GROUNDWATER EXTRACTION AND MONITORING SYSTEM
REMEDIAL ACTION WORK PLAN

Simplot Operable Unit

Eastern Michaud Flats Superfund Site

Pocatello, Idaho

January 2010

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Acronyms and Abbreviations

SOW	Remedial Design/Remedial Action Consent Decree Statement of Work
ROD	Record of Decision
RODA	Record of Decision Amendment
RDR	Remedial Design Report
EMF Site	Eastern Michaud Flats Superfund Site
MCL	Maximum Contaminant Level
CSM	Conceptual Site Model for groundwater
EPA	Environmental Protection Agency
IDEQ	Idaho Department of Environmental Quality
VCO/CA	Voluntary Consent Order/Compliance Agreement
AFLB	American Falls Lake Bed
gpm	gallons per minute
kg/day	kilograms per day
mg/L	milligrams per liter
PVC	polyvinyl chloride
TDS	total dissolved solids
Eh	redox potential
pH	hydrogen ion activity
in	inches
ft	feet
TSD	Treatment, Storage and Disposal Facility
TCLP	Toxicity Characteristic Leaching Procedure

1.0 INTRODUCTION

This work plan provides the details for construction of the groundwater extraction and monitoring system described in the Groundwater Extraction and Monitoring System Remedial Design Report (GW RDR, Formation 2009a) for the Simplot Operable Unit (OU) portion of the Eastern Michaud Flats Superfund Site (the “EMF Site”) located near Pocatello, Idaho (see Figure 2-1). The groundwater extraction and monitoring systems are being implemented as part of the comprehensive remedy for the Simplot OU, as described in the Record of Decision (ROD; EPA, 1998) and Interim Amendment to the Record of Decision (IRODA; EPA 2010); and in accordance with the requirements of the Remedial Design/Remedial Action Consent Decree Statement of Work (SOW; EPA, 2002), the Voluntary Consent Order/Compliance Agreement (VCO/CA; IDEQ 2008), and the proposed First Amended Statement of Work for RD/RA Consent Decree (PSOW; EPA 2009).

Extraction of groundwater will be performed in conjunction with source control actions. Groundwater extraction acts as an interim action that will reduce the concentration of COCs in groundwater discharging to the Portneuf River until source control actions are implemented and become fully effective.

The groundwater extraction system is being installed in a “phased and integrated approach” (EPA 1997). In this approach, test extraction wells have been installed and tested to provide location-specific performance data. The extraction system will consist of the existing test extraction system that has been installed in previous investigation phases, along with additional proposed extraction wells that meet CERCLA and VCO/CA objectives. Monitoring wells and exploratory borings have also been installed in phases to address specific data gaps in the site conceptual model for groundwater. Uncertainties in the Conceptual Site Model (CSM) for groundwater have been greatly reduced with the completion of each phase of the extraction system and sufficient information is now available to design the remaining elements of the system, demonstrate that the complete system will meet remedy objectives, and plan the steps necessary to implement the design.

2.0 BACKGROUND

2.1 Site Description

The EMF Site is located near the City of Pocatello, Idaho and includes two industrial facilities (Figure 2-1): the FMC Elemental Phosphorus Facility (which ceased operations in December 2001) and the J.R. Simplot Don Plant. The Don Plant produces phosphoric acid and a variety of liquid and solid fertilizers. The U.S. Environmental Protection Agency (EPA) has divided the Site into three areas: the FMC OU includes the FMC facility and adjacent land owned by FMC; the Simplot OU includes the Don Plant and adjacent land owned by Simplot; and the Off-plant OU which surrounds the FMC and Simplot OUs.

The Simplot Don Plant covers approximately 745 acres and adjoins the eastern property boundary of the FMC facility. The main portion of the plant lies approximately 500 feet southwest of the Portneuf River. Of the 745 acres, approximately 400 acres are committed to the gypsum stack. Another 185 acres are occupied by the plant and its infrastructure. A significant portion of the remaining acreage to the south and southeast of the plant consists of cliffs and rugged steep terrain. A Union Pacific Railroad right-of-way is adjacent to the northern fence line of the Don Plant and passes through the northern portion of the Simplot OU, paralleling U.S. Highway 30. Access to the Don Plant is provided by Interstate 86 and U.S. Highway 30.

The Don Plant began production of a single superphosphate fertilizer in 1944. Phosphoric acid production began in 1954. The plant currently produces a variety of solid and liquid phosphorus- and nitrogen-based fertilizers. The principal raw material for the process is phosphate ore, which is transported to the facility via a slurry pipeline from the Smoky Canyon mine. The primary byproduct from the Don Plant process is gypsum (calcium sulfate) which is stacked on-site.

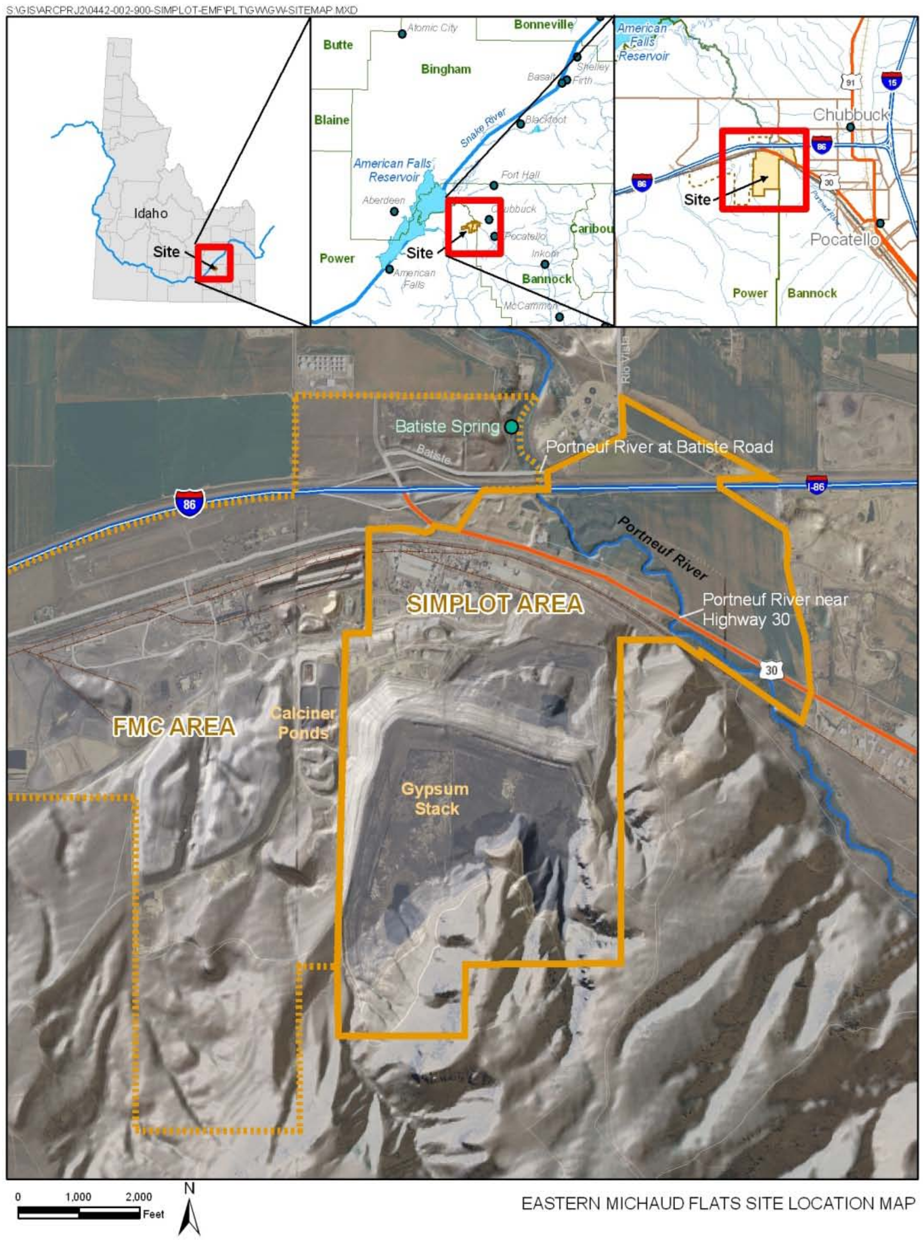

Figure 2-1: Site Location Map

2.2 Project History

Simplot completed the installation and testing of an initial test extraction system from 2003 to 2004 and began operation of ten test extraction wells in June 2004. Simplot submitted the Prefinal Groundwater Extraction RDR in November 2004. EPA, Simplot and their representatives met to discuss the design report in December 2004 and EPA provided comments on the design in April 2005. In May 2005 Simplot and the agencies began an interactive process of revising the design of the groundwater extraction system. This process involved integrating more recent EPA guidance such as *A*

Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems (in draft during the process and published in January 2008; EPA 2008). The process involved a number of meetings to transfer information with the goal of reaching consensus on design issues regarding the conceptual site model, identification of data gaps, design objectives, and required analyses. Simplot started a project website (Formation Environmental 2009b) at this time to document communications, field activities and data analyses.

This interactive process resulted in five additional site investigations that were performed to fill data gaps in the groundwater CSM:

- The Phase 1 Data Gap Investigation (NewFields 2006) was completed in late 2005 and early 2006 to investigate and evaluate the performance of the Upper Zone test extraction wells.

- Phase 2 Data Gap Investigation (NewFields 2008a) was completed over the period from 2006 to 2008 to further investigate and evaluate hydraulic properties and groundwater quality.

