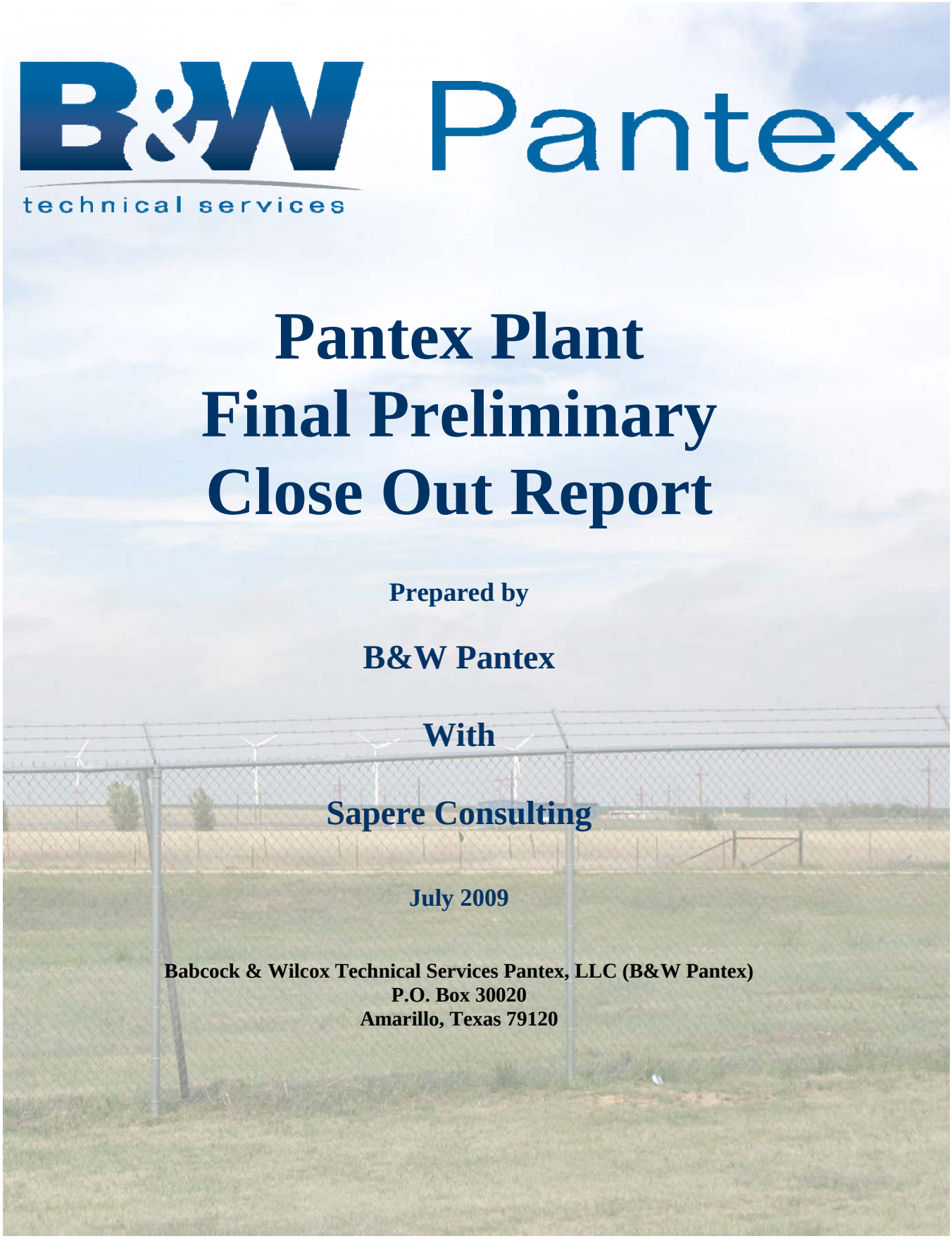

Pantex Plant
Final Preliminary
Close Out Report

Prepared by

B&W Pantex

With

Sapere Consulting

July 2009

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Executive Summary

The purpose of the Preliminary Close Out Report (PCOR) is to document completion of all remedial actions required in the September 2008 Pantex Plant Record of Decision (ROD). Approval of the PCOR will achieve the Comprehensive Environmental Compensation and Liability Act (CERCLA) National Priorities List (NPL) construction completion milestone and qualify Pantex for the construction completion list (CCL).

Introduction

Pantex has been managing waste sites since the late 1960s as part of routine site maintenance and management activities. The work completed through the late 1960s, 1970s, and 1980s primarily included adding final soil covers on landfills at the end of operations. Since the 1990s, work at the site included numerous interim corrective actions and construction of groundwater treatment systems. These environmental restoration activities have occurred at Pantex Plant under both CERCLA and the Resource Conservation and Recovery Act (RCRA).

The Pantex Plant was listed on the NPL on May 31, 1994 (59 FR 27989), making it subject to CERCLA requirements in addition to those of RCRA. Since that time, Pantex has worked continuously with the U.S. Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ) throughout ongoing site investigation and fieldwork. The relationship between the U.S. Department of Energy/National Nuclear Security Agency (USDOE/NNSA), USEPA, and TCEQ continued as a Core Team established in 2001 to gain agreement on a final remedy for the Plant. The remedy selected by the Core Team was formalized in the ROD. The ROD specifies the Remedial Action Objectives (RAOs) that must be met to protect the public health, welfare and environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment.

Response Action Completion Summary

Physical construction of all soil and groundwater response actions at the Pantex Plant was complete on March 31, 2009. Injection of the first round of amendment for all *in-situ* groundwater remedies was completed June 1, 2009 and construction of the perimeter fence around Firing Site 5 was completed on June 3, 2009. Tables 2-1, 2-2, and 2-3 in the PCOR identify the completed Selected Remedy required by the ROD in all soil and groundwater units. Pantex followed a quality assurance and quality control plan (QA/QC) for each project and required documentation to show that the plan was followed along with reports of any deviations. Tables 2-1, 2-2, and 2-3 in the PCOR also describe any changes in the implemented remedy compared to the remedial design. USEPA and TCEQ conducted a pre-final inspection on May 5, 2009 and determined that USDOE/NNSA and its contractors, B&W Pantex Technical Services, LLC (B&W Pantex), have constructed the Selected Remedy in accordance with remedial design (RD) plans and specifications. No further response is anticipated with the exception of long-term operations, maintenance, and monitoring activities. The pre-final inspection photographs are included in Appendix A of the PCOR.

Long-term response actions for some of the implemented remedies are required to achieve the cleanup levels for each RAO. These long-term response actions include implementing institutional controls (ICs), continuing the Zone 11 and Southeast *in-situ* bioremediation systems, operating the groundwater pump and treat systems, and operating the soil vapor extraction (SVE) system at the Burning Ground. Remedy effectiveness will be determined by evaluating data acquired through the long-term groundwater monitoring network.

Soil Unit Preliminary Close Out Summary

A total of 254 active and inactive soil release units were initially identified at the Pantex Plant for further investigation and cleanup. The ROD requires no further action in 95 of these units. The actions required by the ROD at the remaining soil units are ICs, long-term groundwater monitoring, and containment. The categories of units where construction is complete are:

- *Limited Action Soil Units At or Below Screening Levels*. Levels of constituents at 24 soil units are protective of human health and the environment with placement of ICs to restrict the property to industrial use. The ICs will prohibit future reuse for residential housing, elementary and secondary schools, childcare facilities, or playgrounds. These soil units do not pose a risk to groundwater and will not require long-term monitoring for the underlying groundwater.
- *Limited Action Soil Units with Potential to Impact Groundwater*. ICs and long-term groundwater monitoring will be implemented for 90 soil units to restrict property use and to monitor underlying groundwater for potential impacts from the deeper vadose zone. The constituents of concern (COCs) for these soil units are protective of human health and the environment with industrial use restrictions. "Hot spot" excavations/removals were conducted at a number of these units under the State's RCRA interim corrective measures (ICM) authority to mitigate risk. Further evaluation determined that these soil units were unlikely to contribute to the perched groundwater contamination as continuing source areas, but long-term groundwater monitoring is required to address any uncertainties for the deeper vadose zone.
- *Soil Units with Recommended Response Actions*. Forty-five soil units, inclusive of the landfills, were found to require remedial action to control or reduce risks to onsite and/or offsite receptors. Remedial actions approved in the ROD for these units which were initiated as RCRA ICMs include soil excavation and the installation of ditch liners and landfill covers to minimize further impact to groundwater.

Groundwater Preliminary Close Out Summary

Response actions identified in the ROD for the perched groundwater will address both the continued migration of COCs, as well as the restoration of those areas that exceed drinking water standards and risk-based cleanup levels. The two groundwater areas addressed by the ROD are the Southeast Area perched groundwater and the Zone 11 perched groundwater. ICs at these areas will prevent exposure

to contaminants and cross-contamination to the regional Ogallala Aquifer. Construction of the pump and treat systems and *in-situ* bioremediation systems is complete and these systems are operational. The specific response actions completed are:

- The Southeast Pump and Treat System (SEPTS) to stabilize migration and treat perched groundwater contaminants.
- The Playa 1 Pump and Treat System (P1PTS) to reduce the mounding of perched groundwater in the Playa 1 area, mitigating the potential for contaminant migration from the perched groundwater to the Ogallala Aquifer.
- The Southeast area *in-situ* bioremediation system to treat high explosive (HE) contaminants and transform hexavalent chromium to a trivalent form that binds to soils in the perched zone.
- The Zone 11 *in-situ* bioremediation system to treat trichloroethene (TCE) and perchlorate contaminants.

Long-Term Response Actions and Period Remedy Review

Now that physical construction is complete for all the response actions specified in the ROD, remaining work includes implementing ICs and continuing operations, maintenance, and monitoring until the RAOs are achieved. Because this remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years to ensure that the remedy is or will be protective of human health and the environment. Groundwater monitoring data will be reviewed on a more frequent basis and evaluated in an annual groundwater monitoring report to ensure continued protection of human health. The remedial approach may be adjusted by implementing contingency plans to ensure ongoing remedy effectiveness, depending on long-term groundwater monitoring results and technological advances.

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Acronyms and Abbreviations

CCL	Construction Completion List
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS/FS	Corrective Measure Study/Feasibility Study
COC	Constituent of Concern
EE/CA	Engineering Evaluation/Cost Analyses
EPA	U.S. Environmental Protection Agency
FM	Farm-to-Market
GAC	Granular activated carbon
gpm	Gallons per minute
HDPE	High-density polyethylene
HE	High explosive
HHRA	Human Health Risk Assessment
IAG	Interagency Agreement
IC	Institutional Controls
ICM	Interim Corrective Measure
IRAR	Interim Remedial Action Report
ISB	*In-situ* Bioremediation
ISM	Interim Stabilization Measure
IX	Ion Exchange
LTM	Long-Term Groundwater Monitoring System Design Report
MCL	Maximum Contaminant Level
mg/L	Milligrams per liter
NCP	National Contingency Plan
NNSA	National Nuclear Security Administration
NPL	National Priorities List
O&M	Operations and Maintenance
PCOR	Preliminary Close Out Report
P1PTS	Playa 1 Pump and Treat System
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDX	Cyclotrimethylene-trinitramine
ROD	Record of Decision
SEPTS	Southeast Pump and Treat System
SOP	Standard Operating Procedure
SVE	Soil vapor extraction
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TTRF	Texas Tech Research Farm
TTU	Texas Tech University
USDOE	U.S. Department of Energy
VOC	Volatile organic compound

1. Introduction

1.1 Purpose

The purpose of the Preliminary Close Out Report (PCOR) is to document that the U.S. Department of Energy/National Nuclear Security Agency (USDOE/NNSA) has completed construction activities of the Selected Remedy at the Pantex Plant in accordance with *Close Out Procedures for National Priorities List Sites* (OSWER Directive 9320.2-09A-P).[1] As a result, the site has met the requirements for construction complete, which is defined in the directive as, "physical construction of all cleanup actions are complete, all immediate threats have been addressed, and all long-term threats are under control." As a result, approval of the PCOR will signal that the Pantex Plant is eligible for the construction completion list (CCL), which is a compilation of sites presently or formerly on the National Priorities List (NPL). Sites qualify for the CCL when:

1. Any necessary physical construction is complete, whether or not final cleanup levels or other requirements have been achieved;
2. USEPA has determined that the response action should be limited to measures that do not involve construction; or
3. The site qualifies for deletion from the NPL.[2]

Conditions at the Pantex Plant are consistent with item one.

The Environmental Protection Agency (USEPA) and the Texas Commission on Environmental Quality (TCEQ) conducted a pre-final inspection on May 5, 2009 and determined that USDOE/NNSA and its contractors, B&W Pantex Technical Services, LLC (B&W Pantex), have constructed the Selected Remedy in accordance with remedial design (RD) plans and specifications, and no further response is anticipated, with the exception of long-term operations, maintenance, and monitoring activities. USDOE/NNSA and B&W Pantex have initiated the activities necessary to achieve performance standards and site completion. This document also summarizes any changes between the design of components of the Selected Remedy and the implementation of components of the Selected Remedy.

1.2 Regulatory Requirements

The PCOR is being provided in accordance with Article 8.7 of the Interagency Agreement (IAG). The IAG requires that the PCOR be "submitted after completion of the last response action (removal or remedial) and final site inspection."

The Pantex Plant is owned by the USDOE/NNSA, and managed and operated by B&W Pantex. TCEQ has authority under the Resource Conservation and Recovery Act (RCRA) process; and, USEPA has authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Both TCEQ and USEPA will review and approve the PCOR.

[1] As defined in the Pantex Plant *Record of Decision for Groundwater, Soil, and Associated Media*, Sept. 2008.
[2] This item does not apply to sites deferred to RCRA or other authorities and deleted from the NPL prior to completing construction.

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2. Summary of Site Conditions

The purpose of this section is to provide a brief history of the Pantex Plant and the conditions that warranted listing the Plant on the NPL. It also summarizes the interim actions that were conducted to protect human health and the environment prior to implementation of the Selected Remedy.

The components of the Selected Remedy identified in the Record of Decision (ROD) are described and any changes between the remedial design documents and implementation of the components are identified. Lastly, this section identifies the Institutional Controls (ICs) selected for the Pantex Plant to minimize the potential for human exposure to contamination.

2.1 Site Background

The Pantex Plant Superfund Site (USEPA Site #TX4890110527), located 17 miles northeast of Amarillo, Texas, in Carson County, is charged with maintaining the safety, security, and reliability of the nation's nuclear weapons stockpile. Current operations include the development, testing, and fabrication of high explosive (HE) components; nuclear weapons assembly and disassembly, interim storage of plutonium and weapon components; and component surveillance.

The Pantex Plant main area of operations is bounded on the north by Farm to Market Road (FM) 293, on the east by FM 2373, and on the west by FM 683. Recently, USDOE/NNSA purchased 1,526 acres of land east of FM 2373 to provide access for groundwater monitoring and positive control over future land and groundwater use. The Pantex Plant site now consists of a total of 17,559 acres, comprised of USDOE/NNSA owned land and 5,856 acres of safety and security buffer owned by the Texas Tech University (TTU). TTU leases the safety and security buffer property back to USDOE/NNSA; Texas Tech Research Farm (TTRF) manages the buffer zone as range and farm land. Figure 2-1 illustrates the regional setting and major site features of the Pantex Plant.

