FOURTH FIVE-YEAR REVIEW REPORT

For

Palmerton Zinc Pile Superfund Site

Palmerton, Carbon County, PA

PREPARED BY:

U.S. Environmental Protection Agency, Region III

Philadelphia, Pennsylvania

Approved by:

Ronald J. Borsellino, Director

Hazardous Site Clean-Up Division

Date: September 27, 2012

TABLE OF CONTENTS

Tables

Attached

Figures

Attachment - Photos

LIST OF ACRONYMS

ABC	Adrian Brown Consultants, Inc.
AOC	Administrative Order on Consent
APOLLO	APOLLO Environmental Strategies, Inc.
ARAR	Applicable, or Relevant and Appropriate Requirements
ARCADIS	ARCADIS U.S., Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
AT	Appalachian Trail
ATC	Appalachian Trail Conservancy
BBL	Blasland, Bouck & Lee, Inc.
Borough	Borough of Palmerton
BRA	Baseline Risk Assessment
BTAG	Biological Technical Assistance Group
CBS	CBS Corporation
CD	Consent Decree
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Constituent of Potential Concern
C-R	Cummings Riter, Inc.
DOI	United States Department of the Interior
DT	Diversion Trench
EAF	Electric Arc Furnace Dust
ECOLOAM	Mixture of fly ash, sewage sludge and lime
EDD	Eastern Diversion Ditch
EECA	Engineering Evaluation and Cost Analysis
EFCM	Electric Furnace Cinder Material
ENVIRON	ENVIRON International Corporation
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
ERI	Environmental Restoration, Inc.
ESD	Explanation of Significant Differences
EST	Elevated Subsurface Temperature
FWI	Frank and West Environmental Engineers, Inc.
G&W	Gulf & Western Industries, Inc.
GA-1	Geographic Area 1
HEPA	High-Efficiency Particulate Air
HHRA	Human Health Risk Assessment
HII	Horsehead Industries, Inc.
HRDC	Horsehead Resource Development Company, Inc.
IEP	Implementation Evaluation Plan
IER	Implementation Evaluation Report
IPMP	Invasive Plant Management Plan
IRM	Iron-Rich Material
LGNC	Lehigh Gap Nature Center

MCL	Maximum Contaminant Level
MRZ	Metal Reduction Zone
NAWQC	National Ambient Water Quality Criteria
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRD	Natural Resource Damage
O&M	Operation and Maintenance
OSM	Office of Surface Mining
OU	Operable Unit
PADEP	Pennsylvania Department of Environmental Protection
PAGC	Pennsylvania Game Commission
ppm	Part Per Million
PRP	Potentially Responsible Party
PRT	Pollution Reduction Technology
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RDWP	Remedial Design Work Plan
RI/FS	Remedial Investigation/Feasibility Study
RIM	Remedial Interim Measure
ROD	Record of Decision
RPM	Remedial Project Manager
Site	Palmerton Zinc Superfund Site
SUA	Special Use Authorization
SW	Surface Water
TACF	The American Chestnut Foundation
TCI	TCI Pacific Communications, Inc.
Trustee Council	Palmerton Natural Resource Trustee Council
UAO	Unilateral Administrative Order
USACE	United States Army Corps of Engineers
Viacom	Viacom International Inc.
WIC	Wildlife Information Center
ZCA	Zinc Corporation of America

EXECUTIVE SUMMARY

The Palmerton Zinc Pile Superfund Site (Site) in Palmerton, Pennsylvania, is composed of four Operable Units (OUs): OU 1 – Blue Mountain; OU 2 – Cinder Bank; OU 3 – Community Soils; and OU 4 – Area-Wide Groundwater, Surface Water and site wide Ecological Risk Assessment. OU-4 also includes erosion control and revegetation of land on Stoney Ridge and the consolidation and covering of electric furnace cinder material (EFCM) at Stoney Ridge Materials and most recently work to address shallow groundwater in the east end of the Cinder Bank area. The remedies which have been selected for the Site include stabilization via revegetation of contaminated soils (OU 1 and OU 2), runoff diversion, leachate collection and treatment (OU 2), remediation of impacted residential soils and interior house dust (OU 3), and institutional controls (OU1, OU 2 and OU 3). Either all or portions of the remedies selected in the September 4, 1987 Record of Decision (ROD) (OU 1), June 29, 1988 ROD (OU 2) as modified by an August 2002 Explanation of Significant Differences (ESD), and October 9, 2001 ROD (OU 3) for the Site have been implemented. In addition, interim remedial measures, as outlined in a September 30, 2005 Unilateral Administrative Order (UAO) (OU 4), have been implemented. The trigger for this Five-Year Review was the completion date of the *Third Five-Year Review Report*, September 28, 2007.

The assessment during the Fourth Five-Year Review found that the remedies selected in the 1987 ROD for OU 1 continue to be implemented in accordance with the ROD requirements and are expected to be completed in 2013. Construction has been completed for the remedies selected in the 1988 ROD as modified by the August 2002 ESD for OU 2. Remediation of the Cinder Bank was completed in Fall 2002, and included surface-water diversion, leachate collection and treatment, and vegetation enhancements. A Remedial Action (RA) Report summarizing OU 2 RA activities was submitted to the United States Environmental Protection Agency (EPA) in September 2005. Operation and Maintenance (O&M) activities for OU 2 are ongoing. Remedies selected in the 2001 ROD for OU 3 have been completed. The remedy for OU 3 consisted of remediation of residential soil and interior house dust exhibiting elevated concentrations of lead. Exterior soil RA activities were conducted between March 2004 and October 2004 and residential interior RA activities were conducted between October 2004 and May 2005. An RA Report summarizing OU 3 RA activities was submitted to EPA in September 2005.

Pursuant to the 2005 UAO interim remedial measures have been implemented for OU 4 (Stoney Ridge erosion control/revegetation, consolidation and vegetation of the EFCM at Stoney Ridge Materials and an Iron Rich Material (IRM) treatment cell for shallow ground water in east end of the Cinder Bank). A Remedial Investigation/Feasibility Study (RI/FS) Report for OU4 is to be submitted by Environ on behalf of CBS Corporation (CBS) shortly. A Final ROD for OU#4 is planned for 2013.

The protectiveness statement for each OU is as follows:

Protectiveness Statements:

Operable Unit 1 - Blue Mountain: The remedy is expected to be protective of human health upon completion. The final protectiveness determination with regard to ecological risks will be made following completion of the OU 1 remedy and evaluation of long term survivability and translocation of contaminants.

Operable Unit 2 - Cinder Bank: The remedy has been completed and is protective of human health and the environment in the short term; however, follow-up action concerning the burning area of the Cinder Bank is needed to insure long term protectiveness.

Operable Unit 3 - Community Soils: The remedy has been completed and is protective of human health and the environment.

Operable Unit 4 - Area-Wide Groundwater and Surface Water Investigation:

A remedy has yet to be selected for OU4 so a protectiveness determination cannot be made at this time. Further information will continue to be obtained during the Remedial Investigation/Feasibility Study (RI/FS), currently underway. It is expected that the RI/FS will be completed and a ROD issued in 2013.

GPRA Measure Review

As part of this Five-Year Review the Government Performance and Results Act (GPRA) measures have also been reviewed. The GPRA Measures and their current status are provided as follows:

Environmental Indicators

Human Health: HEUC, Human Exposure Under Control.
Ground Water Migration: GMNC, Ground Water Migration Not Under Control. Ground Water migration is expected to be under control when construction is complete for OU4 in FY 2017.

Sitewide RAU: The Site is not Site-Wide Ready for Anticipated Use (SWRAU). Site-Wide Ready for Reuse will be achieved when all construction is complete and Institutional Controls are implemented which is expected in FY 2017.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name:		
EPA ID: PAD002395887		
Region: 3	**State:** PA	**City/County:** Palmerton/Carbon County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**
Author name (Federal or State Project Manager): Charlie Root
Author affiliation: Region 3
Review period: March 2012 – September 2012
Date of site inspection: June 22, 2012
Type of review: Statutory
Review number: 4
Triggering action date: September 28, 2007
Due date *(five years after triggering action date)*: September 28, 2012

Five-Year Review Summary Form (continued)

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU#3, Community Soils

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU1	Issue Category: Changed Site Conditions			
	Issue: Two Resource Islands on Blue Mountain remain to be installed.			
	Recommendation: Complete installation of Resource Islands on NPS property on Blue Mountain.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	06/30/2013

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU1	Issue Category: Monitoring			
	Issue: Question of translocation of contaminants re: long term survivability.			
	Recommendation: Monitor and evaluate the completed portion of Blue Mountain for long-term vegetation survivability and translocation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	03/30/2015

Issues and Recommendations Identified in the Five-Year Review:

OU(s): OU2	Issue Category: Operations and Maintenance			
	Issue: Long term O&M of and access control of Cinder Bank burning areas.			
	Recommendation: Continue O&M of Cinder Bank (OU 2). Once areas of Cinder Bank stop burning, develop a plan to vegetate the areas.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	Ongoing

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU4	**Issue Category: Institutional Controls**			
	Issue: Need for Site wide institutional controls plan			
	Recommendation: Develop Institutional Controls Implementation Plan for the Site.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	03/30/2015

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU4	**Issue Category: Remedy Performance**			
	Issue: RI/FS remains to be completed and a remedy selected for OU 4.			
	Recommendation: Upon completion of RI/FS and updated Risk Assessments select a remedy for OU 4.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/PADEP	EPA/PADEP	06/30/2013

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1 – Blue Mountain	Will be Protective	

Protectiveness Statement:
The remedy is expected to be protective of human health upon completion. The final protectiveness determination with regard to ecological risks will be made following completion of the OU 1 remedy and evaluation of long term survivability and translocation of contaminants.

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU2 – Cinder Bank	Short-term Protective	

Protectiveness Statement:
The remedy has been completed and is protective of human health and the environment in the short term; however, follow-up action concerning the burning area of the Cinder Bank is needed to insure long term protectiveness.

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU3 – Community Soils	Protective	N/A

Protectiveness Statement:
The remedy has been completed and is protective of human health and the environment.

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU4 – Groundwater, Surface Water & Site-Wide Eco Risk	Protectiveness Deferred	

Protectiveness Statement:
A remedy has yet to be selected for OU4 so a protectiveness determination cannot be made at this time. Further information will continue to be obtained during the Remedial Investigation/Feasibility Study (RI/FS), currently underway. It is expected that the RI/FS will be completed and a ROD issued in 2013.

Five-Year Review Report
For
Palmerton Zinc Pile Superfund Site
Palmerton, Pennsylvania

I. Introduction

The purpose of the Five-Year Review is to determine whether the selected remedies at a site are protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review Reports. In addition, Five-Year Review Reports identify issues found during the review, if any, and recommendations to address them.

The United States Environmental Protection Agency (EPA) has prepared this Five-Year Review Report pursuant to Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) § 300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the fourth Five-Year Review for the Palmerton Zinc Pile Superfund Site (Site). The triggering action for this statutory review is the completion date of the *Third Five-Year Review Report*, September 28, 2007. This review was conducted by the Remedial Project Manager (RPM), Charlie Root, for the entire Site from March through September 2012. The Five-Year Review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above concentrations that allow for unlimited use and unrestricted exposure.

II. Site Chronology

A chronology for each of the four identified Operable Units (OUs) is presented in Tables 1 through 4 below.

Table 1: OU 1 – Blue Mountain

Date	Event
September 4, 1987	ROD issued for the OU1.
October 18, 1988	Consent Decree entered into between EPA and Zinc Corporation of America (ZCA), a division of Horsehead Industries, Inc. (HII), to implement the ROD.
1990	U.S. Army Corps of Engineers (USACE) selected to be the Remedial Action (RA) oversight contractor for EPA.
1991 - 1996	775 acres of over 2,000-acre total underwent the remediation application process.
May 7, 1991	EPA approval to start construction was given to ZCA.
January 25, 1995	USACE Audit Report of the 775 remediated acres submitted to EPA.
1995	ZCA planted test plots of tree seedlings.
1995	ZCA stopped remediation work on OU 1 due to disagreement regarding their responsibility to continue work under the 1988 Consent Decree.
November 1999	USACE planted an additional round of tree seedlings at 1995 test plots.
December 10, 1999	EPA issued a Unilateral Administrative Order (UAO) to HII, Horsehead Resource Development Company, Inc. (HRDC) and Viacom International Inc. (Viacom) to remediate the remaining OU 1 acreage.
October 2000	Adrian Brown Consultants, Inc. (ABC), hired by Viacom to remediate the remaining acreage under the UAO, completed test plot applications on 12 1-acre sites.
March 13, 2001	USACE soil scientist, Dr. Charles R. Lee, Ph.D., CPSS, submitted an evaluation of the tree seedling plantings to EPA, known as "The Dr. Lee Report".
March 14, 2001	USACE letter submitted to EPA regarding application rates and coverage concerns of the ABC test plots.
May 2001	Site visit conducted by EPA, and representatives of the Potentially Responsible Parties (PRPs), U.S. Department of the Interior (DOI), Pennsylvania Department of Environmental Protection (PADEP) and USACE to view the success rate of the test plots.
September 11, 2001	Second site visit conducted by EPA, and representatives of the PRPs, DOI, PADEP and USACE to view the success rate of the test plots.
January 2002	ABC submitted draft report detailing the observations, evaluations, and potential resolutions regarding the test plots to EPA.
Spring 2003	Frank and West Environmental Engineers, Inc. (FWI), hired by Viacom, established 56 test plots in warm season grass area.
October 2003	Sampling conducted by Blasland, Bouck & Lee, Inc. (BBL), on behalf of Viacom, in warm season grass test plots and ECOLOAM area.
January 9, 2004	FWI submitted summary of test plot study in warm season grass area to EPA.
February 2004	BBL submitted ECOLOAM sampling results summarized in Preliminary Human Health and Ecological Risk Assessment to EPA.
December 2004	BBL submitted warm season grass area sampling results summarized in Preliminary Human Health and Ecological Risk Assessment, to EPA.
March 2, 2006	FWI submitted Preliminary Remedial Action Design for Geographic Area (GA)-1 to EPA.
April 18, 2006	FWI submitted Demonstration Project Work Plan for National Park Service (NPS)-managed Lands to EPA.
2006	FWI conducts revegetation of over 500 acres in GA-1, revegetation of 25 acres of NPS property for NPS demonstration areas, and establishment of 2-acre tree seed test plot.
December 12, 2006	BBL submitted *Draft* summary of 2006 vegetation, soil, and leaf litter sampling in warm season grass area and ECOLOAM area to EPA.
December 15, 2006	BBL submitted summary of 2006 vegetation assessment of GA-1 and NPS demonstration areas to EPA.

January 30, 2007	Summary of Palmerton Natural Resource Trustee Council (Trustee Council) 2004 soil metals concentration and habitat assessment study submitted to EPA.
March 2008	Aerial application of "shade" seed mix, lime and fertilizer to approx. 610 acres of Pennsylvania Game Commission (PAGC) land on slopes greater than 25%.
Oct. 2007/May 2008	Spring and seep sampling events. Report submitted September 2008.
March/April 2008	Temporary Appalachian Trail (AT) opened to bypass revegetation work area
October 2009	Natural Resource Damage (NRD) claim settlement between Trustees Council and CBS
March 2011	Lehigh Gap Nature Center (LGNC) 29 acres reapplied aerially along lower rail bed
March 2011	411 aces of NPS-managed lands and 89 acres PAGC land aerially applied.
April/May 2011	2- 1 acre tree test plots installed and planted with 12 species of trees including American Chestnut. One on-site plot and one control plot.
March 2012	Aerial application of remaining 140 acres of NPS/PAGC lands implemented
April 2012- May 2012	Two Tree Resource Islands totaling 35 acres are enclosed with eight foot fencing and planted with 8,800 trees including 3,500 American Chestnuts.

Table 2: OU 2 – Cinder Bank

Date	Event
June 29, 1988	ROD for OU2 issued by EPA.
August 1989	Black & Veatch completed Engineering Evaluation and Cost Analysis (EECA).
January 1990	Office of Surface Mining (OSM) recommended air quality testing program to quantify Cinder Bank internal fire emissions.
November 1992 to 1994	HII implemented air quality testing program.
November 13, 1995	1995 Consent Decree entered by the United States District Court for the Middle District of Pennsylvania between U. S. EPA and PADEP and HII and HRDC.
March 1999	HII and HRDC prepared and submitted the Pollution Reduction Technologies (PRT) Work Plan and Vegetation Plan.
May 1999	EPA and PADEP approved the PRT Work Plan and Vegetation Plan.
Spring 2000	Closure of Outfall 023.
July 2000 to May 10, 2001	Metals Reduction Zone (MRZ) #3 mobilization, site preparation, construction, final grading.
July 2000 to February 2002	MRZ #1 mobilization, site preparation, construction, final grading.
July 2000 to March 2002	MRZ #2 mobilization, site preparation, construction, final grading.
August 2000 to January 2001	Construction of Eastern Diversion Ditch (EDD).
September 2000 to October 2001	Construction of Diversion Trench 005 (DT005).
September 2000 to September 2001	MRZ #3 pH adjustment system mobilization, construction, and certification.
Fall 2000 to Spring 2002	Vegetation of Cinder Bank, Pre-Treatment Zone, MRZs #1, #2, and #3.
Fourth Quarter 2000 to March 2002	ZCA evaluated effectiveness of Pre-Treatment Zone.
January 2001 to December 2001	Construction of Pre-Treatment Zone.
March 2001 to September 2001	MRZs #1 and #2 pH adjustment system mobilization, construction, and certification.
Summer 2001	Initial Cleaning of Outfall 022 Conveyance System.
October 2001	MRZ #3 and pH adjustment system in service.
November 2001	Initial Cleaning of Outfall 005 Conveyance System.
January 25, 2002	HII submitted O&M Plan for PRT remediation activities.
April 2002	MRZs #1 and #2 and pH adjustment system in service.

Date	Event
May 24, 2002	ZCA submitted evaluation of Pre-Treatment Zone effectiveness.
August 2002	EPA issued ESD presenting details of a change to OU-2 remedy.
October 31, 2002 to October 31, 2003	HII conducted Implementation Evaluation Plan (IEP) measures.
November 21, 2003	2003 Consent Decree entered by the United States District Court for the Middle District of Pennsylvania between HII, HRDC, Viacom, and TCI Pacific Communications, Inc. (TCI).
February 2, 2004	HII submitted PRT Implementation Evaluation Report (IER).
May 11, 2004	Viacom submitted O&M Plan for non-PRT remediation activities.
August 31, 2005	EPA, PADEP, and Viacom conducted pre-certification inspection.
September 2005	Viacom submitted RA Report to EPA.
May 2009	Burning Area Aerial Infrared Survey conducted.
May 2012	DT005 Wash out Repair
Ongoing	O&M activities.

Table 3: OU 3 – Community Soils

Date	Event
October 9, 2001	ROD for OU 3 issued by EPA.
August 28, 2002	Remedial Design Work Plan (RDWP) approved by EPA.
September 2002	Phase 1 soil sampling solicitation began.
October 2002 to December 2002	Phase 1 soil sampling.
December 2002	First RDWP revision approved by EPA (revised Quality Assurance Project Plan (QAPP)).
January 2003	Phase 1B soil sampling solicitation began.
April 2003 to May 2003	Phase 1B soil sampling.
May 22, 2003	Viacom informed EPA of selection of ROD's contingent remedy.
June 2003	Phase 2 soil sampling solicitation began.
June 2003 to November 2003	Phase 2 soil sampling.
June 11, 2003	Second RDWP revision approved by EPA.
September 30, 2003	Cummings-Riter (C-R) submitted Residential Soil Remedial Action Work Plan (RAWP) to EPA.
October 15, 2003 to November 13, 2003	Exterior soil RA pilot program conducted.
November 21, 2003	Consent Decree entered.
February 19, 2004	C-R submitted Residential Soil Pilot Program Report to EPA.
February 23, 2004	C-R submitted Remedial Design Sampling Summary Report to EPA.
March 2004	Phase 2B soil sampling solicitation began.
March 2004 to October 2004	Exterior soil RA performed.
June 2004 to July 2004	Phase 2B soil sampling.
June 28, 2004	C-R submitted Residential Interiors RAWP to EPA.
July 29, 2004	Residential Interiors RAWP approved by EPA.
August 2004	Interior dust eligibility sampling began.
January 2005 to May 2005	Interior dust remediation performed.
April 2005	Last RD soil sample collected.
August 2005	EPA approved cleanup waiver for five properties (non-OU 3 interior lead present).
September 2005	C-R submitted RA Report to EPA.

