PROPOSED PLAN

FOR AN INTERIM

AMENDMENT TO THE

RECORD OF DECISION FOR THE

EMF SUPERFUND SITE

FMC OPERABLE UNIT

POCATELLO, IDAHO

PREPARED BY:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
SEATTLE, WA

SEPTEMBER 2011

Approved by: [signature]

Daniel D. Opalski
Director, Office of Environmental Cleanup
U.S. Environmental Protection Agency, Region 10

Date: 9/22/2011

Table of Contents

1.0 INTRODUCTION AND OVERVIEW OF THE PROPOSED PLAN

The Eastern Michaud Flats (EMF) Superfund Site is located in Southeast Idaho, approximately 3 miles northwest of Pocatello, Idaho (Figure 1, EMF Site Regional Map). The EMF Site includes two adjacent phosphate ore processing plants, the former FMC Corporation Elemental Phosphorus Plant (FMC) and the J.R. Simplot Company Don Plant (Simplot), which both began operating in the 1940s. The FMC plant ceased operations in December 2001 and was subsequently demolished. Both plants occupy approximately 2,475 acres (approximately 1,450 for FMC and 1,025 for Simplot). The FMC Operable Unit (OU-1) is one of three OUs that constitute the EMF Superfund Site. The other two are the Simplot OU-2 and the Off-Plant OU-3. The EMF Superfund Site encompasses the areal extent of contamination at or from both plants including what the Record of Decision (ROD) described in 1998 as the Off-Plant Subarea (and has since approximately 2002 come to be referred to in site documents as the Off-Plant OU) for portions of the EMF Site beyond plant properties. The term “off-site” has been mistakenly used at times to describe this area in documents in the Administrative Record.

This Proposed Plan presents the U.S. Environmental Protection Agency’s (EPA) preferred alternative to address the contamination risks at the FMC OU, a proposed interim remedial action amendment to the ROD, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 USC §§ 9601 *et seq.* (CERCLA), and the National Contingency Plan, 40 CFR Part 300 (NCP).

This Proposed Plan and supporting documentation will become part of the Administrative Record file consistent with Section 300.825(a)(2) of the NCP. The Administrative Record contains the information upon which the selection of remedial action was based. This Proposed Plan summarizes the information upon which EPA is basing the proposed change to the remedy selected in the 1998 ROD.

Other response actions, including closure and compliance actions under the Resource Conservation and Recovery Act (RCRA), have been and continue to be performed at RCRA regulated units of the FMC facility. These actions are not part of the FMC OU since they are under RCRA subtitle C authority. The work performed under RCRA is not affected by or described in this Proposed Plan.

1.1 Summary of the 1998 Record of Decision

In 1998 EPA issued a ROD for cleanup of the EMF Superfund Site, including the FMC plant area, now known as the FMC OU.

Results from the 1996 EMF *Remedial Investigation (RI) Report and Feasibility Study (FS)* and other site studies provided the basis for the ROD. The ROD identified contaminants of concern (COCs) in soil, groundwater, and air. The ROD concluded that feed stocks, by-products, wastes, and products of FMC production processes contained elevated levels of contaminants of potential concern (primarily metals and radionuclides) that had impacted the plant site and some surrounding off-plant areas. The metals of concern include antimony, arsenic, cadmium, lead, nickel, thallium and vanadium. The radionuclides of concern include lead-210, polonium-210, potassium-40, radium-226, and uranium-238. Two additional contaminants of concern are hydrocarbons and fluoride. Of greatest concern were process wastes containing ignitable, reactive phosphorus, and radionuclide and radon levels which posed unacceptable risks under potential future industrial land use scenarios. The reactive phosphorous was not subject to RCRA regulation when it was released or disposed of in areas addressed by the ROD and this ROD amendment.

The selected remedy in the 1998 ROD for the FMC OU included:

1. Capping the Old Phossy Waste Ponds and Calciner Solids Storage Area and lining the Railroad Swale to reduce or eliminate infiltration of rainwater and prevent incidental exposure to contaminants.
2. Monitoring groundwater and implementing legally enforceable controls that would run with the land to prevent use of contaminated groundwater for drinking purposes under current and future ownership. Groundwater monitoring and enforceable controls would continue until site COCs in groundwater decline to below the maximum contaminant levels (MCLs) or risk-based concentrations (RBCs) for those substances.
3. Implementing legally binding land use controls that would run with the land to prevent potential future residential land use and control potential worker exposures into the future.
4. Implementing a contingent groundwater extraction/treatment system if contaminated groundwater migrated beyond FMC (or Simplot) owned property and into adjoining springs or the Portneuf River. Containment of contamination would be achieved via hydrodynamic controls such as long-term groundwater gradient control provided by low level pumping. Extracted groundwater

would be treated and recycled within the plant to replace unaffected groundwater that would have been extracted and used in plant operations.

5. Conducting operations and maintenance on capped areas and the groundwater extraction system, if implemented.

The remedy described in the ROD did not include remedial actions within the interior footprint of the FMC plant. The ROD assumed indefinite continued operation of the plant by FMC. As a result, the ROD assumed the facility would be operated in accordance with existing facility health and safety plans, which would protect plant workers and any other potential receptors including visitors within the interior footprint, and that closure of the plant would be a regulatory matter whenever the plant closed, presumably after remedial action was completed.

A consent decree to implement the remedy was negotiated and lodged by the United States and FMC but never entered by the Idaho District Court. Following closure of the FMC facility in 2001, it became clear that further investigatory work should be performed, including in the area of the former interior footprint of the plant, and EPA issued an Administrative Order on Consent (2003 AOC) to FMC for a supplemental RI/FS (SRI/SFS) for the FMC OU. Since 2001, FMC has completed decommissioning and demolishing the former facility buildings, maintained access control of the property, and has performed ongoing groundwater monitoring.

1.2 Summary of the Supplemental Remedial Investigation and Feasibility Study

In 2001, FMC ceased production operations. Between 2001 and 2006, the FMC facility was demolished, leveled, and certain former process sumps and pit areas were filled using native soil and former FMC by-products and non-hazardous wastes that consisted of slag and other fill generated during plant operations. Similar fill materials were also used to contour the ground level as the plant expanded over the years.

In addition to other requirements (outlined in Section 2.5), the 2003 AOC required FMC to investigate former operational areas that were not assessed during the RI jointly performed by FMC and Simplot pursuant to a 1991 RI/FS AOC.

In 2009 the Final *Supplemental Remedial Investigation (SRI) Report*, the Final *SRI Report Addendum*, and Final *Groundwater Current Conditions Report* (*GWCCR*) delineated the extent of contamination in the soil and groundwater at the FMC OU. COCs included metals, radionuclides, elemental phosphorus

(P_4), and total phosphorus or orthophosphorus (in surface water from groundwater discharging to the Portneuf River).

These reports also addressed risks to workers from direct contact exposure to fill materials under potential future commercial or industrial uses, risks due to potential migration of COCs to groundwater and subsequent drinking of contaminated groundwater, and risks from the transport of COCs via groundwater to the Portneuf River.

1.3 Summary of Proposed Interim ROD Amendment Remedial Actions

EPA is proposing an interim amendment to the 1998 ROD with a proposed alternative that would enhance the remedial action for groundwater, surface water, and soil at the FMC OU, subject to public comment as required by CERCLA. The proposed alternative may be modified based on comments EPA may receive, and any such changes will be described in the Interim ROD Amendment (or other decision document), and in greater detail in the EPA Response To Comments on this Proposed Plan that will be issued with it. If the changes are significant such that the public could not have anticipated them or have had a fair opportunity to comment on them, EPA may reissue the Proposed Plan with a revised proposed alternative for another public comment period.

The remedial actions in the proposed alternative for the FMC OU include the following components:

- Placement of evapotranspiration (ET) caps over areas that contain non-slag fill (such as elemental phosphorus, phossy solids, precipitator solids, kiln scrubber solids, industrial waste water sediments, baghouse dusts, and plant/construction landfill debris) to prevent direct contact with contaminants and the migration of contaminants to groundwater by reducing or eliminating the infiltration of rainwater, and prevent future potential incidental exposure of workers to contaminants.
- Placement of approximately 12 inches of topsoil cover over areas containing slag fill, ore stockpiles, calciner pond solids stockpiles, and the former Bannock Paving areas to prevent the exposure to gamma radiation and fugitive dust of potential future workers.
- Excavation and onsite consolidation of Parcel 3 of FMC’s Northern Properties to prevent exposure to residents and future potential workers to elevated levels of radionuclides due to windblown fugitive dust from FMC and Simplot ore handling processes.
- Cleaning of underground reinforced concrete pipes that contain elemental phosphorus and radionuclides to prevent exposure to potential future workers.

- Installation of an interim groundwater extraction/treatment system to prevent contaminated groundwater from migrating beyond FMC-owned property and into adjoining springs or the Portneuf River. Containment of contaminated groundwater will be achieved by groundwater extraction. Extracted groundwater will either be treated and disposed of onsite or routed to a municipal treatment facility in Pocatello.
- Implementation of a long-term groundwater monitoring program to evaluate the performance of soil and groundwater remedial actions, and to ensure protection of human health and the environment.
- Implementation of a phosphine monitoring program at FMC OU (also referred to as "CERCLA" to distinguish from RCRA) capped ponds and subsurface areas where elemental phosphorus is present to identify potential phosphine releases or soil chemistry disturbances.
- Implementation and maintenance of institutional controls that include environmental land use easements that prohibit activities that may disturb remedies (such as digging in capped areas) and restrict the use of contaminated groundwater. In addition, engineered controls or barriers such as fencing will be installed to limit site access.
- Implementation of a remedy management system to integrate the existing RCRA pond caps with the development of new caps, access roads, groundwater extraction system, and utility lines.
- Implementation of an OU-wide stormwater runoff management plan to minimize cap erosion and the infiltration of contaminants of concern to groundwater, including site-wide grading and the collection of stormwater in retention basins.
- Performance of operations and maintenance on capped areas and the groundwater extraction system.

The soil and groundwater alternatives considered for this Proposed Plan are discussed in Section 7. The proposed alternative is Soil Cleanup Alternative 3 and Groundwater Cleanup Alternative 2. The proposed alternative addresses the potential risks from exposure to buried elemental phosphorus, metals and radionuclides, contaminated groundwater, and phosphine gas associated with the FMC OU based on the nine criteria for the selection of Superfund remedial actions. This proposed alternative is consistent with remedial actions selected for the Simplot OU of the EMF Superfund Site.

EPA is the lead agency responsible for implementing the ROD as amended, with the Shoshone-Bannock Tribes (Tribes) and IDEQ as support agencies as defined in the NCP. The work will likely be conducted by FMC under a negotiated Consent Decree, or if negotiations are unsuccessful, under a Unilateral Administrative Order issued by EPA to FMC. EPA has prepared this Proposed Plan in consultation with the support agencies and pursuant to Section 117(a) of CERCLA and Section 300.430(f)(2) of the NCP. IDEQ supports the proposed alternative in this Proposed Plan, while the Tribes have been consistently vigorously opposed to managing elemental phosphorus wastes in place and have consistently advocated for treatment or excavation and off-site disposal of these wastes.

1.4 Public Involvement

Your Comments: Comments on this Proposed Plan are welcome and encouraged during the comment period from September 26th to October 26th and on the day of the public meeting on October 12th at the Fort Hall Business Council Chambers, Fort Hall, Idaho, and on October 13th at the Chubbuck City Council Chambers, Chubbuck, Idaho. A Poster Session and Open House with a question and answer period will take place before the meetings from 5:00PM to 6:00PM. Both meetings are from 6:15PM to 9:00PM where oral and written comments will be accepted.

Written comments may be submitted either at the public meeting or mailed to:

Mr. Chris Bellovary
US EPA Region 10
1200 Sixth Ave, Suite 900
Office of Environmental Cleanup, ECL-113
Seattle, WA 98101
(T) 206-553-2723
(F) 206-553-0124
Bellovary.Chris@epa.gov
If emailing comments, please put "FMC OU Proposed Plan" in subject line.

This Proposed Plan has been prepared to facilitate public involvement in the remedial action selection process. It presents EPA's rationale for the proposed alternative for amending the remedial action decision for the FMC OU, and also provides a summary of the other remedial alternatives evaluated as part of the selection process. EPA will select the remedial action for the FMC OU after reviewing and considering all information submitted during the public comment period. EPA may modify the proposed alternative or select another response action presented in this Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all the alternatives presented in this Proposed Plan.

Proposed Plan Organization: Following this introduction, the Proposed Plan contains major sections including Site Background, Site Characteristics, Scope and Role of the Proposed Response Action, Summary of Site Risks, Remedial Action Objectives, Summary of Remedial Alternatives, Evaluation of Alternatives, Proposed Alternative, and Community Participation.

The Proposed Plan summarizes information from referenced documents that are contained in the Administrative Record file for the EMF Superfund Site, which may be reviewed at any of the following locations:

Idaho State University Library
Government Documents
850 South 9th Avenue
Pocatello, Idaho 83209
(208) 282-3152

Shoshone-Bannock Library
Tribal Business Center
Pima Drive and Bannock Avenue
Fort Hall, Idaho 83203
(208) 478-3882

(NEW) American Falls Library
308 Roosevelt Street
American Falls, Idaho 83211

EPA Region 10 Superfund Records Center
1200 Sixth Avenue, Suite 900, ECL-076 (7th Floor)
Seattle, WA 98101
(206) 553-4494

2.0 SITE BACKGROUND

2.1 Location

The EMF Site is located in southeastern Idaho, approximately 3 miles northwest of Pocatello, Idaho and adjacent to the Portneuf River, a tributary of the Snake River. The EMF Site is comprised of the former FMC Corporation elemental phosphorus production plant that ceased operation in 2001 (FMC OU-1), the J.R. Simplot Company phosphate fertilizer processing facility (Simplot OU-2), and surrounding areas (Off-Plant OU-3) affected by releases from the facilities. The EMF Site Regional Map is presented in Figure 1.

2.1.1 Geology

The FMC OU consists of the former plant operations area, Northern Properties, and Western Undeveloped Area (WUA) which are situated on the Michaud Flats and the Southern Undeveloped Area

(SUA) which extends south onto the northern base of the Bannock Range, which is part of the Basin and Range Province. Surface soils at the FMC OU are windblown deposits called loess, much of which have been reworked from site operations and erosion. Under the loess are Michaud Gravel and Aberdeen Terrace deposits. Under those deposits are the American Falls Lake Beds-Sunbeam Formations. Finally, Starlight Formation volcanics and sediments underlay the area of the FMC OU. The regional geology and the FMC OU are presented in Figure 2. The stratigraphy of the FMC OU generally can be described as discontinuous layers of unconsolidated sediments deposited on an erosional surface that was incised in volcanic bedrock.

2.1.2 Hydrology and Hydrogeologic Setting

Major surface water features of the region near the FMC OU include the Snake River, Portneuf River, and the American Falls Reservoir which are presented in Figure 3. There are no naturally-occurring perennial surface water systems within the FMC OU. Surface water runoff from the FMC OU former operations area from rain is infrequent and is largely contained within the former operations area.

Basalt and gravel aquifers underlay the Michaud Flats. These aquifers are recharged by groundwater from the adjoining Bannock and Pocatello mountain ranges and from the Pocatello Valley aquifer. The Michaud Flats aquifer system can be divided into a shallow aquifer and a deeper aquifer. The deeper aquifer is the primary water-producing aquifer within the Michaud Flats. Groundwater flows within the regional aquifer system discharge to the Portneuf River, American Falls Reservoir, or the Fort Hall Bottoms. Between I-86 and the American Falls Reservoir, the Michaud Flats aquifer system discharges approximately 200 cubic feet per second (cfs) of groundwater to the Portneuf River. The American Falls Lake Beds (AFLB) form an aquitard that separates the shallow from the deeper aquifers within the Michaud Flats area, but the AFLB are not present along part of the Portneuf River in the area of Batiste Springs. Groundwater depths range from more than 150 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. In the northern portion of the FMC OU, groundwater is 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 4, 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.

2.1.3 Climate

The EMF Site is semi-arid, with approximately 11 inches of precipitation per year. Net annual evapotranspiration rates typically exceed annual precipitation. Prevailing winds are from the southwest as depicted in the wind rose for the Pocatello Airport in Figure 5. There is also a secondary wind component out of the southeast which appears to be a drainage wind that flows out of the Portneuf River valley, primarily at night.

2.1.4 Ecology

Much of the FMC OU was an industrial facility and much of the land surface has been disturbed resulting in limited areas with vegetation inside the FMC OU. Major terrestrial vegetation cover types and wildlife habitats include agricultural, sagebrush steppe, and wetland/riparian. Figure 6 presents the major terrestrial vegetation cover types in the area. Wildlife habitats in the vicinity include sagebrush steppe, grassland riparian, cliff, and juniper. The most significant aquatic habitats in the vicinity are the Portneuf River, associated springs and riparian corridor, and the Fort Hall Bottoms (a sacred site to the Shoshone Bannock Tribes). These areas are designated wetlands under the National Wetland Inventory of the U.S. Fish and Wildlife Service. The Portneuf River supports an extensive riparian community, which is an important source of food, cover, and nesting sites for many wildlife species. Numerous migratory bird species use areas in and near the EMF Site by the thousands, particularly the Fort Hall Bottoms.

2.2 EMF Site Subareas

During the 1991-1996 RI/FS, property outside the FMC and Simplot operational areas (beyond their plant area fence lines) was described as “Off-Plant” or (inaccurately) as "off-site" ("off-site" is inaccurate because the Off-Plant subarea is part of the EMF Site). The EMF Site boundaries were defined in the ROD after the RI/FS was completed. The Off-Plant OU is defined by the "areal extent of contamination" beyond the FMC (and Simplot) property lines, but within the EMF Superfund Site. In the risk assessment and FS, adjacent FMC or Simplot-owned properties, some of which were acquired during the RI, were considered part of the “Plants” and were not evaluated for either current or future residential use. The FS, risk assessment, and ROD refer to these areas as the FMC Subarea, Simplot Subarea, and Off-Plant Subarea based on ownership. Subareas have since become Operable Units (FMC OU-1, Simplot OU-2, and Off-Plant OU-3), and as such, this Proposed Plan uses the term OU. This Proposed Plan only addresses the risks posed by the contamination at the FMC OU-1 and therefore is the primary OU discussed in more detail below.

2.2.1 FMC OU

The FMC OU is on FMC's exclusively-owned fee land, most of which is located within the Fort Hall Indian Reservation. The FMC OU consists of the former FMC operations area (the former FMC production plant property, which includes but is significantly larger than the former interior plant footprint) and the Southern and Western Undeveloped Areas (SUA and WUA), all located south of Highway 30, and the FMC-owned Northern Properties to the north of Highway 30, as well as several parcels located north of Interstate 86 (I-86). The easternmost portions of the FMC OU as well as the entire Simplot OU are located outside the Reservation. The nearest residence is within ½ mile north of the Northern Properties. Figure 7 presents the land usage in the vicinity of the EMF Site.

Summary of Former FMC Plant Operations

The former FMC operations area produced elemental phosphorus from phosphate-bearing shale ore mined regionally. Figure 8 presents the location of the current Remediation Areas (RAs) within the FMC OU. Figure 9 presents the location of the former FMC operations area. The layout of the former operations area was used, in part, to scope both the RI and SRI. Ore was shipped to FMC via the Union Pacific Railroad during the summer months and stockpiled. The ore was crushed, screened, and formed into briquettes prior to heat treatment (known as calcining). The calcining process involved heating the ore briquettes to a sintering temperature of approximately 1,200°F – 2,000°F to form nodules. Carbon monoxide (CO), a by-product of the phosphorus furnace reaction, was used as fuel to fire the calciners. The nodules were blended with coke and quartzite (known as silica) to make the phosphorus furnace feed. This mix of nodules, coke, and silica was fed into four electric arc furnaces. The furnace reaction primarily yielded gaseous elemental phosphorus (product), carbon monoxide gas (used as an energy source for the process), slag (by-product/waste), ferrophos (by-product), precipitator dust (waste), calciner solids (waste), and phossy solids (waste). The elemental phosphorus gas was subsequently condensed to a liquid state and stored in sumps and tanks in the furnace building as well as at the phosphorus loading dock prior to shipment off-site as product. Elemental phosphorus will burn upon contact with air. Therefore, to prevent oxidation, the condensed phosphorus product was kept covered with water from the time it was produced through loading and transport off-site.

At various times some of the wastes or by-products were sold or had some commercial value. With the exception of ferrophos, the materials remaining on the FMC OU have no commercial value and are wastes or fill materials that will require long-term management. As the plant was expanded over time, the property was contoured and waste fill was used in many areas of the FMC operations area to contour the ground level for further operations. As a result, the former FMC operations area contains large areas of various fill, predominantly slag.

Process water (known as phossy water) was used to isolate elemental phosphorus from contact with air and was also used to slurry precipitator dust. Numerous surface impoundments were historically dewatered and/or covered. The railroad swale was designed as a stormwater retention area but also received phossy water (and therefore elemental phosphorus) from process spills in the furnace building and phosphorus loading dock. Phossy water, phossy solids, and precipitator slurry were typically managed separately in a series of surface impoundments located to the west of the furnace building. A number of these surface impoundments were RCRA regulated units (Ponds 8S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18A, 8E, and 9E, see Figure 9) and are not subject to proposed actions under this Proposed Plan, because they have already been closed and capped by FMC with EPA oversight pursuant to a 1999 RCRA Consent Decree.

Air deposition from plant emissions resulted in contaminants being dispersed aerially throughout the region. Air deposition from FMC plant operations has been confirmed within the FMC OU-1, the Simplot OU-2, and the Off-Plant OU-3. Risks posed by air deposition within the FMC OU-1 are addressed in this Proposed Plan. Potential impact and associated remedial actions as may be necessary for the Off-Plant OU would be addressed in a future Proposed Plan for that OU.

Primary Sources of Contamination in the FMC OU

Primary sources of contamination are those areas where wastes were directly placed in contact with air, soil, groundwater, or surface water by FMC as part of plant operations. Six primary sources of contamination have been identified on the former operations area, each of which exhibits unique characteristics:

- Areas containing by-products and/or wastes that were operated dry (i.e., without a sustained hydraulic head) so there was no downward force to drive contaminants into groundwater
- Areas containing by products and/or wastes that were operated with sustained hydraulic head (e.g., ponds)
- Areas with potential limited applied head (e.g., railroad swale)
- Areas with residual elemental phosphorus from former spills and process leaks from production, storage, and handling areas

- Areas in which only slag was used as fill
- Landfill areas

Secondary Sources of Contamination in the FMC OU

Primary sources that leached contaminants have impacted underlying subsoils. In turn, these subsoils comprise secondary sources of contamination because they have the potential to impact underlying groundwater. Surface soils within FMC's Northern Properties and SUA/WUA have been impacted by deposition of emissions (primarily fugitive emissions from former ore handling operations, but also stack emissions).

There are two main potential secondary sources of contamination:

- Subsoils beneath primary sources
- Surface soils impacted by deposition from former and ongoing EMF facility air emissions such as FMC's Northern Properties/SUA/WUA

Summary of Previous Environmental Investigations

The EMF Site has been the subject of many environmental investigations. Most notable for this Proposed Plan are the RI and SRI as summarized in the *EMF RI Report*, FMC OU *SRI* and *SRI Addendum Reports*, and *GWCCR*. The 1996 *EMF RI Report* provides detailed information for the FMC, Simplot, and Off-Plant OUs (Subareas) for air, soil, and groundwater. The FMC OU SRI evaluated FMC OU areas not investigated during the RI due to ongoing plant operations, but also re-evaluated and augmented significant portions of the 1991-1996 RI. Areas north, south, and west of the former operations area were also investigated for impacts from windblown contaminants. Sampling from the SUA and WUA and the FMC-owned Northern Properties are presented in the *SRI Addendum Report*.

The data presented in the *SRI Report* and *SRI Addendum Reports*, *GWCCR*, and the *EMF RI Report* provide the primary basis for the evaluations presented in the *SFS Report* for the FMC OU.

Development and Description of Remediation Areas (RA)

During the SRI/SFS, the impacted areas of the former operations area were divided into 24 Remediation Units (RUs). A RU was intended to delineate areas analogous to one or more RCRA Solid Waste

Management Units (SWMUs) with similar former processes or characteristics (including types of constituents of potential concern) that were typically in the same geographical area. The SRI Work Plan was based upon investigations of these RUs. Upon completion of the SRI, including additional investigation of the Northern Properties and SUA/WUA in the fall of 2008, the contamination assessment of each RU showed that many have similar characteristics, warranting an evaluation of similar remedial approaches.

As the CERCLA process moved into the SFS, combining (or in some cases dividing) RUs/parcels into new geographical areas based on remedial action similarities facilitated SFS processes, remedy selection analyses, and should in the future, facilitate remedy implementation. These newly defined areas are referred to as Remediation Areas (RAs). In general, the RAs are defined based on the following: 1) geographic proximity, 2) similarity of COCs, 3) types of risks present, and 4) a consistent remedial approach. Figure 8 presents the RAs that were used as part of the development and evaluation of each remedial alternative described in this Proposed Plan. Table 1 includes a summary of RAs, RUs, description of fill materials, and associated SWMUs.

2.3 1998 Record of Decision

In 1998, EPA issued a ROD for cleanup of the EMF Superfund Site, including the FMC plant area, now known as the FMC OU. It concluded that hazardous substances releases from FMC production processes contained elevated levels of contaminants of concern (primarily metals and radionuclides) that had impacted the FMC facility and some surrounding off-plant areas. Of greatest concern were process wastes containing ignitable reactive phosphorus primarily in pre-RCRA era waste ponds, along with radionuclide and radon levels which posed unacceptable risks under potential future industrial land use scenarios.

The Remedial Action Objectives (RAOs) in the 1998 ROD for the FMC OU were:

A. Reducing the exposure to radon that would occur in future buildings constructed within the Plant Area under a future industrial scenario.
B. Preventing external exposure to radionuclides in soils at levels that pose estimated excess cancer risks greater than 1 x 10^{-4}, or where that is not practicable, site specific background levels.
C. Preventing ingestion or inhalation of soils containing COCs at levels that pose estimated excess risks above 1 x 10^{-4}, a non-cancer risk hazard quotient (HQ) of 1, or where that is not practicable, site specific background levels.

D. Reducing the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding RBCs or chemical specific Applicable or Relevant and Appropriate Requirements (ARARs), specifically MCLs.
E. Preventing potential ingestion of groundwater containing COCs having concentrations exceeding RBCs or MCLs.
F. Restoring groundwater that has been impacted by site sources to meet all RBCs or MCLs for the COCs.

The selected remedy in the 1998 ROD for the FMC OU included:

1. Capping the Old Phossy Waste Ponds and Calciner Solids Storage Area and lining the Railroad Swale to reduce or eliminate infiltration of rainwater and prevent incidental exposure to contaminants;
2. Monitoring groundwater and implementing legally enforceable controls that will run with the land to prevent use of contaminated groundwater for drinking purposes under current and future ownership. Groundwater monitoring and enforceable controls will continue until site COCs in groundwater decline to below the MCLs or RBCs for those substances.
3. Implementing legally binding land use controls that will run with the land to prevent potential future residential land use and control potential future worker exposures.
4. Implementing a contingent groundwater extraction/treatment system if contaminated groundwater migrates beyond FMC-owned property and into adjoining springs or the Portneuf River. Containment of contamination shall be achieved via hydrodynamic controls such as long-term groundwater gradient control provided by low level pumping. Extracted groundwater will be treated and recycled within the plant to replace unaffected groundwater that would have been extracted and used in plant operations.
5. Conducting operations and maintenance on capped areas and the groundwater extraction system, if implemented.

2.4 Summary of Remedial Action to Date

While implementing the SRI/SFS AOC, FMC has undertaken the following actions consistent with the 1998 ROD:

- Monitoring groundwater at the FMC OU.

- Conducting periodic supplemental groundwater investigation/monitoring programs or events as requested by EPA or IDEQ as presented in the *GWCCR.*
- Recorded restrictive environmental easements that prohibit residential use of FMC-owned properties within the FMC OU.

2.5 2003 Administrative Order on Consent Requirements for the FMC OU

In December 2001, FMC stopped production of elemental phosphorus and closed the plant. EPA issued the SRI/SFS AOC to FMC in October 2003 to investigate and evaluate former plant areas that were not investigated during the RI and determine whether additional actions were needed to protect human health and the environment. The 2003 AOC required the following activities:

1. Complete a memorandum updating the RI:
   - Update the conceptual site model (CSM) and identify former working areas at the plant that were not addressed by the remedy selected in the 1998 ROD
   - Delineate areas not previously evaluated in the RI/FS
   - Develop a RBC for elemental phosphorus in soil
   - Update the *EMF RI Report*

   In December 2004, EPA approved the final *RI Update Memo*.

2. Conduct a SRI to refine the extent of contamination and associated risks. FMC conducted SRI field work between May and December 2007. The *SRI Report* was approved by EPA in November 2009. The *SRI Addendum Report*, December 2009, and the *GWCCR*, July 2009 included additional SRI studies.

3. Submit a SFS Report that develops and evaluates remedial alternatives using CERCLA remedy selection criteria to identify a preferred alternative to address the risks at the FMC OU. The final *SFS Report* was approved by EPA on July 18, 2011.

2.6 Summary of Public Involvement Activities Regarding the EMF Superfund Site

EPA has regularly issued and continues to prepare and issue fact sheets and newsletters about the EMF Site for the public. In addition, public meetings are periodically held to provide information and to solicit input on EMF Site progress. The most recent public outreach and informational meetings were held in Pocatello and Fort Hall in May 2010. The public is encouraged to comment in writing and invited to attend the public meetings regarding this Proposed Plan. More information regarding public involvement activities can be found on EPA's EMF website: http://go.usa.gov/iTC

3.0 SITE CHARACTERISTICS

3.1 Physical Site Characteristics

The terrain at the EMF Site is generally flat for several miles from the southwest, clockwise through the northeast of the Simplot facility. East of Pocatello, the Pocatello Mountain Range rises from about 4,400 feet to about 6,500 feet above mean sea level. Southeast of the FMC and Simplot facilities is the city of Pocatello, located in the funnel-shaped Portneuf River Valley. The valley virtually closes at the southern end of Pocatello at the Portneuf Gap. The Bannock Range then bounds the west side of Pocatello and the Lower Portneuf River Valley. The north end of the Bannock Range is just south of the FMC OU. The Bannock Range and Michaud Flats meet along an escarpment that runs east-west through the FMC OU. Additional details are provided in Section 2.0.

3.2 Nature and Extent of Soil Contamination

The RI completed in 1996 and SRI completed in 2009 delineated the nature and extent of soil contamination at the FMC OU. They revealed that wastes and by-products were disposed of at ground level and used extensively as fill to contour the ground level as operations expanded over time. Table 2 provides a summary of waste fill by RA and includes the average fill depths, total fill volume, predominant fill type, and secondary fill type. The concentrations of COCs in wastes and source materials are provided in Table 3. Primary release mechanisms of contaminants into the surrounding environment at the FMC OU include erosion/stormwater runoff, use of waste/by-product as fill, subsurface excavation/reactions/vapor from elemental phosphorus, and seepage-infiltration/percolation.

The release of contaminants into surrounding media, such as underlying soils, can be a source of contaminants to other media, such as groundwater, which becomes a secondary source of contamination.

“Predominant Fill Type” in Table 2 describes the primary material in the fill while “Secondary Fill Type” describes other materials observed in the fill to a lesser extent. RA-H does not contain fill material. It is comprised of two landfills used to dispose of ordinary workplace trash or wastes (food, papers, equipment, etc.), slag, furnace digout/rebuild wastes, and various industrial wastes. RA-H is estimated to cover 17.5 acres. The estimated volume including the overlying slag in this area is 6,500 cubic yards.

Table 3 presents typical levels and concentrations of COCs in source and waste materials at the FMC OU. In many cases different materials are mixed, including native soil and slag. Phosphine gas can be generated in fill within RAs that contain elemental phosphorus due to the reaction of elemental phosphorus with moisture that may be present in fill. Phosphine gas has not been detected in ambient air at levels that would present a risk to human health in the FMC OU.

The 95% upper confidence limits on arithmetic mean background levels used for the Human Health Risk Assessment for the FMC OU are presented to provide a frame of reference for concentrations. If a contaminant concentration is above this 95 Upper Confidence Limit (UCL) background concentration it is 95% likely to derive from FMC and/or Simplot operations. Metals (antimony, arsenic, cadmium, lead, nickel, thallium and vanadium), fluoride, and hydrocarbons are listed in milligrams per kilogram (mg/kg) and radionuclides (lead-210, polonium-210, potassium-40, radium-226, and uranium-238) are listed in picocuries per gram (pCi/g). Phosphine gas concentrations are in parts per million (ppm). Radium-226 in surface soil is more readily available for direct contact and has been determined to be a primary contaminant of concern in surface soil. Elemental phosphorous and other contaminants of concern exist at depths down to approximately 90 feet below ground surface. They would therefore pose a risk should they be excavated, or as a result of groundwater migration.