- A groundwater geophysical investigation (NewFields 2008b) was completed in the summer of 2008 to aid in the lateral and vertical delineation of contaminated groundwater in the Simplot OU between State Highway 30 and the Portneuf River.

- A special sampling event was completed in the spring of 2008 (NewFields 2008c). This sampling event incorporated an expanded list of analytes and sampling locations to the routine 2^{nd} quarter 2008 quarterly monitoring scope.

- A subsurface investigation was completed in the Phosphoric Acid Plant (PAP) Area in the winter of 2008-2009 (Simplot 2009).

Work plans for each of these investigations were prepared by Simplot and approved by EPA and IDEQ. After field investigations, draft reports were prepared by Simplot and comments on the reports were prepared by the agencies. In addition, as part of the interactive process, Simplot prepared draft technical memoranda on design issues and agencies prepared comments on these memoranda. All documents have been placed on the project website and are available to all project team members. Collectively, this body of work provides the technical basis for the designs presented in this document.

On April 11, 2008 Simplot signed a VCO/CA with the Idaho Department of Environmental Quality (IDEQ). The VCO/CA is intended to implement Simplot's responsibilities at the Don Plant fertilizer manufacturing facility located near Pocatello Idaho under the approved Total Maximum Daily Load (TMDL) for nutrients for the Lower

Portneuf River. Groundwater discharging from the Don Plant area has been identified as a major source of phosphorus loading to the river.

2.3 Design of Groundwater Extraction and Monitoring Systems

The design of the groundwater extraction and monitoring systems is presented in detail in the Groundwater Extraction and Monitoring System Remedial Design Report (Formation Environmental 2009a). A summary of the design of the systems is provided in the following paragraphs.

2.3.1 Groundwater Extraction System

The groundwater extraction system currently consists of 20 test extraction wells that were installed in two prior phases of work; phase 1 in 2003-2004 and phase 2 in 2007-2008. Eleven (11) of these wells are currently active. In the remedial design report a third phase of extraction well installation is proposed. In the third phase well 410 will be replaced with a new multilevel extraction well (E-1), two of the wells installed during the PAP subsurface investigation will be converted to extraction wells (wells 416 and 419), and an additional extraction well is proposed east of the existing well 413 (E-2). The locations of the extraction wells are shown in Figure 2-2.

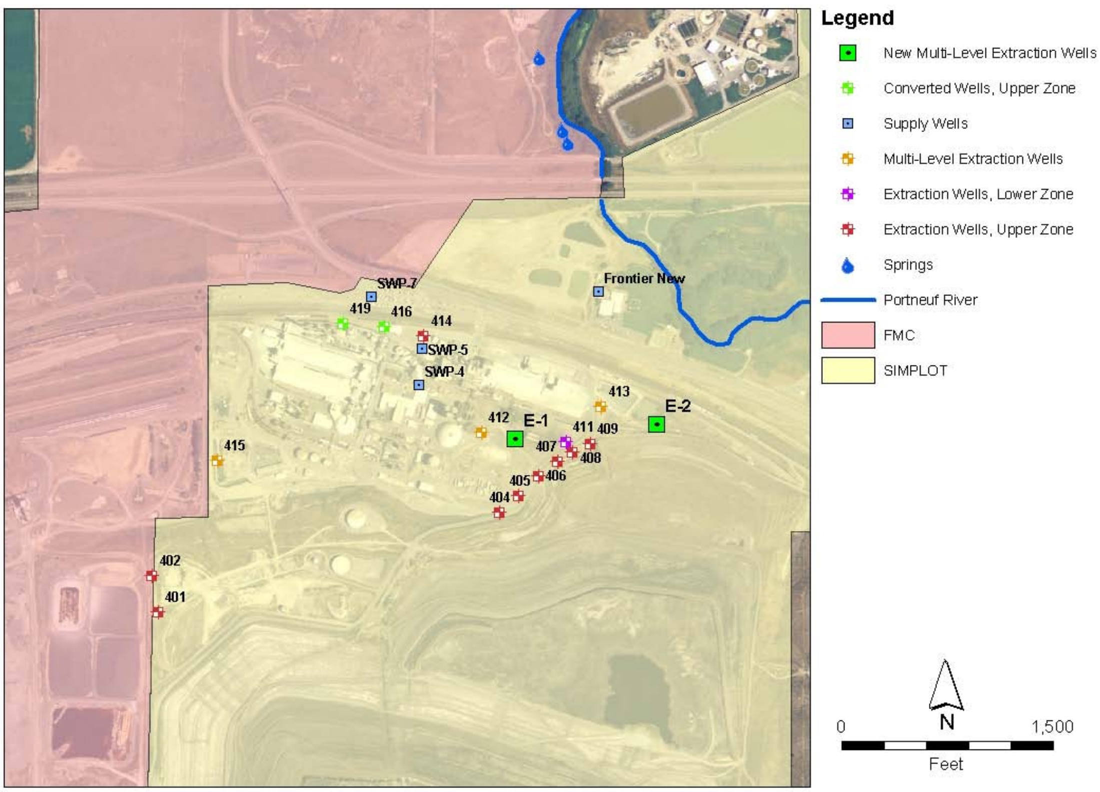

Figure 2-2: Location of existing extraction wells, monitoring wells 416 and 419 to be converted to extraction, and new multilevel wells, E-1, and E-2.

2.3.2 Groundwater Monitoring System

The groundwater monitoring system in the Simplot OU has been divided into four sub-areas based on monitoring objectives and performance criteria. The sub-areas are shown in Figure 2-3. The sub-areas are as follows:

- Don Plant Area
- Target Capture Overlay (in Don Plant Area)
- Assessment Area
- Compliance Area

The Don Plant Area includes potential source areas, areas immediately downgradient of potential source areas and the target groundwater extraction capture zones. The monitoring well network in this area is expected to provide groundwater quality data that can be used to track constituent concentration trends, evaluate the migration of and concentrations of constituents in groundwater to the target capture zones, and assess the adequacy of the target capture zones. The network also needs to provide water level data at a sufficient scale so that groundwater gradients and flow paths can be evaluated. The monitoring well data will also be used to assess source control actions at the gypsum stack and in the PAP Area.

The Target Capture Overlay Area is superimposed on the Don Plant Area and has additional monitoring requirements. Data collection needs in this overlay also include tracking groundwater flow and water levels in extraction wells, and the collection of additional water level data from monitoring wells to assess extraction well capture.

The Assessment Area is downgradient of the groundwater extraction system and extends to the Compliance Area. The groundwater monitoring network in this area is expected to provide sufficient lateral and vertical spacing to delineate the plume of groundwater affected by Simplot operations. Water quality and water-level data will be collected from the network of wells to confirm the position of the plume, assess trends in water quality, and assess groundwater gradients and flow paths. In addition, a subset of monitoring wells in the upgradient portion of this area will be used to provide an interim target concentration that can be compared to the concentrations in the Compliance Area.

Groundwater concentration data collected in the Compliance Area will be compared with applicable water quality standards. Similar to the Assessment Area, monitoring wells need to be placed at appropriate lateral and vertical spacing to delineate the position of the plume of affected groundwater prior to its discharge to the Portneuf River.

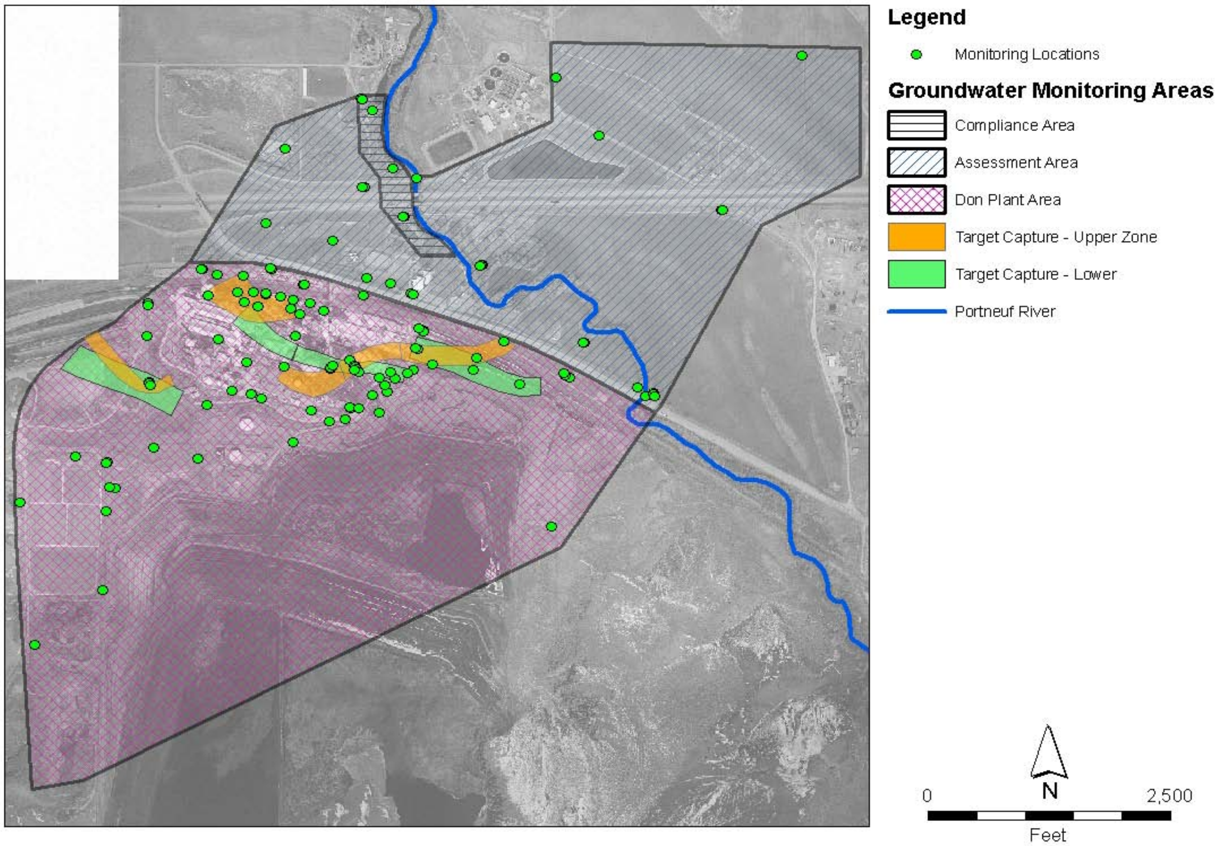

Figure 2-3: Location of monitoring areas within the Simplot Area

In the GW-RDR, thirteen additional monitoring well nests are proposed for installation. The locations of the additional wells are shown in Figure 2-4.

