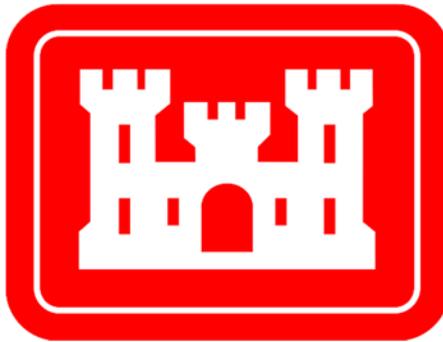


DECISION DOCUMENT

**FOREST PARK
RECREATION CAMP**

CITY OF ST. LOUIS, MISSOURI

FUDS PROJECT NO. B07MO098801



Prepared by:

U.S. Army Corps of Engineers

September 2017

Table of Contents

List of Tables	ii
List of Figures	ii
List of Abbreviations and Acronyms	iii
1 Declaration.....	1-3
1.1 Site Name and Location	1-3
1.2 Statement of Basis and Purpose	1-3
1.3 Assessment of the Site	1-3
1.4 Description of the Selected Remedy	1-3
1.5 Declaration of Statutory Determinations	1-4
1.6 Data Certification Checklist.....	1-4
1.7 Authorizing Signature	1-5
2 Decision Summary.....	2-1
2.1 Site Name, Location, and Brief Description	2-1
2.2 Site History and Enforcement Activities.....	2-1
2.2.1 Site History	2-1
2.2.2 Previous Investigations and Remedies	2-2
2.3 Community Participation.....	2-3
2.4 Scope and Role of Operable Unit or Remedy	2-4
2.5 Site Characteristics.....	2-4
2.5.1 Site Geology.....	2-4
2.5.2 Nature and Extent of Contamination	2-4
2.6 Current and Potential Future Site and Resource Uses.....	2-5
2.7 Summary of Site Risks	2-5
2.7.1 Hazard Identification.....	2-5
2.7.2 Exposure Assessment.....	2-5
2.8 Remedial Action Objectives.....	2-6
2.9 Description of Alternatives	2-6
2.9.1 Description of Remedy Components.....	2-6
2.10 Comparative Analysis of Alternatives	2-7
2.10.1 Overall Protection of Human Health and the Environment.....	2-8
2.10.2 Compliance with ARARs	2-8
2.10.3 Long-Term Effectiveness and Permanence	2-8
2.10.4 Reduction of Toxicity, Mobility, and Volume through Treatment	2-9
2.10.5 Short-term Effectiveness	2-9
2.10.6 Implementability.....	2-9
2.10.7 Cost	2-9
2.10.8 State/Support Agency Acceptance.....	2-10
2.10.9 Community Acceptance.....	2-10
2.11 Selected Remedy	2-10
2.11.1 Summary of the Rationale for the Selected Remedy	2-10
2.11.2 Summary of Estimated Remedy Costs.....	2-11
2.12 Statutory Determinations	2-13
3 Responsiveness Summary	3-1
3.1 Summary of Comments and Responses.....	3-1

3.2 Technical and Legal Issues3-1
4 References.....4-1

List of Tables

Table 2-1 Cost Estimate Summary for the Selected Remedy

List of Figures

Figure 1 Site Location Map
Figure 2 Area of Concern Map

List of Abbreviations and Acronyms

AGC	Advanced Geophysical Classification
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DD	Decision Document
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DMM	Discarded Military Munitions
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
FUDS	Formerly Used Defense Site
IC	Institutional Control
LTM	Long-term Management
LTMP	Long-term Management Plan
MC	Munitions Constituents
MoDNR	Missouri Department of Natural Resources
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MOA	Memorandum of Agreement
MRS	Munition Response Site
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDAI	No Department of Defense Action Indicated
NPL	National Priorities List
O&M	Operation and Maintenance
RAO	Remedial Action Objective
USACE	United States Army Corps of Engineers
UU/UE	unlimited use and unrestricted exposure
UXO	Unexploded Ordnance
WP	White Phosphorus
WWI	World War I

1 Declaration

1.1 Site Name and Location

Forest Park Recreation Camp, Formerly Used Defense Site (FUDS) Property Number B07MO098801, is located within the west central portion of the City of St. Louis, approximately 5 to 6 miles west of the downtown area as shown on **Figure 1**. The Munitions Response Site (MRS) at the FUDS property is the Forest Park Recreation Camp MRS.

1.2 Statement of Basis and Purpose

This Decision Document (DD) presents the Selected Remedy for Forest Park Recreation Camp MRS. In coordination with the Missouri Department of Natural Resources (MoDNR), the United States Army Corps of Engineers (USACE) chose this remedy to address the human health and environmental hazards posed by Munitions and Explosives of Concern (MEC), including unexploded ordnance (UXO) at the site. MEC also includes Discarded Military Munitions (DMM) or Munitions Constituents (MC) that present in high enough concentrations, could pose an explosive hazard. The Selected Remedy was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

1.3 Assessment of the Site

The Selected Remedy for the Forest Park Recreation Camp MRS presented in this DD is necessary to protect the public health or welfare or the environment from potential exposure to MEC in the form of UXO.

1.4 Description of the Selected Remedy

The Selected Remedy for the Forest Park Recreation Camp MRS will address the risk to human health and the environment associated with potential hazards associated with exposure to MEC at the site.

Specific elements of the Selected Remedy include the following:

- Distributing educational awareness materials to the City of St. Louis
- Long-term management actions consisting of annual inspections, educational awareness support consisting of safety briefings by an ordnance safety specialist, and stakeholder interviews in order for USACE to remain actively informed of any changes in information regarding the site
- Statutory five-year reviews of remedy components and determination that the remedy continues to minimize hazards and is protective of human health, safety, and the environment
- Monitoring the status of City Ordinance 68328
- Periodic assessments of munitions detection technology to determine the practicality of implementing MEC removal actions on site

The remedy selected in this DD is the final remedy for the Forest Park Recreation Camp MRS and the final planned remedy for MEC at the site. USACE shall retain ultimate responsibility

for remedy integrity. The remedy includes a land use control strategy that provides multiple layers of protectiveness. In addition, if City Ordinance 68328 is voided or somehow undone in the future, USACE shall work with the property owner (currently the City of St. Louis) to develop a new land use control (LUC) in order to achieve the Remedial Action Objective presented in this DD. The purpose of City Ordinance 68328 is to bind the City of St. Louis to the provisions of a Memorandum of Agreement (MOA) between the City of St. Louis and USACE and to provide notice of buried military munitions at the Forest Park Recreation Camp MRS to all future owners. The MOA defines the relationship, responsibilities, and general objectives under which the City of St. Louis and USACE operate relative to the Forest Park Recreation Camp MRS. Long-term management actions shall be the responsibility of USACE-Kansas City District. Details will be provided in a Long-Term Management Plan that will include information on the removal action and will be consistent with the terms of the MOA contained in City Ordinance 68328.

