regarding the water quality concentrations that will be conveyed to the POTW. These monitoring wells may be outside the influence of the five extraction wells. MW-123, 145,189 should be used instead; these monitoring wells are within the influence of the five extraction wells.
    >
    > **FMC Response (June 2010):** As discussed during the March 30 and 31, 2010 meeting between FMC, EPA, IDEQ and the Tribes, that reviewed preliminary agency comments on the SFS Report, FMC does not agree that the wells suggested in this comment for characterizing the water that would be sent to the POTW are representative of water quality at the Groundwater Alternative 2 extraction wells. Those wells are too distant from the extraction wells under this alternative and do not account for attenuation of groundwater COCs between the suggested wells and the

FMC northern boundary extraction area. However, FMC did evaluate extracted groundwater concentrations with two different sets of wells located within or very close (well 111) to the alternative 2A and 2B northern boundary extraction area. As shown in the summary table below, the average concentrations for the 3 well sets evaluated are essentially the same. Considering that these estimated average concentrations were developed to evaluate the most appropriate treatment methodology to meet the preliminary treatment targets for the A and B water disposal options, FMC does not believe the SFS Report needs to be revised to present a different or alternative set of wells to support selection of disposal options and/or identification of appropriate treatment technologies.

Parameter	Average Wells 110, 146 and TW-9S	Average Wells 110, 111 and 146	Average Wells 110 and 146
pH (Field)	7.01	7.02	6.99
SC (UMHOS/CM)	1521.7	1412.0	1361.5
Redox (mV)	-100.0	-99.6	-100.0
Potassium	43.4	40.4	35.9
Sulfate	168.0	166.7	171.5
Chloride	136.3	130.6	110.9
Fluoride	0.30	0.31	0.41
Ammonia	0.17	0.15	0.15
Nitrate	6.63	6.30	4.97
Orthophosphate/ Total Phosphorus	2.54	2.79	2.21
Arsenic	0.03	0.03	0.04
Flouride	0.34	0.36	0.47
Selenium	0.012	0.012	0.016

17. QAPP and FSP, page 4-1. A signature page is needed in the QAPP.

FMC Response: While FMC acknowledges that EPA's guidance suggests that QAPPs include a signature page, the relevant approval (i.e., signature) is the EPA RPM's approval of the Work Plan which presumably will be in the form of an EPA letter. A signature page does not appear to add any value to the QAPP contained in the Work Plan. No revision of the Work Plan is warranted.

18. 4.3 Data Quality Objectives, page 4-3. The data quality objectives should be stated in the text of this section and from the Table 4-1 only one data quality objective was stated, "Verify Model Predictions and determine the alignment and layout for the final design of the full-scale HCS to capture contaminated groundwater before it migrates beyond the FMC Plant site". The EPA believes there are three data quality objectives:

- To installation five extraction wells and associated piezometers which will contain the groundwater that has impacted the shallow aquifer.
- To conduct aquifer testing to obtain site specific hydraulic parameters to design a full-scale HCS
- To collect groundwater samples from the new installed extraction wells to determine the direction of water treatment either option A (discharge and treatment at the City of Pocatello POTW) or option B (on-site treatment followed by infiltration/evaporation).

It is recommended that EPA and FMC discuss the data quality objectives for this hydrogeologic study work plan. Once the agreed upon DQOs have been set then table 4-1 could be finalized.

FMC Response: FMC agrees that the introduction to Section 4.3 and Sections 4.3.1 could be expanded to include the observations (e.g., lithologic logging) and Section 4.3.3 needs to be revised to include the groundwater profiling (per response to EPA General Comment 2) that will be conducted during installation of the extraction wells. However, the first bullet in this comment does not accurately reflect an objective of the proposed extraction zone hydrogeologic study and appears to paraphrase the IRODA selected groundwater remedy that states "Install an interim groundwater extraction/treatment system to contain contaminated groundwater, thereby prevent contaminated groundwater from migrating beyond the FMC OU and into the Simplot OU and/or adjoining springs or the Portneuf River." As stated in the Work Plan, the proposed extraction wells and piezometers and aquifer testing will provide needed inputs to refine the groundwater extraction system remedial design. A "problem statement" to the effect that "there are no existing extraction wells in the identified groundwater extraction zone to implement the IRODA identified groundwater remedy for the FMC OU" that leads to a "decision" to install extraction wells / piezometers seems unnecessary and does not add value to the Work Plan. Similarly, a "problem statement" to the effect that "there is no extraction zone-specific hydrogeologic or aquifer characterization data" that leads to a "decision" to install extraction wells / piezometers in order to perform aquifer (pump) testing seems unnecessary and does not add value to the Work Plan.

The proposed revisions to the introduction to Section 4.3 and Sections 4.3.1 are provided below. If acceptable, conforming revisions will be made to Table 4-1.

4.3 DATA QUALITY OBJECTIVES

During execution of the Hydrogeologic Study there are three types of data to be collected:

- Qualitative / semi-quantitative observations associated with drilling the boreholes (e.g., lithologic logging), determination of the well screen interval and screen slot size, and development of the extraction wells and piezometers;

- Physical measurements (e.g., groundwater elevations) associated with drilling the boreholes (e.g., depth of lithologic samples), construction of the extraction wells and piezometers (e.g., setting bottom of casing), and aquifer pumping tests; and,

- Physical and chemical analyses of groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

The Data Collection Quality Objectives for the Hydrogeological Study are presented in Table 4-1.

4.3.1 Extraction Well and Piezometer Installation

There is no "problem statement" associated with the installation of the extraction wells and piezometers during the execution of this Plan. Thus, no specific, numeric data quality objectives (DQOs) have been established. However, there will be numerous observation and measurements performed during drilling of the boreholes for the extraction wells that will be utilized to finalize well construction / completion details as summarized below:

Observation / Measurement during Drilling	**Extraction Well Construction Element**
Static water level in borehole	Top of screen will extend approximately 5 feet above static water level
Lithologic logging in saturated zone: soil types	Screened casing slot size
Groundwater chemistry profiling	Screen length and bottom of hole / well if SC < 500 umhos/cm and phosphate field analysis < 0.1 mg/l before encountering top of the AFLB
Lithologic logging: top of AFLB	Screen length and bottom of hole / well if SC > 500 umhos/cm and phosphate field analysis > 0.1 mg/l in sample at or above the top of the AFLB

As specified in Section A.2.3 of the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, the screened interval for each extraction well will be selected based on stratigraphic interpretations and groundwater chemistry profiling during drilling activities and after consulting with the MWH Hydrogeological Manager. The use of qualified field personnel (geologists/hydrogeologists), adherence to the Extraction Well and Piezometer Installation Field Procedures detailed in Appendix A, and field documentation will assure the wells/piezometers will be installed properly and will meet the requirements for this hydrogeologic study and completing the design and ultimately the full-scale implementation of the HCS.