3.3 Nature and Extent of Groundwater and Surface Water Contamination

Many groundwater studies, including long-term groundwater monitoring, have been completed over the years. The results of these studies were compiled and evaluated in the *GWCCR* that was approved by EPA in 2009. For purposes of evaluation, the FMC OU was divided into the following groundwater areas for evaluation in the *GWCCR*:

- Western Ponds Area

- Central Plant Area
- Joint Fenceline/Calciner Ponds Area
- Area North of Highway 30 and I-86 (FMC Northern Properties)

The *GWCCR* concluded that the groundwater quality and the area of EMF-impacted groundwater essentially remained unchanged from the 1996 final RI Report data summary through 2008. Figures 10 through 15 present updated groundwater concentration maps for arsenic, potassium, sulfate, nitrate, total phosphorus/orthophosphate and selenium, respectively, for the FMC OU. These constituents were selected for the concentration maps as the primary indicator parameters, based on their prevalence above representative concentrations, to delineate the area of EMF-impacted groundwater. Due to the arid nature of the EMF Site, radiological and chemical constituents will typically only leach from source and fill materials into the underlying soils if there is sustained hydraulic head or limited hydraulic head e.g., an uncovered wet waste pond, collection in low areas of rainwater runoff, or unlined ponds, such as the RCRA Pond 8S).

The average depth of the FMC groundwater contaminant plume varies across the FMC OU as follows:
Elevated terrain in joint FMC-Simplot fenceline area (e.g., well 161): 160' - 200' bgs.
Western Pond area (e.g., Pond 8S wells): 90' - 140' bgs.
Northern former operations area fenceline (e.g., well 110): 65' - 100' bgs.
FMC Northern Property Parcel 3 – near FMC trailers (e.g., well 517): 60' - 100' bgs.
FMC Northern Property Parcel 3 – southeast corner I-86 and West Pocatello interchange (e.g., well TW-12S): 50' - 90' bgs.
Batiste Springs (FMC Northern Property Parcel 6) near Batiste spring well house: 15' - 45' bgs.

EMF impacted groundwater does not migrate beneath FMC Northern Properties Parcels 1, 4 and 5.

3.3.1 Summary of Groundwater Contamination in the Western Ponds Area

The nature of impacts to groundwater in the Western Ponds Area can be summarized as elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and metals such as arsenic and manganese.

Over the ten years of routine monitoring, elemental phosphorus has been sporadically detected in both upgradient and downgradient wells at Pond 8S, as well as in rinseate blanks associated with the elemental phosphorus sampling and analysis events. Although detected at a small number of monitoring wells in the former operations area, elemental phosphorus has not been detected downgradient of the facility since elemental phosphorus oxidizes in groundwater to phosphorus/orthophosphate very quickly.

3.3.2 Summary of Groundwater Contamination in the Central Plant Area

The nature of impacts to groundwater in the Central Plant Area can be summarized (like the Western Ponds Area) as elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and metals such as arsenic and manganese. Arsenic is the most significant groundwater COC in this area measured at a concentration above an MCL (many COCs, like total phosphorus/orthophosphate, a major concern at the EMF Site, do not have an MCL).

Over the ten years of routine monitoring, elemental phosphorus has been sporadically detected in both upgradient and downgradient wells at the slag pit sump in wells 121 and 123, as well as in rinseate blanks associated with the elemental phosphorus sampling and analysis events.

The Central Plant Area (RA-B) includes RUs 1 and 2 (see Table 1) which include the former furnace building, secondary condenser, and phosphorus loading dock as presented in Figure 16. These were the primary elemental phosphorus product production, storage, and handling areas within the former operations area.

Elemental phosphorus was produced within the four electric arc furnaces in the furnace building. As a result of the furnace reaction, elemental phosphorus gas was generated within the furnaces. Upon exiting the furnace, the elemental phosphorus gas passed through a series of condensers where the elemental phosphorus was condensed into a liquid, collected in subsurface, brick-lined concrete sumps, and maintained above the melting point of 112°F (44°C). The elemental phosphorus was pumped by displacement with water through above-ground piping to the phosphorus loading dock (also within RA-B), located directly north of the furnace building. Releases of liquid elemental phosphorus from the phosphorus loading dock and condensers occurred and resulted in elemental phosphorus migrating beneath the furnace building approximately 85 feet to groundwater. Due to the significant heat generated and imparted to the soil column in the vicinity of the furnace building, the temperature in the soil column and groundwater in the vicinity of the furnace building remained at or above the 112°F melting point of elemental phosphorus, and elemental phosphorus migrated approximately 700 feet downgradient of the furnace building where it froze in place. Elemental phosphorus is generally insoluble in water (< 3 mg/L), but migration in groundwater appears to be the source of the elemental phosphorus levels detected in monitoring wells 108, 121, 122, and 123.

Although detected at a small number of monitoring wells in the former main plant area, elemental phosphorus has not been detected downgradient of monitoring wells 108, 121, 122, and 123, probably because it oxidizes in groundwater. The oxidized P_4 product concentrations are insignificant and indistinguishable from total phosphorus concentrations measured elsewhere at the EMF Site.

3.3.3 Joint Fenceline/Calciner Ponds Area

The nature of impacts to groundwater in the Joint Fenceline/Calciner Ponds Area can be summarized as elevated concentrations (i.e., greater than background levels) of common ions, lowered pH, and elevated concentrations of nutrients such as ammonia, nitrate, and total phosphorus/orthophosphate, and elevated levels of metals such as arsenic and selenium above their respective MCLs. No elemental phosphorus has been detected in groundwater in this area.

3.3.4 Area North of Highway 30 and Interstate 86

The groundwater impacts in the area north of Highway 30 and I-86 can be summarized as elevated concentrations (i.e., greater than background levels) of common ions, elevated concentrations of nutrients such as nitrate and total phosphorus/orthophosphate, and levels of arsenic above MCLs. The area north of Highway 30 and I-86 includes a series of wells that historically and currently are on the fringe or outside of the EMF-impacted groundwater area. These wells form a “fence” of sentry wells to the north of the EMF Site that are used to monitor contaminant migration from the EMF Site to their discharge point in the springs located along the Portneuf River north of I-86. No elemental phosphorus has been detected in groundwater in this area.

3.4 Summary of Concentrations of Contaminants of Concern in Groundwater

The following table lists the Contaminants of Concern for groundwater from the 1998 ROD, updated by recent SRI data, and how those concentrations compare to risk based concentrations, drinking water MCLs where available, and to “Comparative Values” (secondary MCL for manganese and the preliminary remedial goals [PRG] for vanadium and elemental phosphorus) where MCLs are not available. All maximum detected concentrations were detected within the former plant operations area.

FMC OU GROUNDWATER COCs

Substance of Concern	Units	1991-2010 Maximum Detected Concentration - FMC Plant OU Wells[1]	Risk Based Concentration	Maximum Contaminant Level (MCL)	2008 Updated Comparative Value (CV) [from Table 4.2-1 GWCCR]	2000-2010 Maximum Detected Concentration - FMC Plant OU Wells[1]	Percentage Valid Detected Results >= CV through 4Q10 - FMC Plant OU Wells[1]
Arsenic	mg/l	2.66	0.000048	0.01	0.01	0.393	66.6%
Fluoride	mg/l	193	0.93	4	4	193	6.3%
Manganese	mg/l	91.2	0.077	-	0.05	2.66	44.4%
Nitrate	mg/l	466	25.03	10	10	46.1	18.9%
Selenium	mg/l	4.88	0.07	0.05	0.05	0.204	5.0%
Vanadium	mg/l	0.45	0.108	-	0.18	0.182	1.9%
Elemental phosphorus	mg/l	0.258	NA	NA	0.00073	0.258	7.2%

1 The FMC Plant OU groundwater results are from monitoring locations: 100-series wells are 100 through 191 inclusive; the TW-series wells are TW-1 through TW-12 inclusive (including shallow, intermediate and deep); the selected 500-series wells are 500, 501, 502, 514, 515, 516, 517, 521, 522, 523, 524 and 525; and Batiste Spring and Swanson Road Spring (aka the Spring at Batiste Road).

Batiste Spring and Well 525 are very near the discharge point where EMF-affected groundwater meets with surface water in the Portneuf River. Near this discharge point there is a commingling of Michaud aquifer groundwater with EMF-affected groundwater. Average concentrations of COCs in EMF-affected groundwater are diluted by Michaud aquifer groundwater before discharge into the Portneuf River. The only EMF Site COC greater than an MCL in groundwater discharging into the Portneuf River is arsenic.

4.0 SCOPE AND ROLE OF PROPOSED RESPONSE ACTION

The proposed alternative is necessary to reduce risks to both human health and the environment under current and future land use scenarios. Pursuant to the Simplot OU-2 Consent Decree as amended, Simplot OU-2 contributions to surface and ground water are being addressed. The Simplot OU-2 is a greater contributor than the FMC OU-1 of EMF Site COCs in groundwater to surface water. Remedial action at the Simplot OU-2 has already reduced the Portneuf River's average annual phosphorus concentration by 65% from the 2004-2007 average concentration, with a schedule to achieve a 94% reduction by 2022. This progress will be impeded unless prompt remedial action is undertaken to address the migration of COCs from the FMC OU-1 to the Simplot OU-2 groundwater plume which feeds the Portneuf River. For this reason, the ET caps preventing infiltration of rainwater into FMC OU-1 areas designated in this Proposed Plan, and treatment of FMC OU-1 groundwater containing COCs should be implemented as quickly as possible. EPA believes the proposed alternative in this Proposed Plan will be fully protective of human health and the environment.

4.1 Shoshone Bannock Tribes' Soil Cleanup Standards

In December 2010, the Shoshone Bannock Tribes promulgated stringent soil cleanup standards (SCS), which appear, among other things, to require excavation and/or treatment of all buried elemental phosphorus wastes on the Fort Hall Reservation. The proposed alternative would not meet these standards. EPA believes these stringent regulations may be ARARs. EPA has authority to waive more stringent than federal requirements in state or tribal laws or regulations, but waivers of duly promulgated requirements by states or tribes are never undertaken lightly or easily, particularly where such requirements are novel, substantially more stringent than federal requirements, and without precedent. The proposed alternative in this Proposed Plan is offered as an Interim Amendment to the ROD to allow the proposed remedial action to be promptly implemented, to ensure timely implementation of the Simplot OU-2 remedial action, and to eliminate current potential exposures in the interim at the FMC OU while the tribal SCS and potential waivers thereof undergo thorough further analyses.

The proposed ET capping and groundwater treatment is necessary to address FMC OU groundwater contributions to surface water, and would be necessary even if EPA concluded that excavation and/or treatment of contaminated soil and waste in accordance with the new tribal regulations (or otherwise) could and should be implemented. This is because such an alternative would take many years to implement (20 to 40 years), and FMC OU COC groundwater loading would need to be addressed in the interim. EPA expects that treatment will not be selected in the future, and that a final ROD will be issued in which EPA will determine the extent to which the SCS are ultimately found to be ARARs, and the applicability of the ARAR waiver provisions in § 121(d)(4) of CERCLA. CERCLA requires that ARARs must be met or waived upon completion of remedial action. Very careful consideration of any proposed waiver or waivers, which could have significant precedential implications for some of the largest Superfund sites in the country, will have to occur among, at a minimum, EPA Region 10, EPA Headquarters, and the United States Department of Justice (DOJ) in consultation with the Tribes.

4.2 Summary of RCRA and CERCLA Programs at the FMC OU

The FMC facility includes hazardous waste management units that are regulated under RCRA. Those units are not part of the FMC OU, or subject to this proposed CERCLA remedial action.

Those hazardous waste treatment, storage, or disposal units consist of the RCRA ponds and other units that were closed under the 1999 RCRA Consent Decree. These RCRA ponds are subject to RCRA post closure requirements, which include requirements to monitor the ponds for releases and to ensure that their caps are not damaged. Other solid waste management units at the FMC facility that are not regulated hazardous waste units are part of the FMC OU, and are also subject to RCRA Corrective Action requirements in addition to CERCLA Remedial Action requirements. The soil and groundwater remedies in this Proposed Plan for the FMC OU are also expected to satisfy the RCRA Corrective Action requirements for those units.

RCRA waste ponds (Ponds 8S, 11S, 12S, 13S, 14S, 15S, 16S, 17S, 18A, 8E, and 9E) at the FMC facility contain elemental phosphorus wastes and other phosphorus compounds that are producing phosphine gas beneath their caps. Previously approved RCRA closure plans for these ponds anticipated the potential for phosphine gas generation and included a contingent gas collection system beneath the caps. Carbon treatment technology for safely removing and treating phosphine gas from the extracted gas was subsequently added for some of these ponds. The current conceptual site model for the CERCLA RAs does not anticipate phosphine gas production in these areas (a potential risk to site workers in ambient air). Nevertheless, the proposed alternative in this Proposed Plan includes a comprehensive phosphine gas monitoring program and contingent required extraction should conditions at units covered by the proposed remedial action warrant it. EPA's RCRA program is developing additional strategies to treat and manage phosphine gas production within the RCRA ponds as part of RCRA post closure requirements. The proposed remedial action will be coordinated with all RCRA program activity at the facility.

4.3 Principal Threat Waste

EPA identified elemental phosphorus existing in concentrations exceeding 1,000 ppm in soil as a source material and principal threat waste at the FMC OU because it will present a significant risk to human health and the environment should exposure occur.

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by contaminants at a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria. This analysis provides a basis for making a statutory finding that the remedy employs treatment, to the extent practicable, as a principal element.

As part of the selection of a proposed or preferred alternative, EPA balances the preference for treatment within the nine criteria in accordance with the NCP. In addition, consistent with EPA's response to comments on NCP Section 40 CFR 300.430(a)(1) (55 FR at 8703) beginning with:

> "Treatment is less likely to be practicable when sites have large volumes of low concentrations of material, or when the waste is very difficult to handle and treat; specific situations that may limit the use of treatment includes sites where: 1) Treatment technologies are not technically feasible or are not available within a reasonable timeframe; 2) the extraordinary size or complexity of a site makes implementation of treatment technologies impracticable; 3) implementation of a treatment-based remedy would result in greater overall risk to human health and the environment due to risks posed to workers or the surrounding community during implementation…; "

EPA also considered the following issues when evaluating potential treatment alternatives for the principle threats posed at the FMC OU:

- The limited availability of reliable proven treatment technologies for elemental phosphorus
- The very large volume of elemental phosphorus contaminated soil, much of it at significant depth and unevenly distributed throughout the soil column
- The significant risks posed to workers and the surrounding community during implementation of any treatment alternative over a prolonged (20 to 40 years) treatment period. Risks include exposure to spontaneous oxidation or burning of elemental phosphorus for workers, and the potential for incidental/accidental air emissions even in the most careful long-term operations.

The FMC facility was the largest elemental phosphorus manufacturing facility in North America. FMC estimates that there are 5,050 to 16,380 tons of elemental phosphorus in 780,100 cubic yards of contaminated material in place down to 80 feet bgs within the FMC OU alone. Elemental phosphorus is present on the FMC OU in some areas as fill from process wastes (such as precipitator dust and phossy solid waste). However, the majority of the elemental phosphorus at the FMC OU is present beneath the former furnace building where elemental phosphorus product was stored and leaked from product sumps from ground level to groundwater where it migrated in liquid form down-gradient several hundred feet and to depths of 80 feet bgs before solidifying (see figure 16). Because of the hazards associated with collecting soil samples contaminated with elemental phosphorus, the SRI defined the limits of the lateral and vertical extent of elemental phosphorus contamination based on modeling, assumptions, and extrapolation of historical operations data. This was done to minimize the number of elemental phosphorus contaminated waste samples that would be collected, and because the sampling methodology was determined to be adequate for estimating the volume and determining the location of reactive and ignitable wastes.

Elemental phosphorus (P_4) is a RCRA ignitable and reactive waste that has physical properties that are unlike most COCs encountered in environmental response actions. Its general properties include:

- It is pyrophoric, or spontaneously ignitable in air; it oxidizes with exposure to atmospheric oxygen at normal temperatures.
- The reaction in air produces phosphorus pentoxide (P_2O_5), phosphorus trioxide, plus lower oxides and hydrolysis products, including phosphine. Clouds of combustion products are opaque and obscure visibility.
- The smoke and other by-products further react to form a phosphoric acid aerosol.
- P_4 slowly reacts with water to produce phosphine gas (PH_3). Phosphine is the active ingredient in certain rodenticides and insecticides.
- P_4 is used in matches and in weaponry (smoke shielding, incendiary weaponry).
- Managing it requires implementation of special health and safety practices to protect workers.
- P_4 is highly toxic by ingestion, inhalation, and skin absorption and may be fatal at high concentrations; is corrosive to body tissues; and is likely to cause skin burns upon contact.

Due to its unique properties, managing elemental phosphorus requires special handling techniques not only for routine handling, but also for emergency response. These handling requirements were examined in the SFS.

Elemental phosphorus is relatively safe when maintained under water and using well-engineered equipment, experienced operators, and established procedures. However, when not under a blanket of water or other inert material, the operations personnel necessary for remedial activities would potentially be exposed to widely ranging physical and toxicological risks due to the nature and extent of elemental phosphorus that exists at the FMC OU.

The largely uncontrolled conditions during excavation would expose workers to risks from fire, dermal, and respiratory hazards. Some workers in enclosed spaces would likely be required to wear Level A personal protective equipment (PPE), although significantly modified (if practical) to protect them from thermal exposure (e.g., most Level A protective suits do not protect against burns). Elemental phosphorus protective suits worn at most manufacturing plants are constructed with an aluminum coating, designed to be immediately shed upon an elemental phosphorus exposure.
Well-designed processes, highly-trained workers, and a comprehensive Environmental, Health, and Safety Management System (including extensive health, safety and environmental procedures) would be critical to ensure the safety of remedial action implementation workers.

During operation of the FMC plant, public health and potential exposures often were controlled by the same measures that FMC established to keep plant workers safe. Typical engineering controls prevented public access to hazardous areas throughout the facility (e.g., fencing). Air monitoring and scrubbers were installed to meet Clean Air Act requirements to control phosphorus-related and other air emissions from the facility. During any remedial or corrective action that involved the handling of elemental phosphorus contaminated soils, engineering controls also would be in place to protect workers. However, contrasted with the controlled manufacturing process, excavation and treatment of elemental phosphorus contaminated wastes would substantially increase the likelihood of uncontrolled releases, especially to the air, due to the widely varying uncontrolled conditions, most particularly that the waste materials in the soil matrix are not homogeneous, and difficulty in designing appropriate engineering controls. The risk of uncontrolled air releases would increase with the quantity of soils being remediated, as well as the levels of contamination. For example, active remediation of higher concentrations of elemental phosphorus in impacted soils and greater quantities of impacted materials has greater risk than active remediation of lower concentrations and smaller quantities.

Response to elemental phosphorus spills and fires also requires special precautions. In general, responders should first attempt to reduce the discharge of the material if possible while avoiding skin contact and inhalation. Typically, full fire fighters protective clothing and self-contained breathing apparatus should be worn. A spill of molten or solid elemental phosphorus on land will generally result in ignition. Once ignited, elemental phosphorus typically melts and flows like a fluid while burning towards any low point. The burning phosphorus is usually contained by forming a mechanical barrier with sand, soil, or sand bags to prevent spreading. The fire is extinguished by removing the availability of oxygen by covering the material with soil, sand, or low pressure water. This operation is typically hindered by the presence of dense, white smoke.

EPA evaluated remedial alternatives in detail in the SFS and during the development of this Proposed Plan. This evaluation included analyzing the utilization of treatment technologies versus capping and management of wastes in place. Both standard and innovative technologies were considered that would allow the elemental phosphorus contaminated soil to be excavated, processed, and stored. Capping and management in place was selected over treatment for the following reasons:

- EPA concluded that capping and management in place is implementable and would be protective, and cost-effective;
- EPA concluded that there were no existing or innovative technologies that could reliably, safely, and effectively be utilized to excavate and treat the elemental phosphorus contaminated wastes at the FMC OU.
- Based on its experience at this and other sites and research done for the SFS, EPA determined excavation and treatment of elemental phosphorus contaminated wastes at the FMC OU would be extremely challenging from an engineering perspective.
- In addition, costs for treatment were estimated to be one to two orders of magnitude higher than costs to manage the wastes in place without any assurance that the engineering challenges related to excavation and treatment could be overcome.
- EPA further believes that implementing a treatment alternative would pose greater risks to workers and/or residents than risks posed by managing the wastes in place. Significant human health risks arise for remedial workers and any emergency responders from excavating, transporting and treating large volumes of elemental phosphorus contaminated waste. These risks also exist to a lesser degree for the public at large that might be exposed during remedial activities at the FMC OU.

5.0 SUMMARY OF SITE RISKS

This section summarizes the methods, assumptions and findings of the human health and ecological risk assessments performed in support of the SRI/SFS.

5.1 Human Health Risk Assessment

With EPA oversight and subject to EPA approval, FMC performed a human health risk assessment (HHRA), as documented in the *SRI Report*, which included a conceptual site model that summarizes potential risks at the FMC OU. The results of the HHRA are part of the support for this Proposed Plan.

5.1.1 Summary of Human Health Risks at the Former Operations Area

The SRI HHRA evaluated risks to the following potential future workers for the former operations area:

- Outdoor commercial/industrial workers
- Indoor commercial/industrial workers
- Construction workers
- Utility workers
- Maintenance workers

Commercial industrial land use is the only expected future land use scenario for this area of the FMC OU.

Exposure pathways evaluated in the SRI HHRA included the following:

- Incidental ingestion of soil
- Dermal absorption from soil
- Inhalation of fugitive dust
- External exposure to gamma (ionizing) radiation
- Inhalation of volatiles outdoors
- Ingestion of shallow groundwater contaminated by leachate
- Inhalation of radon outdoors
- Dermal exposure to fire and inhalation of phosphorus pentoxide (P_2O_5) smoke from spontaneous oxidation (i.e., burning) of elemental phosphorus

Carcinogenic risks to potential future workers associated with exposure to residual source/fill materials exceed EPA's acceptable excess cancer risk range of 1×10^{-4} to 1×10^{-6}. Incremental excess cancer risks for future workers were as high as 4×10^{-3}. These risks are primarily from radium-226. Risks from chronic and subchronic exposures via other pathways (i.e., ingestion and inhalation) also exceed RAOs in the 1998 ROD for select incidental fill/source materials present in several areas.

For non-carcinogenic risks hazard quotients (HQs) for future workers were as high as 139, primarily due to the presence of elemental phosphorus. A HQ of 1.0 or higher may trigger CERCLA response action. The presence of elemental phosphorus in the subsurface within some RAs represents an unacceptable potentially acute hazard if excavated or otherwise disturbed. The elemental phosphorus could ignite, causing burns and inhalation hazards from intensely irritating phosphoric acid aerosols with potential to spread beyond the immediate area.

Groundwater risks from former operations area's groundwater contamination were found to exceed protective levels. Incremental risks to future workers who ingest groundwater from the FMC OU were estimated to be as high as 5×10^{-3}, primarily due to arsenic. An HQ as high as 37 was calculated for future workers who ingest groundwater, primarily due to arsenic concentrations. Arsenic, fluoride, nitrate, radium-226, selenium, thallium, gross alpha, and gross beta exceed groundwater MCLs.

5.1.2 Summary of Human Health Risks at the FMC-Owned Northern Properties, the Southwest Undeveloped Area, and the Western Undeveloped Area

The *SRI Addendum* HHRA evaluated risks to the following potential future residents and workers for the Northern Properties, SUA, and WUA:

- Outdoor commercial/industrial workers
- Indoor commercial/industrial workers
- Construction workers
- Utility workers
- Residents – including children and adults (Northern Properties only)

Exposure pathways evaluated in the *SRI Addendum* HHRA included:

- Incidental ingestion of soil
- Dermal absorption from soil
- Inhalation of fugitive dust
- External exposure to gamma (ionizing) radiation
- Inhalation of volatiles outdoors
- Ingestion of shallow groundwater flowing from the former operations area
- Ingestion of homegrown fruits and vegetables (residents only)

FMC-Owned Northern Properties

The cumulative total lifetime excess cancer risks to the most exposed receptors (i.e., hypothetical future residents and future outdoor workers) were estimated at 2×10^{-3} and 6×10^{-4}, respectively. Radium-226 via external exposure via the gamma radiation pathway, and arsenic exposure via the groundwater ingestion pathway comprised over 90% of the cumulative total excess cancer risk estimates for both hypothetical future residents and future outdoor workers.

The highest cumulative total reasonable maximum exposure (RME) non-cancer risk estimate to hypothetical future residential receptors was 62, as a result of potential homegrown produce ingestion, groundwater ingestion and incidental soil ingestion.

A cumulative total RME non-cancer HQ of 1.8 was calculated for future workers. This HQ is associated with the groundwater ingestion pathway, primarily arsenic exposure.

Southwest Undeveloped Area and the Western Undeveloped Area

No unacceptable risks to future workers were identified in the SUA and WUA.

5.2 Ecological Risk Assessment

5.2.1 Summary of Ecological Risks at the Former Operations Area

An ecological risk assessment (ERA) was not performed for the former operations area because it does not provide habitat suitable for use by potential terrestrial and/or aquatic receptors.

5.2.2 Summary of Ecological Risks at the FMC-Owned Northern Properties, the Southwest Undeveloped Area, and the Western Undeveloped Area

An ERA was conducted for the FMC-owned Northern Properties and SUA/WUA and included as part of the *SRI Addendum Report*. This assessment evaluated potential risks to terrestrial receptors using conservative EPA-approved methods and assumptions, and found only marginal exceedances for fluoride on several of the FMC-owned Northern Properties. Consistent with EPA guidance, community or population level impacts are unlikely to be associated with these marginal exceedances, and consideration of remedial alternatives based on the findings of the ERA is not warranted.

6.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives provide a general description of what the cleanup will accomplish. RAOs address 1) media, 2) receptors, 3) COCs, 4) potential exposure pathways, and 5) expected use.

6.1 Summary of RAOs

RAOs for the FMC Subarea from the 1998 ROD are:

A. Reduce the exposure to radon that would occur in future buildings constructed within the plant area under a future industrial scenario.

B. Prevent external exposure to radionuclides in soils at levels that pose estimated excess risk greater than 1×10^{-4}, or site-specific background levels where that is not practical.

C. Prevent ingestion of soils containing COCs at levels that pose estimated excess risks above 1×10^{-4}, a non-cancer risk HQ of 1, or site-specific background levels where that is not practical.

D. Reduce the release and migration of COCs to the groundwater from facility sources that may result in concentrations in groundwater exceeding RBCs or chemical specific ARARs, specifically MCLs.

E. Prevent potential ingestion of groundwater containing COCs having concentrations exceeding RBCs or MCLs (chemical specific ARARs) (see Table 36 of the 1998 ROD). The RBCs shown in Table 36 correspond to an excess cancer risk of 1×10^{-6} or a Hazard Index of 1.0. (Note that Hazard Index is another term for HQ which has been used exclusively in this Proposed Plan.)

F. Restore groundwater that has been impacted by site sources to meet all RBCs or MCLs for the COCs.

As part of the Interim ROD Amendment, EPA is proposing to replace the 1998 RAOs listed above with the following updated RAOs, which were developed and used in the SFS development and evaluation of alternatives:

1. Prevent exposure via all viable pathways (external gamma radiation, incidental soil ingestion, dermal absorption, and fugitive dust inhalation) to soils and solids contaminated with COCs thereby resulting in an unacceptable risk to human health assuming current or reasonably anticipated future land use;

2. Minimize generation and prevent exposure to phosphine and other gases at levels that represent an unacceptable risk to human health or the environment;

3. Prevent the direct exposure to elemental phosphorus under conditions that may cause it to spontaneously combust, posing a fire hazard or resultant air emissions that represent a significant threat to human health or the environment.;

4. Prevent potential ingestion of groundwater containing COCs in concentrations exceeding RBCs or ARARs, or site-specific background concentrations if RBCs or ARARs are more stringent than background;

5. Reduce the release and migration of COCs to groundwater from facility sources resulting in concentrations in groundwater exceeding RBCs or ARARs, or site-specific background if RBCs or ARARs are more stringent than background;

6. Restore groundwater that has been impacted by FMC OU sources to meet RBCs and ARARs for COCs, or site-specific background levels if RBCs or ARARs are more stringent than background, within a reasonable restoration timeframe;

7. Reduce the release and migration of COCs to surface water from facility sources at concentrations exceeding RBCs or ARARs, including water quality criteria (WQC) pursuant to Sections 303 and 304 of the Clean Water Act.

Following public comment on this Proposed Plan, an Interim ROD Amendment will be issued by EPA to modify the remedial action selected for the FMC OU (the FMC Plant Subarea in the 1998 ROD). The proposed soil capping to meet the cleanup levels for radium-226 is projected to meet the cleanup levels and RAOs for all metals and radionuclides, other than elemental phosphorus (RAO 1). The proposed ET capping for all areas containing elemental phosphorus is projected to meet RAOs 2 and 3 for elemental phosphorus. The proposed ET capping in conjunction with the proposed groundwater extraction and treatment, and proposed Institutional Controls is projected to meet the water-related RAOs 4 through 7.

6.2 Proposed Soil Cleanup Level for Radium-226

As long as the buried elemental phosphorus is not exposed, the most significant COC concentrations in soils are radium-226. Cleanup levels for radionuclides like radium-226 are based primarily on radiological PRGs, including federal ARARs which specify media concentrations, formulae, or risk levels to be met unless they are more stringent than natural background levels. The Uranium Mill Tailing Radiation Control Act (UMTRCA) standard for radon flux is also an ARAR.

The main objective of the proposed alternative is to mitigate risks posed to human health or the environment. The presence of radium-226 could pose a risk to air quality by emitting radon, alpha, beta, and gamma radiation. Persons traversing the FMC OU may inhale or ingest contamination adsorbed to particulate matter.

The proposed site-specific Cleanup Level for radium-226 in soil is the sum of the site-specific background mean and a risk-based value. The site-specific background mean for radium-226 is 1 pCi/g. The risk-based value, representing a 2 in 10,000 excess cancer risk, is 1.5 pCi/g. Therefore, EPA proposes a cleanup level of 2.5 pCi/g (which is 1.5 pCi/g above the radium-226 background concentration of 1.0 pCi/g) and corresponds to an acceptable risk range of 2×10^{-4} for the residential scenario and 6×10^{-5} for the industrial scenario. This site-specific Cleanup Level would apply to all areas indicated as areas of concern in the ROD, and is proposed for the following reasons:

- It is distinguishable from background and therefore measurable in the field;
- It is within the acceptable EPA excess cancer risk range

6.3 Soil Cleanup Levels for the FMC OU

The table below presents the cleanup levels for all COCs in soils for workers within the former operations area and potential future residents in the Northern Properties. Final cleanup levels will be selected in the proposed Interim Record of Decision based on the proposed cleanup levels and consideration of public comments received on this Proposed Plan.

Soil Cleanup Levels for Workers and Residents within the Former Operations Area and Northern Properties

COCs	Cleanup Levels	
	Worker[1,2]	Residential[3]
Arsenic (mg/kg)	150	-
Cadmium (mg/kg)	39	3.1
Fluoride (mg/kg)	49,000	7,200
Lead-210 (pCi/g)	67	-
Radium-226 (pCi/g)	3.8	2.5
Elemental Phosphorus	-	-

[1]Cleanup Levels are only provided for COCs associated with worker risk on the former operations area or Northern Properties.
[2]The lower of the outdoor/commercial/industrial worker and construction worker PRGs from the SFS Work Plan is cited.
[3] Cleanup Levels are only provided for those COCs on the FMC Northern Properties that present the greatest risk.

Cleanup Levels were selected for the former operations area and Northern Properties for COCs in soil that posed a significant risk to workers and potential future residents. The COCs for which cleanup levels were developed exceed risk based levels for their respective pathways and receptors and present the greatest risk. Other soil COCs do not contribute significant or distinguishable risk to workers. Meeting the cleanup levels for radium-226 would achieve the RAOs for all other COCs. Groundwater cleanup levels are MCLs, or RBCs for COCs that do not have established MCLs, as presented in Section 3.4.

7.0 SUMMARY OF REMEDIAL ALTERNATIVES

Alternatives for cleanup were developed for soil and groundwater contamination. EPA considered 8 soil alternatives and 4 groundwater alternatives. A set of "Common Elements" was developed and included in each soil alternative, except the No Action Alternative. In addition, two types of landfill caps are considered in several of the soil alternatives. Each is described below.

7.1 Common Elements

Common elements are present in all remedial alternatives and include; topsoil cover (also known as gamma cover) and evapotranspiration (ET) caps. The following is a brief description of each core element.

1. *Institutional Controls* – Environmental land use easements, running with the land, which limit activities to commercial/industrial uses, prohibit activities that may disturb the selected remedial alternative, and restrict use of groundwater.