1.5 Declaration of Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with federal and state requirements that are applicable or relevant and appropriate to the remedial action, and is cost-effective.

The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy because treatment is impracticable due to technical constraints related to the presence of significant amounts of subsurface metallic construction debris associated with the 1904 World's Fair.

If effectively implemented, MEC removal would reduce the potential for exposure. However, implementation of MEC removal using current technologies, including available advanced methods for geophysical classification, would be challenging given the significant frequency and concentration of metallic debris from the 1904 World's Fair that would shield MEC items from detection. A primary benefit of Advanced Geophysical Classification (AGC) is the reduction in the number and extent of excavations required to remediate the MEC. The nature and distribution of the 1904 World's Fair debris would reduce the effectiveness of AGC at the Forest Park Recreation Camp MRS. Acceptable confidence in removal effectiveness would require excavations in areas that may not contain any MEC and would not contribute to reduction in explosive risk. However, continued advancements in geophysical classification and other technologies could result in development of a more effective treatment option in the future.

Because this remedy will result in the potential for MEC to remain on-site, a statutory review will be conducted no less frequently than every five years after initiation of the selected remedy as long as hazardous substances, pollutants, or contaminants remain above levels that allow for unlimited use and unrestricted exposure (UU/UE). The draft Five-Year Review Reports will be provided to MoDNR for review.

1.6 Data Certification Checklist

The following information is included in the Decision Summary section of this DD. Additional information can be found in the Administrative Record file for this site.

- Contaminant of concern (Section 2.5.2).

- Baseline risk represented by the contaminant of concern (Section 2.7).
- Current and reasonably anticipated future land use assumptions (Section 2.6).
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.11.2).
- Key factor(s) that led to selecting the remedy (i.e., describe how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Sections 2.10 & 2.11).

1.7 Authorizing Signature

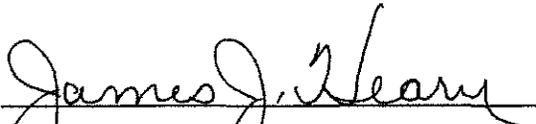
Acceptance of this DD is denoted by signature at the end of this section on the authorizing signature page. The USACE Northwestern Division Commander has re-delegated signature authority for this DD pursuant to Memorandum CENWD-PDM, August 11, 2016, Subject: Re-delegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for the Formerly Used Defense Sites Program.

**FINAL DECISION DOCUMENT
FOREST PARK RECREATION CAMP MUNITIONS RESPONSE SITE (MRS)
CITY OF ST. LOUIS, MISSOURI**

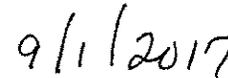
APPROVAL

This Decision Document presents the selected remedy for the FOREST PARK RECREATION CAMP MRS, City of St. Louis, Missouri (B07MO098801). The U.S. Army Corps of Engineers, executing under the Defense Environmental Restoration Program and the Formerly Used Defense Sites program, is the lead agency. The United States Army Corps of Engineers developed this Decision Document consistent with Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This Decision Document, presenting a selected remedy with a total cost-to-complete estimate recorded in the FUDS Management Information System of \$277,936 is approved by the undersigned, pursuant to Memorandum, CENWD-PDM, August 11, 2016, Subject: Re-delegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for the Formerly Used Defense Sites Program.

APPROVED:



James J. Hearn, SES
Director, Regional Business
Northwestern Division



Date

2 Decision Summary

2.1 Site Name, Location, and Brief Description

Site name:	Forest Park Recreation Camp MRS
Location:	City of St. Louis, Missouri
Identification number:	FUDS project no. B07MO09881
Lead agency:	U.S. Army Corps of Engineers, Kansas City District
Federal support agency:	U.S. Environmental Protection Agency Region 7
State support agency:	Missouri Department of Natural Resources (MoDNR)
Source of cleanup monies:	Defense Environmental Restoration Account (DERA), U.S. Department of Defense (DoD)
Site Type	Patriotic public demonstrations and bivouacs
Site description:	<p>The Forest Park Recreation Camp MRS is located within the west central portion of the City of St. Louis, Missouri, approximately 5 – 6 miles west of the downtown area. (Figure 1). The former Forest Park Recreation Camp was established in 1942 as a recreation camp for soldiers. However, as early as 1917, military demonstrations were held at Forest Park, which included Army troops from Jefferson Barracks performing daily mock World War I (WWI) battles using munitions containing white phosphorus (WP). WP is a chemical used in smoke, tracer, illumination, and incendiary (fire-producing) munitions. These activities resulted in the burial of MEC consisting of WWI-era mortar shells in a portion of Forest Park. Since 2004, USACE has been conducting long-term management (LTM) actions to include annual site inspections and stakeholder interviews so USACE remains actively informed of any changes in information regarding the site. USACE also monitors the status of City Ordinance 68328, which is a LUC that binds the City of St. Louis to the provisions found in a MOA and also provides notice of buried military munitions to all future owners at the Forest Park Recreation Camp MRS. The MOA between the USACE and City outlines LTM actions to protect onsite construction workers from exposure to MEC.</p>

2.2 Site History and Enforcement Activities

2.2.1 Site History

2.2.1.1 Military Operations, 1917-1943

Documented military use of Forest Park began with WWI. The only known military use of Forest Park was for patriotic public demonstrations and bivouacs, which are temporary encampments or shelters. Between 1917 and 1918 numerous military demonstrations were

held at Forest Park, which included an Army tank demonstration, a military parade and a demonstration of British aircraft. In 1926, the City of St. Louis held the St. Louis Exposition. As part of the Exposition, Army troops from nearby Jefferson Barracks performed daily mock WWI battles using munitions containing white phosphorus (WP).