The USDOE/NNSA-owned main property covers 10,177 acres. Industrial operations occur in major operational areas, identified as Zones 10, 11, and 12, on approximately 2,000 acres in the central portion of the Pantex Plant. The remainder of this USDOE/NNSA main property is managed to support and secure the industrial operations, including more than 6,000 acres used for agricultural purposes. Most surface water runoff at the Pantex Plant flows through several major drainage ditches into four local playa basins (Playa 1, 2, 3, and 4) on, or adjacent to, the site. USDOE/NNSA also owns Pantex Lake, which is 2.5 miles northeast of the Plant boundary.

The Pantex Plant's historical waste management practices have included thermal treatment of explosives, explosive components, and contaminated liquids and solvents (including test residues of explosives and depleted uranium); burial of industrial, construction, and sanitary waste in unlined landfills; disposal of solvents in pits or sumps; discharge of untreated industrial wastewaters to unlined ditches and playas; and the use of surface impoundments for the disposal of chemical constituents. These prior practices have resulted in the release of both chemical and radionuclide constituents to the environment; both soil and perched groundwater have been affected.

The Pantex Plant was first listed on the NPL on May 31, 1994 (59 FR 27989). As described in the ROD, environmental restoration activities have occurred at Pantex Plant under both CERCLA and RCRA, and therefore, Pantex Plant is subject to regulation by the USEPA and TCEQ.

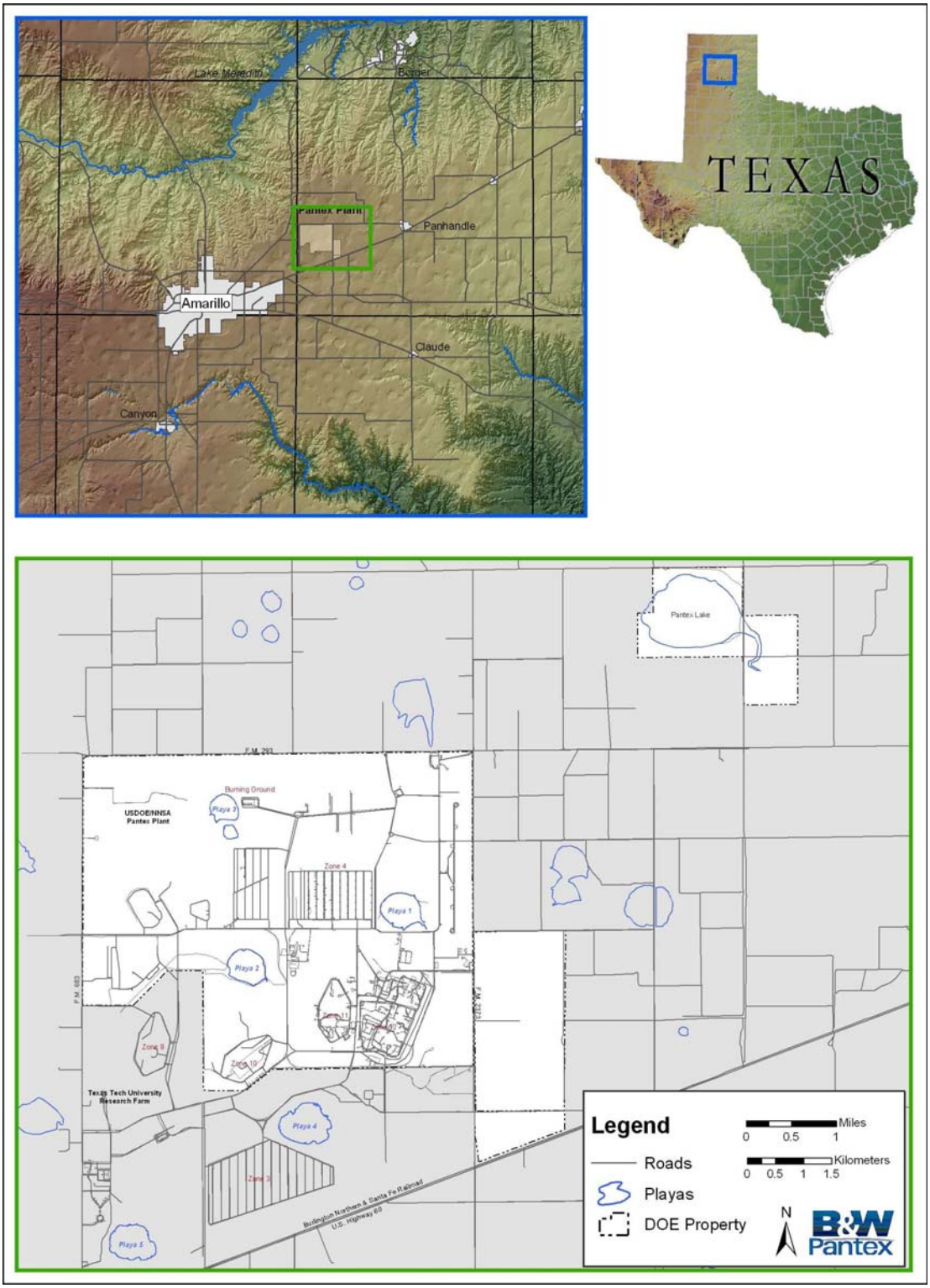

Figure 2-1. Regional Setting and Major Site Features at the Pantex Plant

2.2 Remedial Action Objectives

Remedial Action Objectives (RAOs) were established in the ROD for soil, subsurface soil, and perched groundwater. These RAOs will be used to determine if the components of the Selected Remedy are meeting expectations.

The RAO developed for surface soil is:

- Reduce the exposure risk to onsite industrial and construction/excavation workers through removal, treatment, or prevention of contact with constituents of concern (COCs) in the soil.

The RAO developed for subsurface soil is:

- Reduce potential impact to perched groundwater and the Ogallala Aquifer through source abatement and stabilization/control measures in the vadose zone.

Perched groundwater RAOs were developed to address two separate groundwater issues: 1) restoration of perched groundwater to drinking water standards, and 2) protection of the Ogallala Aquifer. While the Selected Remedy addresses both objectives, protection of the Ogallala Aquifer is the primary goal of implementing remedial actions for groundwater at the Pantex Plant.

The specific RAOs for perched groundwater remedies are:

- Reduce the risk of exposure to perched groundwater through contact prevention.
- Achieve cleanup standards for the perched groundwater COCs (i.e., restoration of the perched groundwater).
- Prevent growth of perched groundwater contaminant plumes.
- Prevent contaminants from exceeding cleanup standards in the Ogallala Aquifer.

2.3 Interim Actions

Interim actions were implemented for the contaminated soils associated with the majority of the release units. Numerous interim actions were performed during the investigation phase of the program, before and during the Human Health Risk Assessments (HHRAs), as depicted in Figure 2-2. These interim actions were taken to mitigate immediate risk, implement protective measures, and control exposure, as necessary.[3]

2.3.1 Interim Stabilization Measures

Two of the aforementioned interim actions taken under RCRA authority, the Burning Ground Soil Vapor Extraction (SVE) System and the Southeast Pump and Treat System (SEPTS), were recognized as interim stabilization measures (ISMs) in 2003. RCRA required these ISMs be modified, as needed, to effectively stabilize the contaminants. Therefore, both systems have changed over the past five years. The SEPTS began as a treatability study when it was first installed in 1995. The SEPTS was expanded to improve its capability to control and begin to dewater the impacted areas of the perched groundwater, reduce contaminants in the sensitive areas of the perched groundwater, and mitigate potential impacts from the perched groundwater to the Ogallala Aquifer.

[3] Appendix A of the ROD contains a table that identifies specific Interim Corrective Measures (ICMs), ISM, and removal actions implemented at the site. This table identifies the regulatory driver under which each interim action was completed.

The Burning Ground SVE System, originally installed with 28 extraction wells, has been reduced to focus treatment on the area of the solvent evaporation pit, where solvent vapor concentrations continue to be sustained. Treatment of the extracted vapors is now accomplished using granular activated carbon (GAC) units instead of the catalytic oxidation unit used when the system was first installed. This system is also being evaluated for future conversion to passive *in-situ* treatment through bioremediation.

Several other ISMs were implemented under RCRA authority as information from the HHRAs and the Corrective Measure Study/Feasibility Study (CMS/FS) efforts progressed. Engineered covers were placed on the Burning Ground Landfills [Solid Waste Management Units (SWMUs) 37 through 44], synthetic liners were installed in the SWMU 2 and 5/5 ditches that drain Zone 12, and soil removals were performed to eliminate hot spots driving the direct contact risk. As part of standard operating procedures or as interim actions, all landfills were covered to reduce direct contact risk to workers and the threat of infiltration and migration to groundwater. These interim actions were brought forward as part of the CERCLA Selected Remedy and are discussed in further detail in Section 2.4.

2.3.2 Removal Actions

All but two of the cleanup actions taken at the site before issuance of the ROD (the Playa 1 Pump and Treat System and the Southeast *In-situ* Bioremediation System) were performed under RCRA authority. These two systems were implemented as non-time critical removal actions under CERCLA. As allowed under CERCLA, two Engineering Evaluation/Cost Analyses (EE/CAs) were issued in 2007 for non-time critical removal actions proposed by USDOE/NNSA to address the threat to the Ogallala Aquifer in the southeast area of the Plant from migration of perched groundwater contaminants; both EE/CAs were subject to public comment. Groundwater modeling, conducted by the Pantex Plant as part of the HHRAs, indicated that in the absence of corrective measures in the perched groundwater, the Ogallala Aquifer could be impacted above drinking water standards within approximately 20 years.

The following two CERCLA non-time critical removal actions were implemented in response to the modeling results:

- To reduce the volume of water in the perched groundwater and decrease the driving force for migration to the Ogallala Aquifer, a pump and treat system was installed to extract and treat the perched groundwater that is mounded beneath Playa 1. This system is known as Playa 1 Pump and Treat System (P1PTS).
- An *in-situ* bioremediation (ISB) system was installed to treat perched groundwater in areas sensitive to vertical migration to the Ogallala Aquifer in the Southeast area.

2.4 CERCLA Selected Remedy

The overall cleanup strategy for the Pantex Plant is to continue to protect human health and the environment through control of potential exposure to contaminated soils and perched groundwater for both human and ecological receptors, to restore the perched groundwater to drinking water standards, and to protect the underlying Ogallala Aquifer.

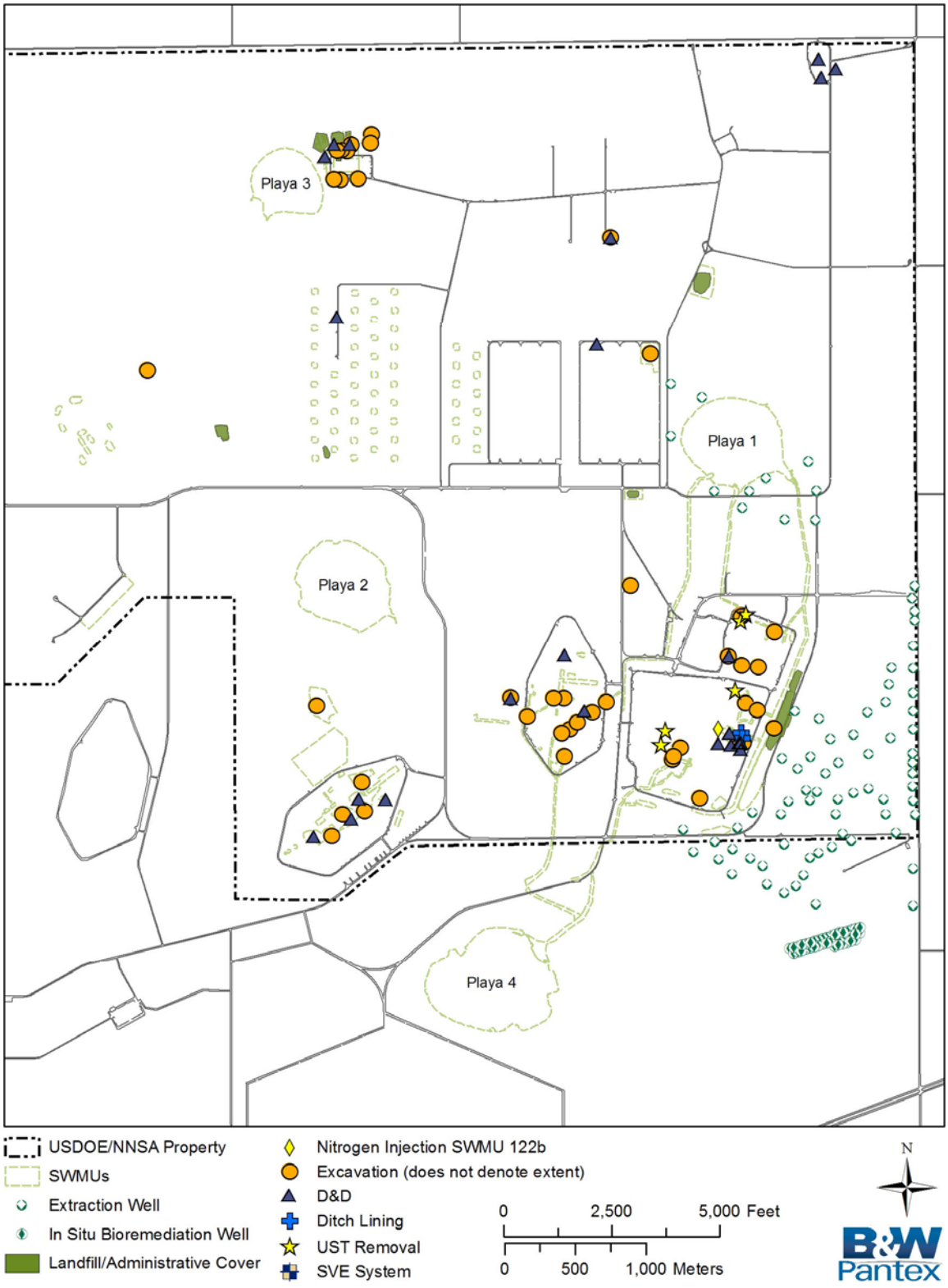

Figure 2-2. Interim RCRA and CERCLA Actions Conducted at the Pantex Plant

The components of the Selected Remedy address soil units requiring a remedial response and perched groundwater contaminants in two focus areas, the Southeast Area and Zone 11. The Selected Remedy for soils is:

- ICs for select units (Limited Action Soil Units, Burn Pads 11 through 13 [SWMUs 25, 26 and 27], and Zone 12 Main Drainage Ditch [SWMU 5/12a]).
- Presumptive Remedy of SVE (with future modifications to effectively reduce the source term) and ICs for Burning Ground Solvent Evaporation Pit (SWMU 47).
- Containment and ICs for the following units:
    - Covers installed for the Burning Ground Former Ash Disposal Trench (SWMUs 14-24) and the former operational area of Firing Site 5 (SWMU 70) will control the potential for exposure to contaminants in soil and minimize the potential for migration of contaminants from soil to groundwater via infiltration. ICs will be implemented to maintain these protective covers and provide for continued containment of contaminated soils, while also restricting access and land use.
    - Installed synthetic liners in Zone 12 ditches (SWMU 2 and SWMU 5/5) will prevent long-term leaching of contaminants to perched groundwater via infiltration. ICs will restrict access, land use, and protect the integrity of the covers or liners.
- Containment (presumptive remedy) and ICs for the twenty-six Pantex Plant landfills. Covers installed will prevent exposure to soil contaminants, minimize the potential for contaminant leaching to groundwater, and promote surface water runoff and erosion control. ICs will restrict access and property use, and ensure continued integrity of the covers.