4.3.3 Groundwater Samples - Field and Laboratory Analyses

Field analyses will be performed on groundwater samples collected during drilling the boreholes for the extraction wells, during development of the extraction wells and piezometers, and during the aquifer testing from the extraction wells.

The groundwater field parameters will be measured utilizing calibrated field meters with the calibration frequency and accuracy specified on Table 3-2. Note that during drilling the extraction wells the groundwater chemistry profiling samples will be field analyzed for the parameters listed on Table A.2.3-1. The field meters for those parameters will meet the calibration frequency and accuracy specified on Table 3-2 with the exception of phosphate. Phosphate will be field-analyzed using a Hach portable colorimetric phosphate test kit (Model PO-23 or comparable). The Model PO-23 has two (2) measurement concentration ranges of 0.1 to 5 mg/l and 1 to 50 mg/l which should be adequate for the range of expected groundwater phosphate concentrations at the extraction well locations. Hach does not specify a calibration method / frequency or precision/accuracy information for their portable phosphate test kits.

In addition to the field analyses, groundwater samples will be collected from the extraction wells during the aquifer (pump) testing for laboratory analyses. The groundwater samples from the extraction wells will be analyzed at a NELAP-accredited analytical laboratory for the parameters specified on Table 3-2. The acceptable level of uncertainty is included in Table 3-2 as accuracy and precision goals. Samples will be collected and handled as described in Section 4.4.2 below. The specified reporting limits are below the lower of the groundwater cleanup standard or Pocatello POTW Pretreatment Limit to assure the data are useable.

19. 4.3.1 Extraction Well and Piezometer Installation, page 4-2. Problem statements and decisions must be identified for each DQO for sections 4.3.1-4.3.3

    FMC Response: Refer to the response to EPA Specific Comment 18.

20. 4.4 Sampling /Measurement Procedures. 4.4.1 Extraction Well and Piezometer Installation Procedures, page 4-3 and Appendix A, a.2.6

    The development of the 2” diameter piezometer should meet the same criteria of the extraction wells.

    FMC Response: The piezometers will be used strictly as observation points for ground water elevations and therefore do not need to be developed to the same extent as the extraction wells. However, as stated in Section A.2.6 of Appendix A (Well and Piezometer Development Procedures), the extraction wells and piezometers will be developed using a combination of a surge block and bailer and either a portable centrifugal pump, a submersible pump, or airlift pump. During extraction well and piezometer development, water quality parameters such as pH, specific conductivity, temperature, and turbidity will be monitored. These parameters will be measured with a portable water-quality meter. The parameters will be measured at the beginning of well development and after the evacuation of each borehole volume. A minimum of six rounds of water quality parameter measurements will be made; and well development will continue until the criteria set forth in Section A.2.6 are met. Specific to the piezometers, development will continue until the purged water is reasonably

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free of sediments (as determined by the MWH field representative). No revision to the Work Plan is warranted.

21. Appendix A, a.5. X and Y coordinates must be reported out in the state of Idaho state plane coordinates northing and eastings.

    FMC Response: Section A.5 references SOP-3 (Location and Topographic Survey) for surveying the extraction well and piezometer locations. As specified in SOP-3, all measurements will be referenced to the State Plane Coordinate System, North American Datum 1983 and North American Vertical Datum 1988. No revision of the Work Plan is warranted.

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Shoshone-Bannock Tribes Comments, Email dated September 5, 2013 and Transmitted to FMC by EPA Email on September 13, 2013

```
General comment:
 The Shoshone-Bannock Tribes would like to evaluate the groundwater model
report referenced throughout this document specifically, the parameters
selected for groundwater flow and contaminant transport models, assess the
reasonableness of predicted parameters, gain a better understanding of
sorption coefficients, dispersivity and porosity parameters.
```

FMC Response: As summarized in the response to EPA Specific Comment 12, the groundwater model was developed over an approximately 1 year period (May 2009 through the July 2010 final groundwater model report) with significant review and input from EPA and opportunity for review and input from IDEQ and the Tribes. Appendix A of the Groundwater Model Report for the FMC Plant OU (Appendix E of the SFS Report, July 2010) includes the meeting minutes, presentation materials and follow-up materials from the six (6) meetings, including the July 2009 site visit, that were conducted to obtain review and input on the groundwater model. The Tribes had full opportunity to review and provide input into the development of the groundwater flow and transport model and modeled groundwater remedial action simulations during the development of those models and Groundwater Model Report for the FMC Plant Operable Unit. No revision to the Work Plan warranted.

```
During the Step Drawdown, all production wells at Simplot should have their
pumping rates measured.  All irrigation wells within a determined radius
should be inventoried and identified for pumping rates.
```

FMC Response: The EMF RI Report and the Groundwater Current Conditions Report for the FMC Plant Operable Unit, June 2009 - Final (GWCCR) provide tabulated lists of surrounding production wells. More importantly, as documented in EMF RI Report, GWCCR and FMC's annual RCRA, CERCLA and Calciner Pond Groundwater Monitoring Reports (most recent annual reports for calendar year 2012), production patterns at Simplot or surrounding agricultural or other production wells have no observable influence on the groundwater potentiometric surface or inferred flow direction at the FMC OU. In addition, during FMC plant operation and utilization of production wells at the FMC OU, that pumping had no observable influence on the groundwater potentiometric surface or flow direction in areas surrounding the FMC OU. No revision to the Work Plan is warranted.

```
Section 2.1.1
 second bullet:  migration of site related constituents from shallow
groundwater to the deeper zone is inhibited by upward vertical hydraulic
gradients of confining strata throughout large portions of the EMF study
area.
 Add: however, site related COCs have been measured in wells in the deep
aquifer.  This groundwater discharges to the Portneuf River along both the
east and west side of the river and regionally.
```

FMC Response: The comment apparently is referring to bullet 2 in Section 2.1.4 of the Work Plan (no such statement appears in Section 2.1.1). The bulleted summary in in Section 2.1.4 of

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the Work Plan is accurate and was taken from the EPA-approved GWCCR. No revision to the Work Plan is warranted.

```
Third bullet:  remove limited to the area south of I-86 from this paragraph.
Water from the EMF area discharges to the Portneuf River which flows north of
I-86.
```

FMC Response: The comment apparently is referring to bullet 3 in Section 2.1.4 of the Work Plan (no such statement appears in Section 2.1.1). The bulleted summary in Section 2.1.4 of the Work Plan is accurate and was taken from the EPA-approved GWCCR. No revision to the Work Plan is warranted.

```
SOP 4-  All purged water must be tested for total metals  and meet the
Shoshone-Bannock Tribes soil cleanup standards and other appropriate
requirements prior to discharge on the ground.
```

FMC Response: Standard Operating Procedure (SOP 4) – Investigation-Derived Waste (IDW) Management was taken directly from the EPA-approved SOP No. 7 included in the Supplemental Remedial Investigation Work Plan (May 2007), and modified as appropriate for the Remedial Design field studies. The SOP is consistent with EPA regulations and guidance. No revision to the Work Plan is warranted.