Table 4: OU 4 – Groundwater, Surface water & Site-Wide Eco-risk

Date	Event
February 2001	EPA Environmental Response Team completed the Draft Ecological Risk Assessment demonstrating unacceptable risk to 15 of 18 ecological endpoints.
April 2002	Horsehead completed construction of the pollution reduction technologies (PRTs). Sampling and analysis of surface water (SW) treated by PRTs indicate that PRTs have lowered contamination at all affected outfalls except 019 and 022.
June 2002	Tetra Tech/Black & Veatch, Remedial Investigation Report.
December 2002	Tetra Tech/Black & Veatch, Final Feasibility Study Report.
May 2003	Horsehead monthly compliance report indicates that chronic zinc exceedances at 019 were caused by wetlands adjacent to the Cinder Bank. Propose diversion ditch and application of iron rich materials (IRM) and metal reduction zones (MRZs) lined with IRM.
February 2004	Horsehead submitted an Implementation Evaluation Report (IER) proposing modifications to PRTs which effect 022. After modifications, 022 is in compliance.
June 19, 2005	Adrian Brown Consultants, Inc. (ABC) submitted Palmerton OU-4 Interim Measures Investigation Work Plan to EPA. Work Plan details investigation activities for soil and groundwater at the east end of the Cinder Bank.
June 2005 to October 2005	Interim Measures Investigation Work Plan activities implemented.
August 15, 2005	PRPs submitted to EPA OU 4 Interim Remedial Measures – Additional Work Element: Cinder Bank Toe Flow Measurement .
August 16, 2005	PRPs submitted Stoney Ridge Materials Work Plan to EPA.
September 30, 2005	EPA issued UAO for performance of RI/FS to Viacom, TCI, HH Liquidating Corp., and HRD Liquidating Corp.
July 1, 2005 (Revised September 14, 2005)	APOLLO Environmental Strategies, Inc. (APOLLO) submitted final revision of Stoney Ridge Erosion and Revegetation Activities Work Plan to EPA. Details plan to install erosion control measures (e.g., rock check dams and sedimentation basins) and revegetate areas of Stoney Ridge.
August to October 2005	APOLLO and FWI conduct erosion control and revegetation activities on Stoney Ridge.
Fall 2005	APOLLO conducted consolidation and grading of Electric Furnace Cinder Material (EFCM) at Stoney Ridge Materials.
October 17, 2005	ABC submitted Palmerton OU4 Interim Measures Report to EPA.
October 2005	BBL submitted Ecological Risk Assessment (ERA) Work Plan to EPA.
November 21, 2005	ABC submitted RI/FS Work Plan to EPA.
September to October 2006	Environmental Restoration, Inc. (ERI) installed soil cover and FWI installs vegetative cover on consolidated and graded EFCM at Stoney Ridge Materials (excluding north slope).
October 13, 2006	ABC submitted Palmerton OU4 Interim Measures Investigation Work Plan for investigation activities at the east end of the Cinder Bank to EPA.
October 2006	FWI performed revegetation activities at an additional 5 acres of Stoney Ridge.
November to December 2006	Interim Measures Investigation Work Plan activities implemented.
March 2008	Palmerton OU4 Deep Well Sampling and Hydraulic Testing Work Plan approved. Could not be implemented due to inability to reach an access agreement with Palmerton Water Authority
2009/2010	Quarterly sampling of Palmerton Water Authority supply wells
June 2010	Palmerton OU4 Deep Well Sampling and Hydraulic Testing Report
December 2011 – March 2012	Deep Aquifer Investigation of existing deep wells. Geophysical and packer testing work conducted.
August 2011 – November 2011	Remedial Interim Measures for East End Cinder Bank shallow ground water IRM Treatment Cell implemented
May 2012	Wetlands Restoration test plots planted

III. Background

Physical Characteristics

The Site is located in Carbon County, Pennsylvania, in the vicinity of the Lehigh Gap and is approximately 15 miles north of Allentown, Pennsylvania. Figure 1 presents a general Site location map. It is located in a narrow valley bounded by Stony Ridge on the north and Blue Mountain on the south.

From 1898 to about 1981, zinc smelters were operated within the Borough of Palmerton (Borough). The two former zinc smelters are located separately on east and west sides of the Lehigh Gap. The East Plant is at the eastern end of the Borough and at the foot of Blue Mountain. The Borough borders the East Plant to the north. The East Plant and the Borough are separated by Aquashicola Creek which flows westward and joins the Lehigh River in Lehigh Gap southwest of the Borough. The Borough is located north of Aquashicola Creek. The West Plant is located in the western end of the Borough on the northern bank of the Lehigh River (Figure 2).

A residue pile, known as the Cinder Bank, lies adjacent to the East Plant and along the base of Blue Mountain. The Cinder Bank is approximately 2.5 miles long, 200 feet high, 200 feet wide at its crest, and 1,000 feet wide at the base. This equates to approximately 200 acres of surface area (Figure 2). The Cinder Bank consists of mostly residual metals and carbonaceous material. Due to historical residue management practices (i.e., deposition of residue on to the pile before it was fully quenched), portions of the Cinder Bank continue to smolder.

The major watercourse in the vicinity of the Site is the Lehigh River. The drainage pattern of the Site is toward Aquashicola Creek, which flows through the valley bounded by Blue Mountain to the south and Stoney Ridge to the north. Buckwha Creek joins Aquashicola Creek approximately 0.5 mile upstream of Harris Bridge. Mill Creek joins Aquashicola Creek near the East Plant's main gate. Aquashicola Creek joins the Lehigh River just southwest of the Borough at the Lehigh Gap.

Land and Resource Use

The East and West Plants were operated by The New Jersey Zinc Company (New Jersey Zinc) from 1898 to 1967. During smelting operations, lead, cadmium, zinc, and arsenic were emitted as dust and particulate fallout from stack emissions. The smelting operation was purchased from New Jersey Zinc in 1967 by Gulf & Western, Inc. (G&W). Primary zinc smelting operations ceased at the East and West Plants in about 1981.

In 1981, Horsehead Industries, Inc. (HII) purchased the smelters and began operating the facility as a hazardous waste recycling plant. It presently processes the Resource Conservation and Recovery Act (RCRA) hazardous waste K061, electric arc furnace (EAF) dust. This dust is a residue from the steel mill industry and contains concentrations of lead, cadmium, and zinc.

HII was the parent company of two onsite subsidiaries, Horsehead Resource Development Company, Inc. (HRDC) and Zinc Corporation of America (ZCA). HII and certain of its

subsidiaries filed for bankruptcy in 2002. In connection with the bankruptcy, Horsehead Corp. acquired certain of the HII assets at Palmerton and continues to operate the hazardous waste recycling plant. G&W was the predecessor of Viacom International Inc. (Viacom) and TCI Pacific Communications, Inc. (TCI). Viacom and TCI were collectively referred to as "Viacom" in previous Five-Year Review Reports. Viacom is now CBS Corporation (CBS). Throughout this report, "Viacom" and "CBS" will be used to refer to these companies; the name used will reflect the name of the company at the time of action or report submission mentioned.

The Site is composed of a number of public and privately-owned properties. The Site consists of the Borough, the village of Aquashicola, portions of Lower Towamensing Township, and portions of Blue Mountain. Based on United States Census data, the population for the Borough for 2010 was 5,414. Horsehead Corp. owns or manages property south of the Borough including the East Plant, Stoney Ridge Materials, and land south of the East Plant on the northern slopes of Blue Mountain. Lehigh N.E. Development Corporation and Phibro Animal Health own property on the northern slopes of Blue Mountain, east of Lehigh Gap and south of Aquashicola Creek. The National Park Service (NPS) owns and maintains land associated with the Appalachian National Scenic Trail, which winds along the ridge of Blue Mountain and through the associated gaps of the area. The Pennsylvania Game Commission also owns property on Blue Mountain - referred to as State Game Lands. The Lehigh Gap Nature Center (Nature Center) (formerly Wildlife Information Center [WIC]) owns and operates land west of the Lehigh Gap, south and west of the Lehigh River (Figure 3).

Public access is allowed for recreational use on Nature Center property, NPS property, and State Game Lands. Public access is restricted via No Trespassing signs, cables, gates and berms on other privately-owned lands on Blue Mountain. Aquashicola Creek and Buckwha Creek are managed by the Commonwealth of Pennsylvania as cold-water fisheries and are stocked with trout. The Lehigh River is managed as a warm-water fishery, although it is also stocked with trout (Pennsylvania Department of Environmental Protection [PADEP], 2005).

History of Contamination

During operation, the smelters emitted zinc, lead, cadmium, and sulfur dioxide. These releases contributed to the defoliation of approximately 2,000 acres on Blue Mountain, deposition of heavy metals within the Borough and the valley, and the stockpiling of approximately 32,000,000 tons of residue. Metals from the residue pile (which is called the Cinder Bank) migrated to the shallow aquifer and Aquashicola Creek, which flows through the Borough into the Lehigh River. It was apparently common practice to deposit this residue in this waste pile before it was fully quenched. Therefore, parts of the interior of the Cinder Bank continue to burn.

As described in the 1987 OU 1 ROD, surface soil samples collected on Blue Mountain indicated the presence of concentrations of cadmium from 364 parts per million (ppm) to 1,300 ppm; lead from 1,200 ppm to 6,475 ppm; and zinc from 13,000 ppm to 35,000 ppm. Most of these metals are contained within the top 6 to 10 inches of soil.

The Site was included on the National Priorities List (NPL) in September 1983 because of the possible threat to human health and the environment posed by the Cinder Bank. Further investigation indicated that elevated concentrations of heavy metals were present throughout the Palmerton area.

Basis for Taking Action

Analytical results for groundwater, soil, surface water, sediment, and biota samples indicated the presence of elevated metals concentrations. The metals with the highest detected concentrations were arsenic, cadmium, copper, lead, and zinc. All of these metals are listed as hazardous substances pursuant to CERCLA in Table 302.4 - List of Hazardous Substances and Reportable Quantities (40 CFR § 302.4(a)), and as toxic pollutants pursuant to the Federal Water Pollution Control Act (40 CFR § 401.15).

In the 1987 OU 1 ROD, EPA identified cadmium, lead, and zinc in soil, surface water, and biota as metals of concern. EPA identified cadmium, copper, lead, and zinc in soil, sediment, surface water, groundwater, and biota as metals of concern in the 1988 OU 2 ROD. For both OU 1 and OU 2, direct contact with the metals of concern along with erosion and storm water run off containing these metals were the primary exposure pathways. EPA identified arsenic, cadmium, lead, and zinc as metals of concern in the 2001 OU 3 ROD. Ingestion of contaminated residential soil and/or indoor dust was the primary exposure pathway of concern for OU 3.

IV. Remedial Actions

EPA divided the Site into four OUs because of the size and complexity of the Site. OU 1 addresses metals exposure and migration via revegetation of approximately 2,000 acres of non-residential land on the north face of Blue Mountain. OU 2 consists of remediation of the Cinder Bank. OU 3 consists of remediation of residential soils and interior house dust exhibiting elevated concentrations of lead, which are a result of historical zinc processing operations. OU 4 is defined as the area-wide investigation of groundwater and surface water, and includes an ecological risk assessment (ERA). OU 4 also includes erosion control and revegetation of land on Stoney Ridge and the consolidation and covering of electric furnace cinder material (EFCM) at Stoney Ridge Materials.

On November 21, 2003, a Consent Decree was entered in the United States District Court for the Middle District of Pennsylvania settling the cost recovery litigation between the United States and Horsehead Industries, Inc., Horsehead Resource Development Company, Inc. (collectively Horsehead), Viacom International Inc., and TCI Pacific Communications, Inc. (collectively Viacom) in connection with the Palmerton Site. The Consent Decree provided that Horsehead and Viacom would pay a total of $13,000,000.00 in past costs paid by the United States at the Site through December 31, 2001, to settle their potential liability in connection with the Site. EPA received $12,600,000.00 from the settlement and the Department of the Interior (DOI) received $400,000.00. In addition, Horsehead and Viacom agreed to perform all work required by the RODs for OU1, OU2 (as amended by the OU2 ESD as discussed below), and OU3 at the Site. Horsehead and Viacom also agreed to reimburse EPA for any future response costs, including remedial action oversight costs, incurred by EPA with respect to OU1, OU2, and OU3, to the extent such costs exceed $1.75 million. The initial $1.75 million in future costs was funded with proceeds from a 1999 *de minimis* settlement in connection with the Site which were received by the United States and put into a Special Account for the Site. Also as part of the settlement Horsehead and Viacom made a lump sum payment of $300,000.00 to DOI in reimbursement of its future response costs. Horsehead was also obligated to perform the work required by a 1995 Consent Decree in connection with OU2 (i.e. implement the PRT Plans) and to pay EPA $252,745.00 in past oversight costs in connection with OU1. In addition, Horsehead

agreed to dismiss counterclaims it had filed against the United States under Sections 107 and 113 of CERCLA. OU4 of the Site is not included in this settlement. On September 30, 2005, EPA issued a UAO to Viacom, TCI, HH Liquidating Corp. (formerly HII), and HRD Liquidating Corp (formerly HRDC) for performance of an RI/FS, an ecological risk assessment, and interim measures at Stoney Ridge and Stoney Ridge Materials. The following sections present Remedial Action Objectives (RAOs), selected remedies, and summaries of the implemented remedies for each OU emphasizing actions taken since the last five year review in September 2007.

OU 1 – Blue Mountain

OU 1 addresses metals exposure and migration via revegetation of approximately 3,000 acres of non-residential land on the north face of Blue Mountain. The RI/FS was conducted by EPA. On September 4, 1987, EPA signed a ROD presenting the remedial actions (RAs) for OU 1. A Consent Decree (CD) between EPA and ZCA, a Division of HII, for implementation of the OU 1 ROD was entered by the United States District Court for the Middle District of Pennsylvania on October 18, 1988. The ROD refers to the remediation of approximately 2,000 acres; however, the exact limits of restoration were not precisely established. A disagreement between EPA and ZCA regarding ZCA's responsibility to continue work under the 1988 CD was never resolved and on December 10, 1999, EPA issued a UAO to HII and Viacom requiring completion of the remedial activities selected in the ROD. On November 21, 2003, a Consent Decree was entered (as described in more detail above) which superseded the 1999 UAO.

Remedial Action Objectives

The RAOs of the September 4, 1987 ROD are as follows:

1. minimize direct contact with contaminated soil
2. reduce volume of runoff
3. reduce contamination in runoff
4. mitigate environmental damage

Remedy Selection

The remedy selected in the 1987 ROD included the application of a sludge/lime/fly ash mixture with grass and tree seeds. While not addressing all applicable or relevant and appropriate requirements (ARARs), the selected alternative was deemed consistent with those action-specific ARARs addressing sludge application, PADEP concurred with the interim remedy, selected in the ROD.

Based on the experiences and evaluations of the initial remedy implementation (1988 through 2001), EPA adopted an alternate approach to implementing the remedy on the remaining acreage. EPA decided to utilize a self-sustaining meadowland revegetation approach that has lesser metals uptake and which includes performance of sampling and analysis of appropriate indicator plant species for metals to determine if translocation of contaminants is occurring. Based on pilot testing results, EPA determined that this approach will achieve the RAO's of the September 4, 1987 ROD.

Remedy Implementation

This section summarizes the remedy implementation conducted at OU 1 to comply with the RAOs established in the 1987 ROD. A more detailed summary of remedy implementation prior to 2007 is provided in the Third Five-Year Review Report.

Revegetation of Blue Mountain

The first phase of OU1 remediation was conducted between 1991 and 1996. This area included the revegetation with sludge/lime/fly ash (ECOLOAM) plus grass/tree seed application as selected in the 1987 ROD. This area, located south of the Borough and immediately behind the east plant, is referred to as the ECOLOAM Area. The RA was highly successful in establishing grass cover, but tree seedling establishment was less successful. The application method for this approach also required construction of over 60 miles of switch back roads on the mountain. Based on the experiences and evaluations of the initial remedy implementation, EPA adopted an alternate approach to implementation of the remedy on the remaining acreage which was consistent with the RAO's of the 1987 ROD. This approach consisted of native warm season grass revegetation with plant species that have less metal uptake along with application methods that minimized road construction.

In 2005 and 2006, following extensive pilot testing, over 500 acres were revegetated using a mixture of warm season grass seed, lime, fertilizer and compost (compost applied to ground-applied areas only). This land owned by Lehigh Gap Nature Center (LGNC), Lehigh New England Development Corporation and Phibro Animal Health is collectively referred to as GA-1. The location of GA-1 and the ECOLOAM area are shown on Figure 3. Ground application was accomplished via a modified agricultural tractor and spreader. Aerial application was planned for areas on a slope of 25 percent or greater or areas not easily accessible to ground application equipment. Aerial application was completed via fixed wing "crop dusting" aircraft. Both approaches have been highly successful in establishing grass cover while tree seedling establishment has been significantly less successful. However, more recent aerial application including pitch and other species of pine have shown encouraging results in germination and survival of those species. Natural recruitment of various pioneer tree species (particularly grey birch and aspen) is occurring on Blue Mountain.

Also remedial activities on publically-owned NPS-managed lands (NPS lands) and PAGC-managed lands (PAGC lands) (collectively referred to as GA-2) began in 2006 with four NPS Demonstration Project areas (total of approximately 25 acres) being revegetated using both aerial- and ground-application methods. Figure 4 and Figure 5 show the locations of the four NPS Demonstration Project Areas within OU 1. Grass germination counts and live vegetation coverage were high, considering the large amounts of rock cover present within the sampling areas.

Following extensive evaluation and discussion of the previous full scale aerial and ground application of GA-1 and the results of the three aerially-applied demonstration plots in 2006, remediation of GA-2 began in 2008 with aerial application of approximately 610 acres of mostly PAGC lands. These activities are summarized in the *2008 Aerial Application Report*. Aerial application in the spring of 2008 consisted of applying three "shade seed mixes" primarily on PAGC lands located east of Lehigh Gap. The total 2008 aerial application area is shown on Figure 6.

Also in March 2008, representatives of the Appalachian Trail Conservancy (ATC) and NPS constructed a temporary AT which was established to re-route hikers around the area of future remedial actions. The temporary trail relocation was funded through an agreement with CBS, but the design and construction was carried out by ATC and NPS personnel with expertise in the field of trail construction. The temporary trail begins from the parking lot at Little Gap and runs across Blue Mountain to the confluence of the summer and winter trails above Lehigh Gap. The temporary trail utilizes the upper most switchback road of the Ecoloam revegetation area for a portion of its length. The primary purpose of the relocation was to get hiker foot traffic off the existing access road/AT, which was intended to be used as a construction haul road. The relocated AT is depicted on Figure 5. It will remain in use until all OU1 construction activities are completed. After construction activities are completed, a permanent AT will be designed and constructed across the top of Blue Mountain in the area affected by the remedial action. The intention is that design and construction of the permanent AT will be funded through an agreement with CBS in the same way as the temporary AT relocation.

Discussions regarding performance standards and monitoring details continued between CBS, its contractors, and the response agencies throughout 2008 and 2009 in an effort to reach agreement on a comprehensive remedial design outline including performance standards for the GA-2 area. Ultimately on June 23, 2009, EPA in consultation with the other response agencies sent a letter to CBS entitled *Outline of Remedial Design (RD) Components – Palmerton Zinc Pile National Priorities List Site, Operable Unit 1, Geographical Area 2* (GA-2 RD/RA Work Plan) outlining an acceptable full-scale aerial and ground application approach along with performance standards, which should be used to form a final RD/RA work plan for GA-2. In September 2009, bi-weekly calls among the response agencies, CBS, and its contractors were initiated to assist in keeping the process moving forward. The bi-weekly calls have continued to the present and have been beneficial in keeping open lines of communication and the process moving forward.

Ultimately ground application was planned on bare or senescent areas accessible to ground application equipment in GA-2. As in GA-1 remediation, ground application would differ from aerial application in that ground application would include mulch from local mushroom houses, whereas aerial application would not. Mushroom mulch proved to be an important amendment in GA-1 remediation, providing a thin layer of organic matter to bare areas which lacked vegetation cover and litter layer.

Additionally, during the increased communications in the fall of 2010, it was determined that aerial application would move forward in 2011 while plans for road construction to allow for transportation of the necessary amendments to the top of the mountain for ground application and a resource island test plot plan were completed. In March 2011, approximately 500 acres of GA-2 received aerial application. Aerial application in the spring of 2011 consisted of applying a "sun seed mix" and a "shade seed mix". Figure 7 shows the area receiving aerial application in 2011.

In preparation for ground application activities planned for 2012 on top of Blue Mountain east of the Lehigh Gap and west of Little Gap, contractors for CBS submitted a *Geographical Area 2 (GA-2) Access Road and Staging Area Engineering Design Report* describing road improvements required for hauling seed and ground application amendments (i.e., mulch, fertilizer, and lime) to staging areas on top of the mountain. New construction, consisting of

switchback roads, was required within Little Gap from Blue Mountain Road to the top of Blue Mountain. In addition, the existing access road footprint on top of Blue Mountain would be improved and staging areas for amendments would be constructed at four locations across the ridgeline of Blue Mountain from Little Gap to Lehigh Gap.

A site walk was conducted by Settling Defendants and Response Agencies on July 6, 2011 to view the 2008 and 2011 aerial application areas, proposed road improvement areas, and the 2011 on-site tree test plot (Photo Attachment, Page 1) . As a result of observations and discussions during and after the walk, the response agencies requested revisions to the access road layout to minimize disturbance to existing trees and vegetation. An additional site visit was conducted on August 10, 2011 to walk the revised switchback road locations from Blue Mountain Road to the top of Blue Mountain. Based on observations of the significant vegetation germination from the 2011 aerial application made during these site walks and subsequent discussions during weekly conference calls, Response Agencies and Settling Defendants agreed during a September 19, 2011 conference call that the benefits of ground application would not outweigh the disturbance caused by access road improvements and switchback construction in Little Gap if aerial application, hand seeding and resource island planting was sufficient to remediate the remaining bare and senescent areas on top of Blue Mountain. Subsequently, on a September 26, 2011 conference call, the USEPA requested that Settling Defendants submit an aerial application work plan for spring 2012 aerial application on the remaining bare and senescent areas on top of Blue Mountain and also submit a minimal road improvement work plan to improve the existing footprint of the access road to support resource island construction and monitoring activities.

During the fall of 2011, Settling Defendants and Response Agencies were also attempting to develop the location of resource islands within GA-2 as well as appropriate performance standards. The GA-2 RD Outline proposed 70 acres of land on top of Blue Mountain to be enclosed with deer exclusion fencing for the establishment of woody tree and shrub species. Stemming from the resource island performance standard discussions a test plot plan was proposed to test the establishment success of woody species on a smaller scale before planting resource islands at full scale (70 acres) starting in 2012.

To evaluate the establishment of woody species planted within deer exclusion fencing on GA-2 in order to better inform the performance standard discussions, two one-acre fenced test plots were established (Figure 8). One plot was established within GA-2, in an area planned for full scale ground application and resource island installation (the onsite plot) (Figure 9). The second plot was established within an existing deer exclusion fenced area on PAGC-managed lands, located approximately 5 miles from the site (the offsite control plot). Both plots were planted with 12 woody plant species known to occur on Blue Mountain (including the American Chestnut).