In 1942, the Army was granted permission to use 17 acres in the southeastern corner of Forest Park for a recreation camp for soldiers. The camp accommodated approximately 1,500 men and was to operate for the duration of World War II. In 1943, during the recreation camp's operation, a mock battle for the public took place near the Art Hill area of Forest Park with soldiers from Jefferson Barracks. This mock battle included 350 soldiers, amphibious jeeps, a smoke screen and a final assault up Art Hill. By 1947, the camp was abandoned and the southeast corner of the park was restored.

2.2.2 Previous Investigations and Remedies

2.2.2.1 1988 – 2002 Interim Munition Response Activities

In 1988, workers installing a sprinkler system on the third fairway of the lower 9-hole golf course at Forest Park uncovered a live 3-inch Stokes mortar round containing WP. The round was given to an individual who thought it was a type of time capsule. The next week the individual attempted to open the round in his home and caused the phosphorus to ignite. A local fire department responded and was able to contain the phosphorus by burying the round. The Granite City Illinois Support Center, 50th Explosive Ordnance Disposal (EOD) Attachment recovered the round and disposed of it.

As part of the \$100 million of improvements at Forest Park as outlined in the 1995 Master Plan, the Forest Park Golf Course underwent renovations starting in 2001 with full-time construction oversight performed by USACE-St. Louis. Not long after renovations began in September 2001 at the lower nine-hole course (Hawthorne Course), a bulldozer worker uncovered a 4-inch Stokes mortar while moving soil. In 2002 as renovation work continued, two more Stokes mortar rounds were recognized by construction workers and later removed by the St. Louis Metropolitan Police Department.

All three munition items contained WP, according to the police who transported the rounds to a quarry south of the city for detonation.

In June 2002, a construction worker excavated a Livens projector. The Livens projector was a British designed mortar-like munition used in WWI that typically contained chemical agents, but could also contain flammable or explosive fill. The Livens projector was removed by the St. Louis Metropolitan Police Department, who determined it to be empty of WP.

2.2.2.2 2004 Engineering Evaluation/Cost Analysis

As a result of the munitions response activities, an Engineering Evaluation/Cost Analysis (EE/CA) was conducted in 2004 in order to develop alternatives to address buried WWI military munitions at the Area of Concern (AOC) for the Forest Park Recreation Camp MRS (**Figure 2**). Based on the EE/CA's findings, four response action alternatives were developed that included 1) No Department of Defense Action Indicated (NDAI); 2) Institutional Controls (ICs); 3) Comprehensive Surface Clearance with ICs; and 4) Comprehensive Subsurface Clearance with ICs.

An Action Memorandum authorizing implementation of the response action to address buried WWI military munitions at the AOC for the Forest Park Recreation Camp MRS was signed on November 23, 2004 and selected Alternative 2-Institutional Controls.

2.2.2.3 2004 Response Action

Implementation of the response action began in 2004 with the reproduction and distribution of educational awareness pamphlets to the City of St. Louis engineering and construction departments, the St. Louis Parks and Recreation department, the Norman K. Probsteyn golf staff, and the St. Louis Art Museum facility director.

In 2005 and as part of the response action, a MOA between the City of St. Louis and USACE was signed.

As a final component of the response action and in accordance with the terms of the MOA, City Ordinance 68328, which is a LUC that was created by the City of St. Louis and approved by Board of Aldermen in 2009.

The purpose of the ordinance is to bind the City to the provisions of the MOA, which is similar to the purpose of a deed restriction or restrictive covenant. Because a deed to the Forest Park property does not exist, the creation of a city ordinance was agreed to by the City, MoDNR and USACE. City Ordinance 68328 also provides notice of buried military munitions at the AOC for the Forest Park Recreation Camp MRS to all future owners.

2.2.2.4 2005-Present Long-Term Management

Long-term management (LTM) activities, consisting of annual site inspections and stakeholder interviews so that USACE remains actively informed of any changes in information regarding the site, continue today. In addition, USACE distributes educational awareness pamphlets to the City of St. Louis engineering and construction departments, the St. Louis Parks and Recreation department, the Norman K. Probsteyn golf staff, and the St. Louis Art Museum facility director as part of the annual stakeholder interviews, monitors the status of City Ordinance 68328, and coordinates safety briefings prior to excavation activities by City of St. Louis contractors in the AOC for the Forest Park Recreation Camp MRS.

2.3 Community Participation

USACE-Kansas City District has developed a relationship with the communities around Forest Park through various public involvement activities.

The EE/CA was made available for public review from July 13, 2004 to August 13, 2004. A public meeting was also conducted by USACE-Kansas City District at the Dennis and Judith Jones Visitor and Education Center in Forest Park on July 13, 2004.

The Proposed Plan was made available for public review on September 6, 2016. A copy of the Administrative Record file, which contains the Proposed Plan and supporting documentation is located online at:

<http://www.nwk.usace.army.mil/Missions/Environmental/EnvironmentalProjects/FormerForestParkRecreationCamp.aspx>

Additionally, the Administrative Record file can be accessed at the St. Louis Public Library at 1301 Olive Street, St. Louis, Missouri 63103.

The notice of availability of the Proposed Plan and date for the public meeting was published September 5, 2016 in the *St. Louis Post-Dispatch*. The public comment period was September 6, 2016 to October 7, 2016. The public meeting was held on September 13, 2016 at the Dennis and Judith Jones Visitor and Education Center in Forest Park, and the Selected Remedy was presented. Site information was available at the public meeting for public review and representatives from the USACE and MoDNR were present to answer questions from the public.

2.4 Scope and Role of Operable Unit or Remedy

The Selected Remedy presented in this DD will be the final remedy for remediation of MEC at the Forest Park Recreation Camp MRS. This remedy continues LTM actions consisting of annual site inspections and stakeholder interviews so that the USACE remains actively informed of any changes in information regarding the site, distribution of additional educational awareness pamphlets to the City of St. Louis, monitoring of City Ordinance 68328, and conducting safety briefings to City of St. Louis contractors prior to construction activities involving excavation on the AOC for the Forest Park Recreation Camp MRS.