2. *Engineering Controls* **-** Fencing around the FMC OU, entrance gates, visitor controls, warning signs, and required training for visitors to help control access and potential exposures.

3. *Soil/Fill Management* – A soil and fill management plan that would prohibit the excavation of areas containing topsoil covers or evapotranspiration caps and would strictly manage when and where excavation could occur (for example, digging to access utility lines).

4. *Cap Integration, Monitoring, and Maintenance* – There are currently 11 capped former waste ponds (overseen by EPA under its RCRA program) and 5 capped calciner ponds (overseen by IDEQ through a Voluntary Cleanup Order) at the former FMC facility. Each of the alternatives would require construction of one or more caps that may intersect with one or more of the RCRA or calciner pond caps. Careful consideration will be required during remedial design to maintain integrity of caps, grade the area appropriately for stormwater runoff, build access roads that do not interfere with cap integrity, and consider easements and infrastructure in cap design (such as active power lines or access to the Simplot Don Plant substation). Monitoring wells, pond leachate collection systems, and other monitoring and/or maintenance systems will be included in cap designs.

5. *Cap/Cover Monitoring* – All caps/covers implemented under this action would require long-term monitoring. The cap monitoring program would depend on the cap type. Settlement of fill and soils, erosion due to storm events, vegetation on the surface of the caps, security (such as fences and signs), and stormwater/precipitation drainage systems will be monitored.

6. *Phosphine (PH_3) Monitoring* – Elemental phosphorus (P_4) is known or suspected to be present in the subsurface soil/fill in the following areas: furnace building, phosphorus loading dock, and secondary condenser area (in RA-B), slag pit area (in RA-B), Pond 8S recovery process area (in RA-C), railcars buried within the slag pile (in RA-F1), former phossy ponds and precipitator slurry ponds (in RA-C), railroad swale (in RA-K), and areas with underground piping or storm sewers (in RA-E), precipitator slurry (in RAs B, C, D, and E) and phossy water (in RAs B, C, and D). Phosphine monitoring will be conducted in areas that have been identified to potentially generate phosphine gas in the future to ensure that phosphine gas does not accumulate at levels that would pose a threat to human health or the

environment. Phosphine monitoring is necessary for any type of cap placed over areas with elemental phosphorus. Phosphine monitoring would include the following elements:

- Monitoring the surface of the cap to identify potential phosphine releases to ambient air through the cap;
- Monitoring the shallow subsurface around and within the cap to identify potential releases of phosphine from the perimeter of the cap and to assess if concentrations of gases in soil gas change over time; and
- Monitoring of the soil properties within the cap materials to ensure there are no changes in the basic soil properties that would threaten the cap integrity or vegetative cover.

Monitoring would continue on a periodic basis (e.g., semi-annually) until the first 5-year review, at which time monitoring frequency would be reevaluated, and possibly discontinued. More precise phosphine monitoring details will be developed during the remedial design phase of remedial action implementation.

7. *Stormwater management* – FMC OU-wide stormwater runoff management will minimize cap erosion and infiltration of COCs to groundwater from contaminated fill. Stormwater will be addressed by FMC OU-wide grade planning, integration into cap design, and collection of stormwater in retention basins. The number of retention basins will be determined during remedial design.

8. *Fugitive Dust Control* – Generation of fugitive dust will be controlled during the implementation phase of the remedial action by the following activities:

- Maintenance of existing vegetation wherever possible (undisturbed areas);
- Application of water and dust control agents to active unpaved roadways;
- Maximized use of existing paved roadways;
- Application of water, dust control agents, and other practices in areas of active excavation and/or placement;
- Scheduled inspections to ensure that these mitigation measures are effective in controlling fugitive dust.

9. *Groundwater Monitoring* – Long-term groundwater monitoring will be used to evaluate the performance and effectiveness of the soil and groundwater remedial actions. The specific locations and construction details of these wells will be determined during remedial design. Wells added during construction will be integrated with the existing groundwater monitoring program.

7.2 Description of Landfill Covers

A significant element in several of the remedial alternatives includes management of waste in place through the installation of landfill covers. Two types of covers have been identified for use at the FMC OU. The first type of cover uses topsoil to block gamma radiation from emanating from the waste. The second type of cover is an evapotranspiration cap designed to comply with RCRA hazardous waste requirements and radioactive waste requirements and thereby block gamma radiation, direct contact with contaminants, as well as prevent the infiltration of rainwater into the waste and subsequently into groundwater.

7.2.1 Topsoil Cover

A topsoil cover involves placement of at least one foot of native soil over fill or soil containing radionuclides and other COCs, to eliminate gamma exposure. Exposure rate measurements at FMC OU test plots have shown that one foot of native soil cover is sufficient to reduce exposure to gamma radiation to meet the soil radiological RAOs. A topsoil cover with the appropriate Common Elements (primarily Institutional Controls, Soil/Fill Management, Cap/Cover Monitoring) achieves RAOs for potential human exposure pathways for: 1) gamma radiation, 2) incidental ingestion, 3) direct dermal exposure, and 4) inhalation of fugitive dust. If a redevelopment option is identified during remedial design that would provide equally protective shielding this could be incorporated into the remedial design. For instance, many likely redevelopment projects would include asphalt or concrete parking lots and/or other areas that could be designed to meet the same protective standards as a topsoil cover.

7.2.2 Evapotranspiration (ET) Cap

Evapotranspiration caps employ the principle of "water balance" to minimize percolation of precipitation. The soil layer will be thick enough to store infiltrated precipitation during winter and early spring, and native vegetation will be placed over the thick soil layer to remove the stored water through evaporation and transpiration (by plants) of infiltrated water during late spring, summer, and fall. ET caps prevent the leaching and migration of COCs in fill and soil by preventing precipitation from infiltrating contaminated fill and soil. Properly maintained ET caps, when combined with institutional controls achieve RAOs for protection of human health and the environment with respect to potential soil exposure pathways including: 1) gamma radiation emission, 2) incidental ingestion, 3) direct dermal exposure, 4) the threat of elemental phosphorus fire, and 5) inhalation of fugitive dust. ET caps can be readily implemented because they are constructed of readily available native soil and the establishment of native vegetation.

These common capping elements may vary from one assembled alternative to another and likely will not be fully defined until the Remedial Design (RD). The following soil alternatives were evaluated:

7.3 Soil Alternatives

7.3.1 Soil Alternative 1 (No Action)

Soil Alternative 1 includes no actions to control exposures of human receptors to contaminants. Under Soil Alternative 1, no treatment, containment, institutional controls, stormwater, erosion control or operation and maintenance would occur at the FMC OU. There are no costs associated with Soil Alternative 1.

7.3.2 Soil Alternative 2 (Common Elements, Receptor-Initiated Remediation, Topsoil Cover and Evapotranspiration (ET) Capping, and Clean and Treat Offsite)

As part of the SFS, FMC developed an alternative utilizing receptor initiated remediation. Under this alternative, FMC proposed that remedial action in some areas would not take place until redevelopment plans for the property were initiated. EPA reviewed this alternative and determined that it would not meet RAOs. Although discussed in detail in the *SFS Report*, Soil Alternative 2 was not considered as a viable alternative for this Proposed Plan.

7.3.3 Soil Alternative 3 (Common Elements, Topsoil Cover and Evapotranspiration Capping, Excavate and Consolidate RA-J, Clean and Treat Offsite)

The Common Elements are the critical elements in Soil Alternative 3. Figure 17 presents the remedial action proposed by Soil Alternative 3. Each succeeding soil alternative beginning with this alternative expands or modifies the alternative before it. After grading, ET caps would be installed at RAs B, C, D, E, F1, F2, H, and K. A topsoil cover would be installed over the large area represented by the former slag pile (RA-F) and RAs A, A1, and G. The only area to employ excavation and consolidation would be RA-J, which includes Parcel 3 from the FMC-owned Northern Properties. RA-J was not used for plant production activities. It contains windblown dust primarily from FMC and Simplot ore handling areas, and some slag was applied to the surface for roads and parking. Excavation and consolidation at RA-J would consist of surface scraping to a maximum of 6 inches below ground surface (bgs) (or mechanically mixing by tilling in place with clean soil below) to achieve the industrial/commercial cleanup levels listed in Section 6.2.

Underground process piping that may contain elemental phosphorus, precipitator solids, and/or phossy solids is believed to remain in RAs B, C, D and E. This piping would be contained under an ET cap which meets the RAO for elemental phosphorus by preventing direct exposure under conditions that may spontaneously combust. Potential elemental phosphorus residues in underground 16-inch, reinforced concrete storm/sewer piping in RA-A would be cleaned to remove these residues and soil/materials potentially containing metal and radiological constituents. The removal of elemental phosphorus from the underground pipes can be done safely because the material is relatively homogeneous, contained in pipes, and is a relatively small quantity. Sludges would be disposed of off-site following characterization in an appropriate landfill or be incinerated. This would allow continued use of these storm sewers for stormwater management.

7.3.4 Soil Alternative 4 (Common Elements, Topsoil Cover and Evapotranspiration Capping, Excavate and Consolidate RA-A & RA-J, Clean and Treat Offsite)

The Common Elements and ET and topsoil cover included in Soil Alternative 3 are included as components of Soil Alternative 4. Figure 18 presents the remedial action proposed by Soil Alternative 4. After grading to establish the appropriate cap slopes and stormwater drainage/collection, ET caps would be installed at the same RAs (RAs B, C, D, E, F1, F2, and H). Similarly, this alternative includes a topsoil cover over RAs F and G. Where contaminated fill/soils within RAs are generally shallow, are not a threat to groundwater, and do not contain elemental phosphorus, conventional excavation methods would be employed to rip, scrape, and/or push soils for consolidation or reuse within caps at other RAs. Two examples would be: 1) fill materials consisting primarily of slag on the surface in RA-A which may be ripped or removed down to native soils (ranging in depth from 1 to 18 feet and averaging 7 feet bgs) and re-used in constructing ET caps at other RAs; and 2) shallow soils (0 to 6 inches) from RA-J that would be either scraped and mixed for reuse in constructing ET caps at other RAs, or mechanically mixed in place to meet soil cleanup levels. RA-K, which was shown to contain at least 1,000 ppm of elemental phosphorus, would also be excavated and consolidated with other excavated materials placed under an ET cap at any other RA where elemental phosphorus is known to be present (e.g., RA-B). Underground process and storm/sewer piping would be addressed as under Soil Alternative 3 (process piping would be covered with ET caps and the sewer piping would be cleaned in-place, with sludges properly disposed offsite).

7.3.5 Soil Alternative 5 (Common Elements, Topsoil Cover and Evapotranspiration Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat Onsite)

Figure 19 presents the remedial action proposed by Soil Alternative 5. RAs A, D, E, F, F1, F2, G, and H would be capped similarly to Soil Alternative 4 following extensive excavation of soils/fill containing elemental phosphorus to a depth of 10 feet bgs. Excavated elemental phosphorus-contaminated soils/fill would be treated on-site using a caustic hydrolysis treatment process. The only other changes from Soil Alternative 4 are that RA-I and RA-J in the Northern Properties would be excavated (or tilled in place if feasible and effective) to a depth of 12 inches to meet residential cleanup levels, as specified in Section 6.2; and hydrocarbon-contaminated soils at RA-A1 would be treated in place by landfarming as opposed to excavation and placement under an ET cap. All other common/core remedial actions are included.

7.3.6 Soil Alternative 6 (Common Elements, Topsoil Cover and Evapotranspiration Capping, Excavate and Consolidate RA-A, RA-I, & RA-J, Clean and Treat Onsite, Excavate and Treat Buried Rail Cars)

Soil Alternative 6 is essentially the same as Soil Alternative 5, except that where elemental phosphorus is known to exist, excavation would not stop at 10 feet but would continue until either: 1) it is not practicable for the specifically approved equipment to safely excavate any deeper; or 2) all the elemental phosphorus-contaminated materials have been removed. The excavated soil containing elemental phosphorus would be treated on-site using caustic hydrolysis. In addition, buried railcars believed to be in RA-F1 would also be excavated and treated on-site. In each instance, the excavated areas would receive ET caps. All other remedial action from Alternative 5 are included. Figure 20 presents the surface of each RA following the remedial action proposed by Soil Alternative 6.

7.4 Other Soil Alternatives

The Shoshone Bannock Tribes requested EPA to estimate the costs for treatment and disposal of all elemental phosphorus contaminated wastes at the facility, including those that are currently managed in the RCRA ponds. The RCRA ponds were closed and capped in accordance with requirements of the 1999 RCRA Consent Decree and are subject to RCRA Post Closure requirements. They are not part of the FMC OU and are not being considered for CERCLA remedial action. To address Tribal concerns, EPA prepared additional evaluations identified as Soil Alternatives 7 and 8 to evaluate the removal and treatment of wastes in the RCRA units in addition to the areas covered by the SRI/SFS. These additional evaluations weren't presented in the SFS, but they are presented here because they are part of the record and may inform some comparisons.

7.4.1 Soil Alternative 7 (Common Elements, Topsoil Cover and Evapotranspiration Capping, Deep Excavate and Consolidate (including all RCRA Waste Ponds), Clean and Treat Onsite)

Soil Alternative 7 evaluates the impact of expanding the remedy for the RAs listed for Soil Alternative 6 (and 5) to all the RAs. In addition, all closed RCRA ponds or units would be excavated and all wastes within those ponds would be treated for elemental phosphorus-contaminated soil/fills. Similar to Soil Alternative 6, the excavated wastes containing elemental phosphorus would be treated onsite using caustic hydrolysis and then capped consistent with RCRA requirements. All other remedial action from Alternative 6 would be included in the RCRA areas as needed.

7.4.2 Soil Alternative 8 (Deep Excavation and Consolidation (including all RCRA Waste Ponds), Clean and Treat Onsite, Disposal Offsite)

Soil Alternative 8 evaluates the impact of removing all FMC-impacted materials from the FMC OU by excavating (or scraping) and treating all contaminated soils/fill in all RAs and RCRA waste ponds down to native soil. The metals- and elemental phosphorus-contaminated materials would be treated onsite prior to disposal offsite with caustic hydrolysis and metals stabilization. The treated fills, wastes, and slag would then be disposed of offsite in a landfill with a topsoil cover or cap to prevent gamma radiation exposures to landfill workers. The remaining native soil would be graded, contoured, and leveled onsite. All other remedial actions from Alternative 7 are included. This would result in clean closure of the FMC facility.

7.5 Groundwater Alternatives

7.5.1 Groundwater Alternative 0 (No Action)

Under Groundwater Alternative 0, no actions to control exposures of human receptors to contaminants, including any institutional controls, containment or treatment or long-term monitoring would occur at the FMC OU. There are no costs associated with Groundwater Alternative 0.

7.5.2 Groundwater Alternative 1 (Source Control, Institutional Controls and Long-Term Monitoring)

Groundwater Alternative 1 is comprised of three primary elements:

1. Source control (i.e., capping) would be (and have already been) implemented to prevent further degradation of the shallow groundwater underlying identified sources,
2. Institutional controls in the form of environmental easements would be recorded to prevent access to and consumption of impacted shallow groundwater, and
3. Long-term groundwater monitoring (LTM) would be conducted to evaluate the short and long-term decline of COCs in groundwater resulting from source controls to confirm the efficacy of the remedy.

All of the proposed soil alternatives (with the exception of the "No Action" Soil Alternative) would include some type of source control that minimizes or prevents further leaching of COCs to groundwater (i.e., capping, or extraction and treatment). COCs already in the groundwater would naturally attenuate over time from the natural mixing in the aquifer. While no significant biological or chemical degradation of COCs has been observed (or would be expected since the COCs are inorganic), significant attenuation has been observed through mixing of affected groundwater with the Michaud Flats aquifer.

Access restrictions, in the form of environmental easements containing prohibitions on consumption of impacted groundwater, would be implemented to prevent any future ingestion of contaminated groundwater. LTM would continue to verify that the soil remedies are working and ensure that concentrations of COCs decrease over time as predicted by groundwater modeling performed during the SRI and SFS. A long-term CERCLA groundwater monitoring program will be designed to monitor the effectiveness of the source control remedial action(s).

7.5.3 Groundwater Alternative 2 (Source Control, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at the Former Operations Area Boundary, and Treatment and Disposal of Contaminated Groundwater)

Groundwater Alternative 2 includes the source controls, institutional controls, and LTM that comprise Groundwater Alternative 1. It adds groundwater extraction from the shallow aquifer to provide hydraulic containment of the contaminated groundwater thereby preventing further downgradient migration of FMC OU COCs. Extraction wells would be located in the northeastern corner of the former operations area to capture impacted shallow groundwater before it can migrate downgradient beyond the former operations area boundary. Although precise specifications will be determined in the Remedial Design, groundwater modeling indicates that 5 extraction wells would be sufficient and a total combined extraction rate of approximately 530 gallons per minute (gpm) would fully capture impacted groundwater migrating beyond the former operations area. Contained groundwater would be treated in one of the following ways:

1. By the Pocatello Publicly Owned Treatment Works (POTW), and then discharged to the Portneuf River. The approximate locations of the proposed extraction wells and piping are presented in Figure 21.
2. By a water treatment facility built onsite. Treated water would be discharged to an infiltration basin from which it would either percolate down to groundwater (and ultimately discharge to Batiste Springs and the Portneuf River) or evaporate into the atmosphere. Figure 22 presents the preliminary design location of the extraction wells, treatment plant, and infiltration basin. Alternatively, the treated water would be transferred to the Pocatello POTW and discharged to the municipal wastewater treatment plant in compliance with the appropriate permitted discharge limits.

7.5.4 Groundwater Alternative 3 (Source Controls, Institutional Controls, Long-Term Monitoring, Hydraulic Containment of Contaminated Groundwater at the Former Operations Area Boundary, Groundwater Extraction at Source Areas, and Treatment and Disposal of Contaminated Groundwater)

This alternative includes: 1) the source controls, institutional controls and LTM that comprise Groundwater Alternative 1; and 2) groundwater extraction from the shallow aquifer in the northeastern portion of the former operations area in Groundwater Alternatives 2 to provide hydraulic containment. It adds groundwater extraction downgradient of specific identified source areas presented in Figure 23. The three primary areas from west to east are:

- Area A – Former “Phossy” Ponds 3E through 6E (beneath Pond 15S and Phase IV ponds area);
- Area B – Former Pond 8S; and
- Area C – Northeast Plant area to capture a variety of sources, including Simplot sources in the joint fenceline area. Area C is the same shallow aquifer area described in Groundwater Alternative 2; in the context of Groundwater Alternative 3 and Figure 23 it is referred to as Area C.

Area A would require approximately 4 extraction wells with a total groundwater removal rate of 60 gpm. Area B would require 5 extraction wells with a total extraction rate of 90 gpm. Area C, as noted above, uses the same number and locations for extraction wells as Groundwater Alternative 2 (5 wells at 520 gpm). The combined total groundwater removal rate from all zones is approximately 670 gpm. Figure 24 presents the locations of these identified source areas, the treatment plant and Pocatello POTW, in addition to the approximate locations and number of extraction wells in each of these areas. Similar to Groundwater Alternative 2, under Groundwater Alternative 3, the contained groundwater would be treated in one of the following ways:

1. The contained groundwater would be treated by the Pocatello POTW, and then discharged to the Portneuf River.
2. The contained groundwater would be treated by a water treatment facility built onsite and discharged as described for Alternative 2.

8.0 EVALUATION OF ALTERNATIVES

Remedial alternatives are compared using nine criteria in the National Contingency Plan (NCP) as derived from CERCLA. These criteria are in three categories; threshold criteria, balancing criteria, and modifying criteria.

- **Threshold criteria** must be met by an alternative for it to be eligible for selection. The threshold criteria are:
    - *Overall Protection of Human Health and the Environment*
    - *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)*
- **Balancing criteria** are used to weigh major trade-offs among eligible alternatives. The balancing criteria are:
    - *Long-Term Effectiveness or Permanence*
    - *Reduction of Toxicity, Mobility, or Volume Through Treatment*
    - *Short-Term Effectiveness*
    - *Implementability*
    - *Cost*
- **Modifying criteria** by their nature are considered after comment on the Proposed Plan. The modifying criteria are:
    - *State Acceptance*

- *Community Acceptance*

This section summarizes each alternative against the threshold and balancing criteria which are used to evaluate the different alternatives individually, and to compare them to each other to select a proposed alternative, along with what is currently known for the modifying criteria. For sites or OUs like the FMC OU which are located entirely or in part on a tribal reservation, the tribal government for the reservation is treated like a state government for the State Acceptance criterion.

The Soil Alternatives and a summary of each alternative's ability to meet each criterion are summarized on Table 4 and described in detail in Section 8.1 below. The Groundwater Alternatives and a summary of each alternative's ability to meet each criterion are summarized on Table 5 and described in detail in Section 8.2 below.

8.1 Soil Alternatives Comparative Analysis

As described in the *SFS Report*, the greatest potential risks during the construction phase of FMC OU remedial action are related virtually exclusively to Alternatives 5-8 that include excavation and treatment of buried elemental phosphorus wastes in increasing degrees. These risks are: 1) elemental phosphorus fire/elemental phosphorus reaction products exposures to remediation workers, and 2) elemental phosphorus reaction product exposures beyond workers to the environment and to the community downwind to variable degrees depending on conditions at the time reaction products are generated. Generally, throughout the evaluation of the 5 balancing criteria used to compare different aspects of the alternatives, those that propose to cap less and treat more will rank increasingly more preferable for the first 2 balancing criteria (long term effectiveness and permanence, and reduction of toxicity, mobility and volume through treatment) and increasingly less preferable for the 3 other balancing criteria (short term effectiveness, implementability and cost). ET capping of elemental phosphorus wastes should remain fully protective of human health and the environment for as long as ET caps are properly maintained, which should not be difficult or costly to achieve.

8.1.1 Overall Protection of Human Health and the Environment:

The "no action" soil alternative and Alternative 2 are not protective of human health and the environment and therefore do not meet this threshold criterion. All of the other alternatives are protective of human health and the environment by eliminating, reducing, or controlling risks posed by the FMC OU through either containment of contaminated soils, engineering controls, and institutional controls (Alternatives 3 and 4) or these elements in varying degrees with varying degrees of excavation and treatment

(Alternatives 5-6). The covers and ET capping proposed in Alternatives 3 through 6 reduce direct contact risk and soil ingestion risk to less than 1×10^{-6}. Perpetual cap maintenance would be required to ensure total protectiveness. Alternative 4 differs from Alternative 3 by including some contaminated soil consolidation, which results in a reduction in the cap footprint that would have to be maintained.

Alternatives 5 and 6 include some amount of treatment of the soil contaminated with elemental phosphorous thereby decreasing the residual volume and thereby in turn somewhat increasing the assurance of long-term protectiveness of these alternatives. However, like all the excavation and treatment options for this OU, this long term benefit would come at the expense of an inversely proportional increase of very significant short term human health risks during remedy implementation. Therefore, even though removal and treatment of elemental phosphorus-contaminated soils permanently eliminates any risk of these very long lasting wastes from ever igniting or reacting, this significant benefit must be weighed against the very significant risks of grievous personal injury or death associated with handling these wastes to remove or treat them at the FMC OU. Alternatives 3 through 5 would all result in very significant untreated quantities of contained elemental phosphorus waste within the FMC OU.

8.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

The no action alternative cannot comply with ARARs and thus does not meet the required threshold criteria. Alternative 2 similarly does not comply with ARARs and is not protective. To the extent that any alternative does not meet RAOs or ARARs, neither threshold criterion is met, and thus further evaluation against the balancing criteria is not appropriate.

Section 121(d) mandates that upon completion, remedial action must at least attain (or waive) all applicable or relevant and appropriate requirements (ARARs) of any Federal environmental laws, or more stringent promulgated State environmental or facility-siting laws. In December 2010, the Shoshone-Bannock Tribes promulgated Soil Cleanup Standards for Contaminated Properties (SCS) as regulations under their Waste Management Act, and on December 3, 2010 sent a letter (SBT 2010) to EPA requesting that they be considered ARARs for the FMC OU. The SCS provide cleanup levels for more than 100 contaminants for both unrestricted and commercial/industrial land use within the Fort Hall Indian Reservation. In some cases, the SCS requires the development and assessment of a site-specific conceptual site model and risk assessment that considers a Tribal exposure scenario reflecting the lifestyle which some tribes have argued that treaties (and other agreements) were designed to protect, including, most controversially, environmental conditions or contaminant concentrations in various media reflecting the often pristine environmental conditions at the time the treaties were executed. The SCS appear to

EPA at this time to be ARARs for remedial actions on the Reservation. EPA is proposing to select an interim remedial action for soil and groundwater for the FMC OU after consideration of public comment on the proposed alternative in this Proposed Plan. The Final Record of Decision (ROD) Amendment will include remedial action that will fully attain or provide for the formal waiver of all ARARs, or portions thereof, including the SCS to the extent they are ultimately confirmed as ARARs by EPA in consultation with DOJ, at or before the completion of all remedial actions. Any and all waivers will be pursuant to Section 121(d)(4) of CERCLA. The proposed alternative in this Proposed Plan invokes the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial action. EPA believes this preferred interim action will address immediate human health and environmental risks at the FMC OU and will neither exacerbate conditions at the EMF Site nor interfere with the implementation of any future final remedy.

The SFS for the FMC OU was completed prior to promulgation of the Tribes' SCS which appear to require treatment and/or removal of all ignitable/reactive soils. EPA re-evaluated the technical implementability and health and safety issues as well as costs associated with the excavation and treatment alternatives considered during the SFS in evaluating CERCLA's statutory preference for treatment for principle threat waste (PTW) as described in Section 4 of this Proposed Plan. EPA also conducted another thorough review of all potential treatment technologies for elemental phosphorus contaminated soils. Caustic hydrolysis was again identified as the least uncertain and least costly among all potential treatment technologies, and EPA's bases for not selecting it were unchanged. The very significant danger in the projected decades of excavation and subsequent handling common to all excavation and treatment technologies that ultimately caused EPA to reject treatment notwithstanding the CERCLA statutory preference for treatment, especially for PTW, remains no less an impediment as a result of the SCS. Similarly, after careful re-evaluation, EPA concluded, consistent with its prior analyses, that no proven in situ treatment technologies for elemental phosphorus contaminated soils at sites with far smaller quantities than the FMC OU have been developed or proven to be feasible.

The potential hazards associated with the excavation of soils contaminated with elemental phosphorus are described in detail in the SFS. A concise description these hazards are given in Section 2.2.1.1 in the Appendix A of the SFS Report, Identification and Evaluation of P_4 Treatment Technologies.

8.1.3 Long-Term Effectiveness and Permanence

Soil Alternatives 2-6 all use capping as the predominant remedial element with increasing degrees of consolidation and/or excavation and treatment, particularly for elemental phosphorus wastes, along with associated institutional controls. As noted at the end of Section 8.1.1 on the threshold criterion of overall protectiveness, generally, as alternatives propose to cap less and treat more they will rank increasingly more preferable for this balancing criterion. However, because of the quality and projected durability of all the proposed caps, residual risk levels after capping are very low. All the proposed caps would be constructed of local earthen materials of varying thicknesses. They would all be engineered for generally comparable long-term effectiveness and performance as well as effective storm water drainage, therefore no significant deterioration is expected to occur. Long-term operation and maintenance (O&M) includes monitoring and repair as necessary to maintain long-term cap integrity. Soil Alternative 4 ranks modestly more preferable than 3 because RAs A, J and K would be excavated and consolidated rather than capped in place which would reduce the capped footprint by 104.5 acres (from 458.8 acres to 354.5 acres). Soil Alternatives 5 and 6 rank more preferable than Soil Alternative 4 in this criterion because they would excavate and treat substantially more elemental phosphorus wastes, respectively.

8.1.4 Reduction of Toxicity, Mobility, and Volume through Treatment

As noted above, alternatives that propose to treat more (and cap less) will rank increasingly more preferable for this balancing criterion. Soil Alternatives 3 and 4 use capping as a predominant element along with associated institutional controls. Capping and institutional controls do not reduce the toxicity, mobility or volume of COCs through treatment because no treatment occurs. Active treatment in Alternatives 3 and 4 is limited to the sludges in sewer piping in RA-A. Capping is not treatment; therefore these alternatives do not substantially reduce the toxicity, mobility, or volume of contamination. Soil Alternative 5 includes treatment of the elemental phosphorus contaminated soil down to ten feet bgs where it is present at a concentration that would present a risk of auto ignition if disturbed. Alternative 5 would reduce the residual elemental phosphorus contaminated soil but greater than 50,000 yd^3 would remain untreated. Alternative 6 would provide for treatment of all phosphorus contaminated material down to the water table in RU1. Alternative 6 would treat approximately 900,000 yd^3 of phosphorus contaminated soil. It therefore ranks more preferable for this criterion than Alternative 5, which in turn ranks more preferable than Alternative 4.

8.1.5 Short-Term Effectiveness

Soil Alternative 3 ranks most preferable for this criterion. Capping takes substantially less time to implement than excavation and treatment. Consequently, the more treatment an alternative proposes the longer it will take to implement and become effective. More significantly, the longer any treatment alternative takes to implement, the longer increasing risks of casualty (with increasing amounts of treatment of elemental phosphorus wastes) will persist. During excavation and treatment of soils there would be significant risks to both workers and the public as emphasized in various places in this Proposed

Plan. The estimated time to implement the caps and institutional controls required by Soil Alternative 3 is 2 to 3 years. Soil Alternative 4 is estimated to add another year for the wastes that would have to be removed and consolidated from RAs A, J, and K. Soil Alternative 5 would require approximately 20 to 25 years, 20 years longer construction time than Soil Alternative 3 (if the middle of the estimated range is used) due to the additional amount of elemental phosphorus-impacted material that would require removal and treatment from RAs B, C, K, and underground piping (up to 10 ft bgs). Soil Alternative 6 would require at least an estimated 12 years longer construction time than Alternative 5 due to the removal and treatment of all elemental phosphorus-impacted material within RAs B, C, and K (below 10 ft bgs).

8.1.6 Implementability

The primary elements (capping and institutional controls) utilized most extensively by Soil Alternative 3 are proven, straightforward, and relatively easy to design and construct or implement (administratively and technically). Capping is a well-understood technology that is typically applied to the remediation of large mining and mineral processing sites with metals and radionuclides, and is commonly used for elemental phosphorus-contaminated soils. Sources of clean soil and crushed slag are available on-site for cap construction. Engineering and construction services are also expected to be readily available. Generally, as with short term effectiveness, as excavation and treatment are added by degrees, implementability becomes more difficult. Soil Alternatives 4, 5, and 6 present increasingly significant technical challenges and are increasingly more difficult to implement than Soil Alternative 3 for the following specific reasons:

- Soil Alternative 4: The excavation/consolidation of RA-K requires the removal, storage, transport, and placement of soil/fill adjacent to the northern former operations area boundary in an area that has been demonstrated (during the SRI) to contain some elemental phosphorus. The excavation and handling of heterogeneously distributed elemental phosphorus-contaminated material has not been successfully demonstrated. Spontaneous combustion of elemental phosphorus contaminated wastes must be minimized if not eliminated. This would likely require some type of wet excavation as well as temporary enclosures to manage phosphorus pentoxide (P_2O_5) and other gases that may be generated. Lastly, a significant amount of clean fill would be needed to contour this area for stormwater management and/or future land use.

- Soil Alternative 5: In addition to exacerbating the challenges presented by Soil Alternative 4, due to significantly increased quantities of elemental phosphorus wastes to be excavated and handled, on-site treatment of excavated elemental phosphorus wastes would require the design and construction of a treatment plant. While FMC did construct a treatment plant to treat similar wastes just before it ceased elemental phosphorus manufacturing operations, the plant was never operated and successful operation was never proven. Further, the plant was designed to treat a homogeneous waste stream from the plant and a significant amount of material sizing and handling would be required prior to treatment of FMC OU elemental phosphorus-contaminated soils. Wet excavation and on-site treatment of large volumes of elemental phosphorus-impacted soils have never been demonstrated.

- Soil Alternative 6 presents the same challenges as Soil Alternatives 4 and 5, compounded by a substantially larger volume of elemental phosphorus-impacted material to be excavated and treated onsite, i.e., greater uncertainty in technical implementability.

8.1.7 Cost

Costs, like implementability challenges, progressively escalate from Soil Alternative 3 to Soil Alternative 8 (Soil Alternatives 7 and 8 which were described earlier for informational purposes only are costed as part of this section for the same limited purposes, though they were not compared for the other remedy selection criteria). The following are the net present value costs (at a 7% discount rate, 30 years for Alternatives 3 through 5, 37 years for Alternative 6, and 44 years for Alternatives 7 and 8) for the Soil Alternatives. The key features, capital costs, and operations and maintenance costs for of each of the Soil Alternatives are summarized in the table below.