The Selected Remedy for the Southeast area perched groundwater is:

- Continued operation of the SEPTS to stabilize migration and treat perched groundwater contaminants.
- Construction and operation of the P1PTS to reduce the mounding of perched groundwater in the Playa 1 area, mitigating the potential for contaminant migration from the perched groundwater to the Ogallala Aquifer.
- Continued operation of the *in-situ* bioremediation system to treat HEs contaminants and transform hexavalent chromium to a trivalent form that becomes bound in the soil matrix.
- ICs to prevent exposure to contaminants and cross-contamination to the regional Ogallala Aquifer.

The Selected Remedy for the Zone 11 perched groundwater is:

- ISB to treat trichloroethene (TCE), perchlorate, and RDX (a high explosive compound) contaminants.
- ICs to prevent exposure to contaminants and cross-contamination to the regional Ogallala Aquifer.

Effectiveness of the Selected Remedy for the Pantex Plant Site will be determined through groundwater monitoring implemented through the *Sampling and Analysis Plan*, April 2009 and supported by the *Long-Term Groundwater Monitoring System and Design Report*, April 2009.

2.5 Soil Units

The Remedial Design package provided documentation of the remedial designs for the soil units identified in the ROD as requiring remedial action. The location of these soil units are represented in Figure 2-3: Limited Action Soil Units, and Figure 2-4: Soil Units with Recommended Response Actions inclusive of Landfills. In most cases, these actions were completed as interim actions and were selected in the ROD as components of the final Selected Remedy with the addition of ICs. A pre-final inspection was conducted by USEPA and TCEQ on May 5, 2009 to evaluate the soil components of the Selected Remedy (Appendix A). Tables 2-1 and 2-2 summarize the soil actions that have been conducted, identify the interim remedies, identify the final remedy, describe changes between the design and the implementation of the Selected Remedy and identify any issues or remaining activities noted during the pre-final inspection. Table 2-1 summarizes activities for the soil units identified in the ROD as requiring response that were not landfills and Table 2-2 summarizes the activities for landfills. The information included in the tables is summarized from the documents included in the *Final RD Package*, April 2009.

All landfills were determined to require containment as the final remedy in the ROD. As part of standard operating procedures (SOP) instituted at Pantex, soil covers were placed on the landfills. Typical SOP required placement of one-half foot of daily cover, one foot of intermediate cover, and two feet of soil cover at the end of operations. Landfill trenches were excavated into the Blackwater Draw Formation, which exhibits soils rich in silts and clays to depths of about fifty feet below ground surface. Soil from this formation exhibits a low permeability because of its fine-grained nature. Material for daily, intermediate, and end of operations covers was excavated from the Blackwater Draw Formation, resulting in a low permeability soil cover similar to the anticipated permeability of the base of these landfills.

Soil covers were placed on all landfills at the end of operations, but in some cases, investigation activities found the remaining risk posed by the landfills required additional remedial activities, such as addition of a more robust cover or hot spot removal. Table 2-2 identifies which landfills required additional actions, including hot spot removal or addition of a more robust cover. If a more robust cover was added, the design documents in the Remedial Design (RD) package include specific details related to the construction of the cover.

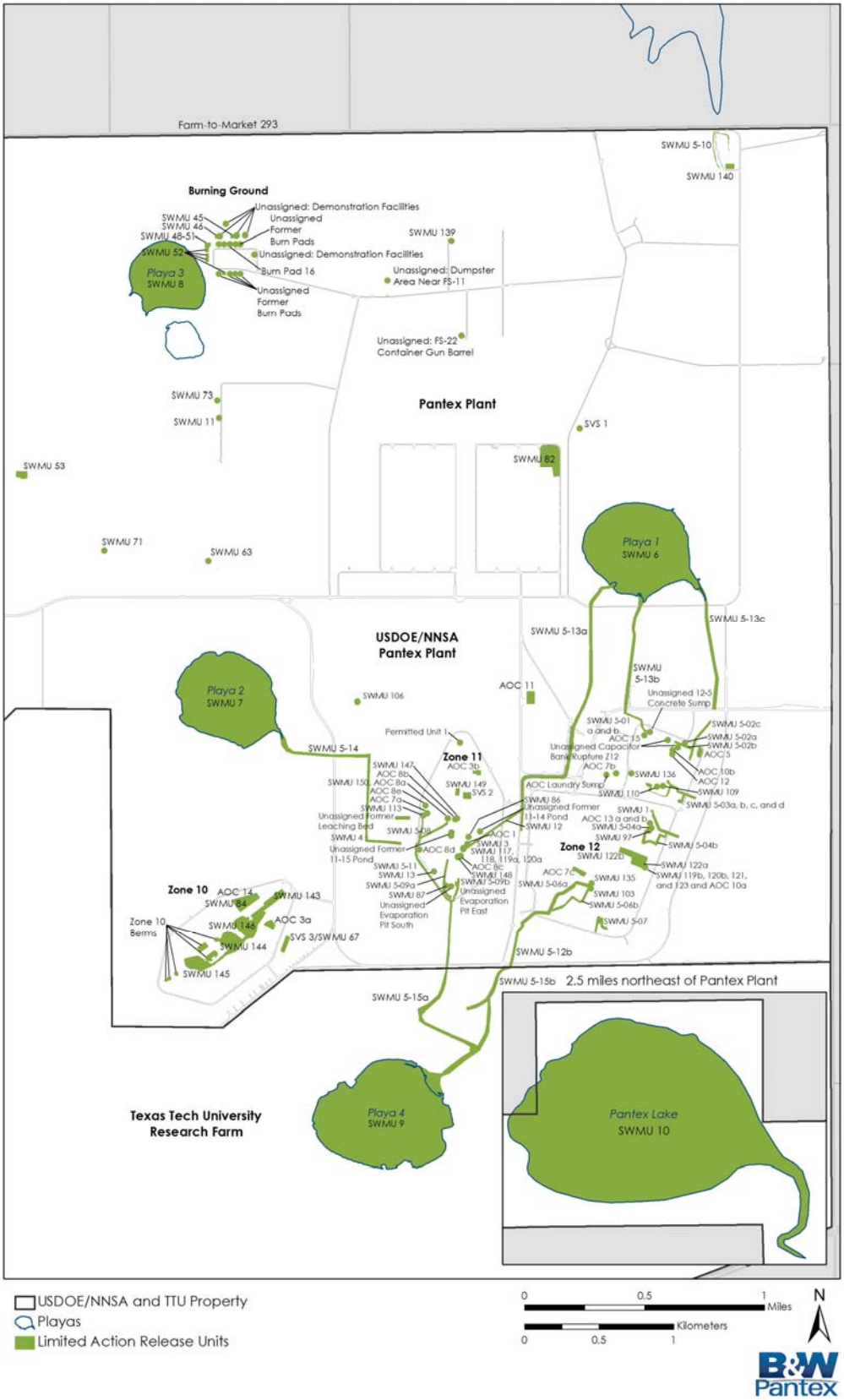

Figure 2-3. Pantex Plant Limited Action Soil Units

Table 2-1. Selected and Implemented Remedies for Soil Units

Unit	Problem	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 5/12a: Zone 12 Main Drainage Ditch	Direct contact risk	Hot spot removal: 32.8 tons of soil removed and extension of the Landfill 3 cover adjacent to the SWMU	2006	Institutional controls	Institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 25: Burning Ground Explosive Burn Pad	Direct contact risk	None	Not Applicable	Institutional controls	Institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 26: Burning Ground Explosive Burn Pad	Direct contact risk	None	Not Applicable	Institutional controls	Institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 27: Burning Ground Explosive Burn Pad	Direct contact risk	Hot spot excavation: 292 cubic yards of soil was removed	1999	Institutional controls	Institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Problem	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 5/05: Zone 12 Drainage Ditch	Potential to impact groundwater	The ditch was re-graded to positively drain and was lined with reinforced polypropylene.	2004	Maintain the synthetic liner and institutional controls	Maintain the synthetic liner and institutional controls	1. Different ballast material (river cobblestone instead of stone) 2. Addition of neoprene protectors in connections between metal and liner material 3. Ditch slope was reduced in some areas 4. Culverts were flushed and one was replaced 5. Water lines were relocated to a deeper depth	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Hot spot removal near the ditch: 24.4 tons of soil removed	2006				
SWMU 2: Zone 12 Drainage Ditch	Potential to impact groundwater	The ditch was re-graded to positively drain and was lined with reinforced polypropylene.	2004	Maintain the synthetic liner and institutional controls	Maintain the synthetic liner and institutional controls	1. Different ballast material (river cobblestone instead of stone) 2. Addition of neoprene protectors in connections between metal and liner material 3. Ditch slope was reduced in some areas 4. Culverts were flushed and one was replaced 5. Water lines were relocated to a deeper depth	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Problem	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMUs 14-24: Former Ash Disposal Trench	Direct contact risk	Placement of a permanent vegetative cover.	2006	Maintain the vegetative cover and institutional controls	Maintain the vegetative cover and institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 47: Burning Ground Solvent Evaporation Pit	Potential to impact groundwater	Full scale SVE system was constructed	2002	Soil Vapor Extraction	Soil Vapor Extraction	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 70: Firing Site 5	Direct contact risk	Hot spot removal of approximately 1,800 cubic yards of soil. The associated buildings were decontaminated and demolished and the area was backfilled and re-graded	1999	Covers and institutional controls	Covers and institutional controls	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Figure 2-4. Soil Units with Recommended Response Actions Inclusive of Landfills

Table 2-2. Selected and Implemented Remedies for Landfills

Unit	Reason for Action	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SVS 8: Abandoned Zone 10 Landfill: Construction Debris Landfill	Direct contact risk	Addition of standard soil cover at the end of operations	Late 1960s (1968-69)	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Hot spot removal (60 yards^3) and restoration of the cover	2002				
Zone 10 Building Construction Debris Landfills (5)	Presumptive Remedy	Addition of standard soil cover at the end of operations	Unknown	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 68d: Active Sanitary Landfill	Presumptive Remedy	Addition of standard soil cover at the end of operations	Mid-1980s	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SVS 5: Landfill East of 11-13 Pad: Construction Debris from Buildings 11-12, 11-13	Presumptive Remedy	Addition of a standard soil cover at the end of operations	Between 1970-1977	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 60: Landfill 9 (Group III), Building Demolition Debris Landfill	Presumptive Remedy	Addition of standard soil cover at the end of operations	1997	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 61: Landfill 10 (Group III), Building Demolition Debris Landfill	Presumptive Remedy	Addition of standard soil cover at the end of operations	1971	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Reason for Action	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 54: Landfill 3	Presumptive Remedy	Hot spot removal (6,036 yards^3) and addition of a low permeability administrative soil cover	2000	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Hot spot removal (33 tons) and cover extension	2006				
SWMU 56: Landfill 5 (Group III), Building Construction Debris Landfill	Presumptive Remedy	Addition of standard final soil cover at the end of operations	1959	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 57: Landfill 6 (Group III) Building Construction Debris Landfill	Direct contact risk	Addition of standard soil cover at the end of operations	1976	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Hot spot removal (8 yards^3) and restoration of the cover	1996				
SWMU 68a North: Original General Purpose Sanitary Landfill	Presumptive Remedy	Addition of standard soil cover at the end of operations	1952	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 37: Burning Grounds Landfill 1	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	Cover extended further	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 38: Burning Grounds Landfill 2	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Reason for Action	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 39: Burning Grounds Landfill 3	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 40: Burning Grounds Landfill 4	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 41: Burning Grounds Landfill 5	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 42: Burning Grounds Landfill 6	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 43: Burning Grounds Landfill 7	Direct contact risk	Addition of an evapotranspiration cover	2004	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 44: Burning Grounds Landfill 8	Direct contact risk	Hot spot removal (290 yards^3)	1999	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Addition of an evapotranspiration cover	2004				
SWMU 58: Landfill 7 Associated with Concrete Batch Plant	Presumptive Remedy	Addition of standard soil cover at the end of operations	1959	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Reason for Action	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 64: Landfill 13	Direct contact risk	Addition of a maintenance cover; approximately 3,125 cubic yards of compacted fill dirt and 1,090 cubic yards of topsoil were placed on the landfill and the area was revegetated	1997	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
		Hot spot removal (42 tons)	2006				
SWMU 66: Landfill 15, Demolition Debris Landfill	Presumptive Remedy	Addition of standard soil cover at the end of operations	1980	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Prairie dog burrows noted in cover. Actions are needed to control and repair holes in the cover. Survey completed; deed restriction to be developed and recorded in Carson County Records.
SWMU 68b: General Purpose Sanitary Landfill 1	Direct contact risk	Addition of a maintenance cover; approximately 7,352 cubic yards of compacted fill dirt and 3,077 cubic yards of topsoil were placed on the landfill and the area was revegetated	1997	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

Unit	Reason for Action	Interim Measure	Date	Selected Remedy	Implemented Remedy	Changes from RD	Pre-Final Inspection
SWMU 68c: General Purpose Sanitary Landfill 2	Direct contact risk	Addition of a maintenance cover; approximately 2,173 cubic yards of compacted fill dirt and 982 cubic yards of topsoil were placed on the landfill and the area was revegetated. A soil erosion fence was added to the landfill because the landfill was in close proximity to a drainage ditch.	1997	Containment and Institutional Controls	Maintenance of the cover added as the ICM and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SVS 7a and 7b: Igloo Demolition Debris Landfills Zone 4 (SVS 7a) and Zone 5 (SVS 7b)	Presumptive Remedy	Addition of standard soil cover at the end of operations	1970s	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.
SVS 6: Unnumbered Zone 7 Landfills, Demolition Debris Landfills	Presumptive Remedy	Addition of standard soil cover at the end of operations	1978	Containment and Institutional Controls	Maintain the standard soil cover and institutional controls.	None	Survey completed; deed restriction to be developed and recorded in Carson County Records.

2.5.1 Remaining Soil Activities

In order to ensure continued reliability of the Selected Remedy for the soil units, maintenance plans were developed to outline the activities that need to be performed on a regular basis. The RD package contains these plans, specifically the *Maintenance Plan for Landfill Covers,* April 2009, which defines the maintenance activities required for all landfill covers, including covers for SWMU 70, and the Former Burning Grounds Ash Disposal Trench. A separate maintenance plan was developed for the ditch liners completed at SWMU 2 and SWMU 5-5 and a *Start-Up and Interim Operations and Maintenance Plan*, November 2006, was developed for the Burning Grounds SVE system.

