Formerly Utilized Sites
Remedial Action Program
(FUSRAP)

Maywood Chemical Company Superfund Site

ADMINISTRATIVE RECORD

Operable Unit 2 - Groundwater

Document Number

GW-020

US Army Corps
of Engineers®
New York District

FUSRAP
Maywood Superfund Site

Final
Groundwater Record of Decision

Formerly Utilized Sites Remedial Action Program
Maywood Superfund Site

Prepared by:

US Army Corps
of Engineers®

May 2012

FINAL

FUSRAP MAYWOOD SUPERFUND SITE GROUNDWATER RECORD OF DECISION

FUSRAP MAYWOOD SUPERFUND SITE

MAY 2012

U. S. ARMY CORPS OF ENGINEERS
NEW YORK DISTRICT OFFICE

FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
BRA	Baseline Risk Assessment
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cfs	cubic feet per second
COC	Constituent of Concern
COPC	Constituent of Potential Concern
DAF	dilution attenuation factor
DNAPL	Dense Nonaqueous Phase Liquid
DOE	Department of Energy
EPA	Environmental Protection Agency
Fe	iron
Fe+2	ferrous iron
Fe+3	ferric iron
FFA	Federal Facility Agreement
FMSS	FUSRAP Maywood Superfund Site
FS	Feasibility Study
ft	feet
FUSRAP	Formerly Utilized Sites Remedial Action Program
GPM	gallons per minute
GWFS	Groundwater Feasibility Study
GWRI	Groundwater Remedial Investigation
HI	hazard index
HQ	hazard quotient
IGWSRS	impact to groundwater soil remediation standards
LOAEL	Lowest Observed Adverse Effects Level
LTM	Long-Term Monitoring
LUC	Land Use Control
m^3/s	cubic meters per second
MCL	Maximum Contaminant Level
MCW	Maywood Chemical Works
mg/kg	milligrams per kilogram
mg/k-d	milligrams per kilogram per day

Acronyms and Abbreviations (continued)

MISS	Maywood Interim Storage Site
MNA	Monitored Natural Attenuation
Mn	manganese
NCP	National Contingency Plan
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJGWQC	New Jersey Groundwater Quality Criteria
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NW	northwest
O&M	Operation and Maintenance
OUs	Operable Units
PCE	tetrachloroethene
PIC	Public Information Center
PQL	practical quantitation limit
PRG	Preliminary Remediation Goals
RAO	remedial action objective
redox	oxidation reduction
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SLERA	screening-level ecological risk assessment
SSL	soil screening level
SW	southwest
TBC	to be considered
TCE	trichloroethene
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VC	vinyl chloride

I. DECLARATION

A. Site Name and Location

Former Maywood Chemical Works (CERCLIS ID No. NJD980529762) also known as the
FUSRAP Maywood Superfund Site
Maywood Interim Storage Site (MISS)
100 West Hunter Avenue
Maywood and Rochelle Park, New Jersey (NJ)

B. Statement of Basis and Purpose

The Maywood Chemical Company Superfund Site in Bergen County, NJ is listed on the United States Environmental Protection Agency (EPA) Superfund National Priorities List (NPL). The National Superfund Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) identification number is NJD980529762. The Maywood Chemical Company Superfund Site (hereafter referred to as the “Formerly Utilized Sites Remedial Action Program [FUSRAP] Maywood Superfund Site” or “FMSS”) consists of property owned by the Federal Government (the Maywood Interim Storage Site [MISS]), the Stepan Company (former location of the Maywood Chemical Works [MCW]), and other government, commercial, and residential properties in Maywood, Lodi, and Rochelle Park, NJ, which are also known as the “Vicinity Properties”.

To facilitate cleanup of the site, the FMSS was divided into the following three Operable Units (OUs):

- OU 1: Soils and buildings at the MISS, Stepan Company, and the 22 commercial and Government Vicinity Properties. This OU includes soil, buried bulk wastes (including the Nuclear Regulatory Commission [NRC] licensed burial pits), and buildings (all contaminated buildings are located on the Stepan Company property and the MISS).
- OU 2: Groundwater impacted by FUSRAP waste and contaminated groundwater at the MISS.
- OU 3: Non-FUSRAP chemical wastes.

Note that the OUs as presented are consistent with their appearance in the Soils Record of Decision for the site, while the EPA CERCLIS database has an alternate listing of the OUs.

This *Record of Decision* (ROD) presents the selected remedial action for OU 2 groundwater at the MISS. The selected remedial action was chosen in accordance with the requirements of the *Comprehensive Environmental Response, Compensation and Liability Act* (CERCLA) as amended by *Superfund Amendments and Reauthorization Act* (SARA), 42 U.S.C §9601-9675, and to the extent practicable, the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP), as amended, 40 Code of Federal Regulations (CFR) Part 300. The decisions are based on information contained in the Administrative Record File for the FMSS and have been made by the United States Army Corps of Engineers (USACE) and EPA Region 2. Comments on the *Groundwater Proposed Plan, FUSRAP Maywood Superfund Site (Proposed Plan)* (USACE, 2010a) for the MISS groundwater were received from the EPA, State, and local community and were considered during the selection of the final remedy. These comments, and associated responses, are documented in **Section III** – Responsiveness Summary. The New Jersey Department of Environmental Protection (NJDEP) has not concurred with the Selected Remedy.

C. Assessment of Site

The response action for groundwater selected in this ROD is necessary to protect public health, welfare, or the environment from actual or threatened releases of hazardous substances into the environment.

D. Description of Selected Remedy

To address the contaminated groundwater, USACE's preferred remedy, Alternative No. 3, consists of the removal and off-site disposal of non-radiological contaminated soil on the MISS; in situ treatment of arsenic in the overburden aquifer; monitored natural attenuation (MNA) of lithium, benzene, and arsenic in groundwater; groundwater monitoring; and groundwater use restrictions. In addition, metals, volatile organics, and natural attenuation parameter analyses for groundwater will be conducted to monitor changes in aquifer conditions and chemical concentrations over the course of the remedial action. This remedy would commence upon execution of this ROD and a subsequent Long-Term Groundwater Monitoring Plan. The remedy will be considered complete once non-radiological source soils that cause groundwater contamination above cleanup levels are removed on the MISS and groundwater monitoring indicates that constituents of concern (COC) are at or below cleanup levels on the MISS and off-site groundwater monitoring well sampling locations, using standard methods of demonstrating achievement of groundwater remediation cleanup levels.

Major components of the Selected Remedy, Alternative No. 3, Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS include the following (full descriptions of this and other Alternatives are presented in **Section II.K** of this ROD):

- Removal and off-site disposal of non-radiological contaminated soil on the MISS, to include pond sludge on the MISS.
- If required, in situ treatment of arsenic in the overburden aquifer using oxidation reduction (redox) alteration.
- MNA of lithium and benzene in overburden and shallow bedrock groundwater, and MNA of arsenic in shallow bedrock groundwater. MNA refers to the process of documenting the progress and effectiveness of natural attenuation through a defined monitoring program. Natural attenuation is the combination of physical, chemical, and biological processes that result in reasonably predictable reductions in contaminant concentrations over time.
- Land use control (LUC) components will be presented in a Maywood document entitled, "Groundwater Operable Unit Land Use Control Implementation Plan for the FUSRAP Maywood Superfund Site" that will include use restrictions applicable to site groundwater. LUCs will be utilized, as appropriate, to limit potential future on-site and downgradient off-site public and construction worker exposure to

groundwater contaminants until target cleanup goals are achieved. Downgradient off-site groundwater use within the contaminated plumes will be controlled using well restrictions in a groundwater Classification Exception Area (CEA). In addition, other restrictions will be, and have been in several instances, implemented where contaminated soils or potential impacts to contaminated groundwater may occur (e.g., utilizing a notification system with local utilities, government authorities, and the public, and periodic inspections of properties to determine changes in land use).

- Groundwater monitoring to evaluate the performance of the in situ treatment, and to monitor the natural attenuation of lithium, benzene, and arsenic in groundwater. Long-term monitoring (LTM) will be implemented to ensure effectiveness of the remedy until compliance with target cleanup goals has been achieved. The time frame for compliance has been estimated at 280 years.
- The remedial action will be considered complete and will be discontinued when non-radiological source soils that cause groundwater contamination above cleanup levels are removed on the MISS, and groundwater monitoring indicates that COCs are at, or below, cleanup levels on the MISS and off-site groundwater monitoring well sampling locations, using standard methods of demonstrating achievement of groundwater remediation cleanup levels.
- Appropriate environmental monitoring to ensure effectiveness of the remedy.

Consistent with the EPA Region 2 Clean and Green policy, USACE will evaluate the use of sustainable technologies and practices with respect to any remedial alternative selected for the site.

E. Statutory Determinations

The Selected Remedy, as documented in this ROD, is protective of human health and the environment, complies with Federal and State laws that are applicable or relevant and appropriate to the remedial action, and is cost-effective. The Selected Remedy will utilize permanent solutions to the maximum extent practicable.

Alternative No. 3 satisfies the statutory preference for remedies employing treatment that reduces toxicity, mobility, or volume by utilizing in situ treatment of arsenic in the overburden groundwater. MNA would be the primary technology for lithium and benzene in overburden and shallow bedrock groundwater, and to a lesser extent for arsenic in overburden groundwater. However, MNA would be the primary technology for arsenic in shallow bedrock groundwater. Groundwater monitoring would be used to track aquifer redox conditions, which could impact the attenuation, fate, and transport of benzene and arsenic after treatment.

Periodic reviews, no less than every five years after initiation of the selected remedial action, will be conducted in accordance with CERCLA Section 121(c) and the NCP Section 300.430(f)(4)(ii), and will continue as long as hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure, and until the groundwater (via MNA) has achieved cleanup criteria.

F. Data Certification Checklist

The following table provides the location of key groundwater remedy selection information contained in the ROD, **Section II**, Decision Summary. Additional information can be found in the Administrative Record File for the site.

ROD Data Checklist Item	ROD Section Number Reference
COCs and their respective concentrations.	II.I
Current and reasonably anticipated future land-use assumptions used in the baseline risk assessment and ROD.	II.G
Baseline risk represented by the COCs.	II.H
How principal threats are addressed.	II.M
Key factors that led to the selection of the remedy.	II.N.1
Estimated capital, annual operation and maintenance, and the total present worth costs for the Selected Remedy, discount rate, and the number of years over which the remedy cost estimates are projected.	II.N.3
Potential land and groundwater use that will be available at the site as a result of the Selected Remedy.	II.N.4

G. Authorizing Signatures

6/28/2012

USACE

Date

Christopher J. Larsen
Colonel, US Army
Division Engineer

7/5/2012

EPA Region 2

Date

Walter E. Mugdan, Director
Emergency & Remedial Response Division

II. DECISION SUMMARY

This section presents a summary of USACE and EPA decisions regarding groundwater present on the MISS that has been identified as requiring:

> Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS.

A. Site Name, Location, and Description

The FMSS is in a highly developed area of northeastern NJ located in the Boroughs of Maywood and Lodi and the Township of Rochelle Park (**Figure 1**). It is located approximately 12 miles north-northwest of New York City, and 13 miles northeast of Newark, NJ. The population density of this area is approximately 7,000 people per square mile. The MISS (a portion of the FMSS) is an 11.7-acre fenced lot that was previously part of a 30-acre property owned by the Stepan Company. The Federal Government acquired the MISS from the Stepan Company in 1985. The MISS contains two buildings (Building 76 and a Pump House), temporary office trailers, a water reservoir, and two railroad spurs. The water reservoir, Pump House, and one of the railroad spurs are still in use by the Stepan Company. The MISS is bounded on the west by NJ State Route 17; on the north by a New York, Susquehanna & Western Railway line; and on the south and east by the Stepan Company property. Residential properties are located north of the railroad line and within 75 yards of the northern MISS boundary.

The FMSS is listed on the EPA Superfund NPL. The CERCLIS identification number is NJD980529762. The USACE was delegated authority for the FUSRAP by the Energy and Water Development Appropriations Act of 1998 and subsequent appropriations acts. This delegation has been, and is, interpreted to include the cleanup of waste associated with thorium processing activities at the MCW, and has been further clarified in subsequent appropriation acts. The FMSS consists of property owned by the Federal Government (the MISS), the Stepan Company (former location of the MCW), and local government, commercial, and private properties in Maywood, Lodi, and Rochelle Park, NJ, which are also known as the "Vicinity Properties".

USACE is conducting partial environmental restoration of the FMSS as part of the USACE FUSRAP program. Other non-FUSRAP-related chemical contamination is being addressed under a separate investigation by the Stepan Company. A Federal Facilities Agreement (FFA) for the FMSS was signed in 1990 by the EPA and the Department of Energy (DOE) to address each party's responsibilities at the FMSS. The FFA also defines FUSRAP waste as it relates to DOE's responsibilities at the FMSS. The DOE was the USACE's predecessor as lead Federal agency for cleanup of FUSRAP waste on the FMSS. A Memorandum of Understanding, signed by the DOE and USACE in March 1999, defines the roles and responsibilities of both agencies in the management and execution of the FUSRAP Program. It also establishes the framework for the execution of FUSRAP (DOE and USACE, 1999).

USACE is utilizing the administrative, procedural, and regulatory provisions of CERCLA and the NCP to guide the remediation process. The FMSS is being addressed under three separate Remedial Investigation (RI)/Feasibility Study (FS) OUs, all coordinated with the

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DATE	8/18/10
DESIGNED BY	--
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CHECKED BY	G. Gaillot
APPROVED BY	--
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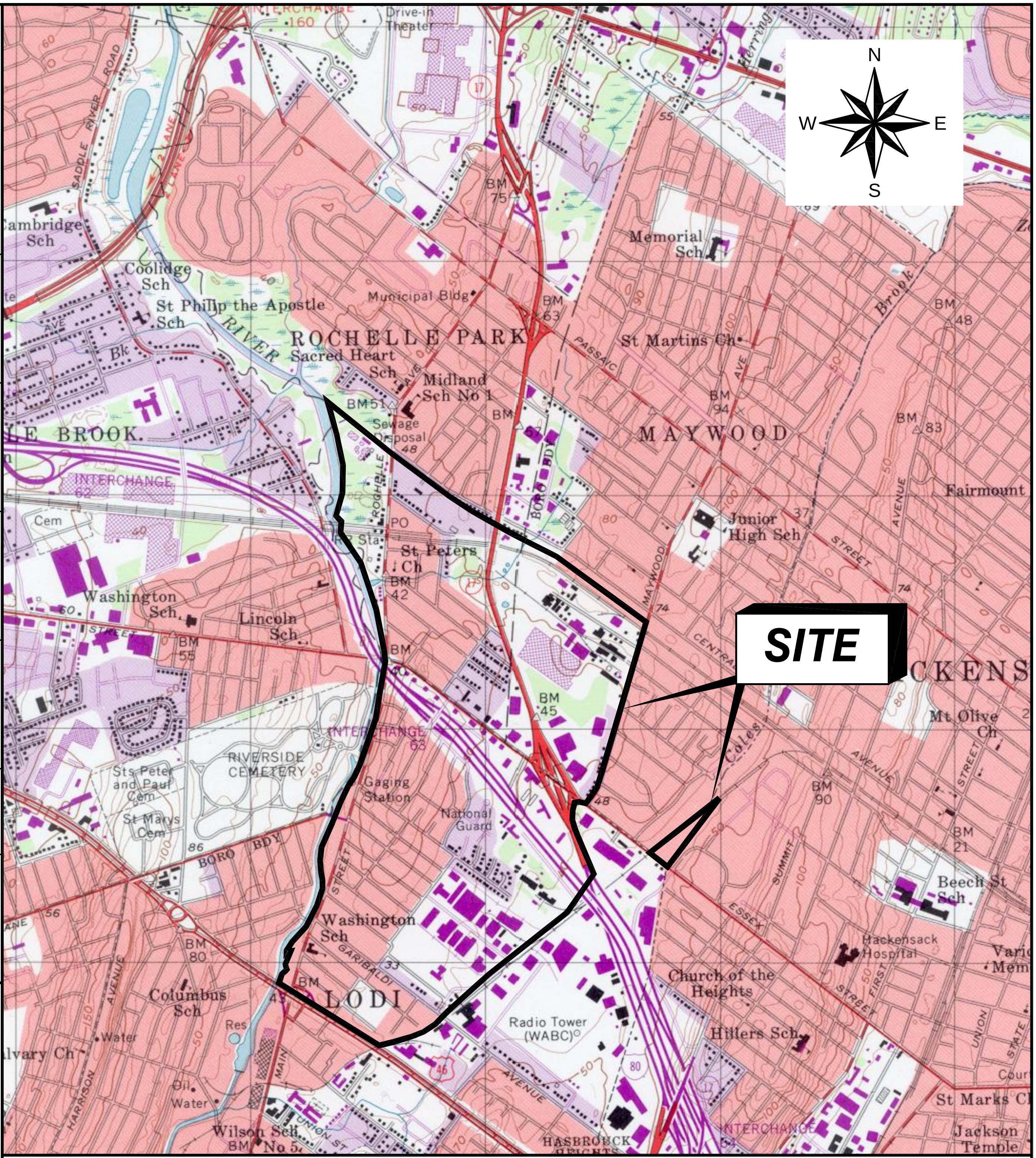

SCALE

0 2000 4000 FEET

REFERENCE:

7.5 MIN USGS TOPOGRAPHIC MAP OF
HACKENSACK, NJ QUADRANGLE. DATED: 1997

FIGURE 1

SITE LOCATION MAP

MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps
of Engineers

FUSRAP
Maywood Superfund Site

Shaw
Shaw Environmental, Inc.

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Plot Date/Time: Aug 18, 2010 - 10:19am
Plotted By: bernadette.oconnor

EPA. USACE is responsible for two of the three RI/FS OUs for waste identified as “FUSRAP waste” and waste located on the MISS in accordance with the FFA. One RI/FS addressed soil and building contamination (2002) located on the Federal Government-owned MISS and the Vicinity Properties. The second addresses groundwater contamination at the MISS and Vicinity Properties related to thorium processing activities and chemical groundwater contamination originating on the MISS (subject of this ROD). The Stepan Company is responsible for the third RI/FS that addresses non-FUSRAP-related chemical contamination in soils or groundwater related to the areas of the site outside of the MISS. See **Figure 2** for the layout of the FMSS.

B Site History and Enforcement Activities

B.1 Site History

The original plant on what is now the FMSS was constructed in 1895 and became known as the Maywood Chemical Works after incorporation on December 24, 1918 under the laws of the State of New Jersey. Principal products manufactured by the MCW included aromatics (mainly for the soap industry), flavorings, lithium (in 30 different forms), pharmaceuticals (quinine, cocaine, and caffeine among others), protein (extracted from leather), and rare earth salts (for the glass industry).

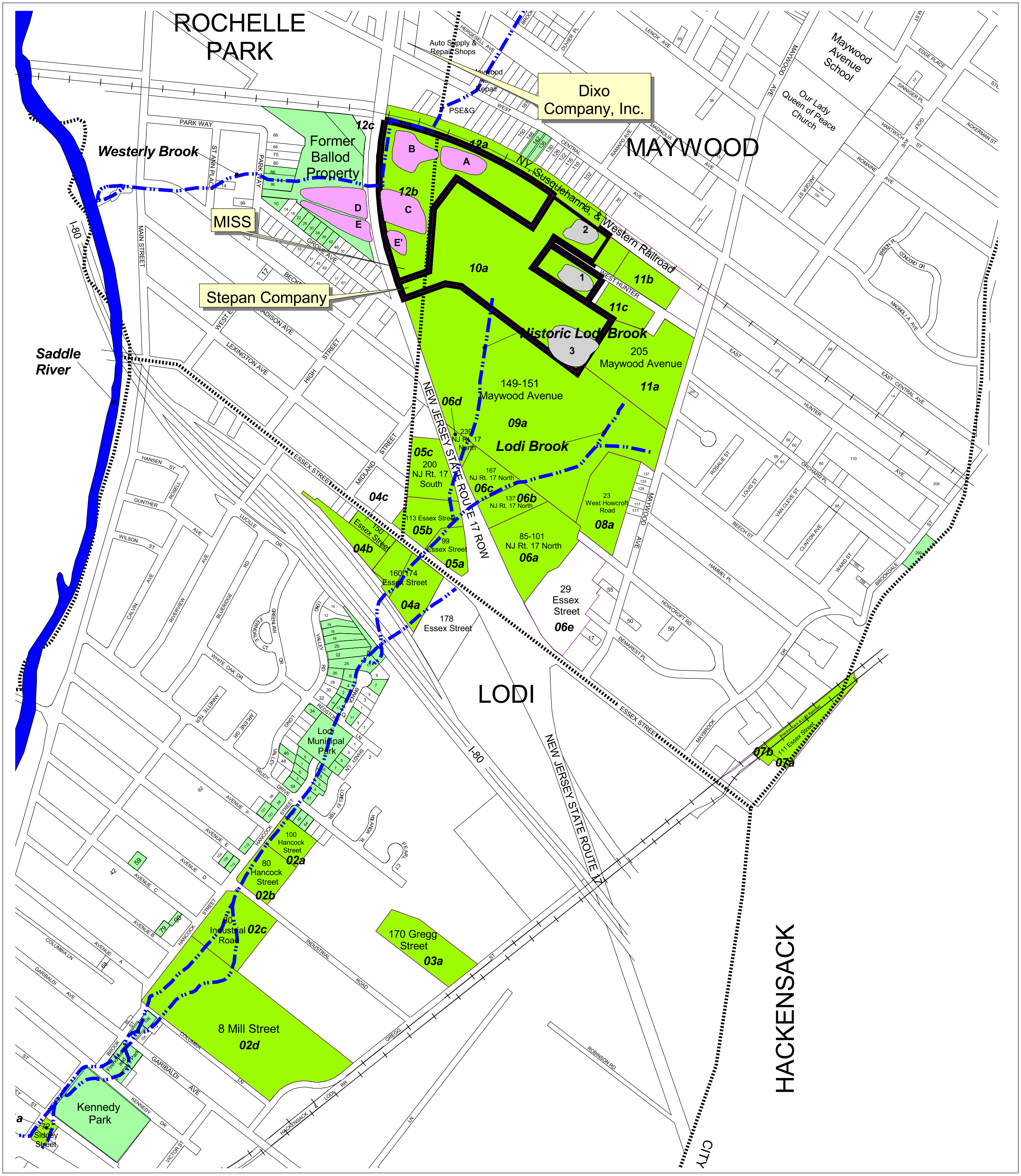
Starting in 1916, portions of the facility were used to extract thorium and rare earth metals from monazite sands. The extracted thorium was then sold to other companies for use in manufacturing industrial products, such as mantles for gas lanterns. The wastes from this process were pumped as slurry to holding ponds. In 1932, the disposal areas were partially covered by the construction of NJ State Route 17. The MCW stopped extracting thorium in 1956 after approximately 40 years of production. The property was subsequently sold to the Stepan Company in 1959.

The MCW owned and operated mining properties in the vicinity of Keystone, South Dakota, which produced lithium ore that was transported to the MCW for processing. The company produced lithium compounds, including lithium chloride, lithium fluoride, and lithium hydroxide. Lithium wastes were believed to have been disposed in diked areas at the MCW.

Protein extraction from leather digestion was performed by the MCW. Leather wastes are believed to have been buried in two primary shallow disposal areas on the Stepan Company property.

Wastes from the various manufacturing processes were generally stored in open piles and retention ponds, as indicated previously. Some of the process wastes were removed for use as mulch and fill on nearby properties, thereby contaminating those properties with radioactive thorium.

The EPA listed the MCW on the Superfund National Priorities List on September 8, 1983. In late 1983, Congress assigned DOE a research and development project to clean up the radioactive wastes at the MCW. DOE then placed the Site in the FUSRAP Program. In 1985, the Federal Government acquired an 11.7-acre portion of the Stepan Company property to store soils excavated by DOE from the Vicinity Properties until a suitable permanent storage site (the MISS) was identified. During DOE’s initial residential cleanups,



Phase 1 Properties

🟩 *Soil Remediation complete*

Phase II Properties

🟩 *Soil Remediation complete or ongoing*

⬜ *Burial Pits (remediation substantially completed)*

🟪 *Retention Ponds*

Figure 2
FMSS and Surrounding Properties

Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Chemical Company Superfund Site website at <www.fusrapmaywood.com>.

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BOSFS01\maywood\task0205\gis\0205_fs&pp_Rev4.apr - fs&pp - Dec. 14, 2010 approximately 35,000 cubic yards of soil were excavated and stockpiled at the MISS. At the time, there was no licensed disposal site for this type of material.

Opposition by area residents and officials to further stockpiling of soil at the MISS led the Government in 1986 to halt further cleanups while community outreach continued in an effort to reach a mutual understanding of the cleanup needs and challenges.

In 1992, DOE completed a remedial investigation that defined the nature and extent of contamination. In 1993, a Baseline Risk Assessment (BRA) was completed. In 1994, the Government entered into a contract with Envirocare of Utah, which obtained a license suitable for disposal of the Maywood waste soils (as well as other waste in the FUSRAP program). Interim cleanup actions resumed in the fall of 1994, with the shipment of 5,000 cubic yards of soil to Envirocare of Utah.

Removal of the stockpile resumed in the spring of 1995 and was completed during the winter of 1996. Radiological surveys at 25 residential Vicinity Properties were completed in March 1995. Cleanup of these properties began in the fall of 1995 and continued in 1996 with the cleanup of a total of 13 residential properties. During the 1996 work, three additional properties were found to contain some contaminated soil. These properties were cleaned up during the summer of 1997.

B.2 Removal Action for Residential and Commercial Property Soils

As stated, the DOE cleaned up 25 residential properties and a portion of one commercially zoned property in 1984 and 1985. Due to the limited commercial disposal capacity for radiological wastes at that time, the excavated materials from these cleanup efforts were stored on property that was a part of the original MCW processing site. The DOE acquired this property from the Stepan Company and named it the MISS. In 1995 and 1996, the DOE removed these stored materials from the MISS and sent them to a licensed, permanent, off-site commercial disposal facility. Also during 1995, the cleanup of the remaining residential properties, four municipal properties (three parks and a fire station), and one commercially zoned property (96 Park Way) was initiated. These interim cleanup actions were completed in 2000 by the USACE. An *Engineering Evaluation/Cost Analysis for the Cleanup of Residential and Municipal Vicinity Properties at the Maywood Site*, was completed in 1995. The Selected Remedy was documented in the 1995 *Action Memorandum for the Removal of Contaminated Materials from the Residential and Municipal Vicinity Properties.* Closing out residential properties will be addressed in another document.

A time-critical removal action was completed by the USACE during the winter of 2000 to remove contaminated sediments from portions of Lodi Brook and a swale located at the western terminus of West Howcroft Road, Maywood. The removal action re-established the hydraulic grade of the Brook and swale.

In July 2001, the USACE published and made available for public comment the *Engineering Evaluation/Cost Analysis for a Removal Action in Support of NJDOT Roadway Improvement Projects at the FUSRAP Maywood Superfund Site*. The accompanying Action Memorandum was approved in November 2001, and the removal action authorized under these documents was initiated in January 2002.

The *Feasibility Study for Soils and Buildings at the FUSRAP Maywood Superfund Site*, as well as the *Proposed Plan for Soils and Buildings at the FUSRAP Maywood Superfund Site*, were completed in August 2002. The *Record of Decision (ROD) for Soils and Buildings at the FUSRAP Maywood Superfund Site* was released in September 2003. The final remedy for soils documented in the ROD included: 1) excavation/remediation of soils with contamination above remedial action objectives (RAO); 2) physical separation to sort materials for disposal as mixed waste, other bulk waste, and radioactive waste; 3) institutional land-use controls; 4) off-site disposal of FUSRAP materials; 5) decontamination and demolition of buildings, as necessary; and 6) environmental monitoring of the effectiveness of the remedy. The Soils and Buildings OU ROD has been implemented, and the remedial action is ongoing. The Soils and Buildings OU ROD remediation is being conducted on 23 vicinity commercial and public properties, and the MISS.