Key features, Capital Costs, and Costs of Operation and Maintenance of Soil Alternatives

Alternative	Meet RAOs? (Y/N)	Time to Implement (Years)	Capital Costs ($)	Operation Costs ($/year)	Net Present Value ($)
Soil 1	N	0	$0	$0	$0
Soil 2	Y	Unknown	N/A	N/A	N/A
Soil 3	Y	2-3	$43,600,000	$602,000	$47,200,000
Soil 4	Y	2-4	$76,800,000	$547,000	$81,600,000
Soil 5	Y	20-25	$353,000,000	$4,500,000	$405,100,000
Soil 6	Y	37	$474,500,000	$8,881,000	$591,100,000
Soil 7[1]	Y	44	$720,900,000	$16,900,000	$949,600,000

Soil 8[1]	Y	≥ 44	$3,323,700,000	$13,000,000	$3,499,700,000

[1] Soil Alternatives 7 and 8 are presented for informational purposes only, as discussed above in Section 7.4.

Costs for Soil Alternatives 1 through 5 and Groundwater Alternatives 0 through 3 were developed by FMC and reported in the *SFS Report.* Costs for Soil Alternatives 6 through 8 were developed by EPA and are presented in *Cost Estimates for the Soil and Groundwater Alternatives for the FMC OU Proposed Plan* (BAH, 2010). These costs are projected to be accurate within +50% to -30%, consistent with EPA policy and guidance.

These cost estimates show that those Soil Alternatives that involve significant treatment of elemental phosphorus contaminated wastes (Soil Alternatives 5 – 8) cost approximately 10 to 100 times more than Soil Alternatives that manage these wastes in place.

8.2 Groundwater Alternatives Comparative Analysis

The Groundwater Alternatives and a summary of their comparative rankings of high, moderate, or low under each criterion are summarized on Table 5 and are described in detail below. As part of the SFS, FMC developed a groundwater flow and transport model (*Groundwater Model Report*, *SFS Report* Appendix E). The primary purpose of the model was to compare the fate of groundwater contaminants under the proposed SFS groundwater remedial alternatives. The results from the model's predictive runs for the groundwater alternatives are summarized below:

- Simulations of each of the three Groundwater Alternatives (excluding the no action alternative) indicated that the areal extent of arsenic in groundwater within the former operations area (as defined by the 0.01 mg/l contour) would be reduced by 26% over 100 years for Groundwater Alternative 1, by 28% over 100 years for Groundwater Alternative 2, and by 37% over 100 years for Groundwater Alternative 3. The areal extents of total phosphorus/ orthophosphate and potassium (above background levels) would be reduced by 62% and 51% over 100 years, respectively for Groundwater Alternative 1, by 64% and 56% over 100 years, respectively, for Groundwater Alternative 2, and by 79% and 65% over 100 years, respectively, for Groundwater Alternative 3. Groundwater restoration, i.e., meeting risk-based concentrations (RBCs) and ARARs are therefore not predicted to be met within 100 years by any of these alternatives, while Groundwater Alternative 3 predicted to be most efficacious of the alternatives.

- Sensitivity analyses indicated that the transport model was most sensitive to uncertainty in sorption coefficients. The sorption coefficient used in the model is an indicator of how easily COCs are bound and released to sands, silts, and clays in the formation. Because the precise values for these sorption coefficients are not well understood, there was substantial uncertainty in the predictions cited above of how long it would take to achieve FMC OU groundwater RAOs.

- Therefore, additional predictive simulations were run in which these coefficients were halved and doubled. Even with lower sorption coefficients, RAOs are not predicted to be met for any of the groundwater constituents within 100 years. A sorption coefficient relates the separation of a contaminant between soil and water in a soil-water mixture. The amount of a specific contaminant bonded to the soil is compared to the concentration of that contaminant dissolved in water. This ratio makes up the sorption coefficient for a specific contaminant for specific soils.

8.2.1 Overall Protection of Human Health and the Environment

The No Action groundwater alternative would meet none of the RAOs and therefore is not protective of human health and the environment. The source control (soil alternative), institutional controls, and long-term monitoring under each of the groundwater alternatives meet two of three groundwater RAOs for protection of human health and the environment by:

- Preventing the ingestion of contaminated groundwater through an institutional control; and
- Reducing/eliminating the release of COCs from identified sources through by source control implemented as soil remediation.

The hydraulic containment wells at the former operations area northern boundary (as opposed to everywhere) under Groundwater Alternatives 2 and 3 are predicted to demonstrate restoration of groundwater downgradient from the former operations area and beneath FMC's Northern Properties within a 25 to 50 year timeframe, but restoration is predicted to take more than 100 years for the remainder of the OU. In addition, achieving groundwater restoration further downgradient in the area where FMC- and Simplot-impacted groundwater discharges to the Portneuf River is highly dependent on the success of the ongoing Simplot groundwater remedial action. Simplot has performed mass loading calculations and estimates that FMC-impacted groundwater migrating downgradient from the former operations area northern boundary accounts for less than 5% of the total arsenic and total phosphorus mass load to EMF-impacted groundwater migrating to the river, as reported in the *Groundwater Extraction and Monitoring System Remedial Design Report* (Simplot, 2009). Although EPA has not approved the Simplot mass loading calculation, EPA's Interim ROD Amendment for the Simplot OU states that EPA believes Simplot is a significantly larger contributor of phosphorus to the Portneuf River than FMC. Groundwater Alternatives 2 and 3 are predicted to incrementally reduce the areal extent of groundwater exceeding the arsenic MCL in the former operations area by 2% and 9% respectively, compared to Groundwater Alternative 1. As noted in the previous section, groundwater modeling predicts that none of the alternatives will achieve groundwater restoration everywhere beneath the former operations area within a reasonable time frame (within 100 years).

8.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Groundwater Alternative 0 (No Action) will not comply with the groundwater ARARs. Groundwater Alternatives 1, 2, and 3 would prevent consumption of contaminated groundwater above MCLs through institutional controls implemented by environmental easements. However, it is unclear how long it would take to meet MCLs or whether MCLs would be met within a reasonable time frame. Source control under Groundwater Alternatives 1, 2, and 3 supports meeting groundwater quality ARARs by reducing or eliminating future releases of COCs to groundwater. The groundwater model however, predicts that none of the alternatives will fully comply with the groundwater quality standards (arsenic MCL and RBCs for total phosphorus) within a reasonable timeframe (i.e., could require more than 100 years to restore groundwater quality within the former operations area).

EPA is proposing to select an interim remedial action for groundwater for the FMC OU in this Proposed Plan. The Interim Record of Decision (ROD) Amendment will include the requirement to fully attain or waive all ARARs at the completion of remedial action, and will invoke the waiver in Section 121(d)(4)(A) of CERCLA for interim remedial actions. The proposed alternative in this Proposed Plan will neither exacerbate conditions at the site nor interfere with the implementation of any future final remedy. The Interim ROD Amendment will eventually be followed by a Final ROD Amendment that will further address compliance with all ARARs, consistent with CERCLA, including any concurrent or future waivers.

8.2.3 Long-Term Effectiveness and Permanence

The No Action Groundwater Alternative does not prevent potential exposure to (consumption of) impacted groundwater or reduce the release or potential release of source area COCs to groundwater. Source Control (consisting of the selected soil remedial alternative), institutional controls, and long-term monitoring under Groundwater Alternatives 1, 2 and 3 should be effective in the long term. As long as the environmental easements are complied with or enforced as necessary, they should prevent the ingestion of contaminated groundwater, and source control should remove future contributions to the groundwater and allow it to attenuate over time.

The hydraulic containment wells at the former operations area northern boundary under Groundwater Alternatives 2 and 3 are predicted to demonstrate the practicability of restoration of groundwater downgradient from the former operations area and beneath FMC's Northern Properties within 25 to 50 years. As noted earlier however, achieving groundwater restoration downgradient in the area where FMC and Simplot-impacted groundwater discharges to the Portneuf River is highly dependent on the success of the Simplot groundwater remedial action. Groundwater Alternatives 2 and 3 are predicted to incrementally reduce the areal extent of groundwater exceeding the arsenic MCL in the former operations area by 2% and 9% respectively, compared to Groundwater Alternative 1. Groundwater modeling predicts that none of the groundwater alternatives will achieve groundwater restoration beneath the former operations area within 100 years, which is also subject to substantial uncertainties.

Groundwater Alternative 3 ranks the most preferable for this criterion, followed by Groundwater Alternatives 2 and then 1. These ranking are premised on the predicted achievement of this criterion in the shortest timeframe with the most reduced degree of uncertainty.

8.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The No Action Groundwater Alternative does not meet this criterion. Groundwater Alternative 1 reduces or eliminates release and migration (i.e., mobility) of COCs from the source areas to underlying groundwater by implementing source control, but does not include treatment. In addition to source control, Groundwater Alternatives 2 and 3 hydraulically contain impacted groundwater thereby preventing it from migrating downgradient from the former operations area northern boundary by pumping and then reducing the volume and toxicity of impacted groundwater through treatment. Groundwater Alternative 3 ranks the most preferable of these alternatives for this criterion by achieving it to the greatest degree, Groundwater Alternatives 2 and 1 rank less preferable in that order on this basis.

8.2.5 Short-Term Effectiveness

The No Action Groundwater Alternative is not effective in the short term. Groundwater Alternative 1 is effective in the short-term at preventing access and exposure to impacted groundwater principally through institutional controls by cutting off the pathway to receptors, and also by reducing or eliminating the mobility of COCs from the source areas to underlying groundwater by implementing source control. The time frame for implementation of Groundwater Alternative 1 will be dependent on the selected soil (source control) remedy, but the institutional controls and LTM could be implemented immediately following EPA approval of the Remedial Design/Remedial Action Work Plan. Groundwater Alternatives 2 and 3, which include the restoration of groundwater downgradient from the former operations area and beneath FMC's northern properties is predicted to take 25 to 50 years, so they provide no additional short-term effectiveness, but certainly no less for this reason. The short-term risks associated with Groundwater Alternatives 1, 2 and 3 would be the same as those associated with the selected soil (source control) remedy. The final design of Groundwater Alternatives 2 or 3 will require additional confirmation of hydrogeologic parameters in the extraction zone. Groundwater Alternatives 2 and 3 will require either an agreement with the Pocatello POTW meeting discharge permit requirements, or design and construction to EPA satisfaction of a treatment system and percolation ponds. Groundwater Alternative 2 would take a relatively short time (within the same time frame as source control) to construct and begin operation depending on the complexity of the system. Groundwater Alternative 3 would require a longer timeframe due to additional design and construction considerations but this additional time would not make it less effective in the short-term. The construction and operation of either Groundwater Alternative 2 or 3 would present little risk to the community, workers, or the environment and would therefore be comparable to Groundwater Alternative 1 in this respect. For all of these reasons, Groundwater Alternatives 1, 2 and 3 rank essentially equally for this criterion. The additional benefits of Groundwater Alternatives 2 and especially 3 as compared to Groundwater Alternative 1 would at least arguably not occur soon enough to impact the ranking for short term effectiveness.

8.2.6 Implementability

The No Action alternative is invariably literally the easiest to implement. Groundwater Alternative 1 also is relatively easy to implement, both administratively and technically, consistent with the relative implementability of the selected soil (source control) remedy. Groundwater Alternatives 2 and 3 pose no significant additional technical or administrative implementability issues, but are necessarily somewhat more difficult to implement both technically and administratively because of uncertainties regarding the required treatment system and the disposal options for the treated water.

8.2.7 Cost

There are no costs associated with the No Action Alternative. Groundwater Alternatives 1, 2 and 3 include source control, i.e., the soil remediation alternative (costs not included in the groundwater alternative estimates) and institutional controls. Groundwater Alternative 3 has a significantly higher estimated cost to implement than Groundwater Alternative 2, in the range of as much as an order of magnitude. Groundwater Alternative 2 similarly has an estimated approximate order of magnitude cost compared to Groundwater Alternative 1. There would also be less steeply graduated annual O&M costs associated with long-term monitoring of groundwater trends for each of these alternatives. The range of net present value (NPV) costs of Groundwater Alternatives 2 and 3 reflect the capital costs associated with construction of an onsite groundwater treatment facility and an onsite infiltration basin or disposal at the Pocatello POTW. The key features, capital costs, and operations and maintenance costs for of each of the groundwater alternatives are summarized in the table below.

Key features, Capital Costs, and Costs of Operation and Maintenance of Groundwater Alternatives

Alternative	Meet RAOs? (Y/N)	Time to Implement (Years)	Capital Costs ($)	Operation Costs ($/year)	Net Present Value ($)
GW 0	N	0	$0	$0	$0
GW 1	N	≤1	$57,000	$71,000	$960,000
GW 2	Unknown	1-4	$579,000 - $2,700,000	$552,000 - $712,000	$9,600,000 - $11,200,000
GW 3	Unknown	2-4	$5,100,000 - $6,500,000	$1,100,000 - $1,400,000	$24,200,000 - $25,100,000

EPA expects these costs to be accurate within +50% to -30%.

8.3 Modifying Criteria for Soil and Groundwater Alternatives

8.3.1 State and Tribal Acceptance

The Shoshone Bannock Tribes have expressed vigorous opposition to the selection of Soil Alternative 3. The Tribes oppose capping elemental phosphorus contaminated wastes in place at the FMC OU, and want removal and/or treatment of all such wastes or materials instead. The Tribes do not support the proposed Soil Alternative. The Tribes also oppose any groundwater alternative that will not achieve groundwater restoration within 100 years throughout the FMC OU.

IDEQ has expressed support for the selection of Soil Alternative 3 and Groundwater Alternative 2 as interim remedies.

8.3.2 Community Acceptance

Community acceptance of the proposed alternative will be evaluated after the public comment period for this Proposed Plan. The input from the meetings and written comments will be carefully reviewed and a responsiveness summary will be prepared. The responsiveness summary will be presented with the Interim ROD Amendment for the FMC OU along with the selected remedy. A form for submitting comments is attached in Section 14.0 of this document.

9.0 PROPOSED ALTERNATIVE

EPA is recommending the selection of Soil Alternative 3 as an interim remedy, which contains the following implementation refinements which will be more precisely developed during remedial design:

- Integration of a reuse/redevelopment option if development plans are timely identified during remedial design and do not significantly alter the proposed alternative in any way. Any significant differences would be documented in an Explanation of Significant Difference(s) or become the basis of a subsequent Proposed Plan and Interim ROD Amendment if the remedy is sufficiently changed.
- Consolidation of contaminated soil and minimization of the extent of the covers and caps (i.e., to make cover/cap footprint as small as practicable.
- Optimization of the storm water control system including appropriate placement of storm water retention basins.
- A contingency for vapor extraction and treatment if phosphine or other harmful phosphorus related gases develop under an ET capped elemental phosphorus waste containing area within the FMC OU that would pose a threat of release to ambient air at a level that would result in unacceptable risk to human health.

EPA is recommending the selection of Groundwater Alternative 2 as an interim rather than final remedial action because of uncertainty as to whether any of the groundwater alternatives can achieve groundwater restoration within 100 years. Groundwater Alternative 2 (in conjunction with source control (ET capping) that would be part of Groundwater Alternatives 1, 2, and 3), allows for the collection of more site specific data to be used (as opposed to only modeling) to determine with greater confidence if groundwater restoration could be achieved within a reasonable timeframe, while avoiding the long term delay in initiation of pumping in an area which will likely require some degree of pumping in any eventuality. Groundwater Alternative 3 does not provide any reduction in time to meet RAOs at a significantly higher cost. Groundwater Alternative 3, or perhaps some groundwater alternative that was not evaluated in the SFS and this Proposed Plan, could be selected and implemented in the future should its implementation prove necessary. Groundwater monitoring data will continue to be evaluated during the five year review process to inform any future necessary groundwater remedy alterations.

10.0 COMMUNITY PARTICIPATION

EPA continues to provide information regarding the cleanup of the EMF Superfund Site to the public through newsletters, public meetings, the Administrative Record for the EMF Site, direct mailings, announcements published in the *Idaho State Journal, Sho-Ban News, Power County Press, and Blackfoot Morning News,* and through its EMF Superfund website which may be accessed at: http://go.usa.gov/iTC

EPA, the Tribes, and IDEQ encourage the public to gain a more comprehensive understanding of the EMF Site and cleanup activities in progress. Details about the public meetings and instructions for providing public comment on this Proposed Plan are provided in Section 1.5 of this Proposed Plan. Section 14.0 contains a blank comment form to facilitate comment. For additional information on this project, please contact:

Mr. Chris Bellovary
US EPA Region 10
1200 Sixth Ave, Suite 900
Office of Environmental Cleanup, ECL-113
Seattle, WA 98101
(T) 206-553-2723
(F) 206-553-0124
Bellovary.chris@epa.gov
(For emailed comments, please put “FMC OU Proposed Plan” in the subject line.)

Documents referred to in this Proposed Plan may be found in the Administrative Record, which is available for public review at the following locations:

Idaho State University Library
Government Documents
850 South 9th Avenue
Pocatello, Idaho 83209
(208) 282-3152

Shoshone-Bannock Library
Tribal Business Center
Pima Drive and Bannock Avenue
Fort Hall, Idaho 83203
(208) 478-3882

(NEW) American Falls Library
308 Roosevelt Street
American Falls, Idaho 83211
(208) 226-2335

EPA Region 10 Superfund Records Center
1200 Sixth Avenue, Suite 900, ECL-076 (7th Floor)
Seattle, WA 98101
(206) 553-4494

11.0 LIST OF ACRONYMS USED IN THE PROPOSED PLAN

AFLB	American Falls Lake Beds
AOC	Administrative Order of Consent
ARAR	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act (The Superfund Law)
cfs	cubic feet per second
COC	contaminant of concern
CSM	conceptual site model
EMF	Eastern Michaud Flats (Superfund Site)
EPA	Environmental Protection Agency
ERA	ecological risk assessment
ET	evapotranspiration
FS	Feasibility Study
gpm	gallons per minute
GWCCR	*Groundwater Current Conditions Report*
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
I-86	Interstate 86
IWW	industrial waste water
IDEQ	Idaho Department of Environmental Quality
LTM	long-term monitoring
MCL	maximum contaminant level
ug/L	micrograms per liter
mg/L	milligrams per liter
MNA	monitored natural attenuation
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPV	net present value
OU	operable unit
O&M	operations and maintenance
P_4	elemental phosphorus
PCDA	Pollution Control Development Agreement
PH_3	phosphine gas
POTW	Publicly Owned Treatment Works

ppm	parts per million
PRG	preliminary remediation goal
PTW	Principle Threat Waste
RA	Remediation Area
RAO	remedial action objective
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
RIR	Receptor-Initiated Remediation
RME	reasonable maximum exposure
ROD	Record of Decision
RODA	Record of Decision Amendment
RPM	remedial project manager
RU	Remediation Unit
SBT (Tribes)	Shoshone Bannock Tribes
SFS	Supplemental Feasibility Study
SRI	Supplemental Remedial Investigation
SUA	Southern Undeveloped Areas
SWMU	solid waste management unit
TI	Technical Impractability
TMDL	Total Maximum Daily Load
TSD	Treatment Storage or Disposal
UMTRCA	Uranium Mill Tailings Radiation Control Act
WUA	Western Undeveloped Areas

12.0 GLOSSARY

acute hazard - the ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a hazardous substance.

adjoining - bordering; lying adjacent to another; or sharing a boundary.

Administrative Order on Consent (AOC) - a legal order issued by EPA to individuals, corporations, and/or other parties with terms agreed to by those party(s) to perform tasks such as correcting regulatory violations, implementing cleanup actions, refraining from specified actions, among other things.

alkaline - a term used to describe substances that have a value higher than 7 on the pH scale.

Amended ROD (or ROD Amendment) - a major change or addition to a Record of Decision.

Anderson filter media - an Anderson filter was used to capture dust particles generated in the former furnace building during the processing of elemental phosphorus at the former FMC Plant. Anderson filter media refers to the filter material after it had been used to filter dust particles that may have contained contaminants of concern.

annual evapotranspiration rates - the annual sum of evaporation and plant transpiration from the earth's land surface to atmosphere.

annual precipitation - the annual sum of any form of water (rain or snow or hail or sleet or mist) falling to the earth (about 11-12 inches for Pocatello, ID).

Applicable or Relevant and Appropriate Requirement (ARAR) - legal requirements for Superfund cleanups in federal environmental statutes or regulations, or more stringent state or tribal environmental or facility siting statutes or regulations.

aquifer - an underground geological formation, or group of formations, containing water. Aquifers are sources of groundwater for wells and springs.

aquitard - a geological formation that may contain groundwater but is not capable of transmitting significant quantities of groundwater under normal hydraulic gradients. An aquitard may prevent groundwater from migrating or mixing with another source.

background concentrations - the concentration of a substance in an environmental media (air, water, or soil) that occurs naturally or is not the result of human activities, or at least not local or regional human activities (natural background); or the concentration from other than releases at a site, including other sources from human activities (anthropogenic background).

balancing criteria - Criteria 3-7 of the nine criteria used to evaluate and compare remedial alternatives developed in a Feasibility Study. The balancing criteria are long-term effectiveness and permanence, reduction of toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost.

base flow - is the portion of stream or river flow that comes from "the sum of deep subsurface flow and delayed shallow subsurface flow." It is not the same as groundwater flow.

below ground surface (bgs) - the depth at which contamination, groundwater, or any other object of interest is found below the surface of the ground.

calciner pond solids - phosphate-ore was heated in a large furnace called a calciner prior to being mixed with coke and silica for elemental phosphorus production at the former FMC Plant. The calciner would drive off water and other low-boil chemicals from the phosphate-ore, which were called calciner fines. These calciner fines were captured, mixed with water, and sent to ponds to dry.

caustic hydrolysis - a chemical process in which a certain molecule is split into two parts by the addition of a molecule of water using caustic materials (such as sodium hydroxide, NaOH).

characterization - the use of scientific techniques to determine properties and compositions of something.

chemical precipitation - the process of removing contaminants (in a liquid) by combining other chemicals to form solids, which can be filtered or stabilized.

chemical signature - a unique combination and concentration of chemicals in a substance, such as groundwater. Groundwater from the Eastern Michaud Flats will have a different chemical signature than groundwater from another aquifer.

chronic exposure - multiple exposures occurring over an extended period of time or over a significant fraction of an animal's or human's lifetime (usually seven years to a lifetime).

Clean Water Act - the primary federal law regulating surface water pollution.

cleanup - actions taken to deal with a release or threat of release of a hazardous substance that could affect humans and/or the environment. The term "cleanup" is sometimes used interchangeably with the terms remedial action, removal action, response action, or corrective action.

commingled - blended or mixed.

compliance - meeting or exceeding requirements of relevant laws and regulations.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - a federal law (passed in 1980) clean up hazardous waste sites; commonly referred to as Superfund.

Consent Decree (CD) - Under CERCLA, a settlement agreement, approved by a judge and entered in federal court between EPA and potentially responsible parties (PRPs) through which PRPs conduct remedial action at a Superfund site, or any other activities in the definition of AOC above.

consolidation - the act of combining scattered material into a solid mass.

contaminant of concern (COC) - the primary physical, chemical, biological, or radiological substance or matter that has an adverse effect on air, water, or soil. There may be more than one contaminant of concern at a given area.

cubic feet per second (cfs) - a measure of the volume of groundwater or surface water within a fixed period of time. Commonly used to describe flows in rivers or aquifers, one cubic foot (liquid) is equivalent to about 7.5 gallons (liquid).

deposition - airborne pollution that falls to the ground in precipitation, in dust, or simply due to gravity, or water borne pollution that settles in sediment.

dermal absorption - process by which a chemical penetrates the skin and enters the body as an internal dose.

ecological risk assessment (ERA) - a part of the Superfund process used to estimate the effects of human actions on a non-human life called receptors (plants and animals). An ERA includes identifying hazards, determining the exposure of those hazards to receptors and the effects of the exposure on those receptors, and risk characterization.

elemental phosphorus (P_4) - was prepared at the former FMC Plant in electric furnaces where phosphate-ore, coke, and silica were continually heated. Elemental phosphorus is pyrophoric which means it ignites when exposed to oxygen. Elemental phosphorus is used to produce phosphoric acid and other products such as fertilizers, food additives, and cleaning compounds.

emissions - pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residential chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

Environmental Protection Agency (EPA) - the primary agency of the United States charged with protecting the environment.

escarpment - a long steep slope or cliff at the edge of a plateau or ridge; usually formed by erosion.

evapotranspiration (ET) - the sum of evaporation and plant transpiration from the Earth's land surface to atmosphere.

excavation - the act of excavating, or of making hollow, by cutting, scooping, or digging out a part of a solid mass

extraction - the process used to remove groundwater through a discharge well.

Feasibility Study (FS) - an analysis of alternatives often with a proposed or recommended alternative. For cleanup of a Superfund site, the FS usually starts shortly after the Remedial Investigation (RI) is underway.

fugitive dust - particles lifted into the ambient air caused by human-made and natural activities such as the movement of soil, vehicles, equipment, blasting, and wind. This excludes particulate matter emitted directly from the exhaust of motor vehicles and other internal combustion engines, from portable brazing, soldering, or welding equipment, and from pile drivers.

gallons per minute (gpm) - a unit of volumetric flow rate of liquids, commonly used to describe groundwater flow.

gamma radiation - high-energy, penetrating radiation emitted in the radioactive decay of many radionuclides. Gamma rays are similar to X rays, but X rays generally have lower energy. Energy is measured in Curies (Ci) and is measured in soil as picocuries per gram (pCi/g).

groundwater - the supply of fresh water found beneath the Earth's surface, usually in aquifers, which supply wells and springs, and most surface water bodies. Because groundwater is a major source of drinking water, there is growing concern over contamination from leaching agricultural or industrial pollutants or leaking underground storage tanks.

hazard index - the summation of the hazard quotients for all chemicals to which an individual is exposed. A hazard index value of 1.0 or less than 1.0 indicates that no adverse human health effects (non-cancer) are expected to occur.

hazard quotient - the ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse health effects are likely to occur. A typical acceptable range for a hazard quotient is less than 1.0.

human health risk assessment (HHRA) - the investigation to determine the likelihood that a given exposure or series of exposures may have damaged or will damage the health of human beings.

hydraulic conductivity - the rate at which water can move through a permeable medium, like native soil, gravel, silt, etc.

hydraulic head - a specific measurement of water pressure above an earth-based reference point. It is usually expressed in units of length by measuring the water surface elevation at the entrance (or bottom) of measurement tube (called a piezometer). In an aquifer, hydraulic head can be calculated from the piezometer's elevation and depth in a well. Hydraulic head can similarly be measured in a column of water using a standpipe piezometer by measuring the height of the water surface in the tube relative to an earth-based reference point.

hydrologic - related to the science of the properties, distribution, and effects of water on a planet's surface, in the soil and underlying rocks, and in the atmosphere.

hypothetical - a situation, statement, or question about something posed or imaginary rather than actual or real.

implement - perform, as in performing a remedy; or enforce, as in compliance with laws and regulations.

incidental soil ingestion - soil ingested unintentionally, e.g., from small soil particles on hands during food handling or other activities, or dust trapped in nasal passages and inadvertently swallowed.

infiltration - the process of water entering the soil.

institutional controls - administrative and legal controls that minimize the potential for human exposure to contamination and/or protect the integrity of the remedy.

interim – not final, for a period prior to an end or final point.

lateral - to the side.

leaching - a process by which soluble constituents are dissolved and filtered through soil by a percolating fluid.

lime - calcium oxide (CaO), a widely used caustic compound.

loess - sediment formed by the accumulation of wind-blown silt and lesser and variable amounts of sand and clay.

maximum contaminant level (MCL) - The federal Safe Drinking Water Act standard for the maximum permissible level of a contaminant in water delivered to any user of a public system.

medium - environmental category (e.g., surface water, groundwater, soil, air) in which contaminants may be present and may migrate.

migration - the movement of a contaminant (or anything else) from one location or media to another.

milligrams per kilogram (mg/kg) - a unit of measure which expresses concentration of a contaminant in question within its medium. Equates to parts per million (ppm).

milligrams per liter (mg/l) - a similar unit of measurement of (usually) liquid/gaseous mixture.

modifying criteria - Criteria 8 and 9 of the nine criteria used to evaluate and compare remedial alternatives developed in a Feasibility Study. The modifying criteria are state (and/or tribal) acceptance and community acceptance.

National Oil and Hazardous Substances Pollution Contingency Plan (National Contingency Plan or NCP) - federal regulations for Superfund site cleanups and responses to oil and other spills into surface waters or elsewhere.

net present value (NPV) - a standard method to appraise long-term projects by converting future estimated costs to present value.

nine criteria - The criteria in the NCP used to evaluate and compare remedial alternatives developed in a Feasibility Study. The nine criteria are overall protectiveness of human health and the environment, compliance with ARARs, long-term effectiveness and permanence, reduction of toxicity, mobility, and volume through treatment, short-term effectiveness, implementability, cost, state (and/or tribal) acceptance, and community acceptance.

non-operational - not associated with operation; not operating; not working.

nonpoint source - a Clean Water Act term for a surface water pollution source, commonly groundwater, that is not a point source subject to Clean Water Act permitting.

Operable Unit (OU) - part of a Superfund site cleanup created by EPA for administrative convenience., i.e., to better address a site The Eastern Michaud Flats Superfund Site is divided into three OUs (Simplot OU, FMC OU, and Off-Plant OU).

operations and maintenance (O&M) - Activities conducted after remedial action, or after remedial action construction, to ensure that the action is fully implemented and remains effective.

orthophosphate - the most common form of phosphorus ion in solution in rivers like the Portnuef River.

parcel - a piece of land.

parts per million (ppm) – another unit of measure commonly used to express concentrations of contaminants.

pathway - the physical course a contaminant takes from its source to exposed organisms or receptors.

percolation - the movement of water downward and radially through subsurface soil layers, usually continuing downward to groundwater.

perennial surface water systems - streams or rivers that have continuous flow in parts of its bed all year round during years of normal rainfall.

permeability - the rate at which liquids pass through soil or other materials in a specified direction.

phosphine (PH_3) - the compound with the formula PH_3 a colorless, flammable, toxic gas.

phosphorus - an essential element used in weapons, detergents, fertilizers and cola soft drinks, among other commercial applications.

phossy solids - dried solids from FMC process water that was used to cover elemental phosphorus. Elemental phosphorus burns when in contact with air, therefore water was used to cover liquid elemental phosphorus during production. This "phossy water" would be pumped into ponds where the liquid evaporated, leaving phossy solids.

potentially responsible party (PRP) - a Superfund legal term for parties liable for cleanups. They are current and past owners or operators of all or part of a site, and parties who arranged for either disposal or transport of hazardous substances at or to a Superfund site.

precipitate - a substance separated from a solution or suspension by chemical or physical change.

precipitator solids - solids from a pollution control device that collected particles from an FMC process air stream.

preliminary - denoting an action or event preceding or in preparation for something more important; designed to orient or acquaint with a situation before proceeding; "a preliminary investigation".

preliminary remediation goal (PRG) - a goal which combines current human health toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air, and water) that are considered by EPA to be health protective of human exposures over a lifetime.

primary release mechanism - the method by which a contaminant was released into the environment, for example, a smoke stack emitting metals, or dumping molten slag onto the ground.

proposed alternative - the remedial alternative proposed by the EPA in a Proposed Plan using the nine criteria in the NCP.

Proposed Plan - a remedial action plan with a proposed alternative issued by EPA for public comment.

Publicly Owned Treatment Works (POTW) - waste-treatment works owned by a governmental entity usually designed to treat domestic wastewaters.

radionuclide - radioactive particle with a distinct atomic weight which may have a long life as a soil or water contaminant. Each radionuclide decays at a different (half-life) rate.

radium-226 (Ra-226) - The most stable isotope of radium with a half-life of 1601 years. Decays into radon gas. The Curie (Ci) is a unit of radioactivity with the same disintegration rate as 1 gram of radium-226.

radon - a colorless naturally occurring, radioactive, non-reactive gas formed by radioactive decay of radium atoms in soil or rocks.

Resource Conservation and Recovery Act (RCRA) - a federal solid and hazardous waste regulatory and cleanup law.

receptor – an organism exposed to a contaminant or stressor.

Record of Decision (ROD) - a Superfund cleanup decision issued by EPA containing selected Remedial Action.

Remedial Action - the selected cleanup in a ROD, also used to describe the construction or implementation phase of a Superfund site cleanup that follows remedial design.

Remedial Action Objectives (RAOs) - site-specific narrative goals for remedies based on risks to receptors and ARARs (see ARARs definition).

remedial alternative - a possible remedy evaluated in a Feasibility Study. A "No Action" alternative is always included in a set of remedial alternatives for comparison purposes.

Remedial Design (RD) - the Superfund cleanup phase prior to Remedial Action that primarily consists of the development of engineering plans and specifications for a cleanup, but may include further sampling or other investigatory tasks to resolve uncertainties and/or refine cleanup actions.

Remedial Investigation (RI) - an in-depth study including sampling and analyses to determine the nature and extent of contamination at a Superfund site, and establish criteria to support the analyses of alternatives in the succeeding Feasibility Study(FS).