ICs are also required for all the soil units. ICs are typically used to augment the engineered components of a Selected Remedy to minimize the potential for human exposure to contamination. Such controls are primarily administrative in nature, taking forms such as restrictive covenants to restrict groundwater access and use. The details of the ICs will be provided in the *Land and Groundwater Use Controls Implementation Plan* and are described in greater detail in Section 2.8.

2.6 Groundwater Selected Remedy

The Selected Remedy for perched groundwater consists of:

- Playa 1 Pump and Treat System.
- Southeast Pump and Treat System.
- Southeast *In-Situ* Bioremediation System.
- Zone 11 *In-Situ* Bioremediation System.
- ICs.

Long-term groundwater monitoring (of both perched groundwater and the Ogallala Aquifer) will be conducted to provide data for evaluating the effectiveness of these remedial components. Table 2-3 provides a high level summary of the components and the sections below describe the history and purpose, design and implementation activities, changes between what was designed and what was constructed, and current operational status of these components. A pre-final inspection was conducted by USEPA and TCEQ on May 5, 2009 to assess the construction status of the groundwater components of the Selected Remedy (Appendix A).

2.6.1 Playa 1 Pump and Treat System

2.6.1.1 History and Purpose

Historical waste management practices impacted perched groundwater underlying Playa 1 at the Plant. These historical practices included disposal of industrial wastewater and wastes to unlined ditches and playas. The discharge of this industrial wastewater focused recharge in the Playa 1 area and led to a mounding of perched groundwater beneath it. Sampling has identified high explosives, primarily RDX, and boron in this perched groundwater. Removal of high explosives and chemicals from the perched groundwater beneath Playa 1 is needed to improve long-term protection of the Ogallala Aquifer.

Table 2-3. Summary of Groundwater Selected Remedy

Location	Problem Warranting Action	Selected Remedy	Remedial Action Initiation Date	Available Documentation
Playa 1	High explosives (RDX) and boron in perched groundwater	Pump and Treat to remove HE and boron from the perched groundwater and provide protection of the Ogallala Aquifer	2008	• Final Design Basis Document • Final O&M Manual • EE/CA for Playa 1 Dewatering • Construction Completion Report
Southeast Area	High explosives (RDX) and chromium in perched groundwater	Pump and Treat to HE and chromium from the perched groundwater and provide protection of the Ogallala Aquifer	• 1995 as a treatability study • 1999 as an ICM • 2004 modification • 2005 modification	• SEPTS Implementation Report • SEPTS O&M Plan, Rev. 2
	High explosives (RDX) and chromium in perched groundwater	*In-situ* bioremediation to reduce contaminant concentrations in the perched groundwater	2007	• EE/CA for *In-Situ* Bioremediation • Final Design Basis Document • Final Implementation Report • Final O&M Report
Zone 11	Perchlorate and TCE in perched groundwater	*In-situ* bioremediation to reduce contaminant concentrations in the perched groundwater	2009	• Final Design Basis Document

The P1PTS, also known as the Perched Aquifer Dewatering Project, is a non-time critical removal action designed to limit the spread of a groundwater contaminant plume by dewatering the perched groundwater and reducing the hydraulic head in the Playa 1 vicinity. The strategy for the project involved the installation of a series of extraction wells surrounding Playa 1 in all but the upgradient direction, and dewatering the perched aquifer by creating a cone of capture around it. The system consists of ten extraction wells, a treatment system and building, and associated wellhead controls and piping.

2.6.1.2 Design and Implementation Activities

Design activities commenced in early 2007. The final design was complete in July 2007 and documented in the *Final Design Document*. As noted in the *Playa 1 Perched Aquifer Dewatering System Operations and Maintenance Manual* (January 2009), the major components of the treatment system include:

- Influent settling/equalization tanks
- Influent transfer pump
- Bag filters
- Intermediate holding tank
- Intermediate transfer pumps
- Granular Activated Carbon backwash system
- GAC vessels
- Ion exchange (IX) vessels
- SKALAR real-time monitoring system (for boron)
- Effluent holding tank
- Effluent transfer pump
- Control panel
- Typical controls and devices located on the treatment system include inline flow transmitters, ultrasonic tank level sensors, high-level alarm floats, and pressure transmitters.

Following completion of the final design, these components, along with the necessary extraction wells (see Figure 2-5), piping systems, and building infrastructure required to operate the treatment system were installed and the treatment plant was ready for operation on September 30, 2008. Construction of the permanent effluent line to the Pantex Plant Wastewater Treatment Facility was completed on October 23, 2008.

The following is a summary of the Playa 1 Pump and Treat System:

Treatment System
(Capacity = 250 gpm or 324,000 gpd/118 million gal/yr at a 90% operational efficiency)

- Granular Activated Carbon
- Boron Ion Exchange (for irrigation quality)

Extraction Wells and Conveyance Lines

- 10 Extraction Wells
- Two miles of conveyance line connecting extraction wells to the treatment units
- Discharge line to the subsurface irrigation holding lagoon

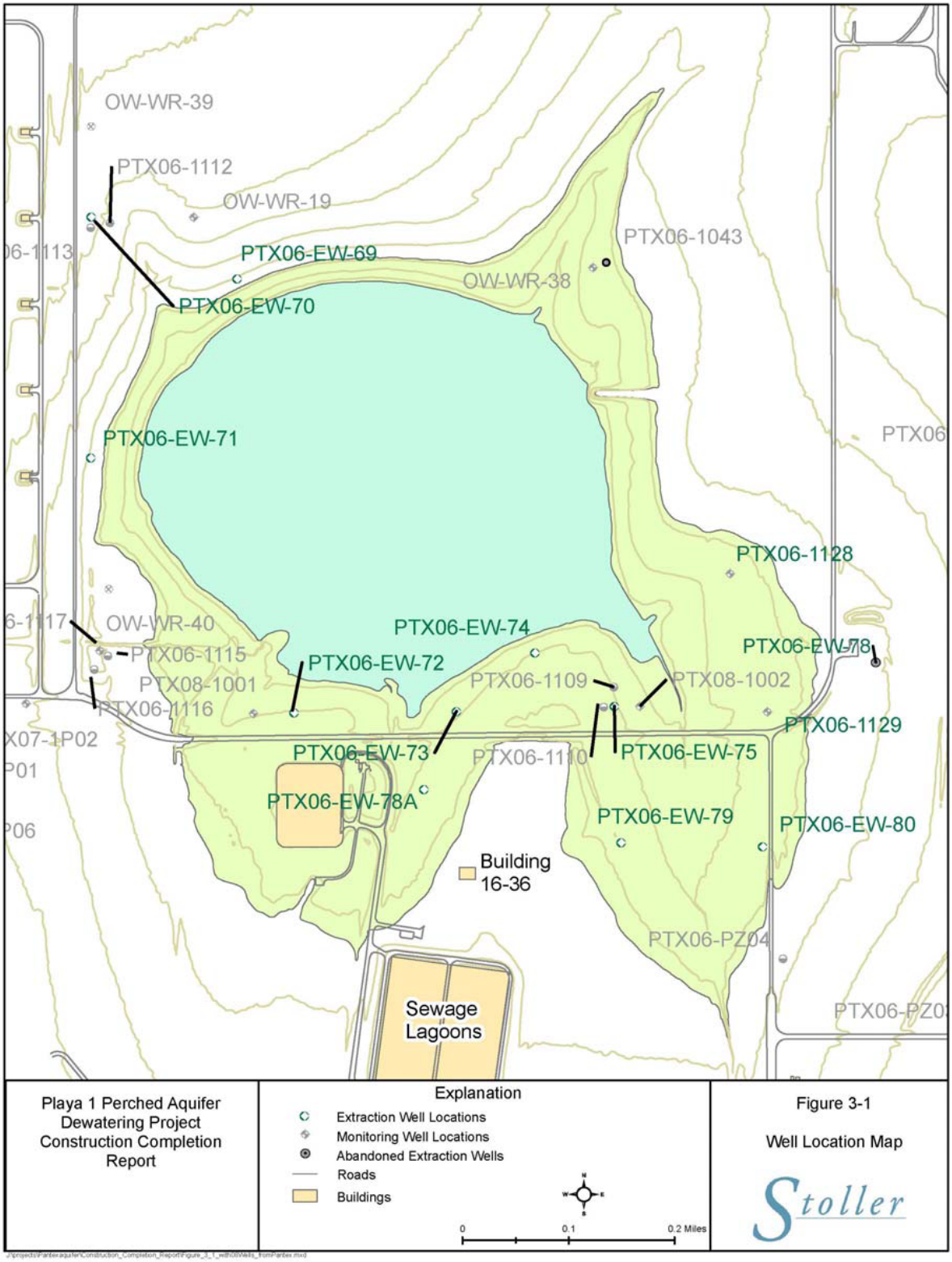

Figure 2-5. Playa 1 Pump and Treat Wells Locations

This system and its components are described in detail in the *Construction Completion Report – Playa 1 Perched Aquifer Dewatering Project*, December 2008 and *Final Design Basis Document– Playa 1 Perched Aquifer Dewatering Project*, March 2007.

2.6.1.3 Changes between Design and As-Built

Although there were no changes that impacted how the P1PTS operates, there were two changes for the P1PTS from the original design. The first was that of the ten extraction wells installed during construction of the remedy, only eight are being used for extraction purposes because limited saturated zone thickness was encountered during installation of two wells. These two wells are now used as monitoring wells. Two wells constructed for the pump test (Playa 1 Feasibility Study) were incorporated into the final system as extraction wells, resulting in a total of ten extractions wells that feed the treatment system. The second change was to the sewage line to take effluent away from the treatment plant, due to the slight elevation differences between the outfall at the building and the discharge point at the designated manhole. As such, a separate septic system was constructed. This system consists of an approximately 1,000-gallon holding tank and two leach field lines with seven and eight bio-diffusion chambers on each line, respectively.

2.6.1.4 Current Operational Status

The P1PTS is operating as designed. The primary metric for successful operation of this system is reduction of the mounded water beneath the Playa 1 area and corresponding reduction in the flux of water leaving this region of the perched groundwater moving towards the SEPTS. Accordingly, perched groundwater thickness is expected to decline at a rate of one to two feet per year from the 2008 perched groundwater potentiometric surface contours during the first five years of implementation and more slowly thereafter. This will be a function of reduced yield from the extraction wells over time. Contaminant concentrations are expected to decrease after five to ten years of operation through treatment of the extracted water; the overall mass of contaminants in the perched aquifer will be reduced as the volume of water decreases. However, the rate of contaminant mass reduction will decrease as the water yield decreases. The system is expected to operate until RAOs are achieved.

2.6.2 Southeast Area Pump and Treat System

2.6.2.1 History and Purpose

The SEPTS started as a field-scale treatability study installed in 1995 to gather data and evaluate potential corrective measure alternatives for perched groundwater. The primary objectives of the study were to obtain field estimates of extraction well yield and to evaluate the effectiveness of GAC for removal of HEs from the extracted groundwater.

The field-scale study was subsequently expanded in 1996 and 1998 to increase the volume of groundwater being extracted, test the treatment system's ability to sustain operation with increased flow, and evaluate effectiveness of chromium removal from perched groundwater by chemical precipitation. The expansions ultimately resulted in a network of 18 extraction wells and two injection wells and an enclosed treatment plant consisting of two GAC units with a 300 gpm capacity

for removal of organic constituents and a 50-gallon per minute (gpm) chemical precipitation and microfiltration unit designed to remove hexavalent chromium.

In 2000, an ICM was designed. The expanded system included installing 30 additional extraction wells, eight monitoring wells, and seven injection wells. As constructed, the system included 49 extraction wells with an average total extraction rate of 180 gpm and nine injection wells. The design also included expansion of the treatment system building to allow installation of new equipment to handle new GAC systems and a chemical precipitation pre-treatment system. Capacity of the new GAC systems was 500 gpm, and capacity of the chemical precipitation system was 120 gpm. This system was incorporated into the Compliance Plan issued by TCEQ in 2003 as an ISM.

Since 2001, additional modifications have been made to the well field and treatment system to improve overall system performance and increase efficiency of individual components. These activities included upgrades for disposition of the treated water, expansion of the treatment building, conversion to ion exchange for chromium treatment, expansion of the extraction well field, addition of a chromium polisher unit, and combining high explosive/volatile organic compound (HE/VOC) and hexavalent chromium influent streams. In addition, a major extraction well field expansion, completed in 2007, and conveyance lines to commercial agriculture use locations are designed to bring the SEPTS in line with the overall remediation strategy set forth in the ROD.

2.6.2.2 Design and Implementation Activities

Due to the SEPTS's modifications over time, the design process has been ongoing. The *SEPTS Implementation Report* presents a bibliography of all available design documentation beginning with the design of the treatability study initiated in 1995 through the subsequent expansions and modifications.

The major operations and processes of the SEPTS include:

- Affected Groundwater Extraction Wells
- Chromium Removal – Ion Exchange
    - Influent Equalization
    - Ion Exchange
- HE and VOC Groundwater Treatment
    - Influent Equalization
    - Activated Carbon Filtration
    - Effluent Equalization
- Treated Water Injection
- Chromium Polishing
- Boron Removal – Ion Exchange
- Effluent Equalization and Subsurface Discharge
- Sediment Processing – Concentration and Dewatering
- Supervisory Control and Data Acquisition System
- Miscellaneous Systems
    - Sumps
    - Compressed Air
    - Safety Showers
    - Online Analyzer (Chromium and Boron)

The following is a current summary of the Southeast Area Pump and Treat System (see Figure 2-6):

Treatment System
(Capacity = 300 gpm or 389,000 gpd/142million gal/yr at a 90% operational efficiency)

- Granular Activated Carbon
- Chromium Ion Exchange
- Boron Ion Exchange (for irrigation quality)

Extraction Wells and Conveyance Lines

- 62 Extraction Wells
- Seven miles of conveyance line connecting extraction wells to treatment units
- Discharge lines from the treatment system to:
  - Subsurface irrigation holding lagoon
  - Four injection wells completed into the perched groundwater

This system and its components are described in detail in the *Southeast Pump & Treat Implementation Report*, February 2009 and the S*outheast Pump & Treat O&M Plan, Rev. 2*, March 2007.