The FMSS consists of 88 designated properties located in the Boroughs of Maywood and Lodi and the Township of Rochelle Park: the Stepan Company property, which includes contaminated buildings and three NRC-licensed burial pits; the MISS which includes another contaminated building; 59 residential properties; three properties owned by the State or Federal Government; four municipal properties; and 20 commercial properties. The DOE identified these properties through surveys performed by Oak Ridge National Laboratory. Two commercial and one government property were originally part of the MCW, and were used for waste storage and burial. The remaining commercial, government, and residential properties were contaminated by transport of soil by surface water runoff along former stream channels, or by use of contaminated material as fill and mulch.

Waste consolidation conducted by the Stepan Company in the 1960s on the former MCW plant property included relocation and burial of approximately 19,100 cubic yards of excavated waste materials. The Stepan Company sold the portion of the original plant property located west of NJ State Route 17, now known as 96 Park Way, Rochelle Park, after relocation of these waste materials. The Stepan Company currently holds an NRC license for the storage of thorium-bearing materials in three on-site burial pits which are being addressed as part of the Soils and Buildings OU ROD. The remediation of these three burial pits was substantially completed by the USACE in September 2010. Restoration and closeout reporting will proceed in FY 2012 at which time the USACE will hand physical possession of the licensed burial pits for purposes of control of radiation from FUSRAP materials subject to NRC jurisdiction back to Stepan Company [not scheduled to occur until May 2012 per recent USACE letter to NRC].

Constituents identified as FUSRAP waste in the Soils and Buildings OU ROD include radium-226 (Ra-226), thorium-232 (Th-232), and uranium-238 (U-238). The Soils and Buildings OU ROD requires LUCs to be implemented for properties where FUSRAP waste concentrations in inaccessible soils remain above cleanup criteria. LUCs that have been implemented as part of the Soils and Buildings OU ROD include periodic inspections of properties to determine changes in land use; distribution of notification letters that identify locations of FUSRAP waste to property owners, utility companies, government agencies, and other commercial entities; and the posting of content on the project website that provides the public with project information including maps that identify areas of FUSRAP waste. The latter two LUCs inform the public to contact the USACE before excavation is performed in areas where FUSRAP waste remains. Additional LUCs in the form of deed notices have been, and will continue to be developed, if necessary, on a property-by-property basis. The objectives of the LUCs are to restrict land uses to commercial or industrial use, prohibit residential or unrestricted use, and prohibit excavation in designated restricted areas. The LUCs are to remain in place until the cleanup standards stated in the Soils and Buildings OU ROD are achieved. In addition, environmental monitoring is being performed on an annual basis. This is accomplished through sampling and monitoring of the air, surface water, sediment, and groundwater.

C. Community Participation

Community participation activities provide the public with an opportunity to express its views on the preferred cleanup remedy. USACE and EPA considered State and public input from the community participation activities conducted during the RI/FS phase for groundwater remediation. Community participation was conducted in accordance with CERCLA and the NCP.

The *Groundwater Proposed Plan, FUSRAP Maywood Superfund Site* was released to the public on September 14, 2010. The document was made available to the public in the Administrative Record maintained at the USACE FUSRAP Public Information Center (PIC), 75A West Pleasant Avenue, Maywood, NJ, 07607 and online at www.fusrapmaywood.com. Notices of availability were published in local newspapers. An initial 30-day public comment period was held from September 20, 2010 through October 19, 2010. At the request of a stakeholder, a 30-day extension of the comment period through November 18, 2010 was subsequently granted, with public notice made in local newspapers accordingly. In addition, a public meeting was held on October 14, 2010. At this meeting, representatives from USACE provided information and answered questions regarding groundwater contamination at the MISS and the remedial alternatives under consideration. A transcript of the public meeting is included as Attachment 1 of this ROD and is also available to the public in the PIC and online in the *Administrative Record* files for the FMSS. USACE and EPA responses to the comments received during the comment period are included in the Responsiveness Summary, which is **Section III** of the ROD.

A *Community Relations Plan*, also available in the *Administrative Record* file, has been prepared and implemented to keep the public informed of site activities and to invite community input. As part of the Plan, USACE has produced progress update fact sheets, developed a public website, maintained the *Administrative Record* files, published press releases and legal notices, and maintained a project mailing list. In addition, neighborhood/small group meetings were conducted and coordination/informational activities were maintained with Vicinity Property owners and occupants during implementation of the soils remediation. The FMSS project also maintains the fully-staffed PIC office in Maywood's central business district. The office houses the Administrative Record file and other site documents and reports, as well as display materials illustrating site history, current status, and technical information. PIC materials are available for public review, and photocopying facilities are also provided. In addition, the PIC has hosted scheduled small group meetings and handles telephone inquiries as they are received.

D. Scope and Role of Operable Unit or Remedial Action

The scope of the proposed groundwater remedial action is to address groundwater contaminated with FUSRAP waste at the MISS and Vicinity Properties.

As with many Superfund sites, the problems at the FMSS are complex. The FMSS is being addressed under three separate actions coordinated by the EPA Region 2. The USACE is addressing thorium and other wastes at the site defined as "FUSRAP waste" within the soils/buildings and groundwater. Stepan Company is addressing other chemical wastes (non-FUSRAP waste) at the FMSS. All three actions are being conducted under CERCLA. Although the USACE and Stepan Company are independently preparing decision documents for their respective OUs, the EPA is overseeing and coordinating all three actions.

The FMSS is organized into three OUs. Work covered under the scope of this ROD is highlighted in bold in the following list of OUs:

- Soils/Buildings at the MISS, 23 commercial and Government Vicinity Properties contaminated with FUSRAP waste as defined previously (all contaminated buildings are located on the Stepan Company property and the MISS). This OU includes the Stepan Company burial pits, licensed and regulated by the NRC.
- **Groundwater impacted by FUSRAP waste and contaminated groundwater on the MISS.**
- Non-FUSRAP chemical wastes.

The first OU, presented in the Soils and Buildings OU ROD, addresses the contaminated soils and buildings at the 24 remaining properties of the original 88 designated Vicinity Properties. These properties are the MISS and 23 commercial and government properties. Included in the remediation are the contaminated buildings on the Stepan Company property and the MISS that meet the definition of FUSRAP waste. Several of these properties are known or suspected to have contaminated soils under permanent structures such as buildings. These soils are considered inaccessible and will be addressed at such time in the future as the property owners make these soils accessible.

The second OU, the subject of this ROD, addresses groundwater contamination at the MISS and Vicinity Properties related to thorium processing activities and chemical groundwater contamination originating on the MISS.

The third OU, the subject of a future ROD, is being addressed by Stepan Company for non-FUSRAP-related chemical contamination in soils or groundwater related to the areas outside of the MISS under both an administrative order on consent and an administrative order.

The OUs as presented represent the conventional listing of the OUs for the Maywood site, although the EPA CERCLIS database has an alternate listing of these OUs.

E. Documentation of Significant Changes

The Proposed Plan for the FMSS was released for public comment in September 2010. The Proposed Plan identified Alternative 3 as the proposed remedy – Use Restrictions, Groundwater Monitoring, In situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS. At the time of the public comment period, the NJDEP did not have an interim soil or impact to groundwater screening level for lithium. The interim cleanup value proposed by the NJDEP in response to the Proposed Plan is 14 micrograms per liter (µg/L) as a site-specific groundwater cleanup goal, which equates to a 55 milligrams per kilogram (mg/kg) soil remediation goal. USACE and EPA agree that the cleanup goals for lithium, as identified in the Proposed Plan, are generally protective of human health and the environment. Furthermore, USACE believes that the NJDEP interim value of 55 mg/kg in soils will, on average, be met through the implementation of the selected remedy. For these reasons, it did not appear warranted to restart the feasibility study process, incur additional costs, and further delay the selection of a groundwater remedy. NJDEP also commented that USACE calculations for impact to groundwater cleanup level should have considered the NJ Impact to Groundwater Soil Screening Level of 0.005 mg/kg for benzene and Impact to Groundwater Soil Screening Level of 19 mg/kg for arsenic. These numbers represent the cleanup values in soil to obtain the cleanup values in groundwater based on applicable or relevant and appropriate requirements (ARARs) found in the Proposed Plan. USACE defers to NJDEP based on the specifics of this site and will use the new numbers provided for arsenic (19 mg/kg) and benzene (0.005 mg/kg), which are more stringent than the soil cleanup levels in the Proposed Plan.

Lithium has been widely observed in groundwater at the MISS. Since the groundwater BRA evaluation of lithium indicated a significant non-cancer contribution to the total hazard index (HI), and the Groundwater Remedial Investigation (GWRI) reported that lithium exceeded the EPA Region 9 tap water Preliminary Remediation Goal (PRG) (a non-promulgated risk-based remedial goal), USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of the following: constructability and stability issues; future redevelopment of the site; property transfer if determined to be excess to Federal needs; and prevention of potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk. Since ARARs are not available for lithium in groundwater, a risk-based action level was derived for lithium, based upon ingestion of groundwater. Based on agreements between the EPA Region 2 and USACE, a risk-based action level of 730 μg/L was derived using the exposure parameters and the toxicity values used in the baseline risk assessment (provisional oral reference dose 2×10^{-2} milligrams per kilogram per day (mg/k-d), based on Schou and Vestergaard, 1988) with two uncertainty factors of 10 applied to account for sensitive subpopulations and use of the lowest observed adverse effect level [LOAEL]). The basis for the action level is a hazard quotient (HQ) of 1 using the above-described toxicological information. In order to achieve this groundwater goal, a soil cleanup number for lithium has been established at 194 mg/kg,)as discussed in **Section II.I**. EPA Region 2 and USACE agree that these levels for lithium in groundwater and soils are protective and thus appropriate to manage risks on the MISS.

If post-remedial action soil sampling results fail to achieve the impact to groundwater cleanup value of 19 mg/kg for arsenic, the option of in situ treatment of arsenic in overburden groundwater will be evaluated in coordination with EPA and implemented and monitored if deemed appropriate.

Since there were no changes to the alternatives in the Proposed Plan, only clarification to the selected alternative, USACE and EPA have determined that the changes identified above could be reasonably anticipated by the public based on the alternatives and other information available in the Proposed Plan or the supporting analysis and information in the Administrative Record file. These changes represent a more conservative cleanup approach. Therefore, the agencies did not seek additional public comment on a revised Proposed Plan.

F. Site Characteristics

The site characteristics summarized here are described in the *Final Groundwater Remedial Investigation Report, FUSRAP Maywood Superfund Site* (USACE, 2005b) and *Final Groundwater Feasibility Study Report (GWFS), FUSRAP Maywood Superfund Site,* (USACE, 2010b).

F.1 Surface and Subsurface Features

The FMSS and MISS are located in the Piedmont Physiographic Province within the U. S. Geological Survey (USGS) Hackensack Quadrangle. The Piedmont Province in NJ is located within the Newark Basin, a northeast trending half graben which extends southwest (SW) from the Hudson River Valley in New York to southeastern Pennsylvania.

The Newark Basin is primarily composed of a sequence of sedimentary rocks and intrusive igneous rocks, commonly referred to as the Brunswick Group. The sedimentary rocks within the Brunswick Group consist of sandstones, shales, mudstones, and conglomerates having strike orientations ranging from N20E to N35E, and dipping between 7 and 15 degrees to the northwest (NW).

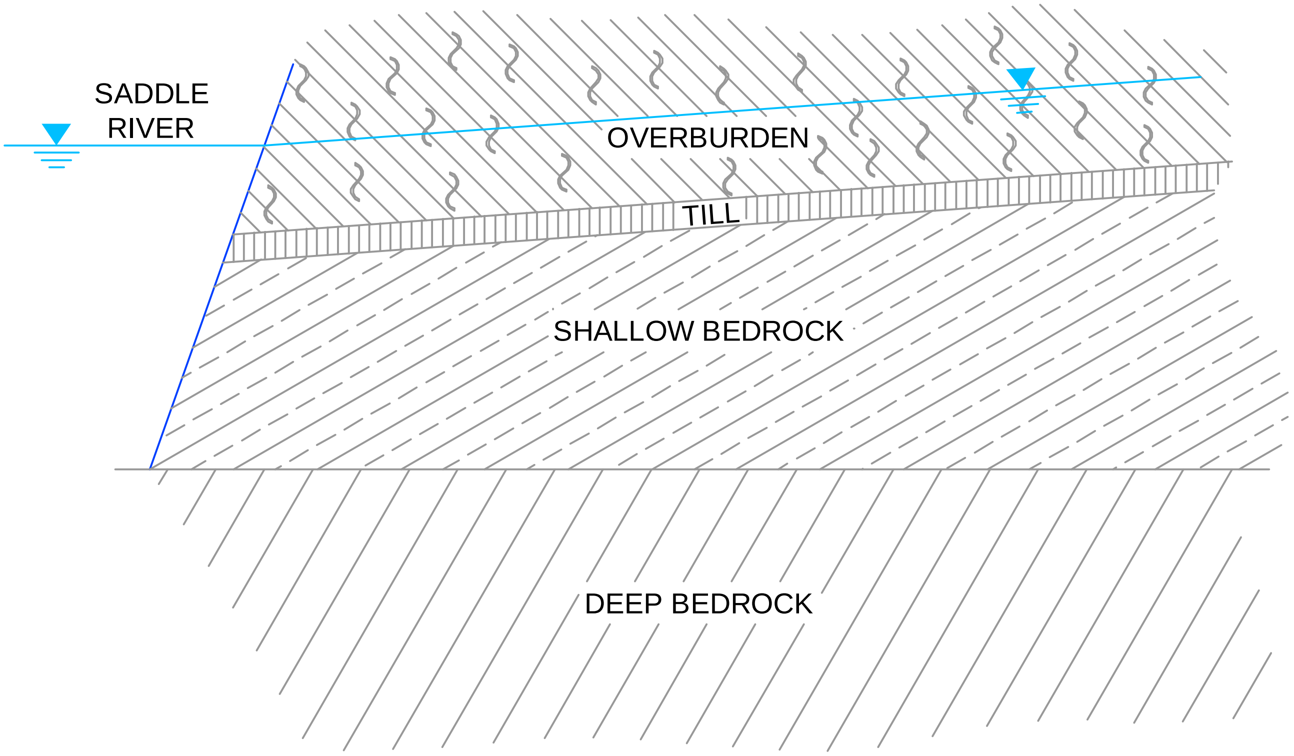
The sedimentary rocks of the Brunswick Group are divided into three formations: a lower unit, the Stockton Formation; a middle unit, the Lockatong Formation; and an upper unit, the Passaic Formation. The FMSS and MISS are underlain by the Passaic Formation Sandstone Member which is described as an interbedded grayish red to brownish red, medium to fine grained, medium to thick bedded sandstone and brownish to purplish red, coarse grained siltstone; the unit is planar to ripple cross laminated, fissile, locally calcareous containing desiccation cracks, and root casts. Upward fining cycles are 6 to 15 feet (ft) thick. Maximum thickness is approximately 3,600 ft.

Groundwater beneath the FMSS and MISS occurs in bedrock and locally in overburden deposits. **Figure 3** provides a generalized cross-section of the region's geological units, which comprise the regional aquifer.

Groundwater within the FMSS and MISS is classified as Class II groundwater. Class II groundwater has a designated use of potable groundwater with conventional water supply treatment, either at its current water quality (Class II-A) or subsequent to enhancement or restoration of regional water quality, so that the water will be of potable quality with conventional water supply treatment (Class II-B). Both existing and potential potable water uses are included in the designated use.

A brief description of the bedrock and overburden units is provided in the following paragraphs.

<u>Bedrock</u>: Regionally, groundwater in bedrock occurs under confined and unconfined conditions within a network of interconnected bedrock joints (fractures) and open bedding fractures in the Passaic Formation. The permeability of the Passaic Formation is fracture controlled, with the exception of some sandstone aquifer units. Regionally, the Passaic Formation provides a major source of groundwater in the Newark Basin and locally to a number of water districts in Bergen County. The bedrock aquifer is layered (heterogeneous), typically consisting of a series of alternating aquifers and aquitards several tens of feet thick.



NOT TO SCALE

FIGURE 3

GENERALIZED GEOLOGIC CROSS-SECTION

MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps
of Engineers

FUSRAP
Maywood Superfund Site

Shaw
Shaw Environmental, Inc.

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	8/18/10	--	WS/BBF	G. Gaillot	--	134455-A1

Xref :
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Plot Date/Time: Aug 18, 2010 - 10:14am
Plotted By: bernadette.oconnor

The water bearing fractures of each aquifer are more or less continuous, but hydraulic connection between individual aquifers is poor. These aquifers generally dip downward for a few hundred feet and are continuous along the strike for thousands of feet. Shallow bedrock, the depth of most interest, generally extends 10 to 35 feet below the bedrock surface. Shallow bedrock monitoring well's yield on the FMSS range from 0.5 to 50 gallons per minute (GPM) with most wells producing 0.5 to 2.0 GPM. Shallow bedrock yields have been measured locally in three wells, during short-term pumping tests (two to 72 hours), with average flows of 10.5, 16, and 17 GPM. Long term pumping rates from single wells located on the MISS, based on computer modeling, are expected to be less than 5 GPM.

A shallow bedrock potentiometric surface map for the FMSS and MISS is shown on **Figure 4**. Shallow bedrock groundwater flow at the MISS is generally towards the west and the Saddle River. However, some groundwater flows to the NW and SW due to the influence of a bedrock high to the east of the MISS.

Flow arrows, showing the varying flow directions, are also shown on **Figure 4**. The varying direction of groundwater flow across the MISS is a result of a bedrock high to the east on Stepan Company property.

Overburden: Saturated, laterally continuous overburden deposits were mapped in parts of the FMSS, and comprise the local overburden aquifer. Overburden material typically consists of a lower undifferentiated till and gravel unit (on bedrock), which is overlain by gravel, upper undifferentiated till and sand, and an upper sand unit. In most FMSS areas, the sand (unit) is covered by fill of varying thickness. The highest aquifer permeability and porosity (and groundwater yield) is typically encountered in stratified drift (well sorted glacial outwash deposits composed of sand, gravel, silt, and clay laid down by glacial melt water in a river flood plain and in glacial lake deltas and alluvial fans), and is expected in the mapped gravel and sand units. Stratified drift deposits are usually laterally extensive within a paleodrainage, but can vary in composition, permeability, and well yield. The reported yield of stratified deposits in the Hackensack Quadrangle ranges from one to several hundred GPM; however, local wells are expected to yield from 0.5 to 5 GPM. The gravel and/or sand units are mapped in all overburden aquifer areas, and are expected to transmit the majority of groundwater in the overburden aquifer.

Figure 5 shows that MISS overburden groundwater elevation contours bend around the bedrock high on the adjacent Stepan Company property resulting in radial groundwater flow off the high and a NW to SW range of flow directions on the MISS. Groundwater flow arrows on **Figure 5** show northwest MISS overburden groundwater flow along the eastern portion of the northern boundary, a westerly groundwater flow direction towards the Saddle River in the center portion of the MISS, and a SW groundwater flow direction at the southern end of the MISS.

Groundwater - Surface Water Interaction

The interaction between groundwater and surface water is discussed in the following paragraphs.

Westerly Brook: The upstream portion of Westerly Brook is conveyed by culvert pipe under the MISS and 96 Park Way, Rochelle Park and opens to a channel at St. Ann Place in Rochelle Park.

Legend:

MW-15D (32.41)	Shallow Bedrock Monitoring Well (July, 2001 Head Measurement Displayed in Parentheses.)
32	Equipotential Contour in feet above Mean Sea Level (MSL). Contour Interval = 2 feet.
←	Groundwater Flow Direction

Note: Figure 1-4 initially appeared as Figure 3-15a of the GWRI – November 2004

Horizontal Scale in feet

0 500 1000 1500

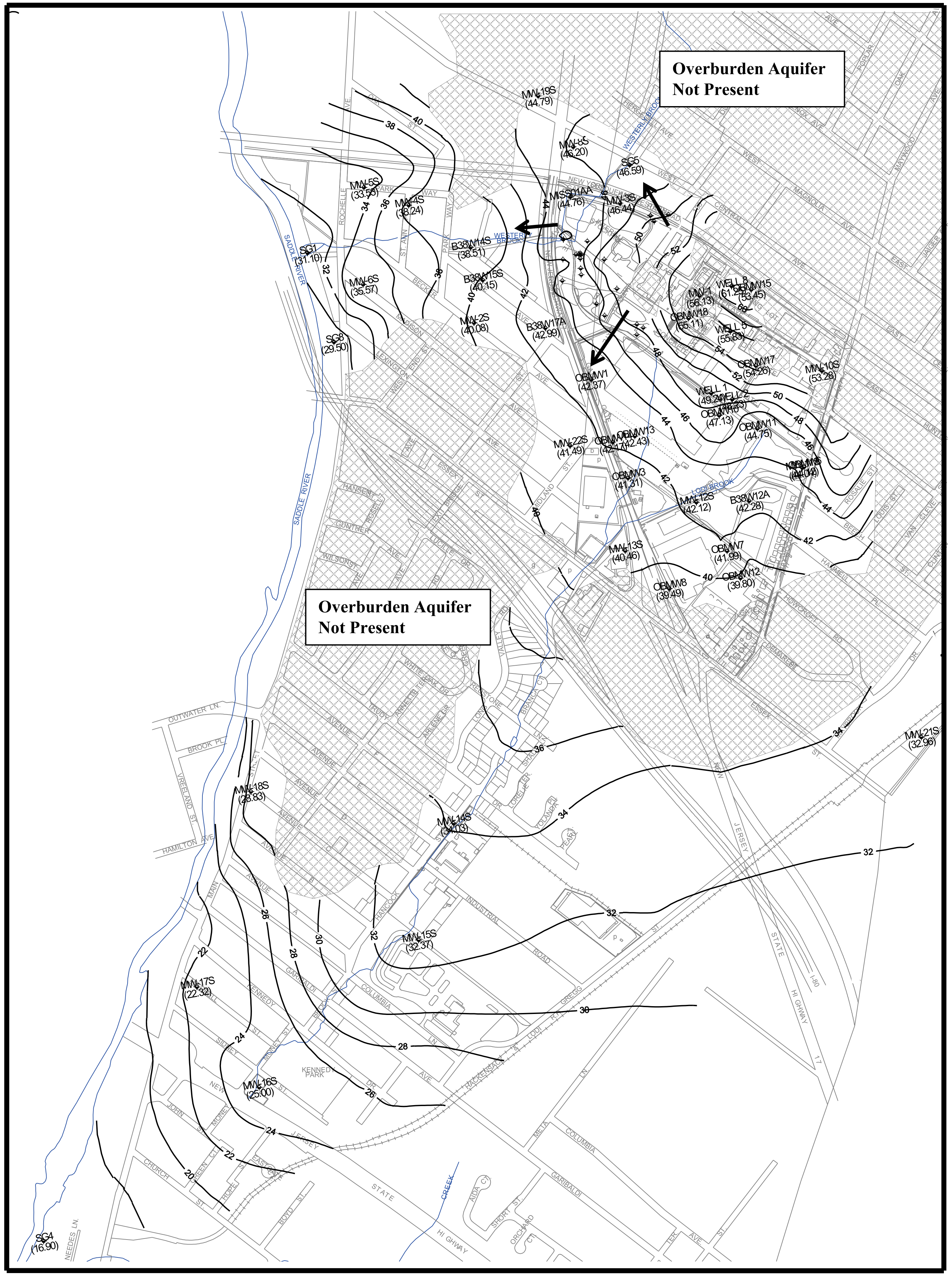
Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Chemical Company Superfund Site website at <www.fusrapmaywood.com>.

Figure 4
Shallow Bedrock, Groundwater Potentiometric Surface Map of FMSS (July 2001 Synoptic Event)

US Army Corps of Engineers

FUSRAP Maywood Superfund Site

Shaw Shaw Environmental, Inc.



N

W E

S

Legend:

MW-15S ✦ (32.37) **Overburden Monitoring Well**

▨ **Zone of 0 ft. Saturated Thickness (i.e., overburden aquifer not present).**

32 **Equipotential Contour in feet above Mean Sea Level (MSL). Contour Interval = 2 feet.**

← **Groundwater Flow Direction**

Note: Figure 1-5 initially appeared as Figure 3-19a
of the GWRI – November 2004

Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Chemical Company Superfund Site website at <www.fusrapmaywood.com>.

Horizontal Scale in feet

0 500 1000 1500

Figure 5
Overburden, Groundwater Surface Elevation Map of FMSS
(July 2001 Synoptic Event)

US Army Corps of Engineers®

FUSRAP Maywood Superfund Site

Shaw® Shaw Environmental, Inc.

A video survey conducted by USACE in 2000 found that both the north- south and east-west sections of the Westerly Brook culvert leak heavily at open and cracked joints. Invert elevations for the Westerly Brook culvert pipe show that the culvert pipe is partially below the seasonal low groundwater table, and in some locations was installed on the top of bedrock. These data suggest that groundwater from the MISS is infiltrating into Westerly Brook through open joints in the culvert pipe.

Lodi Brook: Lodi Brook originates on the 149-151 Maywood Avenue, Maywood property, and flows approximately 1,400 ft as an open channel through the 149-151 Maywood Avenue property to NJ State Route 17. At NJ State Route 17, Lodi Brook is principally routed into a culvert pipe and flows south to the Saddle River.

Lodi Brook is a continuously-fed or perennial stream, with an estimated base flow of 0.06 cubic meters per second (m^3/s) (2 cubic feet per second [cfs]) (DOE, 1992). Lodi Brook originates in the low marshy areas on 149-151 Maywood Avenue, and is probably fed by shallow groundwater at the two headwater tributaries; however, the main channel does not appear to be a major groundwater discharge point.

Lodi Brook also receives intermittent stormwater runoff from local residential and commercial areas (via storm drains) during wet weather. Seasonal groundwater and surface water interaction is expected during prolonged dry and wet periods.

The GWRI indicates that base flow rate estimates were based on the *Remedial Investigation Report for the Maywood Site* (DOE, 1992). The DOE report indicates that there is no available stream gauge flow data for Lodi and Westerly Brooks, and that flow rates were "visually" estimated to provide "order of magnitude" estimates.

Site Topography

The topography of the MISS ranges in elevation from approximately 51 to 67 ft above mean sea level. The highest elevations are in the northeastern portion of the property. The property is enclosed by a chain-link fence, and access is restricted.

F.2 Sampling Strategy

Numerous groundwater investigations have been conducted at the FMSS by Federal and State agencies. Soil investigations are detailed in the *Proposed Plan for Soils and Buildings at the FUSRAP Maywood Superfund Site* (2002), and are not discussed here.

The DOE began investigating the FMSS and surrounding area in 1983, conducting radiological surveys throughout the FMSS from 1984 through 1987. They conducted an RI at the FMSS from 1989 through 1991 covering the Stepan Company property, the MISS, eight residential properties, and five commercial/governmental properties. The 1992 DOE RI Report concluded that information regarding the nature and extent of groundwater contamination was incomplete and that further investigation was needed.

In order to fill data gaps, a Phase I groundwater RI field program was conducted by the USACE in 1999 and 2000 and included the following elements:

- Direct push (Geoprobe®) groundwater investigation.
- Existing monitoring well inventory.
- USACE monitoring well sampling.

- Groundwater level measurement.
- Video inspection of the Westerly Brook and Lodi Brook culverts.

A Phase II groundwater field program conducted by the USACE during 2000 to 2002 included the following elements:

- Area water purveyor and well search.
- Direct push (Geoprobe®) groundwater investigation.
- Installation of overburden and bedrock monitoring wells.
- Survey of all USACE and Stepan Company monitoring wells.
- Groundwater sampling of USACE and the Stepan Company monitoring wells.
- Groundwater level measurements.