Remediation Areas (RA) - during the FMC OU Supplemental Feasibility Study, Remediation Units were redefined as Remediation Areas to better group areas with similar wastes. Boundaries were redrawn to more accurately define areas within the FMC OU with similar characteristics that could be remediated using similar methods.

Remediation Units (RU) - boundaries drawn during the FMC OU Supplemental Remedial Investigation to encompass one or more areas with similar processes or characteristics, including contaminants of concern. In all, 24 remediation units were drawn.

riparian - of or related to the bank of a river or other waterway, a zone where land meets water.

risk driver - a contaminant of concern responsible for significant site risks.

risk-based concentration (RBC) - a calculated maximum safe level of a particular contaminant of concern (phosphorus, arsenic, etc.) in a particular medium (soil, groundwater, air, etc).

saline - salt water.

semi-arid - the climate of a region that receives low annual precipitation.

sensitivity analysis - compares how changing the inputs of a simulation affect the output of that simulation.

slag - a vitrified by-product of the melting of phosphorus-ore to separate the phosphorus from the other materials in the ore. Slag is a mixture of metal oxides and silicon dioxide. FMC slag is high in gamma radiation, aluminum, calcium, fluoride, magnesium, and orthophosphorus.

sodium bicarbonate - a compound with the formula $NaHCO_3$, commonly known as baking soda.

sodium chloride - common table salt, NaCl.

source materials - the input materials used to produce a product. For FMC, the source materials to produce elemental phosphorus included phosphate-ore, silica, and coke.

stratigraphy - the formation, composition, and sequence of sediments, whether consolidated or not.

subchronic exposure - multiple or continuous exposures lasting for approximately ten percent of an experimental species lifetime, usually over a three-month period.

subsoil - the layer of soil between the topsoil and bedrock.

Superfund - a term for the hazardous waste cleanup law (CERCLA), also the EPA program that implements that law.

Supplemental Feasibility Study (SFS) - an additional Feasibility Study (see Feasibility Study definition).

Supplemental Remedial Investigation (SRI) - an additional Remedial Investigation (see Remedial Investigation).

surface water - all water naturally open to the atmosphere (oceans, rivers, lakes, reservoirs, ponds, streams, etc.).

threshold criteria - Criteria 1 and 2 of the nine criteria used to evaluate and compare remedial alternatives developed in a Feasibility Study (FS). Threshold criteria are overall protection of human health and the environment and compliance with ARARs. Alternatives that do not meet both threshold criteria are not carried forward as viable alternative in a FS.

transpiration - the process by which water vapor is lost to the atmosphere from living plants. The term can also be applied to the quantity of water thus dissipated.

unacceptable human health risks - risks that exceed levels of concern identified by a regulatory agency like EPA. For cancer causing agents, the level of concern is usually related to the chance of getting cancer over one's lifetime due to exposure to a carcinogen; for agents with effects other than cancer, the level of concern is based on a toxicity dose, a dose that may cause harm to an individual.

unacceptable risk - risk estimates that exceed regulatory levels of concern, for either human health or ecological receptors.

vertical gradients - changes in the concentration of a substance over vertical distance.

water quality criteria (WQC) - Clean Water Act state and federal surface water standards used as ARARs for Superfund cleanups, among other purposes. Criteria are based on concentrations harmful to organisms in the water, to people drinking the water (if it is potable), or eating organisms from the water.

13.0 REFERENCES

(BAH, 2010). Booz Allen Hamilton. 2010. Cost Estimates for the Soil and Groundwater Alternatives for the FMC OU Proposed Plan.

(BEI, 1996). Bechtel Environmental, Inc. 1996. Remedial Investigation for the Eastern Michaud Flats Site. Bechtel Environmental, Inc. Draft issued September 1995 and revised August 1996 (*EMF RI Report*).

(BEI, 1997). Bechtel Environmental, Inc. 1997. Feasibility Study Report FMC Subarea. April 1997 (*1997 FMC Subarea FS*).

(BEI, 2004a). Bechtel Environmental, Inc. 2004. Scoping and Planning Memorandum, February 2004 (*Scoping and Planning Memo)*.

(BEI, 2004b). Bechtel Environmental, Inc. 2004. RI Update Memorandum, December 2004 (*RI Update Memo)*.

(E&E, 1996). Ecology and Environment, Inc., 1995. Baseline Human Health Risk Assessment, Eastern Michaud Flats, Pocatello, Idaho, prepared for U.S. Environmental Protection Agency. (*Baseline HHRA*).

(E&E, 2005) Preliminary Assessment/Site Investigation (PA/SI) for the Lower Portneuf River, prepared for U.S. Environmental Protection Agency.

(EPA, 1988). Guidance for Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (*EPA RI/FS Guidance*).

(EPA, 1991). EPA's Guide to Principal Threat and Low Level Threat Wastes (*Principal Threat Waste Guidance*).

(EPA, 1998) Record of Decision of the Eastern Michaud Flats Superfund Site, Pocatello, Idaho *(1998 ROD)*

(EPA, 2000). A Guide to Developing and Documenting Cost Estimates During the Feasibility Study.

(EPA, 2003). Administrative Order on Consent for Supplemental Remedial Investigation / Feasibility Study For FMC Plant Operable Unit (*2003 AOC*)

(EPA, 2003). Treatment Technologies for Historic Ponds Containing Elemental Phosphorus – Summary and Evaluation (*2003 Treatment Technology Report*).

(MWH, 2007a). Supplemental Remedial Investigation Work Plan for the FMC Plant Operable Unit. May 2007 (*SRI Work Plan)*.

(MWH, 2007b). SRI Field Sampling Plan for the FMC OU – May 2007 *(SRI FSP*, MWH, 2007b*)*.

(MWH, 2008a). Work Plan Addendum - Field Modification #13, Additional Southern and Western Undeveloped Areas Field Investigations. October 2008 (*Field Mod #13*).

(MWH, 2008b). Work Plan Addendum - Field Modification #14, Northern FMC-Owned Properties and Background Soil Sampling. October 2008 (*Field Mod #14*).

(MWH, 2009a). Supplemental Remedial Investigation Report for the FMC Plant Operable Unit - Final. May 2009 (*SRI Report*).

(MWH, 2009b). Groundwater Current Conditions Report for the FMC Plant Operable Unit - June 2009 (*GWCCR)*.

(MWH, 2009c). Identification and Evaluation of P4 Treatment Technologies – January 2009 (*P4 Treatment Technologies*).

(MWH, 2010a). Supplemental Remedial Investigation Addendum Report for the FMC Plant Operable Unit - January 2010 (*SRI Addendum Report)*.

(MWH, 2010b). Supplemental Feasibility Study Work Plan for the FMC Plant Operable Unit (*SFS Work Plan*)

(MWH, 2010c). Groundwater Modeling Report for the FMC OU- March 2010 (GW *Modeling Report*).

(MWH, 2010d). Supplemental Feasibility Study Report for the FMC OU- March 2010 (*SFS Report*).

(SBT, 2010). Letter sent from Shoshone-Bannock Tribes to EPA requesting that the Tribes promulgated Soil Cleanup Standards for Contaminated Properties be included as ARARs for the remedy decision, December 3, 2010.

(Simplot, 2010) Groundwater Extraction and Monitoring System Remedial Design Report, 2010.

(USACE, 2009). Remediation of P_4 Contaminated Matrices at FMC, Pocatello, Idaho – January 2009.

14.0 PUBLIC COMMENT SHEET FOR THE PROPOSED PLAN TO AMEND THE FMC OU RECORD OF DECISION

NAME:
ADDRESS:
DATE:

MAIL TO:
Mr. Chris Bellovary
US EPA Region 10
1200 Sixth Ave, Suite 900
Office of Environmental Cleanup, ECL-113
Seattle, WA 98101
(T) 206-553-2723
(F) 206-553-0124
Bellovary.Chris@epa.gov
If emailing comments, please put "FMC OU Proposed Plan" in subject line.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION
OF FILL, AND ASSOCIATED RCRA SWMUs

FMC OPERABLE UNIT
PROPOSED PLAN 2011

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
RA-A 103 acres	3, 4, 5, 6, 20, and portions of 24	This area contains former office areas, parking areas, railroad siding, laydown areas, and Bannock Paving area. Most of the remedial area is covered with non-leachable fill including primarily slag, coke, silica, concrete, asphalt, and native soil. Underground piping (storm sewers) containing COCs (including P4) exists in RU 3 as listed separately below. RA-A does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Coke Ferrophos PCDT water residue	SWMU# 1 Drum Storage Unit SWMU# 38 Road Segments SWMU# 39 Chemical Lab Drain Pit SWMU# 46 Railcar Loading and Unloading Area-BPC SWMU# 47 Bannock Paving Areas SWMU# 47 Coke Settling Pond (former BAPCO Unit) SWMU# 48 Surface roads Bannock Paving Company SWMU # 61 Laboratory Chemical Disposal Area SWMU# 63 Long-Term Phosphorus Storage Tanks SWMU# 66 Boiler Fuel Tank and Pipeline Area SWMU# 68 Railroad Spurs SWMU# 70 Satellite Storage Area for Spent Laboratory Solvents SWMU# 72 Former Satellite Storage Area for Waste Paint Solvents SWMU# 92 P4 Maintenance Cleaning Facility (Decon Building) SWMU# 99 Drum Storage Area at Training Center SWMU# 101 Railcar Loading Overflow Tank
RA-A1 < 1 acre	Portion of RU 20	This area is located at the former Bannock Paving area and included above ground fuel storage tanks and vehicle fueling area. This area was investigated during the SRI in 2007 and found to contain fuel PAHs above the soil SSLs. RA-A1 does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag PCDT water residue Fuel spill residue	SWMU# 47 Bannock Paving Areas SWMU# 48 Surface roads Bannock Paving Company
RA-B 10.8 acres	1, 2, and down gradient to include P4-impacted capillary fringe.	This area contains former the furnace building, phos dock, secondary condenser, and slag pit and extends to the east to capture the capillary fringe soils contaminated with P4. Surface and/or subsurface fill within this remedial area contains P4 (subsurface), phossy solids, precipitator solids, slag, ore, concrete, asphalt, and silica. Underground piping containing COCs (including P4) exists in RA-B. RA-B encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag P4 Precipitator solids Phossy solids Underground Piping Containing P4	SWMU# 5 Slag Pit Wastewater Collection Sump SWMU# 13 Andersen Filter Media (AFM) Washing Unit SWMU# 36 & 55 Rail Car Loading/Unloading, and Phos Dock SWMU# 38 Road segments SWMU# 41 (partial) Stacks and Vents SWMU# 54 Phos Dock Area SWMU# 60 Secondary Condenser/Former Fluid Bed Dryer Area SWMU# 68 Railroad Spurs SWMU# 73 Satellite Areas for Spent Anderson Filter Media SMWU# 74 East AFM Bin Area SMWU# 75 Precipitator Dust Slurry Pots SWMU# 76 Medusa Scrubber Blowdown Collection Tank SWMU# 77 P4 Load Dock, Scrub. Blowdown Sump, and NS Tank SWMU# 78 Washdown Collection Sumps--Furnace Building Area

1 RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
2 Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
3 These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
			SWMU# 79 Northeast Collection Sump - Furnace Building Area SWMU# 80 Southeast Collection Sump - Furnace Building Area SWMU# 81 Furnace Washdown Collection Tank (V-3600) SWMU# 82 Facility-Wide Wastewater Piping System SWMU# 86 V-3700 Tank and Associated Piping SWMU# 90 V-3800 Tank and Associated Piping SWMU# 91 NOSAP Intercept Tank (Tank T-8010) SWMU#102 Former Slag Pit (prior to slag handling) SWMU# 104 #3 P4 Sump
RA-C 34.6 acres	RUs 13, northern portion of 12, eastern portion of 22b, and a small portion of RU 24 between RUs 1 & 2 and RU 22b.	This area contains former phossy/precipitator slurry ponds, the piping corridor between RUs 1 and 2 and 22b (small portions of RUs 12 and 24), and the Pond 8S recovery process. Surface and/or subsurface fill within this area contains P4 (subsurface), phossy solids, precipitator solids, slag, ore, ferrophos, concrete and asphalt. Underground piping containing COCs (including P4) exists in RUs 13, 22b and 24. RA-C encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Precipitator solids Phossy solids P4 Ferrophos PCDT water residue Underground Piping Containing P4	SWMU# 4 Former 8S Recovery Process SWMU# 25 Pond 0S SWMU# 26 Pond 00S SWMU# 27 Pond 1S SWMU# 28 Pond 2S SWMU# 29 Pond 3S SWMU# 30 Pond 4S SWMU# 31 Pond 5S SWMU# 32 Pond 6S SWMU# 33 Pond 7S SWMU# 34 Pond 10S (Including Precipitator Dust Pile atop pond 10S) SWMU# 38 Road Segments SWMU# 43 Ferrophos Storage Areas SWMU# 53 Old Pond 7S Tree-Line Area SWMU# 56 Drum Storage Area for other Nonhazardous Wastes SWMU# 57 Transformer Salvage Area SWMU# 58 PCB Storage Shed (removed 2000) SWMU# 59 Waste Oil Storage Area SWMU# 62 Area West of Mobile Shop SWMU# 64 (partial) Phossy Waste Pipeline Cleanout Areas SWMU# 65 (partial) Precipitator Slurry Pipeline Cleanout Areas SWMU# 71 Satellite Storage Areas for Waste Degreasing Solvents SWMU# 82 (partial) Facility-wide Wastewater Piping System SWMU# 83 High-pressure steam cleaning Station SWMU# 84 Used Oil Collection Tank SWMU# 107 Portable Storage Tanker for Dielectric Fluid

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
RA-D 33.6 acres	Western portion of RU 22b including former Pond 9S	This area contains former clarified phossy water/precipitator slurry overflow ponds and precipitator slurry ponds. No P4 is present but surface/subsurface fill contains phossy solids, precipitator solids, slag, and ore. RA-D encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Precipitator solids Phossy solids PCDT water residue Underground Piping Containing P4	SWMU# 6 Area 9S SWMU# 19 Pond 1E SWMU# 20 Pond 2E SWMU# 21 Pond 3E SWMU# 22 Pond 4E SWMU# 23 Pond 5E SWMU# 24 Pond 6E SWMU# 52 Pond 7E
RA-E 21.2 acres	RU 8, southern portion of RU 9, and southern portion of RU 16.	This area contains former ore kilns, kiln scrubber ponds, calciners, calciner pond solids stockpile, silica stockpiles, and calcined ore stockpiles. No P4 is present but surface/subsurface fill contains slag, ore, silica, kiln pond solids (subsurface). Underground piping containing COCs (including P4) exists in RU 8 and is listed separately below. RA-E encompasses identified and potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** Slag Ore Calciner pond solids Calcined ore Coke Underground Piping Containing P4	SWMU# 12 Wastewater Treatment Unit SWMU# 17 Calciner Pond Sediment Stockpile SWMU# 35 Three kiln Scrubber Ponds SWMU# 38 Road Segments SWMU# 41 Stacks and Vents (i.e., calciner system) SWMU# 51 Kiln (scrubber) Overflow Pond SWMU# 67 Former Flare Pit for Carbon Monoxide SWMU# 103 New Horizontal Flare Pit
RA-F 171 acres including RA-F1 and RA-F2	RUs 19, 11, and southern portion of 12	This area contains the slag pile and bullrock pile (RU 19) and former equipment maintenance/laydown areas (RUs 11 and 12). Surface and subsurface fill within this area consists predominantly of slag and bull rock. Southwestern corner of slag pile was location of the former plant landfill (RU 19b) and is listed separately below. Railcars containing P4 and phossy solids (RU 19c) are listed separately below. RA-F does not encompass any identified or potential sources of COC releases to groundwater. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Precipitator solids Phossy solids Ferrophos PCDT water residue	SWMU# 38 FMC surface road segments SWMU# 42 Slag Pile

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
RA-F1 (Buried Railcars) 2.7 acres		In 1964, 21 railcars containing an estimated 10 to 25% P4 sludge were placed at the southern edge of the slag pile and covered with native soil. The railcars were then covered with 80 to 120 feet of slag as the slag pile progressed to the south. RU 19c is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Phossy solids P4	None
RA-F2 (Former Landfill) 20.3 acres		This sub-area is located within the southwestern corner of the slag pile (RU 19). Landfill operations within this sub-area (RU 19b) began at the inception of plant operations in 1949 and ceased in 1980. Wastes placed in RU 19b included slag, office wastes (consisting of office and lunchroom solid wastes), industrial wastes (consisting of asbestos, spent solvents, oily residues, transformer oil, kiln scrubber solids, phosphorus-bearing wastes, fluid-bed dryer wastes, and AFM) furnace rebuild/digout wastes (consisting of furnace feed materials, carbon materials, concrete, rocks, and debris), IWW sediments, and baghouse dust. These wastes are covered by 50 - >100 ft of slag. RU 19b is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Office wastes Industrial wastes – asbestos wastes, spent solvents, and oily residues, transformer oil, kiln scrubber solids, phosphorus-bearing wastes, fluid-bed dryer wastes AFM Furnace digout/rebuild wastes	SWMU# 44 Landfill (old)

[1] RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
[2] Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
[3] These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION
OF FILL, AND ASSOCIATED RCRA SWMUs

FMC OPERABLE UNIT
PROPOSED PLAN 2011

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
RA-G 65.9 acres	RUs 7, northern portion of 9, 10, 15, northern portion of 16, and portions of 24.	This area contains the ore stockpiles, silica stockpile, IWW pond and ditch, dry process waste pile (RU 15) and the northern portion of RU 16. Surface and subsurface fill within this area include various plant solid materials including ore, baghouse dust, coke, carbon, calciner solids, and slag. RA-G does not encompass any identified or potential sources of COC releases to groundwater. The northeastern portion of RA-G (on State land) includes areas within the PCDA Development Agreement. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Ore Coke Calcined ore Calciner pond solids Precipitator solids	SWMU# 16 Calciner Solids Pile SWMU# 37 Shale Ore Handling Areas SWMU# 38 Road segments SWMU# 49 Industrial Wastewater Basin SWMU# 50 Industrial Wastewater Ditch SWMU# 69 Oversize Ore, Broken and Used Electrode, Baghouse Dust Storage and Recycling, and Used Conveyor Belt Area SWMU# 105 Coke Unloading Building SWMU# 106 Nodule Pile
RA-H 17 acres	RUs 17 and 18	This area contains the active plant landfill (RU 18) and the construction/demolition debris landfill (RU 17). Surface and subsurface fill within this area contains solid waste including plant trash, Andersen filter media (AFM), asbestos, empty containers, concrete, carbon, and furnace feed materials (ore, silica, coke). RA-H is a potential source of COC releases to groundwater [3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Furnace feed materials (ore, silica, coke) Office wastes Packaging materials AFM Asbestos containing materials Carbon	SWMU# 38 Road segments SWMU# 45 Landfill (also referred to as Solid Waste Landfill) SWMU# 89 Roadway Landfill
RA-I 191 acres	Northern Properties (Parcels 1, 2, 4, 5, and 6)	This area of the FMC Plant OU is north of the Plant Site and includes all land owned by FMC (Parcels 1, 2, 4, 5, and 6) with exception of Parcel 3. It was not used for plant production activities, but was used for various agricultural, commercial and recreational activities. Some slag was applied to the surface for roads and parking. RA-I does not encompass any identified or potential sources of COC releases to groundwater. **Sources Considered for HHRA and ERA Exposure Scenarios:** Fugitive dust and stack emissions deposited on land surface.	None

1 RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
2 Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
3 These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 1
SUMMARY OF RAs, RUs, DESCRIPTION OF FILL, AND ASSOCIATED RCRA SWMUs

FMC OPERABLE UNIT
PROPOSED PLAN 2011

RAs Area	RUs	Description and Fill/Source Materials	Associated RCRA SWMUs[1]
RA-J 15 acres	Northern Properties (Parcel 3)	This area of the FMC Plant OU contains property (Parcel 3) north of Highway 30, but south of I-86 on State lands. It was not used for plant production activities, but was used for various agricultural and commercial activities. RA-J does not encompass any identified or potential sources of COC releases to groundwater. **Sources Considered for HHRA and ERA Exposure Scenarios:** Fugitive dust and stack emissions deposited on land surface.	None
RA-K (Railroad Swale) 2.4 acres	RU 22c	This sub-area is located along the northeastern border of the FMC Plant Site and was used for stormwater retention. In addition to stormwater, the Railroad swale (RU 22c) also received an intermittent flow of phossy water and is known to contain low levels of P4 and phossy solids. In the late 1980s, the railroad swale was excavated and backfilled with slag and ore. RU 22c is a potential source of COC releases to groundwater[3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios:** Slag Phossy solids P4 Ore	SWMU# 18 Railroad Swale
UG Piping		This sub-area includes underground piping that remains in place and may contain P4, precipitator solids, and/or phossy solids. This UG piping is believed to exist in RUs 1, 2, 3, 8, 12, 13, 22b and 24. UG Piping is a potential source of COC releases to groundwater[3]. **Fill/Source Materials Considered for HHRA Exposure Scenarios[2]:** P4 Precipitator solids Phossy solids	SWMU# 64 Phossy Waste Pipeline Cleanout Areas SWMU# 65 Precipitator Slurry Pipeline Cleanout Areas
FMC Plant OU Groundwater		The nature and extent of the FMC Plant OU wide impacted groundwater and evaluation / identification of FMC (and non-FMC) sources of groundwater impacts are described in the Groundwater Current Conditions Report for the FMC Plant OU (MWH, June 2009).	

1 RCRA SWMUs do not necessarily contribute to the Remediation Area (RA) risk, but are identified here to integrate RCRA corrective action into the SFS under the "one clean-up" initiative.
2 Risks associated with exposure to the contents of underground piping runs are evaluated separately from risks associated with exposure to other surface and subsurface fill/source materials identified in an RU.
3 These RAs / subareas have not been identified as sources that have discernibly impacted groundwater (GWCCR, June 2009); however, based on historical knowledge and/or the SRI results, the SFS will consider these RAs / subareas as potential sources of COC releases to groundwater.

TABLE 2
SUMMARY OF WASTE FILL BY REMEDATION AREA

FMC OPERABLE UNIT
PROPOSED PLAN 2011

RAs	Comprised of RUs	Area (acres)	Fill Volume (yd^3)	Ave Fill Depth (ft)	Predominant Fill Type[1]	Secondary Fill Type[1]
A	3, 4, 5, 6, 20, and portions of 24	103	1,203,234	7.2	Slag, Silica, Concrete, Asphalt	Underground Piping, Coke, Ferrophos, PCDT Water Residues, Fuel Spill Residues
B	1, 2, and down gradient to include P4-impacted capillary fringe	10.8	135,570	7.8	Slag, Silica, Concrete, Asphalt	P4, Precipitator Solids, Phossy Solids, Underground Piping
C	13, northern portion of 12, eastern portion of 22b, and small portion of 24	34.6	410,165	7.3	Slag, Concrete, Silica	P4, Precipitator Solids, Phossy Solids, Underground Piping, Ferrophos, PCDT Water Residues
D	Western portion of 22b	33.6	350,606	6.5	Slag	Precipitator Solids, Phossy Solids, PCDT Water Residue, Underground Piping, P4
E	8, southern portions of 9 and 16	21.2	171,423	5.0	Calcined Ore, Raw Ore, Slag, Concrete, Silica, Calcined Pond Solids	Kiln Pond Solids, Underground Piping, Coke
F	19, 11, and southern portion of 12 (including buried railcars)	171	14,841,591	Approximately 120	Slag	Precipitator Solids, Phossy Solids, Ferrophos, PCDT Water Residue, Buried Railcars (P4, Phossy Solids)
G	7, northern portion of 19, 10, 15, northern portion of 16, and portion of 24	65.9	1,078,092	10.1	Raw Ore, Slag, Concrete, Silica, Calcined Ore, Bullrock, Calcined Pond Solids	Coke, Precipitator Solids, Graphite/Carbon, Calcined Pond Solids
H	17 and 18	17.5	Approximately 6,500 (7,800 tons of waste, assume 1.2 tons/yd3)	0.23	Slag, Ore, Silica	Office Wastes, Packaging Materials, AFM, Asbestos, Carbon
I	Northern Properties (Parcels 1, 2, 4, 5, 6)	191	42,963	0.14	Fugitive Dust from Plant Operations	Slag for roads
J	Northern Properties (Parcel 3)	15	4,028	0.17	Fugitive Dust from Plant Operations	Slag for roads
K	Railroad Swale/22c	1.3	22,000	10.5	Slag	P4, Precipitator Solids, Phossy Solids, Underground Piping

[1]"Predominant Fill Type" describes the primary materials observed and "Secondary Fill Type" describes secondary materials observed in the fill.

TABLE 3
TYPICAL LEVELS AND CONCENTRATIONS OF CONTAMINANTS OF CONCERN PRESENT IN SOURCE MATERIALS

FMC OPERABLE UNIT PROPOSED PLAN 2011

Contaminants of Concern	Ore	Slag	Precipitator Solids	Phossy Solids	Calciner Pond Solids	Calcined Ore	Ferrophos	Coke[1]	Soil	95th UCL Background Concentrations
Antimony (mg/kg)	-	-	146	194	-	-	-	-	-	0.28
Arsenic (mg/kg)	14.6	-	44.6	180	14.3	-	-	-	-	10.4
Cadmium (mg/kg)	125	-	5,240	2,010	538	-	-	-	-	0.72
Hydrocarbons (mg/kg)	-	-	-	-	-	-	-	3.75 - 31.1	-	-
Fluoride (mg/kg)	-	-	-	-	1,300	-	-	-	-	302
Lead (mg/kg)	-	-	1,073	-	-	-	-	-	-	23.9
Lead-210 (pCi/g)	36.3	13	1,140	409	34.1	21.9	-	-	-	2.02
Nickel (mg/kg)	-	-	-	-	-	-	1,150	-	-	18.7
Phosphine (mg/kg)	-	-	-	-	-	-	-	-	0 – 1.0[2]	0
Polonium-210 (pCi/g)	-	-	657	72.3	458	-	-	-	-	1.17
Potassium-40 (pCi/g)	-	-	152	27.4	70.4	-	-	-	-	15.0
Radium-226 (pCi/g)	29.6	25.1	11.3	-	17.4	26.7	-	-	-	0.953
Thallium (mg/kg)	-	-	-	-	340	-	-	-	-	0.13
Uranium-238 (pCi/g)	27.5	29.3	6.39	-	17.9	24.2	-	-	-	0.88
Vanadium (mg/kg)	-	-	-	-	-	-	6,330	-	-	19.6

[1]Coke contains polycyclic aromatic hydrocarbons, six of which were found to be in concentrations that pose risk. There is no “background” concentration for hydrocarbons.
[2]Phosphine may be present in soils where elemental phosphorus is known to be present, such as RAs B, C, D, K, and F1.

TABLE 4
SOIL ALTERNATIVES SUMMARY OF COMPARTIVE RANKINGS

FMC OPERABLE UNIT
PROPOSED PLAN 2011

EVALUATION CRITERION	SOIL ALTERNATIVE 1	SOIL ALTERNATIVE 3	SOIL ALTERNATIVE 4	SOIL ALTERNATIVE 5	SOIL ALTERNATIVE 6	SOIL ALTERNATIVE 7	SOIL ALTERNATIVE 8
Overall Protection of Human Health and the Environment	Low	High	Moderate to High	Moderate to High	Moderate to High	Moderate to High	Moderate to High
Compliance with ARARs	No	Yes	Yes	Yes	Yes	Yes	Yes
Long-Term Effectiveness - Reliability of overall remedy - Adequacy of controls - Magnitude of residual risk	Low	Moderate to High	Moderate to High	Moderate to High	High	High	High
Reduction of Toxicity, Mobility or Volume through Treatment	Low	Low	Low	Moderate	Moderate to High	Moderate to High	High
Short-Term Effectiveness - Time to achieve protection - Protection of the community, workers, and environment	Low	High	High	Moderate	Low to Moderate	Low	Low
Implementability -Administrative difficulty -Technical Challenges -Availability of Services	High	High	High	Low	Low	Low	Low
Capital Cost	$0	$43.6M	$76.8M	$353M	$474.5M	$720.9M	$3.32B
Annual O&M Cost	$0	$602K	$547K	$4.5M	$8.9M	$16.8M	$13M
NPV Cost	$0	$47.2M	$81.6M	$405.1M	$591.1M	$949.6M	$3.5B

Ranking: **HIGH =** Good performance in the category. **MODERATE** = Satisfactory performance in the category. **LOW** = Unsatisfactory performance in the category.

All cost estimates are in 2009 dollars. NPV is based on 7% discount rate over 30-year period for Soil Alternatives 3-5, 37 years for Soil Alternative 6, and 44 years for Soil Alternatives 7 and 8.