As part of the larger goal to determine realistic tree germination performance standards, establishment of pure and second generation backcrossed American Chestnut seedlings was also tested at the site, in cooperation with the The American Chestnut Foundation (TACF), in hopes of obtaining blight resistant American Chestnut seeds from TACF to add to full-scale resource island planting.

American Chestnuts were historically found at the site and throughout the eastern United States. However, by 1930 they were likely absent from the mountain due to die off from chestnut blight.

A few young blight affected individual trees have been observed in GA-2 along the Appalachian Trail east of Lehigh Gap.

Forty chestnut oak acorns were planted in the off-site control plot and 40 chestnut oak acorns were planted in the on-site test plot. In total six species of oak (acorns and seedlings), two types of American Chestnut, and four other species were planted in the off-site control and on-site test plots as indicated in Table 7. Monitoring activities were conducted in June, July, August, and September of 2011 to determine percent germination of American Chestnut seed and chestnut oak acorns, and percent survival of planted bare root and containerized seedlings in the on-site test plot and off-site test plot (Table 8).

The pure and hybrid American Chestnut seed exhibited a percent germination rate which was acceptable to TACF and which justified continued use of TACF hybrid seeds and seedlings in the full scale resource islands. Both pure and second generation chestnut seeds germinated significantly better in the on-site test plot than the off-site control plot. However, this was due primarily to how the control plot seeds were planted, as well as the amount of clay type soil present . All oak species in the on-site test plot and five oak species in the off-site control plot exhibited greater than 78 percent survival. None of the acorns planted in the on-site test plot germinated, and 8 percent germinated in the off-site control plot. In summary, the test plot plan evaluation provided valuable information to design resource islands to be constructed in spring 2012, which would include hybrid American Chestnut seed and seedlings, and six species of bare root oak seedlings along with a variety of other tree species with confidence that ultimately performance standards for tree establishment could be met.

The Aerial Application Work Plan was completed on March 13, 2012 for aerial application on the remaining bare and senescent areas on top of Blue Mountain. Pursuant to a Special Use Authorization between CBS and NPS and a Special Use Permit with PAGC, aerial application on a total of 128 acres was completed in March 2012 in accordance with the work plan instead of the previously planned ground application. The Aerial application included bare/senescent areas of GA-2 which did not receive aerial application in 2008 or 2011. Figure 10 shows the area receiving aerial application in 2012.

Also beginning in March 2012, Resource Island 1 (R1) and Resource Island 2 (R2) were constructed and planted. A total of 21 acres are enclosed in R1, with 14 acres planted. R2 has 35 total acres enclosed with 25 acres planted. Figure 11 shows the layout of R1 and R2. Eleven species of woody plants were planted on the 39 total acres planted within R1 and R2. Six oak species (chestnut, black, Northern red, scrub, post, and white), along with hybrid American chestnut seeds were planted within R1 and R2. Oak species included six of the seven of those evaluated in the 2011 test plots. Blackjack oak was not commercially available in 2012 but will be collected and nursery cultivated for planting within resource islands (R1 to R4) in 2013. Four additional species planted and evaluated in the 2011 test plots were planted within R1 and R2. These species included black gum, chokecherry, smooth sumac, and staghorn sumac.

Approximately 2,330 American Chestnuts, obtained from TACF, were planted within R1 and R2. Approximately 2,100 BC2F3 (50% blight resistant) nuts were planted along with 200 nuts and 30 blight resistant BC3F3 seedlings (95% blight resistant). In total over 8,800 bare root seedlings of the various species were planted in R1 (3,302) and R2 (5,310). Photos of the resource island enclosures and planting can be found in the Photo Attachment pages 2, 3 and 4. It is planned that R3 (12 acres) and R4 (22 acres) will be constructed and planted by spring 2013.

Germination monitoring and intensive management of the planted trees will continue until the performance standard for 5- 10 year old oak or chestnut at 50 per acre and 35 per acre of other species are met in the resource islands.

In addition to aerial application and resource island planting, hand seeding of tree and shrub species was conducted in target areas of GA-2. Areas which did not receive aerial application in 2008, 2011 or 2012 were hand seeded with a seed mix similar to that used in aerial application activities to fill in between the existing application areas. Areas formerly applied which are still sparse in grass cover and have few established woody species will be hand-seeded with tree or shrub species as a second attempt to establish woody species in these areas.

Invasive Plant Management Plan

In 2010, ARCADIS, on behalf of CBS, began to implement an invasive plant management program (IPMP) on certain properties at the Site including areas of GA-1, PAGC property and OU2. The program's primary focus is herbicide application via licensed applicator targeting Butterfly Bush and Tree of Heaven, which are prevalent on some revegetated areas of the Site. Since 2010, during the summer and fall 8-10 trained applicators have been dedicated to herbicide application of target species on certain revegetated areas of the Site including, the Cinder Bank. The program anticipates annual reevaluation of target species based on field observations made during the previous application season. In September 2011, EPA approved the Final Invasive Plant Management Plan for GA- 2 and under a Special Use Permit, contractors on behalf of CBS, expanded the IPMP to include the revegetated areas of GA-2 as well. Invasive plant management will likely need to be a sustained effort in the future in the revegetated areas of the Site.

OU1 – Institutional Controls

The following institutional controls were required by the November 21, 2003 Consent Decree for OU 1: no activities shall be conducted which would interfere with or adversely affect the integrity or protectiveness of the remedial measures to be implemented or that would impair the ability of the United States to manage its land and resources located within OU 1; Owner Settling Defendants shall not use, or allow to be used, for residential development or agricultural purposes any property located within OU 1 that is owned or controlled by Owner Settling Defendants; notice of the above shall be properly filed. Settling Defendants have complied with these requirements and the proper notices have been filed in Carbon County, Pennsylvania for property within OU 1 owned by them. In addition, Lehigh Gap Wildlife Center (formerly known as the Wildlife Information Center) has recorded a conservation easement in Carbon County for the property that it owns within OU 1. The National Park Service and PA Game Commission manage or own a significant portion of the land within OU 1 which is currently managed for recreational purposes. EPA has not yet determined the instruments to be used as institutional controls on these properties for the long term. Finally, two parcels owned by private interests need to be investigated with regard to implementing institutional controls to protect the integrity of the revegetation and to prohibit residential and agricultural uses of the property within OU 1. An institutional controls implementation plan will be developed to investigate the property within OU 1 and implement the appropriate controls. The appropriate Site wide institutional controls implementation plan will be addressed in the OU4 ROD.

OU 2 – Cinder Bank

Remedial Action Objectives

OU 2 consists of remediation of the Cinder Bank. In September 1985, ZCA entered into an Administrative Order on Consent (AOC) to conduct an RI/FS for the Cinder Bank. The RI/FS was submitted to EPA in May 1988. Based on the results of the RI/FS, EPA issued a ROD for OU 2 on June 29, 1988.

The RAOs presented in the 1988 ROD were the following:

1. Minimize direct contact with the Cinder Bank
2. Reduce volume of runoff from the Cinder Bank
3. Reduce contamination in runoff from the Cinder Bank
4. Reduce the volume of run-on from Blue Mountain to the Cinder Bank
5. Collect and treat leachate from the Cinder Bank
6. Reduce wind-borne emissions
7. Reduce particulate erosion

Remedy Selection

A more detailed description of remedy selection for OU 2 can be found in the September 2007 Third Five Year Review Report for the Site. A brief summary is provided below.

A 1995 Multi-media CD required HII and HRDC to design and install pollution reduction technologies (PRTs) at and in the vicinity of the Cinder Bank to address National Pollutant Discharge Elimination System limit violations related primarily to discharges from outfalls associated with the Cinder Bank. Many tasks included in PRT work plans (i.e., *Pollution Reduction Technologies Work Plan* [HII, 1999] and *Cinder Bank Vegetation Plan* [ZCA, 1999]) were consistent with the remedy selected in the 1988 ROD.

Based on the coincidence of 1988 ROD and PRT work plan requirements, EPA issued an Explanation of Significant Differences (ESD) in August 2002 that summarized the differences between the remedy selected in the 1988 ROD and the remedy implemented under the PRT work plans. The 2002 ESD concluded that remedial actions conducted in accordance with the PRT work plans will accomplish the remedy selected in the 1988 ROD provided that O&M activities also include access control measures and inspections of portions of the Cinder Bank that continue to smolder.

Remedy Implementation

Construction activities were conducted between July 2000 and mid-year 2002. Detailed descriptions of the construction activities are provided in the *Remedial Action Report Operable Unit 2* (OU 2 RA Report) (Viacom, 2005). Figure 12 illustrates OU 2 features. Construction activities are also summarized in more detail in the September 2007 Third Five Year Review Report for the Site.

Cinder Bank revegetation is also complete, excluding approximately 27 acres which do not support vegetation because of elevated subsurface temperatures (ESTs), resulting from past or current combustion of Cinder Bank material. This area of the Cinder Bank is commonly referred to as the burning area.

In accordance with the 1988 ROD/2002 ESD objectives and the 2003 Consent Decree, and to the extent not conducted by Horsehead Corp. pursuant to the PRT O&M Plan, CBS conducts O&M activities to maintain and monitor existing OU2 vegetation, assess areas with elevated subsurface temperatures (EST), and maintain ancillary components (e.g., gates, warning signs, access roadway). These activities are being conducted in accordance with the *Operation and Maintenance Plan; Operable Unit No. 2 – Cinder Bank* (Non-PRT O&M Plan) and are currently ongoing. Results of these O&M activities are provided to EPA and PADEP in monitoring reports following O&M monitoring events. Inspections are conducted four times each year (i.e., April, June, September, and November). The major components of the OU2 remedy continue to function as designed.

During each monitoring event, observations are made regarding changes in vegetative cover and other noticeable environmental changes (e.g., odor) from baseline conditions. Once EST areas stop burning, a plan to vegetate the areas will be submitted to EPA for review and approval.

Additional Burning Area Signage

In follow-up to the issue raised in the third five year review with regard to assessing OU2 access and following photo documented eyewitness accounts of hunters walking on top of the Cinder Bank near the burning area EPA, in consultation with PADEP, requested that CBS add additional warning signs around the perimeter of the burning area.

In July 2008, contractors, on behalf of CBS installed additional signs every 50 yards along the road just south of the Cinder Bank burning area and every 50 yards around the burning area to the east from the southern access road to the northern access road. Signage was not placed on the western side as this side borders the operating east plant area and trespassers are unlikely to approach the burning area from this direction. The signs read: Danger - Unsafe Area – Do Not Enter – Burning Cinder Area. Photos of the steam vents in the burning area and the additional signage can be found on page 5 of the Photo Attachment. No reported hunters or other trespassers have been observed in the area since the additional signage was installed.

Burning Area Air Monitoring and Aerial Infrared Evaluation

In November 2008, based on observations of significant changes in the number of vents and volume of steam and smoke being vented from the burning area made during routine site inspections, EPA, in consultation with PADEP, requested, pursuant to the O&M Plan and 2003 Consent Decree, that CBS submit a work plan including sufficient air and temperature monitoring to assess the conditions of the burning area over time and determine if corrective measures are required or feasible.

On March 4, 2009, EPA, in consultation with PADEP, approved a work plan submitted by Environ International Corporation (ENVIRON) on behalf of CBS to assess the condition of the ESTs and determine if any changes pose a threat to public health or compromise the revegetation portion of the OU 2 remedy. The work plan called for collecting 10 air samples approximately

every 1,000 feet around the perimeter of the burning area. At each location the concentration of carbon monoxide, oxygen, nitrogen dioxide, sulfur dioxide and hydrogen sulfide were to be collected using two MultiRAE plus sampling units. Data at each location was to be logged over a five minute period. The plan also called for Aerial thermal infrared images of the burning area to be collected at four different times, March/April 2009 and October 2009, as well as March/April 2010 and October 2010.

The air monitoring was performed in July 2009 and the results from a total of 12 locations spaced approximately 1,000 feet apart around the perimeter of the burning area and one background location were submitted to EPA in an August 14, 2009 letter report from Environ on behalf of CBS. The results indicated that there was essentially no difference in the concentration of the 12 samples collected from the perimeter of the burning area and the background sample and all the results were within the normal range for outdoor ambient air. Based on the air monitoring results, the burning area venting did not appear to pose an increased risk to human health at its perimeter.

Aerial Infrared Surveys were conducted in May 2009, October 2009 and March 2010 as summarized in a July 2010 letter report from Environ on behalf of CBS. The area of EST appears to be approximately the same size during each of the surveys. The March 2010 survey indicates that the area was slightly hotter during this event. The Aerial Infrared Surveys did not indicate any significant change in the size of the burning area and will be used as a baseline for future Aerial Infrared Surveys to be conducted as part of ongoing O&M of OU 2 to determine if the EST is changing over time.

Continued Eastern Diversion Ditch (EDD) Breach

Following completion of OU 2 RA activities, and in conjunction with OU 4 RI/FS and interim measures activities, EPA determined that it would be beneficial to have certain measures implemented to prevent impacted groundwater in the wetlands from mixing with the treated water from Outfall 019, and then discharging into Aquashicola Creek. Outfall 019 is the discharge location from the two major Cinder Bank leachate collection and treatment cells (MRZ #1 and MRZ #2) constructed under the PRT work plan in the east end area of the Cinder Bank (Figure 12).

On June 15, 2005, Viacom submitted an *Interim Measures Work Plan for Breaching of East Diversion Ditch and Re-routing Metal Reduction Zone Effluent* to EPA. A revised work plan was submitted on June 22, 2005, and EPA, in consultation with PADEP, approved the revised work plan. The activities outlined in the work plan (i.e., an EDD breach) were completed by July 1, 2005. The EDD routes surface water run-off from Blue Mountain around the east end of the Cinder Bank into the wetlands area at the toe of the bank (Figure 12). Since 2005 surface water in the EDD is diverted and does not enter the wetland system near Outfall 019. The diversion has subsequently provided for slightly drier conditions in which to implement the investigations described below for OU 4 in the East End Cinder Bank area. Ultimately, as part of the establishment of the restoration wetlands discussed under OU4 below, the breach will be repaired and the EDD surface flow will be directed to the wetlands as part of its final hydrology design.

Drainage Trench (DT005) Repair

In August 2011, heavy rain fall run-off from the remnants of a tropical storm passing through the area eroded cinders around and damaged an approximate 450 foot section of the DT005 half pipe in an area adjacent to the East Plant. Several subsequent significant rain events through November 2011 caused significant damage to DT005 requiring repair. Page 6 of the Photo attachment shows the DT005 damage. Contractors for CBS replaced the 450-foot section of 60-inch diameter damaged half pipe in the drainage channel with a 48-inch diameter corrugated metal pipe (CMP1) sized to match the carrying capacity of the pipes located upstream and downstream of the damaged section. A drop inlet/manhole was installed at the upper end where the most significant erosion occurred and corresponding to the area with the greatest elevation change within the drainage channel. Extending from the new manhole, the 48-inch CMP was installed in the existing eroded channel and connected with the downstream 8-foot diameter manhole. The CMP was backfilled to match existing grade adjacent to the drainage channel. Following backfilling and grading, the area was stabilized and re-seeded. Page 7 of the Photo attachment provided pictures of the restored repaired area. Also, existing underground drain pipes in the East Plant area, which clogged during the erosion events were pressure jetted with water and cleared with a vacuum truck.

Invasive Plant Management Plan

In 2010, ARCADIS, on behalf of CBS, began to implement an invasive plant management program on certain properties at the Site including the revegetated areas of the Cinder Bank. The program's primary focus is herbicide application via licensed applicator targeting Butterfly Bush and Tree of Heaven, which are prevalent on OU 2 and other revegetated areas of the Site in general. Since 2010, during the summer and fall, 8-10 trained applicators have been dedicated to herbicide application of target species on certain revegetated areas of the Site including, the Cinder Bank. The program anticipates annual reevaluation of target species based on field observations made during the previous application season.

OU 2 - Institutional Controls

The following institutional controls were required by the November 21, 2003 Consent Decree for OU 2: no activities on or with respect to property located within or comprising OU 2 that interfere with or adversely affect the integrity or protectiveness of the remedial measures for OU 2; Settling Defendants shall implement the Access Control Plan for OU 2 in accord with the requirements of the Consent Decree and the O&M Plan as approved by EPA. The appropriate notices have been recorded in Carbon County, Pennsylvania by the Settling Defendants and the plans are being implemented as discussed below.

The Cinder Bank primary access points have been secured with gates, cables, or berms to prevent unauthorized access. Additionally, signs have been installed and are maintained to warn trespassers. Inspections are conducted four times each year (i.e., April, June, September, and November). During each inspection, observations are made regarding the conditions of the ancillary components. Damaged control barriers or signs are repaired or replaced, as necessary. Long-term O&M of the areas with elevated surface temperatures includes the monitoring and revegetating scenario described above.

OU 3 – Community Soils

Remedial Action Objectives/Remedy Selection

OU 3 consists of remediation of residential soils and interior house dust exhibiting elevated concentrations of lead resulting from historical zinc processing operations. (See Figure 13 for an illustration of the eligibility boundary from the 2001 ROD.) In September 1985, EPA entered into an AOC with HII, and its division, The New Jersey Zinc Company, the owner/operator of the Site at that time, and G&W, a former owner/operator of the Site. Under the terms of that agreement, G&W agreed to conduct an RI/FS for OU 3. A draft RI and risk assessment were completed in 1988 and revised in 1994. EPA subsequently took over the RI/FS and risk assessment for OU 3.

In February 1991, the Pennsylvania Department of Environmental Resources, now known as PADEP, sampled dust in two Palmerton residences. The results of these samples indicated elevated levels of lead, cadmium, and zinc. At the request of PADEP, EPA conducted sampling in an additional 24 Palmerton residences. Identified constituent concentrations were similar to those identified by PADEP. EPA amended the AOC with HII after HII agreed to perform an interior cleanup of the homes. HII completed the interior cleanup in spring 1992. EPA also issued a UAO to Paramount Communications Inc. (successor to G&W) to conduct a study to identify the possibility of additional impacted residences. The activities required by EPA were completed; however, EPA was not satisfied that the activities completely delineated the areas of environmental impact due to the limited number of participating residents.

In October 1991, EPA conducted a comprehensive environmental sampling program in Palmerton in conjunction with the Agency for Toxic Substances and Disease Registry (ATSDR). Based on the sampling results and the receptor population, EPA performed an interim removal action between April 1994 and 1997. Interior cleaning (High-Efficiency Particulate Air [HEPA] vacuuming and carpet removal and replacement) and/or exterior remediation (excavation of the top 2 inches of soil and tilling in of agricultural amendments or topsoil) were performed at 202 residences.

EPA conducted a Baseline Risk Assessment (BRA) for OU 3 to determine the long-term risk, if any, associated with the elevated levels of metals in the community. The BRA was used to prepare the final FS. The FS, which evaluated remedial alternatives to address the risks identified in the BRA, was completed in June 2000. EPA issued the ROD for OU 3 on October 9, 2001, to address the risks identified in the BRA. The ROD described two possible remedies, a Selected Remedy and Contingent Remedy. In a letter dated May 22, 2003, Viacom informed EPA that it would be implementing the ROD's Contingent Remedy (combined Alternatives 5A/3A).

The remedy implemented included the following components: soliciting property owners for participation in the RA through letters, fact sheets, local media outlets, and personal contacts; eligibility composite soil sampling for lead at participating properties; exterior soil remediation, potentially including tilling-in topsoil or amendments, and/or excavation and proper disposal of the excavated soil; meeting a performance standard of 650 ppm for lead for non-play area soil (based on composite sampling); sampling and cleanup, if needed, of play areas to a performance

standard of 400 ppm lead in the soil (based on composite sampling); post-remediation soil sampling to demonstrate cleanup with results reported to the property owner; establishing institutional controls to notify potential buyers of a property where sampling indicates eligibility for cleanup, but the owner declined to have the cleanup performed; dust sampling for lead in RA-eligible residential structures; vacuuming and cleaning of residential interiors where interior dust samples contain over 650 ppm lead; clearance sampling of cleaned interiors with results reported to the property owner.

Remedy Implementation

RA activities are summarized below. Additional detail regarding the RA avtivities implemented at OU 3 can be found in the Third Five Year Review Report and the December 28, 2005 OU3 Remedial Action Report.

Exterior Soil

Contact with property owners was confirmed for 98% of the 2,410 properties eligible for RD sampling. Of the contacted property owners, 1,701 agreed to exterior soil sampling. RD sampling results identified 190 properties with lead concentrations greater than the ROD cleanup criterion. Of these 190 properties, 184 were included in the exterior soil RA; six property owners declined to participate.

Remediated areas were typically restored to original elevations and grades and prepared for seeding. Seeding was conducted using a permanent seed mix and mulch was applied to seeded areas. Erosion and sedimentation controls were established where needed.

Post-remediation soil sampling activities confirmed that all 184 participating properties were successfully remediated.

Interior Dust

The 184 properties participating in the exterior soil RA were eligible for interior dust sampling, provided a residential living unit was present on the property. Permission was received to sample 102 residences. Samples from 20 residences identified lead concentrations greater than the 650 ppm criterion. However, upon additional confirmation sampling, three residences no longer required indoor dust cleaning and three property owners declined to participate. In total, 14 residences were included in the indoor dust RA.

Clearance wipe samples were collected upon completion of interior dust cleaning. Seven residences required no further action because clearance wipe samples did not identify lead at a concentration greater than the cleanup criterion. Seven residences were re-cleaned and post-cleaning samples indicated that RA activities at two additional residences were successful. For the remaining five residences, a request was submitted on behalf of Viacom (now CBS) to EPA for waiver of the criterion based on the presence of non-OU 3 sources of lead (e.g., lead paint). EPA approved this request and sent letters to the affected property owners describing the presence of non-OU 3 sources of lead in their residences. No further action related to the interiors of these residences is required by the OU 3 ROD.