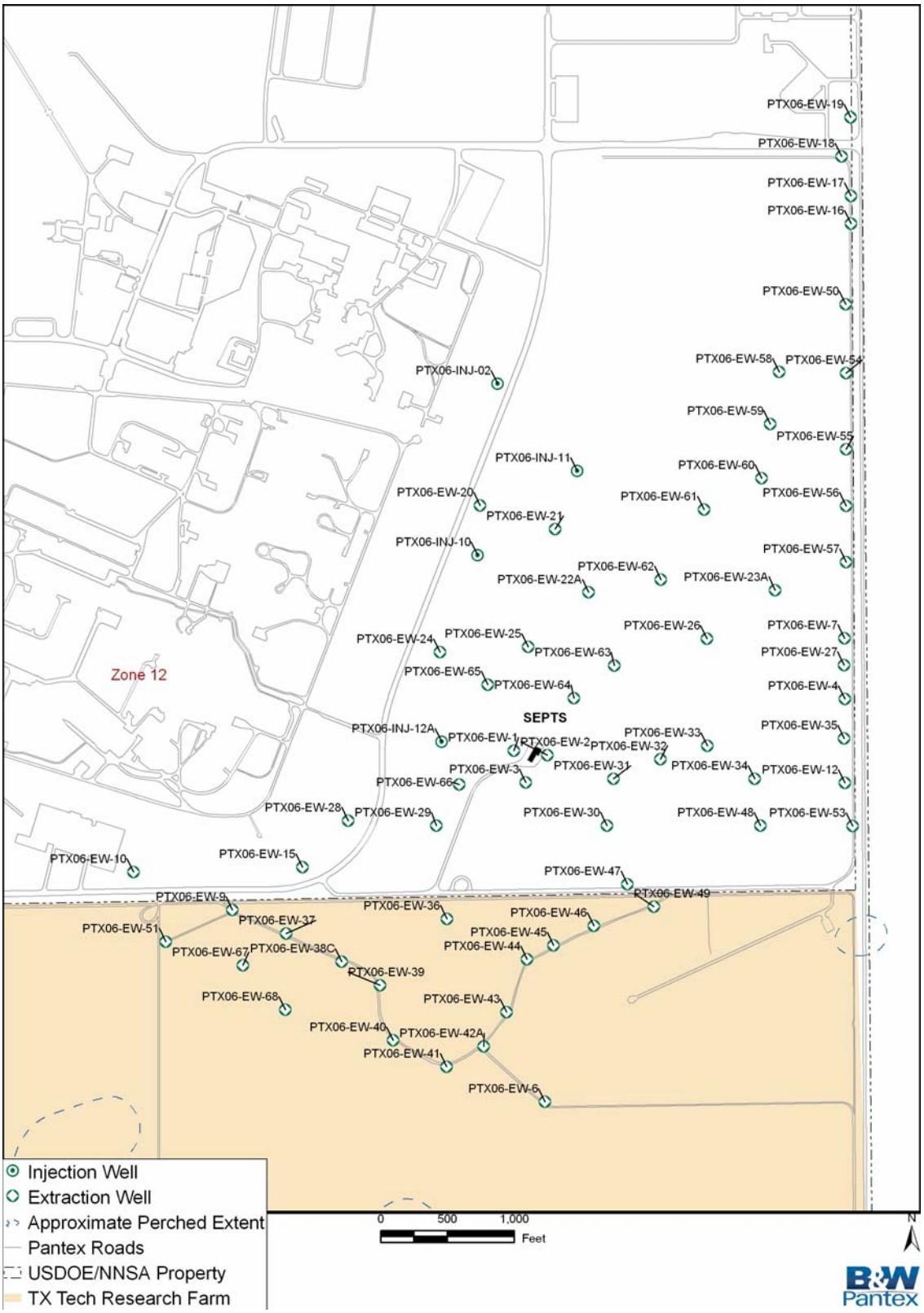

Figure 2-6. SEPTS System Overview

2.6.2.3 Changes between Design and As-Built

Changes to the system that have been made over time are documented in the various design documents identified in the *SEPTS Implementation Report*. The system was constructed as designed for each modification, so there are no significant changes between the design and as-built conditions of the system.

2.6.2.4 Current Operational Status

The SEPTS is operating as designed. Reduction of perched groundwater saturation and contaminant mass are the most important metrics to determine if the system is achieving objectives. Perched groundwater thickness is expected to decline at an average rate of 0.5 feet per year for the first three to five years. Perched groundwater thickness should decline a total of five feet from the 2008 perched groundwater potentiometric surface contours. Contaminant concentrations are expected to remain stable for the first five to ten year period following implementation of the final remedy phase of this system; the overall mass of contaminants in the perched aquifer will be reduced as the volume of water remaining in the system is reduced through extraction and treatment. However, the rate of contaminant mass reduction will decrease as the water yield decreases. The system is expected to operate until RAOs are achieved.

Figure 2-7 illustrates the contaminant removal rates observed from January 2001 through August 2007. Expansions of the SEPTS resulted in a strongly increasing rate of removal for RDX, and total HEs. While the rate of chromium removal also increased during these expansions, the increase was not as substantial because chromium is not as widespread in the perched groundwater as RDX.

2.6.3 Southeast Area In-Situ Bioremediation System

2.6.3.1 History and Purpose

Concentrations of high explosives and chromium in the perched aquifer have the potential to migrate vertically and horizontally to points of exposure in the Ogallala Aquifer. As such, an ISB barrier approach was designed as a non-time critical removal action to create a large treatment zone in the southeast portion of the perched groundwater. As groundwater flows through the treatment zone, the contaminants are treated both biotically and abiotically and the groundwater that leaves the treatment zone is treated to cleanup goals in the perched aquifer downgradient from the system. Thus, the ISB barrier is a barrier to contaminant migration, but not to groundwater flow. This system is known as the Southeast ISB (SEISB) System.

The addition of a bioremediation amendment, in this application an emulsion of lactic acid and soybean oil, provides a carbon source/electron donor for resident bacteria. The carbon source stimulates microbial growth, which first consumes oxygen and then other electron acceptors, creating reducing geochemical conditions. These conditions allow for contaminants to degrade without any external treatment.

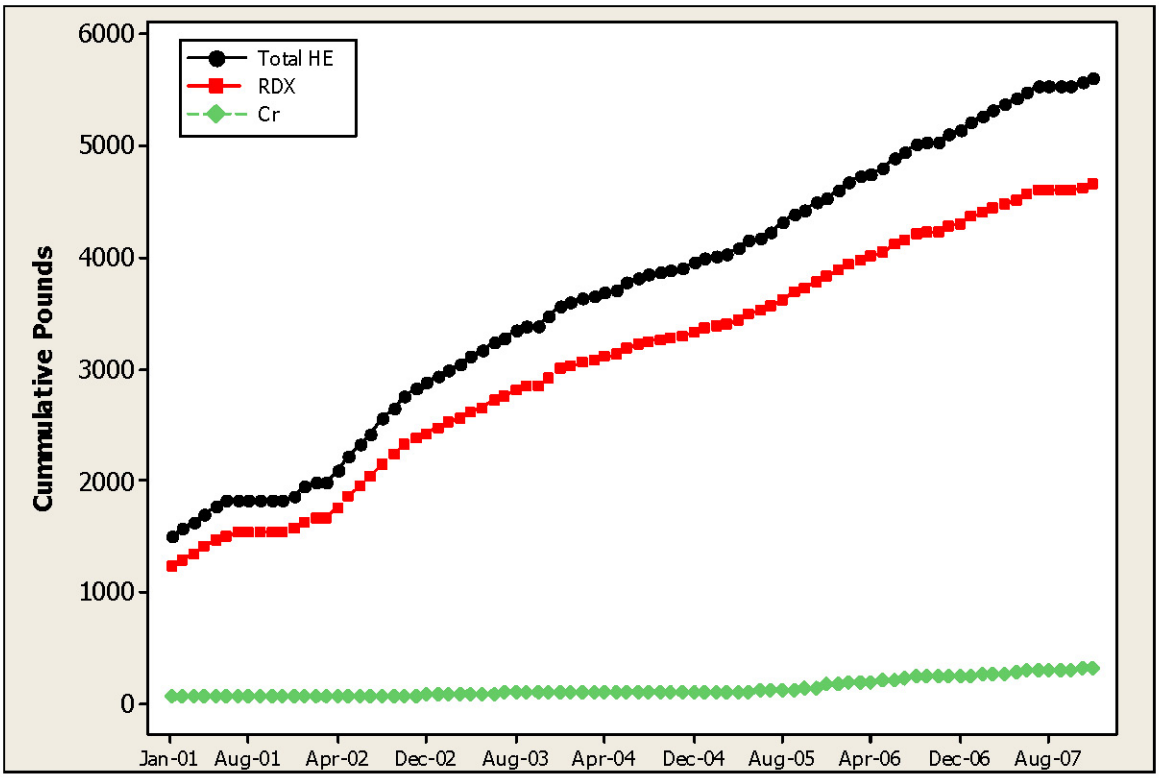

Figure 2-7. Total High Explosives, RDX, and Chromium Removal Trends by the Pump and Treat System

2.6.3.2 Design and Implementation Activities

The design of the ISB System was based on the following objectives:

- Effective use of microbiological processes to establish and maintain a zone of highly reducing conditions, through which the perched groundwater can flow.
- Degrade the maximum possible concentration and mass of RDX and Chromium in perched groundwater as it flows through the ISB Barrier zone.
- Treat RDX and Chromium in groundwater in the ISB Barrier zone to cleanup standards within one year of injection
    - RDX - 0.0077 milligrams per liter (mg/L) [revised to 0.002 mg/L in the ROD]
    - Cr – 0.10 mg/L
- Achieve 95% treatment, aerially within the ISB Barrier treatment zone.
- Optimize the ISB Barrier location to minimize the potential for future vertical migration of COPCs

To achieve these goals, the following activities were conducted:

- Designed the ISB barrier project
    - For automated, year-round conditions
    - To consider the overall project objectives of reducing the mass of HE and Cr in the perched groundwater
- Installed injection wells into the perched groundwater zone
- Analyzed geological and hydrogeological conditions to understand amendment delivery

- Sampled 14 wells for baseline conditions
- Constructed the ISB barrier infrastructure, which included the following:
    - Improved and installed construction roads and created an equipment pad
    - Installed a water supply pipeline
    - Designed and constructed injection equipment infrastructure
    - Installed amendment distribution infrastructure (pipelines, vaults and well connections)
- Effectively injected the bioremediation amendment to create the ISB Barrier
- Monitored post-injection groundwater quality to determine if the COCs are effectively treated
- Provided operation and monitoring recommendations and ISB barrier project progress updates

The following is a summary of the SEISB (see Figure 2-8):

- Amendment Injection Delivery Trailer
    - Designed to allow for transport to other locations for use, as necessary.
- Injection Wells and Conveyance System
    - 42 Injection Wells
    - Injection pad, conveyance lines and distribution vaults provided for use in periodic injections

This system and its components are described in the *Final Implementation Report, Southeast Perched Groundwater In Situ Bioremediation Corrective Measures Design and Construction,* June 2008 and the *Final Design Basis Document – In Situ Bioremediation Corrective Measures Design*, May 2007.

2.6.3.3 Changes between Design and As-Built

Although the design specified that approximately 44,300 gallons of amendment would be injected, 45,635 gallons were actually injected to ensure that all treatment zones received a quantity of amendment that represented the prescribed dose. This additional quantity of amendment does not represent a significant change between what was designed and was implemented.

2.6.3.4 Current Operational Status

All of the wells have been installed and amendment injections are complete. Reduction of contaminant concentrations in the treatment zone is the most important metric to determine if the system is achieving the established objectives. RDX (and other high explosives) and hexavalent chromium in and 200 feet downgradient of the treatment zone are expected to meet cleanup standards within two years of implementation. Residual concentrations of breakdown products may persist, but should also be treated resulting in declining concentration trends within five years of implementation. Based on the current rate of perched groundwater flow and amendment longevity, injections will be necessary about every eighteen to twenty-four months. As perched groundwater is removed from the subsurface, the frequency of injections and volume of amendment to be injected should gradually decrease.

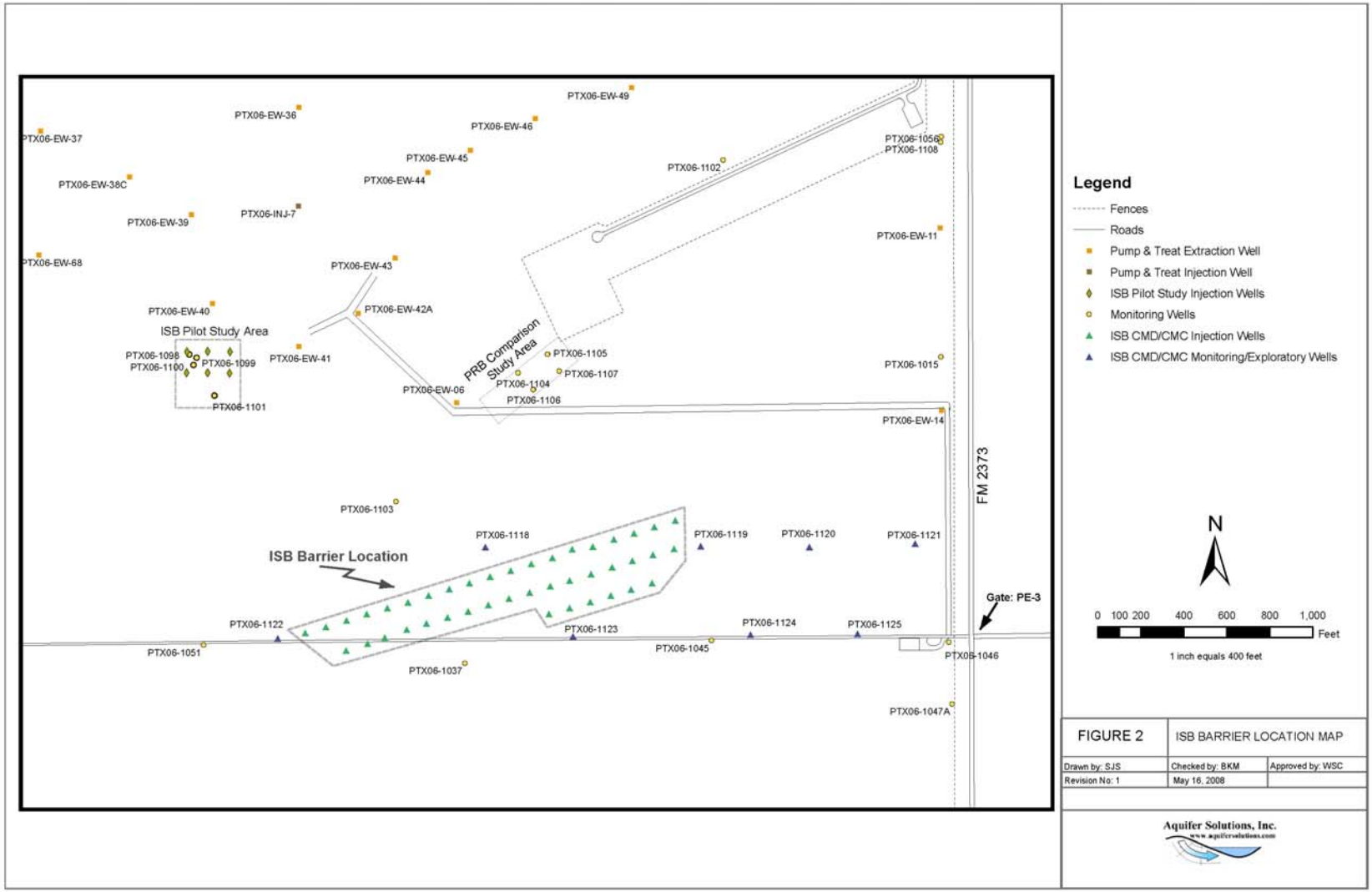

Figure 2-8. Southeast *In-Situ* Bioremediation System

2.6.4 Zone 11 In-Situ Bioremediation System

2.6.4.1 History and Purpose

Historical operations resulted in perchlorate and TCE contamination in the perched aquifer that has the potential to migrate to the Ogallala Aquifer. The overall objective of the Zone 11 ISB barrier is to create a zone where TCE and perchlorate are treated in perched groundwater as it flows south. This is accomplished by injecting a carbon source amendment, the same emulsion used in the Southeast ISB System, to create a biologically active treatment zone through which the perched groundwater must flow. The amendment provides a long-term residual source of carbon that is bound to the aquifer matrix. As groundwater flows through the ISB barrier, TCE and perchlorate will be degraded, and groundwater exiting the barrier to the south will exhibit reduced TCE and perchlorate concentrations.