FMC has consistently made its position clear in this CERCLA process that Tribal regulations do not and cannot constitute ARARs. As stated in the IRODA, EPA has not made a determination whether the Tribes' Soil Cleanup Standards for Contaminated Properties (SCS) are ARARs. No change to the Work Plan is warranted.

```
Table 3-2 - The Tribes request total metals and radionuclides be analyzed
for. The Tribes request this information prior to discharge of any water
within the FMC OU.  Pumping at a low flow may be more representative of
actual groundwater conditions, at least for the initial first 10 minutes
.prior to sampling.
```

FMC Response: The laboratory analytical methods specified for the metals listed on Table 3-2 of the Work Plan are for total metals. No field or laboratory filtration of the groundwater samples for dissolved constituent analyses is proposed. As summarized in Section 8.1 of the EPA-approved GWCCR:

> Supplemental sampling events for expanded metals, organic compound and radionuclide analytical parameters have provided further evidence supporting the findings of the EMF RI that the following constituents are not FMC-related contaminants in groundwater:
>
> - Metals: aluminum, antimony, beryllium, cadmium, copper, lead, molybdenum, mercury, silver, thallium and zinc;
> - Organic Compounds; and
> - Radionuclides.

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The existing groundwater sampling and analytical data demonstrates there is no justification to add any additional metals or radionuclides to the groundwater analyses for the samples collected during the extraction zone hydrogeologic study. No revision to the Work Plan is warranted.

We may have additional comments based on the referenced modeling document.

FMC Response: Comment noted; however, as stated in the response to the first Tribes' comment, the Tribes had full participation and opportunity to comment during development of the groundwater model and simulations presented in the EPA-approved Groundwater Model Report for the FMC Plant Operable Unit. No revision to the Work Plan is warranted.

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Idaho Department of Environmental Quality Comments August 13, 2013

FMC OU Remedial Design Extraction Zone Hydrogeologic Study Work Plan July 2013

IDEQ Comments Received by FMC on September 16, 2013

General Comments

1. New well construction must meet standards set in IDAPA 37.03.09.

   FMC Response: The construction and decommissioning of wells associated with the remedial action will comply with the Idaho Department of Water Resources' (IDWR) Well Construction Standards Rules, IDAPA 37.03.09. As-built diagrams and driller reports will be provided to IDWR following completion of each well. However, the wells (and piezometers) installed pursuant to the CERCLA remedial action will not be permitted with IDWR pursuant to the CERCLA section 121(e)(1) permit exemption for removal or remedial action conducted entirely on-site.

2. Extraction wells should be designed to be as efficient as possible without producing large quantities of silt. This may require the collection of borehole cuttings from the targeted aquifer, conducting particle size analyses on the cutting samples, and then designing a well based on particle size distribution. If particle size analysis has been conducted during prior investigations that support the current selected well screen slot size (10 slot), those data should be presented in the work plan.

   FMC Response: The extraction wells have been designed to be efficient while also minimizing potential silt (or TSS) production. As described in the response to EPA General Comment 2, the soil will be continuously logged from approximately 5 feet above the water table to the bottom of the boring during drilling of the extraction wells to identify specific soil horizons including the American Falls Lake Bed. The currently identified extraction well screen slot size (0.010-inch) is potentially conservative (smaller than necessary) given that virtually all of the existing monitoring wells at the FMC OU have 0.020-inch slotted screen casing and only a few of the over 100 wells produce water with turbidity greater than 5 NTU as measured during purging. In addition to the revisions indicated in the response to EPA General Comment 2, Appendix A, Section A.2.3 of the Work Plan will be revised to clarify that the screen lengths and screen slot size will be based on observations made during drilling and after consulting with the MWH Hydrogeological Manager.

Specific Comments

1. **Page 1-4, section 1.3.2, line 5;**
   Delete the second '-hour'.

   FMC Response: The typographical error will be corrected.

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2. **Page 2-2, section 2.1.2, paragraph 1, lines 5 and 6;**
While the statement concerning the delineation of hydrostratigraphic units in the Bannock Range is technically correct it leads the reader to conclude sufficient effort was exerted during the RI to arrive at the conclusion presented here. DEQ does not agree sufficient evidence was provided to support the conclusion and finds the statement misleading. Please rewrite to present as a theory and not a fact, or provide the reader with information concerning the nature and extent of the Bannock Range hydrogeologic investigation.

FMC Response: The text referenced in the comment will be revised to state:

> Within the Bannock Range area there were no continuous hydrostratigraphic units delineated during the RI. Starlight Formation volcanic flows and interflow units ~~are~~ were not correlative, and the ~~overall~~ distribution of rock types and saturated materials encountered in the RI borings is best described as highly heterogeneous.

3. **Page 2-3, section 2.1.3, paragraph 2, line 2:**
Replace '(28 ft/day)' with "(283 ft/day)".

FMC Response: As stated in the response to EPA Specific Comment 6, the typographical error will be corrected (i.e., the value will be corrected to 283 ft/day).

4. **Page 2-3, section 2.1.3, paragraph 3, line 1:**
Replace 'Measured' with "Estimated".

FMC Response: The text will be revised as suggested in the comment.

5. **Page 2-4, section 2.1.3, paragraph 1, line 1;**
The first sentence is incomplete, please correct.

FMC Response: "Groundwater Elevations, Flow Patterns, and Vertical Gradients" was intended to be a subheading not a sentence. The Work Plan will be revised to format as a subheading and subsequent subheadings will be renumbered and the table of contents revised.

6. **Figure 3-2;**
Change filter pack minimum height requirement to correlate with Section A.3.2.2 (page A-5 top of page).

FMC Response: As stated in EPA Specific Comment 9, the filter pack has been changed from a minimum of 2 feet above well screen to a minimum of 5 feet above well screen. This change will be made consistently through the Work Plan and Appendix A.

7. **Page 4-2, section 4.3.1 and 4.3.2;**
See General Comments 1 and 2. Poor well construction and data collection during the aquifer pump tests may result in over or under estimating aquifer parameters and the effectiveness of the

HCS as a result. DQOs should be set in place to ensure extraction wells are constructed properly and the best possible data is collected during the pump tests.

FMC Response: Refer to the response to EPA Specific Comment 18.

8. **Page 4-4, section 4.4.3, bullet 2;**
   Please include an explanation of how the variable pumping rates between wells will be accounted for in the composite sample.

   FMC Response: Section 4.4.3.2 (Sample Collection) provides a description and example for the composite sampling procedure:

   > "The composite sample will initially be collected in an approximately 5-gallon pre-cleaned container. An aliquot from each extraction well will be collected at the time intervals specified above and on Table 4-1. The volume of the aliquot from each well will be in proportion to the pump rates set for each well during the multi-extraction well containment pump test. For example, if well EW-1 is pumping at 120 gpm, well EW-2 at 100 gpm and EW-3 at 80 gpm, then the aliquot volume from EW-1 and EW-3 will be 20 percent greater and lower, respectively than the aliquot from well EW-2. As nine (9) total aliquots will be collected in a 5-gallon container, the "base" aliquot volume will be about 0.5 gallons."