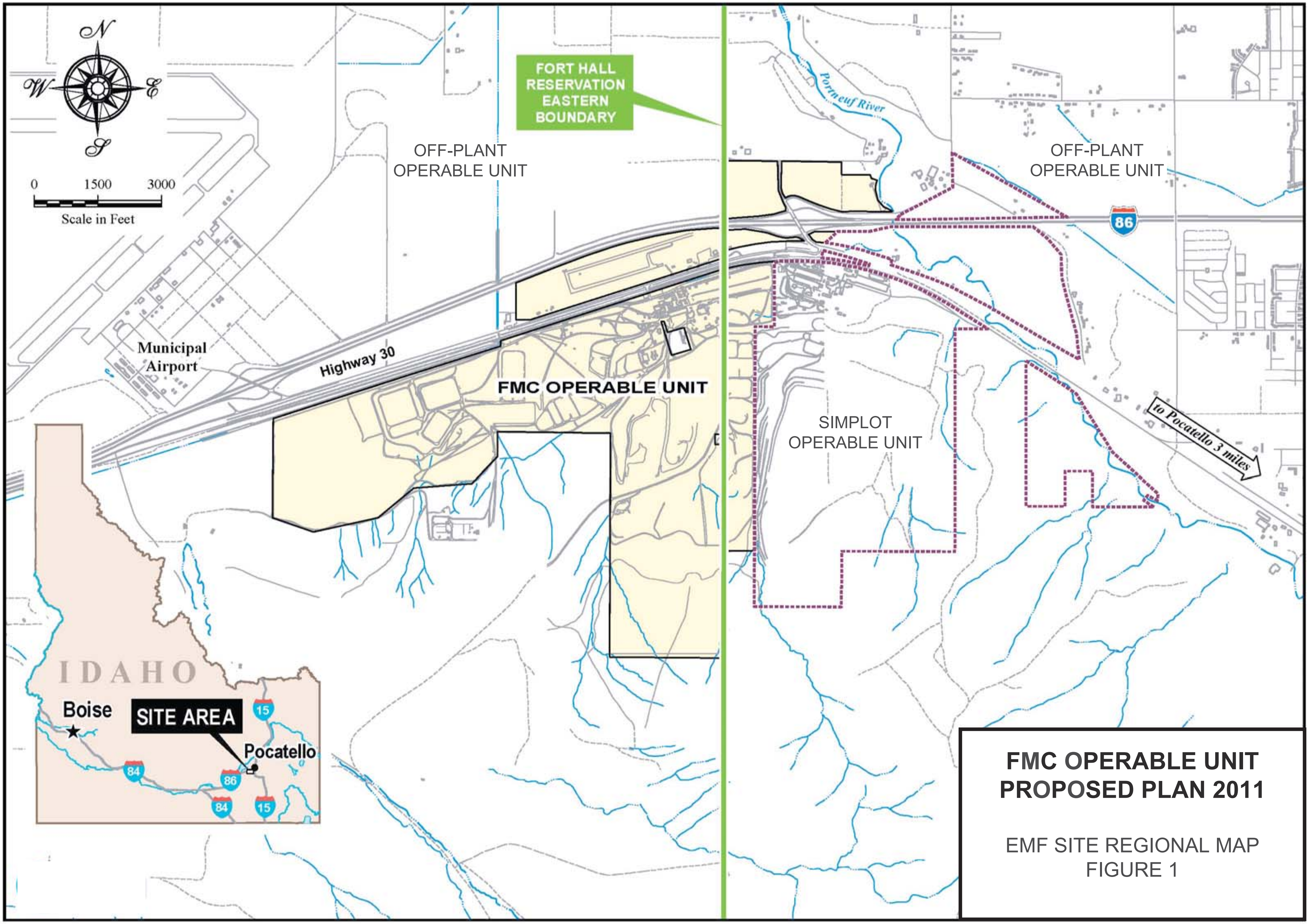
TABLE 5
GROUNDWATER ALTERNATIVES SUMMARY OF COMPARTIVE RANKINGS

FMC OPERABLE UNIT
PROPOSED PLAN 2011

EVALUATION CRITERION	GROUNDWATER ALTERANTIVE 0	GROUNDWATER ALTERANTIVE 1	GROUNDWATER ALTERANTIVE 2	GROUNDWATER ALTERNATIVE 3
Overall Protection of Human Health and the Environment	Low	Low	Moderate	Moderate
Compliance with ARARs	No	Yes[1]	Yes[1]	Yes[1]
Long-Term Effectiveness *- Reliability of overall remedy* *- Adequacy of controls* *- Magnitude of residual risk*	Low	Unknown	Moderate	Moderate
Reduction of Toxicity, Mobility or Volume through Treatment	Low	Low	Moderate to High	Moderate to High
Short-Term Effectiveness *- Time to achieve protection* *- Protection of the community, workers, and environment*	Low	Low	Moderate	Moderate
Implementability *-Administrative difficulty* *-Technical Challenges* *-Availability of Services*	High	High	High	High
Capital Cost	$0	$57K	$579K - $2.7M	$5.1M - $6.5M
Annual O&M Cost	$0	$71K	$552K - $712K	$1.1M - $1.4M
NPV Cost	$0	$960K	$9.6M - $11.2M	$24.2M - $25.1M

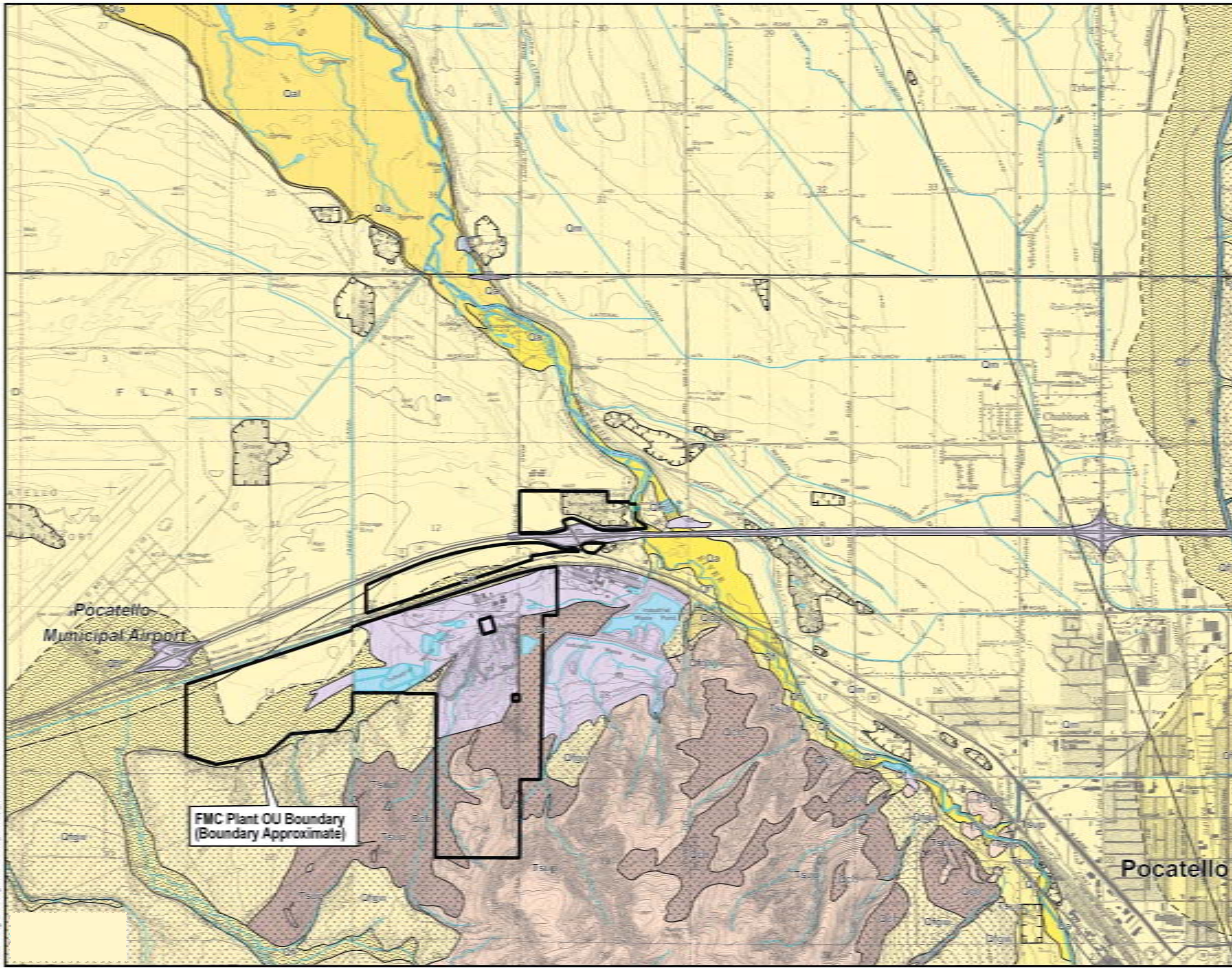
Ranking: **HIGH =** Good performance in the category. **MODERATE** = Satisfactory performance in the category. **LOW** = Unsatisfactory performance in the category.

All cost estimates are in 2009 dollars. NPV is based on 7% discount rate over 30-year period.
More than 100 year may be required to restore groundwater quality to the arsenic maximum contaminant level.



FMC OPERABLE UNIT PROPOSED PLAN 2011

EMF SITE REGIONAL MAP
FIGURE 1



DESCRIPTION OF MAP UNITS

- Made ground (historical)—Artificial deposits of disturbed, transported, and emplaced construction materials derived from various local sources. Primarily formed in the construction of highways, irrigation ditches, and industrial sites.
- Alluvium of lower Portneuf River and Pocatello Creek (Holocene) — Stratified and interfingering deposits of sand and gravel veneered by silty reworked loess.
- Alluvium and lacustrine deposits of the Portneuf River and Ross Fork delta (Holocene)-Laterally discontinuous beds of sand, silt, clay, muck, and peat.
- Alluvial-fan and debris-flow deposits (Holocene)—Muddy sand and gravel and beds of silty redeposited loess.
- Alluvial-fan deposits composed mostly of reworked loess (Holocene)—Primarily bedded to massive silt that is redeposited loess.
- Michaud Gravel (late Pleistocene)—Bouldery gravel and sand; more sand in channeled-flow pathways and in distal parts of deposit where grain size decreases.
- Gravel deposits of the Bonneville Flood, undifferentiated (late Pleistocene) Pebble gravel deposited in eddy bar of Bonneville Flood.
- Loess-mantled alluvial-fan gravel of Wisconsin age (late Pleistocene)—Crudely stratified muddy sand and pebble- to boulder-sized gravel mantled with loess.
- Loess-mantled alluvial-fan gravel of the ancesteral Pocatello Creek (early Pleistocene?) — Crudely stratified, muddy and sandy pebble-to cobble-sized gravel manteld with loess.
- Loess-mantled bedrock colluvium (Pleistocene)—Wind-blown and redeposited loess that mantles, interfingers with, or is mixed with stony colluvium derived from local bedrock.
- Rhyolite porphyry unit—Porphyritic rhyolite.

Source: Idaho Geological Survey, April 1997

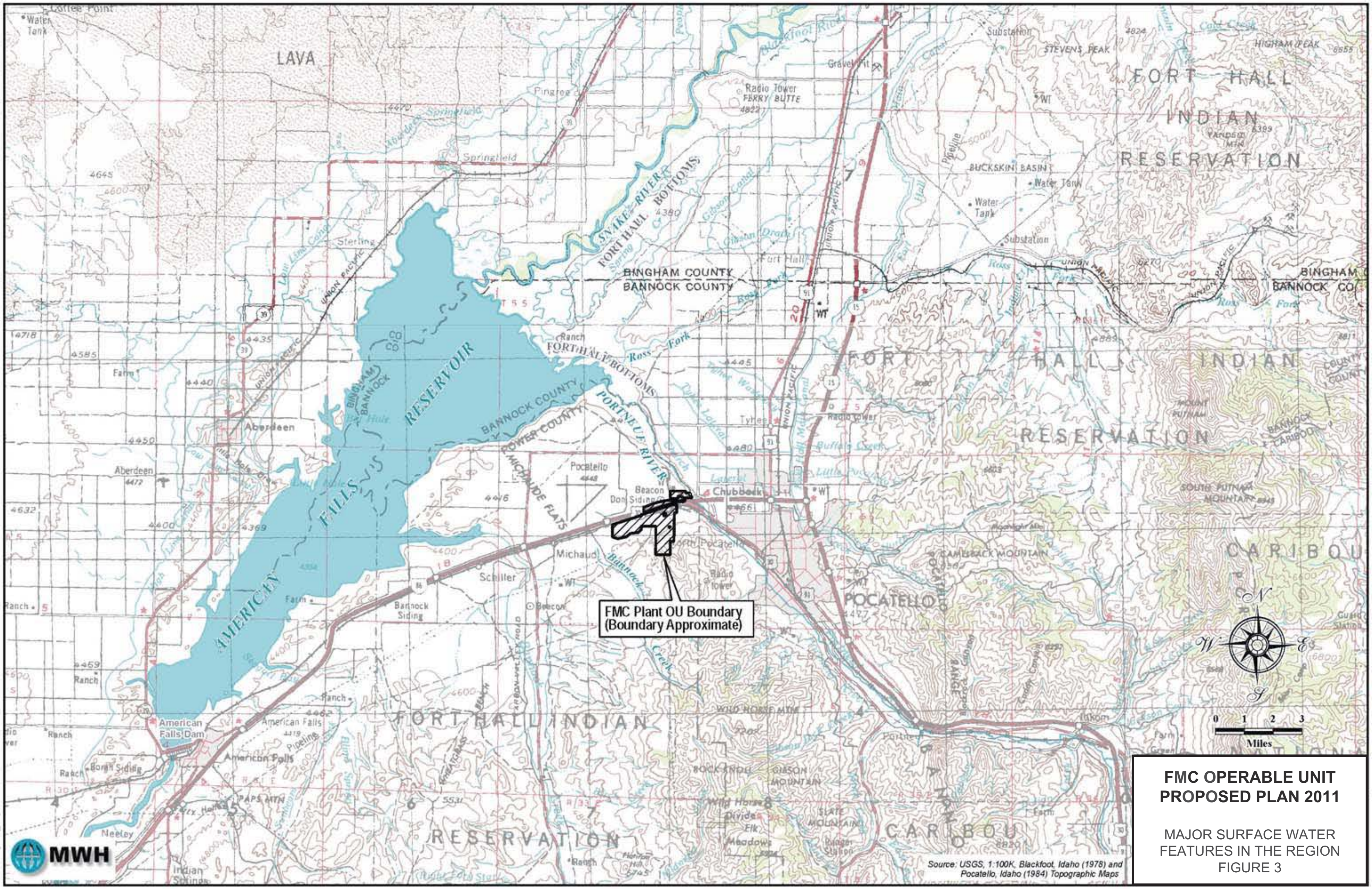
N W E S

0 3000
Feet

FMC OPERABLE UNIT PROPOSED PLAN 2011

REGIONAL GEOLOGY
AROUND THE FMC OU
FIGURE 2

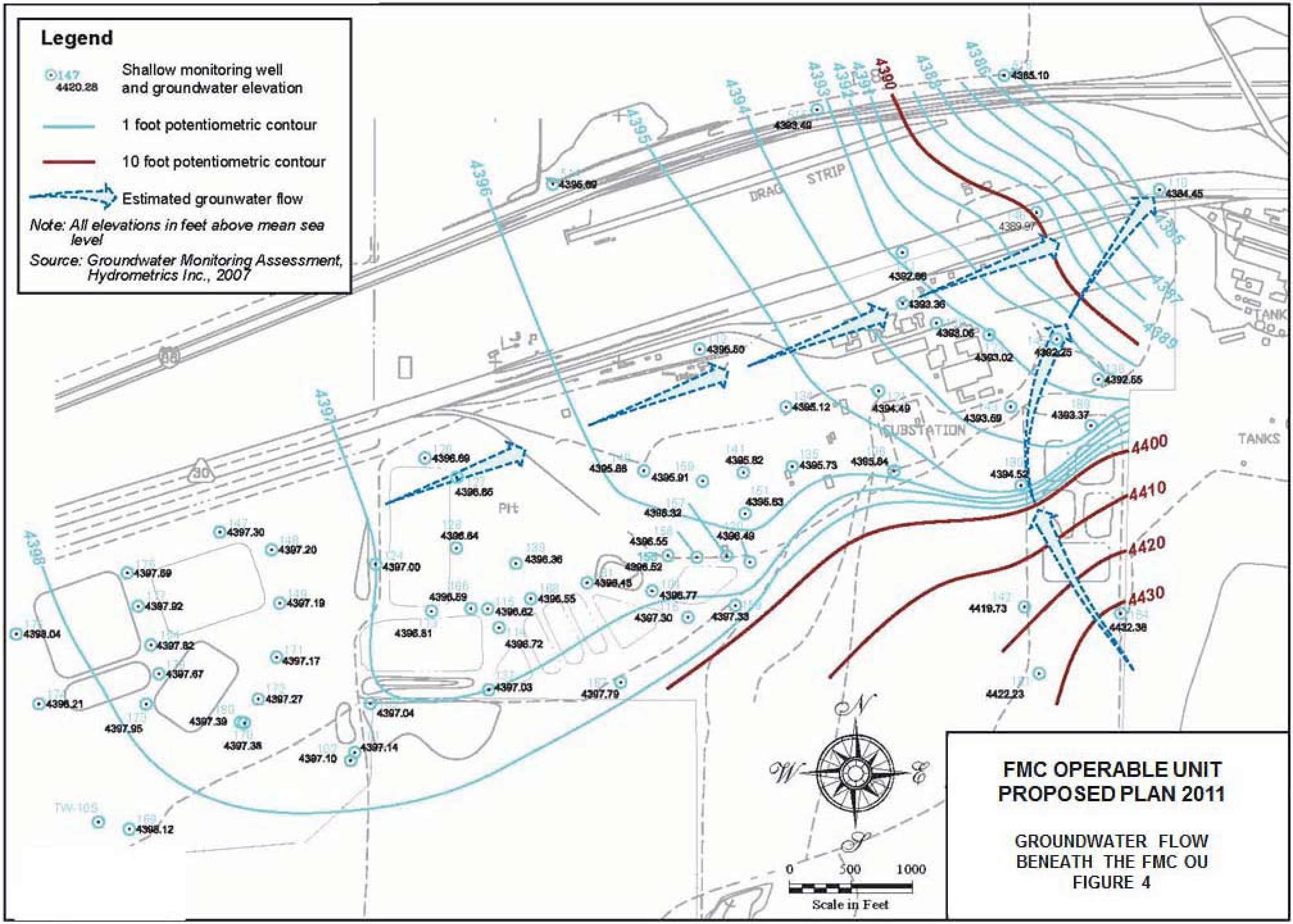
FILE Fig 2-1 Regional Geologic map_1009.ai 10/11/09

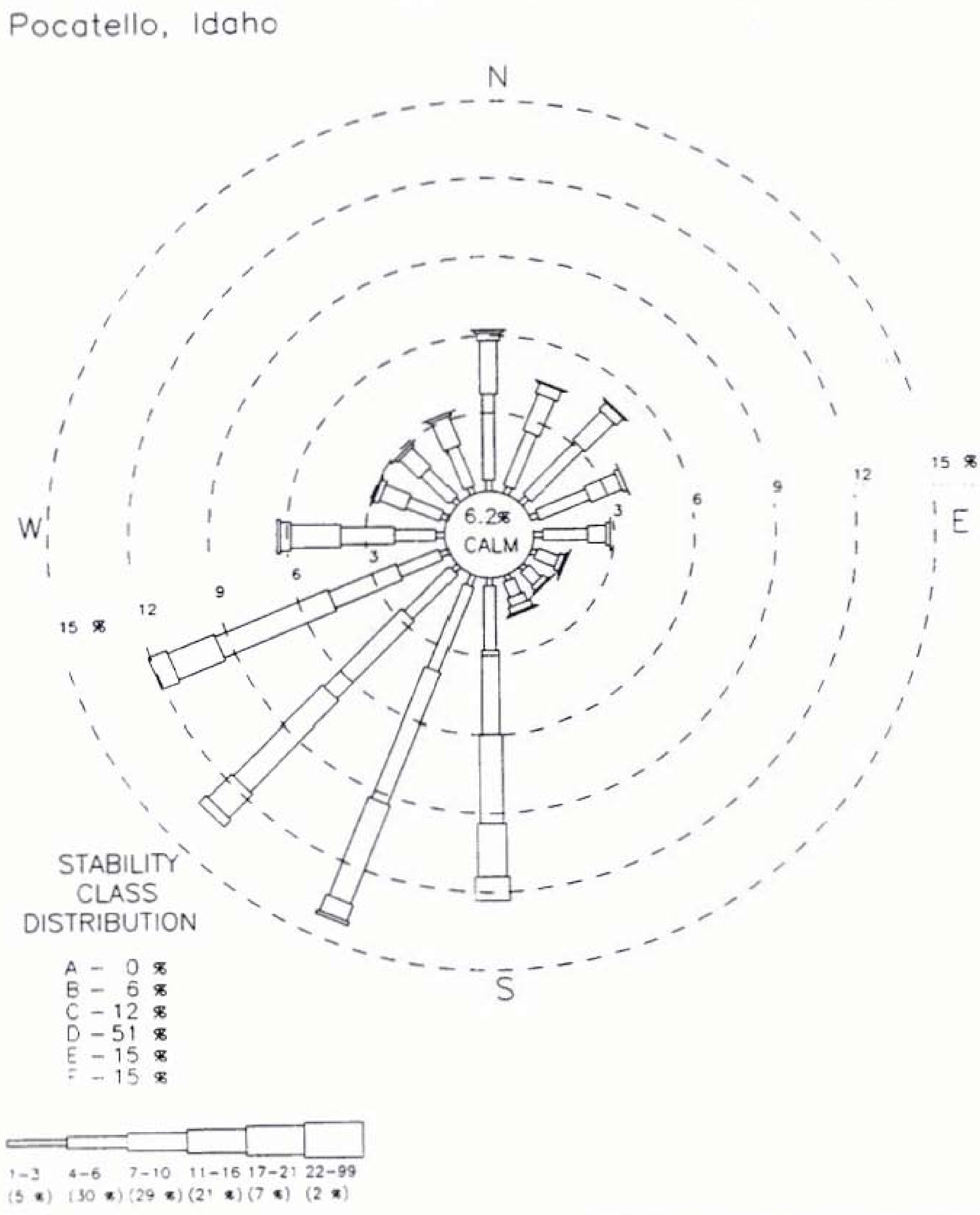


FMC OPERABLE UNIT
PROPOSED PLAN 2011

MAJOR SURFACE WATER FEATURES IN THE REGION
FIGURE 3

FILE Fig 2-3 Major Surface Water Features 1009.mxd 10/11/09


Legend
147 4420.28 Shallow monitoring well and groundwater elevation
1 foot potentiometric contour
10 foot potentiometric contour
Estimated grounwater flow
Note: All elevations in feet above mean sea level
Source: Groundwater Monitoring Assessment, Hydrometrics Inc., 2007
DRAG STRIP
SUBSTATION
TANKS
4390
4400
4410
4420
4430
N
S
E
W
0 500 1000
Scale in Feet
FMC OPERABLE UNIT
PROPOSED PLAN 2011
GROUNDWATER FLOW
BENEATH THE FMC OU
FIGURE 4

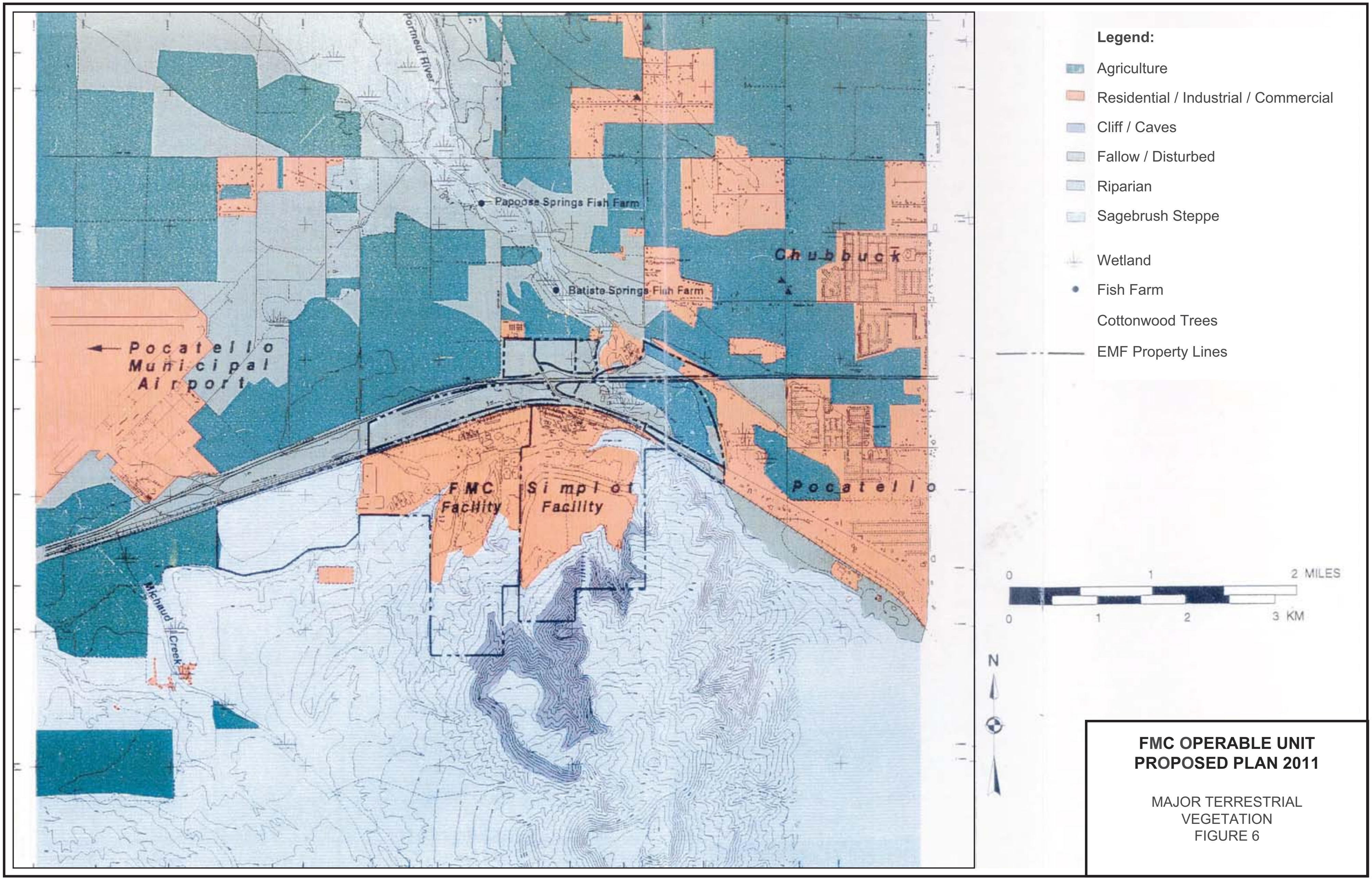


NOTE – WIND DIRECTION IS THE DIRECTION WIND IS BLOWING FROM

WINDROSE AT THE POCATELLO AIRPORT 1984 - 1989

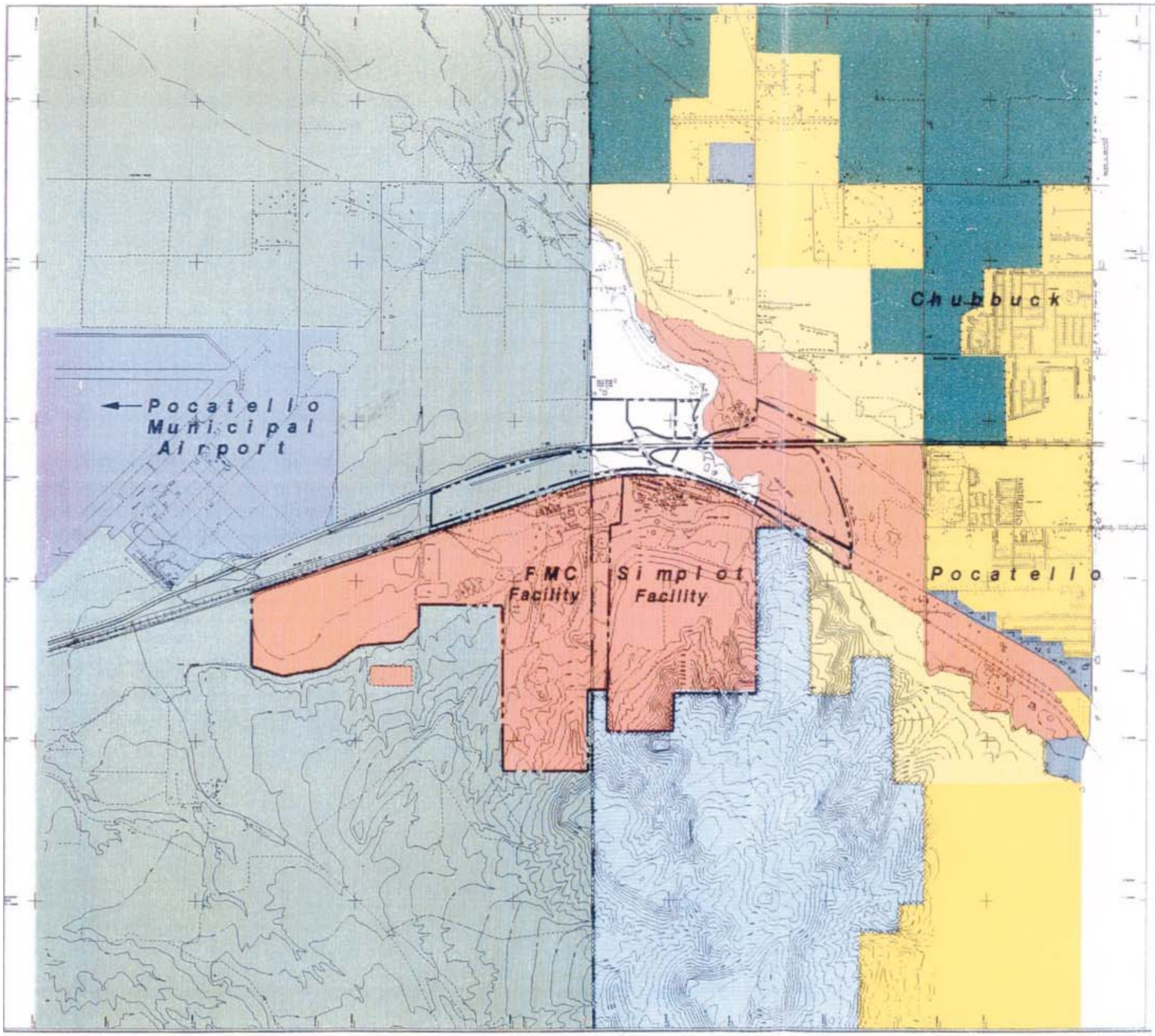
FMC OPERABLE UNIT PROPOSED PLAN 2011

PREVAILING WINDS AT THE FMC OU FIGURE 5



FMC OPERABLE UNIT
PROPOSED PLAN 2011

MAJOR TERRESTRIAL
VEGETATION
FIGURE 6



Legend

- Agricultural
- Industrial
- Residential
- Commercial
- U.S. Bureau of Land Management
- Development District Multiple Use - City of Pocatello
- Development District Multiple Use - Bannock County
- Fort Hall Indian Reservation
- No Zoning

- Fort Hall Indian Reservation Boundary
- U.S. Bureau of Land Management Boundary
- Chubbuck City Limits
- Pocatello City Limits
- EMF Property Lines

Sources:
Bannock County Zoning Map, 1987
City of Chubbuck - 1992 Zoning Map, Bechtel 1992c
U.S. Bureau of Land Management, 1984
City of Pocatello Zoning District Map, 1981