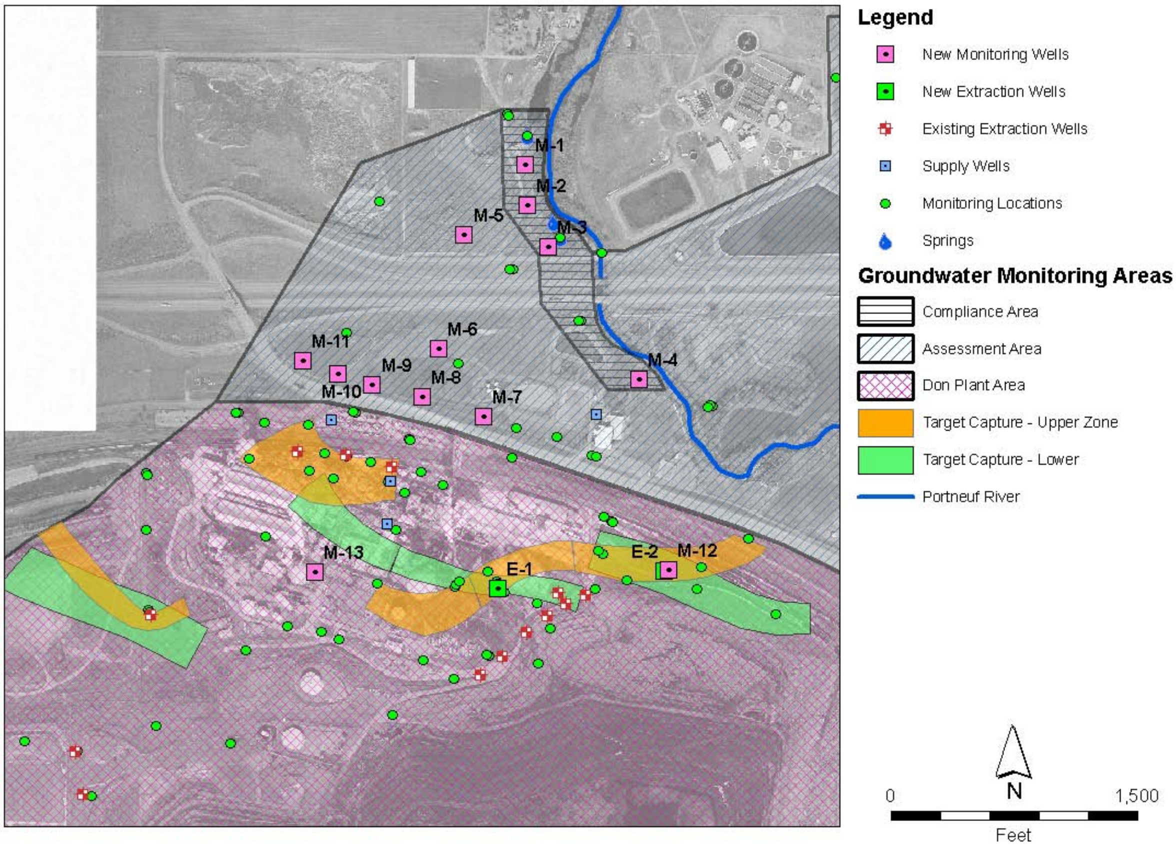

Figure 2-4: Proposed locations of additional monitoring wells.

3.0 TECHNICAL APPROACH

The technical approach for the remedial action (installation of the groundwater extraction and monitoring systems) is described in the following sections. The approach provides for the analysis of field data during drilling and well installation to ensure that the wells are in the proper positions (laterally and vertically), allows for review of design processes that require the analysis of field data, and that the installations are designed properly. The general approach was developed during the Phase 2 Data Gap Investigation and is documented in the Phase 2 Data Gap Investigation Report (NewFields 2008a).

3.1 Phased Approach for Installation of Extraction and Monitoring Wells

The remedial design allows some flexibility for modifications to be made based on observed field conditions. The field data collection program is designed so that many of the decisions can be made during construction. The field program will be documented on the project website http://www.formationenv.com/Simplot_emf/ to allow data to be reviewed by the oversight agencies so that they can provide input during construction. Providing field data on the project website combined with field oversight and remote communication has proved to be an effective process for the completion of construction activities and has been in use since 2005. Based on previous efforts a phased approach will be followed for the construction of the final groundwater extraction and monitoring systems. The following phased approach will be followed:

- First Field Effort – During the first field effort, monitoring wells, shallow extraction wells, and pilot borings for the deep extraction wells are completed using a resonant sonic drilling rig. Sonic drilling has proved to be the best drilling method for this effort. Field logs and analytical data will be posted on the project website and conferences arranged with project personnel and oversight agencies to make critical decisions such as the location of monitoring wells and the position of screen intervals.

- Multilevel Extraction Well Design – Following the first field effort, data collected from the pilot boring program will be used to provide detailed designs of the deep, multilevel extraction wells. A memorandum providing the well designs and supporting calculations will be provided to the oversight agencies for comment/approval.

- Second Field Effort – During the second field effort, the deep multilevel extraction wells will be installed. A drilling rig capable of drilling the large diameter borings using an advance casing air rotary will be mobilized for this effort. Sonic drilling methods are not capable of drilling the borings required to install the deep multilevel wells. Permanent piping, electrical, and instrumentation are completed and aquifer testing is performed at the new extraction wells.

The specific methods that will be used during each of these phases are described in the following sections.

3.2 Investigation, Design, and Construction Methods

3.2.1 Groundwater Chemistry Profiling

During the first field effort, analyses of groundwater samples for indicator constituents of site-affected groundwater will be performed during drilling of multi-level monitoring wells and pilot borings for multilevel extraction wells. The “real-time” analyses will be performed where a more detailed understanding of the vertical distribution of constituents is required for the selection of screen intervals.

Groundwater samples will be collected from the saturated zone during drilling. Since the sonic drilling method will advance casing to 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 will be placed near the tip of the advance casing and the groundwater will be pumped to the surface for analysis and sampling. Groundwater quality parameters will be monitored continuously during pumping until a representative sample can be obtained. Since some potable water is used in the sonic drilling method, pumping must continue until the effects of the introduced water are overcome. Such effects can be observed by monitoring pH, temperature, and specific conductance. Once representative conditions are observed, a sample of the discharge will be collected and analyzed in the field for the parameters listed in Table 3-1. One sample will be collected and analyzed for approximately every 10 feet of drill depth. The results will be used in conjunction with lithologic logging and groundwater productivity observations to select intervals for placement of monitoring well screen.

Table 3-1: Groundwater analyses conducted during drilling.

Analytical Parameter	Method
pH	Multi-probe field meter
Specific Conductivity	Multi-probe field meter
TDS	Multi-probe field meter
Eh	Multi-probe field meter

Analytical Parameter	Method
Oxygen, Dissolved	Multi-probe field meter
Temperature	Multi-probe field meter
Sulfate	HACH portable Colorimeter
Phosphorus	HACH portable Colorimeter

3.2.2 Monitoring Well Relocation and Abandonment

In the design of the groundwater monitoring system the objectives of many of the monitoring well locations include the expectation to encounter either site-affected groundwater or groundwater that is not site-affected. If field observations (see previous section) indicate that groundwater conditions are contrary to the expectations for the location then completion of a monitoring well location should be re-evaluated. The re-evaluation will require rapid analysis of the information and a consensus decision without delay of the drilling contractor. This can be achieved using the project website to rapidly disperse field data and by conferencing.

There are three likely outcomes in this situation:

- Abandon the location and drill a new boring at a new location.
- Complete a monitoring well at the location and drill an additional boring at a new location.
- Complete a monitoring well at the location without drilling any additional borings.

If the monitoring well is abandoned the borehole will be backfilled with bentonite chips while the advance casing is withdrawn.

3.2.3 Upper Zone Extraction Well Design

The design concept for Upper Zone extraction wells was developed during the Phase 1 Data Gap Investigation (NewFields 2006). The design concept allows for the installation of larger screen slot size (up to 0.120-inch) and developing native filter pack. This design was implemented at well 414 during the Phase 2 Data Gap Investigation. The design results in an efficient well; however, productivity of Upper Zone extraction wells is limited by the small saturated thickness encountered at most well locations.

3.2.4 Multi-Level Extraction Well Design

The multilevel extraction well design concept was developed during the Phase 2 Data Gap Investigation (NewFields 2008a). The design concept incorporates two important elements 1) co-extraction of Upper and Lower Zone groundwater and 2) selective placement of well screens.