   No revision to the Work Plan is warranted.

9. **Table 4-1, row 1, column 2 (HCS Model Predicted Capture Zone Determination);**
   Replace 'before if migrates' with "before it migrates".

   FMC Response: The typographical error will be corrected.

10. **Page 5-1, section 5.3 paragraph 1 line 1;**
    Replace 'gamma cap performance evaluation' with "extraction zone hydrogeologic study".

    FMC Response: The typographical/context error will be corrected.

11. **Page A-1, section A.2.3, paragraph 1, line 2;**
    Insert "using" between 'collected' and 'either'.

    FMC Response: The typographical error will be corrected.

12. **Page A-4, section A.3.2.1;**
    Please state how the final borehole depth will be determined, and the determining factors that will be used for selecting the length of the well screen. If the extraction wells are to be designed to extend over the entire aquifer thickness or some other length, please clearly state and provide justification.

    FMC Response: Refer to the response to EPA General Comment 2 and EPA Specific Comment 9.

13. **Page A-4, section A.3.2.2, paragraph 1, line 4;**
    Refer to Figure 3-2 instead of Figure 3-1.

    FMC Response: The reference will be corrected.

14. **Page A-7, section A.4.2.3, paragraph 2, line 7;**
    Refers to Figure A-3, Figure A-3 could not be located, please correct accordingly.

    FMC Response: A figure showing a typical above-ground completion for the piezometers was inadvertently omitted from Appendix A. Figure A-1 will be included that shows a typical above-ground completion will be included and is attached to this response to comments. In addition, as the piezometers will all be completed above-grade, the text describing flush mounted completions will be deleted from Section A.4.2.3 in Appendix A.

15. **Page B-6, section B.3, 5th bullet, line 5,**
    The replacement of 'superposition of drawdown' with "well interference effects" is recommended.

    FMC Response: The text will be revised as suggested in the comment.

16. **Table B-3, row 1 (Extraction Wells), column 2 (Step-Drawdown and Constant Rate…);**
    Revise to maintain consistency with Appendix A.

    FMC Response: The text that summarizes the extraction well construction (approximate depth and screen slot size and sand pack gradation) in Table B-3for Extraction Wells under Step-Drawdown and Constant Rate Extraction Well Test will be revised consistent with the response to EPA General Comment 2 and EPA Specific Comment 9.

17. **Table B-3 row 10 (Discharge Water), columns 2 and 3;**
    Insert "in" between 'collected' and 'tank(s)'.

    FMC Response: The typographical error will be corrected.

18. **Page B-14, section B.4.1.1, step 9 and section B.4.2.1 step 2;**
    This discussion leads the reader to conclude the data loggers will be set after the start of pumping, resulting in the loss of early time data. Please revise the text to clearly state data loggers are to be set prior to the start of pumping.

    FMC Response: MWH field personnel have successfully performed numerous pump tests following this standard operating procedure (SOP) and disagree that the SOP is ambiguous regarding the fact that the pressure transducers and data loggers are installed and programed to begin logging prior to initiation ("Test Start-Up") of pumping from the test well(s). No revision of the Work Plan is warranted.

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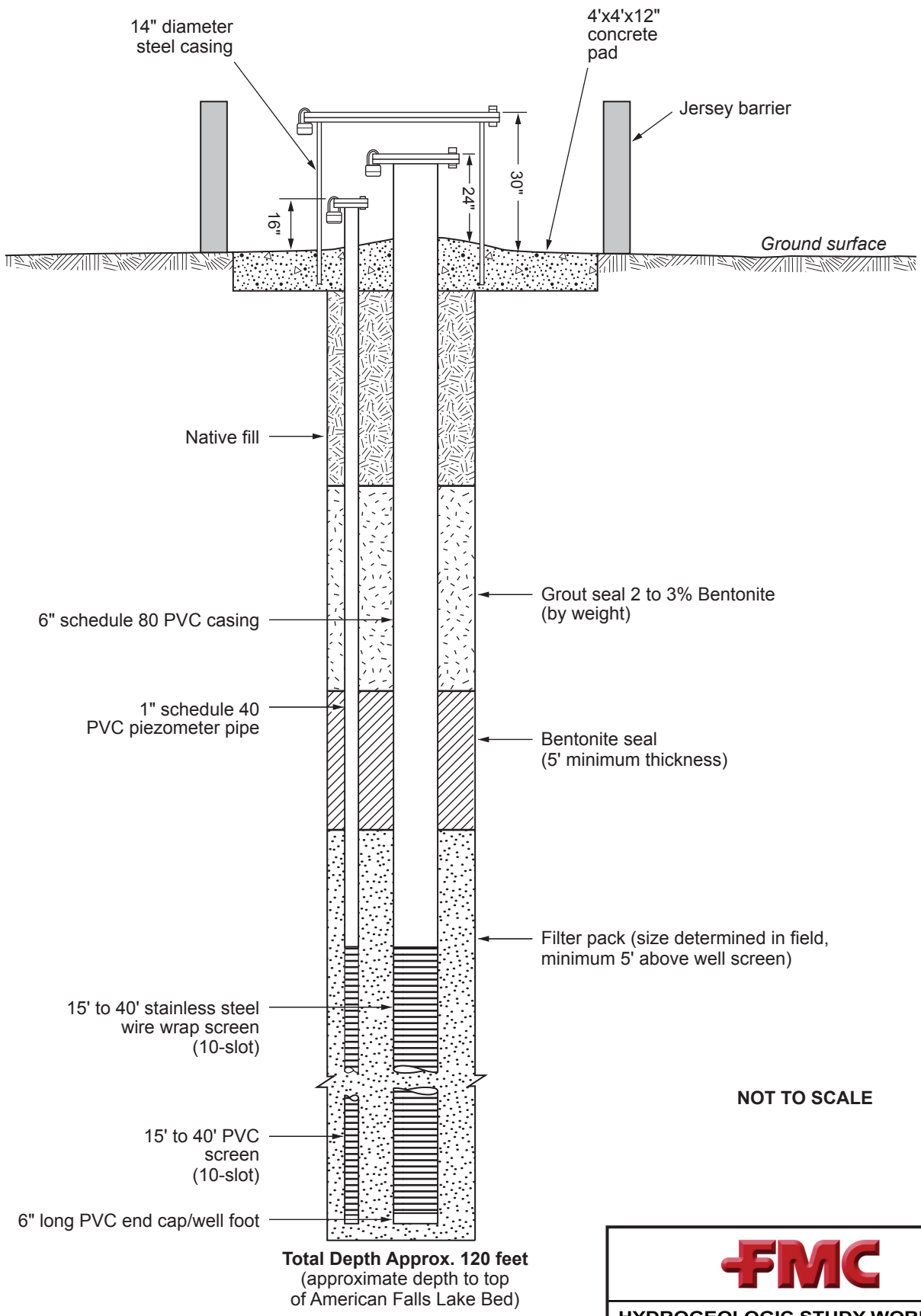