Additional work by the USACE was conducted to investigate the source and downgradient extent of a bedrock groundwater benzene plume. A supplemental groundwater investigation field program conducted during 2003 included the following elements:

- Evaluation of existing soil and groundwater benzene data.
- Installation of additional bedrock wells to delineate the benzene plume.
- Groundwater sampling at selected bedrock wells.
- Biogeochemical sampling at selected wells to characterize biodegradation in the bedrock groundwater aquifer.
- Groundwater level measurements in shallow and deep bedrock wells over the study area.

The Phase I, II, and supplemental activities were documented in the *Final Groundwater Remedial Investigation (GWRI) Report* (USACE, 2005b).

F.3 Nature and Extent of Contamination

The limits of the USACE's responsibilities for the FMSS are defined under an FFA executed by the DOE (USACE's predecessor lead agency) and the EPA Region 2 on September 17, 1990. Under the terms of the FFA, the DOE was responsible for FUSRAP waste, defined as:

- All contamination, both radiological and chemical, whether commingled or not, on the MISS;
- All radiological contamination above cleanup levels related to past thorium processing at the MCW site occurring on any Vicinity Properties;
- Any chemical or non-radiological contamination on Vicinity Properties that would satisfy either of the following requirements:
    1. The chemical or non-radiological contaminants are mixed or commingled with radiological contamination above cleanup levels; or
    2. The chemical or non-radiological contaminants originated in the MISS or were associated with the specific thorium manufacturing or processing activities at the MCW site which resulted in the radiological contamination.

Groundwater samples from the overburden and shallow bedrock aquifers were collected during the 1999-2003 site investigations at the FMSS. The most frequently detected constituents identified in the groundwater at the FMSS were benzene, arsenic, and lithium. **Figures 6**, **7**, and **8** show the MISS-related benzene, arsenic, and lithium combined plumes in overburden and shallow bedrock groundwater.

Concentrations of each overburden and shallow bedrock groundwater contaminant on the MISS were as follows:

Parameter	Number of Detections	Maximum Detection	Minimum Detection	Average Concentration
Benzene	15	5,000 µg/L	1 µg/L	904 µg/L
Arsenic	10	2,600 µg/L	3.6 µg/L	411 µg/L
Lithium	32	16,100 µg/L	883 µg/L	4,720 µg/L

Note: µg/L = micrograms per liter

Because the FFA defines FUSRAP waste to include all contamination on the MISS, arsenic and benzene are considered FUSRAP wastes for the purposes of the proposed groundwater remedy. The *Feasibility Study for Soils and Buildings at the FUSRAP Maywood Superfund Site* (August 2002) and the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site* (August 2003) did not identify the hazardous substances arsenic and benzene as FUSRAP wastes. Groundwater was not directly addressed in the Soils FS due to ongoing groundwater investigations. The data obtained from these ongoing investigations were evaluated during the development of a groundwater *Baseline Risk Assessment (BRA)* (USACE, 2005a) that was performed as part of the RI/FS process and which subsequently identified likely MISS source areas for arsenic, benzene, and lithium in groundwater.

Isolated occurrences of barium, beryllium, lead, thallium, methylene chloride, and toluene were also observed in MISS groundwater, but none of these chemicals were widely distributed in the groundwater (typically detected in five or less wells) with no evidence of a plume.

Elevated iron (Fe) and manganese (Mn) concentrations are attributed to the ongoing degradation of organic constituents (benzene, chlorotoluene, and chlorinated solvents) in groundwater. The highest total manganese and iron concentrations were detected in monitoring wells impacted with organic constituents and is attributed to the dissolving of these constituents from the aquifer matrix. Once the organic constituents are remediated, and/or degraded, iron and manganese would oxidize, become less soluble, and precipitate out of groundwater, returning dissolved-phase concentrations to background levels.

Trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride (VC), xylenes, and 2-chlorotoluene were detected in the groundwater at the MISS. These chemicals were determined to be from an upgradient source. Arsenic was also detected in off-site monitoring wells which are not related to the MISS. Even though these chemicals do not originate on the MISS, they were evaluated during the GWFS in order to determine their effect on the various remedial alternatives. Lithium was widely observed in groundwater at the MISS.

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	*9/13/10*	--	*A. Smith*	*D. McCracken*	*G. Gaillot*	134455-A3

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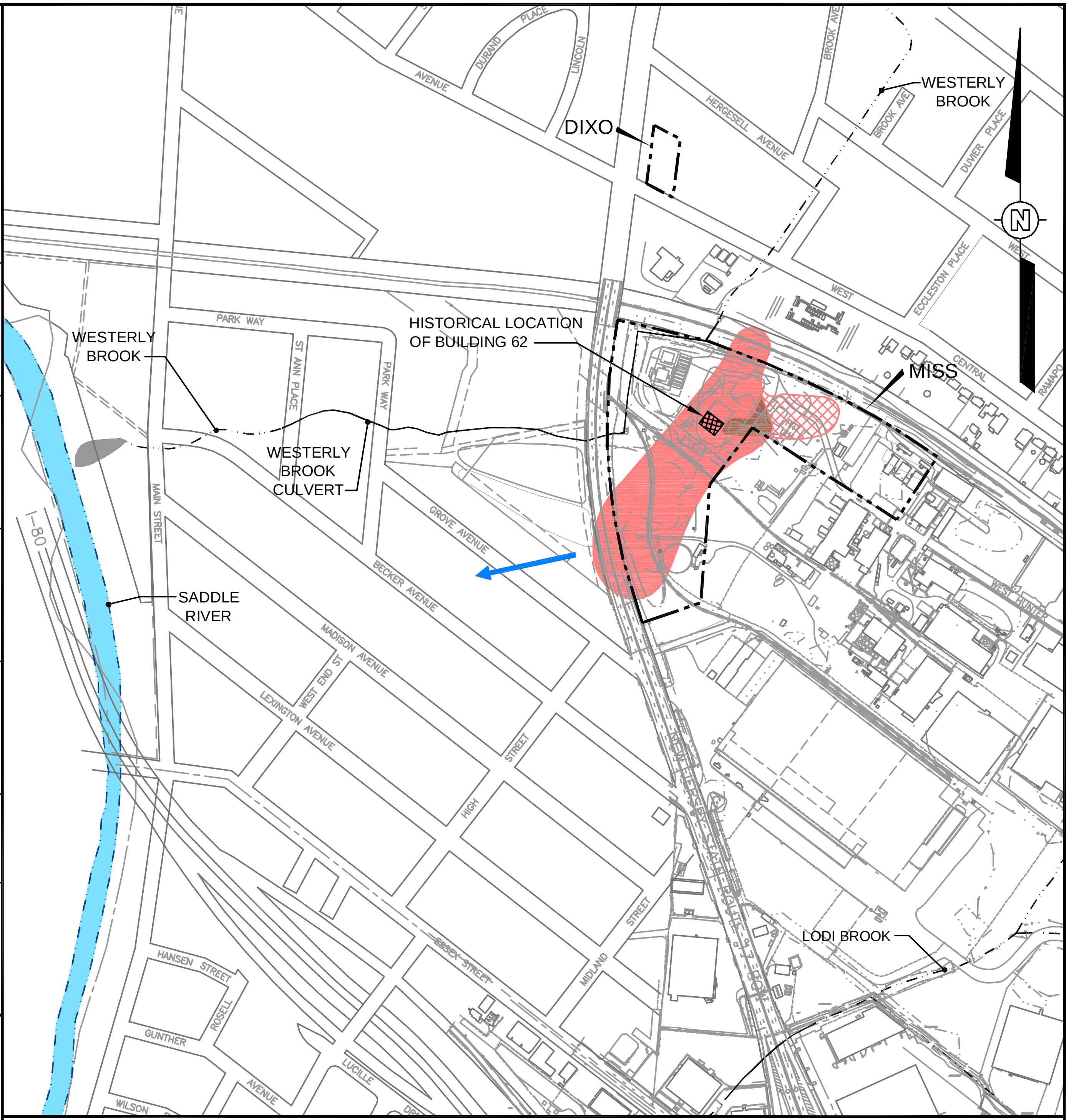

LEGEND:

🟥	INDICATES SHALLOW BEDROCK CONCENTRATION EXCEEDANCE OF NJDEP MCL OF 1 ug/L
▨	INDICATES OVERBURDEN CONCENTRATION EXCEEDANCE OF NJDEP MCL OF 1 ug/L
🟫	INDICATES SHALLOW BEDROCK AND OVERBURDEN CONCENTRATION EXCEEDANCE OF NJDEP MCL OF 1 ug/L
←	GENERAL GROUNDWATER FLOW DIRECTION
MISS	MAYWOOD INTERIM STORAGE SITE

NOTE: FIGURE AMENDED NOVEMBER 17, 2011 TO SHOW HISTORICAL BUILDING 62.

SCALE
0 500 1000 FEET

FIGURE 6

BENZENE GROUNDWATER PLUME

MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps of Engineers

FUSRAP
Maywood Superfund Site

Shaw
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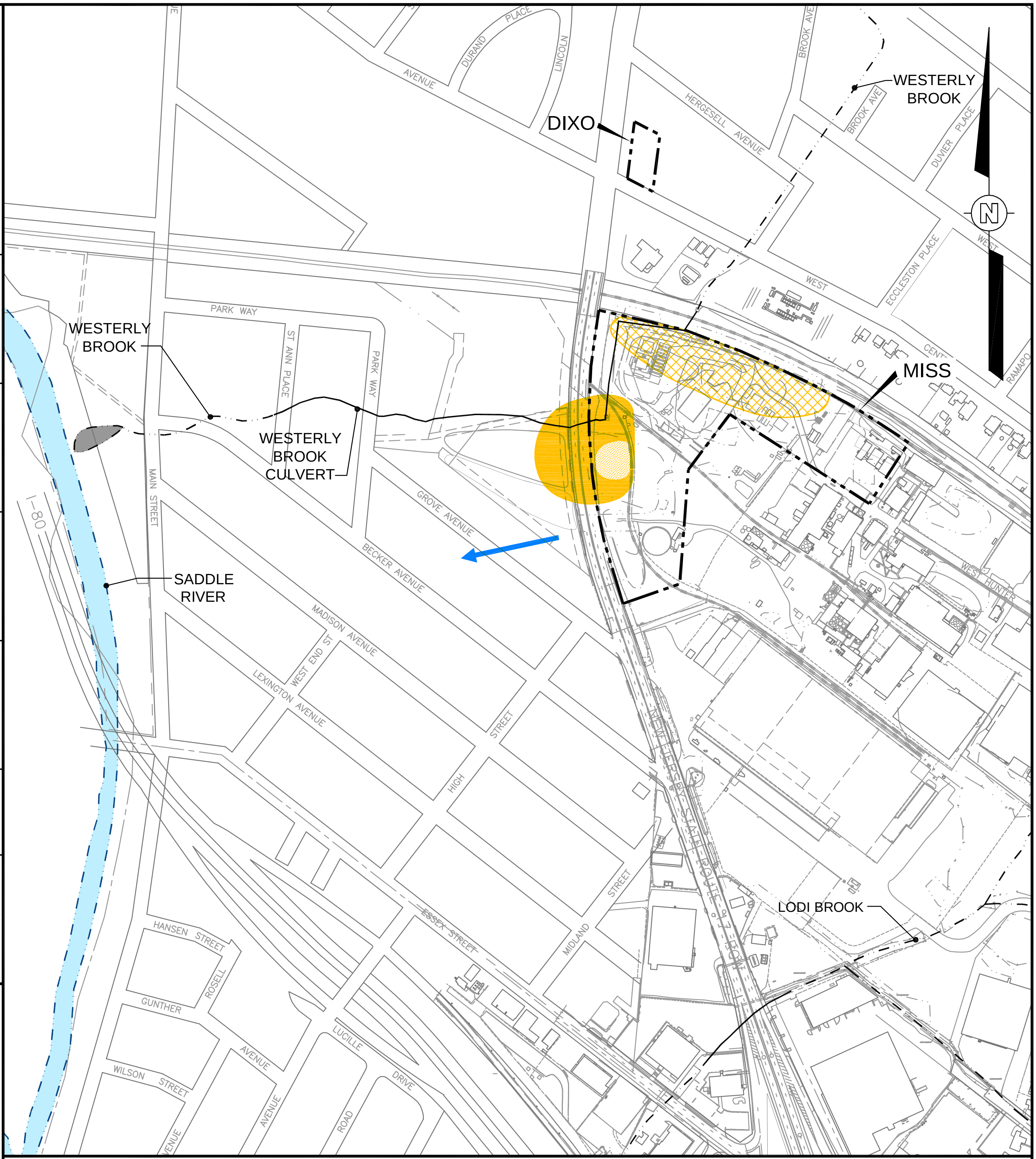
Plotted By: bernadette.oconnor



LEGEND:

🟧	INDICATES SHALLOW BEDROCK CONCENTRATION EXCEEDANCE OF NJGWQC PQL OF 3 ug/L
▨	INDICATES OVERBURDEN CONCENTRATION EXCEEDANCE OF NJGWQC PQL OF 3 ug/L
▒	INDICATES SHALLOW BEDROCK AND OVERBURDEN CONCENTRATION EXCEEDANCE OF NJGWQC PQL OF 3 ug/L
←	GENERAL GROUNDWATER FLOW DIRECTION
MISS	MAYWOOD INTERIM STORAGE SITE

SCALE

0 500 1000 FEET

FIGURE 7

ARSENIC GROUNDWATER PLUME

MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps of Engineers

FUSRAP
Maywood Superfund Site

Shaw Environmental, Inc.

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	9/13/10	--	A. Smith	D. McCracken	G. Gaillot	134455-A4

Xref : 108783X1
Image : FMSS.jpg

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Plot Date/Time: Feb 02, 2011 - 7:58am
Plotted By: arthur.smith

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	*9/13/10*	--	*A. Smith*	*D. McCracken*	*G. Gaillot*	134455-A5

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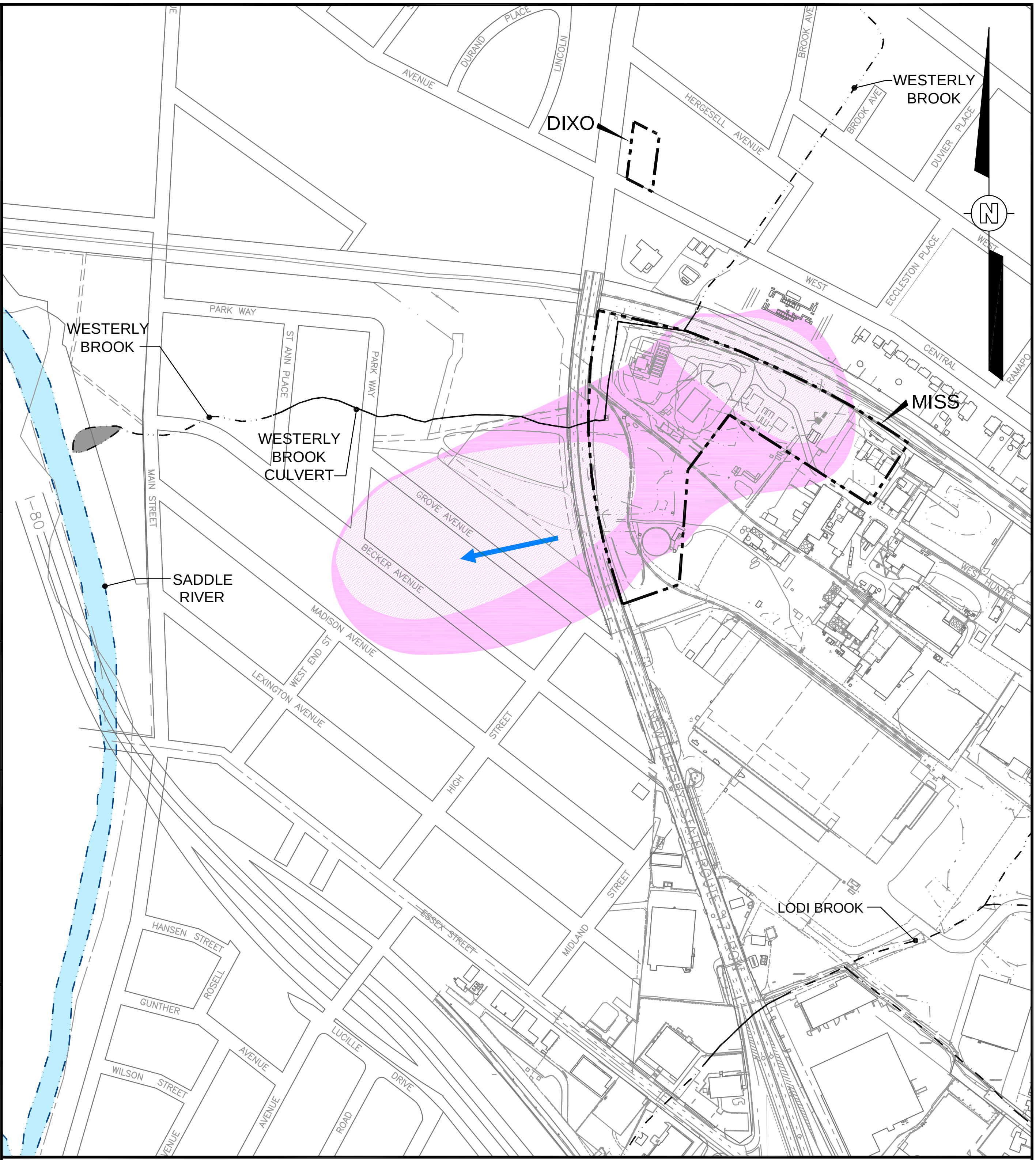

LEGEND:

▨	INDICATES SHALLOW BEDROCK CONCENTRATION EXCEEDANCE OF THE SITE–SPECIFIC CLEANUP LEVEL OF 730 ug/L
▨	INDICATES SHALLOW BEDROCK AND OVERBURDEN CONCENTRATION EXCEEDANCE OF THE SITE–SPECIFIC CLEANUP LEVEL OF 730 ug/L
←	GENERAL GROUNDWATER FLOW DIRECTION
MISS	MAYWOOD INTERIM STORAGE SITE

SCALE

0 500 1000 FEET

FIGURE 8

LITHIUM GROUNDWATER PLUME

MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps of Engineers

FUSRAP
Maywood Superfund Site

Shaw
Shaw Environmental, Inc.

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Plot Date/Time: Feb 02, 2011 - 7:58am
Plotted By: arthur.smith

The GWRI reported that the lithium exceeded the EPA Region 9 tap water PRGs that was published at that time. Lithium is a primary contributor to future unacceptable human health risk as described in **Section H.1** of this ROD. Lithium is not a listed CERCLA hazardous substance; however, USACE will address lithium materials remaining on the Federal Government-owned property in consideration of constructability and stability issues, future redevelopment of the site, property transfer (if determined to be excess to Federal needs) and to prevent potential future use of impacted groundwater on and off the property, since consumption of the lithium-contaminated groundwater would represent an unacceptable risk to human health.

Total uranium, total radium, gross alpha and gross beta are also not included as COCs in the Groundwater OU, based on the results of the BRA which concluded that radionuclides contribute relatively little to the total excess lifetime cancer risks. Furthermore, most of the radiological risks may be due to background levels of the radionuclides. The total radium and total uranium exceedances observed in MISS groundwater are localized and isolated to three wells and two wells, respectively. Additionally, the Soils and Buildings OU remediation will remove potential source areas, and the collection and treatment of excavation water, including groundwater during this effort, will remove water potentially contaminated with radionuclides. Continued groundwater monitoring for radiological constituents has been ongoing at the FMSS on an annual basis and concurrent with ongoing soil remediation. This continued monitoring is part of the USACE Maywood Environmental Monitoring Plan based, in part, on the Soils and Buildings OU ROD.

G. Current and Potential Future Land and Water Uses

The FMSS is located in three communities: the Boroughs of Maywood and Lodi, and the Township of Rochelle Park. The Borough of Maywood is governed by a mayor and council. The Township of Rochelle Park is managed by a township committee, which includes the mayor as one of its members. The Borough of Lodi is not included in this discussion since the Selected Remedy in this ROD does not impact properties in Lodi Borough. **Figure 9** shows the zoning boundaries for the FMSS properties which are shown on **Figure 2**.

G.1 Current Land Use

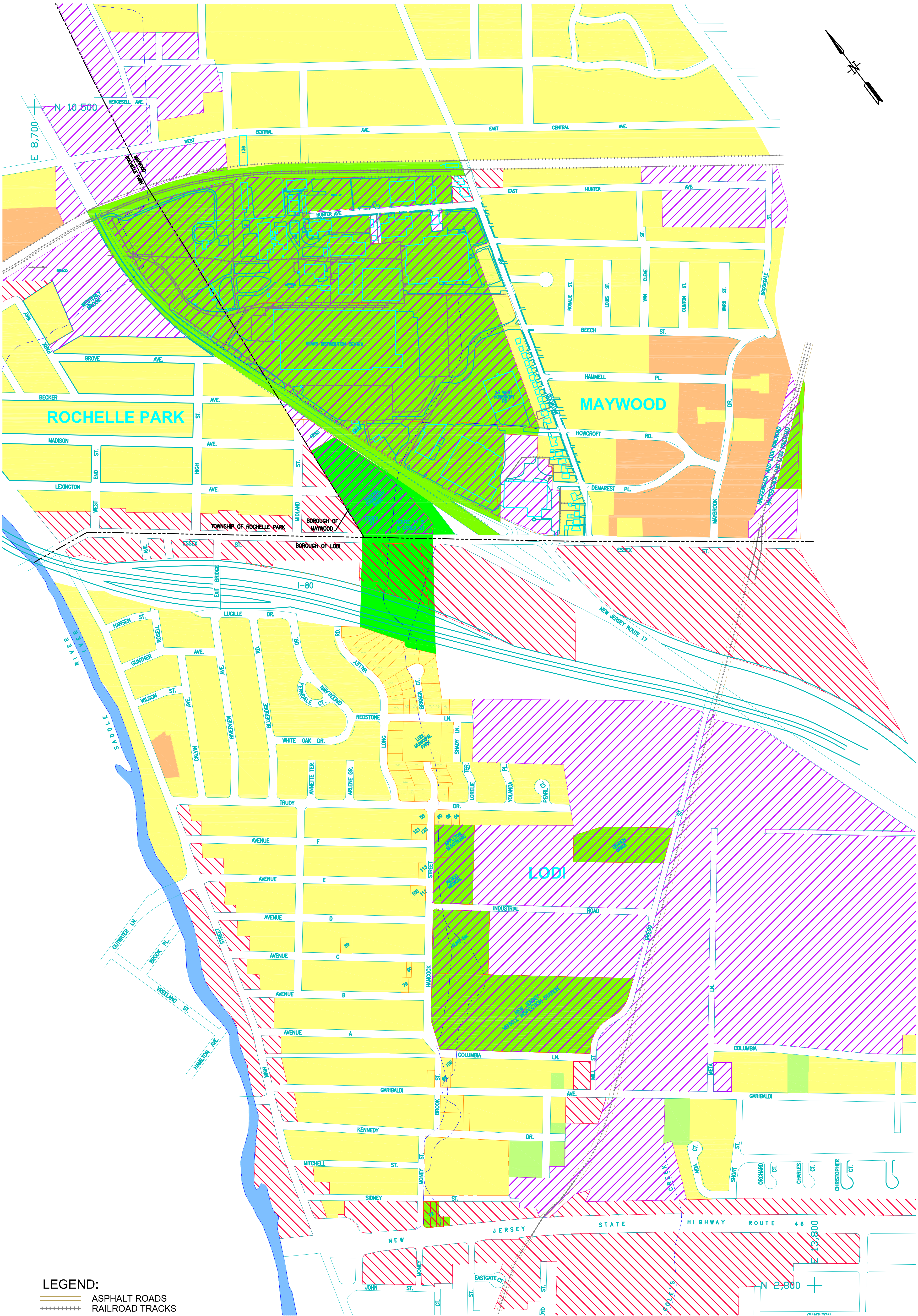
Land use planning is guided principally by the Municipal Land Use Law (Chapter 291, Laws of New Jersey, 1976). It establishes rules, regulations, and procedures for creating municipal planning and zoning boards. It also provides these boards with guidelines for creating zoning ordinances, master plans, and other planning tools. The *Borough of Maywood 2003 Master Plan* was reexamined and a *Master Plan Reexamination Report* issued in 2009, which incorporated several amendments to the Master Plan prepared between 2004 and 2009.

The *Township of Rochelle Park Master Plan* was last issued in 1991 with subsequent reexamination reports issued in 1997 and 2005.

G.1.1 Borough of Maywood

Land use at the MISS, Stepan Company, and the 14 Vicinity Properties located in the Borough of Maywood is currently zoned for limited light industrial activities, except for a small strip of land adjacent to Maywood Avenue that is zoned for residential use (**Figure 9**).

[SWIBOSDFS01\SHARES\MAYWOOD]\MAYWOOD\TASK0256\DRAWINGS\ESK\B\09\C05zone.dwg 07 September 2010



LEGEND:

- ASPHALT ROADS
- RAILROAD TRACKS
- TOWNSHIP BOUNDRIES
- STREAM OR TRIBUTARY
- RIVER OR CHANNEL
- 🟩 PROPERTY TO BE ADDRESSED BY SOILS AND GROUNDWATER RODS
- 🟨 RESIDENTIAL - ONE- AND TWO-FAMILY
- 🟧 RESIDENTIAL - APARTMENTS/LOW RISE
- 🟩 RESIDENTIAL - MEDIUM RISE
- ▨ COMMERCIAL
- ▨ INDUSTRIAL

0 600 1200 FEET

1" = 600'-0"

U.S. Army Corps of Engineers
NEW YORK DISTRICT

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

FIGURE 9
Zoning Boundaries for the FMSS Properties

Industrial land uses comprise approximately 10.4 percent of the total land area of the Borough of Maywood, and include four districts zoned limited light industrial. This classification permits light manufacturing operations, as well as the related functions of processing, wholesaling, warehousing, and storage of goods.

G.1.2 Township of Rochelle Park

Land use for portions of the MISS, Stepan Company, and the 149-151 Maywood Avenue properties that are located in the Township of Rochelle Park are currently zoned for industrial use (**Figure 9**). The commercial and industrial land uses comprise approximately 17.1 percent of the total land area of the Township of Rochelle Park. This classification permits retail trade and service establishments, eating and drinking establishments, business and professional facilities, banks and financial institutions, municipal buildings and facilities, child-care centers, storage, warehouses, truck terminals, and light manufacturing.

G.2 Future Land Use

Reasonably anticipated future use of the land at the FMSS is an important consideration in determining the appropriate extent of remediation. Future use of the land will affect the types and the frequency of exposures that may occur from any residual contamination remaining on the FMSS, which in turn affects the nature of the remedy chosen.

The factors used to determine the reasonably anticipated future land use were as follows:

- Current land use
- Reasonable foreseeable future land use
- Comprehensive community master plans
- Population growth patterns and projections (e.g., Bureau of Census projections)
- Site location in relation to urban, residential, commercial, industrial, agricultural, and recreational areas
- Federal/State/local land-use designation
- Historical development patterns.

These criteria were used to evaluate the FMSS properties addressed by this ROD in the Boroughs of Maywood and the Township of Rochelle Park, as discussed in the following paragraphs.

G.2.1 Borough of Maywood

Historically, the southern area of the Borough of Maywood has been zoned for light industrial use, and continues to experience an increase in population. The Maywood Master Plan has a well-defined industrial development area which includes the MISS. The New York, Susquehanna & Western Railway separates this light industrial area from a mixture of residential, commercial, and light industrial properties to the north, Interstate 80 to the west, Essex Street to the south, and Maywood Avenue to the east. The Maywood Master Plan recommends light industrial zoning classification or mixed development for properties near or adjacent to the MISS. A commercial, high rise zoning designation has been recommended for the MISS.