OU 3 - Institutional Controls

The October 9, 2001 ROD required that every property owner in the OU 3 area (Figure 13) be contacted to determine their interest in participating in eligibility sampling and that the contact should be verified. The ROD also stated that the sampling participation solicitation would be for a limited duration after which the responsibility for any future remedial actions taken to address lead at a residence would be the individual property owner's responsibility. EPA and the Settling Defendants shared an OU3 project office on the primary business street in Palmerton (Delaware Avenue) during the entire sampling participation solicitation process (Sept. 2002 through Sept. 2004). The office was manned during normal business hours 5 days a week to provide a place for residents to have questions answered and drop off access agreements. EPA and the Settling Defendants also held numerous informational sessions in Palmerton during the day and in the evenings while the sampling participation solicitation period was on going.

The October 9, 2001 ROD also contained a requirement that a notification mechanism to protect future residential buyers of homes found to have soil lead levels above 650 ppm but not remediated be implemented. However, shortly after the ROD was issued, the Real Estate Seller Disclosure Law (Pa. C.S.A. §§ 7301 – 7315) became effective in Pennsylvania. This law provides that sellers of residential property must disclose any material defects with the property known to the seller prior to the signing of an agreement of sale with respect to the property. Material defects are defined to specifically include the presence of hazardous substances on the property. The Real Estate Seller Disclosure Law also places an affirmative duty on the agent representing the seller to advise the seller of his responsibilities under the law and to provide the seller with a copy of the disclosure form required by the law. A seller who does not disclose a material defect, such as the presence of hazardous substances on the property, is liable for the actual damages suffered by the buyer as a result of that failure. Therefore, EPA has determined that no further action regarding implementation of institutional controls in connection with OU 3 is required. Periodically, realtors in the Borough of Palmerton and Lower Towamensing Township contact the EPA RPM to request information regarding the clean-up status of property in the area. As discussed below a Site-wide Institutional Controls Plan will be a required component of the remedial alternatives to be evaluated in the OU 4 feasibility study. The design and implementation of a Site-wide Institutional Controls Plan will include a discussion of the Real Estate Seller Disclosure Law relating to OU 3 ICs.

OU 4 – Area-Wide Ground Water, Surface Water and Site-Wide Ecological Risk Assessment

OU 4 includes an area-wide investigation of groundwater and surface water (including a human health risk assessment) and site-wide ecological risk assessment. OU 4 also includes erosion control and revegetation of more than 100 acres of land on Stoney Ridge, and the consolidation and covering of EFCM at Stoney Ridge Materials and most recently installation of a permeable reactive cell to treat shallow groundwater in the East End Cinder Bank Remedial Interim Measures.

OU4 RI/FS Background

Activities prior to September 2007 are summarized in more detail in the Second Five Year Review and Third Five Year Review Report. However a brief background is provided below.

EPA sent Special Notice letters to the Site PRPs in December 1995, offering them the opportunity to perform the RI/FS for OU4. The PRPs declined and EPA determined to use Superfund money to perform the RI/FS instead of issuing a UAO for performance of the work. In consideration of continuing community concerns regarding the possibility of cross contamination of the public water supply, during installation of deep monitoring wells through the known shallow aquifer contamination into the deep aquifer, which provides water for the Public Water Supply, EPA decided to conduct the RI in stages. The first stage involved the evaluation of all existing ground water data including years of routine monitoring of east plant RCRA wells. Additional existing on-site monitoring wells and four residential wells near the east plant were also sampled. As a result of this evaluation, which was presented to the public in April, 1999, EPA determined that no new deep monitoring wells would be necessary to complete the RI/FS for OU4 at that time. However, during subsequent technical review of the draft RI it was determined that the existing data evaluation and supplemental sampling was not sufficient to satisfactorily determine the nature and extent of metals contamination in the deep aquifer and that additional data from the deep aquifer was necessary to complete the conceptual site model for ground water. During this same time period (2001), EPA did complete the field work and evaluation of data for a Site-wide ecological risk assessment (ERA), which was the first in the country under the new EPA eco-risk assessment guidance.

Following lengthy discussions with the Site PRPs on both the findings of the 2001ERA, as well as the deficiencies of the deep aquifer CSM, EPA issued a UAO to Viacom, TCI, HH Liquidating Corp. (formerly HII), and HRD Liquidating Corp (formerly HRDC) on September 30, 2005 for performance of an RI/FS, an ecological risk assessment update, and interim measures at Stoney Ridge and Stoney Ridge Materials.

The work required by the September 30, 2005 UAO for OU 4 includes:

- RI/FS
  - area-wide investigation of groundwater and surface water
  - human health risk assessment

- Ecological risk assessment update
- Stoney Ridge erosion controls
- Stoney Ridge revegetation
- Stoney Ridge Materials consolidation and revegetation

The draft RI/FS to be submitted by contractors for CBS in September, 2012, is intended to incorporate all the existing historical ground water monitoring data, along with data from shallow wells in the east plant area and the east end of the Cinder Bank which were installed in 2005 and 2006, the hydraulic testing and quarterly water quality sampling of the Public Water Supply wells, and the more recent deep bedrock aquifer investigation. It will also include the existing surface water and sediment data, the spring and seep data, data generated by CBS and the Natural Resource Trustees Council during the damage assessment and the 2001 EPA ecological risk assessment findings, as well as an updated human health risk assessment. The draft RI/FS will be reviewed by the response agencies. It is planned that a ROD for OU4 will be completed in 2013 and will be the final ROD for the Site.

Progress under the UAO

As described in greater detail in the Third Five Year Review Report, contractors on behalf of CBS have completed much of the work required by the 2005 UAO, including an investigation of the wetlands soils, ground water and surface water in the area of the East End of the Cinder Bank and installation of 15 shallow ground water wells in the east plant area to supplement the existing RCRA wells.

Additionally as required by the UAO, interim remedial measures at the Stoney Ridge Materials area were implemented by contractors for CBS in fall 2005 through spring 2007 to consolidate, grade, cover, and revegetate a large pile of EFCM, which extended into Aquashicola Creek. This pile was the result of a historic process at the east plant conducted in the 1970's. (Photo Attachment, Page 8)

Other interim remedial measures required by the UAO for Stoney Ridge Erosion and Revegetation were implemented by contractors on behalf of CBS in August and October 2005. This work addressed areas on Stoney Ridge that were impacted by aerial deposition of constituents from historical smelting operations. Reduced vegetation in these areas resulted in increased erosion and sediment transport onto local roads and streams during rain events. The work included installation of erosion control measures (e.g., rock check dams and sedimentation basins) and revegetating impacted areas of Stoney Ridge.

CBS continues to conduct quarterly inspections of the Stoney Ridge Materials, and Stoney Ridge Erosion areas vegetative cover and erosion control measures. While occasional minor maintenance is necessary, overall the erosion control measures and revegetation have been very successful.

However, ongoing operations of Horsehead Corp. at the east plant generate a material known as "iron rich material" (IRM) which is stockpiled in the Stoney Ridge Materials area adjacent to the EFCM covered pile discussed above. The IRM is sold for various approved uses. The IRM does contains the same heavy metals being addressed by Superfund actions under the various remedial activities. The stock piles fluctuate in size and volume depending on economic conditions. In recent years the IRM stock piles have grown very large and are actually larger than the EFCM pile, potentially raising concern with erosion and/or trespassing (Photo Attachment, Page 8). The Stoney Ridge Material property was abandoned as part of the HII, HRDC, and ZCA bankruptcy proceedings, which also raises concerns regarding ultimate responsibility for the piles.

Since the third Five year review the following significant progress has been made toward completion of the OU4 RI/FS and addressing an area of immediate concern indentified during Site investigations of an area of contaminated shallow ground water discharge to Aquashicola Creek in the east end cinder bank area. The progress discussed below includes spring and seep sampling along Blue Mountain, deep aquifer investigations, and implementation of a remedial interim measure to address contaminated shallow ground water discharge to Aquashicola Creek.

Spring and Seep Sampling

In October 2007 and May 2008, ARCADIS, on behalf of CBS conducted spring and seep sampling in accordance with a work plan approved by EPA, in consultation with PADEP, on

September 19, 2007. The sampling was conducted under an October 5, 2007 NPS-issued Special Use Authorization (SUA) and with permission from the Pennsylvania Game Commission (PAGC) and the LGNC.

Samples were collected from springs and seeps on Blue Mountain, including along the Appalachian Trail (AT), spring/seeps along PAGC trails on State Game Lands (SGLs), and ponds on Nature Center property. Background (i.e., reference) locations were also sampled. Water samples were analyzed for target analyte list (TAL) metals, alkalinity, nitrate and total hardness. Water samples collected along the AT were also analyzed for dissolved TAL metals. Field measurements of physicochemical water quality parameters (water quality) and flow were also recorded. Twenty- four (24) total locations were proposed for sampling, 19 locations were sampled in October 2007, and 23 locations were sampled in May 2008. Figure 14 provides a general sample location map, however more detailed sampling maps for all the sample locations can be found in the September 2008, Arcadis, Spring/Seep Water Sampling Report. The locations not sampled during each event were dry at the time of attempted sampling.

Many of the spring and seep sampling locations likely do not support an aquatic community; however, they will be further evaluated during the OU 4 RI/FS and ROD planned for 2013.

Deep Bedrock Aquifer Investigations

A major part of the remedial investigation under the UAO is to better define the water quality and conceptual site model of the deep aquifer and any interaction between the shallow and deep aquifer. As a way to attempt to generate data to resolve this issue and recognize the community concerns regardin installation of deep wells, in Fall 2007, EPA requested that CBS perform quarterly water quality sampling of the deep water supply wells operated by the Palmerton Borough Water Authority at the Site. To achieve that objective, CBS prepared the Palmerton OU-4 Deep Well Sampling Work Plan. During the agency review period of this plan, CBS proposed that hydraulic testing of the deep water supply wells be conducted at the same time as the deep well sampling, thereby obtaining coincident hydrological and geochemical information on the bedrock aquifer that supplies water to the Borough of Palmerton. This modification was submitted on March 6, 2008, as the Palmerton OU-4 Deep Well Sampling and Hydraulic Testing Work Plan. This additional hydraulic test plan could not be implemented as a result of the inability of CBS and the Borough Water Authority to reach a satisfactory access and indemnity agreement.

To overcome the concerns of the Borough of Palmerton about the possibility that the work in the original deep well testing plan would damage the water supply well system, CBS submitted another work plan entitled Palmerton OU-4 Deep Well Sampling and Hydraulic Testing Work Plan. Upon review of this work plan, EPA requested that the sampling and testing portions be separated.

Accordingly, the Palmerton OU-4 Revised Deep Well Sampling and Hydraulic Testing Work Plan was prepared. The plan separated the quarterly water quality sampling and the proposed hydraulic testing. The hydraulic testing work was simplified from the original proposal for testing to eliminate any need to modify, control, operate, sample, or directly measure any of the Borough of Palmerton water supply wells, and incorporated changes made in response to comments received from the PADEP. The investigation described by the approved work plan

was performed in 2009-10, and resulted in a report entitled Palmerton OU-4 Deep Well Sampling and Hydraulic Testing Report, submitted in June 2010.

The eight quarters of water quality sampling of the public water supply wells was completed from October, 2009 through July, 2011. Samples were collected from each of the five municipal supply wells (Well A, Well 4, Well 5, Well 6, and the Foundry Well) and were analyzed for the following contaminants: lead, zinc, cadmium, selenium, copper, manganese, arsenic, iron, silver, thallium, vanadium, sulfates, total suspended solids, chlorides, phosphates, alkalinity, calcium, magnesium, nitrates, nitrites, tetrachloroethylene, trichloroethylene, cis/trans-1,2-dichloroethylene, 1,1-dichloroethylene, and vinyl chloride.

The analytical results from the eight quarters of sampling of the Municipal Water Supply wells will be incorporated into the draft RI/FS being prepared by contractors for CBS to be delivered to EPA in September 2012.

After detailed review of the resulting report of the hydraulic testing, EPA in consultation with PADEP, found that the report did not fully complete the conceptual site model to an extent that would allowed for finalization of the deep ground water portion of the RI/FS, and, in May 2011, requested additional work to define the bedrock aquifer groundwater system. To be responsive to these concerns and to address those additional testing activities considered by EPA to be necessary to complete the statutorily required evaluation of the deep bedrock groundwater and geochemical system at the Site, a work plan entitled Palmerton OU-4 Deep Bedrock Aquifer Additional Investigation Work Plan was prepared and submitted on June 14, 2011.

The work plan was reviewed and commented upon by EPA and PADEP, and the Palmerton OU-4 Deep Bedrock Aquifer Additional Investigation Final Work Plan was approved on December 2, 2011.

A total of six existing bedrock wells were tested in the additional Deep Aquifer Investigation. Waterbearing fractures zones were identified from downhole logging for water quality analysis. Three of the six wells were drilled as part of the municipal water supply system, but were not in service at the time of sampling, or had never been put into service. The logging methods used were (where feasible): Video Log; Optical Televiewer; Heat Pulse Flowmeter; Gamma Ray; Caliper; Resistivity; and Temperature. A total transmissivity test was conducted for each of the six wells. During the total transmissivity test, a water quality sample was taken. Packer testing of selected zones in each borehole was conducted.

General conclusions of the deep aquifer investigation which will be incorporated into the draft RI being prepared by contractors for CBS for submittal in September 2012 seem to confirm the conceptual model of bedrock flow for the Palmerton area, which is generally that precipitation infiltrates into bedrock on the mountainsides, flows down the mountain flanks to the Aquashicola valley, and then flows upward in the bedrock to discharge in the Aquashicola Creek alluvium or its alluvial valley fill. This flow regime seems to protect the water supply wells in bedrock from significant impact by elevated metal concentrations in the valley alluvium.

Remedial Interim Measure (RIM) IRM Treatment Cell East End Cinder Bank Shallow Groundwater

As discussed in more detail in the Third Five Year Review Report, three MRZs were installed as part of the Pollution Reduction Technologies (PRT) project. The MRZs are designed to remove dissolved metals from water emanating from the Cinder Bank. Construction of the three MRZs (MRZ #1 and MRZ #2 are located at the east end of the Cinder Bank and MRZ #3 is located at the west end) was completed in 2001 (Figure 12).

The MRZs have operated as designed since 2001. However, water quality data collected from the Aquashicola Creek in the east end cinder bank area as part of OU4 investigations under the UAO since then indicated that although the total zinc loading of the creek had decreased significantly, a significant source of zinc bearing water continued to reach the creek. Therefore, CBS performed an initial ground water investigation down gradient of the east end of the Cinder Bank in the area of MRZ #1 and MRZ #2. The investigation was performed between July 2005 and February 2006 and consisted of 1) soil investigation to characterize the chemical and physical properties of soils in the vicinity of any proposed RIM in the east end cinder bank area; 2) geologic investigation to determine the depth and conditions of unconsolidated materials at the east end of the Cinder Bank; 3) groundwater investigation to determine groundwater quality, geochemistry, and hydraulics; and 4) surface water flow and quality. The results of the investigation through September 2005 were presented in *Palmerton OU-4 Interim Remedial Measures Investigation Report*. The information developed by this work was used to develop a RIM proposal to address an area of significant shallow ground water contaminant discharge to Aquashicola Creek which was presented in the *Palmerton OU-4 Interim Remedial Measures Design Plan.*

Following review of the Interim Remedial Measures Design Plan, USEPA and PADEP requested additional investigation to confirm the assumptions in the RIM proposal. The additional work was described in the *Palmerton OU-4 Interim Measures Investigation Work plan*. This supplemental investigation was implemented in November and December 2006, and consisted of additional evaluation of the area between the east end of the Cinder Bank and the Aquashicola Creek, additional groundwater investigation, updated characterization of the movement of metals in groundwater, and an updated RIM proposal by CBS to more immediately control the release of metals. The results of the investigation were presented in the *Palmerton OU-4 East Cinder Bank Interim Remedial Measures report*.

The RIM that was ultimately constructed includes placement of IRM in a cell excavated in the valley alluvium, located so that metal-containing groundwater flowing under the Cinder Bank will pass through the IRM and be treated before discharging to Aquashicola Creek. A summary of the RIM is provided below. Figure 15 provides an overview of the components of the RIM.

The RIM construction activities included the dewatering and excavation of alluvium material, excavation of wetland soils, construction of water management and filtration systems, relocation and stabilization of excavated soils, backfill with IRM material, and restoration of all affected work areas. The remediation of wetland soils and implementation of the IRM treatment cell was initiated in accordance with the *Implementation Plan* approved by EPA, in consultation with PADEP, on June 9, 2011.

Dewatering of the IRM treatment cell was accomplished via the installation of a pumping well network installed on the perimeter of the excavation area which consisted of 16 wells. The original dewatering system was supplemented with four additional high-capacity dewatering wells (one on each side of the excavation) equipped with 200-300 GPM pumps after it was determined that the initial 16 dewatering well capacity would not lower the water table sufficiently.

Two IRM sediment control pads were installed northwest of the IRM treatment cell. Inside the berm area of the pads, sedimentation filter bags were connected to the cell dewatering system discharge. Water discharged from the IRM pads was allowed to flow into the floodplain area. A rock filter outlet was placed in a drainage way entering the Aquashicola Creek at the bank as an additional erosion control measure.

Wetland soils were removed to a depth of 1 foot below ground surface and moved to the Pre-Treatment area of the Cinder Bank (Figure 15). Temporary access roads were constructed using a combination of IRM material and swamp mats to accomplish the wetland soil removal. Existing stands of phragmites in the wetland area were treated with a herbicide in an attempt to prevent regrowth.

To better inform the final wetland restoration grading and planting, nine test plots were established in the excavated wetlands area. The purpose of the test plots program is to evaluate the soil amendments and planting/seeding performance in advance of the full-scale wetland restoration to be implemented in fall 2012 and spring 2013 under the approved RIM Implementation Plan. The planting/seeding performance in each test plot will be assessed through one full growing season. Following the review of test plot performance, the final wetland design for construction will be prepared. Several photos of the test plots can be found on page 9 of the Photo Attachment.

Excavation of the RIM treatment cell was initiated following the wetlands soil removal activities on July 18, 2011. Approximately 4,300 cubic yards (1.5 foot cut) of topsoil material was excavated first and relocated to the topsoil stockpile area located immediately east of the cell. Following removal of the topsoil, the colluvium soils were excavated for placement over the Pre-Treatment area. During excavation of the cell, approximately 6,800 cubic yards of this material was stockpiled near the excavation for re-incorporation into the final 3.5-foot cap prior to placement of topsoil after the cell was constructed. This material was staged adjacent to the topsoil stockpile area (Figure 15).

Excavation of the IRM cell was completed in two stages. The first stage of the excavation involved the removal of the top 10-15 feet of colluvium down to an elevation of approximately 407 feet AMSL.

During completion of the initial 10-15 foot excavation (i.e., bench), several heavy precipitation events (including a hurricane and tropical storm) caused the Aquashicola Creek to flood over its banks and inundate the IRM cell excavation (Photo Attachment, page 10). As described above, modifications to the dewatering system were installed to assist in the additional dewatering required to complete the cell excavation.

The remaining colluviums/alluvium material was excavated to full depth in strips (sub-cells). As the sub-cells were excavated, in sections proceeding south to north, the sub-cells were immediately backfilled with IRM (Photo Attachment, page 11).

Approximately 26,000 cubic yards of soil were excavated and relocated to the Pre-Treatment area. IRM was back dumped at the edge of the southern face of the excavation and gradually worked down into the cell using a dozer and tracked excavator (Photo Attachment, page 12)

Following IRM placement, the entire cell was covered with a 6 oz. geotextile fabric. IRM recovered from the sedimentation dewatering pads was transferred and placed on top of the geotextile creating a 6-inch layer of IRM. The reserved 6,800 cubic yards of soil was then placed over the cell to form a 3.5-foot thick cap layer. Following placement of the 3.5-foot soil cap, the stockpiled topsoil was placed and graded out to complete the IRM cell cover layer (Photo Attachment, page 13).

The RIM monitoring program consisted of a baseline sampling event conducted prior to implementation of intrusive construction activities to establish baseline water quality conditions. The baseline sampling event included the existing ground water monitoring wells in the east end cinder bank area and surface water in Aquishicola creek. During the RIM construction, monitoring was conducted to assess any significant changes in water quality resulting from field activities. Monthly groundwater and weekly surface water monitoring was conducted and reported to the Agencies via the weekly construction progress reports. In addition, a post-construction groundwater and surface water monitoring event was completed one month following completion of the IRM treatment cell. Post-construction monitoring of surface water and ground water at the East Cinder Bank area will be conducted on a quarterly basis for one year and will include the initial wells of the baseline event along with selected dewatering wells and two wells installed in the cell itself. The data collected will be used in preparation of the ongoing OU4 RI/FS and will be evaluated to determine if the IRM cell is effective in reducing overall zinc loading of the Aquashicola Creek in the east end area of the Cinder Bank.

OU 4 – Institutional Controls

A Site-wide Institutional Controls Plan will be required a component of the remedial alternatives to be evaluated in the OU 4 feasibility study. The design and implementation of a Site-wide Institutional Controls Plan will be part of any remedy selected for OU 4.

V. Progress Since Last Five-Year Review

The following protectiveness statements were made in the September 28, 2007 Third Five Year Review for the Site:

Operable Unit 1 - Blue Mountain: The remedy is expected to be protective of human health. The final protectiveness determination with regard to ecological risks will be made upon completion of the updated site-wide ERA included in OU4.

Operable Unit 2 - Cinder Bank: The remedy has been completed and is protective of human health and the environment in the short term, however, follow-up action concerning the burning area of the Cinder Bank and continued access control evaluation is needed to insure long term protectiveness.

Operable Unit 3 - Community Soils: The remedy has been completed and is protective of human health and the environment.

Operable Unit 4 - Area-Wide Groundwater, Surface and Site-Wide Ecological Risk Assessment: A protectiveness determination cannot be made at this time until further information is obtained. Further information will continue to be obtained during the Remedial Investigation/Feasibility Study (RI/FS), currently underway. It is expected that the RI/FS will be completed by 2009, at which time a protectiveness determination will be made. It should be noted that exposure to groundwater is minimal since most of the potentially affected area is connected to a public water supply. The few nearby residential wells have been sampled and do not exhibit contaminants that can be currently attributed to on-site groundwater. As the EPA ERA (2001) identified unacceptable aquatic and terrestrial ecological risk, the updated ERA will need to demonstrate that remedial actions have reduced the risk to acceptable levels that are protective of ecological receptors.