Co-extraction of Upper and Lower Zone groundwater is achieved by placing separate well screens in these intervals within the same extraction well. This method was used to install wells 412 and 413 in the East Plant Area during the Phase 2 investigation. Measurements of pumping water levels in these wells indicates that the drawdown of groundwater is below the base of the Upper Zone at normal pumping rates and that effective drawdown can be attained for both the Upper and Lower Zones in the same well. Selective screen placement involves isolating coarse-grained water producing layers with well screen and filter pack that is designed specifically for each interval and not placing well screen across non-productive zones. A general diagram showing the multi-level extraction well design is shown in Figure 3-1.

As discussed previously, the design process involves a phased approach of 1) drilling a pilot boring using sonic drilling methods 2) analyzing the data obtained during drilling and proposing a well design and 3) installing the well using an air rotary advance casing method. Sonic drilling provides continuous core and allows a detailed delineation of subsurface geology. Candidate intervals for well screen placement can be identified based on the geology observed and results of any groundwater profile sampling conducted. Samples of the core within the candidate intervals are submitted for gradation analyses which are used to select screen slot size and filter pack gradation. Selection of appropriate filter pack gradation and screen slot size is made based on the method described in *Groundwater and Wells* (Driscoll 1986). The well design is presented to oversight agencies for approval prior to mobilizing the well installation crew.

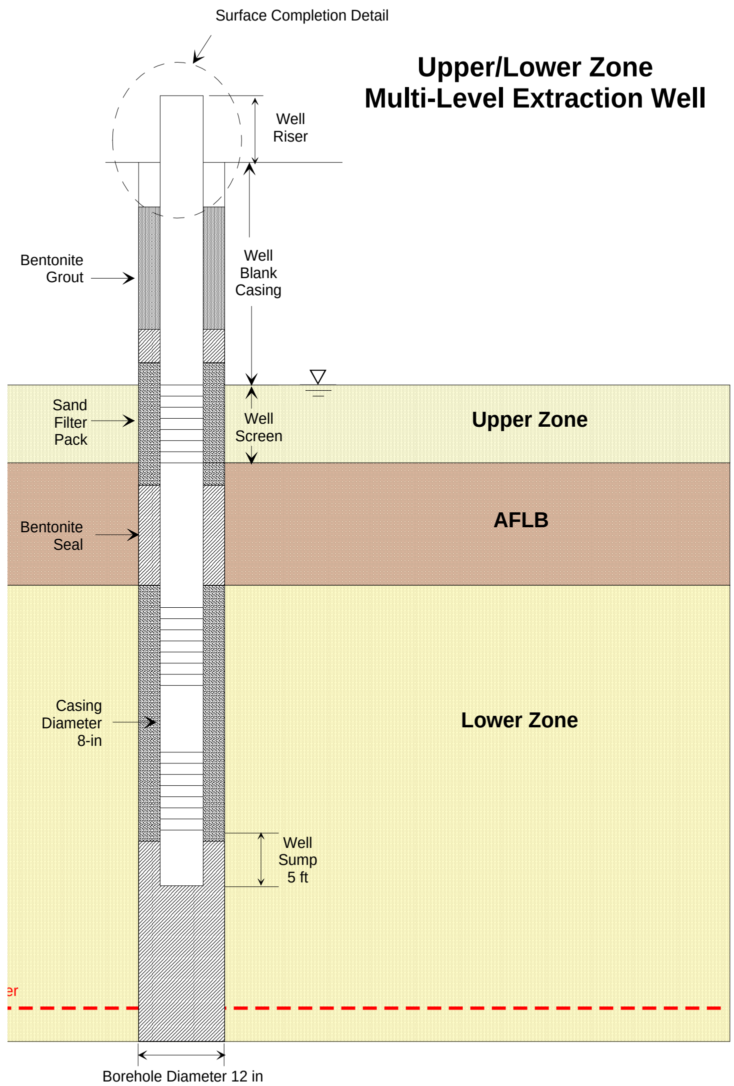

Figure 3-1: Potential configurations for multi-level monitoring well and extraction well completions.

3.2.5 Nested Monitoring Well Design

Monitoring wells will be completed with more than one screened-interval where information regarding vertical distribution of constituents and/or groundwater level is desired following drilling. All screened intervals in nested wells will be within either the upper or the lower zone for multilevel wells being installed in locations where the AFLB is present, for example M-13. During the Phase 2 Data Gap Investigation single monitoring wells with more than one screened interval (multilevel wells) were installed (4-in diameter). These wells were later retrofitted into nested wells by placing a series of 1-in diameter casings within the 4-in casing to provide physically separate intervals. The design concept for additional nested wells involves placing 2-in diameter well casings directly within an 8-in diameter boring.

Monitoring wells will be completed using PVC casing and well screen. Well screen will consist of 0.020-in continuous slot. Filter pack will consist of 10/20 silica sand. Continuous slot well screen provides more open area than non-continuous slot, which enhances the ability to develop the well, and improves well efficiency during sampling. In order to measure vertical distribution of groundwater head potential, screen intervals will be limited in length and separated by blank casing and annular bentonite seals.

Groundwater samples collected from nested monitoring wells will be analyzed to assess the accuracy of the results of the vertical profile groundwater samples collected during drilling, provide measurements of groundwater levels and vertical gradients, and allow head measurements in more than one zone during pumping tests.

3.3 Process for Bringing New Extraction Wells On-Line

Four new extraction wells will be brought on-line as part of this phase of work; the planned wells E-1 and E-2 and the existing wells 416 and 419 which will be converted from monitoring wells. The general process for bringing a new extraction well on line involves the following steps:

1. The well is drilled and completed as specified in the work plan.

2. A step drawdown test is conducted immediately following well development. This test provides information to select the proper pump for permanent installation and size the groundwater collection system. The step drawdown test also provides baseline performance data.

3. The well is fitted with a submersible well pump, discharge piping, well head controls and instrumentation. Above ground controls typically consist of a block valve, sample port, flow meter, control valve and block valve in a pipe size similar to the discharge size of the pump. All above ground piping is insulated and heat taped. A water level indicator is installed in a dedicated ¾-in diameter PVC drop pipe. Discharge piping is typically SDR 11 HDPE and is either buried or placed along pipe racks above grade with insulation and heat tape.

4. The submersible pump is level controlled with a variable frequency drive (VFD) controlling the pump motor. The control valve and VFD can be operated remotely via a telemetry interface. Telemetry allows for the continuous logging of flow rate, level, and VFD at central control. Once installed the well controls and

interface with central control is tested and adjustments made until the well is running at an optimal flow rate.

5. A constant rate aquifer test is performed to provide data that can be used to assess aquifer transmissivity in the vicinity of the extraction well. The aquifer test is performed by shutting off the extraction well so that static water level conditions are established. Locally controlled pressure transducers and data loggers are placed in the pumping well and nearby wells to continuously monitor water levels. Water levels in extraction wells are monitored with both a local pressure transducer/data logger and the system pressure transducer. Pumping is initiated in the extraction well and water levels monitored the extraction well and in nearby wells. Pumping is continued for a minimum of 24 hours.

6. The results of the aquifer test are used to make calibration adjustments to the system level control and to assess aquifer transmissivity. Aquifer transmissivity values and level measurements in nearby wells are used to assess the capture zone for the extraction well.

7. The well is placed in operating mode at the optimal pumping rate indicated by the results of testing.

The first two steps of this process were completed for wells 416 and 419 during the PAP Subsurface Investigation (Simplot 2009).

4.0 WELL DESIGN AND INSTALLATION TASKS

4.1 Task 1 - Drilling and Well Installation, First Field Effort

During the first field effort nine nested monitoring wells, one pilot boring, and one shallow extraction well will be installed. The locations of the wells and borings are shown in Figure 4-1. A summary of the purpose of each of these wells is provided in Table 4-1.