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE 3-2

GENERALIZED EXTRACTION WELL DESIGN

MWH

FILE *Fig 3-2_Generalized Extraction Well Design_mod2.ai* *DATE: 17 Oct 2013*

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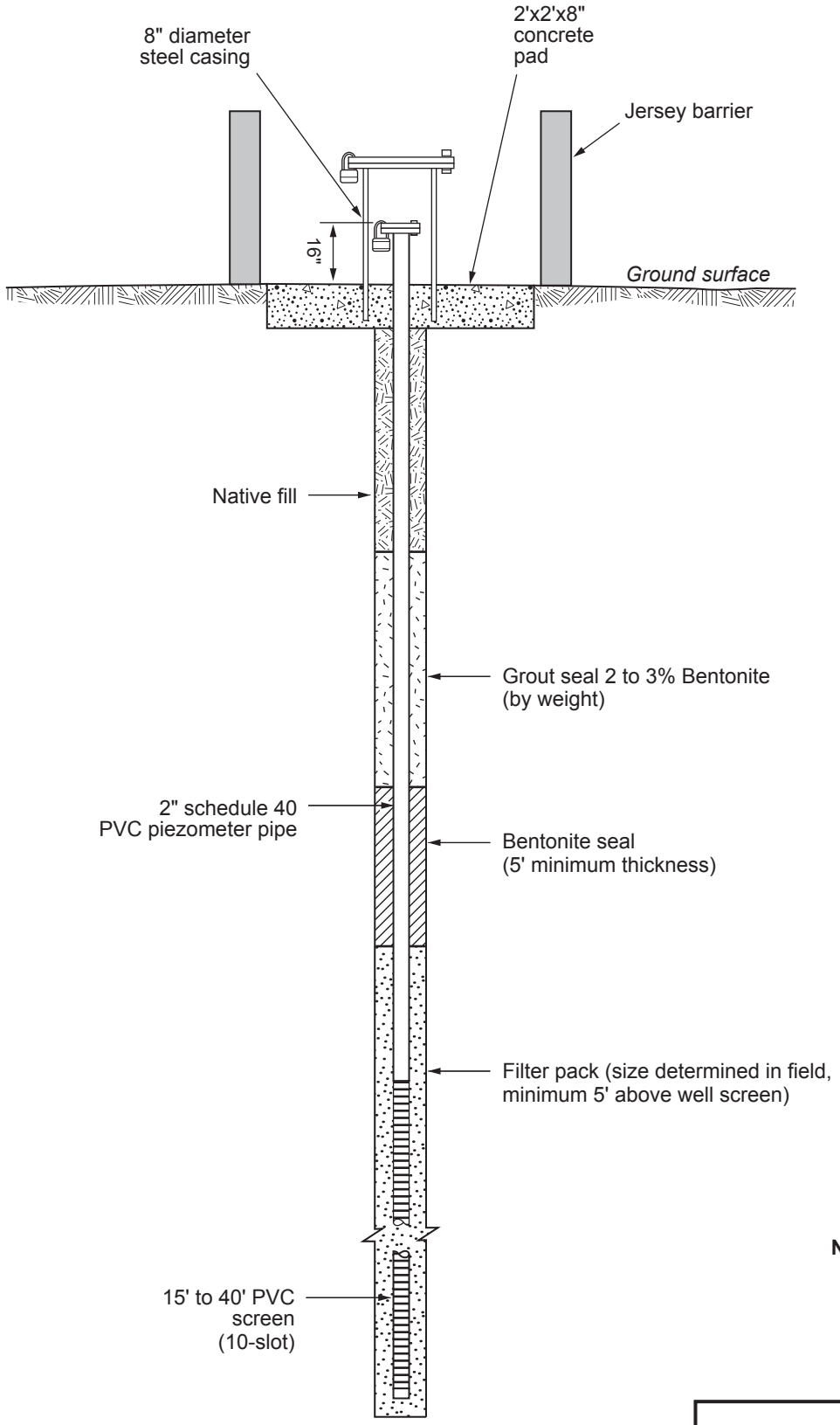

Total Depth Approx. 120 feet
(approximate depth to top
of American Falls Lake Bed)

NOT TO SCALE

FMC

HYDROGEOLOGIC STUDY WORK PLAN

FIGURE A-1

GENERALIZED PIEZOMETER DESIGN AND ABOVE-GROUND COMPLETION

MWH

FILE *Fig A-1_Generalized Piezometer Design and Above Ground Completion.ai* *DATE: 24 Oct 2013*