There were five issues raised in the September 2007 Third Five Year Review. #1) The remaining denuded acreage of Blue Mountain needs to be revegetated; #2) Translocation of contaminants re: long term survivability; #3) Continue O&M of and control access of the Cinder Bank. Address long term O&M, i.e. revegetation of burning areas; #4) Institutional controls need to be established on properties within OU1 not owned by responsible parties; and #5) Complete the OU4 RI/FS and risk assessments and select a remedy for OU4. Significant progress toward addressing the issues raised in the Third Five Year Review is discussed below.

As described in the OU1 remedy implementation section above over 1,200 acres have been revegetated on Blue Mountain since 2007. With the aerial application completed in 2012, initial revegetation efforts of denuded acreage on Blue Mountain are essentially complete. Additionally, two of a planned four resource islands, meant to establish seed sources for trees and shrubs have been installed on top of the mountain. A total of 8,800 trees including 2,300 blight resistant hybrid American Chestnut were planted in the initial two resource islands. Construction of the remaining two resource islands is planned for completion in spring 2013. Also, implementation of an invasive plant management plan to minimize the establishment of invasive plants in the revegetated areas has been implemented.

Although translocation of contaminants via plant uptake and potential plant die off is a continuing concern, there is no indication that any of the revegetated areas are currently suffering from significant die off. The Ecoloam area revegetation was completed over 16 years ago and there are no signs of significant plant die off in that area. Additionally, empirical data regarding translocation of contaminants will be collected as part of long term monitoring that will be established in the OU4 Record of Decision planned for 2013.

Additional access controls, namely additional signage, were established for the burning area of the Cinder Bank as described above in the OU2 remedy implementation section. Also, multiple aerial infrared surveys were conducted of the burning area to establish a baseline to judge the area of increased surface temperature again in the future. Air monitoring was also conducted around the perimeter of the burning area, which showed no signs of increased air contaminants.

A Site-wide Institutional Controls Plan has been required as a component of any remedial alternative to be evaluated in the OU 4 feasibility study being prepared by contractors for CBS.

The draft RI/FS for OU 4 is to be submitted to EPA in September, 2012. The design and implementation of a Site-wide Institutional Controls Plan will be part of any remedy selected for OU 4.

Access issues relating to the installation of deep monitoring wells in the Borough of Palmerton due to fears of cross contamination of the Borough public water supply, as well as access and indemnification issues relating to hydraulic testing of the Borough public water supply have delayed the completion of the conceptual site model for ground water. However, as described in the OU4 section above, significant progress has recently been made toward completion of the ground water investigation, including the deep aquifer. Additionally, construction of the east end Cinder Bank remedial interim measure was completed in November 2011 and is meant to significantly reduce the zinc loading of Aquashicola Creek due to contaminated shallow ground water discharge, as well as provide a five acre area of constructed wetlands below that area of the Cinder Bank.

While none of the issues raised in the Third Five Year Review Report have been completely addressed, significant progress has been made and with the work planned in the near future on OU 1 and the impending selection of a remedy for OU 4 in 2013, any remaining issues should be addressed.

VI. Five-Year Review Process

Administrative Components

The Five-Year Review for the Palmerton Zinc Pile Superfund Site was conducted by Charlie Root, EPA Remedial Project Manager, and supported by the EPA technical review team members including Bruce Pluta, EPA Biological Technical Assistance Group (BTAG) Coordinator, and Dawn Ioven, Senior Toxicologist. Jim Kunkle, PADEP, also provided input into the Five Year Review.

Community Involvement

The EPA RPM, Charlie Root, notified and discussed the Five Year Review with interested community members including the Palmerton Borough Manager, Rodger Danielson, and Dan Kunkle, Executive Director, Lehigh Gap Wildlife Refuge, on several occasion during the past year. An ad announcing the preparation of this Five Year Review was placed in the local paper, The Lehighton Times News, on July 23, 2012. No comments or inquiries have been received in response to the ad.

Document Review

The Five-Year Review process included the review of a number of relevant documents including:

2007 and 2011 Vegetation Assessment Reports
Spring and Seep Sampling Work Plan, September 19, 2007
Palmerton OU-4 Deep Well Sampling Work Plan (ABC, 2007)
Palmerton Public Water Supply Quarterly Sampling Reports; October, 2009 – July, 2011.

Palmerton OU-4 Deep Well Sampling and Hydraulic Testing Work Plan (ABC, 2008a)
Palmerton OU-4 Revised Deep Well Sampling and Hydraulic Testing Work Plan (ABC, 2008a)
2008 Aerial Application Report (ARCADIS, 2008)
Palmerton OU-4 Deep Well Sampling and Hydraulic Testing Report, submitted in June 2010
East End Cinder Bank RIM Implementation Plan, June 9, 2011
2011 GA-2 Performance Monitoring Report
Final Invasive Plant Management Plan for GA- 2, September 2011
Revised Geographical Area 2 2011 Aerial Application Work Plan (ARCADIS, 2011)
Palmerton OU-4 Deep Bedrock Aquifer Additional Investigation Final Work Plan, December 2, 2011
Palmerton OU-4 RIM Construction Report, January 2012
March 13, 2012, Aerial Application Work Plan
GA-2 Test Plot Summary Report and 2012 Resource Island Plan

Data Review

A data review was conducted of the spring and seep sampling, 2007 and 2011 aerial infrared imaging for total vegetation cover of OU1 and the aerial infrared imaging for the burning area of the Cinder Bank. Additionally, the deep aquifer water quality sampling, the eight quarters of water quality sampling of the Palmerton Municipal Water Supply Wells and the background and post construction monitoring well and surface water sampling associated with the east end Cinder Bank IRM cell were reviewed. The review was conducted by the Site RPM, Charlie Root and the EPA Site Hydrogeologist, Mark Leipert.

Site Inspection

EPA conducted Site Inspections of OU 2 (Cinder Bank) and the Stoney Ridge and Stoney Ridge Materials and East End Cinder Bank Remedial Interim Measures portions of OU 4 on June 29, 2012. The Five Year Review Inspection for OU 1 (Blue Mountain) was conducted on June 1, 2012. Participating in the June 29, 2012 inspection were Charlie Root, EPA RPM, Jim Kunkle, PADEP, Russ Cepko, CBS Operations, Inc., and Nick Scala, Environ. Participating in the June 1, 2012, inspection were Charlie Root, EPA RPM and Jim Kunkle, PADEP. During each Site inspection notes were kept regarding minor conditions warranting follow-up by CBS. However no major deficiencies were found. Photos from the inspections can be found on page 14 of the Photo Attachment.

Field conditions of the areas revegetated above the East Plant on Blue Mountain as part of OU 1 via Ecoloam application confirm the continued successful establishment of vegetation. The June 1, 2012 Site inspection indicated the successful establishment of warm season grasses along with the increasing establishment of volunteer birch species on Blue Mountain on the Lehigh Gap Nature Center property. The OU 2 inspection indicated that the remedy continues to operate as intended and that the revegetation efforts on the Cinder Bank continue to be successful. The 90 acres on Stoney Ridge revegetated with warm season grasses as part of erosion control measures continues to maintain vegetation and effectively provide erosion control. The grading and revegetation performed on the Stoney Ridge Materials consolidated slag pile also continues to provide effective cover and erosion control.

VII. Technical Assessment

A. Is the remedy functioning as intended by the decision documents?

Site Wide construction completion has not been achieved to date. The operable units where remedial action has been completed, the Cinder Bank and Community Soils (OU 2 and OU 3) appear to be functioning as intended by the decision documents. Ongoing inspections of the cinder bank under the OU2 O&M plan continue to assess the status of burning area and the effectiveness of access controls. OU 1 revegetation is nearly complete on Blue Mountain with the exception of installation of two additional resource islands scheduled for early spring 2013. Translocation of contaminants via plant uptake needs to continue to be evaluated in connection with long term plant survivability and ecological risk. The RI/FS for OU 4 is planned to be completed and a remedy selected in 2013 which will include a site wide institutional controls implementation plan.

B. Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

Yes, however, translocation of contaminants may be occurring through plant uptake in the revegetated acreage of Blue Mountain (OU 1). Continued sampling and evaluation needs to be conducted to determine if translocation of contaminants is affecting long term survivability of vegetation and ecological risk.

C. Has any other information come to light that could call into question the protectiveness of the remedy?

No.

Technical Assessment Summary:

The revegetation efforts implemented on Blue Mountain (OU 1), the Cinder Bank (OU 2) and Stony Ridge (OU 4) will need to continue to be monitored to ensure the vegetation's long-term survivability. Accordingly, appropriate O&M, including long term monitoring, will need to be implemented for OU 1 and continued for OU 2, including ongoing assessment of the burning area. The remedies selected for Community Soils (OU 3) and the Cinder Bank (OU 2) have been implemented and are functioning as intended by the decision documents. The remedy for Site Wide Groundwater, Surface Water and Site Wide Ecological Risk Assessment (OU 4) needs to be selected and implemented and should include a Site wide institutional controls implementation plan.

VIII. Issues

Table 5: Issues

Issues		Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
#1	Two Resource Islands on Blue Mountain remain to be installed. (OU 1)	N	Y
#2	Question of translocation of contaminants re: long term survivability.	N	Y
#3	Long term O&M of and access control of Cinder Bank burning areas. (OU 2)	N	Y
#4	Need for Site wide institutional controls plan.	N	Y
#5	RI/FS remains to be completed and a remedy selected for OU 4.	Y	Y

IX. Recommendations and Follow-Up Actions

Table 6: Recommendations and Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
1.	Complete installation of Resource Islands on NPS property on Blue mountain	PRPs	EPA	June 2013	N	Y
2	Monitor and evaluate the completed portion of Blue Mountain for long-term vegetation survivability and translocation. (OU 1)	PRPs	EPA	March 2015	N	Y
3	Continue O&M of Cinder Bank (OU 2). Once areas of Cinder Bank stop burning, develop a plan to vegetate the areas.	PRPs	EPA	Ongoing	N	Y
4	Develop Institutional Controls Implementation Plan for the Site	PRPs	EPA	March 2015	N	Y
5	Upon completion of RI/FS and updated Risk Assessments, select a remedy for OU 4.	EPA/PADEP	EPA/PADEP	June 2013	Y	Y

X. Protectiveness Statement

Operable Unit 1 - Blue Mountain: The remedy is expected to be protective of human health upon completion. The final protectiveness determination with regard to ecological risks will be made following completion of the OU 1 remedy and evaluation of long term survivability and translocation of contaminants.

Operable Unit 2 - Cinder Bank: The remedy has been completed and is protective of human health and the environment in the short term; however, follow-up action concerning the burning area of the Cinder Bank is needed to insure long term protectiveness.

Operable Unit 3 - Community Soils: The remedy has been completed and is protective of human health and the environment.

Operable Unit 4 - Area-Wide Groundwater and Surface Water Investigation:

A remedy has yet to be selected for OU4 so a protectiveness determination cannot be made at this time. Further information will continue to be obtained during the Remedial Investigation/Feasibility Study (RI/FS), currently underway. It is expected that the RI/FS will be completed and a ROD issued in 2013.

XI. Next Review

The next Five-Year Review for the Palmerton Zinc Pile Superfund Site is to be completed within five years from the completion of this review in September 2017.

Tables

Table 7
Test Plot Planting Design

Palmerton, Carbon County, Pennsylvania

Common Name	Scientific Name	Field ID	Total (Per Acre)	Total (Test and Control Plot)	Nursery	Origin/Ecotype
Oaks (acorns)						
Chestnut	*Quercus prinus*	CA	40	80	PADCNR	PA
Oaks (bare roots)						
Chestnut	*Quercus prinus*	CH	40	80	Musser Forests	Indiana, PA
Black	*Quercus velutina*	BLK	40	80	Musser Forests	Indiana, PA
Blackjack / Post	*Quercus marilandica /Quercus stellata*	B/J	15	30	PADCNR	PA
Northern Red	*Quercus rubra*	RED	40	80	Musser Forests	Indiana, PA
Scrub	*Quercus ilicifolia*	SO	40	80	Pinelands	Burlington Co., NJ
White	*Quercus alba*	WH	40	80	Musser Forests	Indiana, PA
Oaks subtotal			*215*	*430*		
Oaks Total			**255**	**510**		
American chestnut (seeds)	*Castanea dentata*					
Pure American Chestnut seed		PURE or odd numbers	200	400	TACF	PA
2nd generation backcross		2nd or even numbers	200	400	TACF	PA
American chestnut subtotal			*400*	*800*		
Other Species (bare roots/seedlings)						
Black gum	*Nyssa sylvatica*	GUM	40	80	Octoraro	Southeastern PA
Chokecherry	*Prunus virginiana*	CK	40	80	Musser Forests	Sandwich, MA
Smooth sumac	*Rhus glabra*	SM	40	80	Musser Forests	Indiana, PA
Staghorn sumac	*Rhus typhina*	ST	40	80	Musser Forests	Indiana, PA
Other Species subtotal			*160*	*320*		
Grand Total			**815**	**1,630**		

Notes:

PADCNR = Pennsylvania Department of Conservation and Natural Resources

TACF = The American Chestnut Foundation

1. American chestnuts were planted on a 10-foot-diameter center. Other tree and shrub species were planted on a 5-foot-diameter center randomly intermixed between the American chestnuts.
2. Test and control plots were approximately 1 acre in size and surrounded by deer exclusion fencing.
3. Tree shelters were placed around all plantings.
4. Bare roots and seeds were planted in an auger drilled hole filled with a mixture of on-site soil and 1:1:1 peat:vermiculite:perlite.
5. Soil was collected from a similar on-site species for oaks and black gum and was added around bare root/acorn during planting to provide native rhizosphere microbial community conditions for these species. Commercial inoculum was used for American chestnut seeds and other bare root plantings.

Table 8
Test Plot Tree Survival

CBS Operations, Inc. - Palmerton Zinc Pile Superfund Site
Palmerton, Carbon County, Pennsylvania

Common Name	Scientific Name	Planted as	Number Observed		Live (seedling)				Total Live	
			Test Plot	Control Plot	Test Plot		Control Plot		(Test + Control Plot)	
					count	%	count	%	count	%
Oaks (acorns)										
Chestnut	*Quercus prinus*	acorn	37	40	0	0%	3	8%	3	4%
Oaks										
Chestnut	*Quercus prinus*	bare root	39	40	38	97%	34	85%	72	91%
Black	*Quercus velutina*	bare root	36	40	28	78%	40	100%	68	89%
Blackjack/Post	*Quercus marilandica / Quercus stellata*	bare root	10	13	8	80%	7	54%	15	65%
Northern Red	*Quercus rubra*	bare root	39	36	36	92%	28	78%	64	85%
Scrub	*Quercus ilicifolia*	seedling	39	38	38	97%	34	89%	72	94%
White	*Quercus alba*	bare root	40	40	40	100%	34	85%	74	93%
Oaks subtotal			203	207					365	89%
Oaks Total			**240**	**247**					**368**	**76%**
American chestnut	*Castanea dentata*									
2nd generation backcross		seed	196	183	95	48%	15	8%	110	29%
Pure American Chestnut seed		seed	188	181	93	49%	22	12%	115	31%
American Chestnut subtotal			384	364					225	30%
Other Species										
Black gum	*Nyssa sylvatica*	seedling	38	40	32	84%	39	98%	71	91%
Chokecherry	*Prunus virginiana*	bare root	40	40	36	90%	30	75%	66	83%
Smooth sumac	*Rhus glabra*	bare root	40	40	24	60%	31	78%	55	69%
Staghorn sumac	*Rhus typhina*	bare root	36	37	19	53%	30	81%	49	67%
Other Species subtotal			154	157					241	77%
Grand Total			**778**	**768**					**834**	**54%**

Notes:
% = percent

Figures


Figure 1 - Palmerton Location Map
Lehighton
209
443
Palmerton
895
Mountain Rd
N Walnut St
Slatington
Mountain View Dr
946
W Moorestown Rd
Moorestown Dr
Nazareth Dr
State Route 1011
Lehigh Dr
Pheasant Dr
Morocacy Dr
Nazareth
248
987
329
Daniels Rd
River View Dr
State Route 4022
State Route 4014
Nellis Laurys Rd
Memorial Rd
Park Ave
873
Nor Bath Blvd
Northampton
191
512
Brodhead Rd
33
Schnecksville
Mac Arthur Rd
Levans Rd
Catasauqua
Airport Rd
Mechanicsville Rd
Wertleys Corner Rd
State Route 4005
State Route 1007
Union Blvd
Bethlehem
Kernsville Rd
Lyon Valley Rd
476
Walbert Ave
N 15th St
Allentown
E 4th St
863
100
22
309
222
145
378
© 2012 Google
Google earth

Palmerton Zinc Superfund Site, Palmerton, PA

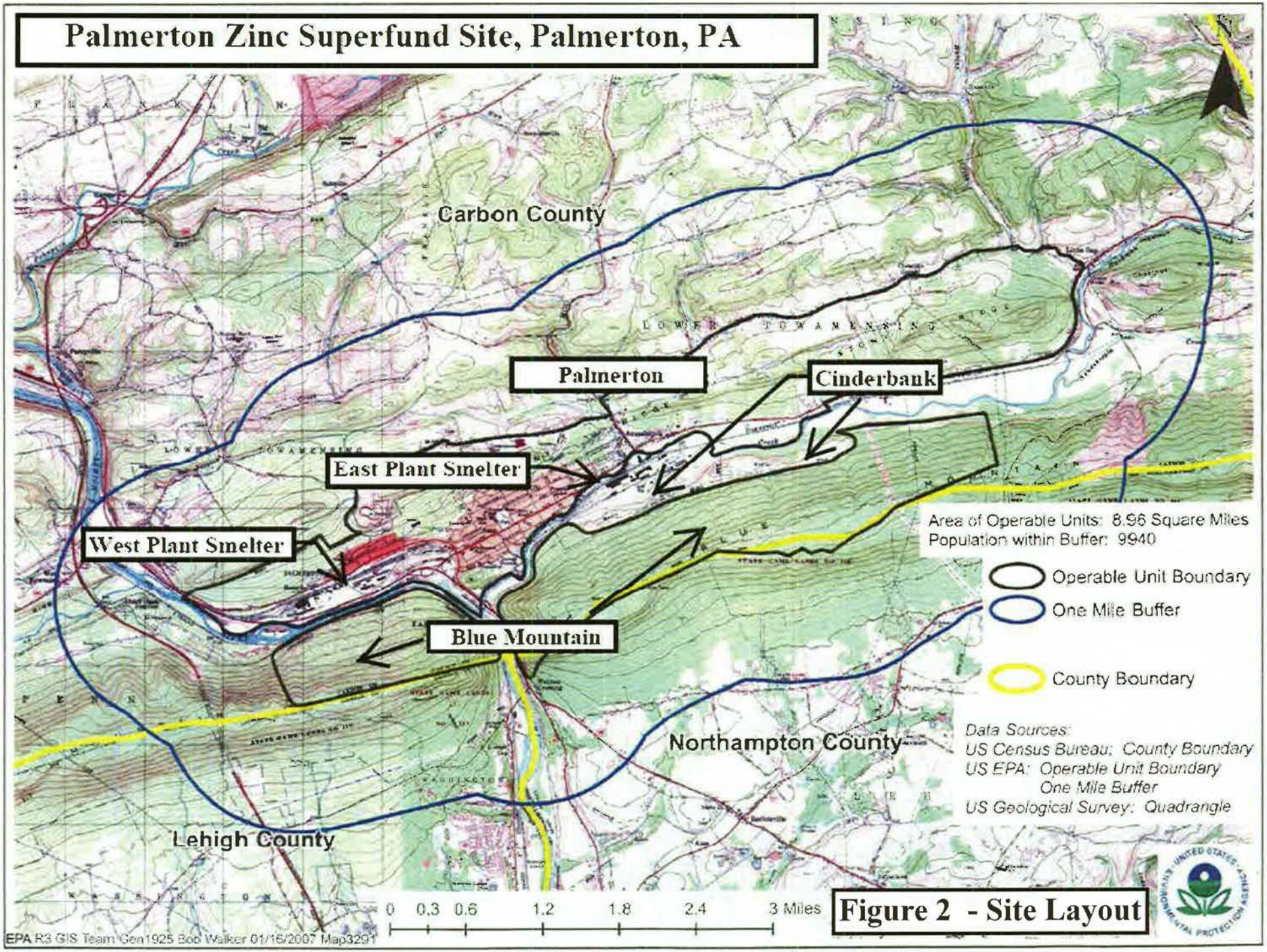
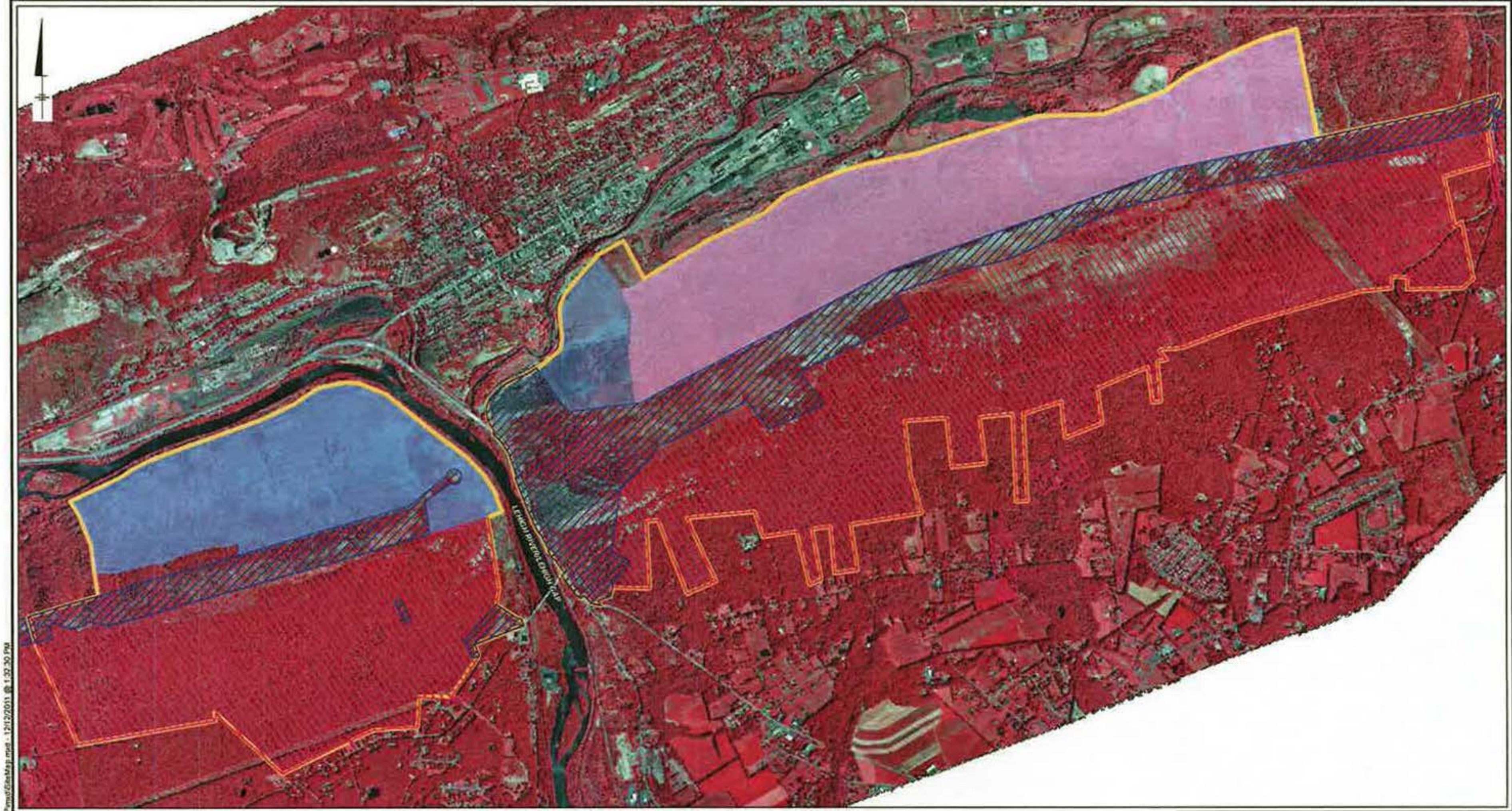