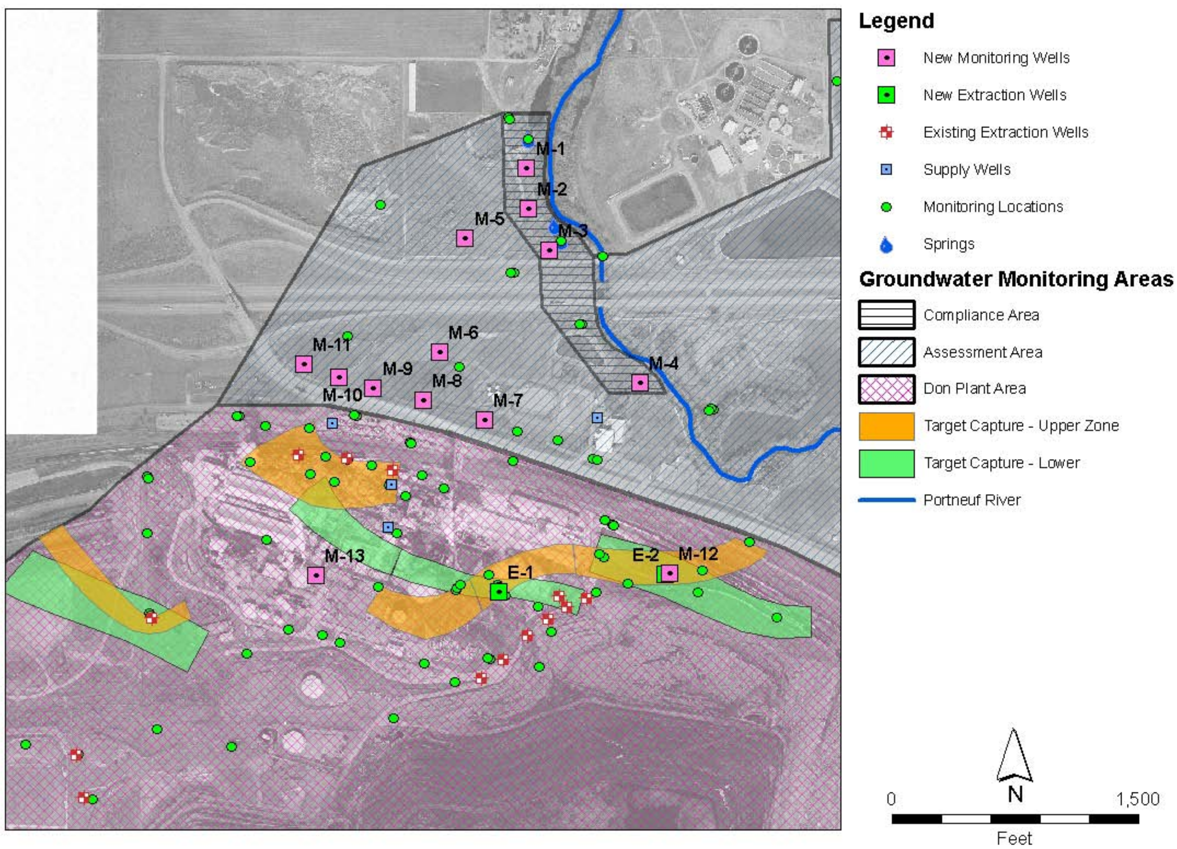

Figure 4-1: Proposed locations of additional monitoring wells

Table 4-1: Summary of first field effort monitoring wells and pilot borings

Proposed Boring	Location	Type	Number of Zones	Primary Purpose
M-1	Compliance Area	Nested Monitoring Well	2	Provide monitoring intervals in affected groundwater and unaffected groundwater

Proposed Boring	Location	Type	Number of Zones	Primary Purpose
M-2	Compliance Area	Nested Monitoring Well	2	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-3	Compliance Area	Nested Monitoring Well	2	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-4	Compliance Area	Nested Monitoring Well	2	Confirm plume boundary. Provide monitoring intervals in unaffected groundwater only
M-5	Assessment Area	Nested Monitoring Well	2	Confirm plume boundary. Provide monitoring intervals in unaffected groundwater only
M-6	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-7	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-8	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-9	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-10	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-11	Assessment Area	Nested Monitoring Well	2 - 3	Provide monitoring intervals in affected groundwater and unaffected groundwater
M-12	Target Capture Area Upper East	Monitoring Well	1	Provide upper zone monitoring interval for the collection of water level data near extraction well E-2
M-13	Target Capture Area Lower Central	Nested Monitoring Well	3 - 4	Provide monitoring intervals in the Central Plant Lower Zone up gradient of SWP-4
Boring E-1 (B-410)	Target Capture Area Upper East	Pilot Boring	NA	Provide well design data for multilevel extraction well that will replace well 410
Boring E-2	Target Capture Area Upper East	Pilot Boring	NA	Provide well design data for multilevel extraction well located east of well 413

4.1.1 Extraction Well Pilot Boring

A pilot boring is required at the locations of the multilevel extraction well E-2. The extraction well E-1 is a proposed replacement for well 410. An exploratory boring was drilled at this location during the Phase 2 investigation, boring B-410. Adequate data were collected from this boring to design the extraction well E-1. As a result, only one pilot boring (for well E-2) will be completed during the first field effort.

The pilot boring for well E-2 will be drilled using the resonant sonic method with a boring diameter of 8 inches. This boring will be drilled to the top of the volcanic bedrock (the trachyandesite of the Starlight Formation) to completely penetrate the target capture zone. This is similar to the pilot boring for the nearby multilevel extraction well 413, and the nested monitoring wells at 363, 364, and 366, completed during the Phase 2 investigation. Groundwater profile sampling will be performed at intervals of approximately 10 feet. Continuous core will be laid out on visqueen that is incremented by depth interval (feet), photographed, and a detailed lithologic log completed. Soil samples will be collected from selected water producing zones for gradation analyses. Gradation analyses will be performed by a local lab. The total estimated depth of drilling is from 125 to 175 feet.

4.1.2 Nested Monitoring Wells

All monitoring wells, M-1 through M-13 will be drilled using the resonant sonic method with a boring diameter of 8 inches. This will allow the installation of up to three 2-inch diameter well casings within the boring, or up to four 1-inch diameter well casings. A Blatypus Pump Mini (BESST), which has a 7/8" diameter, will be used to sample 1-inch wells. If 1-inch casings are necessary in well M-13, EPA and IDEQ will be notified prior to installation. The total depth of the each boring will be determined by chemical analyses of groundwater samples collected during drilling (vertical profile sampling). Drilling will continue into unaffected groundwater a minimum of 30 feet. Unaffected groundwater will be determined by the analysis of sulfate and phosphorus concentration and measurements of specific conductance performed in the field. Based on the analysis of groundwater in the areas where the monitoring wells will be installed, background concentrations are about 60 mg/L for sulfate, 0.1 mg/L for phosphorus, and a specific conductance of about 650 uS/cm. Groundwater profile sampling will be performed at intervals of approximately 10 feet. The borings for wells M-12 and M-13 will be drilled to the top of the volcanic bedrock (the trachyandesite of the Starlight Formation) to completely penetrate the target capture zone. Continuous core will be laid out on visqueen that is incremented by depth interval (feet), photographed, and a detailed lithologic log completed.

At each of the monitoring wells M-1, M-2, M-3, and M-6 one monitoring interval will be located in the zone of affected groundwater and one interval will be located just below the zone of affected groundwater. These wells are located in the area where the AFLB is absent and the plume of affected groundwater has migrated toward the water table due to the upward groundwater hydraulic gradient. The depth interval over which affected groundwater is encountered will be confirmed through groundwater profile sampling and well screens located appropriately.

Monitoring wells M-4 and M-5 are intended to be located outside of the plume of affected groundwater. These locations were selected based on the results of the groundwater geophysical investigation and the groundwater profile sampling that will be conducted during drilling will need to confirm this finding. If the location is suitable (i.e. affected groundwater is not present), the well will be completed with two monitoring intervals. An upper monitoring interval will be positioned to correlate with the screen intervals in nearby wells that are located within affected groundwater and a lower interval will be positioned to correlate with the screen intervals in nearby wells that are located below the zone of affected groundwater. If affected groundwater is encountered at this location then the well nest will be completed in a similar manner as M-1, M-2, and M-3. Based on these criteria, these monitoring well nests will be installed last in the first effort drilling schedule.

Monitoring wells M-7, M-8, M-9, M-10, and M-11 will be installed in a similar manner as M-1 through M-6. Based on the conditions observed at the nearby nested wells 528 and 529, these wells will be located near the northern limit of the AFLB. In this zone, affected groundwater migrating from south the Lower Zone is migrating upward and mixing with affected groundwater in the Upper Zone at the two units merge. As a result, the plume of affected groundwater may extend over a greater depth range and a third screen interval may be required to adequately assess the vertical extent of affected groundwater.

Monitoring well M-12 will be installed approximately 25 feet away from the location of extraction well E-2. The primary purpose of this monitoring well nest is to provide hydraulic data in the Upper Zone near extraction well E-2 that can be used to assess the performance of the well.

Monitoring well M-13 will be installed approximately 10 feet away from the location of Upper Zone monitoring well 341. The boring will be drilled to the top of the volcanic bedrock and well screen intervals placed in productive intervals in the Lower Zone. Up to 4 screen intervals will be placed and 1-in diameter well casing will be used in this case.

Monitoring wells M-1 through M-12 will be constructed with 2-in diameter Schedule 40 PVC casing. Well screens will be 0.020 in continuous slot with a maximum of length of 10 feet. All well casings will be placed within the same boring and well screens will be placed in a filter pack consisting of 10/20 silica sand and will be separated by a minimum of 10 feet of bentonite.

If 4 screen intervals are necessary to complete monitoring well M-13, the wells will be constructed with 1-in diameter Schedule 40 PVC casing. Well screens will be 0.020 in slotted casing with a maximum of length of 10 feet. All well casings will be placed within the same boring and well screens will be placed in a filter pack consisting of 10/20 silica sand and will be separated by a minimum of 10 feet of bentonite. A ZIST receptacle will be installed above the Lower Zone and bedrock well screens to facilitate sampling with a 1-in diameter pump.

4.1.3 Well Development

All wells will be developed by surging, bailing, and pumping. Jetting may also be used if necessary. Water may need to be introduced into the well to facilitate development. Continuous monitoring of field parameters of the water produced during development will be conducted. The water quality data will be used to establish trends in water quality and demonstrate the effect of development. Desired trends are stabilization in specific conductance and pH (to within 10%), and minimization of turbidity (sand and silt). Samples of sediments removed from well will also be collected. Sediment grain sizes will be noted and trends in size during development tracked. During pumping, water levels in the well and discharge rates will be monitored.

4.2 Task 2 - Groundwater Sampling

Groundwater sampling will be performed concurrently with the well drilling task (vertical profile sampling). Low-flow groundwater samples will also be collected from monitoring wells with multiple screened intervals immediately after wells are completed to confirm the results of the profile sample analyses.

4.2.1 Sampling During Drilling

Groundwater samples will be collected at all multilevel well locations and pilot borings during drilling by pumping from within the drill casing. Samples will be collected at approximately 10-foot intervals and analyzed for the parameters listed in Table 2-1. The samples will be used to provide a profile and delineate the vertical extent of affected groundwater.