From 1970 to 2000, the total population in the Borough of Maywood experienced a slight population decline. This 30-year period of population loss has been attributed to a decrease in household size rather than emigration. The Borough of Maywood is a community that is 98 percent developed, with very little vacant or unused land. However, there is vacant land in other parts of Bergen County, allowing for some growth in the county. A review of population characteristics and development projects within the area has indicated a generally stable Borough population through 2010. The 2010 Census Bureau population for Maywood is 9,555, a less than 0.3 percent increase from the 2000 population. Because of this, no major increase in demand for additional housing is anticipated.

No cultural resources, environmental justice issues, wetlands, floodplains, or critical habitats of endangered or threatened species have been identified that would be impacted on or downgradient of the MISS.

G.2.2 Township of Rochelle Park

The Township of Rochelle Park Master Plan has well-defined commercial and industrial development areas. The Master Plan recommends maintaining the current land uses for all FMSS properties.

From 1970 to 2010, the total population in the Township of Rochelle Park, and Bergen County as a whole, declined. According to the 2010 Decennial Census, the population of the Township of Rochelle Park is 5,497, a 2 percent decrease from the 1990 population (www.census.gov). Because the population of much of the surrounding area is expected to remain stable, no major increase in demand for additional housing is expected.

No cultural resources, environmental justice issues, wetlands, floodplain, or critical habitats of endangered or threatened species have been identified that would impact the current industrial zoning.

G.2.3 Reasonably Anticipated Future Land Use and Selection of Cleanup Criteria

Reasonably anticipated future land use and recommended cleanup criteria for individual FMSS properties are shown in Table 4 of the Soils and Buildings OU ROD. Anticipated future land use for the MISS is as follows:

Reasonably Anticipated Future Land Use	Recommended Cleanup Criteria	Factors to Consider during Remedial Design when Selecting Appropriate Controls
Limited Light Industrial	Restricted Use	Property is Federally-owned; former MCW waste burial location; significant volumes of contamination present; industrial use for over 100 years.

G.3 Groundwater and Surface Water Uses

Much of the former surface water drainage patterns responsible for the spread of contamination at the FMSS have now been re-channeled and placed in culverts. Rainwater runoff from most of the MISS empties into the Saddle River via Westerly Brook, which flows under the property and under NJ State Route 17 through a concrete culvert. Neither the Saddle River nor Westerly Brook is used as a source of potable water.

Another perennial stream on the FMSS, Lodi Brook, originates as two branches on the 149-151 Maywood Avenue property. Because of construction, most of the original stream channel has been replaced by a storm drain system beneath the surface. The original stream channel has been identified from historic photographs and maps. The former channel pathway matches the distribution of contaminated materials in the Borough of Lodi. A structure and parking lot at 149-151 Maywood Avenue currently cover the western branch of Lodi Brook. The easternmost branch drains the surface area outside the fence on this property, and then flows underground for most of its route to the Saddle River. Some surface runoff from the MISS moves parallel to NJ State Route 17 and drains into Lodi Brook. Lodi Brook empties into the Saddle River downstream of Westerly Brook's confluence with the river. The 111 Essex Street vicinity property lies adjacent to Coles Brook. Coles Brook flows north-northeast and is part of the Hackensack River basin. Additional information on topography, drainage, and surface water at the FMSS is presented in the GWRI, Sections 3.1 and 3.3.

Surface water samples collected from Lodi Brook and Westerly Brook contained radium and arsenic at concentrations slightly above the State/Federal Maximum Contaminant Level (MCL). None of the samples contained total uranium or total thorium at concentrations exceeding their respective Federal/State MCLs. The sources of the metals impacting Lodi Brook are not migrating from the MISS or are not MISS-related. Sources of contamination, i.e., radium and arsenic in soil, impacting Westerly Brook are being addressed under the Soil and Buildings OU ROD and this Groundwater ROD, respectively. Impacted soils would be removed as a part of the Soils and Buildings OU ROD, effectively eliminating their introduction into the pipe by infiltration via groundwater.

Current surface water use is not projected to change significantly in the future.

Groundwater at the FMSS and MISS occurs in both the bedrock Passaic Formation and the unconsolidated glacial deposits. The Passaic Formation, classified as Class II-A, is a productive aquifer that is a major source of water for public and industrial use. However, groundwater is generally not used for municipal water supply in the lower Saddle River Basin, and the bedrock aquifer in the vicinity of the site is not currently used for drinking water or other domestic use.

As part of the groundwater RI, a well search centered on the MISS indicated the presence of more than 450 wells in a half-mile radius. Of the wells identified, 10 are listed as domestic use. These wells are located side gradient from the MISS. An additional 5-mile radius search centered on the MISS was conducted for water allocation permits, which resulted in the identification of only three water allocation permits within a 1-mile radius. One of these permits is for Stepan Company's surface water withdrawal from the Saddle River. The other two permits are for industrial wells installed in the deeper bedrock aquifer of the Passaic Formation, and are located in the opposite direction of groundwater flow at the MISS.

H. Summary of Site Risks

As part of the RI/FS process, the USACE performed a BRA for groundwater to determine the current and potential future effects of contaminants on human health and the environment.

The BRA was conducted for the entire FMSS and did not specifically evaluate risk related to contaminants located at the MISS.

H.1 Human Health Risk Assessment

The *Final Groundwater Baseline Risk Assessment (BRA)* (USACE, 2005a) for the FMSS was issued in July 2005. The purpose of the BRA was to present an evaluation of human health and ecological risks associated with radiological and chemical contamination detected in groundwater, surface water, and sediment. The BRA was comprised of a quantitative human health evaluation conducted in conformance with a Pathway Analysis Report, approved by the EPA Region 2, and a screening-level ecological risk assessment (SLERA), which is based on relevant data from the GWRI conducted for the FMSS.

The objectives of the BRA were to provide an analysis of potential health risks, currently and in the future, in the absence of any major action to control or mitigate contamination (i.e., baseline risks); and assist in determining the need for and extent of remediation.

The BRA addressed:

- All radiological and chemical constituents detected in groundwater from the GWRI Phase II Study Area, except for non-FUSRAP related chlorinated solvent constituents at select monitoring wells which are attributed to a site located just north of the GWRI Study Area; and
- All radiological and chemical constituents detected in surface water and sediment from Westerly Brook, Lodi Brook, the Saddle River, and Coles Brook in the vicinity of the GWRI Study Area during Phase II.

However, the focus of this ROD is the FUSRAP waste as defined in the FFA and **Section II.D** of this ROD.

The area surrounding the FMSS is primarily residential, so the risk assessment assumed this land use for the future of the site. Five categories of human receptors were identified and evaluated quantitatively: (1) residents who consume or use groundwater (both adults and children); (2) workers who consume groundwater; (3) recreationists who contact surface water (groundwater discharges to surface water); (4) construction workers who are exposed to shallow groundwater during excavation activities; and (5) municipal workers who contact surface water. Their potential for exposure was evaluated for a number of current and future use scenarios based on conservative exposure point concentrations developed for the evaluation. The BRA report was prepared to evaluate the risk to human health and the environment from the radioactive material and chemicals at the FMSS if no remedial actions are taken. The risk of developing cancer from FMSS contaminants was compared to the CERCLA risk range of 10^{-4} to 10^{-6} established in the NCP. This means an increased risk of developing cancer of one in ten thousand to one in one million.

The human health evaluation followed the accepted four-step process to assess potential human health risks. The steps were: data evaluation, exposure assessment, toxicity assessment, and risk characterization.

The residential drinking water scenario was used as a reasonably foreseeable use of the contaminated groundwater for purposes of risk assessment and the decisions to be made on remedial actions. However, there is no current human exposure to the groundwater contaminated with FUSRAP waste located under the Federally-controlled MISS and surrounding commercial properties. Groundwater contaminated with FUSRAP waste is not currently used as drinking water, and a public water supply is available.

The risk characterization indicated the following:

- <u>Current/Future Residents</u>: Evaluation of potential exposure to resident adults assuming potable use of the groundwater resulted in risk estimates that exceed the EPA acceptable cancer risk range and the acceptable level for non-cancer health effects. A HI of 40 was estimated indicating a potential for adverse, non-cancer health effects; arsenic, benzene, lithium, and 2-chlorotoluene in groundwater are the predominant contributors. A total excess lifetime cancer risk of 6×10^{-3} was estimated; arsenic, benzene, and VC are the predominant contributors to the risk estimates.
- Evaluation of potential exposure to resident children, assuming potable use of the groundwater, resulted in risk estimates that exceed the EPA acceptable cancer risk range and the acceptable level for non-cancer health effects. A total HI of 100 was estimated indicating a potential for adverse, non-cancer health effects; arsenic, benzene, lithium, 2-chlorotoluene, manganese, and xylenes in groundwater are the predominant contributors. A total excess lifetime cancer risk of 2×10^{-3} was estimated; arsenic, benzene, and VC are the predominant contributors to the risk estimates.
- <u>Current/Future Workers</u>: Evaluation of potential exposure to workers assuming potable use of the groundwater resulted in risk estimates that exceed the EPA acceptable cancer risk range and the acceptable level for non-cancer health effects. A total HI of 10 was estimated indicating a potential for adverse, non-cancer health effects; arsenic, benzene, and lithium in groundwater are the predominant contributors. A total excess lifetime cancer risk of 1×10^{-3} was estimated; arsenic and benzene are the predominant contributors to the risk estimates.
- <u>Current/Future Construction/Utility Workers</u>: Evaluation of potential exposure to construction/utility workers (assuming dermal contact and inhalation of vapors) working in the vicinity of an excavation in which groundwater infiltrates the bottom of the excavation results in risk estimates that exceed the EPA acceptable level for non-cancer health effects. A total HI of 10 was estimated indicating a potential for adverse, non-cancer health effects; benzene and 2-chlorotoluene in groundwater are the predominant contributors. The estimated total excess lifetime cancer risk is within the EPA acceptable risk range.
- <u>Current/Future Recreationists</u>: Evaluation of potential exposure to resident adolescents assuming contact with surface water and sediment while wading and recreating in Westerly Brook, the Saddle River, or Coles Brook did not result in risk estimates in excess of the EPA acceptable cancer risk range or acceptable level for non-carcinogenic health effects. Occasional consumption of sport fish caught in the Saddle River in the study area should not pose health risks to recreationists.
- <u>Current/Future Municipal Workers</u>: Evaluation of potential exposure to municipal workers assuming contact with surface water and sediment while conducting manhole inspection or clean-outs in the culverted sections of Westerly Brook or Lodi Brook

did not result in risk estimates in excess of the EPA acceptable cancer risk range or the acceptable level for non-cancer health effects.

In summary, the human health evaluation indicated a potential for health risks to residents (adults and children) and workers from exposure to groundwater, should groundwater be used for potable purposes, and to construction/utility workers from exposure to groundwater, should shallow groundwater be contacted during activities involving excavation. The non-cancer hazards indices and excess lifetime cancer risks greater than the EPA acceptable levels are predominantly due to arsenic and benzene. VC is also a predominant contributor to the excess lifetime cancer risks greater than the EPA acceptable level. In addition, lithium, manganese, and 2-chlorotoluene are predominant contributors to the non-cancer hazard indices greater than the EPA acceptable level.

The BRA further concluded that the radionuclides contribute relatively little to the total excess lifetime cancer risks. In addition, most of the radiological risks may be due to background levels of the radionuclides.

The BRA was conducted for the FMSS groundwater, thus the risks from MISS groundwater may not be the same as those previously described.

According to the GWRI, xylenes were detected in four wells only, on or near the Stepan Company property. The xylenes were attributed to the Stepan Company; they are being addressed by Stepan as part of OU 3 and will not be included as a COC in this ROD.

According to the groundwater BRA, the elevated iron and manganese concentrations are attributed to the ongoing degradation of organic constituents (benzene, chlorotoluene, and chlorinated solvents) in groundwater, and utilization (reduction) of these metals as alternate electron acceptors. The highest total Fe and Mn concentrations are detected in monitoring wells impacted with organic constituents and are attributed to the reduction/dissolution of the metals (Fe+2 and Mn+2) for the aquifer matrix. Once the organic constituents are remediated/degraded, iron and manganese (as Fe+3 and Mn+4) would oxidize/precipitate in the aquifer and return to background groundwater concentrations since the natural groundwater condition is oxidizing. As a result of this degradation process, iron and manganese will not be included as COCs in this ROD.

The chemical constituent 2-chlorotoluene was detected in groundwater collected from a limited number of monitoring wells installed on and off the MISS. The groundwater BRA evaluation of 2-chlorotoluene showed a non-cancer contribution to the HI. It was not included as a constituent of potential concern (COPC) in the GWRI, since it is from an upgradient/non-MISS source.

Lithium was widely observed in groundwater at the MISS. Since the groundwater BRA evaluation of lithium indicated a significant non-cancer contribution to the total HI, and the GWRI reported that lithium exceeded the EPA Region 9 tap water PRGs (a non-promulgated risk-based remedial goal), USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of the following: constructability and stability issues; future redevelopment of the site; property transfer if determined to be excess to Federal needs; and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk. Since ARARs are not available for lithium in groundwater, a risk-based action level was derived for lithium, based upon ingestion of groundwater. Based on agreements between the EPA Region 2 and USACE, a risk-based action level of 730 µg/L was derived using the exposure parameters and the toxicity values used in the baseline risk assessment (provisional oral reference dose 2×10^{-2} mg/k-d, based on Schou and Vestergaard, 1988) with two uncertainty factors applied to account for sensitive subpopulations and use of the lowest LOAEL). The basis for the action level is a hazard quotient (HQ) of 1 using the above-described toxicological information. In order to achieve this groundwater goal, a soil cleanup number for lithium has been established at 194 mg/kg,) as discussed in **Section II.I**. EPA Region 2 and USACE agree that these levels for lithium in groundwater and soils are protective and thus appropriate to manage risks on the MISS.

A risk assessment was not performed on upgradient groundwater for arsenic. Available information indicates that upgradient groundwater concentrations are below the New Jersey Groundwater Quality Criteria (NJGWQC) practical quantitation limit (PQL) of 3 µg/L. Background concentrations are discussed in the July 2005 Final GWRI, Volume 1, Section 3.6.2 FMSS Background Groundwater Quality, pages 3-19 and 3-20. The introductory paragraph states "There are no metals, radionuclides or volatile organic constituent exceedances in the corresponding upgradient vicinity property overburden and bedrock wells…" At the time of the GWRI, the exceedance value for arsenic used in the data screening was 8 µg/L. GWRI measured background (upgradient) arsenic concentrations in groundwater for bedrock were reported to range from 2.3 to 3.2 µg/L and in the overburden from non-detected (at a detection level of 3.2 µg/L) to 3.8 µg/L. As presented in Table 3-11 of the GWRI, background concentrations of arsenic in bedrock wells in Bergen County, NJ were reported by USGS to average 2.64 µg/L (based on 28 samples with a range of 1 to 10 µg/L) and in Stratified Drift Deposits (overburden) 1.00 µg/L (based on 2 samples).

Non-FUSRAP chemical constituents in groundwater whose impact on the remedial alternatives evaluated during the GWFS include: lithium, PCE, TCE, VC, 2-chlorotoluene, iron, manganese, and xylenes.

Based on the evaluation of MISS-related constituents in the BRA, the primary risk contributors from groundwater, assuming potable use, were determined to be benzene, arsenic, and lithium.

H.2 Screening-Level Ecological Risk Assessment

The SLERA comprised the following:

- Screening-level problem formulation, which included a description of the environmental setting, preliminary COPCs, constituent fate and transport information, a discussion of ecotoxicity and potential receptors and exposure pathways, and a presentation of assessment and measurement endpoints.
- Screening-level ecological effects evaluation.
- Risk calculations (in the form of HQs and total HIs), using appropriate surface water and sediment screening values for aquatic biota.
- Uncertainty assessment.

The SLERA focused on aquatic biota and did not evaluate the potential risk to higher-level organisms, such as semi-aquatic birds (waterfowl) and mammals, since they have more potential for exposure from surface water and sediments. Fish were considered to be the potential receptors of concern for radiological constituents, since they are more sensitive to radiological exposure than benthic invertebrates. For chemical constituents, fish and benthic invertebrates were the receptors of potential concern, since these organisms have the greatest potential for exposure of the aquatic and semi-aquatic organisms that may utilize the water bodies. Currently, Lodi Brook and Westerly Brook are predominantly culverted and offer little natural habitat. Coles Brook does not appear to have been impacted by the site.

None of the radiological constituents detected in surface water or sediment in any of the water bodies had HQs greater than one. Total hazard indices for radiological constituents in surface water and sediment were less than one for each water body. This indicates that there would be no potential for adverse ecological health effects from the presence of radionuclides in surface water and sediment in water bodies in the vicinity of the FMSS.

A number of chemical constituents detected in surface water and/or sediment in each of the water bodies had HQs greater than one, and therefore, would be chemical constituents of potential concern. In surface water and sediment, these constituents include copper, lead, manganese, silver, and zinc. In surface water, these constituents include aluminum, barium, boron, lanthanum, lithium, and uranium. In sediment, these constituents include antimony, arsenic, cadmium, chromium, and nickel.

However, the potential for adverse ecological health effects may be overstated due to the lack of upstream surface water and sediment samples from the evaluated water bodies. Most of the chemical constituents of potential concern have not been associated with the site and their concentrations in surface water/sediment may be the result of off-site, non-FUSRAP sources and upstream surface water/sediment quality.

There were no apparent differences in the general appearance and ecological health of the upstream and downstream locations based on observations made during visits to the surface water bodies.

There was adequate information to conclude that site-related ecological risks would be negligible with respect to the radiological constituents, and therefore, there would be no need for remediation on the basis of ecological risk.

Some of these constituents may be derived from off-site, non-FUSRAP sources and may reflect upstream surface water/sediment quality.

I. Identification of FUSRAP Groundwater COCs

The following FUSRAP COCs were identified for evaluation in the GWFS due to elevated concentrations in groundwater migrating from sources located on the MISS:

- Arsenic
- Benzene
- Lithium.

The *Feasibility Study for Soils and Buildings at the FUSRAP Maywood Superfund Site* (USACE, 2002a) and the *Record of Decision for Soils and Buildings at the FUSRAP Maywood Superfund Site* (USACE, 2003) did not identify arsenic and benzene as COPCs in the soils. Groundwater was not directly addressed in the soils FS due to ongoing groundwater investigations. The data obtained from the ongoing investigations were evaluated during the development of the BRA and GWFS, which subsequently identified likely MISS source areas for arsenic and benzene in groundwater. Therefore, arsenic and benzene are considered FUSRAP wastes for the purposes of this ROD.

Other chemical constituents present in groundwater were determined not to be COCs, since they are not FUSRAP wastes. These chemical constituents are from non-MISS related activities, upgradient sources, did not contribute to risk at the FMSS due to limited exceedances, or are the result of biodegradation of the organic constituents in groundwater. They were evaluated in the GWFS for completeness and potential effects on the remedial scenarios. These chemical constituents are:

- PCE
- TCE
- VC
- 2-Chlorotoluene
- Beryllium
- Thallium
- Lithium (non-MISS sources)
- Toluene.
- Xylenes (total)
- Arsenic (non-MISS sources)
- Barium
- Lead
- Methylene chloride
- Iron
- Manganese

Isolated occurrences of barium, beryllium, lead, thallium, methylene chloride, and toluene were observed in MISS groundwater, but none of these chemicals were widely distributed in the groundwater (typically detected in five or less wells) with no evidence of a plume. TCE, PCE, VC, xylenes, and 2-chlorotoluene were also detected in the groundwater at the MISS. These chemicals were determined to be from an upgradient non-FUSRAP source. Arsenic, which is not related to the MISS, was also detected in off-site monitoring wells. Even though these chemicals do not originate on the MISS, they were evaluated during the GWFS in order to determine their effect on the various remedial alternatives evaluated.

As discussed in **Section II.H.1**, elevated iron and manganese concentrations are attributed to the ongoing degradation of organic constituents (benzene, chlorotoluene, and chlorinated solvents) in groundwater, and utilization (reduction) of these metals as alternate electron acceptors. They were not included as COCs for the GWFS. Total uranium, total radium, gross alpha and gross beta are not included as COCs due to the results of the BRA, which concluded that radionuclides contribute relatively little to the total excess lifetime cancer risks. Furthermore, most of the radiological risks may be due to background levels of the radionuclides. The total radium and total uranium exceedances are localized and isolated to three wells and two wells, respectively. Additionally, the Soils and Buildings OU remediation would remove potential source areas, and the collection and treatment of excavation water (including groundwater) during this effort would remove water potentially contaminated with radionuclides. As part of the LTM program designed for this ROD, radiological constituents would also be monitored in order to ensure protectiveness of the Soils and Buildings OU remediation.

J. Remedial Action Objectives

The RAOs for MISS groundwater are based on human health and environmental considerations that drive the formulation and development of response actions. Such objectives are developed based on the criteria outlined in Section 300.430(e)(2) of the NCP.

The RAOs for MISS groundwater have been developed such that attainment of these levels would result in the protection of human health, ecological receptors, and the environment.

The following RAOs have been established for the MISS groundwater:

- Comply with Federal and State MCLs or more stringent promulgated NJGWQC that are designated as ARARs for COCs in the groundwater (**Table 1**).
- Eliminate or minimize the source of groundwater contamination associated with MISS non-radiological contaminated soils, to include pond sludge on the MISS, beyond the soils removed during the Soils and Buildings OU remedial action to levels that are protective of groundwater (**Table 2**).
- Eliminate or minimize the potential for human exposure at unacceptable levels by direct contact or ingestion threat associated with groundwater COCs above cleanup levels established in the GW OU ROD for the COCs during implementation of the remedial action.
- Eliminate or minimize the potential for human exposure at unacceptable levels by direct contact or ingestion threat associated with lithium in groundwater. USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of constructability and stability issues, future redevelopment of the site, property transfer if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.

The groundwater cleanup levels are presented in the following table.

TABLE 1

GROUNDWATER CLEANUP LEVELS
FUSRAP MAYWOOD SUPERFUND SITE

Constituent	Groundwater Cleanup Level (micrograms per liter [μg/L])
Arsenic	3[a]
Benzene	1[a]
Lithium	730[b]

Notes:

a The lowest of Federal MCLs (40 CFR Part 141) or NJGWQC or higher practical quantitation limit (PQL) (New Jersey Administrative Code [NJAC] 7:9C).

b Since ARARs are not available for lithium in groundwater, a cleanup level was derived for lithium based on ingestion of groundwater. See **Section II.G.1**.

Impact to Groundwater Soil Cleanup Criteria

Soil remediation at the FMSS was addressed in the Soils and Buildings OU ROD; however, impacts to groundwater from source soils on the MISS were not addressed in the development of soil cleanup levels. Based on the COCs identified in groundwater, soils that have the potential to impact groundwater are addressed under this ROD.

There are several Federal guidance documents that pertain to soil cleanup criteria; however, there is no promulgated Federal impact to groundwater soil cleanup values for the groundwater COCs at the MISS. Similarly, the State of New Jersey does not have promulgated impact to groundwater soil cleanup criteria for the groundwater COCs at the MISS.

The MISS has soil source areas that are continuing to contribute to groundwater contamination. The concentrations of inorganic compounds in MISS soils were evaluated using NJDEP and EPA guidance to determine the potential leaching impacts to groundwater following the procedure outlined in an NJDEP and EPA-approved 2004 SSL Technical Memorandum (USACE, 2004). Of the non-promulgated guidance documents, several were reviewed for possible use as tools to assist in the evaluation of soil cleanup levels for the COCs in the groundwater below the MISS. EPA has developed generic soil screening levels (SSLs) for 110 chemicals based on a migration to groundwater pathway (EPA, 1996 and 2002). The SSL values use a default dilution attenuation factor (DAF) of 20 to account for natural processes that reduce contaminant concentrations in the subsurface. To achieve the groundwater risk-management goal of 730 µg/L for lithium, USACE derived a MISS-specific soil cleanup value of 194 mg/kg (USACE, 2004).

Because the calculated SSL for lithium is site-specific, it represents a more appropriate cleanup target than either of EPA’s generic standards (SSLs or PRGs). This value was calculated based on a DAF of 20 which was determined to be appropriate for the site conditions (USACE, 2004). NJDEP soil remediation guidance states that site-specific impact to groundwater soil remediation standards (IGWSRS) may be developed from Synthetic Precipitation Leaching Procedure (SPLP) data. The value was determined for the MISS and used to develop alternative site-specific standards that are based on an accurate measure of the mobility of lithium in soil at the MISS. Information justifying the use of this approach is currently described in the June 2009 NJDEP Guidance (http://www.nj.gov/dep/srp/guidance/rs). This IGWSRS value applies to soils located in the unsaturated zone. Most lithium soils requiring removal are located in the unsaturated zone. If the groundwater table at the time of remediation is higher than the contaminated soils, the excavations will be dewatered and soil removed under unsaturated conditions. Cleanup confirmation samples will also be collected from the unsaturated zone.

With respect to arsenic and benzene, USACE, as the lead agency, subsequently determined that adding an impact to groundwater standard for benzene and changing from a site-specific standard for arsenic to the NJDEP generic impact to groundwater standard within the preferred Alternative 3 meets the ARARs for arsenic and benzene.

The soil source of benzene on the MISS is suspected to be near the former MCW Building 62 location, the former site of two 20,000 gallon above-ground benzene storage tanks. A review of more recent post-RI/FS groundwater sampling results along with the historical results show non-detected values or a diminishing trend for benzene in site monitoring wells, except one. Concentrations in monitoring well BRPZ-5 remain at elevated levels. This well is located downgradient of the suspected benzene source area. Therefore, investigation and removal of benzene-contaminated soils will be included as a part of the soils removal component of the remedy selected in this Groundwater ROD.

The amount of benzene-contaminated soil is relatively minimal (i.e., estimated at approximately 1,000 cubic yards). The benzene-contaminated soils will be located and removed (excavated) from the site as a part of the impact to groundwater soils remedial action.

The potential impacts to groundwater from these soils and the benzene plume will be monitored over time after removal of the soils. Recent groundwater sampling of the benzene plume on the MISS in 2009 and 2011 indicates that the benzene plume remains on the MISS, is not expanding, and that significant attenuation of the plume has occurred (USACE, 2011). After soil source removal, MNA is proposed as the remedial measure for benzene in groundwater.

The soil cleanup levels for arsenic, lithium, and benzene based on impact to groundwater are provided in **Table 2**.

TABLE 2

SOIL CLEANUP LEVELS TO ATTAIN GROUNDWATER CLEANUP

Constituent	MISS Chemical-Specific Soil TBC (mg/kg)	Cleanup Level (mg/kg)
Arsenic	19[a]	19[a]
Lithium	194	194
Benzene	0.005[a]	0.005[a]

Note: a NJDEP Impact to Groundwater Soil Cleanup value

K. Description of Alternatives

The remedial alternatives summarized here are described in detail in the GWFS. The alternatives were developed for FUSRAP COCs in groundwater, based on RI sample analytical results, as well as the results of the Human Health Risk Assessment. Four remedial alternatives were presented in the GWFS and *Proposed Plan*, as summarized in the following paragraphs.

K.1 Description of Remedy Components

Alternative No. 1 – No Action:

The No Action Alternative, the development of which is required by Section 300.430 of the NCP, was used as the baseline to measure the performance of other alternatives. In this alternative, no groundwater remedial systems will be installed, and no LUCs will be implemented. Soils containing non-radiological contamination (beyond the soils to be removed during the Soils and Buildings OU remedial action) that could impact groundwater will not be removed and disposed off site or otherwise treated. In addition, existing monitoring wells will remain in place. Any improvement of the groundwater and surface water quality will be through natural attenuation including biodegradation, out-gassing, dispersion, and dilution. A long-term management activity, such as groundwater monitoring, will not be conducted; therefore, any improvement or further degradation of water quality will not be documented. The alternative provides a baseline for comparison of risk reduction achieved by each treatment alternative.