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APPENDIX E

Referenced EMF RI Table and Figures

TABLE 3.3-1

HYDRAULIC CONDUCTIVITIES AND TRANSMISSIVITIES OF EMF AQUIFER SYSTEM

TABLE 3.3-1

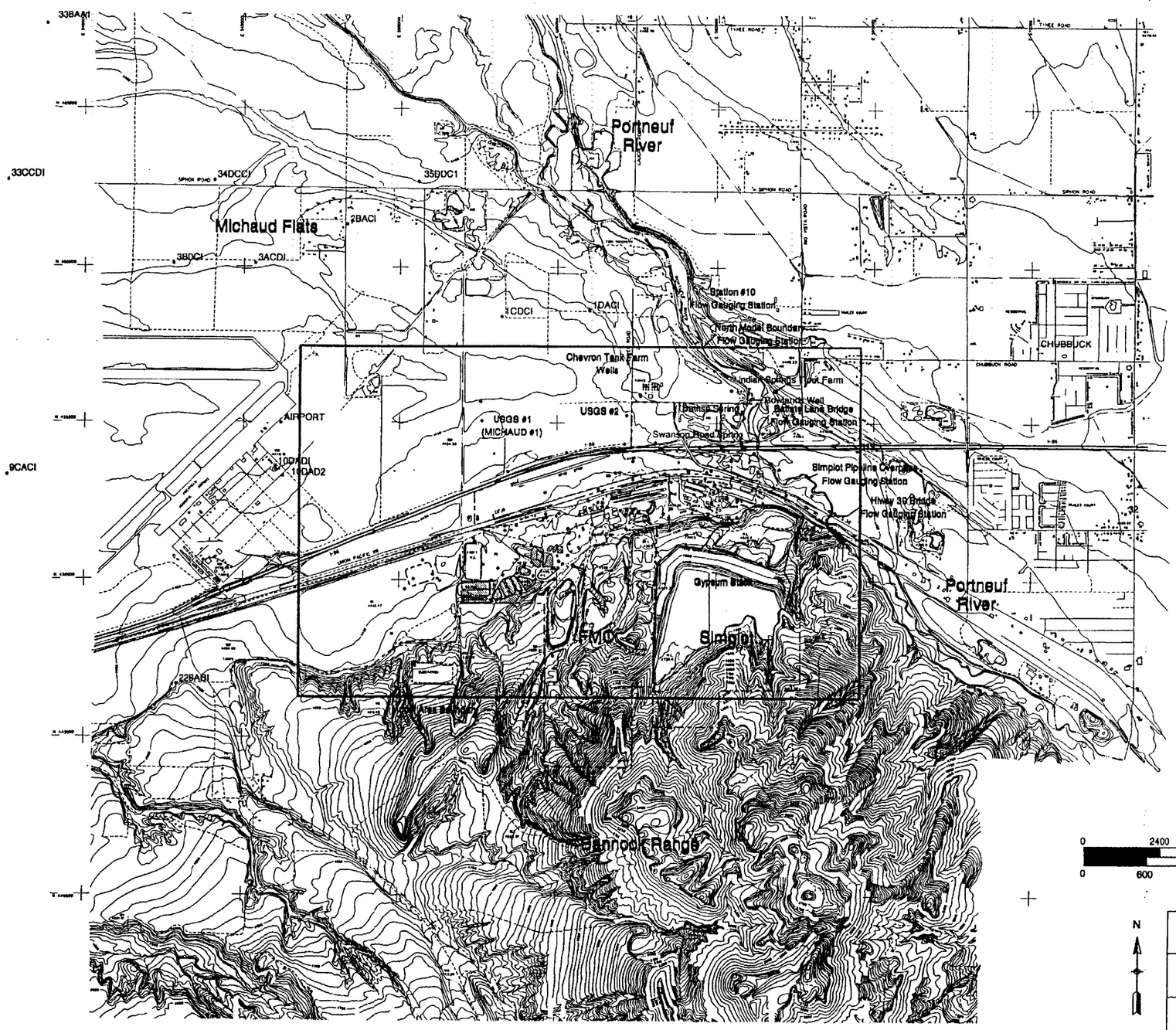
	Shallow Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	104	4.45E-02	126	Slug Test	BEI
	108	1.01E-01	286	Slug Test	BEI
	110	3.80E-02	108	Slug Test	BEI
	111	1.40E-01	397	Slug Test	BEI
	113	1.40E-01	397	Pumping Test	BEI
	126	5.85E-02	166	Slug Test	BEI
	134	1.09E-01	309	Slug Test	BEI
	135	3.15E-02	89.3	Slug Test	BEI
	139	1.90E-02	53.9	Slug Test	BEI
	140	9.70E-02	275	Slug Test	BEI
	146	6.10E-02	173	Slug Test	Hydrometrics
	148	2.45E-02	69.5	Slug Test	Hydrometrics
	150	3.55E-01	1000	Pumping Test	BEI
	153	3.30E-01	935	Slug Test	BEI
	154	1.74E-02	49.3	Slug Test	Hydrometrics
	501	9.05E-02	257	Slug Test	BEI
	514	3.92E-02	111	Slug Test	Hydrometrics
	515	1.05E-02	29.8	Slug Test	Hydrometrics
	516	2.33E-02	66.0	Slug Test	Hydrometrics
BANNOCK RANGE	106	4.30E-03	12.2	Slug Test	Hydrometrics
	142	7.00E-04	1.98	Slug Test	BEI
	300	2.43E-04	0.69	Slug Test	Hydrometrics
	301	1.00E-05	0.03	Slug Test	BEI
	304	4.95E-04	1.41	Slug Test	Hydrometrics
	306	1.17E-03	3.32	Slug Test	Hydrometrics
	307	9.91E-02	281	Slug Test	Hydrometrics
	308	2.51E-02	71.2	Slug Test	Hydrometrics
	313	1.80E-02	51.0	Slug Test	BEI
	316	1.02E-02	28.9	Slug Test	BEI
	323	1.20E-03	3.40	Slug Test	Hydrometrics
	325	5.45E-03	15.5	Slug Test	BEI
	333	9.91E-03	28.1	Slug Test	Hydrometrics
	PEI-2	1.00E-03	2.83	Pumping Test	PEI
	PEI-5	4.50E-04	1.28	Pumping Test	PEI
PORTNEUF RIVER	312	1.40E+00	3970	Pumping Test	BEI
	318	1.40E-03	3.97	Slug Test	BEI
	324	5.45E-02	154	Slug Test	BEI
	327	1.18E-01	334	Slug Test	Hydrometrics
	328	1.84E-01	522	Slug Test	Hydrometrics
	502	1.39E-01	394	Slug Test	Hydrometrics
	503	1.68E+00	4760	Slug Test	BEI
	505	3.66E-01	1038	Slug Test	Hydrometrics
	507	6.40E-01	1810	Slug Test	BEI
	517	7.20E-01	2040	Slug Test	BEI
	518	1.49E-01	422	Slug Test	Hydrometrics

	Deep Wells	Hydraulic Conductivity cm/s	Hydraulic Conductivity ft/day	Type of Test	Source
MICHAUD FLATS	103	5.20E-03	14.7	Slug Test	BEI
	107	2.20E-02	62.4	Slug Test	BEI
	109	5.15E-03	14.6	Slug Test	BEI
	125	7.22E-02	205	Slug Test	Hydrometrics
	133	1.20E-01	340	Slug Test	BEI
	145	2.15E-01	609	Slug Test	BEI
	500	6.70E-02	190	Slug Test	BEI
BANNOCK RANGE	315	1.19E-02	33.7	Slug Test	BEI
PORTNEUF RIVER	311	8.60E-04	2.44	Slug Test	BEI
	317	9.90E-03	28.1	Slug Test	BEI
	319	1.00E-02	28.4	Slug Test	BEI
	321	1.50E-01	425	Slug Test	BEI
	322	2.80E-01	794.7	Pumping Test	BEI
	329	3.65E-01	1030	Slug Test	BEI
	330	5.64E-02	160	Slug Test	Hydrometrics
	504	7.10E-02	201	Slug Test	Hydrometrics
	506	2.30E-01	652	Slug Test	BEI
	512	5.80E-01	1640	Slug Test	BEI
	519	1.59E-02	45.0	Slug Test	Hydrometrics

	Production Wells	Transmissivity (ft^2/day)	Transmissivity (gpd/ft)	Type of Test	Source
MICHAUD FLATS	FMC-6	7370	55130	Pumping Test	BEI
	32ACD1	35100	262550	Pumping Test	USGS
	32DDC1	135700	1015000	Pumping Test	USGS
	33BAA1	21900	163810	Pumping Test	USGS
	33CCD1	41400	309670	Pumping Test	USGS
	34ADD1	40400	302190	Pumping Test	USGS
	34DCC1	36600	273770	Pumping Test	USGS
	35DDC1	164400	1229700	Pumping Test	USGS
	3ACD1	41200	308176	Pumping Test	USGS
	3BDC1	444000	3321100	Pumping Test	USGS
	4BBA1	38500	287980	Pumping Test	USGS
	5BDA1	36800	275260	Pumping Test	USGS
	8ADA1	27300	204200	Pumping Test	USGS
	9CAC1	199000	1488500	Pumping Test	USGS
	12BBC1	54700	409160	Pumping Test	USGS
PORTNEUF RIVER	SWP-7	227270	1700000	Pumping Test	Simplot

References:
BEI = Bechtel Environmental, Inc., Preliminary Site Characterization Summary for the Eastern Michaud Flats site, January, 1994
PEI = PEI Associates, Inc., Evaluation of Waste Management for Phosphate Processing, April 1985
Hydrometrics = Hydrometrics, Inc., Hydraulic Conductivity Testing of Existing Well Sites at the Eastern Michaud Flats Site, Pocatello, Idaho, April 1994
USGS = United States Geological Survey, Water-Resources Investigations Report 84-4201, Hydrogeology of Eastern Michaud Flats, Fort Hall Indian Reservation, Idaho
Simplot = J.R. Simplot files
FMC = FMC files

Hydraulic conductivity at Well 318 not used in K-zone mapping due to potential precipitation reactions in formation related to mixing of low pH water with groundwater.
Transmissivity at Well 311 not used due to possible grout contamination in filter pack.