2.5 Site Characteristics

2.5.1 Site Geology

The City of St. Louis lies at the northeast tip of the Ozark Uplift and is bordered on the north and east by areas altered by glaciers. The bedrock underlying the St. Louis area consists essentially of flat-lying sedimentary formations, mostly limestone. Bedrock formations exposed in the St. Louis area represent three separate geologic systems, the Ordovician, Mississippian and Pennsylvanian, each of which was formed at a different interval of time in the earth's history.

Almost all of the bedrock formations in the St. Louis area have been covered by extensive deposits of windblown silt (loess) carried from the flood plains of the Missouri and Mississippi Rivers and deposited on the upland during post-glacial time. Residual clays formed in place on weathered bedrock are found where the loess cover is relatively thin.

The Forest Park Recreation Camp site soils fall into three different soil profiles. These profiles are quite similar, and are intermingled with each other throughout the park. In general, the permeability of the site soils is moderately slow, and the depth to bedrock is 60 inches or greater.

2.5.2 Nature and Extent of Contamination

The potential contamination at the Forest Park Recreation Camp MRS is MEC, including UXO consisting of WWI-era mortars. Historical records, investigations, and interim removal action findings indicate that the potential exists for MEC to remain within the site, although the depth of MEC is unknown. Stokes mortars were unearthed during excavation work and found on the ground surface. The former Forest Park Recreation Camp was located in the southeastern

corner of Forest Park. During the camp's operation, a mock battle for the public took place in the northwestern portion of Forest Park where military munitions were discovered (**Figure 2**).

2.6 Current and Potential Future Site and Resource Uses

Forest Park is currently used as a recreation area for the City of St. Louis. Facilities at the park include the St. Louis Art Museum, the St. Louis Zoo, the Missouri History Museum, the St. Louis Science Center and the Muny outdoor musical amphitheater. It also serves as a sports center for golf (Norman K. Probststein Golf Course), tennis, baseball, bicycling, boating, fishing, handball, ice skating, roller blading, jogging, rugby and more.

Potential future site and resource use is unlikely to change in the near future. In addition, City Ordinance 68328 includes requirements that help reduce or limit activity within the AOC for the Forest Park Recreation Camp MRS.

2.7 Summary of Site Risks

Based on the EE/CA investigation findings, USACE assessed risk to determine current and future effects on human health and the environment from buried MEC resulting from historical use of WWI-era mortars, such as patriotic military demonstrations during WWI and World War II. Because the AOC for the Forest Park Recreation Camp MRS is currently used as a golf course, the pathways for exposure to MEC only potentially exist below the ground surface for construction workers. No release mechanisms for MC, which are chemical compounds originating from UXO or DMM, were identified at the AOC for the Forest Park Recreation Camp MRS, so no MC risk assessment was conducted. In addition, the likelihood of encountering MEC on the ground surface at the Norman K. Probststein Golf Course, where members of the public are most likely to encounter it, is considered extremely low.

Recurring reviews were conducted in 2010 and 2015 which concluded that the response action is protective and is expected to remain protective of human health and the environment. There have not been any additional reports of military munitions at the site since the renovation of the golf course in 2002.

2.7.1 Hazard Identification

For consideration in this DD, the contaminant of concern and the source of the hazard present on site is MEC resulting from numerous military demonstrations. The types of MEC documented on site are WW I-era conventional ordnance consisting of mortars.

2.7.2 Exposure Assessment

The exposure assessment estimates the extent of human contact with the potential contaminant of concern by characterizing potentially exposed receptors, identifying actual or potential routes of exposure, and estimating the extent of human exposure. Undisturbed MEC does not present a significant hazard to humans or the environment. An exposure can only occur if MEC is encountered and disturbed.

Based on the results of the EE/CA, and the implementation of the selected response action found in the 2004 Action Memorandum, the pathways for exposure to MEC at Forest Park only potentially exist for construction workers in the subsurface.

The current and future receptors are:

- Construction workers, who are assumed to be conducting some form of intrusive activities in the soil.

The most likely exposure pathways for construction workers are:

- Direct contact with MEC during construction activities (e.g. trenching related to water sprinkler system replacement or repair, sod removal or other invasive activities).

Other receptors, such as the public who are participating in golfing activities at the Norman K. Probstain Golf Course, are unlikely to be exposed.

2.8 Remedial Action Objectives

Remedial action objectives (RAOs) provide a general description of what the remediation at the Forest Park Site will accomplish. These goals provide a basis for understanding how the risks identified in Section 2.7 will be addressed by the Selected Remedy.

The overall RAO at the AOC for the Forest Park Recreation Camp MRS is to reduce the potential hazards posed to the public and onsite workers by MEC.

2.9 Description of Alternatives

Four remedial alternatives considered for the Forest Park Recreation Camp MRS are presented in this section.

The four alternatives considered are:

- Alternative 1: No Action
- Alternative 2: ICs
- Alternative 3: Comprehensive Surface Clearance with ICs
- Alternative 4: Comprehensive Subsurface Clearance with ICs

2.9.1 Description of Remedy Components

2.9.1.1 Alternative 1: No Action

The No Action alternative is required to be considered in the CERCLA process, and is used to establish a baseline for comparison with the other alternatives. No Action means that USACE-Kansas City District would not provide LTM actions. Annual site inspections and stakeholder interviews would no longer be performed. Monitoring of City Ordinance 68328 would not be performed by USACE and safety briefings by an ordinance safety specialist would also not be performed. Lastly, five year reviews of the site would not be performed.

2.9.1.2 Alternative 2: Institutional Controls (Selected)

Alternative 2, which is a continuation of all ongoing components of the remedy that was implemented in 2004, consists of the following components:

- Distributing educational awareness materials to the City of St. Louis

- Prepare a Long-Term Management Plan consistent with the terms of the MOA between USACE and the City of St. Louis
- LTM actions consisting of annual inspections, educational awareness support consisting of safety briefings by an ordnance safety specialist, and stakeholder interviews in order for USACE to remain actively informed of any changes in information regarding the site
- Statutory five-year reviews of remedy components and determination that the remedy continues to minimize hazards and is protective of human health, safety, and the environment
- Monitoring the Status of City Ordinance 68328, which is a LUC that binds the City of St. Louis to the terms of the MOA and also provides notice of buried military munitions to all future owners
- Periodic assessments of munitions detection technology to determine the practicality of implementing MEC removal actions on site

2.9.1.3 Alternative 3: Comprehensive Surface Clearance with Institutional Controls

Alternative 3 includes a surface clearance of all military munitions located on the ground surface and the continuation of all ongoing remedy components adopted in 2004 as presented in Alternative 2 above. This alternative was developed as part of the EE/CA in 2004. Comprehensive surface clearance is no longer beneficial since military munitions are not known to be located on the ground surface, and therefore, do not present a risk. It has been retained in this DD to be consistent with previous documentation.