2.6.4.2 Design and Implementation Activities

The Zone 11 ISB System was designed to:

- Effectively use microbiological processes to establish and maintain a zone of highly reducing conditions, through which the perched groundwater can flow.
- Degrade the maximum concentration and mass of TCE and perchlorate in perched groundwater as it flows through the ISB Barrier zone.

To accomplish these goals, the following were constructed in early 2009:

- Amendment Injection System
  - The Amendment Injection Delivery Trailer constructed for the Southeast Area ISB System will be used to inject amendments into the Zone 11 ISB injection wells.
- Injection Wells and Conveyance System
  - 23 Injection Wells
  - Injection pad and connection hoses will be used for periodic injections.

Following installation of these systems, injection of the amendment was initiated.

This system and its components are described in the *Final Design Basis Document, In-Situ Bioremediation Corrective Measure Design,* November 2008.

2.6.4.3 Changes between Design and As-Built

Deviations between the design and the installed system consisted of:

- Permanent electrical power supply instead of using a portable generator;
- Single-walled conveyance line for water supply instead of secondarily contained piping intended for possible future use to transport extracted contaminated water from Zone 11 ISB area to the SEPTS;
- Injections wells completed with 304 stainless steel screen instead of 316 stainless steel screen based on immediate availability and technical compatibility.

2.6.4.4 Current Operational Status

All wells associated with this system have been installed, but injections are ongoing. Initial amendment injection is complete and an Implementation Report is being developed. Reduction of contaminant concentrations in the treatment zone is the most important metric to determine if the system is achieving the established objectives. TCE and perchlorate are expected to be treated within about 200 feet of the treatment zone to cleanup standards within two years of implementation. Residual concentrations of TCE breakdown products may persist, but should also be treated resulting in declining concentration trends within five years of implementation.

2.7 Long-Term Groundwater Monitoring System

The Selected Remedy identified in the ROD includes development of a Long-Term Groundwater Monitoring (LTM) network to confirm the effectiveness of the Selected Remedy. The network was designed to fulfill the following objectives:

- Plume stability evaluation
- Corrective action effectiveness assessment
- Uncertainty management
- Early detection in the Ogallala aquifer

The LTM well network was developed using statistical methods, fate and transport modeling, and site-specific knowledge for the evaluation of response actions (corrective/remedial actions) for Pantex Plant and monitoring uncertainties near source areas. The proposed network is comprised of 143 monitoring wells which includes 113 perched groundwater monitoring wells (Figure 2-9) and 30 Ogallala Aquifer monitoring wells (Figure 2-10). Details regarding layout, screened intervals, pump intake depths, and other design factors are provided in the *Long-Term Monitoring System Design Report*, April 2009. This report also describes the expected conditions for the proposed monitoring wells, an important metric for use in determining when perched groundwater and Ogallala Aquifer contingencies should be considered and the appropriate level of contingent action to implement.

2.8 Institutional Controls

Land and groundwater use controls (ICs) were identified as part of the Selected Remedy in the ROD because COCs will continue to exist at soil units in concentrations exceeding unrestricted release criteria (i.e., an incremental lifetime cancer risk (ILCR) greater than 1×10^{-6} or a hazard index (HI) of 1) following implementation of the Selected Remedy. Controls are necessary to restrict use of soils containing contaminants to industrial purposes[4] and to prevent unacceptable risk to industrial and construction/excavation workers.

[4] Industrial use does not include residential housing, elementary and secondary schools, childcare facilities and playgrounds.

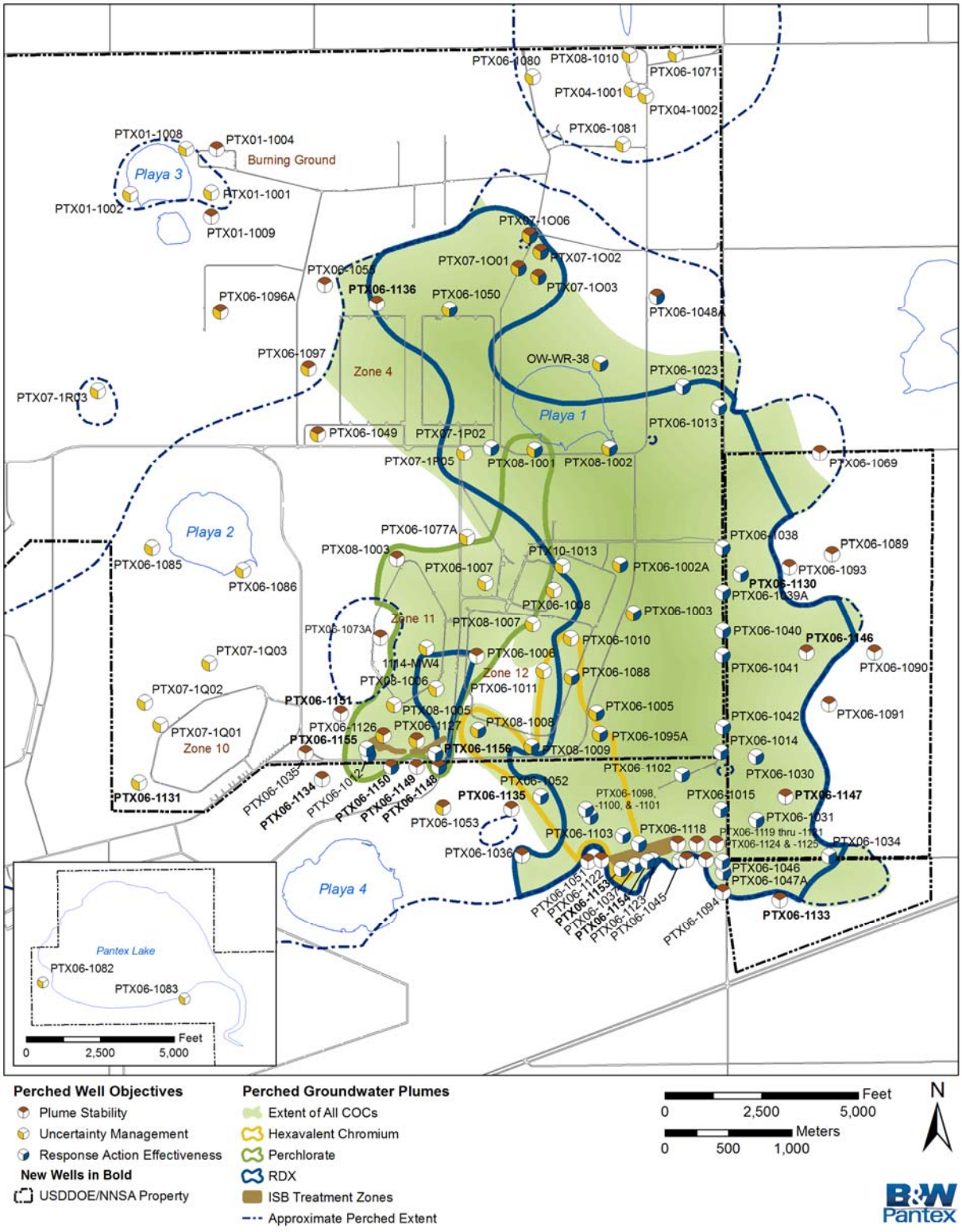

Figure 2-9. Perched Groundwater LTM Network

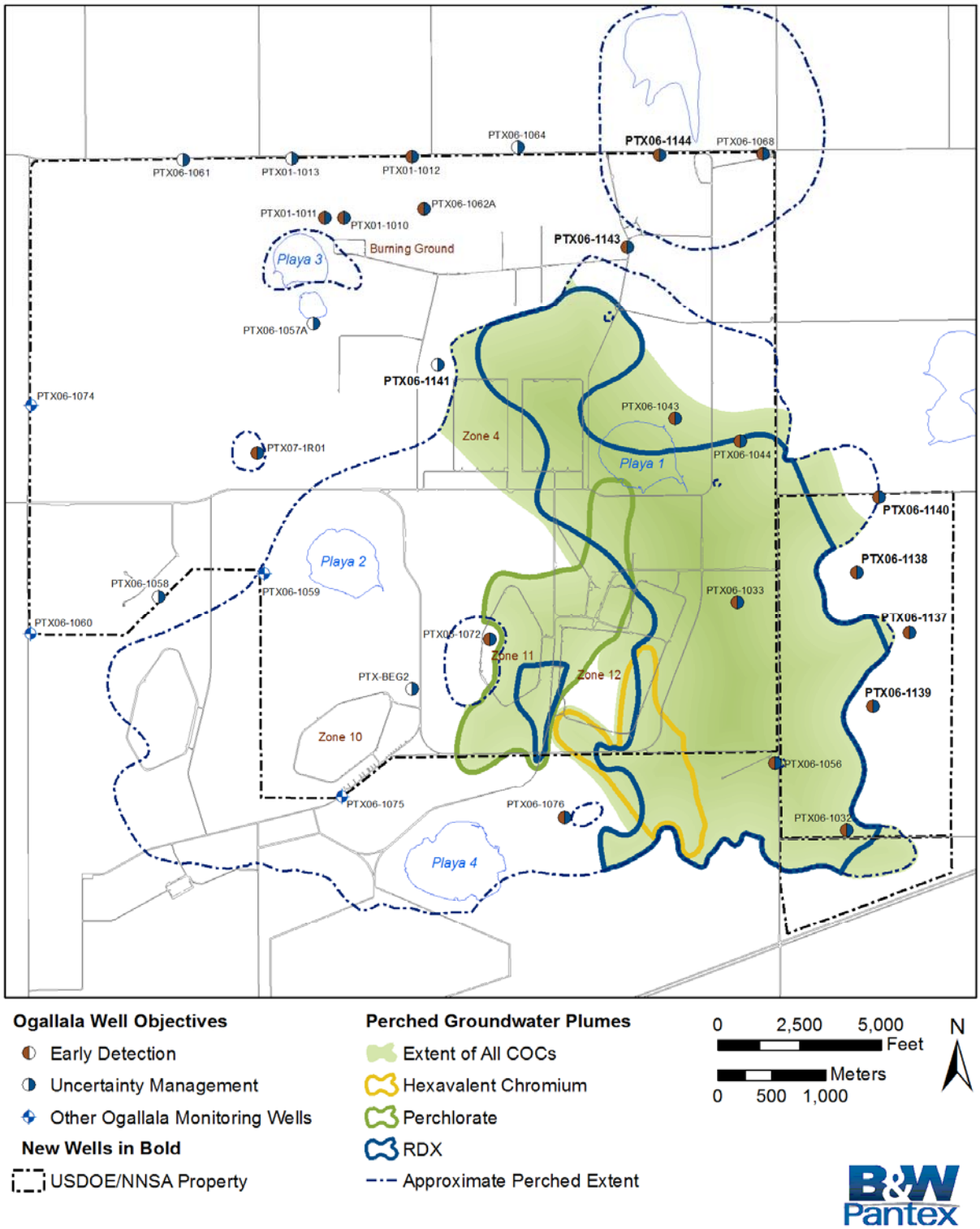

Figure 2-10. Ogallala Groundwater LTM Network

In addition, the perched groundwater beneath the Pantex Plant, including property adjacent and east of FM 2373 and part of the TTRF south of the main Pantex Plant property, contains constituents above drinking water standards (MCLs). This perched groundwater would be unsuitable for drinking water and other domestic uses if it were to be used without treatment; therefore, perched groundwater at the site poses a potential risk to onsite and offsite receptors.

The specific objectives of the ICs for soil and groundwater as identified in the *Land and Groundwater Use Controls Implementation Plan* are:

- Prohibit use of the perched groundwater until cleanup levels are achieved (deed restrictions).
- Prohibit the development and use of property for residential housing, elementary and secondary schools, childcare facilities and playgrounds, where contaminants are left in place above unrestricted levels (deed restrictions).
- Control access to those soils which pose a health risk to industrial and construction/excavation workers (policies; notices of restricted areas).
- Prohibit activities that would damage or degrade the integrity of all components of current and future remedies, including monitoring wells, *in-situ* and *ex-situ* treatment systems, liners, and covers (deed restrictions).
- Develop internal procedures to inform employees about site restrictions for extraction, construction, and access as part of training materials for the Pantex Plant.

The ICs will be maintained at the Pantex Plant until the concentration of hazardous substances in the soil and perched groundwater are at levels that allow for unrestricted use and exposure (i.e., below 1 x 10^{-6} ILCR or a HI of 1 or MCLs for groundwater). USDOE/NNSA is responsible for implementing, maintaining, reporting on, and enforcing land and groundwater use controls.

ICs in the form of informational devices and proprietary controls are currently in place to protect workers and the public from unacceptable exposure to residual contamination. Application areas and the general approach for developing deed restrictions for groundwater is presented in the *Institutional Controls Approach***,** April 2009. Additional detail will be described in the *Land and Groundwater Use Control Implementation Plan,* to be provided in the Interim Remedial Action Report. Figures 2-11 and 2-12 identify the planned soil and groundwater ICs.

2.9 Redevelopment Potential of Pantex Plant

Pantex Plant is currently an operating facility with an ongoing mission of maintaining the safety, security and reliability of the nation's nuclear weapons stockpile. There are no current plans for site redevelopment.