4.2.2 Sampling Following Well Installation

Following well installation and development, low-flow sampling techniques will be employed to provide groundwater samples from the separate screened intervals. Sampling will be performed in accordance with the Groundwater and Surface Water Monitoring Plan (Formation Environmental 2009c). Samples will be analyzed for the parameters listed in Table 4-2.

Table 4-2: Analyte list for groundwater

Analyte	Method	Reporting Limit (RL)	Units
Field Parameters			
Oxidation Reduction Potential	Field Meter	1 mV	mV
Oxygen, Dissolved	Field Meter	0.1	mg/L
pH	Field Meter	±0.1	SU
Specific Conductivity	Field Meter	5	µmho/cm
Temperature	Field Meter	0.1	^{o}C
Turbidity	Field Meter	±0.1	NTU
General Chemistry			
Alkalinity	2320B	1	mg/L
Chloride	300.0	0.2	mg/L
Hardness	2340B	0.347	mg/L
Sulfate	30.0	0.3	mg/L
TDS	2540C	10	mg/L
Metals			
Antimony	200.8	0.003	mg/L
Arsenic	200.8	0.003	mg/L
Beryllium	200.7	0.002	mg/L
Boron	200.7	0.04	mg/L
Cadmium	200.8	0.0002	mg/L
Calcium	200.7	0.04	mg/L
Chromium	200.7	0.006	mg/L
Magnesium	200.7	0.06	mg/L
Manganese	200.7	0.004	mg/L
Mercury	245.1	0.0002	mg/L
Nickel	200.7	0.01	mg/L
Potassium	200.7	0.5	mg/L
Selenium	200.8	0.002	mg/L
Sodium	200.7	0.5	mg/L
Thallium	200.8	0.001	mg/L
Vanadium	200.7	0.005	mg/L
Uranium	200.8	0.001	mg/L
Zinc	200.8	0.01	mg/L
Nutrients and Fluoride			
Nitrite+Nitrate (as N)	353.2	0.02	mg/L
Phosphorus, Total	SM 4500-P-E	0.01	mg/L

Analyte	Method	Reporting Limit (RL)	Units
Fluoride	300.0	0.1	mg/L

4.3 Task 3 - Multi-Level Extraction Well Design

There will be a pause in field activities to allow for the design of the multi-level extraction wells E-1 and E-2. A design memorandum will be prepared and submitted to the oversight agencies for approval. The memorandum will include:

- Boring logs and core photographs of the pilot boring core
- Results of groundwater profile sampling
- Laboratory results of gradation analyses
- An analysis of the gradation tests to determine screen slot size and appropriate filter pack for each screen interval
- Well design drawings showing well construction details

Simplot will begin the drilling contractor selection process during the well design so that wells may be installed as soon as possible following approval of the designs.

4.4 Task 4 - Drilling and Well Installation, Second Field Effort

Extraction wells E-1 and E-2 will be drilled using a casing advance method. The borings will be advanced to provide for a minimum 16-inch diameter borehole to total depth. This will allow the installation of well with a casing diameter of 10 inches. The total depth of the borings will be determined in the well design process.

Both the Upper and Lower Zones will be screened. All screen intervals will be separated by blank casing and a bentonite seal. Well screen will consist of continuous slot stainless steel casing. Slot size and appropriate filter pack will be selected based on the results of gradation analyses.

4.5 Task 5 - Aquifer Testing

The aquifer testing program is designed to provide the hydraulic data necessary for well capture calculations. A series of tests will be performed at each of the new extraction wells E-1 and E-2. Single well pumping tests and/or slug tests will be performed in each of the new monitoring wells installed.

4.5.1 Aquifer Testing with New Extraction Wells E-1 and E-2

The expected sequence of extraction well testing is as follows:

1. Install pumps, discharge piping, and instrumentation at each new extraction well
2. Setup barometric monitoring and site wide groundwater level background monitoring at one Lower Zone and one Upper Zone monitoring well.
3. Perform step drawdown tests in new test wells E-1 and E-2.
4. Perform 24-hour constant rate pumping tests at wells E-1 and E-2.

4.5.1.1 Installation of Pumps, Piping, and Instrumentation

Electrical supply, submersible pumps, discharge piping, flow rate and water level instrumentation will be provided for each of the extraction wells as permanent installations prior to completing aquifer testing. A summary of the preliminary requirements for pumps is provided in Table 4-5.

Table 4-3: Pumping requirements for new extraction wells E-1 and E-2

Extraction Well	Location	Pumping Interval	Maximum Flow Rate (gpm)	Maximum Lift at Well (ft)	Maximum Pump Diameter (in)
E-1	East Plant	Upper and Lower Zones	200	100	6
E-2	East Plant	Upper and Lower Zones	200	100	6

The type of submersible pump (Grundfos model 230S250-9BB) currently installed in wells 410 and 411 is adequate for use for the pumping tests at wells E-1 and E-2. This pump has the capacity to pump over 300 gpm with 150 feet of total head and requires 60 amps of 3 phase 460 volt power.

Flow and water level data will be collected continuously for each extraction well. Flow rates are measured with electromagnetic flow meters (manufactured by Krone). Groundwater level is monitored with pressure transducers (LevelTroll 500 model manufactured by InSitu). Well pumps are fitted with a variable frequency drive (VFD) which allows the speed of the pump motor to be varied to regulate flow rate. The flow and level data are transmitted to a central control point by radio signal.

Discharge piping for the new extraction wells E-1 and E-2 will consist of HDPE piping buried below grade. The piping for well E-1 will be tied into the existing piping at well 410. A new pipeline segment will be constructed from E-2 to well 413 and tied into the existing system. The piping from both E-1 and E-2 will report to the pH adjustment system prior to rerouting to the belt filter spray pits.

4.5.1.2 Barometric and Background Monitoring

Water levels in selected wells close to but outside of the areas of influence of each of the pumping tests will be continuously monitored prior to, during, and following the completion of the aquifer tests. Barometric monitoring will also be performed at the site. The data will be used to develop trends and responses to barometric fluctuations and correct level data used for analysis. The following wells will be continuously monitored (Figure 4-3):

- East Plant – 315 (Upper Zone), 316 (Lower Zone)

4.5.1.3 Step-Drawdown Tests

Step-drawdown tests will be conducted in each test well to assess optimal pumping rates and well performance of these newly installed wells. The following general procedures will be used in each test:

- Step-drawdown tests will consist of at least 4 steps of increasing discharge; each step will be run for a period of 30 to 60 minutes or until the water level has stabilized
- Water levels will be gauged using a pressure transducer placed in the pumping well (e.g., InSitu LevelTroll) and periodically checked with a manual water level indicator.

4.5.1.4 Well E-1 Aquifer Testing – East Plant Upper and Lower Zones

A 24-hour constant rate pumping test will be conducted using well E-1 as the pumping well. Well E-1 will be screened in both the Upper and Lower Zones. The layout of the test is shown in Figure 4-3 and observation well details are provided in Table 4-5. The following general procedures will be followed:

- All east plant extraction wells will be shut down at least one day prior to initiation of testing and remain shut down during the testing.
- Water levels will be gauged using pressure transducers and data loggers (e.g., InSitu LevelTroll). It is anticipated that 8 pressure transducers will be required for this testing.

- Pressure transducers will be installed in the pumping well (E-2), Lower Zone wells 410, 326 and 344, and Upper Zone monitoring wells 338 and 339.
- Measure recovery of water levels following cessation of pumping.

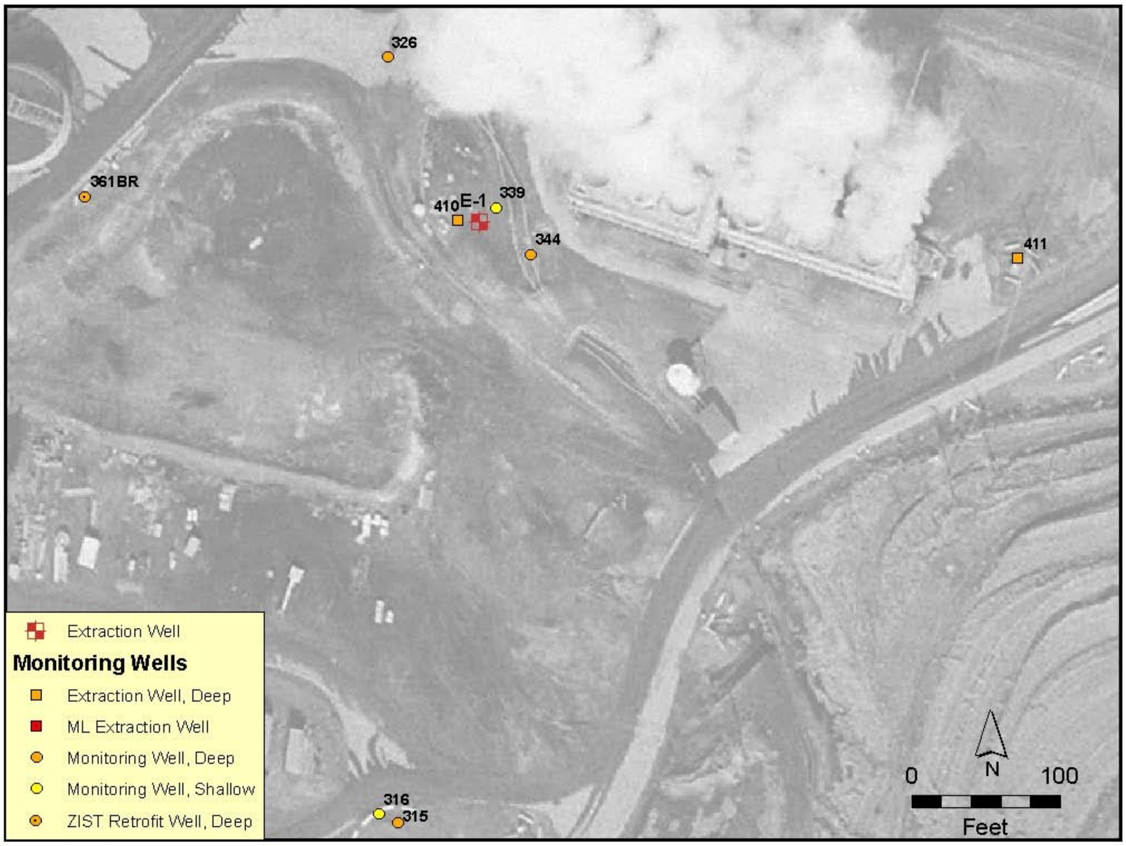

Figure 4-2: Location of wells used for hydraulic monitoring of the E-1 constant rate pumping test