Legend

35DDC1 • Boring and Well Locations
(See Figure 3.3-3 for Base Map & Well Designations Within Model Boundary)

Old Ponds (FMC)

Model Boundary

EMF Property Boundary

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

EMF Flow Model Study Area

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-2	

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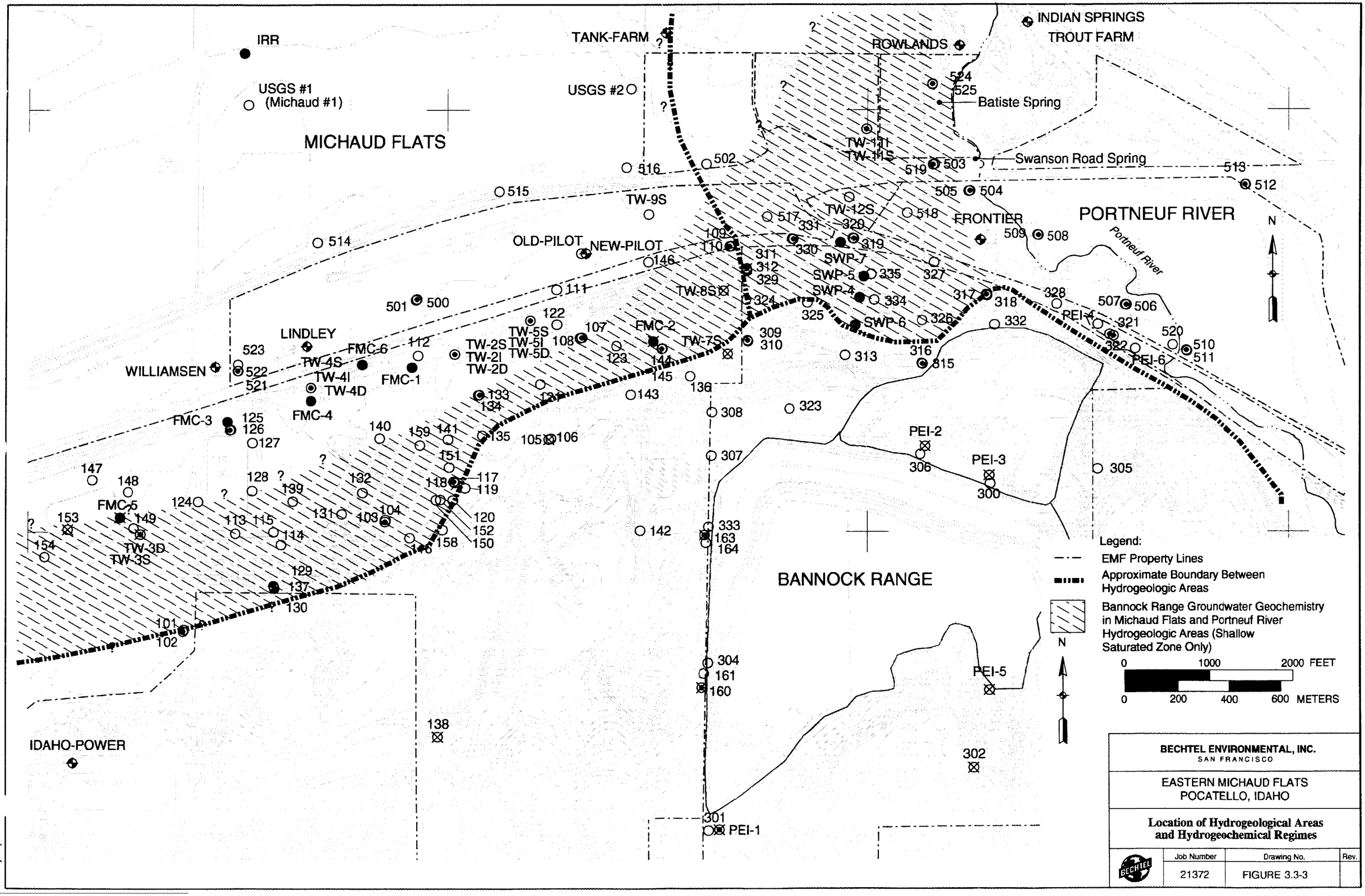

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Location of Hydrogeological Areas and Hydrogeochemical Regimes