- **Groundwater Extraction Component**

  No groundwater extraction component is incorporated under the No Action Alternative.

- **Treatment Component**

  No groundwater treatment component is incorporated under the No Action Alternative.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under the No Action Alternative.

- **MNA**

  While natural attenuation processes may be occurring, the No Action Alternative does not provide physical monitoring or documentation to demonstrate that contaminant levels are decreasing over time.

- **Institutional Control Component**

  No land-use components are incorporated under the No Action Alternative.

- **Operation and Maintenance (O&M) Component**

  No O&M components are incorporated under the No Action Alternative.

Alternative No. 2 – Use Restrictions, Groundwater Monitoring, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS:

Alternative No. 2 was developed to limit public exposure to the contaminated media while demonstrating reduction of contamination by natural processes (known as natural attenuation). The toxicity, mobility, or volume of groundwater contaminants will not be reduced by any engineering process, although one source of groundwater contamination will be removed by excavating the MISS non-radiological contaminated soils, to include all pond sludge on the MISS, and disposing off site. These soils are located beyond the soils to be removed during the Soils and Buildings OU remedial action.

The volume of non-radiological contaminated soil estimated to be excavated from the MISS is 15,600 cubic yards above the groundwater table and 5,400 cubic yards below the groundwater table. MISS non-radiological contaminated soils remediation will take approximately two years to complete.

To document that natural attenuation is occurring, an LTM action such as a groundwater monitoring program will be implemented. Alternative No. 2 also will employ LUCs to limit exposure to FUSRAP-related contamination. LUCs will be instituted to protect the public and construction workers from the risks of exposure to groundwater with COCs above the cleanup standards for the duration of the alternative. LUCs are administrative, legal, or physical mechanisms that restrict the use of, or limit access to, contaminated property to reduce risk to human health and the environment.

- **Groundwater Extraction Component**

  No groundwater extraction component is incorporated under Alternative No. 2.

- **Treatment Component**

  No groundwater treatment component is incorporated under Alternative No. 2.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative No. 2. However, soils which contribute as a source to groundwater contamination will be removed and disposed, as discussed previously.

- **MNA**

  To document that natural attenuation is occurring, an LTM action such as a groundwater monitoring program will be implemented. A Long-Term Groundwater Monitoring Plan will be submitted to the EPA and NJDEP for review and approval. For this alternative, monitoring will be accomplished by sampling existing and newly installed overburden and shallow bedrock wells. These additional groundwater monitoring wells will be used to fill data gaps related to the upgradient and downgradient extent of the arsenic, benzene, and lithium plumes and the new wells will be presented in a Groundwater Monitoring Plan subject to review by the EPA and NJDEP. Groundwater elevations will also be monitored. All remaining FMSS groundwater monitoring wells will be proposed to the EPA and NJDEP for plugging and abandonment. The duration of the groundwater monitoring program will be based on data results which demonstrate that the impacted groundwater has achieved RAOs.

  The effectiveness of the natural attenuation of the groundwater COCs was evaluated using a groundwater flow and solute transport model. The model estimates benzene to be below the cleanup levels in less than 10 years by natural attenuation. Arsenic is projected (through groundwater modeling, which did not account for changing aquifer redox conditions) to remain in groundwater above cleanup levels for more than 3,000 years after benzene is attenuated. However, the speed at which arsenic will reach cleanup levels is expected to increase due to the aquifer geochemical conditions returning to their natural oxidizing state after the benzene is naturally attenuated. This change in the aquifer conditions causes arsenic to be less mobile and is expected to result in decreasing concentrations. The rate of arsenic attenuation may vary across the site due to variations in aquifer geochemical conditions. Lithium concentrations are projected to attain RAOs by natural attenuation in 280 years.

- **Land Use Control Component**

  LUC components will be further defined in the Maywood document entitled, “Groundwater Operable Unit Land Use Control Implementation Plan for the FUSRAP Maywood Superfund Site” which will include use restrictions applicable to site soil and groundwater. Downgradient, off-site groundwater use within the contaminant plumes will be controlled by well restrictions in a groundwater CEA. The CEA will be obtained through the NJDEP, with impacted landowners notified as appropriate. USACE will submit the information listed in New Jersey Administrative Code (NJAC) 7:26E-8.3 to assist NJDEP in establishing a CEA. In the event the State is unable to designate a CEA, USACE will work with local government authorities and affected property owners to develop and implement appropriate LUCs intended to restrict human consumption and use of groundwater in these areas until such time as the levels of arsenic, benzene, and lithium no longer exceed cleanup levels in off-site and MISS wells. Other LUCs which the USACE will implement will include the following:

- – Notify local utilities and governments of the dermal/inhalation risks from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers.
- – Provide project-specific health and safety plans as additional notification.
- – Post warning signs as physical LUCs to notify construction workers of the dermal/inhalation risks on the MISS.

Additionally, LUCs have been implemented for Vicinity Properties where inaccessible soils remain above cleanup criteria as part of the Soils and Buildings OU ROD. These include the following:

- – Periodic inspections of properties (to include periodic reviews, no less than every five years after initiation of the selected remedial action) to determine changes in land use.
- – Distribution of notification letters that identify locations of FUSRAP waste to property owners, utility companies, government agencies, and other commercial entities.
- – Posting website content that provides the public with project information including maps that identify areas of FUSRAP waste.

The latter two LUCs inform the public to contact the USACE before excavation work is performed in areas where FUSRAP waste remains. These LUCs will be updated, once responsibility for the FUSRAP Maywood Site is transferred back to the DOE Office of Legacy Management under the Memorandum of Understanding. Additional LUCs in the form of institutional controls have been, and will continue to be developed, if necessary, on a property-by-property basis. All of these Soils and Buildings OU ROD LUCs will be considered in evaluating the need for any additional LUCs for this GW OU remedial action.

- **O&M Component**

  O&M components included the following:

  - – Maintain LUCs described previously.
  - – Prepare annual monitoring reports.
  - – Excavate and dispose of the non-radiological contaminated soil which was not addressed in Year 1 (**Tables 4** and **5** present activities associated with Year 1 and beyond).
  - – Abandon all unused GWRI monitoring wells during the third year of the program (after the Year 2 Monitoring Report is approved).
  - – Repair/replace monitoring wells, as needed.

Because this alternative will result in contaminants remaining on the MISS above proposed cleanup levels, CERCLA requires that the site be reviewed at least once every five years to ensure the protectiveness of the remedy.

Alternative No. 3 – Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS:

This alternative combines in situ treatment of arsenic, if required, in overburden groundwater only, LUCs, natural attenuation of lithium and benzene in overburden and shallow bedrock groundwater, and arsenic in shallow bedrock groundwater, with the MISS non-radiological contaminated soils remediation to include pond sludge. Groundwater monitoring will be performed to document the performance of the treatment technique and that natural attenuation is occurring.

Documentation of change to the Proposed Plan:

To address specific regulator comments on the Proposed Plan, a few groundwater samples from existing wells on the MISS were collected during July and August 2011. These sampling results, along with the historical results, show non-detected values or a diminishing trend for benzene in site monitoring wells with one exception. Benzene in monitoring well BRPZ-5 still remains at an elevated concentration of 5,600 µg/L, which is generally two to three orders of magnitude higher than other wells sampled on the MISS. Groundwater flow in bedrock is fracture controlled and wells in close proximity could have dissimilar chemical concentrations. For these reasons BRPZ-5 is suspected to be located downgradient of a benzene source area. The soils removal component of the remedy documented in this ROD will include all three COCs.

The amount of benzene-contaminated soil is relatively small (i.e., estimated at approximately 1,000 cubic yards) which will have a minimal impact on the overall cost of the alternative (well within the required estimating accuracy for the remedial alternative). The benzene-contaminated soils will be located and removed (excavated) from the site as a part of the impact to groundwater soils remedial action. Also, based on a review of benzene concentrations in groundwater, MNA is an appropriate and proven method to address groundwater.

USACE believes that this represents a minor change to the remedy, and one that could have been reasonably anticipated by the public based on the alternatives and other information available in the Proposed Plan or the supporting analysis and information in the Administrative Record. In addition, EPA determined that the remedy change will be more conservative and protective in both the short and long term.

The estimated volume of non-radiological contaminated soil to be excavated from the MISS, beyond the excavation limits of soil to be removed during the Soils and Buildings OU remedial action, is 16,600 cubic yards above the groundwater table and 5,400 cubic yards below the groundwater table. MISS non-radiological contaminated soils remediation will take approximately two years to complete.

- **Groundwater Extraction Component**

  No groundwater extraction component is incorporated under Alternative No. 3.

- **Treatment Component**

  The in situ treatment method for arsenic in overburden groundwater is redox alteration. Redox alteration will be used as the treatment method in areas where arsenic exceeds 3 µg/L in overburden groundwater. This method will remove the majority of arsenic present in groundwater on the MISS. This treatment is being proposed since the elevated concentrations of arsenic may not naturally attenuate to below the regulatory standard of 3 µg/L for a considerable period of time. Redox manipulation techniques are most effective for redox-active metals, which are metals that can exist in more than one valence state over the range of Eh, pH, temperature, and pressure conditions that exist in shallow groundwater environments. The different valence states of some of the metals of concern at the site have very different solubilities and/or adsorption affinities, which translate into different mobilities. The redox technique will be selected based on the results of treatability studies.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative No. 3. However, soils which contribute as a source to groundwater contamination will be removed and disposed, as discussed previously.

- **MNA**

  To document that natural attenuation is occurring, an LTM action such as a groundwater monitoring program will be implemented. A Long-Term Groundwater Monitoring Plan will be submitted to the EPA and NJDEP for review and approval. For this alternative, monitoring will be accomplished by sampling existing and newly-installed overburden and shallow bedrock wells. These additional groundwater monitoring wells will be used to fill data gaps related to the upgradient and downgradient extent of the arsenic, benzene, and lithium plumes. The new well locations will be presented in a Groundwater Monitoring Plan subject to review by the EPA and NJDEP. Groundwater elevations will also be monitored. All remaining FMSS groundwater monitoring wells will be proposed to the EPA and NJDEP for plugging and abandonment. The duration of the groundwater monitoring program will be based on the data results which demonstrate that the impacted groundwater has achieved RAOs.

  Based on geochemical evaluations for this alternative, benzene is expected to reach cleanup levels through natural attenuation in less than 10 years. Arsenic concentrations in the overburden groundwater are expected to be less than cleanup levels in less than 1 year after treatment, and naturally attenuate in bedrock groundwater in approximately 180 years. Lithium is estimated to reach cleanup levels by natural attenuation in approximately 280 years.

  The monitoring results would be used to verify that the target RAO concentrations have been achieved.

- **Land Use Control Component**

  LUC components will be further defined in the Maywood document entitled, “Groundwater Operable Unit Land Use Control Implementation Plan for the

FUSRAP Maywood Superfund Site" which includes use restrictions applicable to site soil and groundwater. Downgradient, off-site groundwater use within the contaminant plumes will be controlled by well restrictions in a groundwater CEA. The CEA will be obtained through the NJDEP, with impacted landowners notified as appropriate. USACE will submit the information listed in NJAC 7:26E-8.3 to assist NJDEP in establishing a CEA. In the event the State is unable to designate a CEA, USACE will work with local government authorities and affected property owners to develop and implement appropriate LUCs intended to restrict human consumption and use of groundwater in these areas until such time as the levels of arsenic, benzene, and lithium no longer exceed cleanup levels in off-site and MISS wells. Other LUCs which the USACE will implement will include the following:

- Notify local utilities and governments of the dermal/inhalation risks from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers.
- Provide additional notification by project-specific health and safety plans.
- Post warning signs as physical LUCs to notify construction workers of the dermal/inhalation risks on the MISS.

Continuing and obtaining access will be necessary through right-of-entry agreements between the Government and the landowner (typically renewed annually) to private properties to implement the remedy (i.e., long-term groundwater monitoring at wells located on off-site, private properties).

Additionally, LUCs have been implemented for Vicinity Properties where inaccessible soils remain above cleanup criteria as part of the Soils and Buildings OU ROD. These include the following:

- Periodic inspections of properties (to include periodic reviews, no less than every five years after initiation of the selected remedial action,) to determine changes in land use.
- Distribution of notification letters that identify locations of FUSRAP waste to property owners, utility companies, government agencies, and other commercial entities.
- Posting website content that provides the public with project information including maps that identify areas of FUSRAP waste.

The latter two LUCs inform the public to contact the USACE before excavation work is performed in areas where FUSRAP waste remains. These LUCs will be updated, once responsibility is transferred back to the DOE Office of Legacy Management under the Memorandum of Understanding. Additional LUCs in the form of institutional controls have been, and will continue to be developed, if necessary, on a property-by-property basis. All of these Soils and Buildings OU ROD LUCs will be considered in evaluating the need for any additional LUCs for the GW OU remedial action.

- **O&M**

  O&M components include the following.

  - Maintain LUCs described previously.
  - Prepare annual monitoring reports. Excavate and dispose of the non-radiological contaminated soil which was not addressed in Year 1 (**Tables 4** and **5** present activities associated with Year 1 and beyond).
  - Abandon all unused GWRI monitoring wells during the third year of the program (after the Year 2 Monitoring Report is approved).
  - Repair/replace monitoring wells, as needed.

Because this alternative will result in contaminants remaining on the MISS above proposed cleanup levels, CERCLA requires that the site be reviewed at least once every five years to ensure the protectiveness of the remedy.

Alternative No. 4 – Use Restrictions, Groundwater Monitoring, Ex-Situ Treatment, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS:

This alternative combines groundwater extraction, ex-situ treatment of groundwater, groundwater monitoring, groundwater discharge, and MISS non-radiological soils remediation. Six recovery wells are assumed in this system. These groundwater extraction wells will be placed to address the arsenic, benzene, and lithium plumes in overburden and shallow bedrock on the MISS. The capture zone of these extraction wells will be designed to minimize the capture/influence of non-FUSRAP chlorinated solvent or other plumes downgradient of the MISS. Long-term pumping on the MISS over time could impact the downgradient chlorinated solvent plume, potentially spreading the contamination over a larger area of the aquifer, increasing concentrations downgradient of the source area, and pulling more of the non-FUSRAP contamination onto the MISS.

The estimated volume of non-radiological contaminated soil to be excavated from the MISS (including pond sludge on the MISS) beyond the excavation limits of soil to be removed during the Soils and Buildings OU remedial action is 15,600 cubic yards above the groundwater table and 5,400 cubic yards below the groundwater table. MISS non-radiological contaminated soils remediation will take approximately two years to complete.

- **Groundwater Extraction Component**

  Overburden and shallow bedrock groundwater will be pumped from the six wells located on the MISS installed in shallow bedrock to achieve adequate drawdown.

  Groundwater extraction wells would be placed on the MISS to address the arsenic, benzene, and lithium plumes. The capture zone of these extraction wells would be designed to minimize the capture/influence of non-FUSRAP chlorinated solvent or other plumes downgradient of the MISS. Long-term extraction of groundwater, using wells located on the MISS, has the potential to impact the downgradient chlorinated solvent plume. Extraction of groundwater will capture groundwater located downgradient of the MISS, potentially spreading the chlorinated solvent plume over a larger area of the aquifer, increasing contaminant concentrations downgradient of the solvent plume source area, and pulling more of the non-FUSRAP contamination onto the MISS.

- **Treatment Component**

  Recovered groundwater will be routed to a central treatment facility that will include an air stripper for volatile organics, metals precipitation, reverse osmosis or ion exchange for lithium (lithium is present in groundwater at the MISS and will have to be removed prior to discharge), and carbon to treat any off gases from the air stripper. The specific components for the treatment system will be determined during the system design. It is assumed that treated groundwater would be discharged to the local Publicly Owned Treatment Works.

- **Groundwater or Source Containment Components**

  No groundwater or source containment components are incorporated under Alternative No. 4. However, soils which contribute as a source to groundwater contamination will be removed and disposed, as discussed previously.

- **MNA**

  While natural attenuation is occurring, a program to document these processes is not included in this alternative during the first 30 years while groundwater extraction is operational. The LTM program, described under O&M for this alternative, will be converted to an MNA program when groundwater extraction and ex situ treatment is discontinued.

- **Land Use Control Component**

  LUC components will be further defined in the Maywood document entitled, “Groundwater Operable Unit Land Use Control Implementation Plan for the FUSRAP Maywood Superfund Site” which includes use restrictions applicable to site soil and groundwater. Downgradient, off-site groundwater use within the contaminant plumes will be controlled by well restrictions in a groundwater CEA. The CEA will be obtained through the NJDEP, with impacted landowners notified as appropriate. USACE will submit the information listed in NJAC 7:26E-8.3 to assist NJDEP in establishing a CEA. In the event the State is unable to designate a CEA, USACE will work with local government authorities and affected property owners to develop and implement appropriate LUCs intended to restrict human consumption and use of groundwater in these areas until such time as the levels of arsenic, benzene, and lithium no longer exceed cleanup levels in off-site and MISS wells. Other LUCs which the USACE will implement will include the following:

  - Notify local utilities and governments of the dermal/inhalation risks from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers.
  - Provide additional notification by project-specific health and safety plans.
  - Post warning signs as physical LUCs to notify construction workers of the dermal/inhalation risks on the MISS.

Additionally, LUCs have been implemented for Vicinity Properties where inaccessible soils remain above cleanup criteria as part of the Soils and Buildings OU ROD. These include the following:

  - Periodic inspections of properties (to include periodic reviews, no less than every five years after initiation of the selected remedial action,) to determine changes in land use.
  - Distribution of notification letters that identify locations of FUSRAP waste to property owners, utility companies, government agencies, and other commercial entities.
  - Posting website content that provides the public with project information including maps that identify areas of FUSRAP waste.

The latter two LUCs inform the public to contact the USACE before excavation work is performed in areas where FUSRAP waste remains. These LUCs will be updated, once responsibility is transferred back to the DOE Office of Legacy Management under the Memorandum of Understanding. Additional LUCs in the form of institutional controls have been, and will continue to be developed, if necessary, on a property-by-property basis. All of these Soils and Buildings OU ROD LUCs will be considered in evaluating the need for any additional LUCs for this GW OU remedial action.

- **O&M**

  O&M components included the following:

  - Maintain LUCs described previously.
  - An LTM action, such as a groundwater monitoring program, will be implemented to document the performance of the remedial action. A Long-Term Groundwater Monitoring Plan will be submitted to the EPA and NJDEP for review and approval. For this alternative, monitoring will be accomplished by sampling existing and newly installed overburden and shallow bedrock wells. These additional groundwater monitoring wells will be used to fill data gaps related to the upgradient and downgradient extent of the arsenic, benzene, and lithium plumes. The new well locations will be presented in a Groundwater Monitoring Plan subject to review by the EPA and NJDEP. Groundwater elevations will also be monitored. All remaining FMSS groundwater monitoring wells will be proposed to the EPA and NJDEP for plugging and abandonment. The duration of the groundwater monitoring program will be based on the data results which demonstrate that the impacted groundwater has achieved RAOs.

    Based on groundwater modeling estimates, benzene is estimated to reach cleanup levels in less than eight years under this alternative. Arsenic is projected (through groundwater modeling, which did not account for changing aquifer redox conditions) to remain in groundwater above cleanup levels for more than 3,000 years after benzene is treated. However, the speed at which arsenic will reach cleanup levels is expected to increase due to aquifer geochemical conditions returning to their natural oxidizing state after the benzene is removed by the groundwater extraction system. This change in the aquifer conditions will cause arsenic to be less mobile and is expected to result in decreasing concentrations. The rate of arsenic attenuation may vary across the site due to variations in aquifer geochemical conditions. Down gradient migration and natural attenuation of lithium is expected to continue after the treatment system is shut down in 30 years. Lithium is estimated to reach cleanup levels under this alternative in 275 years, since the groundwater extraction system is designed to limit capture of off-site, non-MISS-related groundwater contamination, and will not remove lithium from these areas.

- Prepare annual monitoring reports.
- Excavate and dispose of the non-radiological contaminated soil which was not addressed in Year 1 (**Tables 4** and **5** present activities associated with Year 1 and beyond).
- Abandon all unused GWRI monitoring wells during the third year of the program (after the Year 2 Monitoring Report is approved).
- Repair/replace monitoring wells, as needed.
- Repair/replace extraction wells, as needed.
- Annual extraction well cleaning and maintenance.
- Perform extraction system upgrade, as needed.

Because this alternative will result in contaminants remaining on the MISS above proposed cleanup levels, CERCLA requires that the site be reviewed at least once every five years to ensure the protectiveness of the remedy.

K.2 Common Elements and Distinguishing Features of Each Alternative

K.2.1 Applicable or Relevant and Appropriate Requirements (ARARs)

Each alternative would be required to meet the ARARs identified in the GWFS and presented as cleanup criteria. Alternative No. 1 does not meet this requirement. Alternative Nos. 2, 3, and 4 will each meet this requirement in different time frames.

K.2.2 Long-Term Reliability of Remedy

For Alternative No. 1, no efforts would be undertaken to remediate the groundwater or the remaining source contamination or mitigate the potential risk. Therefore, this alternative is not reliable in the long-term.

Alternative Nos. 2, 3, and 4 rely on removal of the source material (non-radiological contaminated soil) and LUCs to provide protection. The long-term reliability of Alternative No. 2 is dependent on the performance of MNA. The remedy would result in permanent and irreversible reductions of groundwater constituent levels. If required, Alternative No. 3 provides additional protection with in situ treatment of the arsenic plume in overburden groundwater; however, there is not an in situ technology to effectively treat lithium in groundwater. Alternative No. 3 is expected to provide a high degree of reliable, long-term protection by directly treating the arsenic. Alternative No. 4 relies on the removal and ex situ treatment of groundwater; however, there is a concern to draw in off-site non-FUSRAP related contamination.

K.2.3 Quantity of Untreated Waste and Treatment Residuals to be Disposed Off Site or Managed On Site in a Containment System, and Degree of Hazard Remaining in Such Material

Under Alternative Nos. 2, and 4, a total of 15,600 cubic yards above and 5,400 cubic yards of non-radiological contaminated soil below the groundwater table is estimated to be excavated and disposed from the MISS. Based on the minor change to Alternative No. 3, a total of 16,600 cubic yards above and 5,400 cubic yards below the groundwater table of non-radiological contaminated soil is estimated to be excavated and disposed from the MISS. Groundwater is treated in situ under Alternative No. 3 and ex situ under Alternative No. 4. Alternative No. 2 relies solely on naturally occurring processes and thus, does not require additional substrate or treatment amendment applications as does Alternative No. 3. The materials used during implementation of Alternative No. 3 are expected to be consumed in the subsurface during the treatment process; therefore, there should be no treatment process residuals generated. Some purge water would be generated during routine groundwater monitoring well sampling for Alternative Nos. 2, 3, and 4; however, this material is not considered to be "treatment residuals" and would be managed and disposed according to Standard Operating Procedures developed as part of existing site Work Plans. Alternative No. 4 will generate some treatment residuals which will require disposal or recycling, as appropriate.

K.2.4 Time Frames for Design, Construction, and Meeting Remediation Goals

Design is completed and construction implemented during the first year for Alternative Nos. 2, 3, and 4. Each of these alternatives has additional well construction and soil removal during the second year of implementation. These alternatives also include monitoring, reporting, and well rehabilitation through Year 30 and beyond, as needed. The estimated time frame to reach RAOs is 275 to 280 years for each of the alternatives and is dependent on the attenuation of lithium through dilution and dispersion.

Also associated with each of these alternatives is the requirement for five-year reviews. A remedy resulting in contaminants remaining on the MISS above proposed cleanup levels triggers the statutory requirement for five-year reviews to determine if remediation goals are being achieved.

K.2.5 Costs

Alternative Nos. 2, 3, and 4 each have similar costs for planning and monitoring. Alternative No. 3 has an additional cost of approximately $6.3 million more than Alternative No. 2, primarily for designing and conducting the in situ treatment of arsenic. The costs for Alternative No. 4 are approximately $86 million higher than Alternative No. 3 for installation and O&M of the groundwater recovery and treatment system.

K.3 Expected Outcomes of Each Alternative

Alternative No. 1 would not achieve remedial goals and, thus, is unacceptable. In contrast, the expected outcome for Alternative Nos. 2, 3, and 4 would be the attainment of all RAOs and the ability to release the property for beneficial reuse, but with greatly varying time frames. Only Alternative No. 3 can assure arsenic concentration reduction in a shorter time frame.

L. Comparative Analysis of Alternatives

The advantages and disadvantages of each alternative were compared against the nine CERCLA evaluation criteria established by EPA in Section 300.430(d)(9)(iii) of the NCP as presented in this section. The criteria are addressed in this report as directed in *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988a). These criteria are divided into the following three groups:

- Threshold Criteria:
    - Overall protection of human health and the environment
    - Compliance with ARARs
- Primary Balancing Criteria:
    - Short-term effectiveness
    - Long-term effectiveness and permanence
    - Reduction in toxicity, mobility, or volume
    - Implementability
    - Cost
- Modifying Considerations:
    - State acceptance
    - Community acceptance.

Table 3 presents a summary of the comparative analysis for each alternative.

L.1 Threshold Criteria

The two threshold criteria discussed in the following paragraphs must be met for an alternative to be considered viable.

L.1.1 Overall Protection of Human Health and the Environment

Addresses whether an alternative provides adequate protection and describes how exposure risks are eliminated, reduced, or controlled through treatment or LUCs.

Alternative No. 1, No Action, would not protect human health or the environment.

Alternative Nos. 2, 3, and 4 are each protective of human health and the environment. In each of these alternatives, groundwater would not be used and future use of impacted groundwater would be controlled by instituting well restrictions in a groundwater CEA or other LUCs. The potential for future exposure to COCs above ARARs would be expected to be controlled with well restrictions in a groundwater CEA during implementation of the remedy and would eventually be eliminated.