2.9.1.4 Alternative 4: Comprehensive Subsurface Clearance with Institutional Controls

Alternative 4 includes subsurface clearance of all detectable military munitions to a specified depth and the continuation of all ongoing remedy components adopted in 2004 as presented in Alternative 2 above.

2.10 Comparative Analysis of Alternatives

The United States Environmental Protection Agency has established nine criteria that balance health, technical, and cost considerations to determine the most appropriate remedial alternative (40 CFR 300.430(e)(9)(iii)). These criteria are used to select a remedial alternative that is protective of human health and the environment, attains Applicable or Relevant and Appropriate Requirements (ARARs), is cost effective, and utilizes permanent solutions and treatment technologies to the maximum extent practicable. The four remedial alternatives described in Section 2.9 have been evaluated and compared using the following nine criteria:

1. Overall Protection of Human Health and the Environment
2. Compliance with ARARs
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance

2.10.1 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether a remedial alternative provides protection of human health and the environment and describes how risks which are posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

This criterion was evaluated in terms of possible future human interaction with MEC. Alternative 1 was not considered protective of human health and the environment. Alternative 1 would not remove any MEC and provides no source reduction. Under Alternative 1, annual inspections and stakeholder interviews would cease, the MOA between the City of St. Louis and USACE would not be maintained, monitoring of the status of City Ordinance 68328 and coordination of safety briefings prior to City construction activities would not occur, and five year reviews would not be conducted. Alternative 3 is no longer beneficial since military munitions are not known to be located on the ground surface. Alternative 4 would remove MEC and was determined to provide overall protection of human health and the environment. Alternative 2, which does not remove any MEC and provides no source reduction, was nevertheless determined to provide overall protection of human health and the environment as it is believed to close the pathway between on-site contamination (MEC) and potential receptors (construction/excavation workers). Furthermore, Alternative 2 would provide overall protection of human health and environment without disruption of golf course operations and Forest Park community activities. The removal of all MEC as part of Alternative 4 would reduce the potential for exposure. However, implementation of MEC removal using current technologies, including available advanced methods for geophysical classification, would be challenging given the significant frequency and concentration of metallic debris from the 1904 World's Fair that would shield MEC items from detection. Acceptable confidence in removal effectiveness would require excavations in areas that may not contain any MEC and would not contribute to reduction in explosive risk.

2.10.2 Compliance with ARARs

Compliance with ARARs addresses whether a remedial alternative will meet all ARARs of federal and state laws and regulations related to addressing hazardous substances at the site.

The criteria, Compliance with ARARs, is not applicable as there are no ARARs pertaining to the evaluated alternatives for this site.

2.10.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence addresses the ability of a remedial alternative to permanently reduce or eliminate the potential for MEC exposure hazard.

Alternative 1 provides no effective and/or permanent response to the MEC. Alternative 3 is no longer beneficial since military munitions are not known to be located on the ground surface, and Alternative 4 reduces the potential for MEC exposure by performing a surface and subsurface clearance. However, Alternative 4 would not fully address the MEC exposure at depth and would likely result in a significant quantity of excavated non-munitions debris despite the availability of AGC to aid in detection and classification of isolated anomalies. The existence of buried 1904 World's Fair debris limits the current potential for an AGC-aided excavation to be an effective approach. Alternative 2 was determined to provide the second

least permanent response to the buried munitions as MEC would potentially remain in place below the ground surface.

2.10.4 Reduction of Toxicity, Mobility, and Volume through Treatment

This criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies which permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. This preference is satisfied when treatment is used to decrease the principal threats at a site by destruction of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

Alternatives 1 and 2 provide no reduction in toxicity, mobility, or volume of contaminants. Since no surface munitions are present, Alternative 3 is no longer beneficial. Alternative 4 provides a reduction of toxicity, mobility, and volume by identifying buried MEC locations for subsequent excavation and off-site disposal.

2.10.5 Short-term Effectiveness

Short-term effectiveness addresses short-term risks and the potential consequences and effects of an alternative during the implementation phase. Short-term risks are potential adverse impacts to workers, the community, and the environment during the construction and implementation phases of the remedial action.

Alternatives 1 and 2 both have no associated short-term risks or adverse impacts to workers, the community, and the environment. Since no surface munitions are present, Alternative 3 is no longer beneficial. Alternative 4 will have some short-term negative impacts to the golf course and park facilities related to equipment use, intrusive activities and/or excavation, and possible interaction with MEC.

2.10.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing a specific remedial action alternative. Implementability includes consideration of whether the alternative is technically possible; the availability of necessary materials, equipment, and specialists; administrative and regulatory requirements; and monitoring requirements.

Alternatives 1 and 2 are both technically and administratively feasible and easy to implement. Alternative 3 is no longer beneficial, since no surface munitions are present. Alternative 4 was considered the least implementable given the challenges in coordination with the golf course operators and the City of St. Louis to perform excavation activities and the reliability of technologies to definitively identify MEC items to be removed given the significant presence of non-munitions debris.

2.10.7 Cost

This criterion evaluated the cost to implement each removal action alternative. The cost estimates developed as part of the 2004 EE/CA were order-of-magnitude level estimates based on a variety of information including productivity estimates, cost estimating guidelines and prior experience.

Alternative 1 requires no action, therefore, no costs would be incurred. Alternative 2 has costs associated with LTM activities. Alternative 3 has costs associated with the surface clearances, but lower costs than a comprehensive or limited subsurface clearance. Alternative 4 was determined to be the most costly alternative.