Table 4-4: Observation wells used in the well E-1 aquifer test

Proposed Observation Well	Well Type	Monitoring Zone	Distance from Test Well (ft)
E-1	Proposed Extraction well, 10-in diameter	Multilevel	0
410	Existing extraction well, 8-in diameter	Lower Zone	15
411	Existing extraction well, 8-in diameter	Lower Zone	360
326	Existing monitoring well, 4-in diameter	Lower Zone	130
344	Existing monitoring	Lower Zone	40

Proposed Observation Well	Well Type	Monitoring Zone	Distance from Test Well (ft)
	well, 4-in diameter		
361B	Monitoring Well, 1-in diameter	Lower Zone	265
338	Existing monitoring well, 4-in diameter	Upper Zone	35
339	Existing monitoring well, 4-in diameter	Upper Zone	35

4.5.1.5 Well E-2 Aquifer Testing – East Plant Upper and Lower Zones

A 24-hour constant rate pumping test will be conducted using well E-2 as the pumping well. Well E-2 will be screened in both the Upper and Lower Zones. The layout of the test is shown in Figure 4-4 and observation well details are provided in Table 4-6. The following general procedures will be followed:

- All east plant extraction wells will be shut down at least one day prior to initiation of testing and remain shut down during the testing.
- Water levels will be gauged using pressure transducers and data loggers (e.g., InSitu MiniTroll ®).
- Pressure transducers will be installed in the pumping well (E-2), the proposed Upper Zone well M-11 location, the Upper Zone well 350, the multilevel extraction well 413 and the Lower Zone monitoring wells 363A, 363B, 364A and 364B.
- Measure recovery of water levels following cessation of pumping.

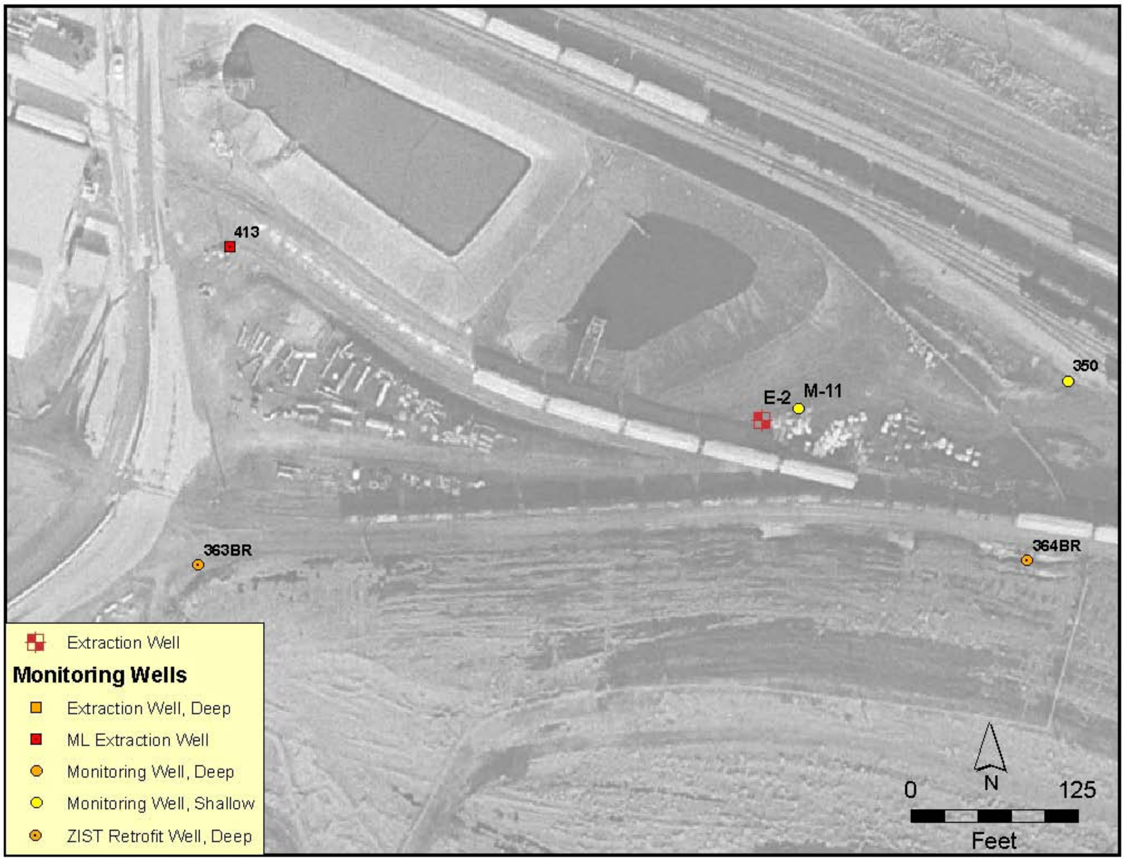

Figure 4-3: Location of wells used for hydraulic monitoring of the E-2 constant rate pumping test

Table 4-5: Observation wells used in the well E-2 aquifer test

Proposed Observation Well	Well Type	Monitoring Zone	Distance from Test Well (ft)
E-2	Proposed Extraction well, 10-in diameter	Multilevel	0
M-11	Proposed monitoring well 4-in diameter	Upper Zone	25
364A, B	Existing monitoring well nest, 1-in diameter	Lower Zones	225
350	Existing monitoring well, 4-in diameter	Upper Zone	230
363A, B	Existing monitoring well nest, 1-in diameter	Lower Zones	430
413	Existing multilevel	Upper and	420

Proposed Observation Well	Well Type	Monitoring Zone	Distance from Test Well (ft)
	extraction well, 10-in diameter	Lower Zones	

4.5.2 Aquifer Testing with New Monitoring Wells

Single well pumping and recovery tests will be performed in the monitoring well nests M-1 through M-11. Each well nest consists of 2 to 3 completion intervals. The tests will be performed immediately following well development by pumping at a constant rate for 30 minutes or until the water level in the well stabilizes. The water level in the well will be monitored continuously during pumping and recovery with a non-vented pressure transducer/data logger placed below the pump.

4.6 Task 6 - Data Evaluation and Reporting

Data obtained during the construction of the groundwater extraction and monitoring systems will be analyzed and presented in a brief report.

The report will include a documentation of the data collected including:

- Boring logs
- Results of gradation analyses
- Well completion diagrams
- Well development logs
- Data collected during step drawdown tests
- Data collected during aquifer tests.

Interpretation of the information collected will be provided. Slug tests, step drawdown tests, and the pumping test data obtained from the three aquifer tests will be used to quantitatively assess both the hydraulic properties and the performance of the test wells. The software AquiferTest 4.0 (Waterloo Hydrogeologic 2005) will be used to assist in evaluating hydraulic data.

5.0 EXTRACTION WELL START-UP AND OPERATION

The four phase 3 extraction wells, 416, 419, E-1 and E-2, will be brought on-line along with the other 11 currently active extraction wells and pumped continuously. As described in Section 3, the process for bringing a new extraction well on line consists of the following seven steps:

1. Install the extraction well.
2. Perform a step drawdown test.
3. Provide pump, piping, controls, and instrumentation.
4. Adjust system until well is running at optimal rate from central control.
5. Perform aquifer tests.
6. Make adjustments based on the results of aquifer testing
7. Place well in continuous operation.

This process integrates testing with design so that, by the time the new wells are brought on line, only minor adjustments are required to attain sustainable operation. Detailed startup procedures for wells 416 and 419 are described in the Wells 416 and 419 Startup Plan (Formation Environmental 2010). Operation and maintenance of the wells once brought on line is described in detail in the Operation and Maintenance Plan (Formation Environmental 2009d). Continuous monitoring of extraction well performance allows for active management of pumping. The effectiveness of pumping is evaluated quarterly and summarized in quarterly reports. Recommendations for any significant changes that may be necessary to optimize operation of the extraction system are provided in annual reports. The scope of quarterly and annual reporting is described in detail in the Groundwater and Surface Water Monitoring Plan (Formation Environmental 2009c).

6.0 MANAGEMENT OF INVESTIGATION DERIVED WASTES

Three types of wastes will be generation during borehole drilling, well installation, well development and aquifer testing:

- Subsurface core samples from borings drilled using sonic drilling methods. No drilling fluids or drilling cuttings are generated during sonic drilling.
- Drilling cuttings generated from the large-diameter borehole drilling for extraction wells.
- Well development and groundwater sampling purge water.