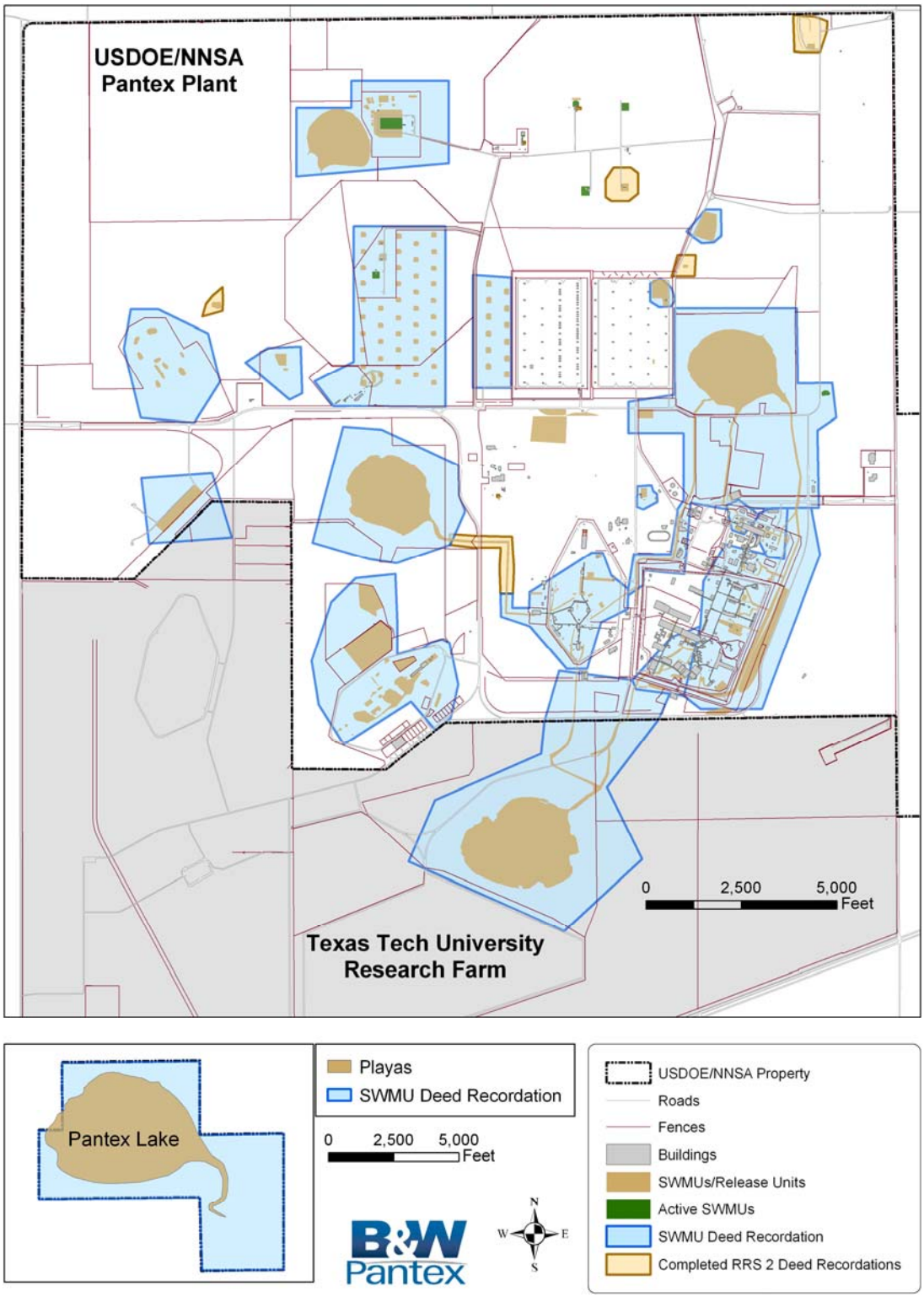

Figure 2-11. Soil Unit Land Use Controls

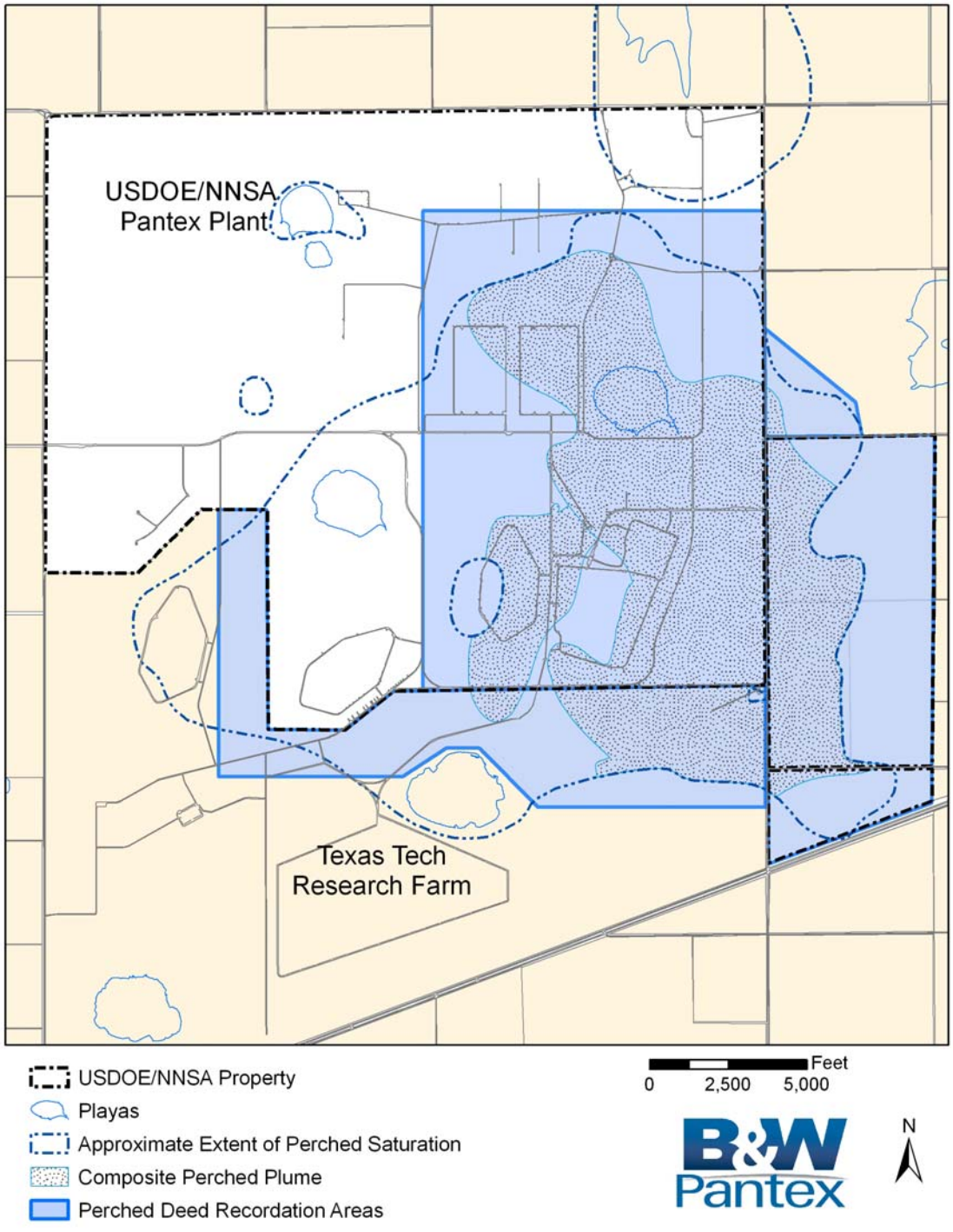

Figure 2-12. Perched Groundwater Land Use Controls

3. Demonstration of QA/QC

Quality Assurance/Quality Control (QA/QC) plans and Quality Assurance Project Plans (QAPP) were developed on a per project basis by the responsible contractor. The requirements for developing the plans were identified by B&W Pantex. During the implementation of the project, the contractor was required to provide submittals to verify the ongoing compliance with the QA/QC plans. If changes were noted that required changes to the project plan or implementation, an approval process was followed.

The objectives of the specific QAPPs varied, but generally were developed to achieve the following:

- To provide a consistent format which describes methods and procedures for acquiring and analyzing samples,
- To describe requirements by various agencies regarding QA/QC procedures, and
- To ensure that data collected, materials utilized during field activities (including mobilization, construction, operation, maintenance, and sampling) and construction compliance with design specifications meets consistent and acceptable levels of quality.

QAPP objectives were achieved by using check-lists, hold points, inspections, and audits.

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4. Schedule for Site Completion

Physical construction for the response actions in the ROD is complete and USDOE/NNSA is currently completing all planning necessary to maintain the remedy, ensure effectiveness, and conduct all long-term operations, maintenance, and monitoring activities. The following sections describe the remaining activities, specify the organizational responsibilities, and provide the anticipated timeline for achieving site completion.

4.1 Remaining Activities

USDOE/NNSA is completing the remaining activities necessary to assure the effectiveness of the soil and groundwater remedy, maintain compliance, and satisfy the requirements for site completion. Table 4-1 provides the schedule of remaining activities to complete the remedial design and corrective measures documentation. This will establish the foundation for implementing and managing long-term operations, maintenance, and monitoring activities needed to gather data for the first Five-Year Review.

4.1.1 Remedy Effectiveness

USDOE/NNSA will rely on ICs, operation of the groundwater treatment systems, and groundwater monitoring. Section 2.8 describes the plan that is already in place for fully implementing ICs. Operation of the groundwater systems will be conducted in accordance with the Interim Remedial Action Report (IRAR) which is scheduled for completion in January 2010. Groundwater monitoring plans are described in Section 2.7 and will be conducted in accordance with the *Long-Term Monitoring System Design Report*, April 2009. Groundwater monitoring data will be reviewed on a yearly basis and evaluated in an annual progress report to ensure continued protection of human health. Because the Selected Remedy will result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted every five years to ensure that the remedy continues to be protective of human health and the environment.

4.1.2 Assure Consistency with the National Contingency Plan

As documented in the ROD, cleanup criteria established for the RAOs, remedy selection, and public participation were conducted in accordance with the National Contingency Plan (NCP). USEPA and TCEQ conducted a pre-final inspection on May 5, 2009 (Appendix A) and determined that USDOE/NNSA and B&W Pantex have constructed the Selected Remedy in accordance with RD plans and specifications.

4.1.3 Satisfy Requirements for Site Completion

Site completion will be achieved when all RAOs are met. Remaining work for site completion includes implementing ICs and continuing long-term operations, maintenance, and monitoring activities. Although physical construction of the selected remedy is complete, some soil and groundwater operations and maintenance activities must still be completed to ensure the effectiveness and protection of the completed remedy.

4.1.3.1 Soil Unit Site Completion Activities

The only remaining activities for the soil units necessary to assure effectiveness of the remedy and consistency with the NCP are completing the activities required to implement ICs and implementing the maintenance plan. These activities include final surveys and negotiating final easements. Construction of fence around SWMU 70 (Firing Site 5) to improve enforcement of institutional controls was completed in June 2009. Ongoing maintenance activities are required at the landfills to ensure the covers are meeting design requirements. The final activity necessary for the soil units to satisfy the requirements for interim remedial action is development of the IRAR, for which approval is anticipated by March 2010.

4.1.3.2 Groundwater Site Completion Activities

Remaining activities for the groundwater systems that are necessary to assure effectiveness of the remedy and consistency with the NCP consist of implementing ICs and continuing operation, maintenance and long-term monitoring. Currently USDOE/NNSA is in the process of executing agreements to place deed restrictions on the property not owned by the USDOE/NNSA. Institutional controls are scheduled to be completed by September 2009.

Four additional wells were identified as necessary to meet monitoring objectives during review of the *Draft Final Remedial Design package*, February 2009, and were included as part of the final monitoring network in the *Long-Term Monitoring System Design Report*, April 2009. These wells are scheduled for completion in August/September 2009.

4.2 Organizational Responsibilities

The IAG sets forth the roles and responsibilities of the agencies for performing and overseeing the remediation activities pursuant to CERCLA, the NCP, and Executive Order 12580, as amended by Executive Order 13016. The IAG also integrates CERCLA and RCRA into the remediation process. USDOE/NNSA is defined in the IAG, as the lead agency under the NCP, responsible for planning and implementing remedial and removal actions necessary to protect public health or welfare of the environment from the release or threatened release of hazardous substances at or solely from the Site.

4.3 Site Completion

The ROD assumes that ICs and the long-term groundwater operations, maintenance, and monitoring activities will be maintained until the cleanup criteria for the RAOs are achieved. Since the ROD is already signed, the majority of the documentation required for site completion will be finalized once the IRAR is approved. Anticipated approval of the Final IRAR is March 2010. USDOE/NNSA will maintain records if any ROD amendments or Explanation of Significant Differences are needed during remedy implementation.

After all remedial action is complete and RAOs are achieved, USDOE/NNSA will submit a final Remedial Action Report for TCEQ and EPA approval. USDOE/NNSA will also document site completion through a Final Close Out Report and will submit it for TCEQ and EPA approval before applying to delete the entire site from the NPL. It is assumed that if continued ICs or groundwater monitoring is required following achievement of RAOs, USDOE/NNSA will develop the necessary groundwater monitoring plan and continue to implement ICs, as necessary.

Table 4-1. Completion Schedule

Activity	Completion Date
Draft Final IRAR Submitted	October 30, 2009
Final IRAR Submitted	January 29, 2010
Five-Year Review	September 30, 2013

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5. Summary of Remediation Costs

This section summarizes the costs for soil units and for the groundwater systems. For the soil units, costs are represented for the interim actions and for the ICs. The costs for the groundwater systems that were included in the ROD and in the Remedial Design package are both represented.

5.1 Soil Units

The costs for the interim actions in addition to the costs for implementation of the ICs represent the contract award amounts for the Selected Remedy for the soil units. The cost for developing ICs has been estimated for all soil units. The total cost to implement ICs for all the soil units is $89,500.