Figure 2 - Site Layout



LEGEND:

- APPROXIMATE OU-1 BOUNDARY
- ECOLOAM
- GA-1
- GA-2
  - NPS LANDS
  - PGC LANDS

0 2,000 4,000 Feet

GRAPHIC SCALE

NOTE:

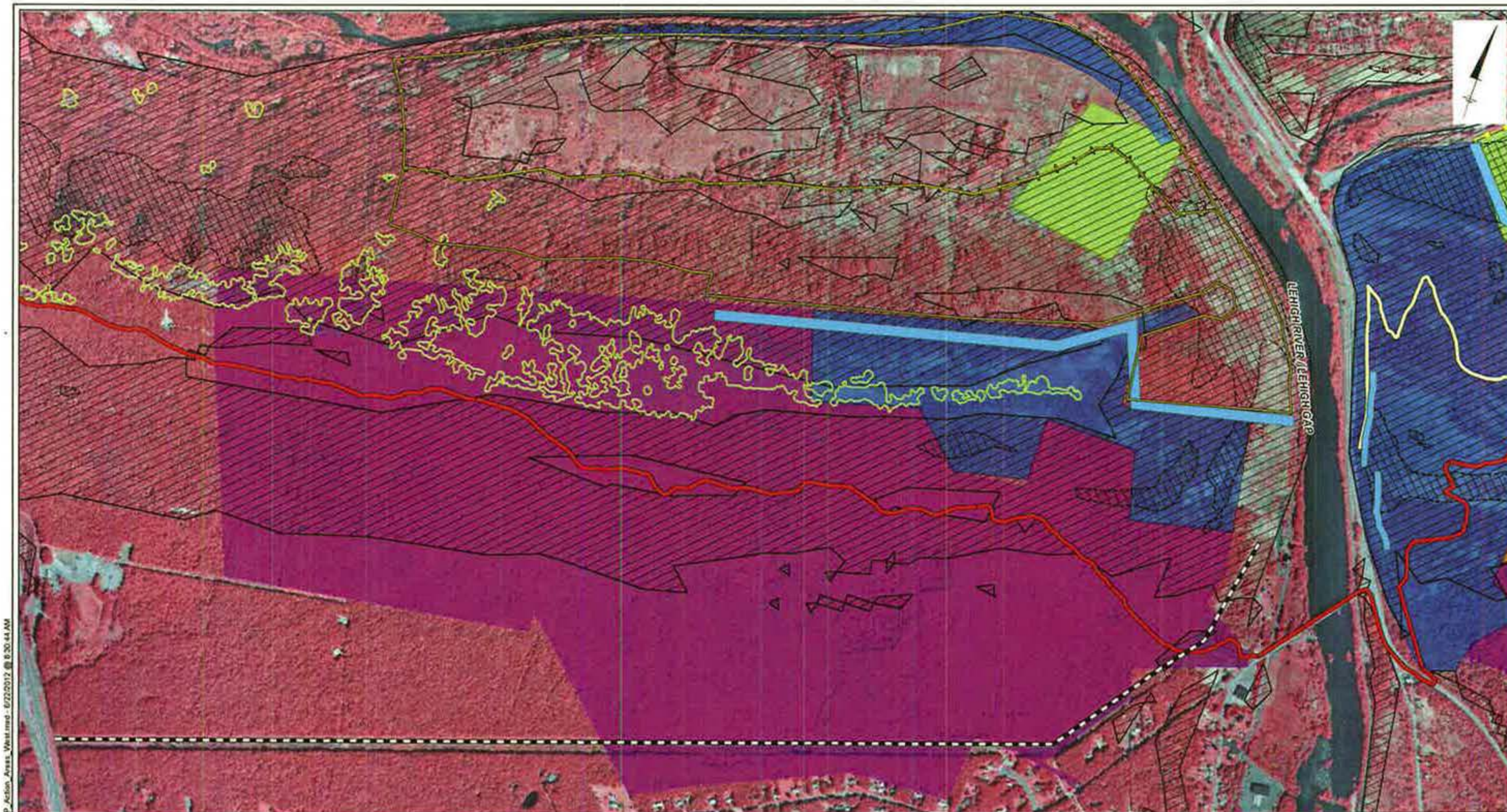
1. COLOR-INFRARED AERIAL PHOTOGRAPHY COLLECTED AND ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA. COLLECTION DATE: AUGUST 23, 2011.

Figure 3

Blue Mountain, OU#1 - Map

ARCADIS

CITY: SYR DIV/GROUP: IM DB: K SINSABAUGH LD: PIC: PM: TM:
Palmerton (B0019003.0000.00003)



LEGEND:

GA-1

- LGNC (GROUND APPLIED - 2006)
- LGNC (AERIAL APPLIED - 2006)
- UTILITIES
- AT
- WINTER TRAIL
- SLOPES > 60%
- SLOPES > 25%
- DESCHAMPSIA (HAIRGRASS) COMMUNITIES
- 2006 NPS DEMONSTRATION AREAS
- GA-2 AERIAL APPLICATION AREA (2008)
- AERIAL APPLICATION AREA (2011)
- AERIAL APPLICATION AREA (2012)
- NON-APPLICATION/MONITOR AREA

SOURCE:

1. COLOR-INFRARED AERIAL PHOTOGRAPHY COLLECTED AND ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA. COLLECTION DATE: AUGUST 23, 2011.

0 900 1,800 Feet

GRAPHIC SCALE

NOTES:

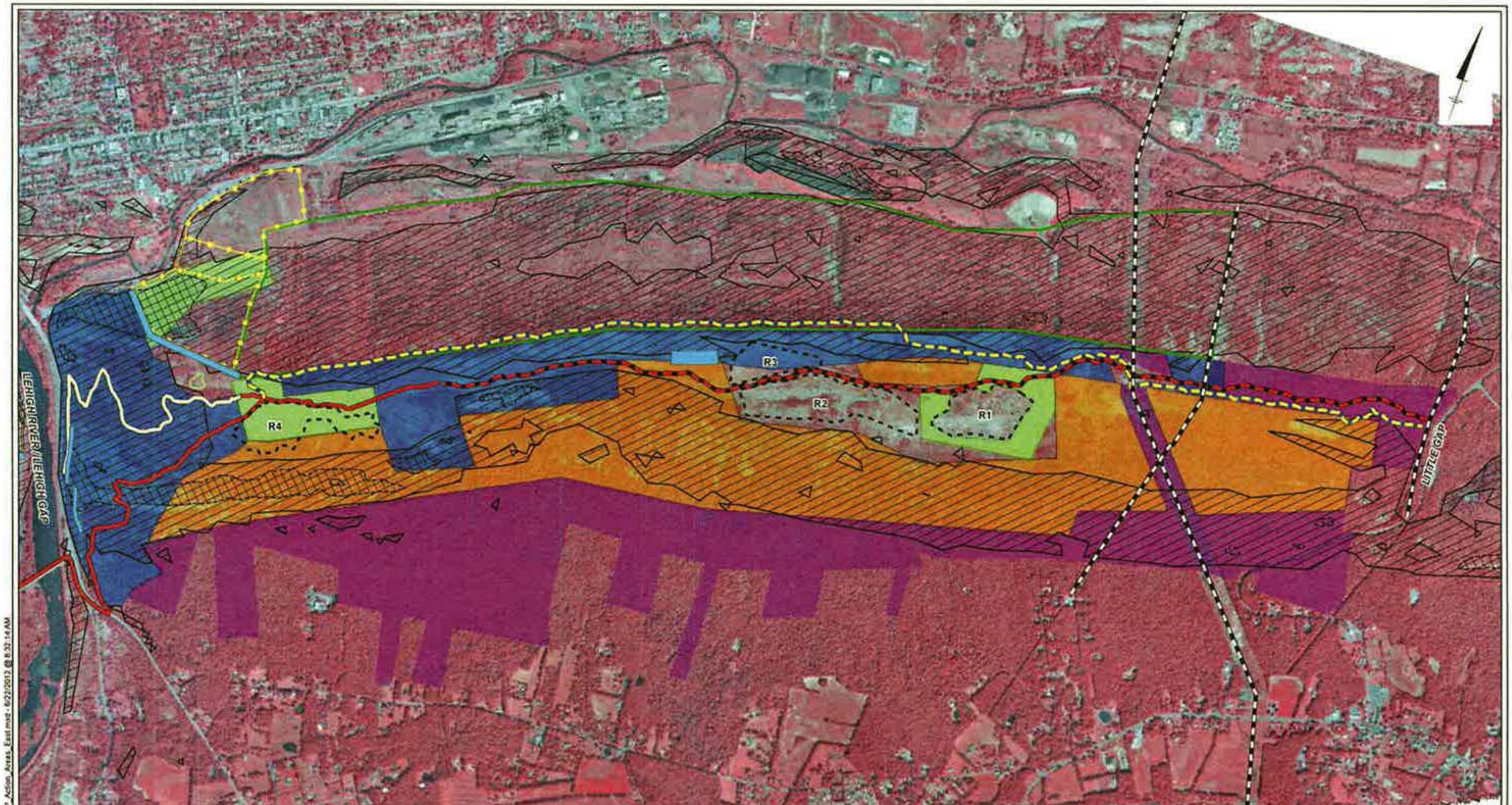
1. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.
2. LGNC = LEHIGH GAP NATURE CENTER
3. AT AND WINTER TRAIL FROM 2005 AERIAL, PROVIDED BY NATIONAL PARK SERVICE.

DRAFT

Figure 4

OU-1 REMEDIAL ACTION AREAS WEST OF LEHIGH GAP

ARCADIS



LEGEND:

GA-1

- PHIBRO ANIMAL HEALTH (GROUND APPLIED - 2006
- LEHIGH NE DEVELOPMENT (GROUND APPLIED - 2006)
- LEHIGH NE DEVELOPMENT (AERIAL APPLIED - 2006)

ECOLOAM

- ECOLOAM AREA

- UTILITIES
- ACCESS ROAD
- TEMPORARY AT
- AT
- WINTER TRAIL
- SLOPES > 60%
- SLOPES > 25%

- DESCHAMPSIA (HAIRGRASS) COMMUNITIES
- 2006 NPS DEMONSTRATION AREAS
- GA-2 AERIAL APPLICATION AREA (2008)
- AERIAL APPLICATION AREA (2011)
- AERIAL APPLICATION AREA (2012)
- NON-APPLICATION/MONITOR AREA

0 1,500 3,000 Feet

GRAPHIC SCALE

SOURCE:

1. COLOR-INFRARED AERIAL PHOTOGRAPHY COLLECTED AND ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA. COLLECTION DATE: AUGUST 23, 2011.

NOTES:

1. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.
2. LGNC = LEHIGH GAP NATURE CENTER
3. ACCESS ROAD AND TEMPORARY AT SURVEYED BY ARCADIS USING TRIMBLE GEOXT HANDHELD GPS DEVICE, AUGUST 2011.
4. AT AND WINTER TRAIL FROM 2005 AERIAL, PROVIDED BY NATIONAL PARK SERVICE.

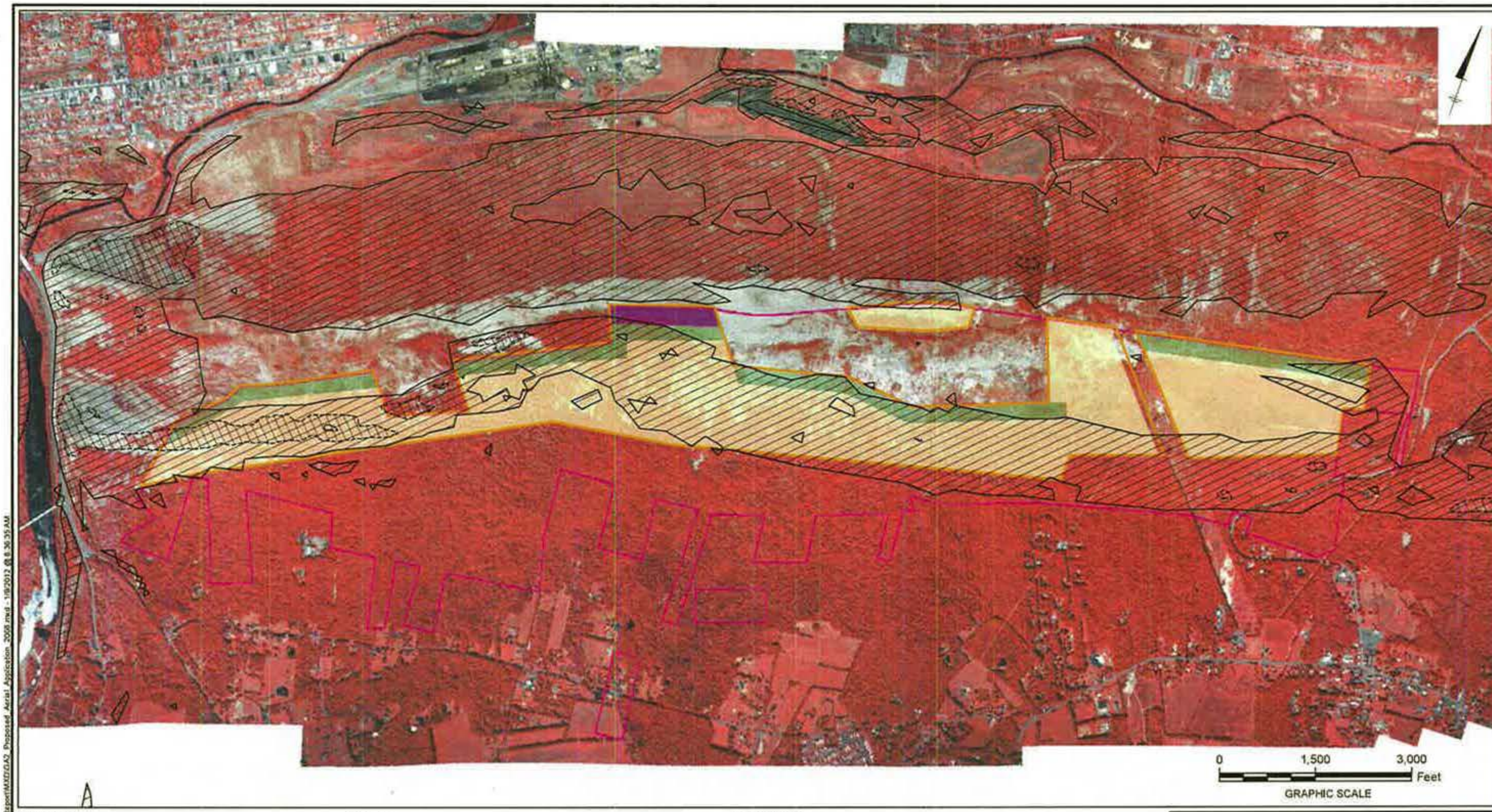
DRAFT

Figure 5

OU-1 REMEDIAL ACTION AREAS EAST OF LEHIGH GAP

ARCADIS

CITY: SYR DIV/GROUP: IM DB: K. SINSABAUGH LD: PIC: PM: TM:



LEGEND:

- PROPOSED AERIAL APPLICATION AREA
- SHADE AREA MIX A (APPROXIMATELY 500 ACRES)
- SHADE AREA MIX B (APPROXIMATELY 100 ACRES)
- SHADE AREA MIX C (APPROXIMATELY 10 ACRES)
- NPS LANDS
- PGC LANDS
- SLOPES > 25%
- SLOPES > 60%

NOTES:

1. BECAUSE OF A GIS DISCREPANCY BETWEEN THE AGENCY SUPPLIED SOUTHERN NPS AND NORTHERN PGC BOUNDARIES EAST OF LEHIGH GAP, THE NPS SOUTHERN BOUNDARY IS USED TO REPRESENT THE COMMON PROPERTY BOUNDARY.
2. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.

SOURCES:

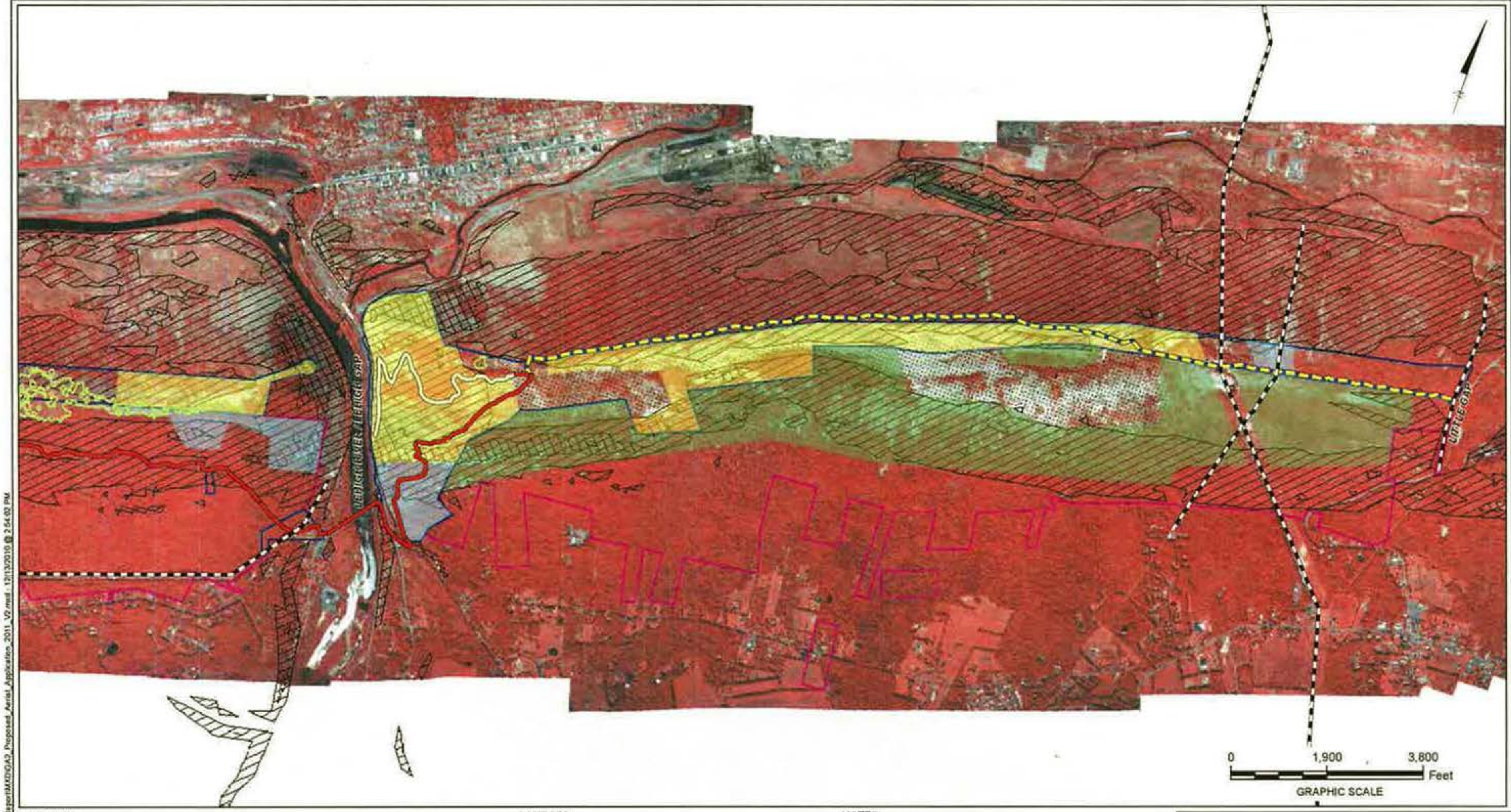
1. INFRARED AERIAL PHOTOGRAPH PROVIDED BY AERIAL ASSOCIATES PHOTOGRAPHY, ANN ARBOR, MI. INFRARED IMAGE TAKEN ON SEPTEMBER 10, 2007.
2. IMAGE ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA.
3. NPS PROPERTY BOUNDARY SUPPLIED BY NATIONAL PARK SERVICE (DATA SOURCE- NPS DEPT. OF LAND ACQUISTION [DLA]). PGC PROPERTY BOUNDARY SUPPLIED BY GAME COMMISSION (DATA FILE- SGL 168 BOUNDARY.SHP).