Core samples remaining at a drill location sonic drill location within the perimeter fence will be removed from the location and disposed of within the gypsum stack. Core samples remaining at drill locations between Highway 30 and the Portneuf River will be disposed of on the ground surface at each drill location. Drilling cuttings from the large-diameter boreholes will be disposed of on the ground surface at the drill locations (E-1 and E-2).

Water generated from well development and groundwater sampling will be disposed of to the ground surface unless field testing indicates that the water has hazardous properties. Procedures for handling, testing and disposing of potentially or known hazardous characteristic water are discussed in the Operations and Maintenance Plan (Formation Environmental 2009d). Water generated from the pumping test at well E-1 will be discharged to the detention basin just west of the well location (Figure 6-1) and water from the E-2 pumping test will be discharged to the East Overflow Pond (Figure 6-2). Water generated from pumping tests will be discharged to these areas unless field testing indicates that the water has hazardous properties. Procedures for handling, testing and disposing of potentially or known hazardous characteristic water are discussed in the Operations and Maintenance Plan (Formation Environmental 2009d).

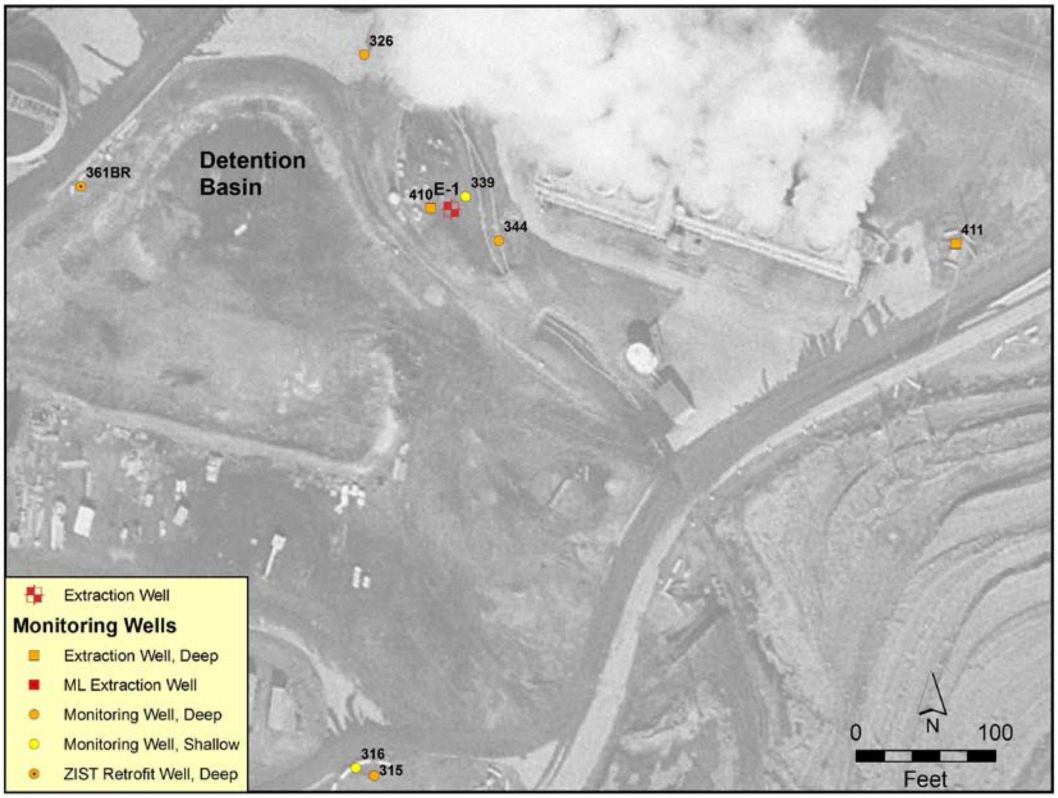

Figure 6-1: Location of proposed extraction well, E-1, and the detention basin.

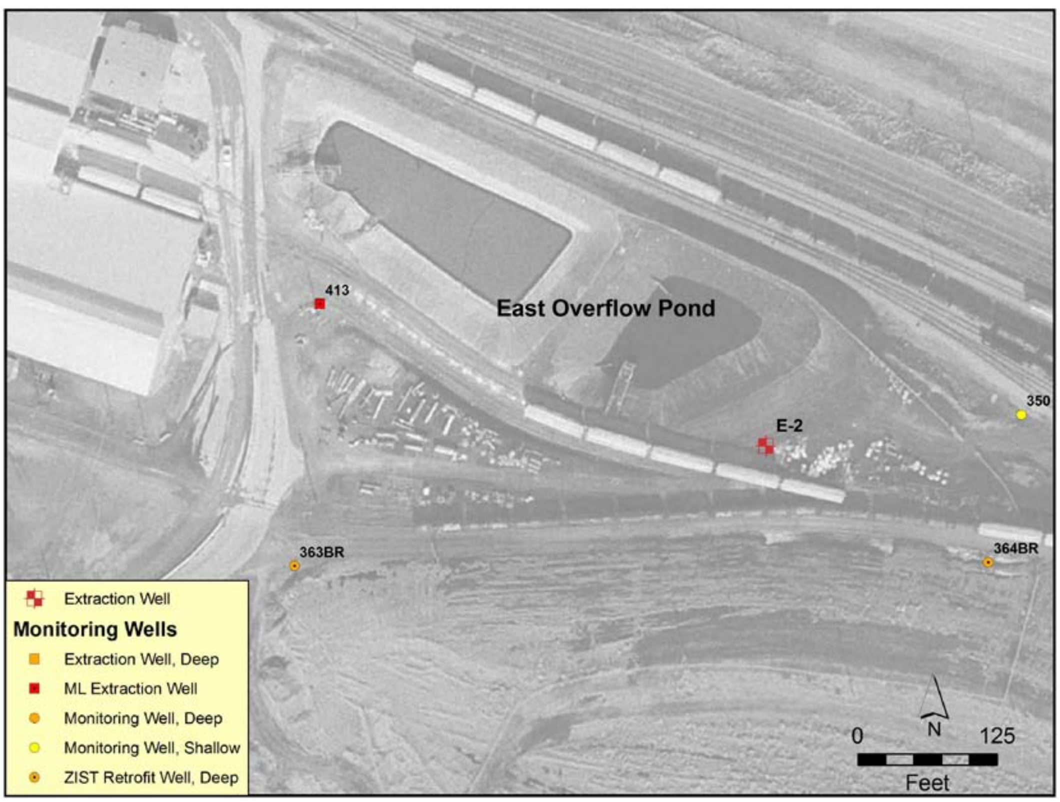

Figure 6-2: Location of proposed extraction well, E-2, and the east overflow pond.

7.0 HEALTH AND SAFETY PLAN

The health and safety program for workers completing tasks under this work plan is two-tiered. The first tier consists of Simplot's Don Plant Health and Safety program and the second tier provides for requirements under CERCLA. A CERCLA Health and Safety Plan was been prepared for these activities during the Phase 2 Data Gap Investigation.

Simplot maintains a comprehensive Site Health and Safety Program. Under this program all contractors are required to complete Simplot's health and safety orientation training. A copy of a Site Health & Safety Plan will be provided for review by all of Contractor's personnel working on the Site. At a minimum, Contractor will be required to comply with the provisions of the Site Health and Safety Plan and all other facility safety requirements. Contractors' employees will be required to sign a Safety Compliance Agreement that is a part of the Site Health & Safety Plan.

In accordance with OSHA standard 29 CFR 1910.120(e), all of Contractors' personnel shall have received 40 hours of training in an OSHA-accredited Hazardous Materials Health and Safety Course and annual 8-hour refresher training.

8.0 REMEDIAL ACTION SCHEDULE

The anticipated schedule for remedial action activities is as follows:

1. Receive approval of the GW RDR, the Groundwater and Surface Water Monitoring Plan, and the GW RAWP.

2. Select and contract drilling subcontractor for first field effort. This process is expected to take approximately 6 weeks.

3. Driller mobilization depends on availability. A firm start date will be requested during the selection process.

4. Begin first field effort (install 13 multi-level monitoring wells and 1 pilot boring).

5. The first field effort is expected to take ten weeks. Since the RAWP allows for modifications to the plan to be made based on field results, this duration may increase.

6. The extraction well design requires completion of pilot borings and analysis of sieve data. The E-1 pilot boring was drilled during the phase 2 investigation. The E-2 pilot boring will be the first location drilled in the first field effort. It is expected that the extraction well design could be submitted to the agencies for approval 4 weeks after the completion of the boring.

7. Begin the driller selection process for second field effort (extraction well installation) once the designs are approved. The driller selection and contracting process is expected to require approximately 6 weeks.

8. Driller mobilization depends on availability. A firm start date will be requested during the selection process.

9. Installation of the two extraction wells is expected to take from 2 to 4 weeks. Based on past experience, the required time to drill and install the wells may increase if extremely difficult drilling conditions are encountered. During well development, step-drawdown testing will be performed to provide well initial well performance information and to size and select a proper pump for permanent installation.

10. An extension to the collection system will be required from well 413 to the location of well E-2. The construction of this line will be conducted in parallel so that the extension is completed by the time well installation is complete.

11. Well head piping, pump installation, electrical work, and the installation of instrumentation and controls will begin once the wells have been installed and developed. This work is expected to take approximately 4 weeks to complete.

12. Prefinal Inspection.

10. Once the wells are operational, aquifer testing will be conducted. This testing provides additional baseline performance data and information that allows the operation of the wells to be fine tuned.

11. Start up completed system - at the end of the second field effort.

12. Final Inspection.

13. Complete data analyses and prepare draft report (within 4 weeks following the completion of the second field effort).

14. Construction completion inspections will be completed as specified in the Consent Decree.

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