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-3	

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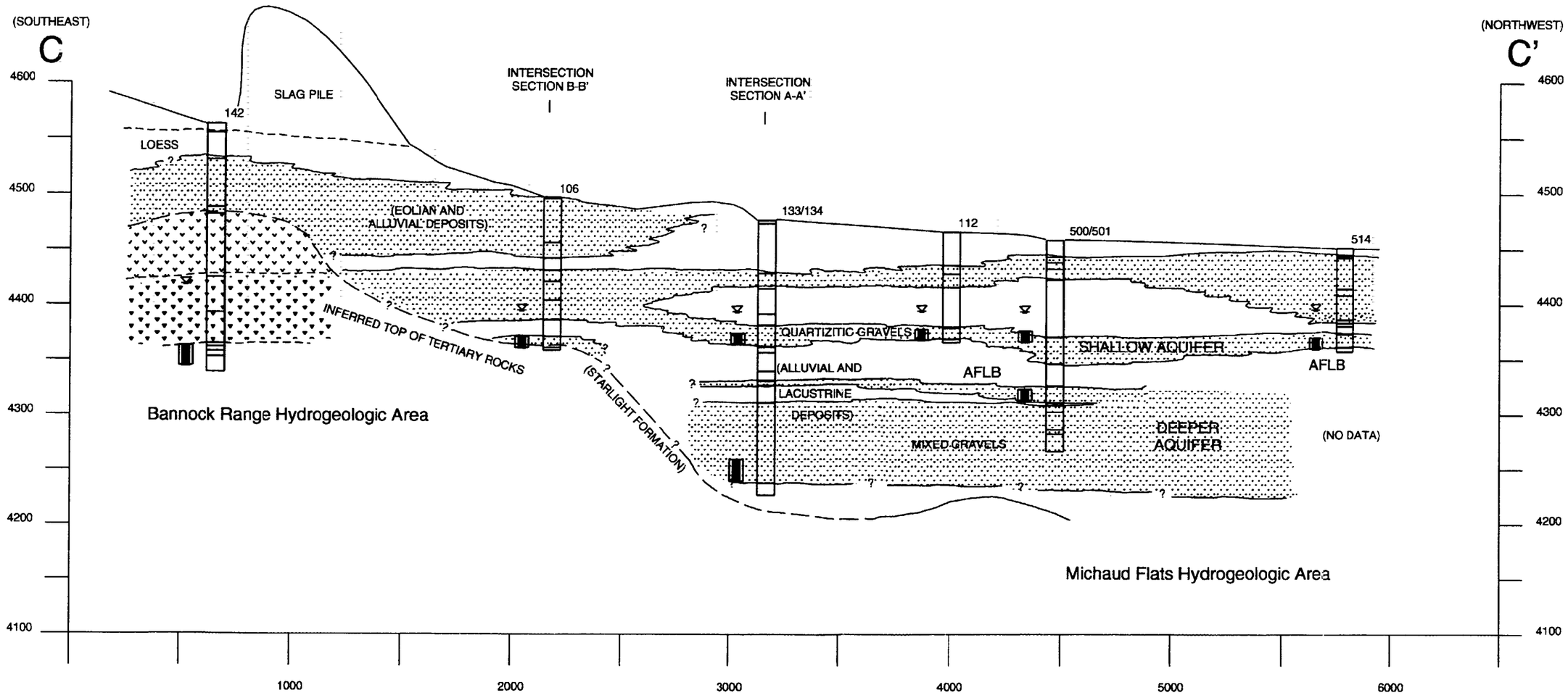

Notes:

1) Ground surface line generalized.
2) Vertical exaggeration = 5x
3) Cross-section is generalized.
   See boring logs in Appendix for further details.
4) Cross-section lines are shown in
   Figure 3.1-5.
5) AFLB = American Falls Lake Beds

Legend:

- Water level
- Well screen

SAND
GRAVELLY SAND
SILTY SAND
CLAYEY SAND
SANDSTONE
GRAVEL
SAND AND GRAVEL
SILTY, SANDY GRAVEL
SILTY GRAVEL
CLAYEY GRAVEL

SILT
CLAYEY SILT
SANDY SILT
GRAVELLY SILT

CLAY
SILTY CLAY
SANDY CLAY
GRAVELLY CLAY

BASALT
RHYOLITE
TUFF

CALICHE
PEAT

ASPHALT
CONCRETE
FILL

BECHTEL ENVIRONMENTAL, INC.
SAN FRANCISCO

EASTERN MICHAUD FLATS
POCATELLO, IDAHO

Hydrogeologic Cross-Section C-C'

Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-4	

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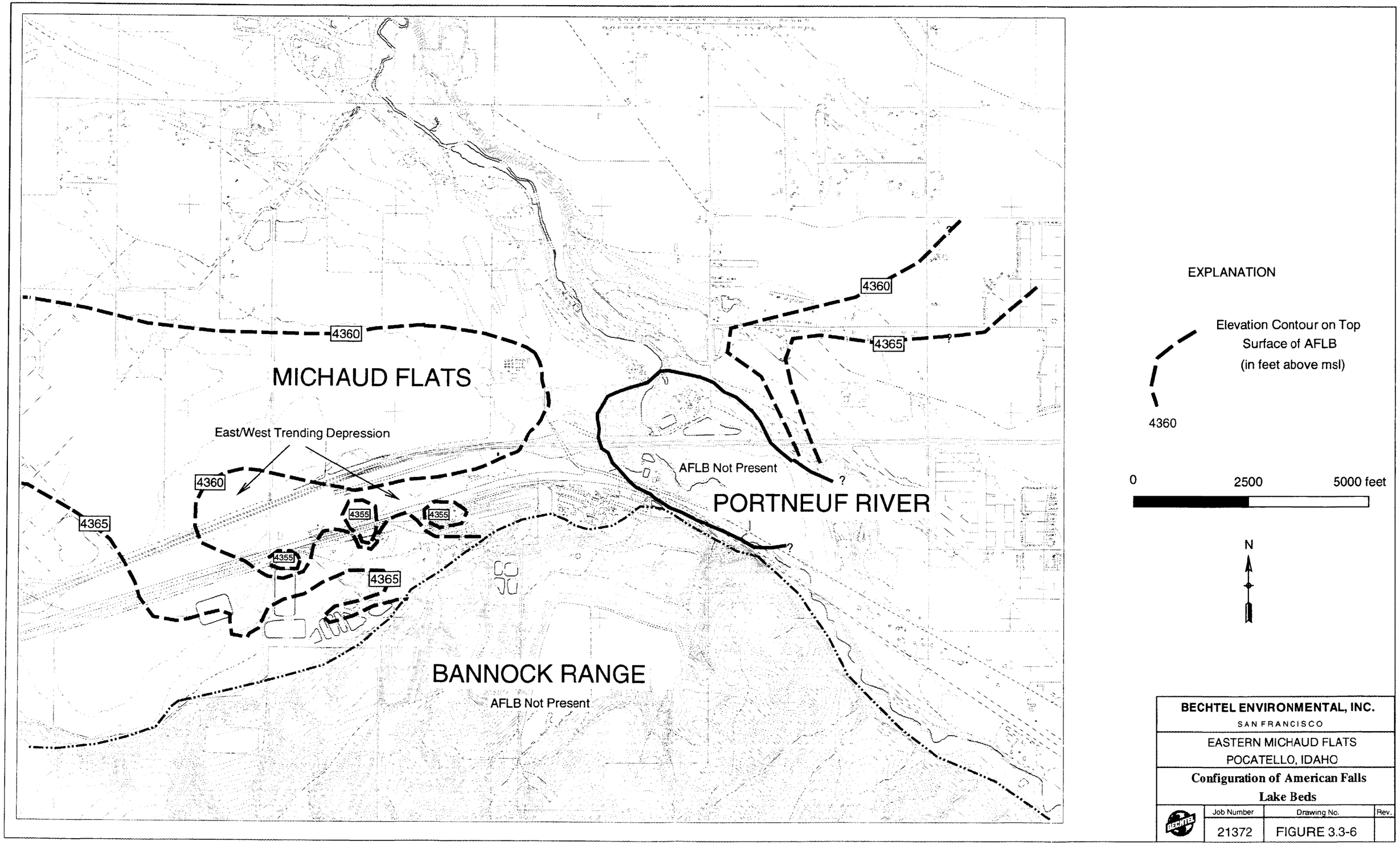

BECHTEL ENVIRONMENTAL, INC. SAN FRANCISCO		
EASTERN MICHAUD FLATS POCATELLO, IDAHO		
Configuration of American Falls Lake Beds		
Job Number	Drawing No.	Rev.
21372	FIGURE 3.3-6	

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