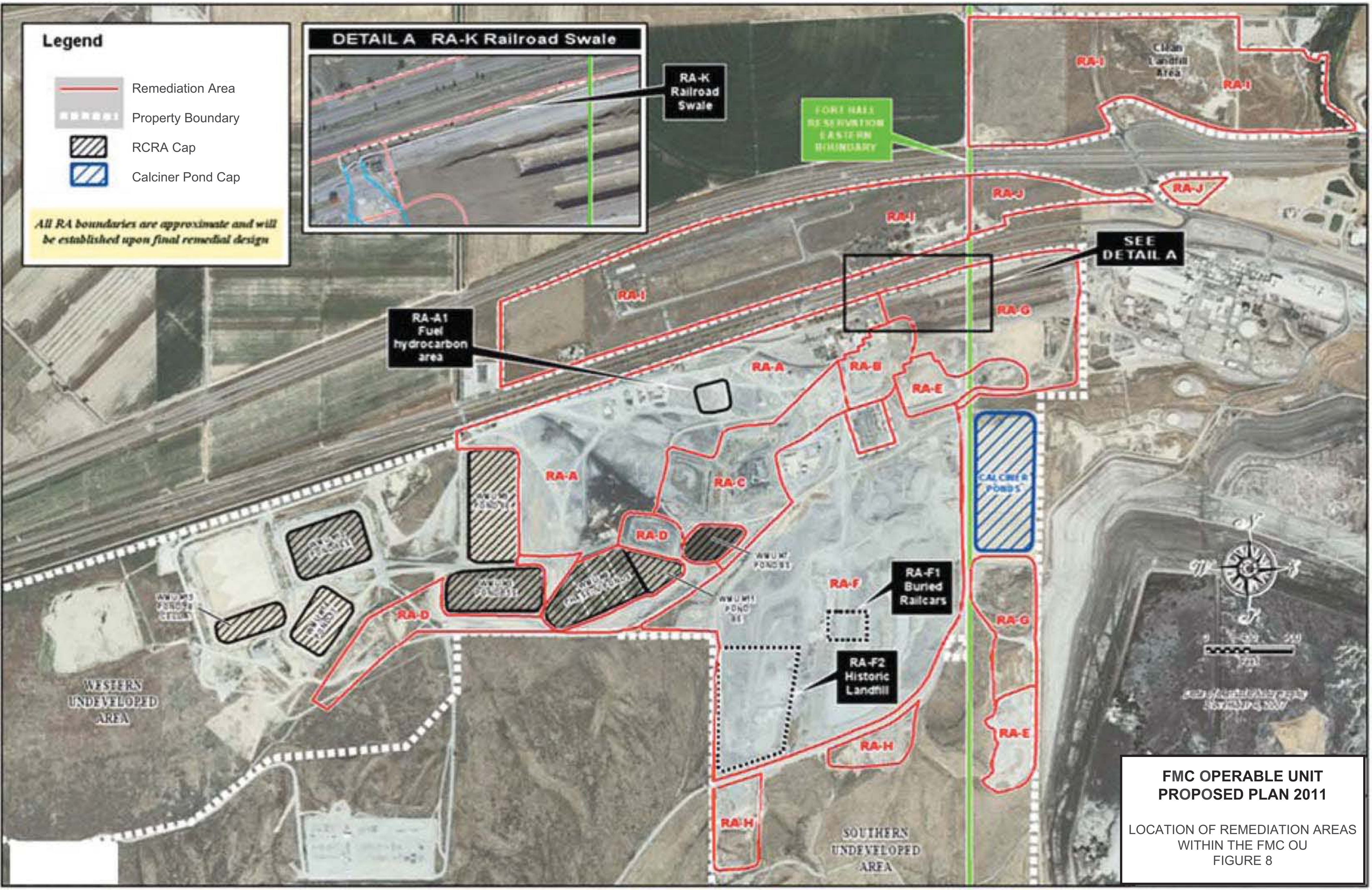
0 1 2 MILES

0 1 2 3 KM

N

FMC OPERABLE UNIT PROPOSED PLAN 2011

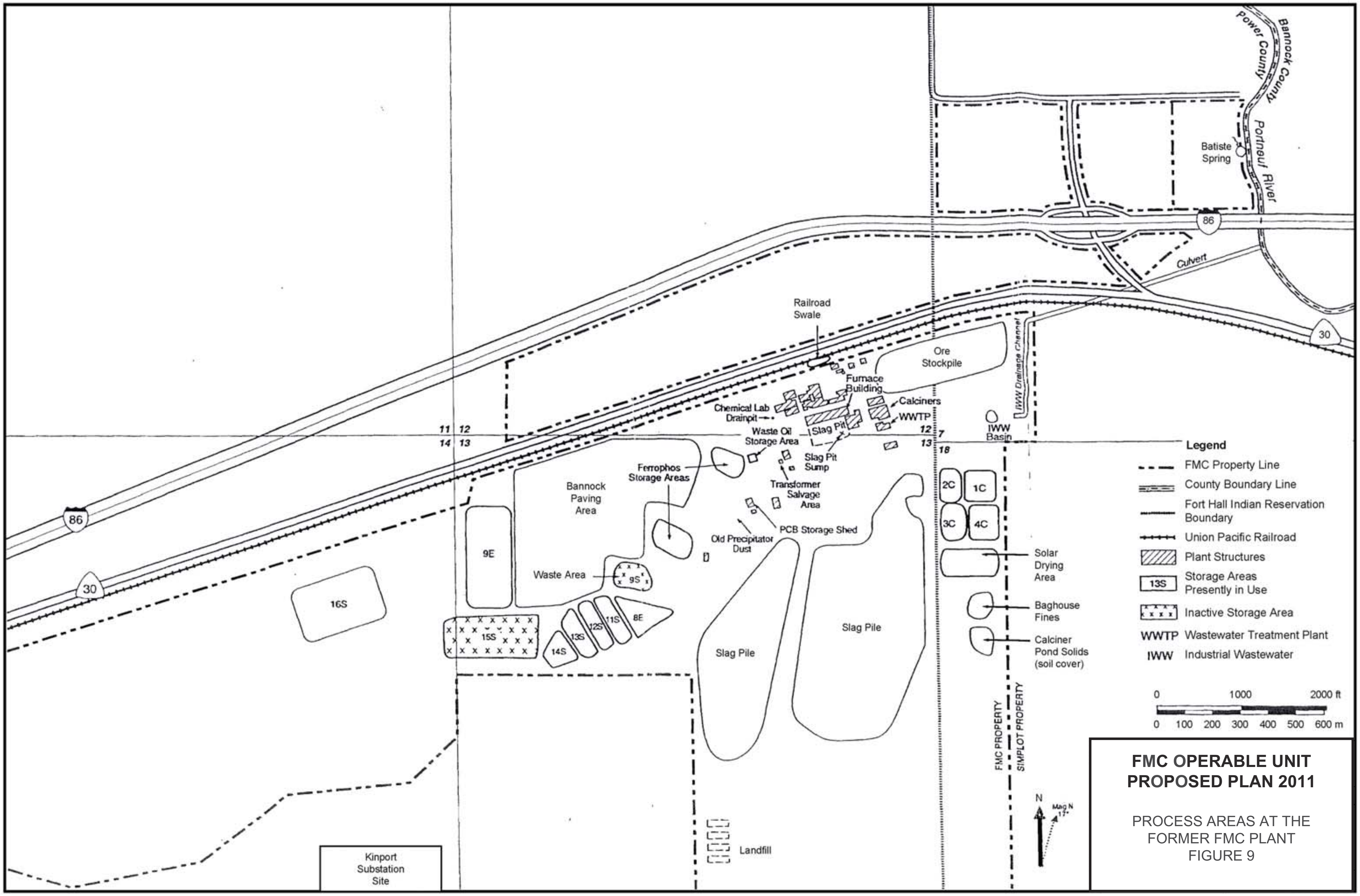
ZONING IN THE VICINITY
OF THE EMF FACILITIES
FIGURE 7



FMC OPERABLE UNIT PROPOSED PLAN 2011

LOCATION OF REMEDIATION AREAS WITHIN THE FMC OU

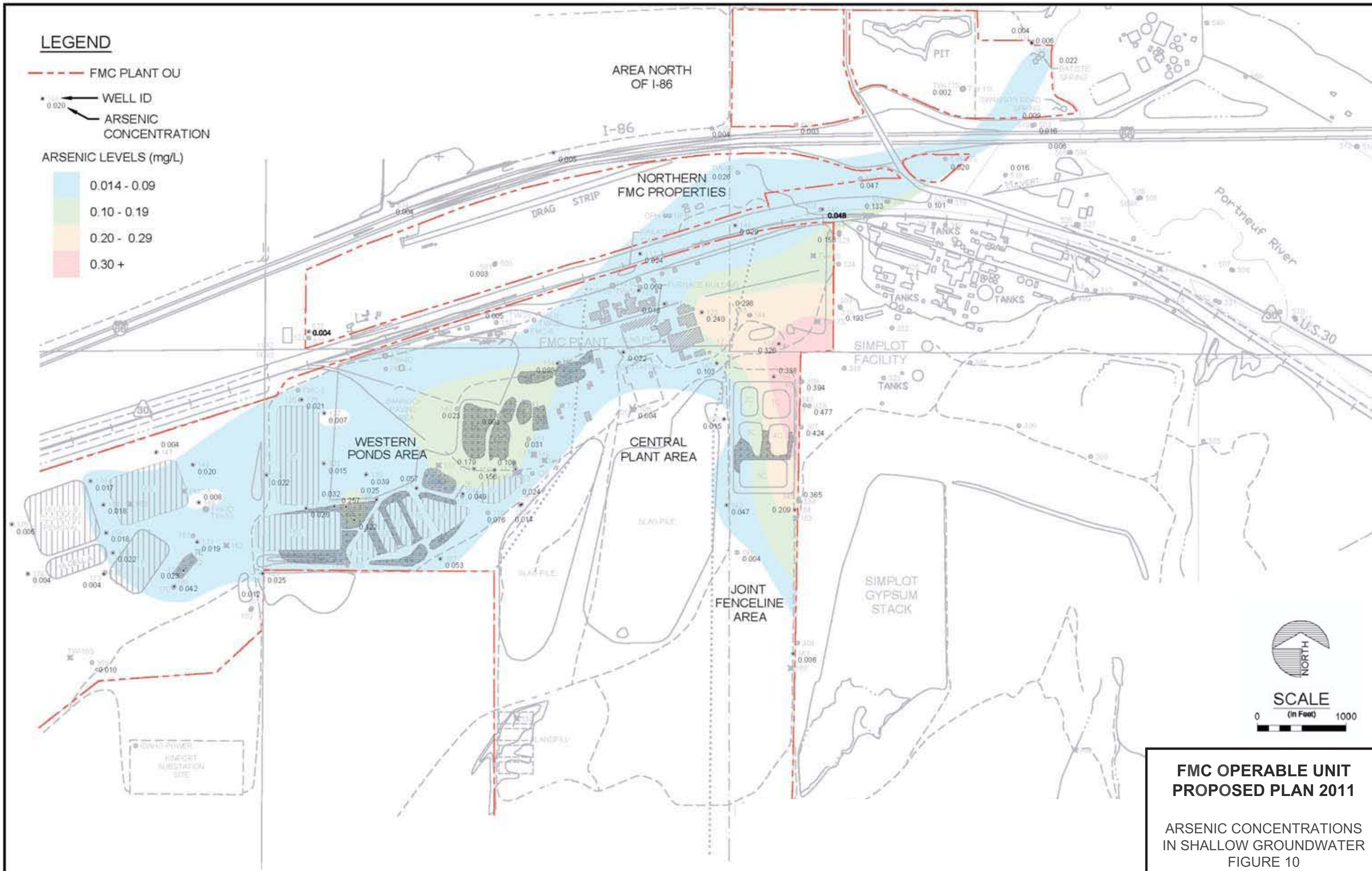
FIGURE 8



FMC OPERABLE UNIT PROPOSED PLAN 2011

PROCESS AREAS AT THE FORMER FMC PLANT

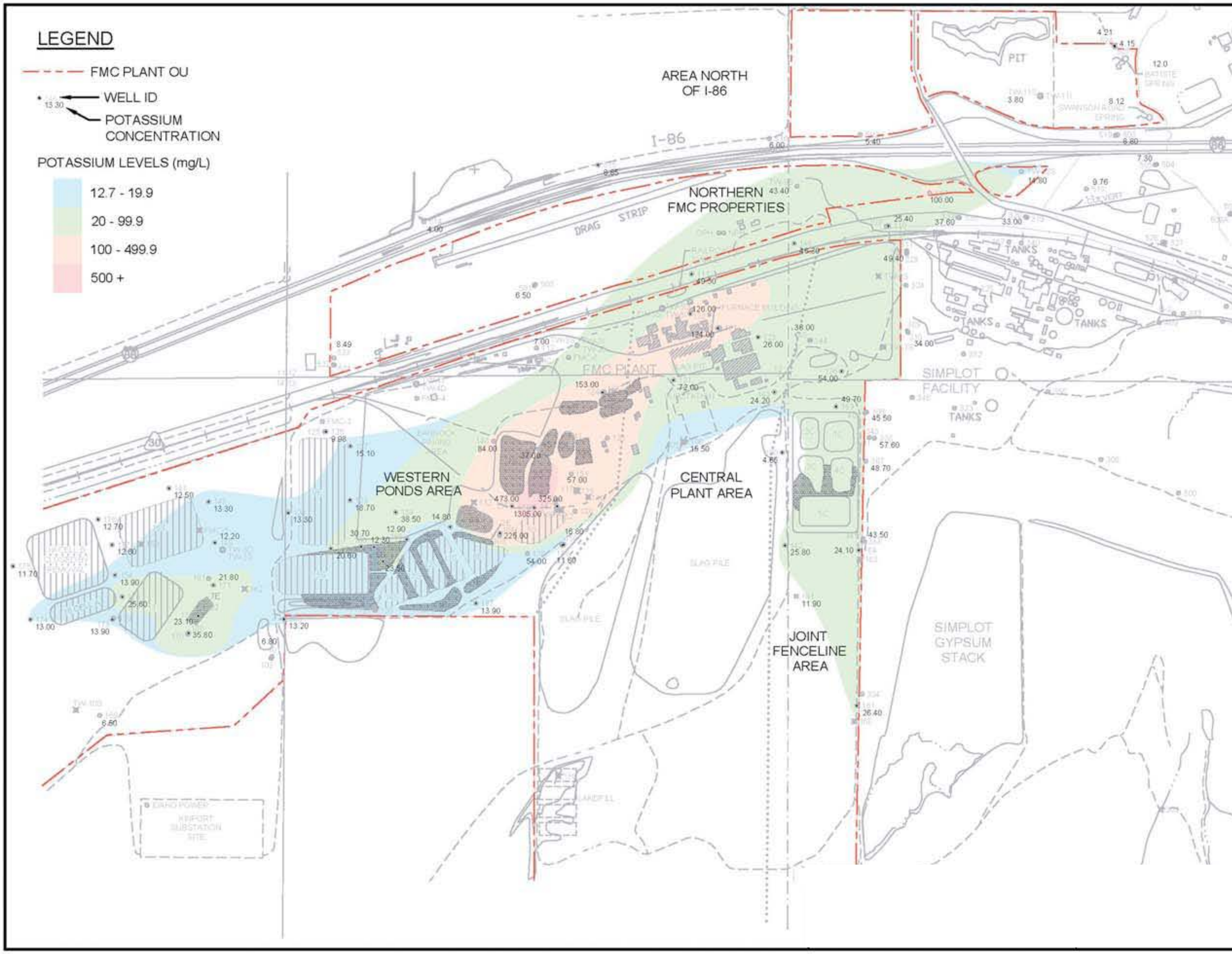
FIGURE 9



FMC OPERABLE UNIT PROPOSED PLAN 2011

ARSENIC CONCENTRATIONS IN SHALLOW GROUNDWATER
FIGURE 10

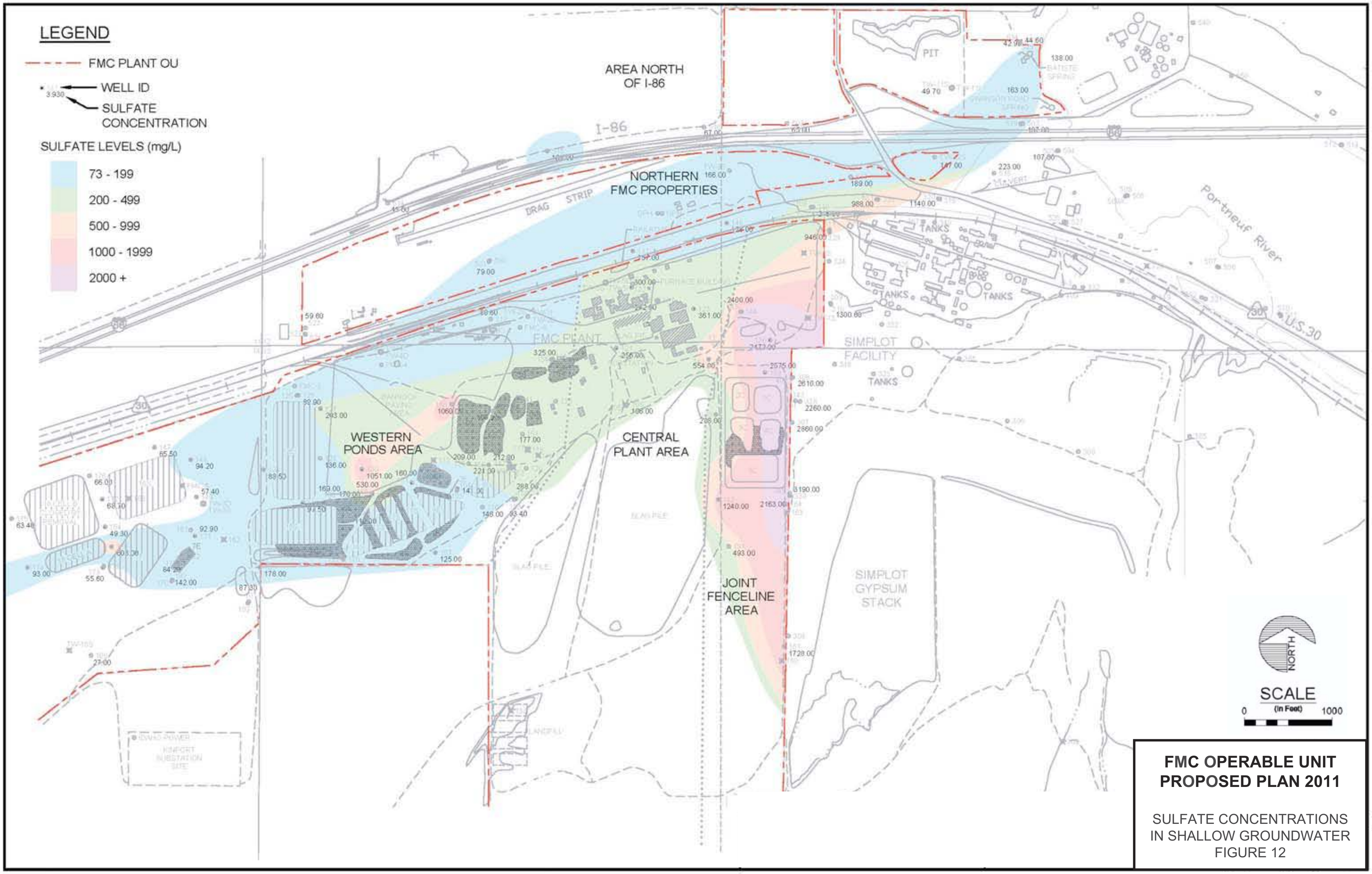
UPDATE TIME: 4:11 PM
LTABORSKY\HEL\20090408\I:\LAND PROJECTS\1303B201\DWG\1303B201H069.DWG



FMC OPERABLE UNIT PROPOSED PLAN 2011

POTASSIUM CONCENTRATIONS IN SHALLOW GROUNDWATER
FIGURE 11

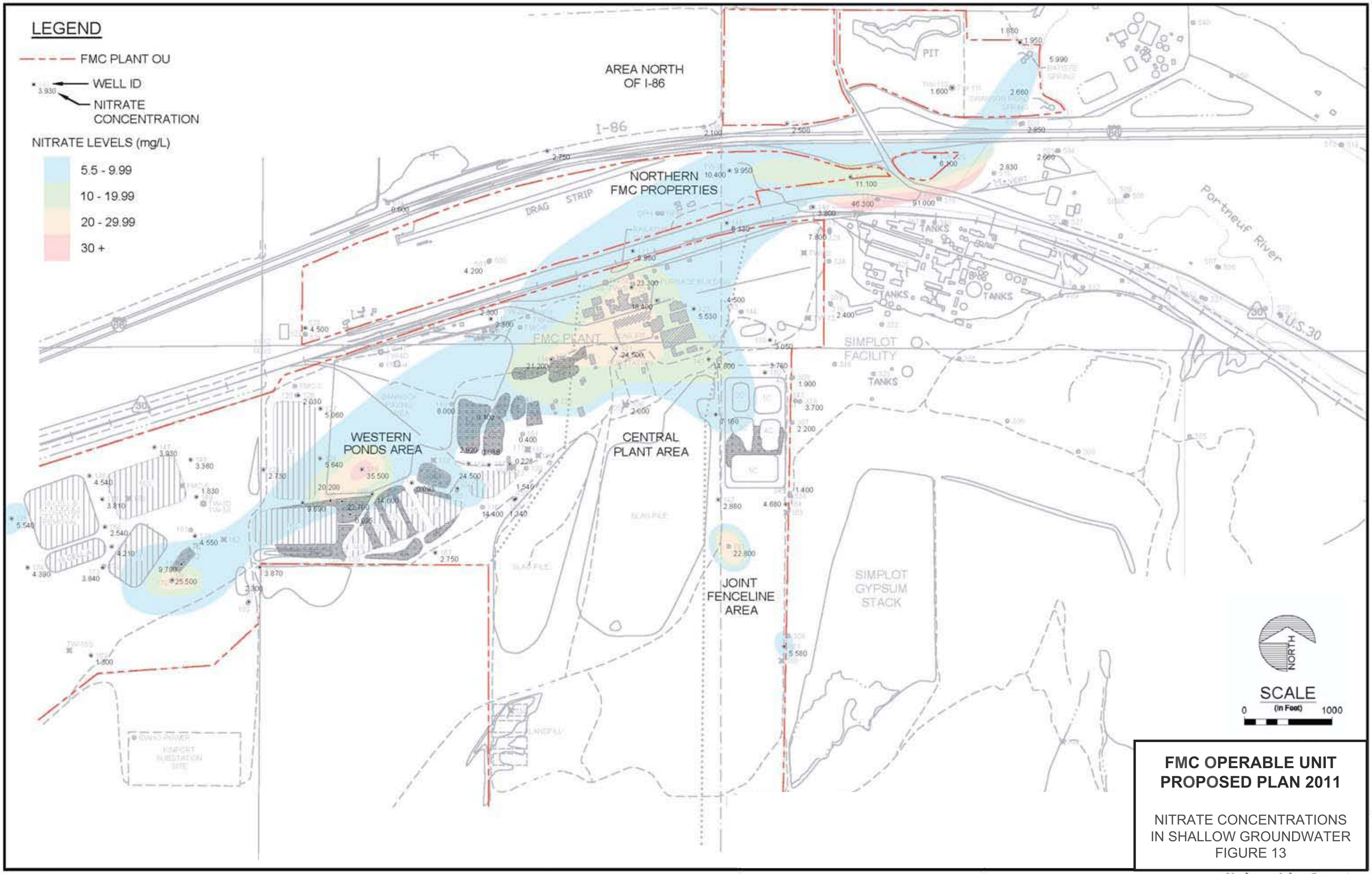
UPDATE TIME: 11:01 AM
LTABORSKY\HEL\20090402\I:\LAND PROJECTS\1303B201\DWG\1303B201H066.DWG



FMC OPERABLE UNIT PROPOSED PLAN 2011

SULFATE CONCENTRATIONS IN SHALLOW GROUNDWATER
FIGURE 12

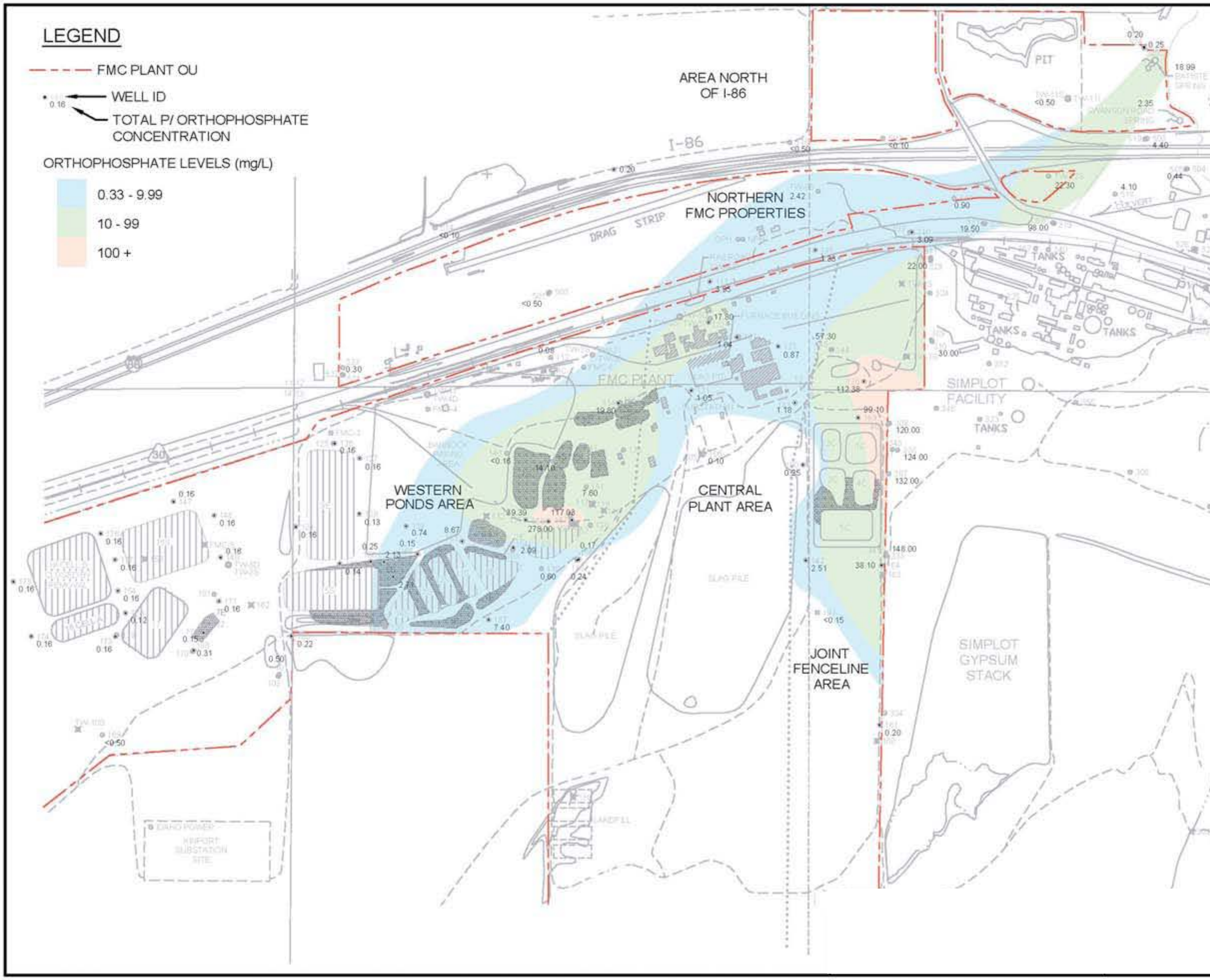
UPDATE TIME: 11:33 AM
LTABORSKY\HEL\20090409\I:\LAND PROJECTS\1303B201\DWG\1303B201H065.DWG



FMC OPERABLE UNIT PROPOSED PLAN 2011

NITRATE CONCENTRATIONS IN SHALLOW GROUNDWATER FIGURE 13

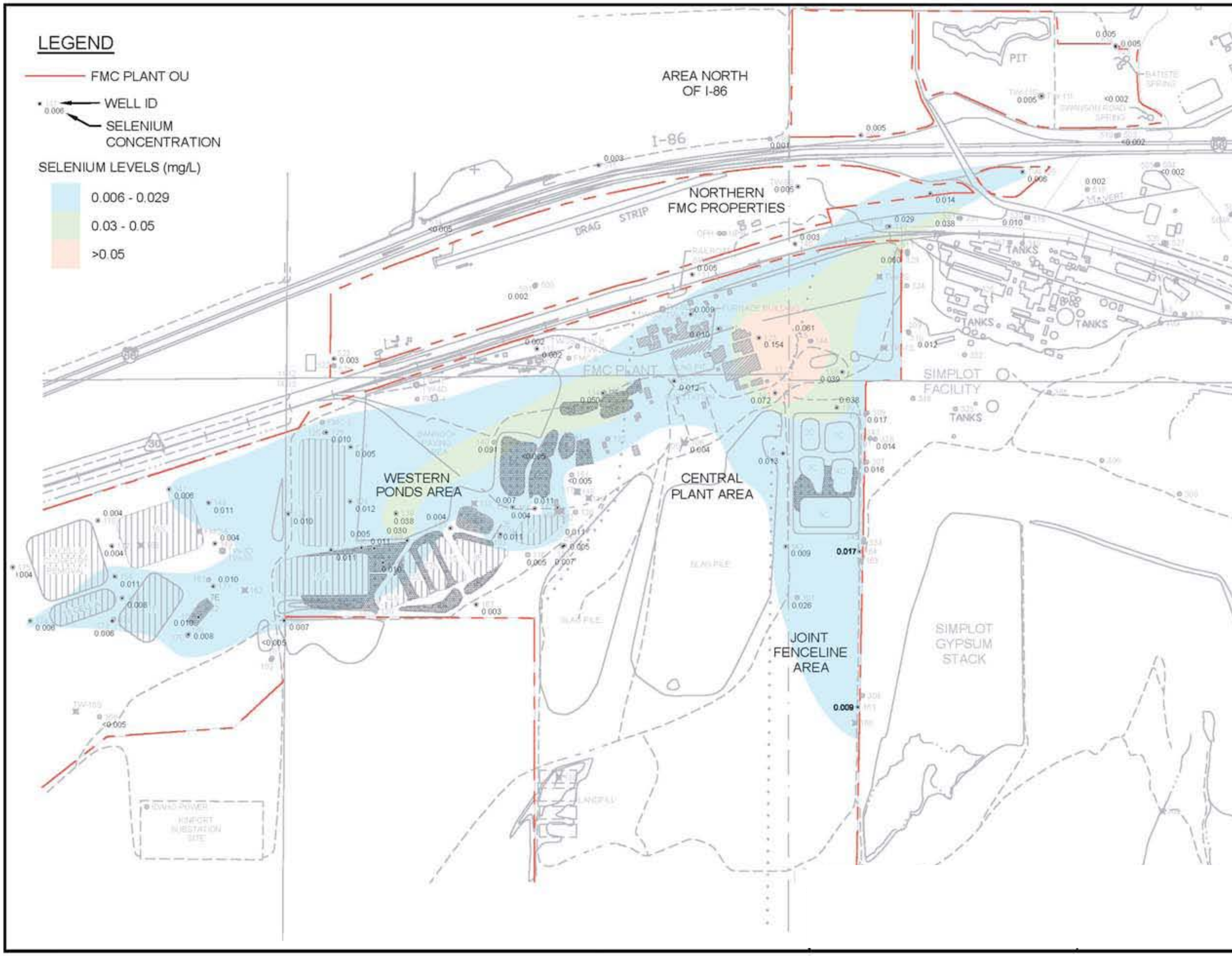
UPDATE TIME: 2:05 PM
LTABORSKY\HEL\20090402\I:\LAND PROJECTS\1303B201\DWG\1303B201H067.DWG



FMC OPERABLE UNIT
PROPOSED PLAN 2011

TOTAL PHOSPHORUS / ORTHPHOSPHATE CONCENTRATIONS IN SHALLOW GROUNDWATER
FIGURE 14

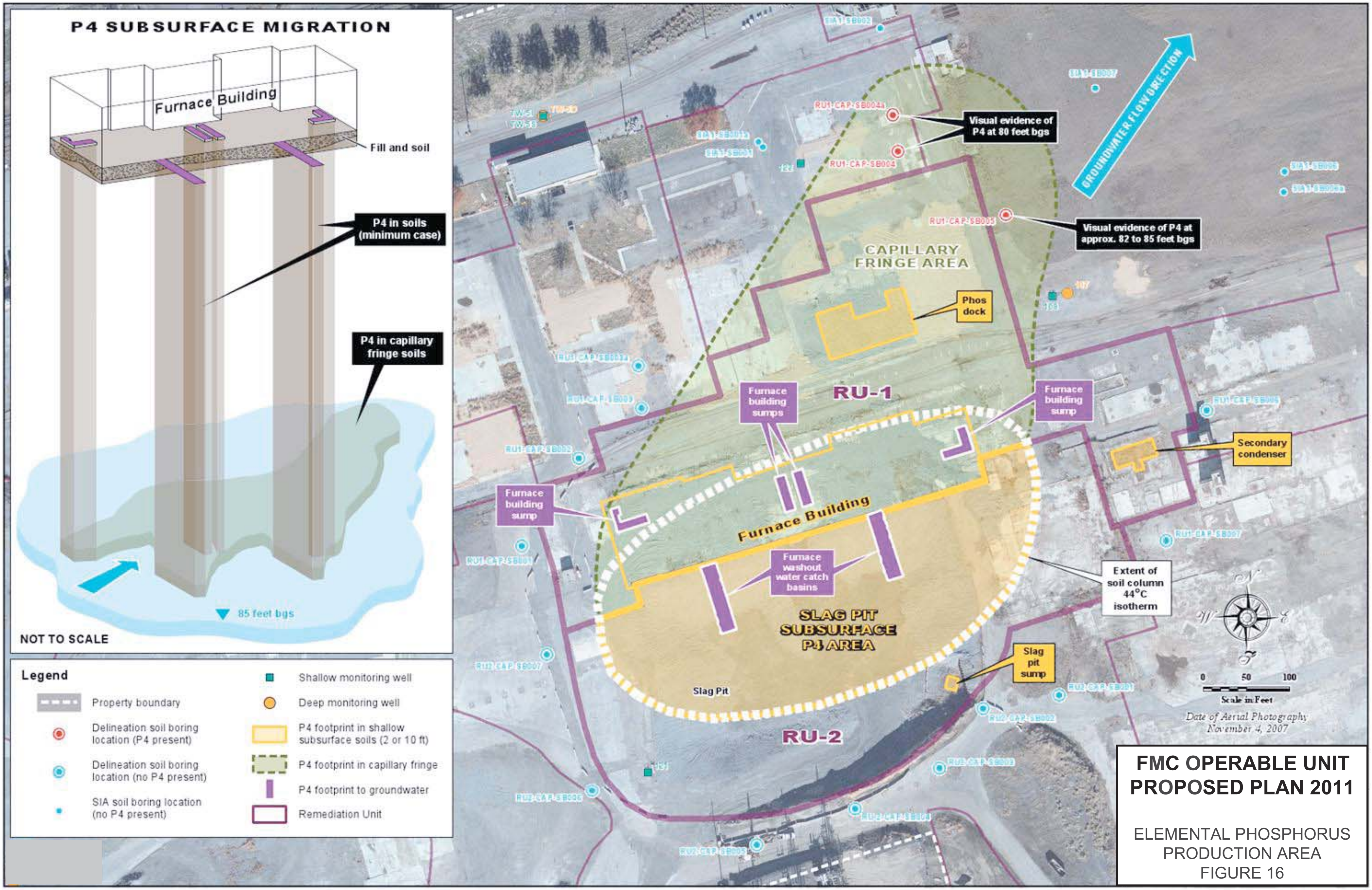
UPDATE TIME: 2:28 PM
GLORENSON\HEL\20090329\I:\LAND PROJECTS\13038201\DWG\13038201H070.DWG