The original cost of implementing the remedial alternatives back in 2004 ranged from \$0 for Alternative 1 (No Action) to \$2,201,930 for Alternative 4. The current annual estimated cost for Alternative 2 is \$10,000, which is associated with inspections, reproduction of educational awareness pamphlets, and interviews of stakeholders. The current estimated cost to implement Alternative 3 (Surface Clearance) is \$2,033,235 in addition to \$10,000 annually in long-term management costs. The current estimated cost to implement Alternative 4 (Subsurface Clearance) is \$4,011,286 in addition to \$10,000 annually in long-term management costs. During years when five year reviews are conducted, the annual cost is \$20,000. For a 30-year period, the total present value cost for Alternative 2 is \$277,936.

2.10.8 State/Support Agency Acceptance

MoDNR supports the adoption of Alternative 2-ICs for the Forest Park Recreation Camp MRS.

2.10.9 Community Acceptance

As noted in Section 2.3, the Proposed Plan for the Forest Park Recreation Camp MRS was made available for public review and comment on September 6, 2016. A Public Meeting was held on September 13, 2016, and the public comment period was established from September 6, 2016 to October 7, 2016. The community did not submit written comments during the public comment period. In addition, members of the public did not attend the public meeting.

2.11 Selected Remedy

The Selected Remedy is Alternative 2 –ICs. The selected remedy consists of the continuation of inspections and stakeholder interviews. The remedy also includes distribution of educational awareness pamphlets, the monitoring of the status of City Ordinance 68328, and safety briefings by USACE ordnance specialists prior to City construction activities. In addition, USACE will perform periodic assessments of munitions detection technology to determine the practicality of implementing MEC removal actions at the AOC for the Forest Park Recreation Camp MRS. Details and implementation of these LTM activities will be the responsibility of the USACE-Kansas City District and will be provided in a Long-Term Management Plan (LTMP) that will include information on the removal action and will be consistent with the terms of the MOA contained in City Ordinance 68328. The LTMP will be completed by the USACE-Kansas City District within twelve (12) months of this DD's approval and submitted to MoDNR for review. Statutory five-year reviews will also be conducted to ensure that this remedy remains protective of human health and the environment and continues to function as intended.

2.11.1 Summary of the Rationale for the Selected Remedy

The selection of the remedy is accomplished through the evaluation of the nine criteria as specified in the NCP. As a result of this evaluation, adopting the response action measures that are already in place as the final remedy is the most appropriate remedial alternative for protecting the public from exposure to MEC. The continuation of annual site inspections and

stakeholder interviews, in addition to monitoring the status of City Ordinance 68328 and providing ongoing educational awareness support to the City of St. Louis provides the most long-term effectiveness and permanence and will achieve overall protection of human health and the environment at the Forest Park Recreation Camp MRS.

The no action alternative (Alternative 1) would consist of USACE no longer providing LTM actions at the AOC for the Forest Park Recreation Camp MRS. USACE would not provide the City of St. Louis with any ongoing educational awareness of the potential of encountering military munitions at the AOC for the Forest Park Recreation Camp MRS, such as safety briefings. Inspections, stakeholder interviews, and reproduction and distribution of educational awareness pamphlets to the City of St. Louis would not be conducted on an annual basis, and five-year reviews would not be performed. In addition, monitoring the status of City Ordinance 68328 would not be performed. Alternative 3, which is a comprehensive surface clearance with institutional controls, no longer applies, since no surface munitions are present. Previous interim removals of WWI military munitions in 1988, 2001 and 2002 were conducted when the munitions were exposed as the result of either sprinkler system installation activities or extensive excavation and grading operations during the renovation of the Norman K. Probststein Golf Course. Original depths of these munition items is unknown. Alternative 4, which is a comprehensive subsurface clearance with institutional controls, could negatively impact operations at the Norman K. Probststein Golf Course and the rest of the Forest Park community during work efforts.

This Selected Remedy effectively reduces MEC hazards at the Forest Park Recreation Camp MRS without disruptions to golf course operations and the Forest Park community by conducting annual site inspections and stakeholder interviews so USACE remains actively informed of any changes in information regarding the site. In addition, the Selected Remedy includes periodic assessments of munitions detection technology, such as AGC, to determine the practicality of implementing MEC removal actions in the future. The Selected Remedy also minimizes MEC hazards by ensuring the status of City Ordinance 68328 is monitored and safety briefings by USACE ordnance specialists prior to City construction activities continue.

2.11.2 Summary of Estimated Remedy Costs

The selected remedy is cost-effective for the risk reduction achieved. The selected remedy is more cost-effective than Alternative 3, which is no longer beneficial since military munitions are not known to be located on the ground surface. The selected remedy is more cost-effective than Alternative 4 given the magnitude of non-munitions debris that would be excavated along with MEC. The additional cost for Alternative 4 may not fully address the potential for MEC and would still require LTM. Alternative 1, which is the least expensive, would not be protective of human health and the environment because continued inspections and stakeholder interviews and safety briefings prior to City construction activities would cease.

The estimated costs for the Selected Remedy are summarized below in **Table 2-1**, and are an order-of-magnitude estimate that are expected to be within +50 to -30 percent of the actual project cost. The information in this cost estimate summary was based on the best available information regarding the scope of the Selected Remedy. Minor changes in the cost elements may occur as a result of periodic inspection and reviews of the Selected Remedy.