TABLE 3
SUMMARY OF DETAILED EVALUATION OF ALTERNATIVES

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume	Implementability	Cost	State Acceptance	Community Acceptance
1. No Action	Current impacts to groundwater would remain unmitigated. Any improvements would be through natural processes. There are no administrative or institutional measures to control the use or exposure to groundwater or monitor contaminant concentrations.	Would not comply with chemical-specific applicable or relevant and appropriate requirements (ARARs); contamination in groundwater.	No increased risks to workers or public, since no activities are conducted. However, a reduction of contamination and achievement of site protection would not occur.	No long-term effectiveness. Contaminated groundwater would continue uncontrolled and unmonitored. Non-radiological contaminated soils would remain in place.	No reduction in toxicity, mobility, or volume of contaminants in groundwater. Only radiological contaminated source soils are removed under the Soils and Buildings ROD. Impacts of the soil removal are not monitored.	Does not require any implementation.	No costs associated with this alternative	State does not concur with Selected Remedy (Alternative No. 3).	No verbal comments; written comments provided in Responsiveness Summary (Section III of this ROD).
2. Use Restrictions, Groundwater Monitoring, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS	Potential human exposure controlled by MISS non-radiological contaminated soil remediation and enforcement of well restrictions in a groundwater CEA. Construction workers would be notified of the groundwater dermal/inhalation exposure risk. Groundwater quality monitored to determine if contaminant plume is changing in concentration and location. USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of constructability and stability issues, future redevelopment of the site, property transfer if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.	Lithium concentration would not meet cleanup goals within 30 years and groundwater contaminated with lithium would continue to migrate downgradient of the MISS. The groundwater model predicts lithium concentrations would increase off site and contamination could reach the Saddle River in more than 100 years. However, due to mixing with surface water, there should be no impact above cleanup goals. Groundwater modeling results indicate that the arsenic will persist in the aquifers for more than 3,000 years under current geochemical conditions. However, it is expected that arsenic concentrations in groundwater would decrease after the benzene attenuates (estimated at less than 10 years) and aquifer redox conditions change. Arsenic is not projected to reach the Saddle River, even under the extended attenuation time frame.	Moderate risk to remedial workers during installation of monitoring wells and non-radiological contaminated soil remediation. Low risk during monitoring. No risk to community. Implementation of LUCs and removal of non-radiological soil would achieve site protection and reduce contamination within three years of the GW OU ROD.	Based on modeling estimates, concentrations of benzene in groundwater would decrease in less than 10 years to less than proposed cleanup levels. Arsenic may be mobile in benzene impacted aquifer areas due to groundwater reducing conditions. Once benzene would no longer be present, attenuation rates for arsenic would be expected to increase. The groundwater model predicts that lithium could take 280 years to reach ARARs. The implementation of well restrictions in a groundwater CEA would control the use of groundwater.	No reduction in toxicity, mobility, or volume of contaminants through treatment of soils or groundwater. Reduction occurs naturally through biodegradation, dispersion, and sorption. Groundwater concentrations would be monitored to confirm natural attenuation processes.	Straightforward to implement. Soil remediation, well installation, monitoring, and LUCs are well documented technologies. Well restrictions in a groundwater CEA would be straightforward due to the small number of off-site, adjacent properties. Groundwater portion of the alternative could be constructed within 2 to 4 months. Non-radiological contaminated soil remediation would take approximately one year.	Capital Costs: $10,332,000 O&M: $20,122,000 Total: $30,454,000 (Present Worth)	State does not concur with Selected Remedy (Alternative No. 3). State offered comment regarding soil cleanup goal for arsenic as presented in the Responsiveness Summary (Section III of this ROD).	Community largely accepts Selected Remedy (Alternative No. 3). No verbal comments from community during public meeting. Written comments provided by Community members in Responsiveness Summary (Section III of this ROD).
3. Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS	Potential human exposure controlled by MISS non-radiological contaminated soil remediation and enforcement of well restrictions in a groundwater CEA. Construction workers would be notified of the groundwater dermal/inhalation exposure risk. The arsenic in overburden groundwater would be attenuated in less than one year Hazardous soil treatment amendments would be used on site to treat arsenic in overburden groundwater. USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of constructability and stability issues, future redevelopment of the site, property transfer, if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.	Lithium concentrations would not meet cleanup goals within 30 years and groundwater contaminated with lithium would continue to migrate downgradient of the MISS. The groundwater model predicts concentrations would increase off site and contamination could reach the Saddle River in more than 100 years. However, due to mixing with surface water, there should be no impact above cleanup goals. Treatment of arsenic in overburden groundwater would meet ARARs for these constituents by providing contaminant mass removal in the site areas of highest concentrations. It is expected that benzene would naturally attenuated in less than 10 years and arsenic in shallow bedrock in approximately 180 years or less (after the benzene degrades and aquifer redox conditions change).	Moderate risk to remedial workers during implementation due to non-radiological contaminated soil remediation, and handling and injection of amendments and performance of tasks. Low risk to community from soil treatment amendments handled off site at injection locations. Implementation of LUCs and removal of non-radiological soil would achieve short-term site protection and a reduction of contamination within three years of the GW OU ROD.	Based on modeling estimates, concentrations of benzene in groundwater would decrease in less than 10 years to less than proposed cleanup levels. Arsenic in overburden in groundwater would decrease below proposed cleanup levels in less than 1 year after treatment and approximately 180 years in shallow bedrock. A concern with in situ treatment proposed under Alternative No. 3 would be the complexities involved regarding the large number of injection points, the determination of appropriate soil treatment amendments to use, and required amendment concentrations and injection volumes to treat the arsenic without mobilizing metals into groundwater from the aquifer matrix. Lithium, which cannot be treated in situ, could take 280 years to attenuate below proposed cleanup goals. The implementation of well restrictions in a groundwater CEA would control the use of groundwater. Success of the arsenic concentration decrease is dependent on maintaining optimum aquifer geochemical conditions, which may require occasional pretreatment of groundwater.	Would reduce mobility and volume in groundwater of contaminants in arsenic plumes. Would not reduce the toxicity and volume of the benzene and lithium. Groundwater concentrations would be monitored to confirm natural attenuation processes.	Moderately complex to implement in situ treatment; a large number of injection points would be required. Variable local permeabilities would impact delivery of treatment medium. Straightforward to implement soil remediation, monitoring well installation, monitoring, and LUCs which are well documented. Well restrictions in a groundwater CEA would be straightforward due to the small number of off-site, adjacent properties. Groundwater technologies could be constructed within 6 to 12 months. Non-radiological contaminated soil remediation would take approximately one year.	Capital Costs: 15,340,000 O&M: $21,447,000 Total: $36,787,000 (Present Worth)	State does not concur with Selected Remedy (Alternative No. 3). State offered comment regarding soil cleanup goal for arsenic as presented in the Responsiveness Summary (Section III of this ROD).	Community largely accepts Selected Remedy (Alternative No. 3). No verbal comments from community during public meeting. Written comments provided by Community members in Responsiveness Summary (Section III of this ROD).

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Short-Term Effectiveness	Long-Term Effectiveness and Permanence	Reduction in Toxicity, Mobility, and Volume	Implementability	Cost	State Acceptance	Community Acceptance
4. Use Restrictions, Groundwater Monitoring, Groundwater Extraction, Ex-Situ Treatment, MNA of Lithium, Benzene, and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS	Potential human exposure controlled by MISS non-radiological contaminated soil remediation and enforcement of well restrictions in a groundwater CEA. Construction workers would be notified of the groundwater dermal/inhalation exposure risk. Benzene reaches concentrations below cleanup levels in less than eight years; the arsenic plume may then attenuate as aquifer redox conditions change to allow precipitation or the dissolved contaminant. The lithium plume would continue to migrate after pumping is discontinued. Hazardous chemicals would be used on site to treat the contaminated groundwater. USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of constructability and stability issues, future redevelopment of the site, property transfer if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.	Extraction of groundwater provides contaminant mass removal, as well as hydraulic control for further off-site migration, except in the case of lithium which would continue to migrate off site when pumping is discontinued at Year 30. Alternative would comply with benzene ARARs within a reasonable period of time, eight years. Extraction of groundwater provides contaminant mass removal, as well as hydraulic control for further off-site migration of the benzene and plumes. Lithium cleanup time is not appreciably shortened over natural attenuation. Arsenic is calculated to remain in the aquifer under current geochemical conditions for more than 2,000 years.	Moderate risk to remedial workers during implementation due to non-radiological contaminated soil remediation, and installation of wells. No risk to community and the environment. Implementation of LUCs and removal of non-radiological soil would achieve short-term site protection and a reduction of contamination within three years of the GW OU ROD.	Based on modeling estimates, concentrations of benzene in groundwater would decrease in less than eight years to less than proposed cleanup levels. Arsenic is expected to attenuate after the benzene is removed from the aquifer. After Year 30, lithium is predicted to reach proposed cleanup goals in 275 years. A concern with the active pump and treat technology proposed under Alternative No. 4 would be the potential to draw off-site non-FUSRAP related contamination into the extraction system. Long-term pumping on the MISS over time, could impact the downgradient chlorinated solvent plume, potentially spreading the contamination over a larger area of the aquifer, increasing concentrations downgradient of the source area , and pulling more of the non-FUSRAP contamination onto the MISS. The implementation of well restrictions in a groundwater CEA would control the use of groundwater.	Would reduce mobility and volume in groundwater. Would also reduce toxicity, volume, and mobility from source areas. Stabilizes the lithium plume during pumping, but once extraction is discontinued, the lithium plume is still predicted to reach the Saddle River.	Straightforward. Consists of soil remediation, installation of recovery wells, monitoring, construction of treatment plant, and LUCs that are well documented technologies. However, the selection of the locations for recovery wells may be complicated by the need for the well to intercept continuous fracture zones in bedrock. Well restrictions in a groundwater CEA would be straightforward due to the small number of off-site, adjacent properties. Groundwater portion of the alternative could be constructed within 9 to 12 months. Non-radiological contaminated soil remediation would take approximately one year.	Capital Costs: $12,936,000 O&M: $109,266,000 Total: $122,202,000 (Present Worth)	State does not concur with Selected Remedy (Alternative No. 3). State offered comment regarding soil cleanup goal for arsenic as presented in the Responsiveness Summary (Section III of this ROD).	Community largely accepts Selected Remedy (Alternative No. 3). No verbal comments from community during public meeting. Written comments provided by Community members in Responsiveness Summary (Section III of this ROD). One commentor (Kin Properties) recommended adopting Alternative 4 and is opposed to LUCs.

For all three alternatives, non-radiological contaminated soil source areas would be remediated. Impacted groundwater is not predicted to reach the Saddle River based on the groundwater fate and transport model data results.

L.1.2 Compliance With ARARs

Addresses whether a remedy will meet all of the ARARs related to hazardous substances released to the environment at the Site.

Alternative No. 1 would not comply with ARARs, since no remedial actions would be performed.

Alternative Nos. 2, 3, and 4 would comply with ARARs for lithium, benzene, and arsenic. Non-radiological soils which contribute to groundwater contamination would be remediated, and chemical-specific ARARs for lithium, benzene, and arsenic would be met through different approaches. The primary difference would be the time frame needed to achieve the ARAR. For each of the three alternatives, LUCs (e.g., well restrictions in a groundwater CEA) would restrict access to impacted groundwater until ARARs or cleanup goals are achieved. In addition, radiological contaminated soils would be remediated under the Soils and Buildings OU ROD for each of these alternatives. For Alternative No. 2, MNA would be the primary technology. In Alternative No. 3, after in situ treatment of arsenic in the overburden, MNA would be the primary technology for lithium, benzene, and arsenic in shallow bedrock. Groundwater monitoring would be used to track aquifer redox conditions, which could impact the attenuation, fate, and transport of benzene and arsenic after treatment. Alternative No. 4 would extract and treat the benzene and arsenic and some of the lithium plumes in overburden and shallow bedrock. In Alternative No. 4, pumping would be discontinued after 30 years, and the remaining lithium plume would be allowed to naturally attenuate. The USACE will address lithium materials remaining on the Federal Government-owned MISS by source area removal of non-radiological impacted soils in consideration of constructability and stability issues, future redevelopment of the site, property transfer if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.

L.2 Primary Balancing Criteria

The five primary balancing criteria discussed in the following paragraphs are used to identify major trade-offs among the alternatives.

L.2.1 Short-Term Effectiveness and Environmental Impacts

Addresses the impacts to the community and site workers during the time it takes to complete the remedial action and meet the RAOs.

Alternative No. 1 would not involve construction activities; therefore, there would be no additional risk to workers or the community. However, a reduction of contamination and achievement of site protection would not occur under this alternative.

Alternative Nos. 2, 3, and 4 would include non-radiological contaminated soil remediation, off-site transportation and disposal, drilling, and installation and sampling of monitoring wells. There would be hazards to the public associated with off-site transportation and to disposal operation workers from non-radiological soils to be excavated under Alternative

Nos. 2, 3, and 4. There may also be short term impacts to the environment from the soils excavation and handling. Remedial Alternative No. 2 would pose a slightly lower risk, since construction of the treatment plant and injection of in situ treatment amendments would not be involved. Alternative No. 3 includes in situ treatment, if required, and Alternative No. 4 also would include construction of a treatment plant. All of these activities would pose a moderate risk to the remedial worker and low risk to the community, since the work would be performed on the Federal Government-owned MISS. Groundwater sampling activities would pose a moderate risk to the remedial worker and a low risk to the community, since the monitoring wells would be capped and locked, all sampling and purge water would be contained and transported to the site for proper disposal, and traffic controls would be maintained during sampling for any wells installed in or near roadways.

For Alternative Nos. 2, 3, and 4, implementation of LUCs and removal of non-radiological soil would achieve short-term site protection and a reduction of contamination within three years of the GW OU ROD.

L.2.2 Long-Term Effectiveness and Permanence

Refers to the ability of the alternative to protect human health and the environment over time, once cleanup levels have been met.

Under Alternative No. 1, source areas would not be addressed, and human health and the environment would not be protected; therefore, there would not be management of residual risk.

Under Alternative Nos. 2, 3, and 4, the source areas would be addressed by the remediation of non-radiological contaminated soil, to include pond sludge on the MISS, beyond the soils to be removed during the Soils and Buildings OU remedial action on the MISS. Under each alternative, groundwater use would be controlled using a LUC, such as well restrictions in a groundwater CEA. Likewise under each alternative, USACE would notify local utilities and governments of the dermal/inhalation risks from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers. Additional notification would be provided through posting of warning signs at the MISS, and by project-specific health and safety plans. Alternative No. 3 would be the most effective, because benzene source soil is removed and if required, it actively treats the overburden arsenic contaminant plume, the source of most of the groundwater exceeding the cleanup standard for this material. The benzene plume is not treated, since it was determined that the difference in time between Alternative No. 2 and Alternative No. 3 to reach cleanup levels would be negligible. For Alternative Nos. 2 and 4, model predictions indicate that the arsenic would persist for more than 3,000 and 2,000 years respectively, under current aquifer geochemical conditions. However, arsenic would be expected to be removed from groundwater at a faster rate when natural (slightly reducing to oxidizing) conditions are restored in the aquifer, after the benzene biodegrades (see GWFS, Appendix B for more details). A concern with the in situ treatment of the arsenic plume, proposed under Alternative No. 3, would be the mobilization of metals present in the aquifer matrix. However, the treatment assumption is that this would not occur or could be controlled.

Optimum aquifer redox conditions would have to be maintained for in situ treatment Alternative No. 3, or the arsenic would re-dissolve with subsequent downgradient migration (GWFS, Appendix B). This may require additional soil treatment amendments injections beyond those assumed for the detailed evaluation of Alternative No. 3. Prior to performing any treatment, a detailed geochemical evaluation should be performed.

Alternative No. 3 does not treat the lithium plume because there are no suitable or cost-effective in situ treatment methods. Alternative No. 4 reduces the time frame for the cleanup of the lithium plume by a few years; however, this plume would be present for a time period similar to Alternative No. 2. This is appropriate, especially considering the current and expected future land use, since any residual soils left on Federal Government-owned property would be diminished as compared to current on-site conditions.

A concern with the active pump and treat technology proposed under Alternative No. 4 would be the potential to draw off-site non-FUSRAP related contamination into the extraction system. Long-term pumping on the MISS over time could impact the downgradient chlorinated solvent plume, potentially spreading the contamination over a larger area of the aquifer, increasing concentrations downgradient of the source area, and pulling more of the non-FUSRAP contamination onto the MISS. Groundwater pumping also has the potential to spread the arsenic plume vertically downward into shallow bedrock.

L.2.3 Reduction in Toxicity, Mobility, or Volume Through Treatment

Refers to anticipated ability of the remedy to reduce the toxicity, mobility, or volume of the hazardous components present at the site through treatment.

Alternative No. 1 would not reduce contaminant toxicity, mobility, or volume.

Both Alternative No. 3 and Alternative No. 4 would include active treatment as part of the alternative. Alternative No. 2 and part of Alternative No. 3 would address the contaminant plume through passive treatment (MNA) of groundwater. Under Alternative No. 2 and part of Alternative No. 3, toxicity, mobility, and volume of groundwater contamination would be addressed through naturally occurring biodegradation, dispersion, adsorption, and mineral precipitation. The primary attenuation mechanism for lithium would be dispersion and dilution; for arsenic the mechanism would be dispersion, adsorption, and mineral precipitation. The primary attenuation mechanism for benzene would be biodegradation. If required, Alternative No. 3 would reduce the toxicity, mobility, and the volume of the groundwater contaminants in the arsenic overburden plume through in situ treatment. Alternative No. 4 would reduce the toxicity, mobility, and volume of the benzene, arsenic, and lithium plumes in groundwater through extraction and ex-situ treatment. However, the time frame to reach the proposed cleanup goal is not significantly reduced from Alternative No. 2.

L.2.4 Implementability

Addresses the technical and administrative feasibility of an alternative, including the availability of material and services required for cleanup.

All the alternatives are administratively feasible, and the required services and materials, where applicable, are available. Therefore, technical feasibility comprises the focus of the implementability analysis. There are no construction, equipment, storage, or disposal-related considerations associated with Alternative Nos. 1 and 2. These alternatives are both technically feasible to implement.

Alternative No. 1 would require no implementation. Alternative No. 2 would be straightforward to implement and uses proven technologies. Alternative No. 3 would be moderately complex to implement, since a large number of injection points are required if in situ treatment is utilized. In addition, the local variable permeabilities of the substrata would impact delivery of the treatment medium. Alternative No. 3 would also require optimum aquifer redox conditions, which may be problematic and substantially increase costs. Most activities for Alternative No. 4 would be straightforward; however, selection of the recovery well locations may increase the complexity, since the wells need to intercept continuous fracture zones. Soil remediation (excavation and disposal) is a proven technology and straightforward to implement under Alternative Nos. 2, 3, and 4. Under all alternatives, implementation of well restrictions in a groundwater CEA would involve a small number of off-site, adjacent properties.

L.2.5 Cost

Evaluates the estimated capital, and operation and maintenance costs.

The costs for each alternative (present worth with an accuracy of plus 50 percent to minus 30 percent) are estimated as follows:

- Alternative No. 1 – Total Cost: is $0.00 (no capital or O&M costs),
- Alternative No. 2 – Capital Costs: $10,332,000; O&M: $20,122,000; Total is $30,454,000,
- Alternative No. 3 – Capital Costs: $15,340,000; O&M: $21,447,000; Total is $36,787,000,
- Alternative No. 4 – Capital Costs: $12,936,000; O&M: $109,266,000; Total is $122,202,000.

Alternative No. 1 has no associated cost, however, it is not protective. Alternative Nos. 2 and 3 provide the lowest overall costs; however, Alternative No. 3 is more effective since under this alternative the arsenic plume is actively treated and remediated in a substantially shorter time frame. Alternative No. 4 has the highest cost but is not as immediately effective as Alternative No. 3 since it does not actively treat the arsenic plume. Additional information regarding the development of cost estimates for each alternative is provided in the GWFS (USACE, 2010b).

L.3 Modifying Criteria

L.3.1 State Acceptance

The State does not concur with the Selected Remedy (Alternative No. 3). NJDEP offered a comment regarding the cleanup level for arsenic in soil. This comment and corresponding response are provided in the Response Summary (**Section III** of this ROD).

L.3.2 Community Acceptance

The community largely accepts Selected Remedy (Alternative No. 3). No verbal comments were received from community participants during the public meeting held on October 14, 2010. Written comments provided by community members (along with responses to the comments) are provided in the Responsiveness Summary (**Section III** of this ROD). One commenter (Kin Properties) recommended adopting Alternative No. 4 as the Selected Remedy and is opposed to the use of LUCs.

M*.* Principal Threat Wastes

Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained. Neither the soils nor groundwater are considered a principal threat waste. Low-level threat wastes are source materials that generally can be reliably contained and would present only a low level of risk in the event of release. Non-radiological contaminated soil will be excavated from the MISS and disposed, and may be considered low-level threat wastes. The groundwater contamination at the site is neither a principal threat waste nor a low-level threat waste. Groundwater is not considered a source material, nor is the COC contamination present in the groundwater considered a source material (e.g., such as a Dense Nonaqeous Phase Liquid would be).

N. Selected Remedy

Alternative No. 3, consisting of use restrictions, groundwater monitoring, in situ treatment of arsenic in overburden groundwater, MNA of lithium, benzene, and arsenic in groundwater, and non-radiological contaminated soil remediation on the MISS, is the Selected Remedy for groundwater remediation at the MISS.

N.1 Summary of the Rationale for the Selected Remedy

Based upon an evaluation of all alternatives, Alternative No. 3 is the selected remedy for the following reasons:

- The alternative will meet the RAOs as described in **Section II.I.**
- The alternative will meet the threshold criteria of protection of human health and the environment and compliance with ARARs.
- Groundwater in the impacted area is not currently used; a public water supply is available; and future use could be controlled with implementation of well restrictions in a groundwater CEA or other appropriate LUC. Additionally, arsenic, benzene, and lithium source soils will be removed from the MISS.
- USACE would notify local utilities and governments of the dermal/inhalation risks from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers. Additional notification would be provided through posting of warning signs at the MISS, and by project-specific health and safety plans.
- Arsenic in overburden groundwater is expected to be reduced to cleanup standards in less than one year with treatment.
- Once the benzene plume is no longer in the system (less than 10 years), aquifer conditions should allow the remaining arsenic in shallow bedrock to attenuate (less than 180 years) and become less mobile in groundwater. The groundwater monitoring program will verify if these conditions occur.
- Lithium is expected to reach cleanup levels in 280 years.

- The results of the groundwater monitoring program will be used to document and evaluate the progress of natural attenuation, and allow unanticipated results to be addressed.
- During sampling activities, this alternative will have low risk to on-site workers during installation of monitoring wells and will pose low risk to the community, since the only off-MISS activities will be groundwater monitoring. The monitoring wells will be capped and locked. All sampling and purge water will be contained and transported to the site for proper disposal, and traffic controls will be maintained during sampling for any wells installed in or near roadways.

The Selected Remedy will be protective of human health and the environment by removing non-radiological contaminated soil on the MISS. Monitoring changes in aquifer conditions and chemical concentrations in groundwater as they naturally attenuate complies with ARARs, is cost-effective, and utilizes proven technologies. Groundwater sampling at selected monitoring wells and on-site soil sampling after excavation on the MISS will use technically acceptable methods to measure compliance with cleanup levels and evaluate remedial action progress. Alternative No. 3 will achieve a higher level of protectiveness and compliance with ARARs than Alternative Nos. 2 and 4. Although the cost of Alternative No. 3 is slightly higher than Alternative No. 2, the cost is substantially lower than Alternative No. 4. Therefore, it is believed that the preferred alternative will provide the most balanced approach among the alternatives with respect to the evaluation criteria.

Consistent with the EPA Region 2 Clean and Green policy, USACE will evaluate the use of sustainable technologies and practices with respect to any remedial alternative selected for the site.

Groundwater monitoring will be conducted annually to document that natural attenuation is occurring and to determine when concentrations of the COCs meet their cleanup goals. The data will be examined to determine whether significant seasonal variation is occurring and, if it is, to identify the season in which maximum concentrations occur. If elevated detections are identified in a particular season relative to the rest of the year, the well will be sampled during that season. Monitoring well closure and decommissioning activities will be included in the Operations and Maintenance Plan, which will be prepared following final approval of this ROD.

Periodic re-evaluation of the number of wells and sampling frequency, to occur no less than every five years of sampling, will be conducted throughout the LTM of the project. The specific sampling frequency and rationale will be included in the Operations and Maintenance Plan.

The groundwater remedy will be considered complete when all wells on the MISS and Vicinity Properties have been determined to be compliant for all COCs through sampling or when statistical methods have been used to determine when cleanup levels will be met.

The determination of wells to be monitored, sampling frequency, and methods of sample collection and analysis will be described in a Monitoring Plan to be developed during remedial design and submitted to the EPA and NJDEP for review and approval.

As data are gathered during the remedy and impacts of the soil source removal are observed, the groundwater monitoring program may be enhanced through the use of groundwater monitoring optimization software such as Monitoring and Remediation Optimization System (MAROS), other optimization software, or through other appropriate decision logic.

Because the Selected Remedy will result in contaminants remaining on the MISS above proposed cleanup levels, CERCLA will require that the remedial action be reviewed at least once every five years to ensure the protectiveness of the remedy until clean-up levels have been achieved.

The Selected Remedy meets the threshold criteria, and provides the best overall balance of tradeoffs in terms of the five balancing criteria. The Selected Remedy addresses State and community concerns.

N.2 Detailed Description of the Selected Remedy

Alternative No. 3 combines in situ treatment of groundwater, if required, with MISS non-radiological contaminated soils remediation (soils located beyond the limits of soils to be removed during the Soils and Buildings OU remedial action), including pond sludge on the MISS, in addition to LUCs, groundwater monitoring, and MNA. The method that was selected for in situ treatment of arsenic in overburden groundwater was redox alteration. It was assumed that a redox altering treatment would be the selected treatment method in Areas of Concern (AOCs) 1 and 2 where arsenic exceeds 3 µg/L in overburden groundwater (**Figure 7**). Benzene and arsenic in shallow bedrock would be allowed to attenuate naturally. Lithium cannot be treated in situ and would also be allowed to naturally attenuate because there are no standard in situ treatment methods for this contaminant.

In situ treatment would require a large number of injection points. Additionally, the in situ treatment amendments would have to be selected with consideration of other contaminants present in the aquifer, and hazardous amendments may be used on site to treat the contaminated groundwater. In situ pilot and bench-scale studies would have to be performed to determine the appropriate amendment, required concentrations, and injection volumes to use to treat arsenic without mobilizing metals into groundwater from the aquifer matrix. A redox altering treatment is assumed to be used in the overburden to treat arsenic at AOCs 1 and 2 (**Figure 10**). Optimum aquifer conditions would have to be maintained for in situ treatment or the arsenic would re-dissolve with subsequent down gradient migration.

All remaining FMSS groundwater monitoring wells would be proposed to the regulatory agencies for plugging and abandonment. The actual duration of the groundwater monitoring program included in this alternative would be based on the data results which demonstrate that the impacted groundwater has been treated to cleanup levels. The sampling will be conducted annually. Additionally, when a well has been in compliance for all COCs for five consecutive sampling periods or three years, whichever comes first, it would be considered for retirement and, after coordination with the regulating agencies, not sampled further unless there is reason to suspect that it may become non-compliant again. Therefore, beginning in Year 3, this alternative assumes, for cost purposes, that the monitoring wells would be sampled on an annual basis. The arsenic overburden plume is estimated to be below 3 µg/L within the first year after treatment.