Figure 6

2008 AERIAL APPLICATION AREA

ARCADIS

SYR-85 JCR
Palmerton (B5037.3)
G:\Vacount\Palmerton\GA2 AerialApplication Report\MXD\GA2 Proposed Aerial Application 2008.mxd - 1/9/2012 @ 8:36:35 AM



CITY: SYR DIV/GROUP: IM DB: KES LD: PIC: PM: TM:

LEGEND:

- COMPLETED 2008 AERIAL APPLICATION AREA
- PROPOSED 2011 AERIAL APPLICATION AREA:
- SHADE SEED MIX
- SUN SEED MIX
- POSSIBLE 2011/2012 GROUND APPLICATION AREA
- DESCHAMPSIA (HAIRGRASS) COMMUNITIES
- TEMPORARY AT LOCATION
- AT (2005 AERIAL)
- WINTER TRAIL (2005 AERIAL)
- UTILITIES
- SLOPES > 60%
- SLOPES > 25%
- NPS LANDS
- PGC LANDS

SOURCES:

1. INFRARED AERIAL PHOTOGRAPH PROVIDED BY AERIAL ASSOCIATES PHOTOGRAPHY, ANN ARBOR, MI. INFRARED IMAGE TAKEN ON SEPTEMBER 10, 2007.
2. IMAGE ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA.
3. NPS PROPERTY BOUNDARY SUPPLIED BY NATIONAL PARK SERVICE (DATA SOURCE- NPS DEPT. OF LAND ACQUISTION [DLA]). PGC PROPERTY BOUNDARY SUPPLIED BY GAME COMMISSION (DATA FILE- SGL 168 BOUNDARY.SHP).

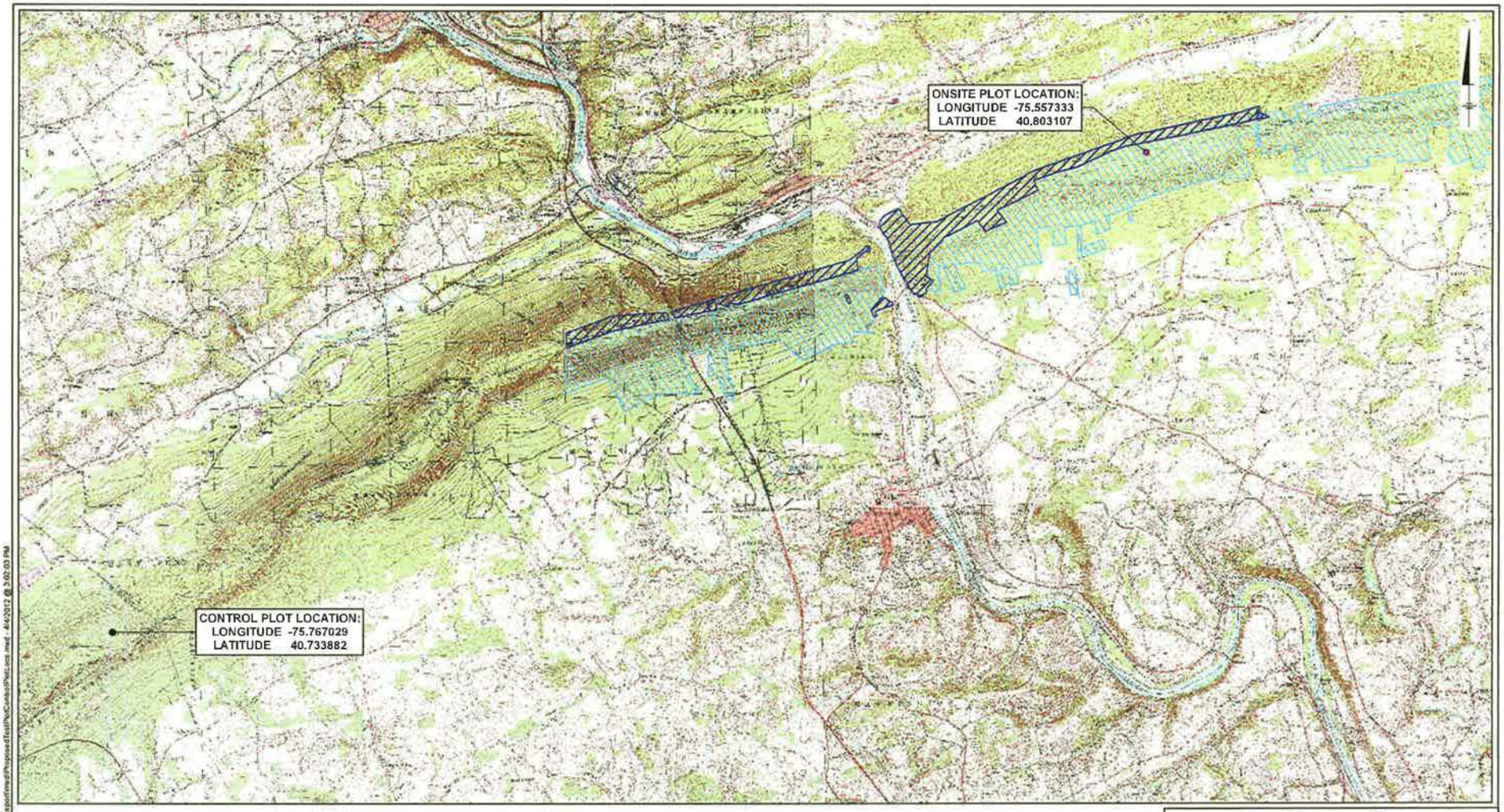
NOTES:

1. BECAUSE OF A GIS DISCREPANCY BETWEEN THE AGENCY SUPPLIED SOUTHERN NPS AND NORTHERN PGC BOUNDARIES EAST OF LEHIGH GAP, THE NPS SOUTHERN BOUNDARY IS USED TO REPRESENT THE COMMON PROPERTY BOUNDARY.
2. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.
3. TOTAL 2011 PROPOSED SUN SEED MIX AREA = 400 ACRES.
TOTAL 2011 PROPOSED SHADE SEED MIX AREA = 100 ACRES.
TOTAL 2011 AERIAL APPLICATION AREA = 500 ACRES.
COMPLETED 2008 AERIAL APPLICATION AREA = 610 ACRES.

Figure 7

2011 AERIAL APPLICATION AREA

ARCADIS



LEGEND:

GA-2

NPS LANDS

PGC LANDS

NOTES:

1. USGS PALMERTON AND LEHIGHTON QUAD MAPS DOWNLOADED FROM THE PENNSYLVANIA SPATIAL DATA ACCESS AT www.pasdapsu.edu.
2. COORDINATES ARE DISPLAYED IN NAD83.

0 1 2 Miles

GRAPHIC SCALE

Figure 8

TEST PLOT LOCATIONS

ARCADIS

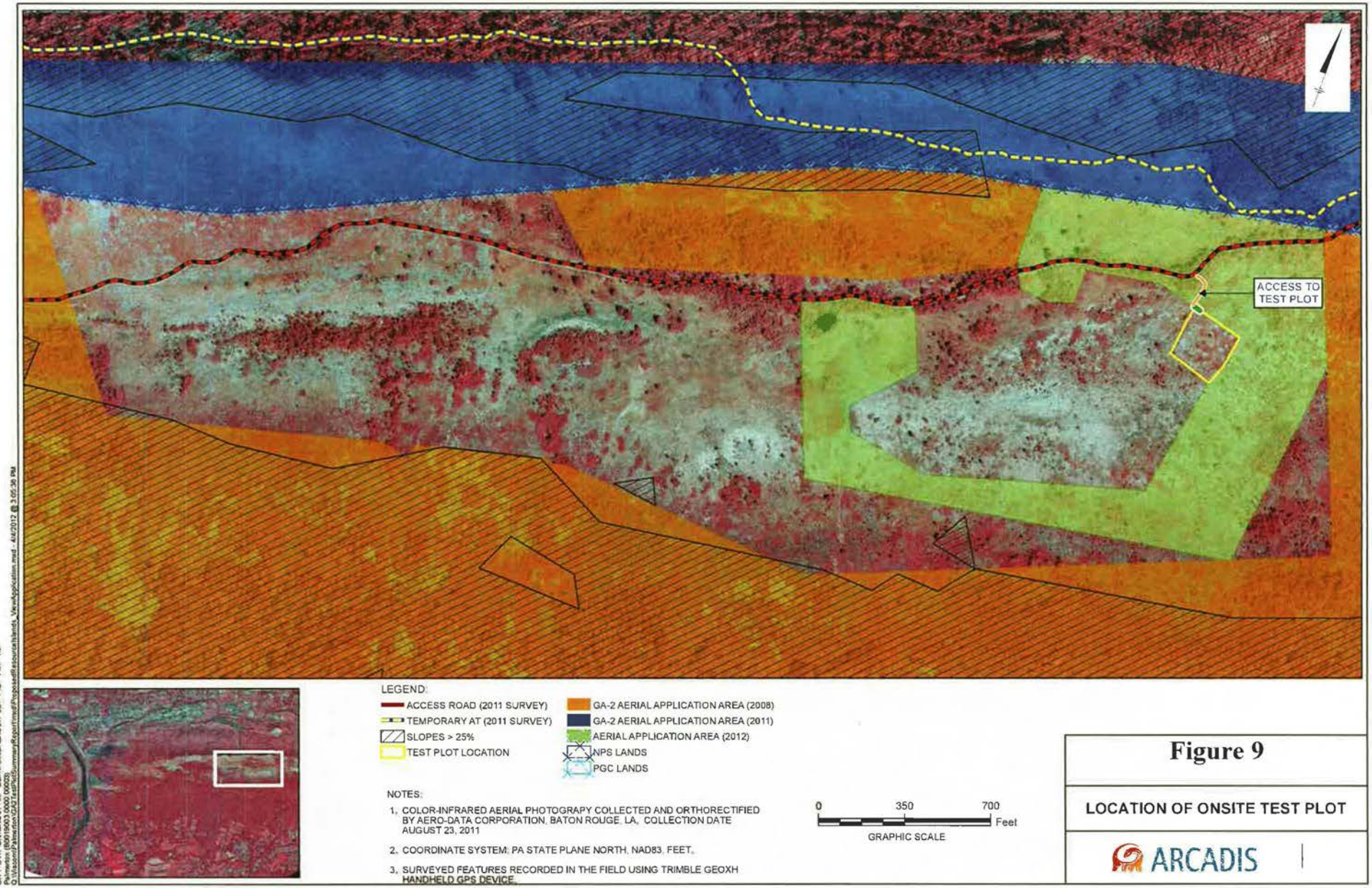
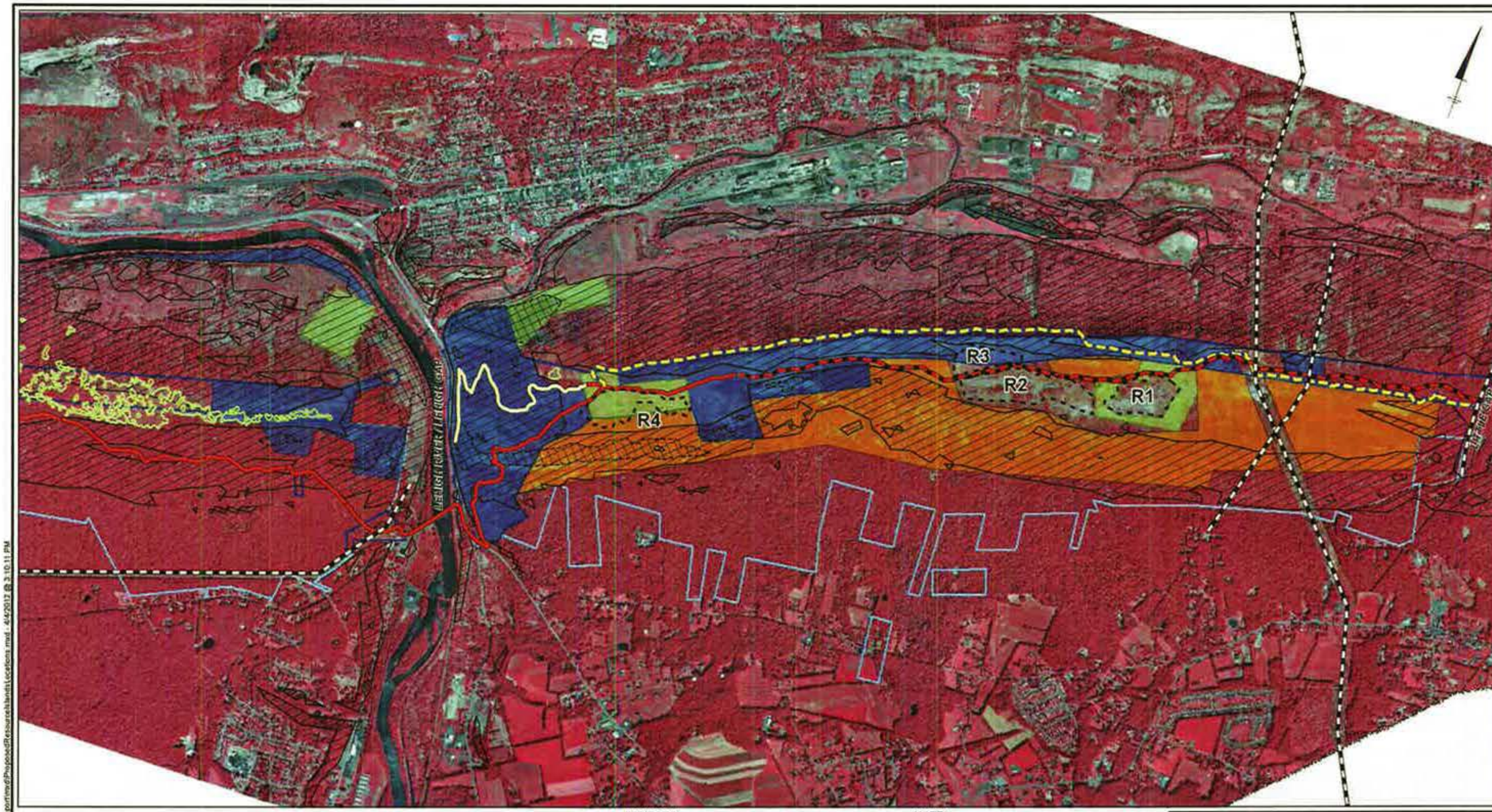


Figure 9

LOCATION OF ONSITE TEST PLOT

ARCADIS



LEGEND:

- ACCESS ROAD (2011 SURVEY)
- TEMPORARY AT (2011 SURVEY)
- AT (2005 AERIAL)
- WINTER TRAIL (2005 AERIAL)
- UTILITIES
- DESCHAMPSIA (HAIRGRASS) COMMUNITIES
- HAIRGRASS COMMUNITY 100-FOOT BUFFER
- SLOPES > 60%
- SLOPES > 25%
- NPS LANDS
- PGC LANDS
- GA-2 AERIAL APPLICATION AREA (2008)
- GA-2 AERIAL APPLICATION AREA (2011)
- AERIAL APPLICATION AREA (2012)
- RESOURCE ISLAND FENCE (SURVEYED 2012)

SOURCES:

1. COLOR-INFRARED AERIAL PHOTOGRAPHY COLLECTED AND ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA. COLLECTION DATE: AUGUST 23, 2011.
2. NPS PROPERTY BOUNDARY SUPPLIED BY NATIONAL PARK SERVICE (DATA SOURCE- NPS DEPT. OF LAND ACQUISTION [DLA]). PGC PROPERTY BOUNDARY SUPPLIED BY GAME COMMISSION (DATA FILE- SGL 168 BOUNDARY.SHP).
3. SURVEYED FEATURES RECORDED IN THE FIELD USING TRIMBLE GEOXH HANDHELD GPS DEVICE.

NOTES:

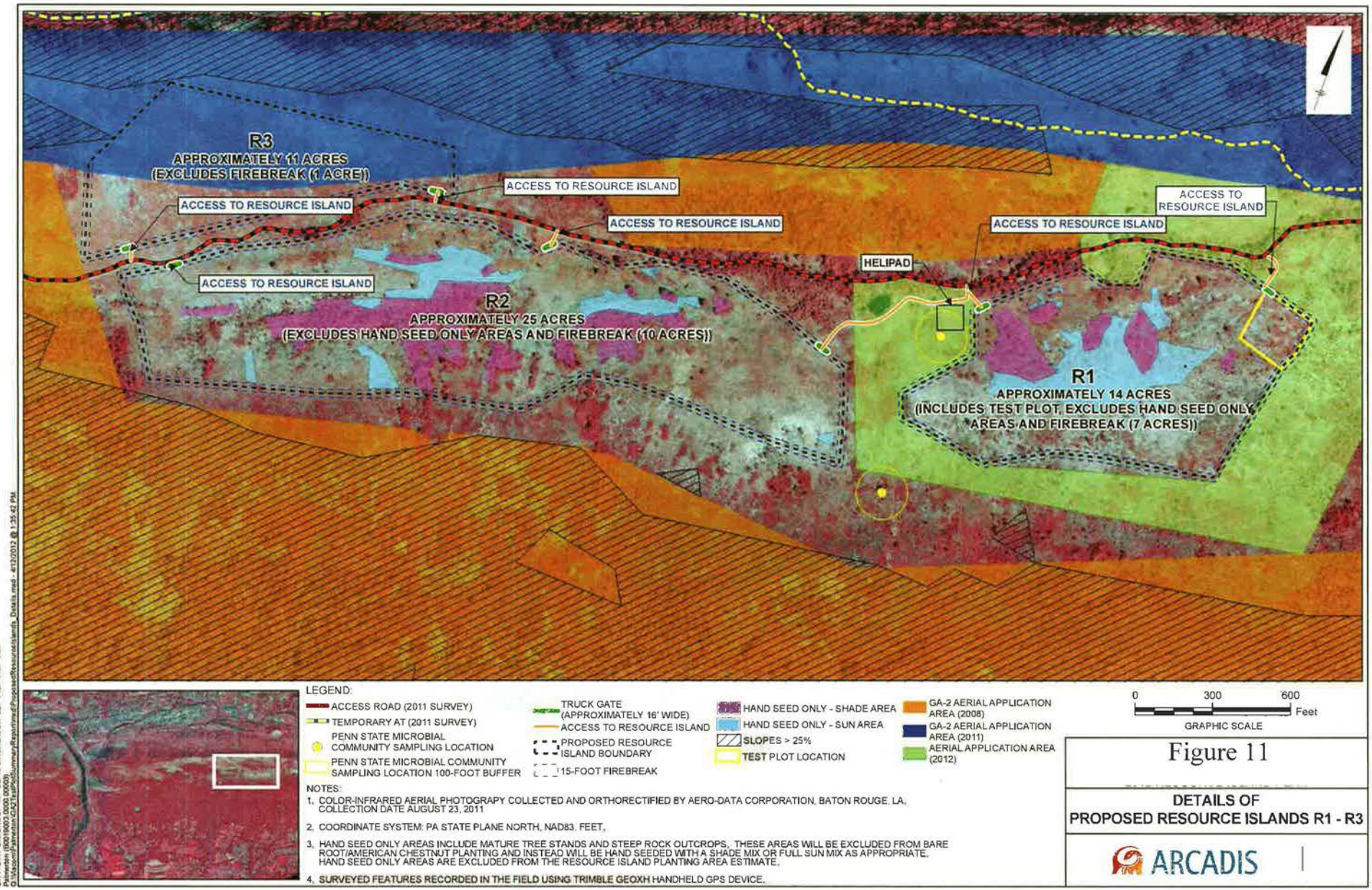
1. BECAUSE OF A GIS DISCREPANCY BETWEEN THE AGENCY SUPPLIED SOUTHERN NPS AND NORTHERN PGC BOUNDARIES EAST OF LEHIGH GAP, THE NPS SOUTHERN BOUNDARY IS USED TO REPRESENT THE COMMON PROPERTY BOUNDARY.
2. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.