Table 2-1 Cost Estimate Summary for Selected Remedy

Year	Fiscal Year	Remedial Action Costs(\$)	Monitoring/ O&M Costs(\$)	5-Year Review Costs (\$)	Total Costs (\$)	Discount with R at 3.0%	Total Present Value Cost (\$)
0	FY18	\$0	\$10,000	\$0	\$10,000	1.000	\$10,000
1	FY19	\$0	\$10,000	\$0	\$10,000	0.971	\$9,709
2	FY20	\$0	\$10,000	\$0	\$10,000	0.943	\$9,426
3	FY21	\$0	\$10,000	\$0	\$10,000	0.915	\$9,151
4	FY22	\$0	\$10,000	\$20,000	\$30,000	0.888	\$26,655
5	FY23	\$0	\$10,000	\$0	\$10,000	0.863	\$8,626
6	FY24	\$0	\$10,000	\$0	\$10,000	0.837	\$8,375
7	FY25	\$0	\$10,000	\$0	\$10,000	0.813	\$8,131
8	FY26	\$0	\$10,000	\$0	\$10,000	0.789	\$7,894
9	FY27	\$0	\$10,000	\$20,000	\$30,000	0.766	\$22,993
10	FY28	\$0	\$10,000	\$0	\$10,000	0.744	\$7,441
11	FY29	\$0	\$10,000	\$0	\$10,000	0.722	\$7,224
12	FY30	\$0	\$10,000	\$0	\$10,000	0.701	\$7,014
13	FY31	\$0	\$10,000	\$0	\$10,000	0.681	\$6,810
14	FY32	\$0	\$10,000	\$20,000	\$30,000	0.661	\$19,834
15	FY33	\$0	\$10,000	\$0	\$10,000	0.642	\$6,419
16	FY34	\$0	\$10,000	\$0	\$10,000	0.623	\$6,232
17	FY35	\$0	\$10,000	\$0	\$10,000	0.605	\$6,050
18	FY36	\$0	\$10,000	\$0	\$10,000	0.587	\$5,874
19	FY37	\$0	\$10,000	\$20,000	\$30,000	0.570	\$17,109
20	FY38	\$0	\$10,000	\$0	\$10,000	0.554	\$5,537
21	FY39	\$0	\$10,000	\$0	\$10,000	0.538	\$5,375
22	FY40	\$0	\$10,000	\$0	\$10,000	0.522	\$5,219
23	FY41	\$0	\$10,000	\$0	\$10,000	0.507	\$5,067
24	FY42	\$0	\$10,000	\$20,000	\$30,000	0.492	\$14,758
25	FY43	\$0	\$10,000	\$0	\$10,000	0.478	\$4,776
26	FY44	\$0	\$10,000	\$0	\$10,000	0.464	\$4,637
27	FY45	\$0	\$10,000	\$0	\$10,000	0.450	\$4,502
28	FY46	\$0	\$10,000	\$0	\$10,000	0.437	\$4,371
29	FY47	\$0	\$10,000	\$20,000	\$30,000	0.424	\$12,730
Total		\$0	\$300,000	\$120,000	\$420,000		\$277,936

2.12 Statutory Determinations

The Selected Remedy is protective of human health and the environment, and is cost-effective.

The remedy does not satisfy the statutory preference for treatment as a principal element of the remedy. Implementing a treatment remedy would have short-term adverse impacts on golf course and park operations due to intrusive activities and/or excavation.

While MEC removal would reduce the potential for exposure, the removal action being adopted as the final remedy has proven to be protective of public health without disruption of the Forest Park community.

Because this remedy will result in the potential for MEC to remain on-site, a statutory review will be conducted no less frequently than every five years after initiation of the selected remedy as long as hazardous substances, pollutants or contaminants remain on-site above levels that allow for UU/UE. The draft Five-Year Review Reports will be provided to MoDNR for review.