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DRAWN BY	ACS/BBF
CHECKED BY	G. Gaillot
APPROVED BY	--
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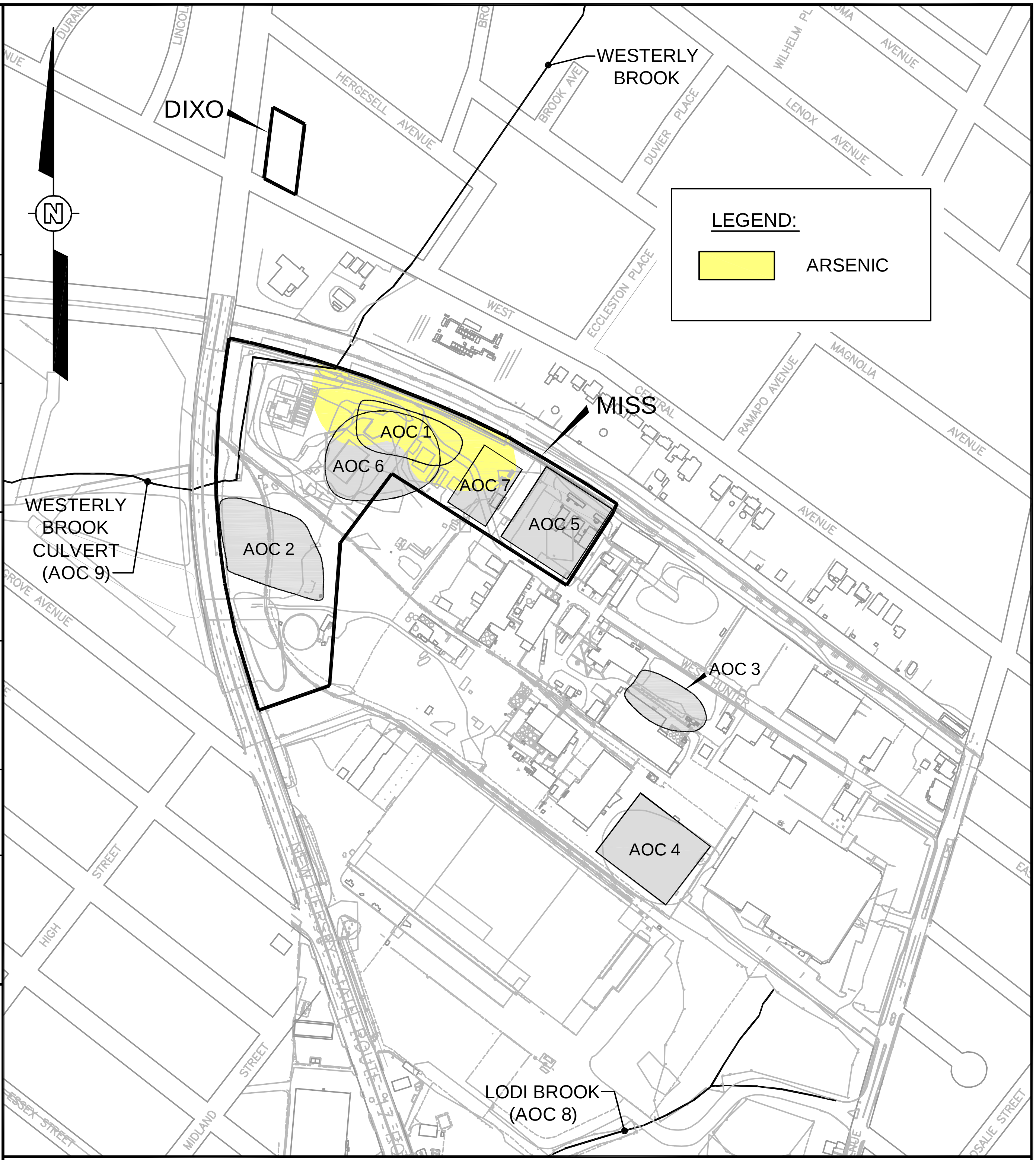


AREAS OF CONCERN:

- AOC 1 - FORMER RETENTION POND A
- AOC 2 - FORMER RETENTION POND C
- AOC 3 - NRC BURIAL PIT 1
- AOC 4 - NRC BURIAL PIT 3
- AOC 5 - WELL B38W18D (FORMER THORIUM MANUFACTURING)
- AOC 6 - PROBABLE BENZENE SOURCE AREA (BEDROCK)
- AOC 7 - PROBABLE BENZENE SOURCE AREA (OVERBURDEN)
- AOC 8 - LODI BROOK
- AOC 9 - WESTERLY BROOK

SCALE
0 400 800 FEET

FIGURE 10
ARSENIC IN SITU TREATMENT AREAS, OVERBURDEN
MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps of Engineers
FUSRAP
Maywood Superfund Site
Shaw
Shaw Environmental, Inc.

Groundwater modeling estimates project that the remaining arsenic present in shallow bedrock will be attenuated in 180 years. Also based on modeling results, the benzene plume is predicted to be attenuated in 7 years in the overburden aquifer and less than 10 years in shallow bedrock. The groundwater model predicts that the lithium contamination would persist in both the overburden and shallow bedrock aquifers for 280 years. The implementation of well restrictions in a groundwater CEA would control the use of the groundwater until proposed cleanup levels are achieved. The groundwater sampling locations are shown on **Figure 11**.

Any well that is proposed for LTM that becomes damaged, or is required to be removed due to remedial action or other activities, would be replaced or repaired, as needed. Continued access to existing FMSS monitoring wells or development of new monitoring wells on offsite properties (i.e., other than the MISS) is contingent on securing access permission from those property owners. The LTM would continue until concentrations are below cleanup levels. All water quality results and the results of the review would be provided in an annual monitoring report.

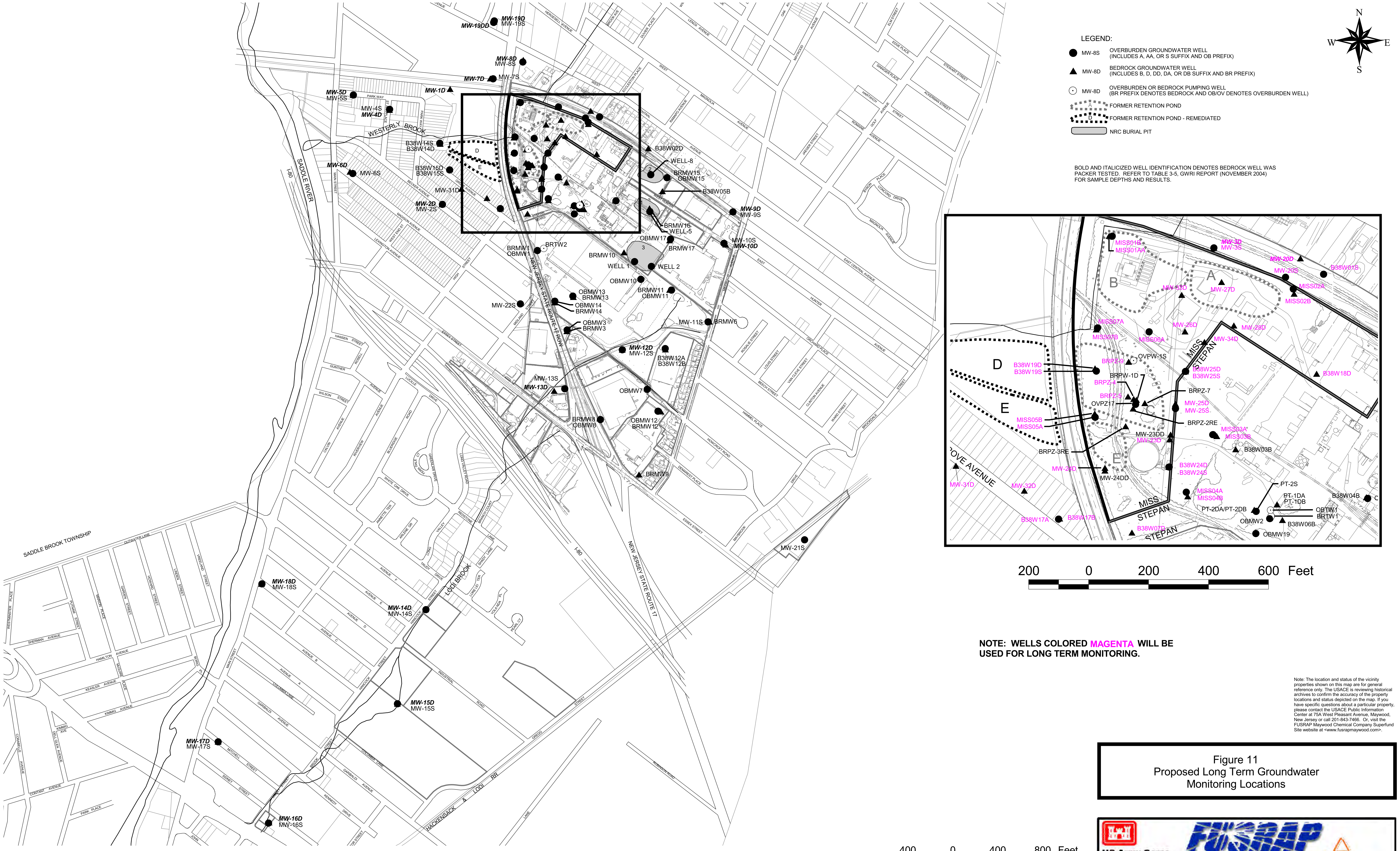
The Groundwater BRA indicated a non-cancer health risk for construction and utility workers due to dermal exposure to groundwater contaminants and inhalation of vapors. The risk would be addressed using LUCs, including notification to local utilities and governments, posted warning signs at the MISS, and by project-specific health and safety plans that would identify the risks to construction workers from dermal exposure to site-related groundwater contaminants.

Consistent with the EPA Region 2 Clean and Green policy, USACE will evaluate the use of sustainable technologies and practices with respect to any remedial alternative selected for the site.

Implementation of the remedial alternative would be considered complete once non-radiological source soils are removed from the MISS, and groundwater monitoring results indicate that FUSRAP COCs are at, or below, the cleanup levels for select MISS and Vicinity Properties groundwater monitoring well sampling locations.

However, although radiological constituents were not identified as COCs in the groundwater RI/BRA, monitoring of radiological constituents will be performed. A long-term Environmental Monitoring Plan created to fulfill monitoring requirements of both USACE RODs (Soils and Groundwater), will include annual sampling for site-specific chemical and radiological parameters (i.e., lithium, arsenic, benzene, total uranium, total radium, and gross alpha) in groundwater. This includes evaluating potential impacts of inaccessible soil contamination.

The radiological monitoring will be conducted annually (in select wells) and will continue as long as radiological contamination remains at the site above the Soils and Buildings ROD (OU1) soil cleanup levels (an average of 15 pCi/g combined Th-232 and Ra-226 on restricted use properties, an average of 5 pCi/g combined Th-232 and Ra-226 on unrestricted use properties, and an average of 100 pCi/g total uranium on all FMSS properties).



NOTE: WELLS COLORED MAGENTA WILL BE USED FOR LONG TERM MONITORING.

Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Chemical Company Superfund Site website at <www.fusrapmaywood.com>.

Figure 11
Proposed Long Term Groundwater
Monitoring Locations

US Army Corps of Engineers.
FUSRAP Maywood Superfund Site
Shaw Environmental, Inc.

\\swibosfs01\envir\maywood\Task1087830305\GWRI-Wells_rev8.apr LAYOUT: Figure 10 11x17 25 August 2010

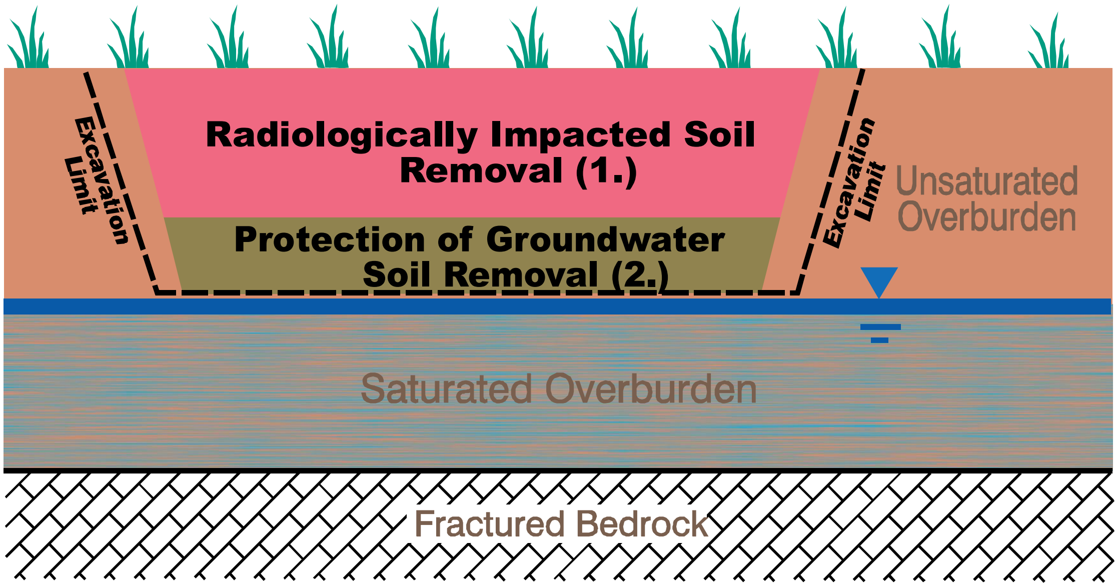
Once soil and groundwater concentrations are less than both USACE RODs' associated protective levels, USACE will request EPA's concurrence to discontinue chemical and radiological monitoring of groundwater.

Because this alternative would result in contaminants remaining on the MISS above proposed cleanup levels, CERCLA requires that the site be reviewed at least once every five years to ensure the protectiveness of the remedy.

The following actions are incorporated into this alternative. These alternative details were developed for GWFS technical evaluations and costing purposes only. Actual design details of the selected remedial action alternative would be determined during the design phase to be implemented after the ROD is approved.

- Excavate MISS non-radiological contaminated soils and dispose off site. All MISS soils above and below the groundwater table, which are contaminated with arsenic, benzene, and lithium would be removed. These soils, which have concentrations of COCs above the SSL values (i.e., those that would cause groundwater contamination above the levels listed in **Table 2**), would be removed. Soil disposal would comply with Resource Conservation and Recovery Act hazardous waste identification, evaluation and disposal requirements. The excavation of MISS non-radiologically impacted soil would be conducted as part of the GW OU ROD concurrently with the removal of MISS radiologically-impacted soils being remediated under the Soils and Buildings OU ROD. This includes excavation of impacted soils in the area of MISS groundwater AOCs 1, 2, and 5. The conceptual approach to MISS radiological and non-radiological soil excavation is shown on **Figure 12**. The volume of non-radiological arsenic, benzene, and lithium contaminated soil estimated to be excavated from the MISS is 16,600 cubic yards above and 5,400 cubic yards below the groundwater table. USACE will address lithium materials remaining on the Federal Government-owned MISS in consideration of constructability and stability issues, future redevelopment of the site, property transfer if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property since consumption of the lithium-contaminated groundwater would represent an unacceptable risk.
- If required, develop an in situ treatment plan for arsenic in overburden groundwater.
- If required, perform in situ pilot and bench-scale studies to determine the appropriate amendments, required concentrations, and injection volumes to treat arsenic in the overburden groundwater without mobilizing metals into groundwater from the aquifer matrix.
- If required, design in situ treatment system including injection point layout, work plan, and health and safety plan.
- If required, perform procurement, utility survey clearance, site preparation, and surveying.
- If required, prepare construction and completion reports.
- If required, treat arsenic in and around AOC 1 and 2 (approximately 4.5 acres) in the overburden aquifer using approximately 660 injection points (Regenesis, 2005).

OFFICE	DATE	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
Pittsburgh, PA	8/18/10	--	G. Jones	G. Gaillot	--	134455-A6



Conceptual Cross-Section of Soil Remediation

"Not to Scale"

Legend:

▼ Groundwater table

Notes:

(1.) To be removed under the Soils and Buildings ROD.

(2.) To be removed under the Groundwater ROD. Some soil will be removed from below the groundwater table in localized areas.

FIGURE 12
CONCEPTUAL DIAGRAM OF MISS SOIL REMEDIATION
MAYWOOD SUPERFUND SITE, NEW JERSEY

US Army Corps of Engineers

FUSRAP
Maywood Superfund Site

Shaw
Shaw Environmental, Inc.

- If required, treat 100 percent of the total area in Year 1, 30 percent of the area in Year 2, and 10 percent of the area in Year 3 (plus additional treatment for any potential rebound in concentrations or incomplete application).
- If required, treat arsenic using a redox altering compound (to be confirmed with bench scale and pilot testing).
- Implement appropriate LUCs, such as well restrictions in a groundwater CEA, deed restriction, or land-use designation to restrict access to groundwater for use as drinking water in areas where arsenic, benzene, and lithium exceed groundwater cleanup levels. However, well restrictions in a groundwater CEA are preferable over institutional controls and land-use designation, since the Federal Government does not own all of the affected property. USACE would request NJDEP establish a CEA in these areas. USACE would submit the information listed in NJAC 7:26E-8.3 to assist NJDEP in establishing a CEA. In the event the State is unable to designate a CEA, USACE would work with local government authorities and affected property owners to develop and implement appropriate LUCs intended to restrict the use of groundwater in these areas until such time as the levels of arsenic, benzene, and lithium no longer exceed cleanup levels in off-site and MISS wells.
- USACE would notify local utilities and governments of the dermal/inhalation risks to construction workers from site-related groundwater contaminants. These entities, in turn, would be asked to notify their workers. Additional notification would be provided through posting of warning signs at the MISS, and by project-specific health and safety plans. These actions would be taken in Year 1 and each time a statutory review report is prepared.
- Develop groundwater monitoring plans for all AOCs.
- Install three additional overburden and three additional shallow bedrock monitoring wells downgradient of MISS groundwater AOCs 1 and 2 (off the MISS and downgradient of the arsenic plume) in Year 1.
- Monitor the COCs and radiological concentrations in groundwater at 24 overburden wells and 24 shallow bedrock wells (upgradient, downgradient, and within the MISS).
- Initiate groundwater analytical program. Each well located on the MISS or located in areas off the MISS, but in locations where potential migration of analytes occurs, would be analyzed for benzene, arsenic, and lithium, and documented in the LTM plan. Additional aquifer parameters would be monitored/analyzed, as needed, to monitor the change in aquifer conditions that may impact the attenuation, fate, and transport of benzene, arsenic, and lithium. These parameters include pH, Eh, dissolved oxygen, organic carbon, ferric and ferrous iron, manganese, sulfide, sulfate, nitrate/ammonia, and methane. The limited number of wells to be sampled for these additional aquifer parameters would be addressed in the LTM plan. Depth to groundwater and groundwater elevations would be determined for each well monitored. Analytical data would be validated upon receipt from the laboratory.
- Prepare a Year 2 report. Additionally, the analytical program would be reevaluated, and the list of chemical parameters reduced as COC concentrations decrease below MCLs.

- Prepare annual monitoring reports.
- Complete a statutory review report every five years in accordance with CERCLA requirements.
- Abandon all unused GWRI monitoring wells in Year 3 (after approval of the Year 2 Monitoring Report).
- Repair/replace monitoring wells, as needed, at a rate of two overburden and two bedrock wells per year, and then abandon all wells at the end of the remedial program.

The GWFS model shows that by Year 30, lithium contamination would still be present in both the overburden and shallow bedrock aquifer. Therefore, 30 years of monitoring are assumed for this alternative. This is the maximum length of time required by CERCLA for use in evaluating alternatives for costing purposes. Due to the length of the monitoring program, well repairs and replacement have been included in this program for costing purposes. Since the plumes are expected to persist beyond 30 years, it is likely that monitoring would continue beyond this time frame.

N.3 Cost Estimate for the Selected Remedy

Total costs for the Selected Remedy (Alternative No. 3) are estimated to be $36,787,000. The costs are based on non-radiological soil remediation (excavation and disposal), in situ treatment of the arsenic plume, implementation and maintenance of LUCs, and performance of an MNA program and other indirect capital costs, as presented in the GWFS. The estimate includes costs for legal (including obtaining private property access rights) and administrative activities associated with obtaining/revising land-use restrictions and development of the monitoring program work plan. **Tables 4** and **5** present a detailed breakdown of the overall cost estimate for Alternative No. 3.

Total capital costs are estimated to be $15,340,000. This includes both direct costs, such as implementation of LUCs, preparation of groundwater monitoring plans; removal and disposal of 11,000 cubic yards of non-radiological contaminated soil during the first year of remedy; performance of a bench-scale and pilot studies of in situ treatment of arsenic-impacted groundwater; design and implementation of the in situ treatment program; and indirect costs, such as management and administrative costs.

Total annual O&M costs are estimated to be $21,447,000 over a 30-year period. These O&M costs include the MNA program which includes the installation of 6 additional monitoring wells; sampling and analysis of COCs and radiological concentrations in groundwater at 24 overburden wells and 24 shallow bedrock wells (upgradient, downgradient, and within the MISS), annually for an additional 30 years. The O&M costs were calculated on a present worth basis using a discount rate of 2.7 percent. O&M Costs are also included for removal and disposal of an additional 11,000 cubic yards of non-radiological contaminated soil in Year 2, as well as two follow-up groundwater treatments for portions of the arsenic plume as shown on **Table 5**.

TABLE 4

Alternative No. 3 – Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation and on the MISS

Capital Costs and Cost Summary

Maywood, NJ

Item Description		Quantity	Units	Unit Cost	Item Cost
General Remedial Activities	Project QA / QC Plan	1	LS	$50,000	$50,000
	Project O&M Plan	1	LS	$50,000	$50,000
	In Situ Groundwater Monitoring Work Plan	1	LS	$50,000	$50,000
	Utility Clearance and Injection Point Layout	1	LS	$25,000	$25,000
	Professional Surveying	1	LS	$20,000	$20,000
	Cleanup and Demobilization	1	LS	$15,000	$15,000
	Construction Reports, Completion Reports, As-Built Drawings	1	LS	$30,000	$30,000
	Classification Exception Area (CEA)	1	LS	$19,400	$19,400
	CEA Deed Notice	20	Each	$696	$13,900
	Notification of Property Owners (registered mail)	20	Each	$116	$2,300
Non-Radiological Soil Remediation	Above Water Table	9000	CY	$500	$4,500,000
	Below Water Table	2000	CY	$900	$1,800,000
In Situ Treatment	Bench/Pilot-Scale Studies, Health and Safety Plan, Materials List, and Procurement	1	LS	$188,400	$188,400
	Site Preparation	1	LS	$25,100	$25,100
	Design	1	LS	$60,000	$60,000
	Treatment Injection for Bedrock Areas	1	LS	$0	$0
	Treatment Injection for Overburden Areas	1	LS	$2,090,000	$2,090,000
Project Management					$893,900
Remedial Action Costs Subtotal					**$9,833,000**
Additional Costs - % of Remedial Costs					
	Overhead/QA Costs	30%			$2,949,900
	Contingency Costs	20%			$2,556,600
Remediation Costs Subtotal					**$15,340,000**
Lifetime O&M Costs (Present Worth)		Table 5			**$21,447,000**
Total Present Worth for Alternative 3					**$36,787,000**

Notes:
1. Site closeout activities are presented on the accompanying O & M cost table.
2. Soil remediation includes all labor, materials, equipment, testing, and disposal costs. Excavation will occur above and below the water table. Water treatment is included for excavations below the water table.

TABLE 5

Alternative No. 3 - Use Restrictions, Groundwater Monitoring, In Situ Treatment of Arsenic in Overburden Groundwater, MNA of Lithium, Benzene and Arsenic in Groundwater, and Non-Radiological Contaminated Soil Remediation on the MISS

Operation and Maintenance Costs
Maywood, NJ

Item Description	Quantity Per Year	Units	Unit Cost	Annual Cost	Number of Yearly Events	Present Worth Cost
In Situ Treatment						
Follow-up Treatment, Year 2 (30% of Year 1 costs)	1	LS	$645,000	$645,000	1	$1,009,000
Follow-up Treatment, Year 3 (10% of Year 1 costs)	1	LS	$215,000	$215,000	1	$327,500
Monitoring (Years 1 and 2)						
Well installation, Well Rehab, Sampling, Lab Analysis, and Validation	1	LS	$380,696	$380,696	1	$595,600
Well Rehab/Replacement, Sampling, Analysis, and Validation	1	LS	$296,696	$296,696	1	$451,900
Monitoring (Years 3 through 13)						
Well Rehab/Replacement, Sampling, Analysis, and Validation	1	LS	$190,000	$190,000	11	$2,796,400
Annual Monitoring (Years 14 through 30)						
Well Rehab/Replacement, Sampling, Analysis, and Validation	1	LS	$167,400	$167,400	17	$2,635,300
Monitoring Report						
Annual Monitoring Report	1	Each	$60,000	$60,000	30	$2,017,900
Year Two Report - from Monitoring Data	1	Each	$60,000	$60,000	1	$93,900
Five Year Report - CERCLA Review	1	Each	$60,000	$60,000	6	$382,400
Non Radiological Soil Remediation (Years 2 and 3)						
Above Water Table (Year 2)	7600	CY	$500	$3,800,000	1	$5,944,700
Below Water Table (Year 2)	3400	CY	$900	$3,060,000	1	$4,787,000
Above Water Table (Year 3)	0	CY	$500	$0	1	$0
Below Water Table (Year 3)	0	CY	$900	$0	1	$0
Site Closeout (Year 3)						
Abandonment of Monitoring Wells - Bedrock Wells	49	Each	$2,500	$122,500	1	$186,600
Abandonment of Monitoring Wells - Overburden Wells	34	Each	$2,500	$85,000	1	$129,500
Site Closeout (Year 30)						
Abandonment of Monitoring Wells - Bedrock Wells	24	Each	$2,500	$60,000	1	$44,500
Abandonment of Monitoring Wells - Overburden Wells	24	Each	$2,500	$60,000	1	$44,500

Lifetime O&M Costs (Present Worth)	**$21,447,000**

Notes:
1. O&M costs are totaled as a present worth cost based on a 2.7% net investment rate for the period of time noted.
2. Lifetime O&M costs include annual QA and contingency costs.
3. The O&M costs include 25% for overhead / QA costs, 20% for O&M contingency costs, and 10% for project management.

Reporting costs include labor and materials necessary for data evaluation, evaluation of site conditions, performance of the remedial actions taken, and recommendation for continuation of groundwater monitoring.

The information in the cost estimate summary is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design, such as the treatability and pilot tests for treatment of the arsenic plume. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

N.4 Expected Outcomes of the Selected Remedy

The Selected Remedy is considered a permanent solution, will attain all RAOs to be protective of human health and the environment, and provide for the ability to release the property for beneficial reuse. Implementation of the remedy will result in the beneficial reuse of the property for commercial/industrial purposes. Unrestricted use of groundwater is expected to be achieved in approximately 280 years. Until that time, LUCs will remain in place to manage the use of groundwater.

O. Statutory Determinations

The Selected Remedy satisfies the statutory requirements of CERCLA Section 121 and the NCP, as described in the following paragraphs.

O.1 Protection of Human Health and the Environment

The Selected Remedy, Alternative No. 3, will protect human health and the environment by use of source removal, in situ treatment of groundwater, and MNA to reduce COC concentrations in groundwater to acceptable levels. It is anticipated that cleanup levels will be achieved in approximately 280 years. The alternative provides for the control of exposure to groundwater through the implementation of LUCs as long as COCs remain above levels that allow for unrestricted use. There are no significant short-term risks associated with implementation of this remedy.

O.2 Compliance with ARARs

Alternative No. 3 is expected to achieve the ARARs and RAOs presented in this ROD. The various chemical-specific groundwater standards for each FMSS groundwater COC are listed in **Table 6**. The ARAR for arsenic is the NJGWQC PQL and the proposed cleanup level is 3 µg/L. The ARAR for benzene is the NJGWQC PQL and the proposed cleanup level is 1 µg/L. Since ARARs are not available for lithium in groundwater, a cleanup level was derived for lithium, consistent with assumptions used in the BRA, based upon ingestion of groundwater; EPA Region 2 and USACE agree that these levels are appropriate and protective to manage risks associated with MISS groundwater.

TABLE 6

GROUNDWATER CHEMICAL-SPECIFIC ARARS AND PROPOSED CLEANUP LEVELS

Constituent	Groundwater ARARs (μg/L)	Source for Cleanup Level
Arsenic	3[a]	NJGWQC PQL
Benzene	1[a]	NJGWQC PQL
Lithium	730	Calculated Value[b]

Notes:

[a] The lowest of Federal MCLs (40 CFR Part 141) or NJGWQC or higher PQL (NJAC 7:9C).

[b] Since ARARs are not available for lithium in groundwater, a cleanup level was derived for lithium consistent with assumptions used in the BRA for ingestion of groundwater.

O.3 Cost-Effectiveness

The Federal Government has determined that the Selected Remedy meets the statutory requirement for a cost-effective remedy. In making this determination, USACE considered the requirements established in the NCP Section 300.430(f)(1)(ii)(D): *A remedy shall be cost-effective if its costs are proportional to its overall effectiveness.* This was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., deciding whether they were protective of human health and the environment, as well as being ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine effectiveness. The relationship of the overall effectiveness of Alternative No. 3 was determined to be proportional to its costs, and thus, is cost-effective.

O.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

The Selected Remedy, which relies on both treatment and naturally occurring processes, will achieve significant reductions in COC concentrations in groundwater. The Selected Remedy satisfies the criteria for long-term effectiveness by reducing COC concentrations. For Alternative No. 3, the combination of source removal, treatment of the arsenic plume in overburden groundwater and natural attenuation of benzene, lithium, and arsenic in shallow bedrock groundwater is expected to gradually reduce the toxicity of the groundwater and the volume of contaminants over time. As concentrations are reduced and target concentrations are achieved across the site, the plume area designated as impacted will recede. The Selected Remedy does not present short-term risks different from the other alternatives, excluding the No Action Alternative. There are no special implementability issues related to the Selected Remedy.