0 2,000 4,000 Feet

GRAPHIC SCALE

Figure 10

2012 Aerial Application Areas and Resource Island Locations



LEGEND:

- ACCESS ROAD (2011 SURVEY)
- TEMPORARY AT (2011 SURVEY)
- PENN STATE MICROBIAL COMMUNITY SAMPLING LOCATION
- PENN STATE MICROBIAL COMMUNITY SAMPLING LOCATION 100-FOOT BUFFER
- TRUCK GATE (APPROXIMATELY 16' WIDE)
- ACCESS TO RESOURCE ISLAND
- PROPOSED RESOURCE ISLAND BOUNDARY
- 15-FOOT FIREBREAK
- HAND SEED ONLY - SHADE AREA
- HAND SEED ONLY - SUN AREA
- SLOPES > 25%
- TEST PLOT LOCATION
- GA-2 AERIAL APPLICATION AREA (2008)
- GA-2 AERIAL APPLICATION AREA (2011)
- AERIAL APPLICATION AREA (2012)

0 300 600 Feet

GRAPHIC SCALE

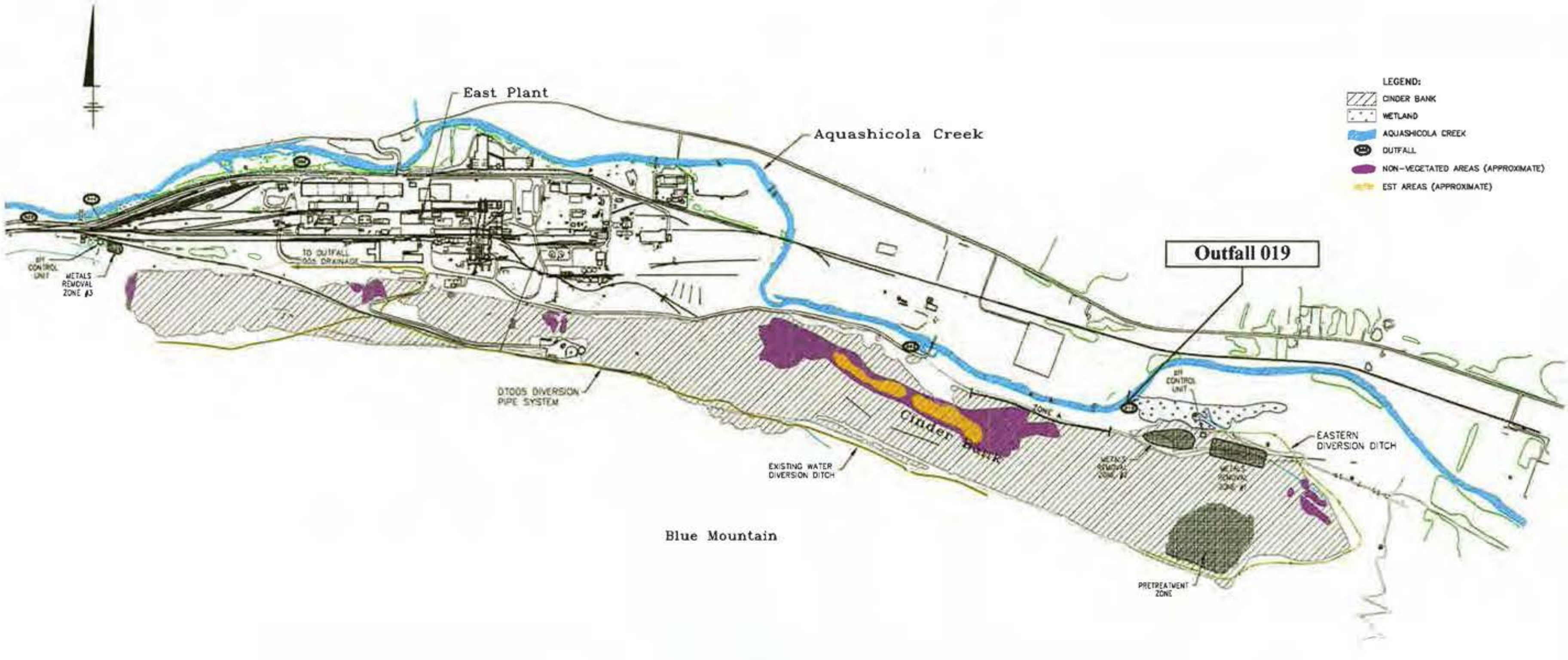
NOTES:

1. COLOR-INFRARED AERIAL PHOTOGRAPY COLLECTED AND ORTHORECTIFIED BY AERO-DATA CORPORATION, BATON ROUGE, LA. COLLECTION DATE AUGUST 23, 2011
2. COORDINATE SYSTEM: PA STATE PLANE NORTH, NAD83, FEET.
3. HAND SEED ONLY AREAS INCLUDE MATURE TREE STANDS AND STEEP ROCK OUTCROPS. THESE AREAS WILL BE EXCLUDED FROM BARE ROOT/AMERICAN CHESTNUT PLANTING AND INSTEAD WILL BE HAND SEEDED WITH A SHADE MIX OR FULL SUN MIX AS APPROPRIATE. HAND SEED ONLY AREAS ARE EXCLUDED FROM THE RESOURCE ISLAND PLANTING AREA ESTIMATE.
4. SURVEYED FEATURES RECORDED IN THE FIELD USING TRIMBLE GEOXH HANDHELD GPS DEVICE.

Figure 11

DETAILS OF PROPOSED RESOURCE ISLANDS R1 - R3

ARCADIS



NOTES:

1. ZONE A IS A DEMONSTRATION BERM CONSTRUCTED OF IRON-RICH MATERIAL. LOCATION OF ZONE A IS APPROXIMATE.
2. EST = ELEVATED SUBSURFACE TEMPERATURE
3. LOCATIONS OF EST AREAS AND NON-VEGETATED AREAS ARE APPROXIMATE.

SOURCE:

BASEMAP CREATED FROM ZINC CORPORATION OF AMERICA ELECTRONIC FILE, "PRT-SITE.DWG", DATED: 4/28/00, AT AN APPROXIMATE SCALE OF 1"=400'.

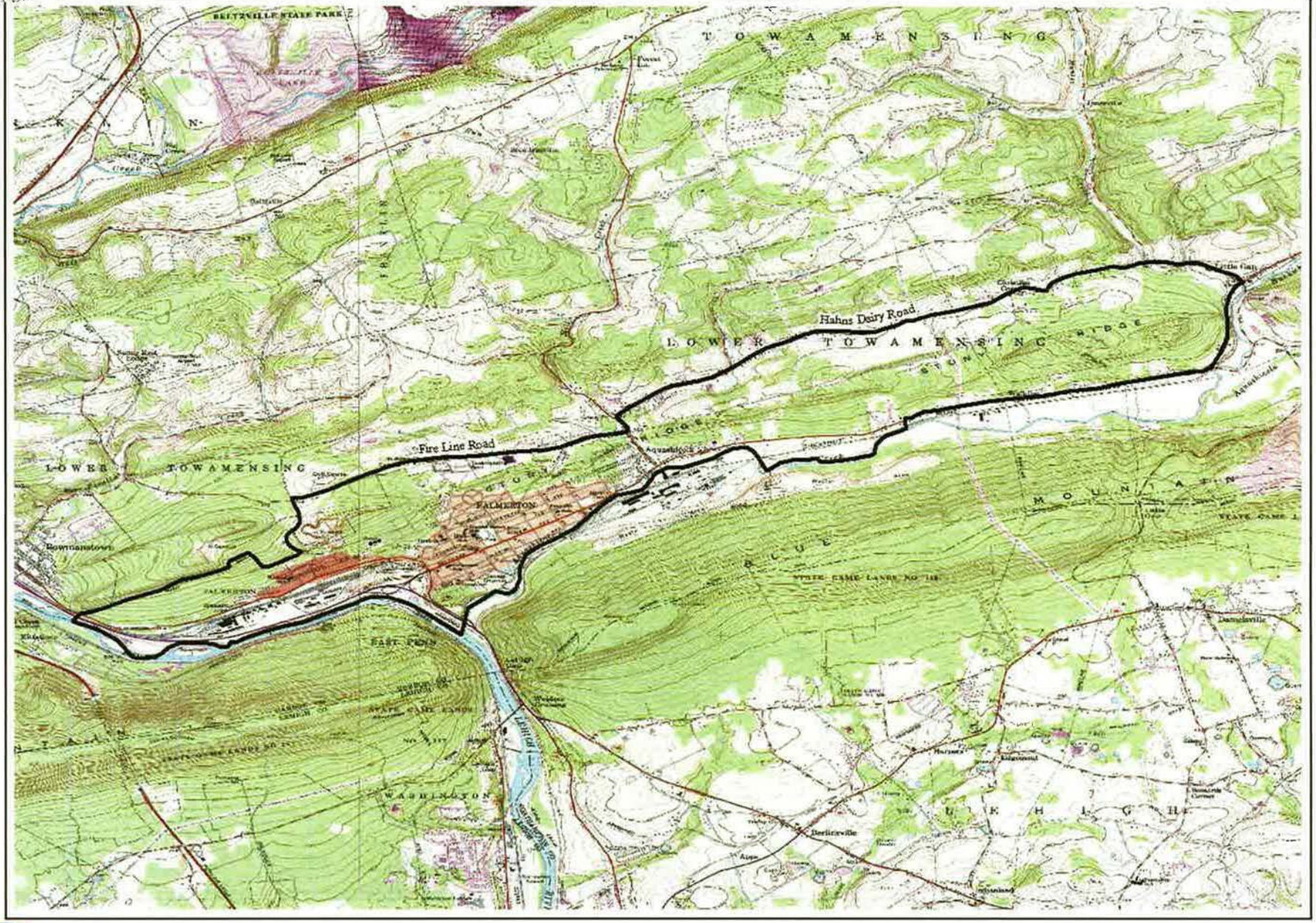
Figure 12

OU-2 FEATURES

BBL
BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

Palmerton Zinc Superfund Site

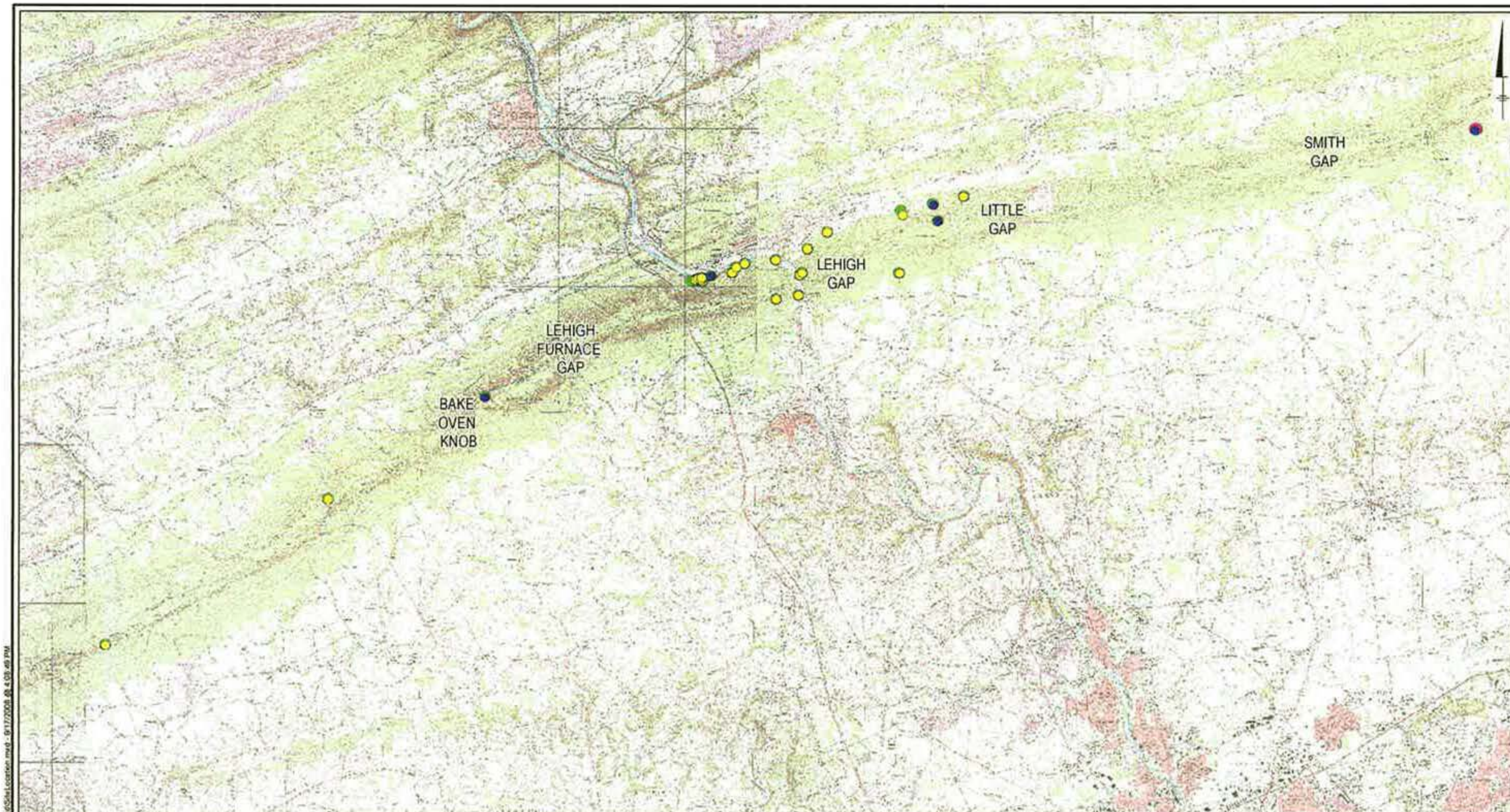
Figure 13 Operable Unit #3 Initial Eligibility Boundary



0 0.5 1 2 Miles

EPA R3 GIS Team SIG595 Bob Walker 8/6/2001 Map 1548

Data Sources: US EPA: Palmerton Boundary
USGS: Topographic Quadrangle 1984



LEGEND:

- APPROXIMATE SAMPLING LOCATION (OCTOBER 2007) - DRY, NO SAMPLE COLLECTED
- APPROXIMATE SAMPLING LOCATION (OCTOBER 2007)
- APPROXIMATE SAMPLING LOCATION (MAY 2008)
- APPROXIMATE SAMPLING LOCATION (MAY 2008) - DRY, NO SAMPLE COLLECTED

NOTES:

1. USGS QUADRANGLES DOWNLOADED FROM THE PENNSYLVANIA SPATIAL DATA ACCESS WEBSITE AT http://www.pasda.psu.edu
2. SAMPLING LOCATIONS WERE LOCATED IN THE FIELD USING A HAND-HELD GPS AND MAPPED IN LAT/LONG (DECIMAL DEGREES), NAD 83, PA STATE PLANE NORTH.

0 10,000 20,000 Feet

GRAPHIC SCALE

Spring/Seep Sampling Locations

Figure 14

ARCADIS

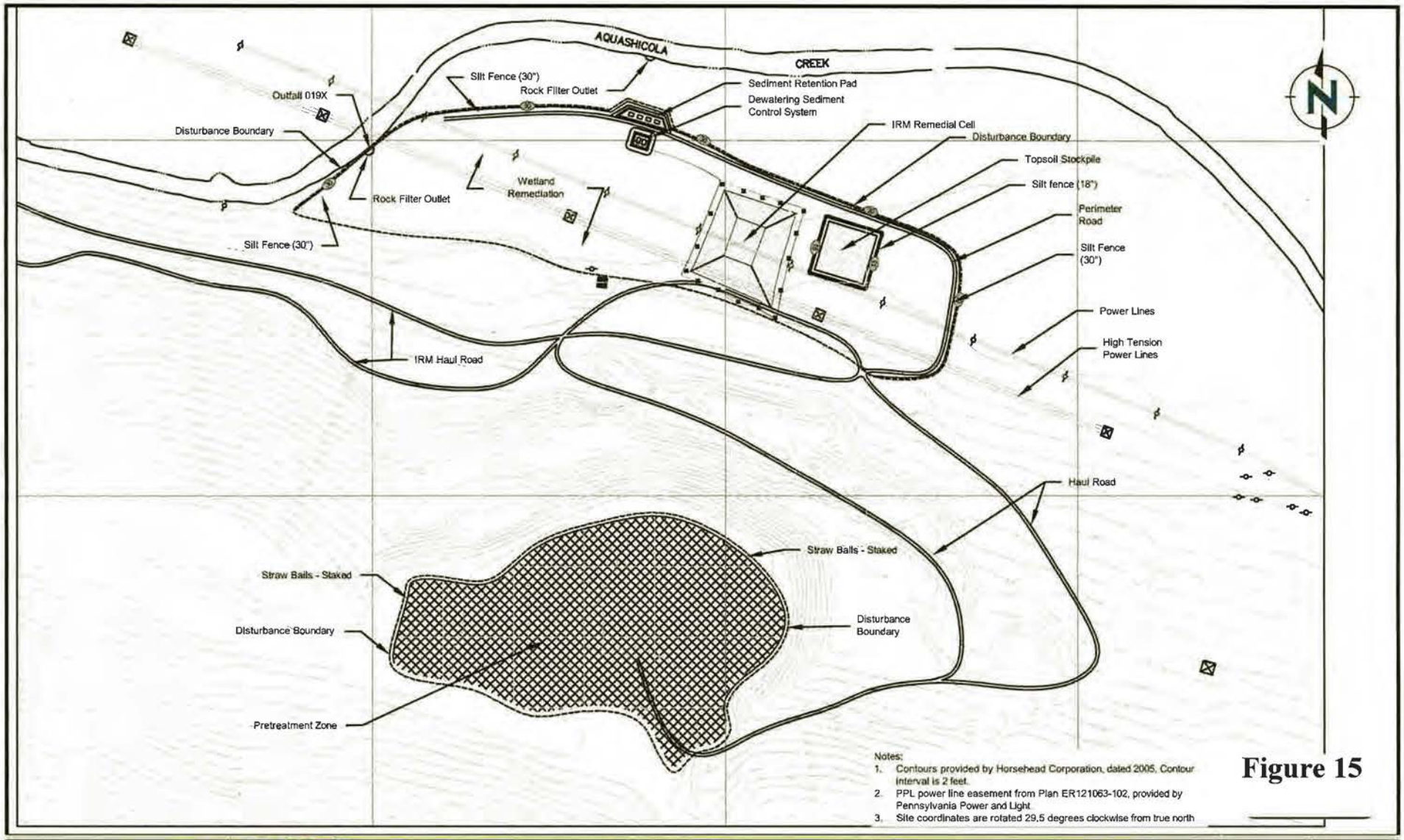


Figure 15

ENVIRON

DRAFTED BY: MSB | DATE: 1/25/2012

CBS Operations Inc.
Salt Lake City, Utah

AdrianBrown
Adrian Brown Consultants, Inc.
Denver, Colorado

PALMERTON OU-4 - REMEDIAL INTERIM MEASURES - AS-BUILT

EAST CINDER BANK, PALMERTON, PENNSYLVANIA

2122602D

BHLEN 1/31/12 [2122602D_EROSION-SEDIMENT CONTROL]

Attachment - Photos

Blue Mountain, OU#1 – Plane used for Aerial Application

Blue Mountain, OU#1 – 2011 Aerial Application area, July 2011

On-Site Test Plot, July 2011.

Fencing for Resource Island 2, April 2012.

Resource Island Planting, April 2012

American Chestnut Cluster, Resource Island 2, May 2012

Tree Planting in rocky area Resource Island 2, May 2012

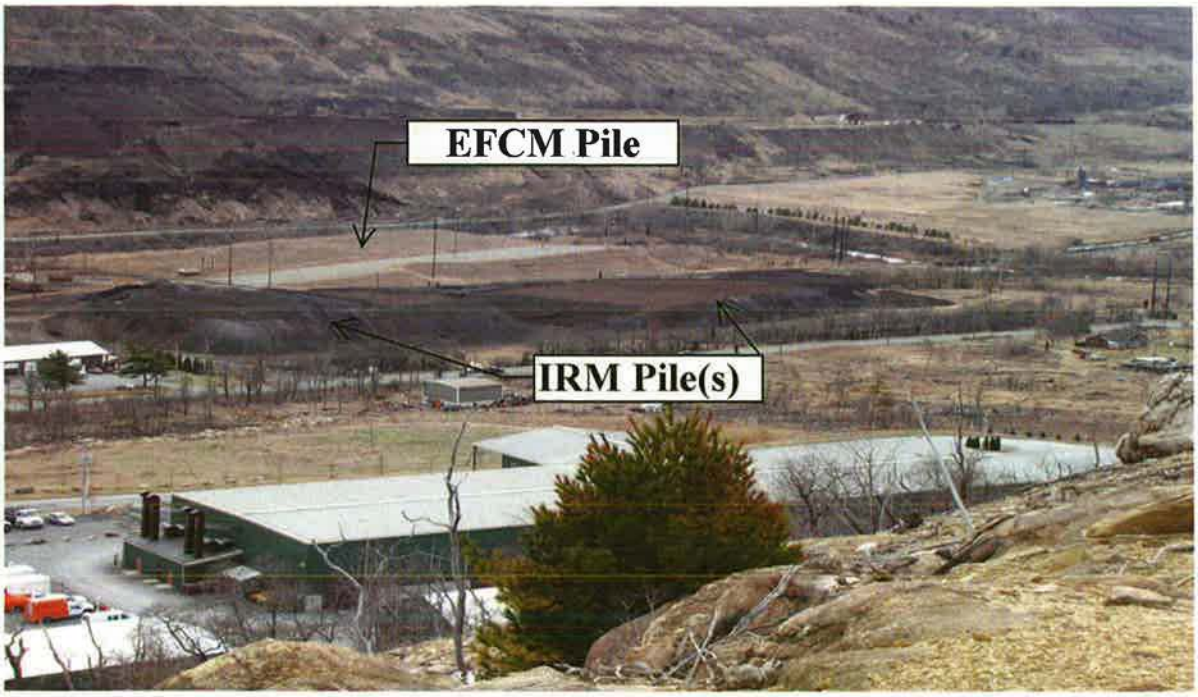
Cinderbank, OU#2 – Additional Burning Area Warning Signs

Cinderbank, OU#2 – Burning Area Venting

Cinderbank, OU#2 – DT005 Washout

Cinderbank, OU#2 – DT005 Washout

Cinderbank OU#2, DT005 New Stilling Basin and Washout repairs



Stoney Ridge Materials IRM Pile, Fall 2011

OU#4 – East Cinderbank Remedial Interim Measure wetlands restoration test plots

OU#4 – East Cinderbank Remedial Interim Measure wetlands restoration test plot

OU#4 – East Cinderbank RIM cell flooding.

OU#4 – East Cinderbank Remedial Interim Measure cell excavation

OU#4 – East Cinderbank Remedial Interim Measure cell excavation cont.

OU#4 – East Cinderbank Remedial Interim Measure cell IRM backfilling

OU#4 – East Cinderbank Remedial Interim Measure cell IRM backfilling cont.

OU#4 – East Cinderbank Remedial Interim Measure cell final grade looking northwest

OU#4 – East Cinderbank Remedial Interim Measure cell final grade looking southeast

2006 Aerial Application Area taken during June 1, 2012 Site inspection.

2005 Ground Application Area taken during June 1, 2012 Site inspection.