Table 5-1. Contract Award Amount for Soil Units

Unit	Interim Measure	Date	Interim Measure Cost
SWMU 5/12a: Zone 12 Main Drainage Ditch	Hot spot removal: 32.8 tons of soil removed and extension of the Landfill 3 cover adjacent to the SWMU	2006	$25,984
SWMU 25: Burning Ground Explosive Burn Pad	None	Not Applicable	Not Applicable
SWMU 26: Burning Ground Explosive Burn Pad	None	Not Applicable	Not Applicable
SWMU 27: Burning Ground Explosive Burn Pad	Hot spot excavation: 292 cubic yards of soil was removed	1999	$400,000
SWMU 5/05: Zone 12 Drainage Ditch	The ditch was re-graded to positively drain and was lined with reinforced polypropylene.	2004	$406,588
	Hot spot removal near the ditch: 24.4 tons of soil removed	2006	
SWMU 2: Zone 12 Drainage Ditch	The ditch was re-graded to positively drain and was lined with reinforced polypropylene.	2004	$100,000
SWMUs 14-24: Former Ash Disposal Trench	Placement of a permanent vegetative cover.	2006	$83,322
SWMU 47: Burning Ground Solvent Evaporation Pit	Full scale SVE system was constructed	2002	$2,500,000
SWMU 70: Firing Site 5	Hot spot removal of approximately 1,800 cubic yards of soil. The associated buildings were decontaminated and demolished and the area was backfilled and regraded	1999	$4,521,278

Table 5-2. Estimated Cost for the Landfills

Unit	Interim Measure	Date	Cost
SVS 8: Abandoned Zone 10 Landfill: Construction Debris Landfill	Addition of a soil cover at the end of operations	Late 1960s (1968-69)	Negligible
	Hot spot removal (60 yards^3) and restoration of the cover	2002	
Zone 10 Building Construction Debris Landfills (5)	Addition of a soil cover at the end of operations	Unknown	Not Available
SWMU 68d: Active Sanitary Landfill	Addition of a soil cover at the end of operations	Mid-1980s	Not Available
SVS 5: Landfill East of 11-13 Pad: Construction Debris from Buildings 11-12,11-13	Addition of a soil cover at the end of operations	Between 1970-1977	Not Available
SWMU 60: Landfill 9 (Group III): Building Demolition Debris Landfill	Addition of a soil cover at the end of operations	1997	Not Available
SWMU 61: Landfill 10 (Group III): Building Demolition Debris Landfill	Addition of a soil cover at the end of operations	1971	Not Available
SWMU 54: Landfill 3	Hot spot removal (6,036 yards^3) and addition of a low permeability administrative soil cover	2000	$1,360,002
	Hot spot removal (33 tons) and cover extension	2006	
SWMU 56: Landfill 5 (Group III): Building Construction Debris Landfill	Addition of a soil cover at the end of operations	1959	Not Available
SWMU 57: Landfill 6 (Group III) Building Construction Debris Landfill	Addition of a soil cover at the end of operations	1976	Not Available
	Hot spot removal (8 yards^3) and restoration of the cover	1996	Negligible
SWMU 68a North: Original General Purpose Sanitary Landfill	Addition of a soil cover at the end of operations	1952	Not Available
SWMU 37: Burning Grounds Landfill 1	Addition of an evapotranspiration cover	2004	$710,785
SWMU 38: Burning Grounds Landfill 2	Addition of an evapotranspiration cover	2004	
SWMU 39: Burning Grounds Landfill 3	Addition of an evapotranspiration cover	2004	
SWMU 40: Burning Grounds Landfill 4	Addition of an evapotranspiration cover	2004	
SWMU 41: Burning Grounds Landfill 5	Addition of an evapotranspiration cover	2004	
SWMU 42: Burning Grounds Landfill 6	Addition of an evapotranspiration cover	2004	
SWMU 43: Burning Grounds Landfill 7	Addition of an evapotranspiration cover	2004	
SWMU 44: Burning Grounds Landfill 8	Hot spot removal (290 yards^3)	1999	
	Addition of an evapotranspiration cover	2004	
SWMU 58: Landfill 7 Associated with Concrete Batch Plant	Addition of a soil cover at the end of operations	1959	Not Available

Unit	Interim Measure	Date	Cost
SWMU 64: Landfill 13	Addition of a maintenance cover; approximately 3,125 cubic yards of compacted fill dirt and 1,090 cubic yards of topsoil were placed on the landfill and the area was revegetated	1997	Not Available
	Hot spot removal (42 tons)	2006	Negligible
SWMU 66: Landfill 15 Demolition Debris Landfill	Addition of a soil cover at the end of operations	1980	Not Available
SWMU 68b: General Purpose Sanitary Landfill 1	Addition of a maintenance cover; approximately 7,352 cubic yards of compacted fill dirt and 3,077 cubic yards of topsoil were placed on the landfill and the area was revegetated	1997	Not Available
SWMU 68c: General Purpose Sanitary Landfill 2	Addition of a maintenance cover; approximately 2,173 cubic yards of compacted fill dirt and 982 cubic yards of topsoil were placed on the landfill and the areas was revegetated. A soil erosion fence was added to the landfill because the landfill was in close proximity to a drainage ditch	1997	Not Available
SVS 7a and 7b: Igloo Demolition Debris Landfills Zone 4 (SVS 7a) and Zone 5 (SVS 7b)	Addition of a soil cover at the end of operations	1970s	Not Available
Unnumbered Zone 7 Landfills: Demolition Debris Landfills	Addition of a soil cover at the end of operations	1978	Not Available

5.2 Southeast Area

Table 5-3 presents the cost estimates that were included in the Pantex ROD for the Selected Remedy for the Southeast Area Perched groundwater. Table 5-4 presents the estimates that were included in the final Remedial Design Package.

Table 5-3. Estimated ROD Cost for the Southeast Perched Groundwater Remedy

	Capital Cost		Periodic and O&M Cost
	Completed	**Remaining**	**(Discounted)**
Existing Perched Groundwater Pump & Treat System Expansion	$1,850,000	$0	$25,200,599
Playa 1 Perched Groundwater Pump & Treat System	$4,420,000	$4,990,920	$22,177,352
Southeast In Situ Bioremediation System	$6,672,500	$0	$36,272,861
Long-Term Groundwater Monitoring Network and Institutional Controls	$0	$2,139,000	$14,745,303
Total	**$12,942,500**	**$7,129,920**	**$98,396,115**

Present Value =	**$118,468,535**

Table 5-4. Estimated Remedial Design Cost for the Southeast Perched Groundwater Remedy

	Capital Cost		Periodic and O&M Cost
	Completed	Remaining	(Discounted)
Existing Perched Groundwater Pump & Treat System Expansion	$1,850,000	$0	$29, 795,339
Playa 1 Perched Groundwater Pump & Treat System	$9,262,000	$0	$26,713,292
Southeast In Situ Bioremediation System	$5,948,500	$0	$25,440,208
Long-Term Groundwater Monitoring Network and Institutional Controls	$1,807,500	$1,687,625	$16,652,833
Total	**$18,868,000**	**$1,687,625**	**$98,601,672**

Present Value =	**$119,157,297**

5.3 Zone 11

Table 5-5 presents the cost estimates that were included in the Pantex ROD for the Selected Remedy for Zone 11 perched groundwater. Table 5-6 presents the estimates that were included in the final Remedial Design Package.

Table 5-5. Estimated ROD Cost for the Zone 11 Perched Groundwater Remedy

	Capital Cost		Periodic and O&M Cost
	Completed	Remaining	(Discounted)
Zone 11 In Situ Bioremediation System	$0	$3,610,800	$26,154,781

Present Value =	**$29,765,581**

Table 5-6. Estimated Remedial Design Cost for the Zone 11 Perched Groundwater Remedy

	Capital Cost		Periodic and O&M Cost
	Completed	**Remaining**	**(Discounted)**
Zone 11 In Situ Bioremediation System	$4,332,000	$1,370,400	$26,154,781

Present Value =	**$31,857,181**

6. Five-Year Review

6.1 Five-Year Review Requirements

Since the selected remedies will result in hazardous substances remaining onsite above levels that allow for unlimited use and unrestricted exposure, a statutory review must be conducted within five years of the initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment. Pursuant to CERCLA Section 121(c), 42 U.S.C. § 9621(c), and as provided in the current guidance on Five Year Reviews [OSWER Directive 9355.7-03B-P, Comprehensive Five-Year Review Guidance (June 2001)], USDOE/NNSA must conduct a statutory review within five years from the initiation of construction at the Site.

The IAG also stipulates that USDOE/NNSA "will review the remedial action no less often than every five (5) years after initiation of the remedial action to assure that human health and the environment are being protected by the remedial action being implemented. The Five-Year Review will include an evaluation of remedy effectiveness, the appropriateness of new technologies, changes in ARARs, recommendations to implement remedial contingencies, and will be consistent with USEPA Five-Year guidelines per CERCLA Section 120(a)(2), 42 U.S.C. § 9620(a)(2). USDOE/NNSA will conduct the review consistent with the requirements of CERCLA, the NCP, and USEPA guidance concerning the conduct of such reviews.

6.2 Five-Year Review Schedule

The first Five-Year Review is scheduled to occur five years from issuance of the ROD, which was September 25, 2008. Therefore, the first Five-Year review will occur in September 2013.

The groundwater systems will be evaluated more frequently to determine progress. The reporting requirements for the systems are identified in the *Long-Term Monitoring System Design Report*, April 2009.

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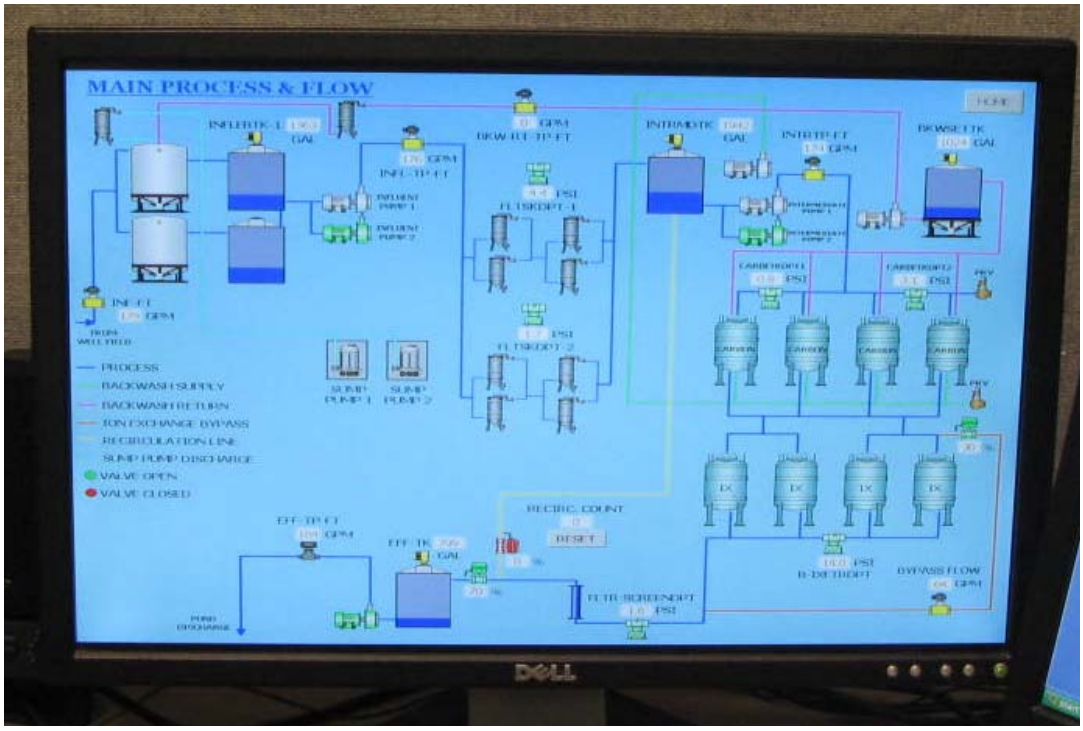
Appendix A: Pre-Final Inspection Photographs

Playa 1 Pump & Treat System (P1PTS) Control Room



Supervisory Control and Data Acquisition System

P1PTS Treatment Units (Influent Tanks, IX Resin Totes, Equalization Tank, GAC Vessels)

Exterior of Control Room (from within the Treatment Bay)

Southeast Pump & Treat System (SEPTS) Control Room

SEPTS Treatment Bay – Pumps & Pre-filters

SEPTS GAC Vessels

SEPTS Chromium and Boron Ion Exchange Units

SEPTS Chromium IX Polishing Unit

Exterior of SEPTS Control Room (from within the Treatment Bay)

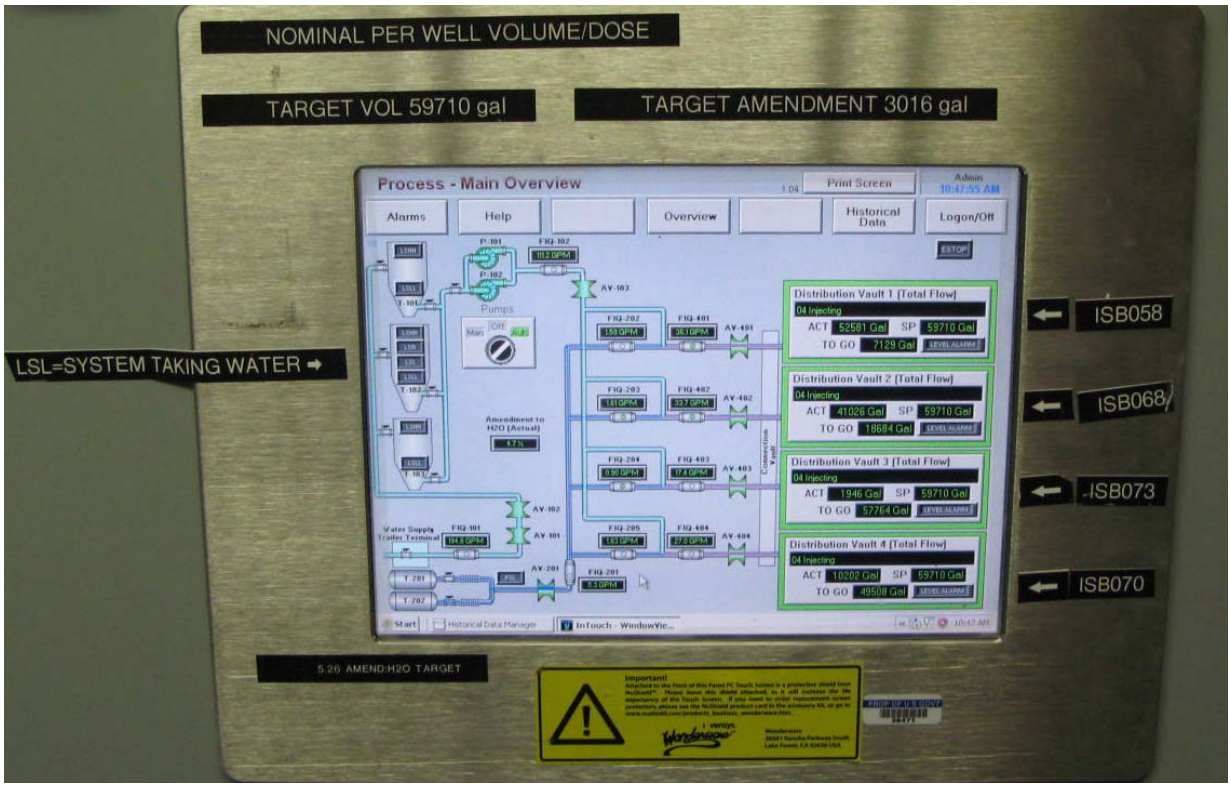
Zone 11 In-Situ Bioremediation (ISB) System

Tankers Containing Newman Zone™ Amendment

Makeup Water Storage Tanks

ISB Injection Trailer

ISB Injection Trailer Control Panels



ISB Injection Control Screen

Injection Pumps, Meters, Piping (inside ISB Injection Trailer)

Air Compressor and Inlet Piping for Amendment and Makeup Water Feeds

Zone 11 ISB Injection Wells (in yellow)

Black Hoses Carrying Amendment to the Injection Wells at the Zone 11 ISB

Southeast In-Situ Bioremediation System (SEISB) Equipment Pad (with electrical and injection distribution connections for the Injection Trailer)

SEISB Injection Wells (in yellow)

SEISB Injection Wells and Distribution Vaults

Burning Ground Soil Vapor Extraction System (with GAC Canisters in the foreground)

Burning Ground Former Ash Disposal Trench Cover (vegetated area in foreground)

Burning Ground Landfill Cover (left side of picture)

Landfill 2 (SWMU 68c) Cover (the area across the fence)

Firing Site 5 Cover

Landfill 15 (SWMU 66) Cover