Figure 1. Forest Park Recreation Camp MRS

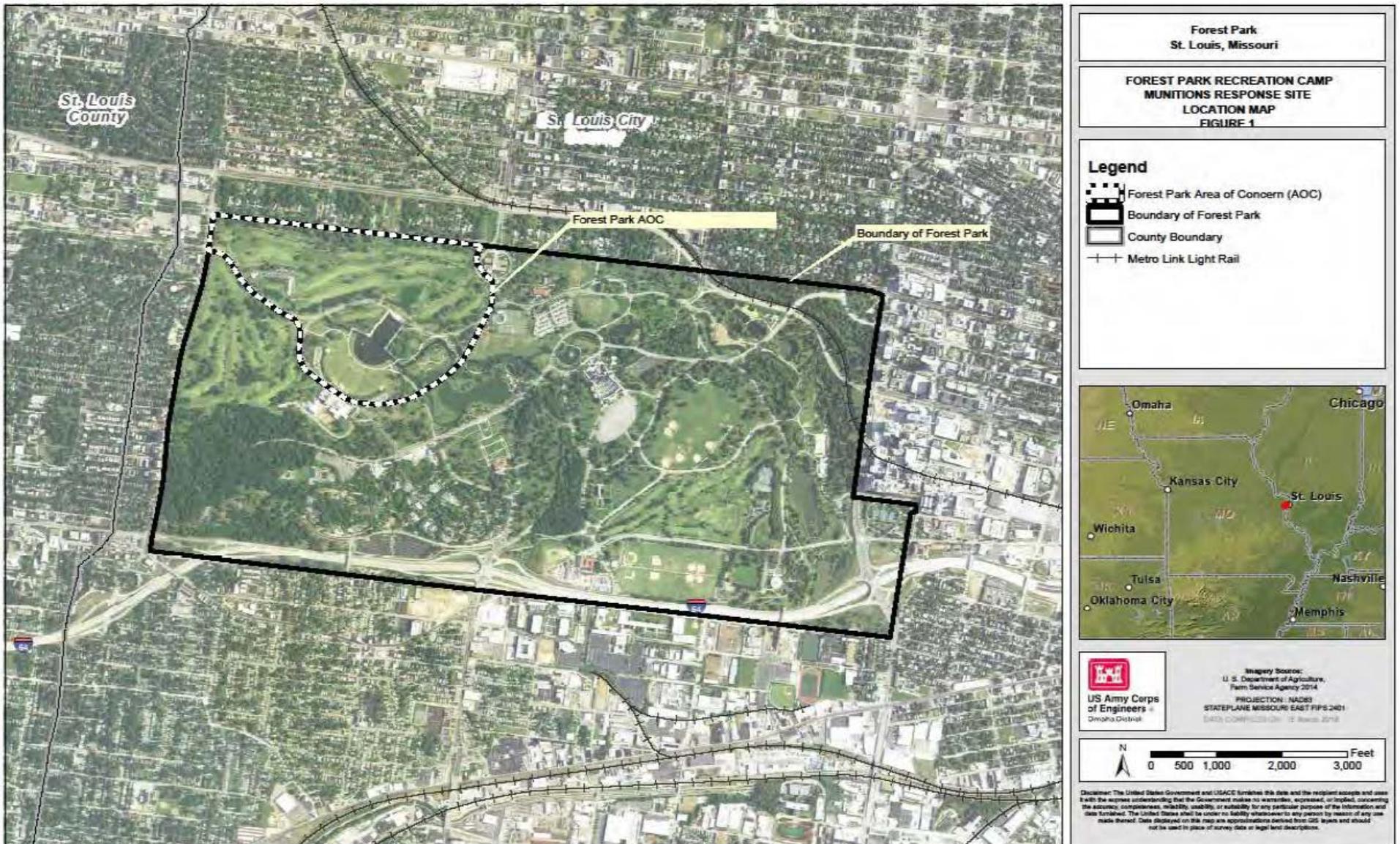
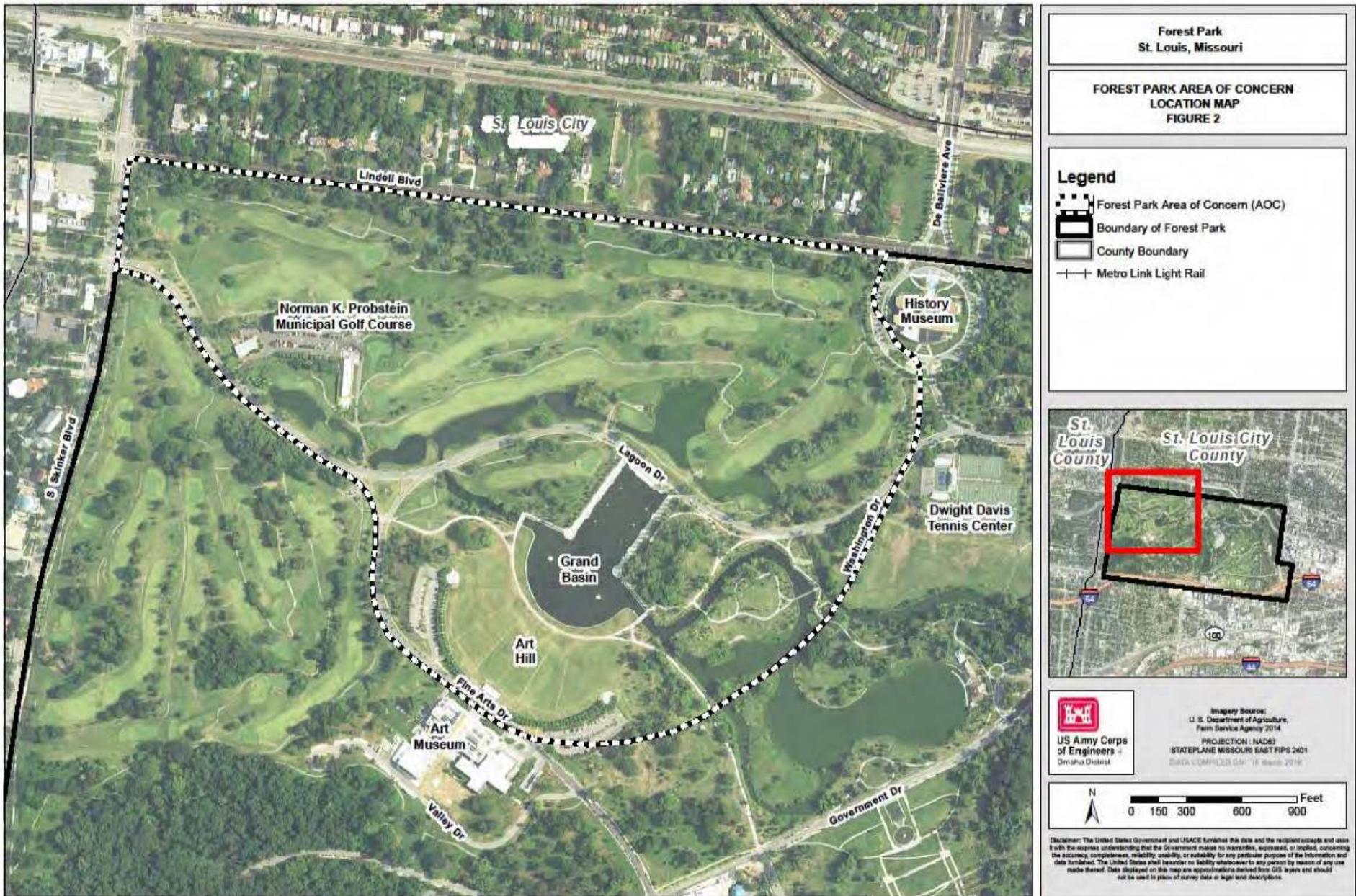


Figure 2. Forest Park Area of Concern



3 Responsiveness Summary

This Responsiveness Summary provides responses from the USACE to comments received during the public comment period for the Proposed Plan. The public comment period was September 6, 2016 to October 7, 2016. The Public Meeting was held on September 13, 2016 at the Dennis and Judith Jones Visitor and Education Center in Forest Park. The notice of availability of the Proposed Plan and date for the public meeting was published on September 5, 2016 in the *St. Louis Post-Dispatch*. In addition, USACE-Kansas City District mailed letters to stakeholders of the Forest Park community notifying them of the availability of the Proposed Plan and encouraging participation in the scheduled public meeting.

3.1 Summary of Comments and Responses

No written comments or questions were received from the public during the public comment period and no one from the public attended the public meeting.

3.2 Technical and Legal Issues

None.

4 References

St. Louis City Ordnance 68328, St. Louis, Missouri, 2009.

U. S. Army Corps of Engineers, 2004, *Munitions and Explosives of Concern, Engineering Evaluation/Cost Analysis Report, Forest Park, St. Louis, Missouri*. September.

U.S. Army Corps of Engineers, 2004a, *Action Memorandum, Former Forest Park Recreation Camp, St. Louis County, Missouri*. November.

U. S. Army Corps of Engineers, 2005, *Memorandum of Agreement (MOA) Between U.S. Army Engineer District, Kansas City and City of St. Louis, Missouri for the Former Forest Park Recreation Camp, St. Louis, Missouri*. March.

U. S. Army Corps of Engineers, 2010, *First Five-Year Review Report for The Former Forest Park Recreation Camp, St. Louis, Missouri Defense Environmental Restoration Program-Formerly Used Defense Site (DERP-FUDS) Site #B07MO098801*. August.

U. S. Army Corps of Engineers, 2015, *Second Five-Year Review Report for The Former Forest Park Recreation Camp, St. Louis, Missouri Defense Environmental Restoration Program-Formerly Used Defense Site (DERP-FUDS) Site #B07MO098801*. September.