FMC OPERABLE UNIT PROPOSED PLAN 2011

SELENIUM CONCENTRATIONS IN SHALLOW GROUNDWATER
FIGURE 15

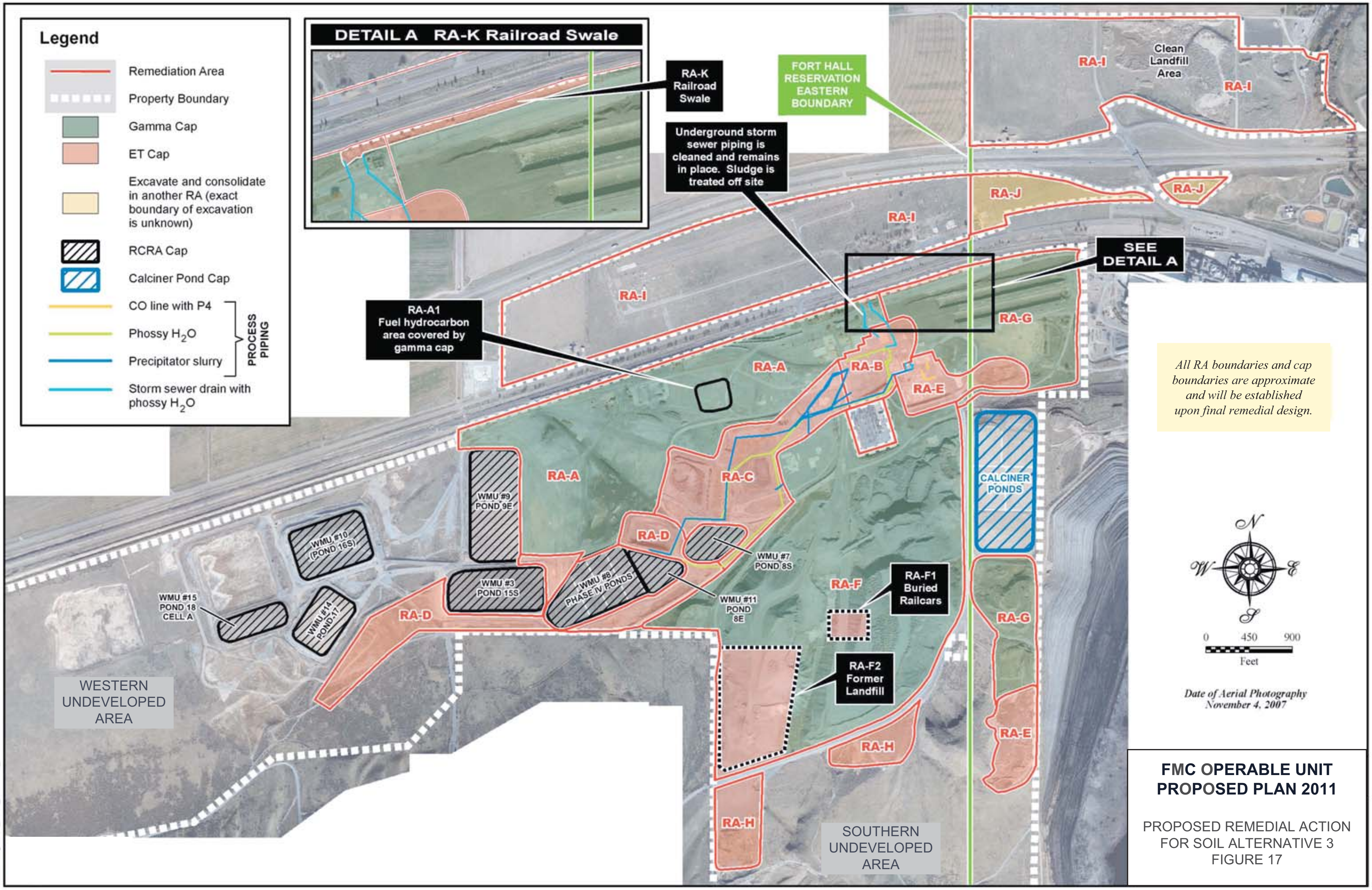
UPDATE TIME: 8:17 AM
LTABORSKY\HEL\20090409\I:\LAND PROJECTS\1303B201\DWG\1303B201H072.DWG



FMC OPERABLE UNIT PROPOSED PLAN 2011

ELEMENTAL PHOSPHORUS PRODUCTION AREA

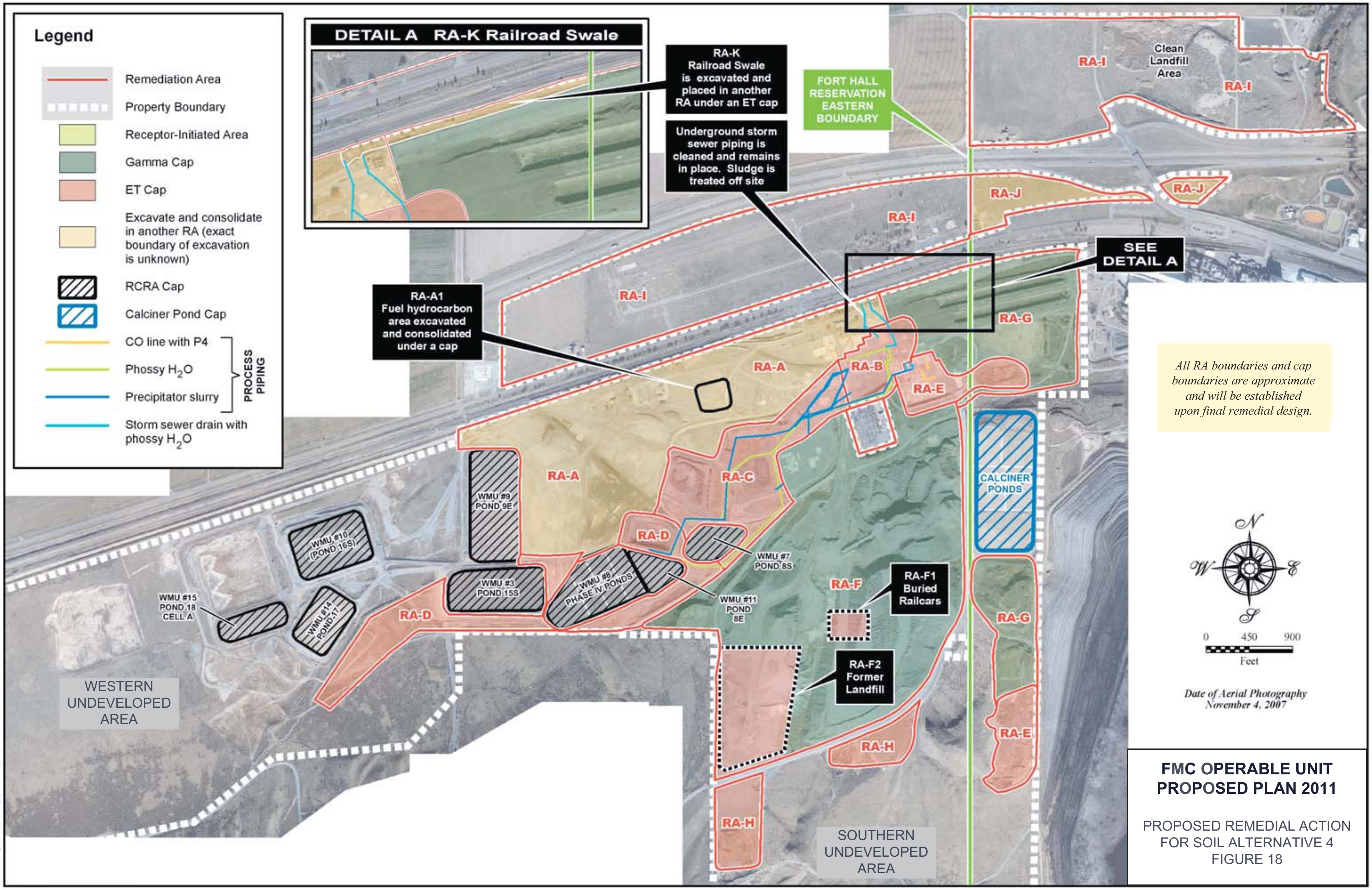
FIGURE 16



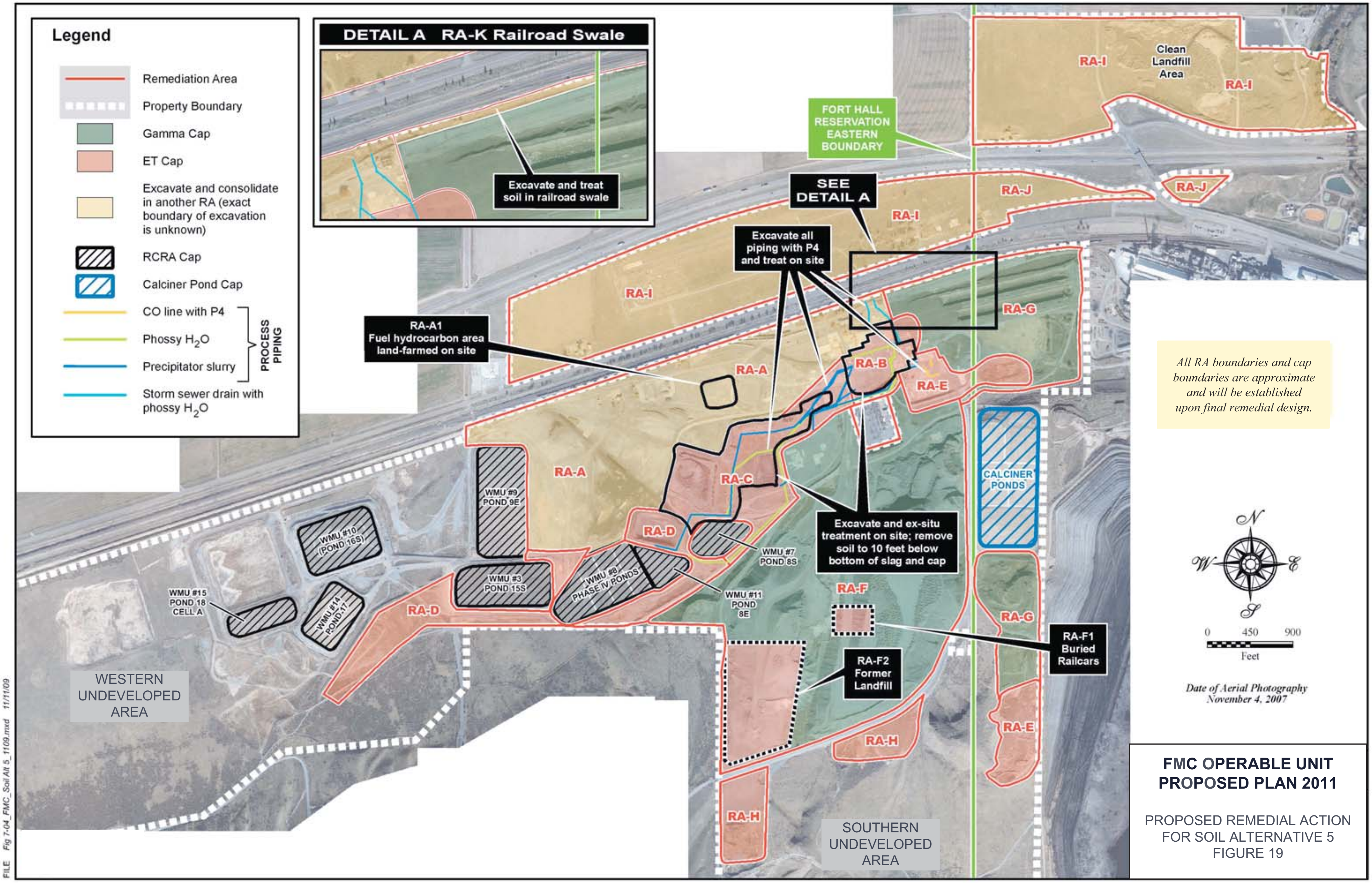
FMC OPERABLE UNIT PROPOSED PLAN 2011

PROPOSED REMEDIAL ACTION FOR SOIL ALTERNATIVE 3
FIGURE 17

FILE Fig 7-02_FMC_Soil Alt 3_0210.mxd 2/24/10

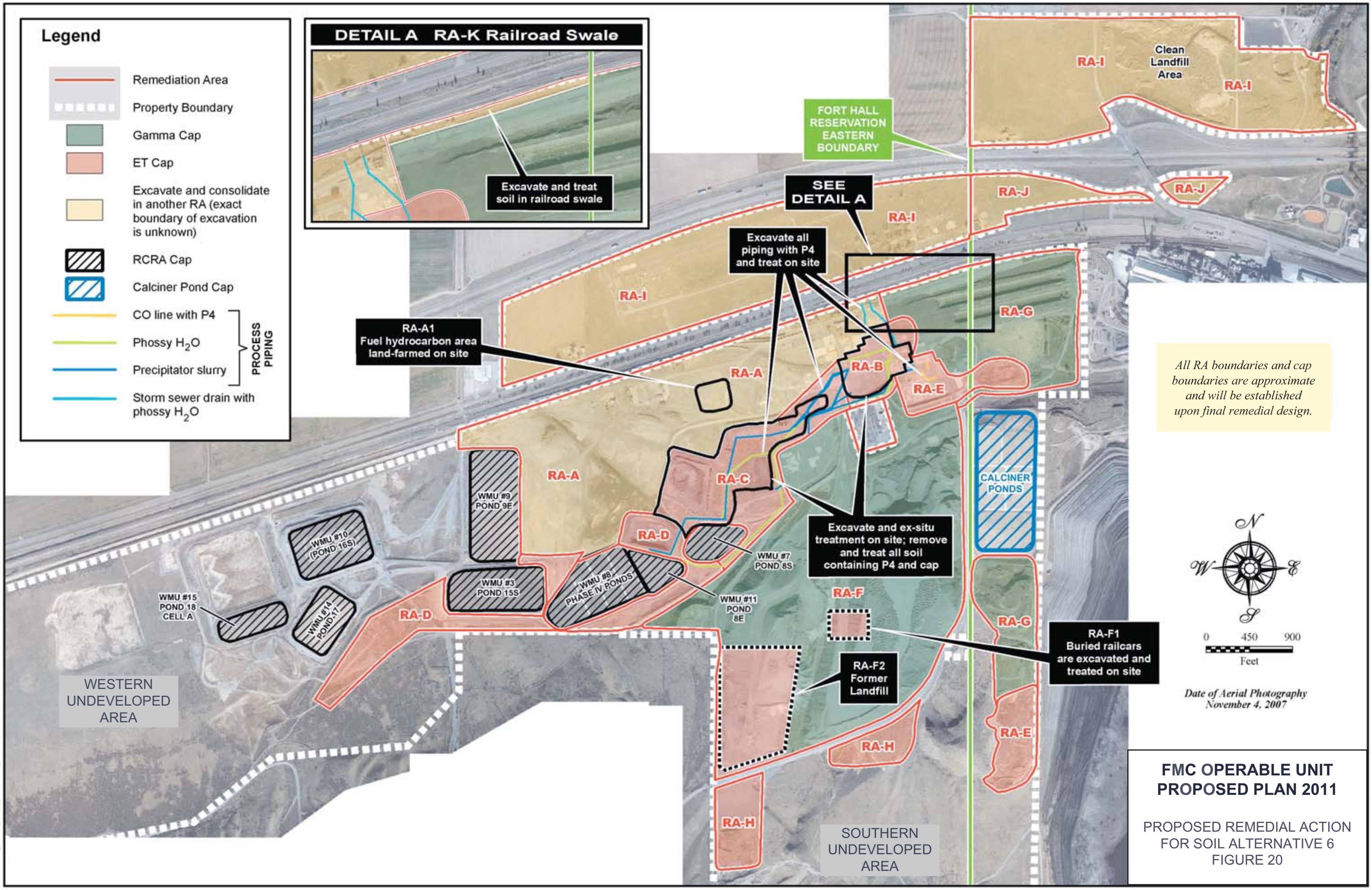


FILE Fig 7-03_FMC_Soil Alt 4_0210.mxd 2/23/10



FMC OPERABLE UNIT PROPOSED PLAN 2011

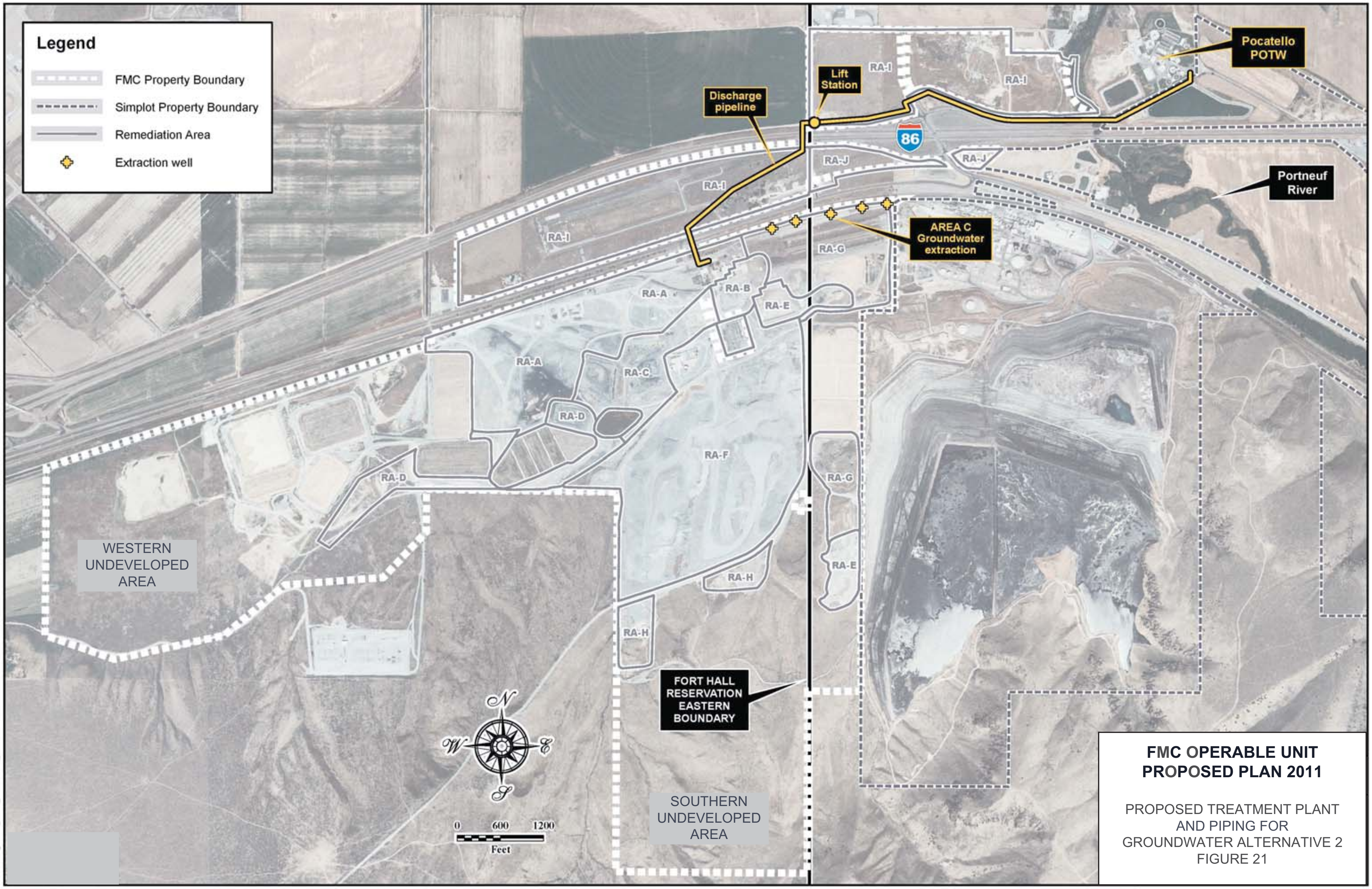
PROPOSED REMEDIAL ACTION FOR SOIL ALTERNATIVE 5
FIGURE 19



FMC OPERABLE UNIT PROPOSED PLAN 2011

PROPOSED REMEDIAL ACTION FOR SOIL ALTERNATIVE 6
FIGURE 20

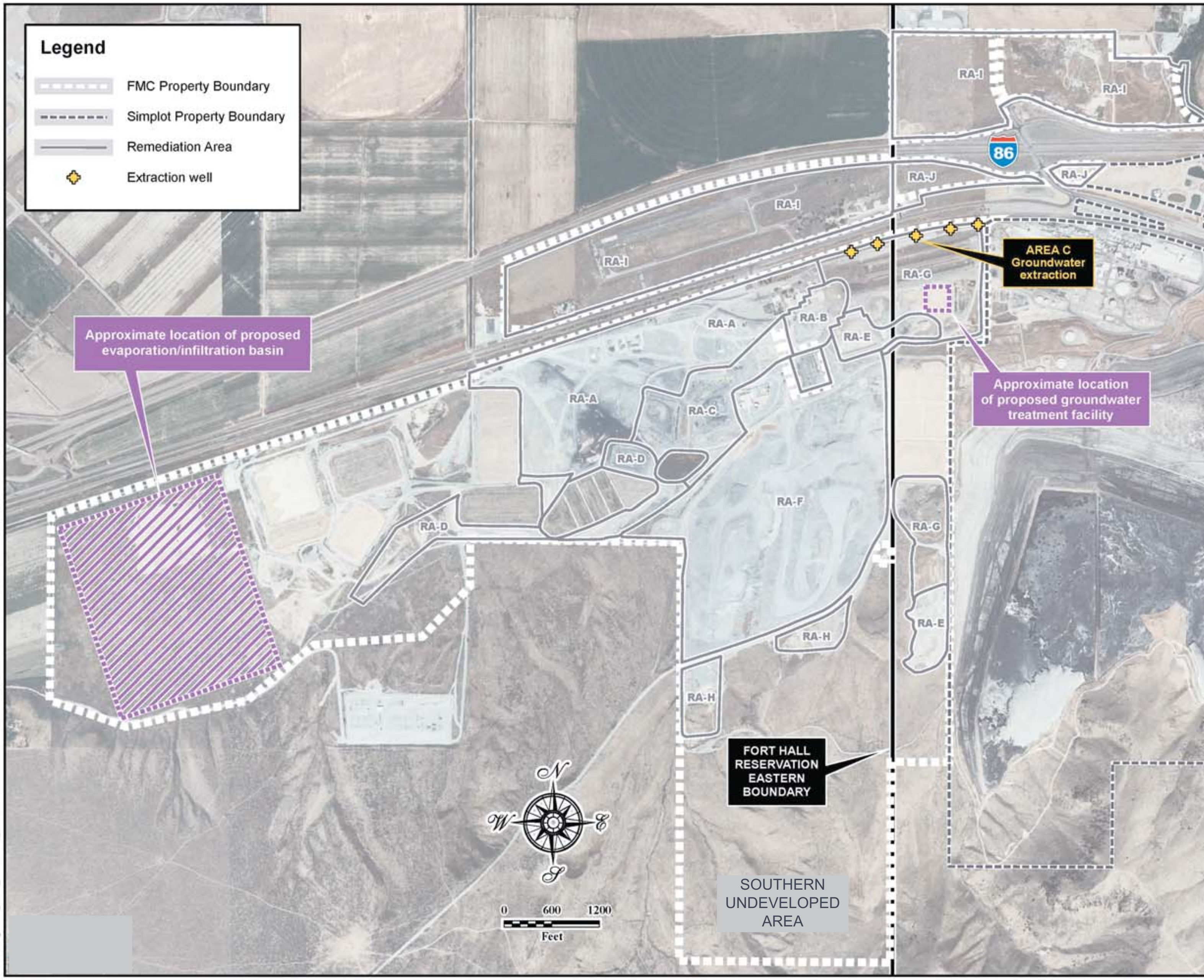
FILE Fig 7-05_FMC_Soil Alt 6_1109.mxd 11/11/09



FMC OPERABLE UNIT
PROPOSED PLAN 2011

PROPOSED TREATMENT PLANT AND PIPING FOR GROUNDWATER ALTERNATIVE 2
FIGURE 21

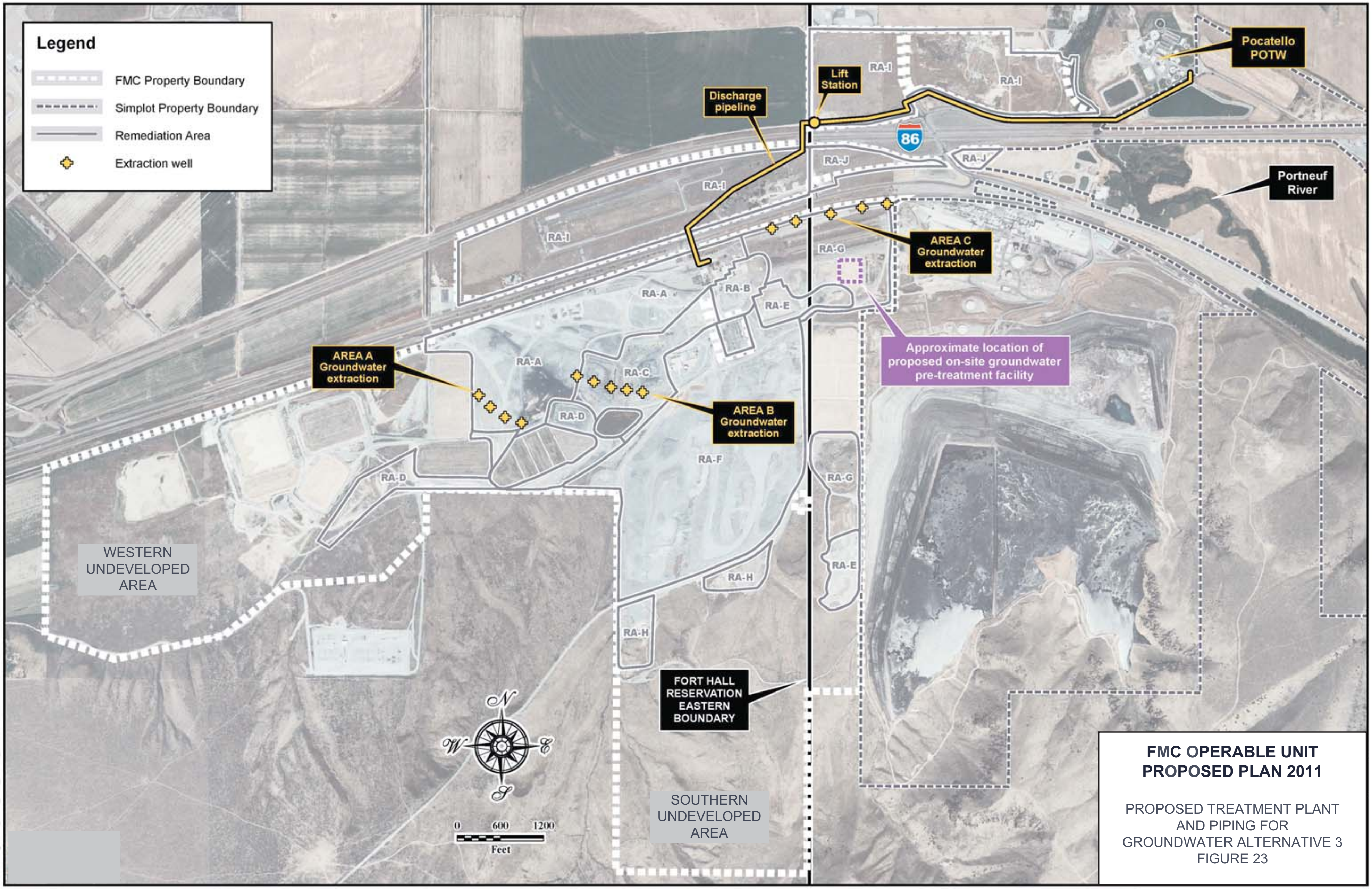
FILE Fig 7-08_FMC_GW Alt 2A_1109.mxd 11/11/09



FMC OPERABLE UNIT
PROPOSED PLAN 2011

PROPOSED TREATMENT PLANT
AND INFILTRATION BASIN
GROUNDWATER ALTERNATIVE 2
FIGURE 22

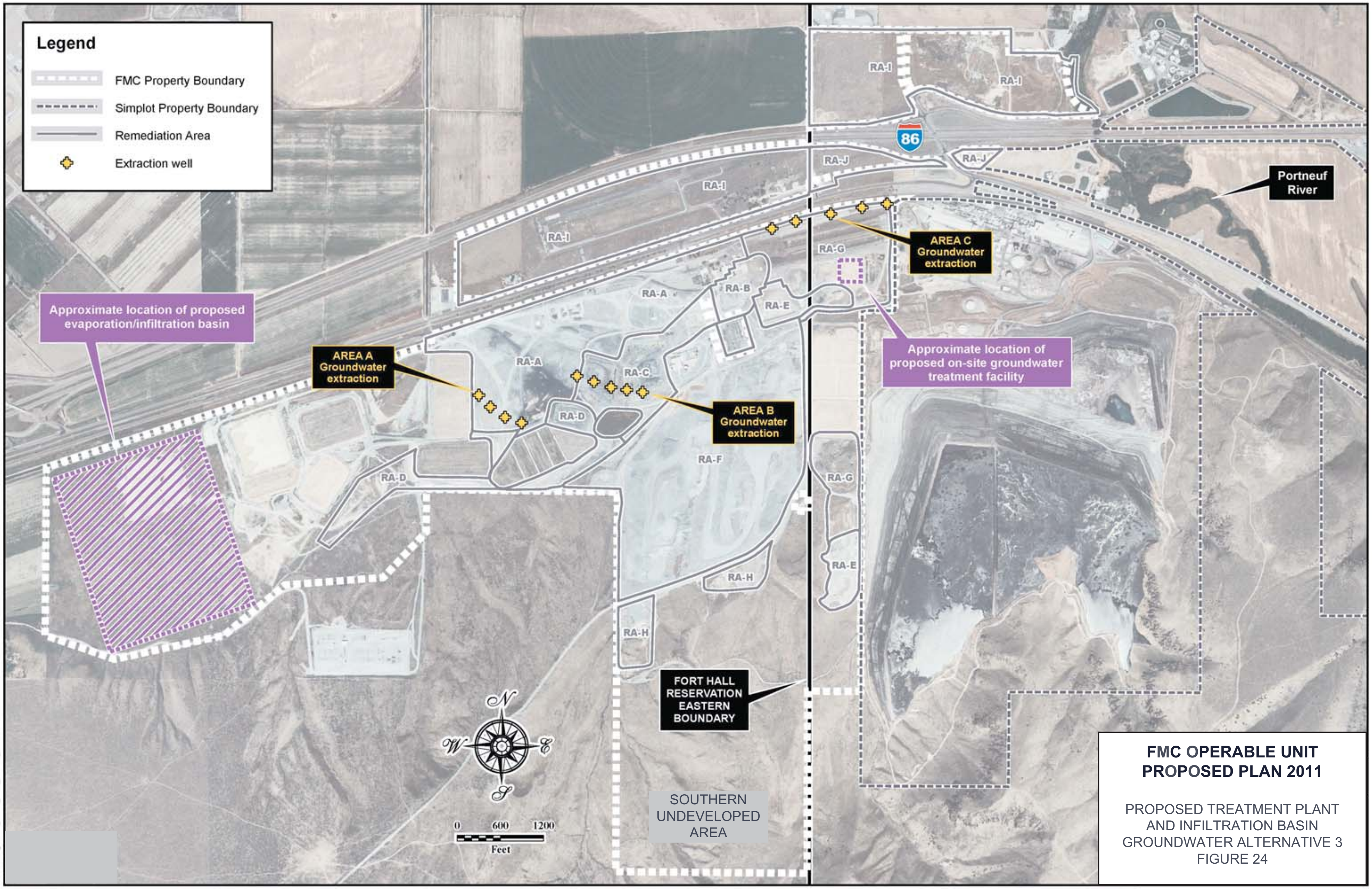
FILE Fig 7-09_FMC_GW Alt 2B_1109.mxd 11/11/09



FMC OPERABLE UNIT PROPOSED PLAN 2011

PROPOSED TREATMENT PLANT AND PIPING FOR GROUNDWATER ALTERNATIVE 3
FIGURE 23

FILE Fig 7-10_FMC_GW_Alt 3A_1109.mxd 11/11/09

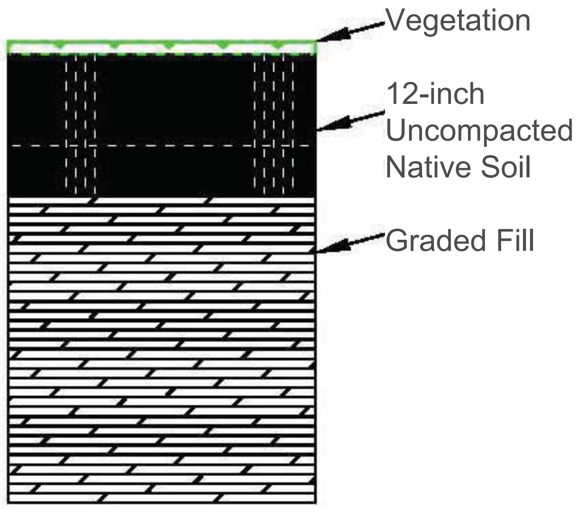


FMC OPERABLE UNIT PROPOSED PLAN 2011

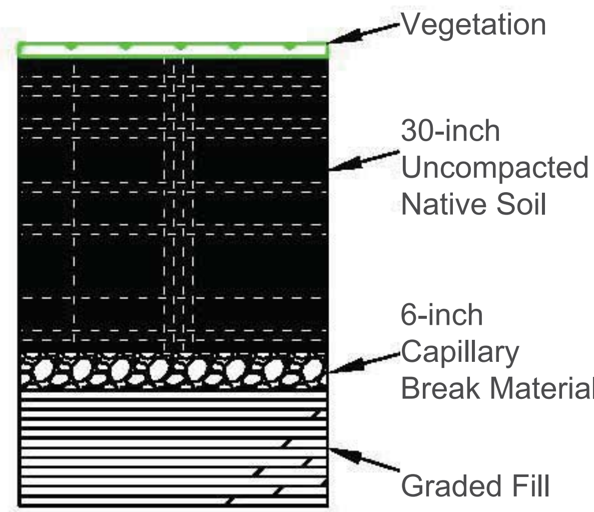
PROPOSED TREATMENT PLANT AND INFILTRATION BASIN GROUNDWATER ALTERNATIVE 3 FIGURE 24

FILE Fig 7-12_FMC_GW_Alt 3B_1109.mxd 11/11/09

GAMMA CAP



ET CAP



FMC OPERABLE UNIT
PROPOSED PLAN 2011

PRELIMINARY CAP DESIGNS
FIGURE 25