O.5 Preference for Treatment as a Principal Element

Alternative No. 3 satisfies the preference for treatment as a principal element of the remedy. This alternative utilizes in situ redox alteration, as needed, to treat arsenic in groundwater. In addition, MNA of benzene, lithium, and arsenic in shallow bedrock groundwater is considered a passive treatment, does utilize a permanent solution, and provides for the documented reduction in toxicity and volume of the groundwater contaminants.

O.6 Five-Year Review Requirements

The Selected Remedy will result in contaminants remaining on the MISS above proposed cleanup levels. As a result, there is a statutory requirement for five-year reviews to determine the protectiveness of the Selected Remedy for the site groundwater. The five-year reviews will be discontinued only after non-radiological source soils are removed from the MISS, and groundwater monitoring indicates that FUSRAP COCs are at, or below, the cleanup levels in all of the MISS and Vicinity Properties groundwater monitoring well sampling locations.

III. RESPONSIVENESS SUMMARY

The public comment period for the MISS Groundwater *Proposed Plan* extended from September 20, 2010 through November 18, 2010. Letters were received from the NJDEP, BNY Mellon, Conestoga-Rovers & Associates, and Kin Properties, Inc., during this time and are attached to this Responsiveness Summary. No verbal comments were received from the attendees during the public meeting held October 14, 2010. The public meeting transcript is provided in Attachment A of this ROD. All comments received have been grouped by commenter and are presented in the following paragraphs.

BNY Mellon (letter dated October 12, 2010)

Comment 1:

Figure 1-1 of the Groundwater Proposed Plan for Formerly Utilized Sites Remedial Action Program (FUSRAP), Maywood Superfund Site, dated September 2010, does not depict 150, 162, and 174 Essex Street as having been remediated. However, correspondence received and based on conversations with William Kollar of Shaw Environmental, it has been remediated. Figure 1-1 should be revised to reflect the fact that the remediation is complete.

Response 1:

The Bank of New York Mellon properties at 150, 160-162, and 174 Essex Street, Lodi, NJ have been remediated under FUSRAP. The FUSRAP status of your properties is accurately presented in the property-specific Post Removal Action Reports transmitted to BNY Mellon in July 2008. Figure 2 of the Maywood Groundwater ROD (corresponding to Figure 1-1 of the Proposed Plan) has been revised to indicate the completed remediation of properties.

State of New Jersey, Department of Environmental Protection (letter dated October 14, 2010)

Comment 1:

NJDEP commented on the proposed use of the chemical-specific soil cleanup level of 41 mg/kg for arsenic. The Proposed Plan states that because a promulgated standard does not exist for arsenic soil contamination at the site, a site-specific cleanup value was calculated for arsenic. Please be advised that on June 2, 2008, the Department promulgated its Remediation Standards, N.J.A.C. 7:26D, including Residential and Non-residential Direct Contact Soil Remediation Standards for arsenic which should be evaluated as applicable or relevant and appropriate requirements (ARARs). For arsenic, both the Residential and Nonresidential Direct Contact Soil Remediation Standards were promulgated at 19 mg/kg, based on background concentrations found in New Jersey soils.

Response 1:

Soil cleanup values presented in the FUSRAP Maywood Groundwater Feasibility Study and Groundwater Proposed Plan were developed to address impacts to groundwater remedial action objectives. Soil contamination related to direct contact of soils was addressed under the Soils and Buildings FS in the associated risk assessment which concluded that arsenic via the direct-contact pathway is not a COC. Therefore, arsenic was not carried forward into the Soils and Buildings ROD (i.e., not requiring remedial action for the Maywood FUSRAP Site).

On June 2, 2008 (amended on November 4, 2009), NJDEP promulgated "Cleanup Standards for Contaminated Sites," N.J.A.C. 7:26D. Subchapter 7 of N.J.A.C. 7:26D allows for the development of site-specific remediation standards based on site-specific chemical and physical properties.

NJDEP soil remediation guidance states that site-specific impact to groundwater (IGW) soil remediation standards may be developed from Synthetic Precipitation Leaching Procedure (SPLP) data. These values were determined for the MISS and used to develop alternative site-specific standards that are based on an accurate measure of the mobility of the arsenic in soil at the MISS. Information justifying the use of this approach is described in the June 2009 NJDEP Guidance (http://www.nj.gov/dep/srp/guidance/rs).

The 2004 FUSRAP Maywood Soil Screening Level (SSL) Technical Memorandum describes the approach used to calculate the site-specific arsenic impact to groundwater cleanup value (Shaw 2004). The approach used in 2004 to derive site-specific IGW values is consistent with the current NJDEP approach. EPA and NJDEP comments on the document are attached to the memorandum. The procedure described in the 2004 SSL Technical Memorandum was used to re-calculate the current arsenic site-specific IGW cleanup value based on the reduced NJ GWQC of 3 µg/L.

A typed version of the derivation of the Arsenic Impact to Ground Water Soil Remediation Standard (IGWSRS) is attached to these RTCs.

Please note that the impact to groundwater soil screening levels (SSLs) were originally derived in 2004 in accordance with the Work Plan approved by NJDEP on May 5, 2004. The derived SSLs were provided to NJDEP in the Soil Screening Level (SSL) Technical Memorandum, (October 2004), Rev 0. In June 2007 the SSL for arsenic was re-calculated using the current NJDEP GWQC in place of the Federal MCL. This was the hand written calculation provided to NJDEP per e-mail request on January 13, 2011.

The guidance provided in your web link was not available in 2007 when the calculation was originally prepared. The draft guidance provided by NJDEP on May 5, 2004 was used in the 2007 calculation. In the typed version (May 23, 2011) we have updated the procedure consistent with Guidance for the Use of the Synthetic Precipitation Leaching Procedure (SPLP) to Develop Site-Specific Impact to Ground Water Remediation Standards (NJDEP, June 2008). The results do not change since the procedure followed in 2007 (Option 3) is consistent with the procedure (Option 1) in the 2008 guidance.

With respect to arsenic and benzene, USACE, as the lead agency, subsequently determined that adding an impact to groundwater standard for benzene and changing from a site-specific standard for arsenic to the NJDEP generic impact to groundwater standard within the preferred Alternative 3 meets the ARARs for arsenic and benzene. The soil cleanup value of 19 mg/kg for arsenic was derived using the 3 µg/L groundwater cleanup level.

The NJDEP generic impact to groundwater standard will be applied in the unsaturated zone of the soil column. Most arsenic soils requiring removal are located in the unsaturated zone. If the water table is above the contaminated soil at the time of remediation, the excavation will be dewatered and soil removed under unsaturated conditions. Cleanup confirmation samples will also be collected from the unsaturated zone under dewatered conditions.

Further, in situ arsenic treatment will be conducted below the water table for elevated arsenic in groundwater areas. As a part of the groundwater monitoring work plan, post-treatment sampling of groundwater will be conducted to monitor progress. The effectiveness of this remedy will be evaluated as a part of the five-year review for the Groundwater OU.

State of New Jersey, Department of Environmental Protection (letter dated November 18, 2010)

Comment 1:

In this letter, NJDEP re-iterated the comment in their October 14, 2010 correspondence regarding the proposed use of the chemical-specific soil cleanup level of 41 mg/kg for arsenic. The Proposed Plan states that because a promulgated standard does not exist for arsenic soil contamination at the site, a site-specific cleanup value was calculated for arsenic. Please be advised that on June 2, 2008, the Department promulgated its Remediation Standards, N.J.A.C. 7:26D, including Residential and Non-residential Direct Contact Soil Remediation Standards for arsenic which should be evaluated as applicable or relevant and appropriate requirements (ARARs). For arsenic both the Residential and Nonresidential Direct Contact Soil Remediation Standards were promulgated at 19 mg/kg, based on background concentrations found in New Jersey soils.

Response 1:

Refer to Response to NJDEP comment dated October 14, 2010. The USACE will use the NJ Generic IGW SSL of 19 mg/kg as the arsenic soil to groundwater cleanup value.

Comment 2:

The NJDEP noted that vapor intrusion could potentially exist at the southwest corner of the site, approximately 150 feet north of the Grove Avenue and Route 17 intersection. At this location, the benzene plume is inferred to have migrated off-site as represented by the 1 µg/L isopleths shown on Figure 1-9 of the Final Groundwater Feasibility Study. The selection of Remedial Alternative 3 as the preferred alternative should be amended to include the evaluation of vapor intrusion issues.

Response 2:

USACE is concerned about benzene in groundwater. Benzene in groundwater has shown through numerous studies to be a contaminant that will degrade very quickly over time. Given the physical features of the site and the primary industrial nature of the current land use, USACE will monitor a select group of overburden wells as part of the five-year review process. A recent evaluation of benzene in groundwater in the overburden aquifer indicated concentrations below the NJDEP vapor intrusion screening guidance of 15 µg/L. This clean barrier "aquifer" combined with the lack of permanent habitable structures above the benzene contamination prevents a completed vapor intrusion pathway. The five-year review process will ensure the continued protectiveness of the remedy. Once concentrations are below a level of 1 µg/L, vapor intrusion should no longer be a concern at the site.

Comment 3:

NJDEP agreed that the radionuclides that were detected in 5 monitoring wells will be addressed by the ongoing remediation of soils underway pursuant to the 2002 Record of Decision for soil.

Response 3:

Noted.

Conestoga-Rovers & Associates (letter dated October 21, 2010)

Comment 1:

Stepan seeks to clarify the status of the lithium as a FUSRAP waste or requests an explanation as to why lithium, at and emanating from the MISS, is not a FUSRAP waste. Stepan believes, however that the groundwater with concentrations of lithium above the cleanup criteria and which is under and/or emanates from the MISS is a FUSRAP waste as defined by the FFA.

Response 1:

USACE differentiates between on-MISS and off-MISS AOCs for purposes of non-radiological constituents. The FFA definition of FUSRAP waste does not include chemicals as FUSRAP waste if they are located off the MISS and not comingled with radiological contamination above cleanup levels, or originated on the MISS, but are not associated with the thorium processing activities at the MCW site which resulted in the radiological contamination. Lithium is not a FUSRAP waste, as it does not meet the test for FUSRAP waste based on definitions in the FFA and applicable law. Also, lithium is not a CERCLA hazardous substance. Even so, the regulators point to lithium's well-documented toxicity, and argue that lithium found at the site can be linked to the manufacture of lithium compounds at the former MCW facility. In light of regulator concerns, USACE has elected to address lithium materials remaining on the Federal Government-owned property in consideration of constructability and stability issues, future redevelopment of the site, property transfer, if determined to be excess to Federal needs, and to prevent potential future use of impacted groundwater on and off the property, since consumption of the lithium-contaminated groundwater would represent an unacceptable risk to human health.

Comment 2:

On page 1-8 of the Groundwater FS Report, USACE states:

“Approximately 2.4 million gallons per day of non-contact cooling water, scrubber water, cooling water, cooling tower blow down water, and storm water are discharged to Lodi Brook from Stepan Company. However, several spills have occurred and were noted as being discharged into Lodi Brook. During on-site NJDEP investigations, observations were made of waste product being washed down the storm sewer leading to Lodi Brook.”

Only non-contact cooling water and storm water are discharged to the Lodi Brook in accordance with NJDEP Permit No. NJ0003182. Further, Stepan has not discharged any effluent other than non-contact cooling water and storm water via its storm sewers to the Lodi Brook, nor has NJDEP alleged or investigated any such discharge. Vessel washing and boiler/cooling tower blow down go to the Process/Sanitary Sewer in accordance with NJDEP Permit No. NJ0003182. Any other waste water or other solid waste is shipped off-site in accordance with applicable regulations.

Response 2:

The disputed text language in the September 2010 FUSRAP Maywood Final Groundwater Feasibility Study was taken from the July 2004 FUSRAP Maywood Final GWRI Report, page 1-13, last paragraph of Section 1.8.2. It appears that the information was derived from Stepan spill reports investigated by NJDEP and NJ Division of Fish, Game, and Wildlife as documented in Table 1-8 of the Maywood GWRI for the periods 1979 through 1988.

Comment 3:

Stepan has conducted investigation and pilot testing activities in addition to those reported by the USACE in the FS. As a result of those activities, the information set forth in the FS is updated as follows:

- Based on site-specific characterization activities, there are two isolated VOC overburden plumes on the Stepan property, one in the Former Aromatic Area and one in the Central Tank Farm Area.
- Recent samples from the leather material area indicate any chromium detections are below the impact to groundwater criterion.
- Significant portions of the non-FUSRAP AOCs are coincident with radiologically-impacted soil, which the USACE is remediating under FUSRAP.

On September 30, 2010, Stepan submitted a Feasibility Study Report to EPA which addresses non-FUSRAP waste contamination. The FS Report covers both soil and groundwater, and reviews remedial alternatives for the non-FUSRAP waste contamination.

Response 3:

USACE acknowledges receipt of the updated Stepan investigation and pilot study information. The Stepan FS will be reviewed when it is released for public comment, for compatibility with USACE current remedial programs for soils and buildings, and the Selected Remedy for the MISS groundwater.

Kin Properties, Inc. (letter dated November 9, 2010)

Comment 1:

The property owner's recommendation would be for Remedial Alternative No. 4 to be adopted.

Response 1:

The property owner's preference is noted. It is true that Alternative No. 4 appears to be the fastest method by which the benzene contamination could be reduced, and the reduction of the arsenic contamination would be facilitated by the reduction of the benzene contamination. However, the relatively minimal time-savings do not justify the substantial additional costs necessary to implement this alternative, an additional approximately $86M more than the costs to implement Alternative No. 3. In addition, under Alternative No. 4, the potential exists to draw off-site non-FUSRAP related contamination into the extraction system. The following additional factors were key in the selection of Alternative No. 3 as the Selected Remedy:

- Alternative No. 3 is considered the most effective alternative because it actively treats the overburden arsenic contaminant by means of in situ treatment of the plume.
- Arsenic in overburden groundwater is expected to be reduced to cleanup standards in less than one year with treatment.
- Alternative No. 3 will achieve a higher level of protectiveness and compliance with ARARs than Alternative Nos. 2 and 4.
- Alternative No. 3 will meet the RAOs.
- The State of New Jersey has concurred with the choice of Alternative No. 3 as the Selected Remedy.

Comment 2:

Kin Properties owners do not see any reason the property should be subjected to any land-use controls. They strongly oppose any attempt to impose land-use controls on the property, especially when it is not affected by the groundwater plume.

Response 2:

In accordance with the Soils and Buildings OU ROD, this property was identified for remediation at levels that would allow for restricted use, meaning that the soils and buildings cleanup will result in contaminants remaining on the property above selected cleanup levels. In addition, inaccessible soils will remain on the site (e.g., under the warehouse) until such time as the property owner makes the soils accessible for remediation. As such, LUCs are required to be implemented in accordance with the Soils and Buildings OU ROD in order to achieve protectiveness. As stated in this GW OU ROD, all of the Soils and Buildings OU ROD LUCs will be considered in evaluating the need for any additional LUCs for this GW OU remedial action. Additional LUCs will be proposed, only if necessary, on a property-by-property basis. In all cases, USACE will work with affected property owners to develop and implement appropriate LUCs.

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Attachment A

Transcript of Proceedings
Public Hearing
Groundwater Proposed Plan

STATE OF NEW JERSEY
COUNTY OF BERGEN
BOROUGH OF MAYWOOD
MAYWOOD PUBLIC LIBRARY
October 14, 2010
Commencing at 6:00 p.m.

IN RE: :
: TRANSCRIPT
PUBLIC HEARING : OF
GROUNDWATER PROPOSED PLAN : PROCEEDINGS
FUSRAP MAYWOOD SUPERFUND SITE :
MAYWOOD, NEW JERSEY :
- - - - - - - - - - - - - - - - - - -

BEFORE:

JAMES T. MOORE
U.S. ARMY CORPS OF ENGINEERS
District of New York

ALSO PRESENT:

WILLIAM KOLLAR
SHAW ENGINEERING

Reported by:
MARY BAUMANN, C.S.R.

CALDARELLA, FENECK & ASSOCIATES

Certified Shorthand Reporters

30-16 Broadway

Fair Lawn, New Jersey 07410

(201) 797-8801

MR. MOORE: Good evening. My name is Jim Moore, Army Corps of Engineers, New York District. We're here tonight with regard to the Groundwater Feasibility Study Proposed Plan. Because of the weather, we decided to adjust our schedule a little bit. What we're going to do for the first half hour is just put some of our subject matter board experts by some of our poster boards. If you have any questions, you can ask them. And after that, what we'll do is we'll have an official presentation, probably about 20 minutes to a half hour. Then after that, we will be just taking the questions from the public.

So if you have any questions at this time, please feel free to ask. Otherwise, we'll reconvene in about another 25 minutes and get the formal presentation underway and, hopefully, give you an opportunity to comment. Thank you.

(A brief recess is taken.)

MR. MOORE: Good evening. If everyone could grab some coffee and some cookies and grab a seat for a second. Just go through our presentation and after that take any comments that you might have. And, Allen, if I am not loud enough in the back of the room, please let me know.

We're here for the public meeting for the Maywood Groundwater Feasibility Study Proposed Plan. The public comment is currently extended through the 19th of October but, however, we have received a request to extend that and we granted that request. So that extension will proceed to November 19th.

Here are the ground rules we'll follow: Some introductions. Also talk about some meeting guidelines. Talk about the Comprehensive Environmental Response, Compensation and Liability Act, which we call CERCLA. Also talk about the Maywood FUSRAP site itself, talk about the proposed plan as well as the public involvement opportunities that we're going to be doing in the future and wrap that with some closing statements.

As far as some introductions, as I said earlier, my name is Jim Moore. I'm with the Army Corps of Engineers from New York District, project manager, and I have with me my technical manager from Kansas City, Josephine Newton-Lund. She's in the back, the lady in red. I also have some EPA regulators. We have Betsy Donovan, the RPM from EPA, and John Fresco is somewhere in the mix. We also have the New Jersey DEP case manager, Donna

Gaffigan. I have the contact information should you want to get that information.

In addition to those people, we also have the former project manager for the site, Allen Roos, in the back. He's also my boss. He's a branch chief. He's a wealth of information on the site. I talk to him often. More than you know.

Just basic guidelines for the meeting. We'd like to have this be a productive meeting so we ask you to turn off your cell phones or put them in silent mode. In addition, we'd like to have one speaker at a time and ask you to speak slowly for this person up here who is transcribing the meeting for us. So I promised her that I would tell you that and make sure everyone is aware.

In addition, we ask the speakers to identify themselves, what hometown they are from and any affiliation they might have. And also try to speak clearly and loud enough for her to hear what your comments are because your comments are very important to us. We want to make sure we capture all this information and then provide a formal written response to all the comments at the end of the comment period.

Lastly, we just ask all parties to limit their comments to five minutes. That I don't think will be an issue tonight. Sometimes we have very well-attended meetings. I think the weather has definitely had an impact upon our meeting tonight, but we want to make sure that everyone has an opportunity to comment. And, lastly, we'll stay as long as necessary to address any comments that you might have.

Just a moment about the CERCLA process to try to convey to the public where we are in the process. As part of the FUSRAP program, we're required to do work consistent with CERCLA. That means we have to first perform a preliminary assessment at the site, look at historical records, see what facility information is available. Based on that preliminary assessment, if the information leads us to the next step, we would go and perform a site inspection. That's a very limited type of assessment, whether that would be soil or groundwater assessments. If those type of assessments indicate contamination is present and above the regulatory criteria, we would go to the next step, which is a remedial investigation. That's a more detailed analysis of the site. We would look at all forms of media, both soil, groundwater, sediment and also surface water. After we do that complete site characterization, we would follow up with a feasibility study and that feasibility study would evaluate the alternatives to the contaminants that were found by media.

Our concern tonight is specifically with regard to groundwater and the options that we evaluated as part of our alternatives. We are currently in the proposed plan stage right now. During the public comment period, this is the public's opportunity to go out and look at the documents that we prepared. These documents have been reviewed by both EPA and State regulators and this is your chance to say I either agree with it, I don't agree with it or I have specific concerns that I'd like to have addressed and factored into the process.

After this process is done, we'll start the preparation of a groundwater record of decision. That groundwater record of decision will finalize what approach we will follow, how much that will cost the taxpayers and how we'll execute that work. And, lastly, once that document is signed, then we'll move to a remedial design phase where we'll implement the remedy within the scope of the work at the site.

Here is a little bit of information about key site properties and features of the site. We're located right about here. That's about right. We're located in the library right about here. Here is Maywood Avenue. Here is the railroad. This parcel right here is the government-owned parcel. This is Stepan Chemical. Here is Sears, big Sears. And all these other properties are the vicinity property locations associated with the Maywood Superfund site. There were 88 vicinity properties that have been identified by the Department of Energy, of which the DOE went out and cleaned up a certain percentage and the Corps went out and cleaned the remaining percentage.

I'm happy to report at this time that our last two vicinity properties that aren't attached to this big parcel right here, that's the Scannell and railroad property, we're currently doing work on those parcels and in the process of remediating them, and probably about a year from now we'll have completed the remediation on these parcels. So we'll no longer be moving trucks across city roads to bring that material back to our site, and we'll be just focusing on operations in this area.

The only other key feature we should bring out there is a drainage feature right here where a lot of the contamination was transported over time, and those areas have already been remediated.

Next let's talk about the feasibility study. That's where we evaluate the potential cleanup options associated with our work. This is the opportunity where the Corps of Engineers presents what we consider to be the preferred alternative. That alternative is what we think makes the most sense and balance out all the risks associated with the site.

In our feasibility study we've evaluated four alternatives. One was no action. We were required by CERCLA to evaluate no action. It is not something that we have an option to do. It's an offer we can't refuse. Everything has to be balanced against that no action criteria.

The second criteria that we looked at or alternative was the removal of non-radiologically contaminated soil at the Maywood Interim Storage Site. That would be the federally owned parcel with monitored natural attenuation of lithium - I am saying it slowly for her - benzene and arsenic in groundwater, and then groundwater monitoring and land use controls and restrictions on the water.

Alternative No. 3 is basically the same as Alternative No. 2. However, we are opting to do treatment of arsenic in groundwater. Everything else is exactly the same, and I am making that abbreviated statement for her hands.

The last option we looked at was the non-radiological contaminated soil removal at the MISS. When we say the words ex-situ treatment, what we mean is pump and treat. We're going to extract water from the overburden, treat it and then reinject it. That process was currently costed out for 30 years. After that process is completed and after the removal is performed, there still will be a monitored natural attenuation component for benzene, lithium and arsenic with some groundwater monitoring and land use restrictions.

Our current cost estimates for our four options are: Alternative No. 1, no action, no money, no cost. Alternative No. 2, $30 million. Alternative No. 3, which is the treatment of arsenic and all the other information associated with Alternative No. 2, is $36 million. And

Alternative No. 4, which is the removal of contaminated soil, 30 years of pumping, also monitored natural attenuation and land use control is $122 million. That's based on current dollars.

Our proposed plan and scope, under CERCLA we are required to present this proposed plan to the public. We have a preferred remedy. Our preferred remedy is Alternative No. 3 for $36 million. We have stated in our documents, hopefully that you had a chance to review, our reasons for our preference and also the analysis on how we came to that conclusion. This is your opportunity to review those documents and ask our technical experts that are here tonight any questions that you might have.

Please keep in mind that our hope is to try to respond to any questions that you might have tonight but the official response will be in writing based on what the stenographer is preparing right now. So again we'll try the best we can to address your comments but the best response will be the official written version.

The proposed plan addresses groundwater contamination at the Maywood site and currently the soil part is currently being addressed as a soil operable unit. This is a question I have. I have to talk to Betsy about it but is there three operable units or four?

MS. DONOVAN: There's three.

MR. MOORE: There are three operable units. So one operable unit that we have is for all the soils work. So anything that's been covered under the 2003 soils log. The second operable unit is for groundwater. That's currently what we're working on now. The third operable unit will be handled by others.

Now, the proposed plan, our preferred alternative, the advantages to it is that it is protective of human health and the environment. We have to meet that criteria. That's what CERCLA says. That's the measure that we have to meet everything against. If it doesn't do those two things, we can't evaluate it. Next, it meets the remedial action objectives for the site and also complies with the established cleanup levels. It includes soil removal action separate from the soil action that's being done under operable unit one to take care of the non-radiological contaminated material as well as long-term monitoring and natural attenuation of any material.

Now, one might ask why did you choose Alternative No. 2 versus 3? What's the difference? The first answer is $6 million, but the real difference between the two is if we did not address the arsenic, based on our model projections, it would take approximately 180 years for those concentrations in groundwater to get to the point where they would be protective of human health, if we chose that route. So we thought about that. We looked at things very hard and close, and we decided it was in the best interests of all parties involved to go ahead and attack the arsenic issue with an injection of material that will make that material innocuous, and that will take about a year. There will be monitored natural attenuation with some other components but we felt this balanced out the remedy the best.

I guess one of the most important points that you have to consider is first no one is drinking the water in Maywood. Everyone is on city water so there really isn't a risk that way. And the second and other important point is that we would be putting land use restrictions or like a Classification Exception Area over the impacted area so that if anyone wanted to put in a well in the future to draw water from that aquifer, they couldn't. If we couldn't make that arrangement with the state, we would make our own arrangements as far as land use controls.

Public opportunity, we're taking oral comments tonight, if you should have them. We're also leaving comment cards, if you have a written comment. If you choose not to make an oral comment but you want to write one down and hand it to us, I would highly suggest you take a comment card because you might think of a comment on the way home. I do my best thinking in the shower. After I get out of the shower, I write my comments down. Then I can mail it in.

We also will still continue to have the documents that we have here in the back at the Maywood FUSRAP Information Center down on Pleasant Avenue and the hours are right there. Also the documents are available on our website, and our website address is listed right over here. If you just go to -- I can't advertise Google or yahoo, if you type Maywood and FUSRAP, you will find our website.

At the time of this presentation the public comment did close on October 19th but, as I mentioned, someone made a request and we extended that to November.

In closing, I have only been on this project for a little less than a year. I still have a lot to learn about this. If you ask a question, I will tell you right now I may not know the answer to it, but I have the person here who will be able to answer it. This is a very large job. There is an awful lot of things that go on at the site. My focus is to try to keep everything moving along but sometimes it's like herding cats. It's very busy. And as long as I can get everybody going in the right direction, that's pretty good for a day.

But here is my contact information right down here. If you ever need to call me, please do. It's always easier to get in touch with Bill Kollar right over there. He is an excellent resource and will be very helpful in addressing any concern that the community might have, and Bill will always work with me to respond to your requests very quickly.

I also provided contact information for Betsy. I didn't tell you I was going to do that but I did.

MS. DONOVAN: I figured you would.

MR. MOORE: And for Julio Vazquez.

Julio is also another remedial project manager that works on the site with EPA. And, lastly, I have to apologize to Donna, I did that same thing for you.

With that, our formal presentation is ended and we're now happy to take any comments that you might have.

MR. FRESCO: You did a good job.

MR. MOORE: It's all because of this guy over here. I stand up and try to sound good. If no one has any comments, what I would like to do is keep our subject matter experts over here at the poster boards. If you have any comments or want to come up and ask us questions, please do. And beyond that, I appreciate you coming out on this really rainy night to hear our presentation and listen to the important work that's being done at Maywood. Thank you.

* * *

I, MARY BAUMANN, License Number XI01271, a Certified Shorthand Reporter and Notary Public of the State of New Jersey, certify that the foregoing is a true and accurate transcript of the proceedings at the place and on the date hereinbefore set forth.

I further certify that I am neither attorney nor counsel for, nor related to or employed by, any of the parties to the action in which this deposition was taken, and further that I am not a relative or employee of any attorney or counsel employed in this case, nor am I financially interested in the action.

____

A Notary of the State of New Jersey
Notary No. 3782
My Commission Expires 3/7/14