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Delivering Environmental, Industrial, and Emergency Solutions

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TRANSMITTAL

DATE:	5/4/2007
TO:	Gordon Girtz, University of Minnesota 1636 Lois Drive Shoreview, Minnesota 55126
FROM:	Brenda Winkler **Phone:** 651-341-3258 Bay West, Inc.
CONTENTS:	**Draft-Final Sampling and Analysis Plan for the Former Gopher Ordnance Works, Rosemount, Minnesota**

MESSAGE:

Dear Mr. Girtz:

As requested by Taunya Howe, United States Army Corps of Engineers, Bay West, Inc. is providing you with the enclosed copy of the Draft-Final Sampling and Analysis Plan for your files.

Please contact me if you have any questions.

Best regards,

Brenda Winkler
651/341-3258
brendaw@baywest.com

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		Electronic mail
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DRAFT-FINAL
SAMPLING AND ANALYSIS PLAN
FOCUSED SITE INSPECTION

For

FORMER GOPHER ORDNANCE WORKS
ROSEMOUNT, MINNESOTA

May 2007

DRAFT-FINAL
SAMPLING AND ANALYSIS PLAN
FOCUSED SITE INSPECTION

For

FORMER GOPHER ORDNANCE WORKS
ROSEMOUNT, MINNESOTA

Prepared for

U.S. Army Corps of Engineers
Omaha District
106 South 15th Street
Omaha, Nebraska 68102-1618

USACE Environmental Remediation Services Contract W9128F-04-D-004
Task Order #0021

Prepared by

BAY WEST, INC.
5 Empire Drive, St. Paul, MN 55103

May 2007

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DRAFT-FINAL
SAMPLING AND ANALYIS PLAN
FOCUSED SITE INSPECTION

FORMER GOPHER ORDNANCE WORKS
ROSEMOUNT, MN

SIGNATURE PAGE

May 2007

Martin Wangensteen, PE, PG, Bay West Program Manager	Date
Brenda L. Winkler, PG, Bay West Project Manager	Date
Marcia Kuehl, Bay West Chemical QC Officer	Date
Michael Schmitt, Quality Control Manager, Severn Trent Laboratories, Denver	Date

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LIST OF ACRONYMS

AOCs .... Areas of Concern
ARAR .... Applicable or Relevant and Appropriate Requirements
AUF .... Area Use Factor
BAF .... Bioaccumulation Factor
Baker .... Michael Baker Jr. Inc
Bay West .... Bay West, Inc.
BCF .... Bioconcentration Factor
bgs .... below ground surface
Bldg .... Building
BOD .... Biological Oxygen Demand
CA .... Corrective Action
CENWO .... Corps of Engineers Northwestern Division Omaha District
CERCLA .... Comprehensive Environmental Response, Compensation, and Liability Act
CFR .... Code of Federal Regulations
CIH .... Certified Industrial Hygenist
CLP .... Contract Laboratory Procedures
COPC .... Contaminants of Potential Concern
CPR .... Cardiopulmonary Resuscitation
CQC .... Contractor Quality Control
CQCO .... Chemical Quality Control Officer
CQCS .... Contractor Quality Control Supervisor
CSF .... Cancer Slope Factors
CSM .... Conceptual Site Model
CUR .... Condition Upon Receipt
CWI .... County Well Index
DCEM .... Dakota County Environmental Management
DCQCR .... Daily Chemical Quality Control Reports
DERP .... Defense Environmental Restoration Program
DNT .... Dinitrotoluene
DOD .... Department of Defense
DOT .... Department of Transportation
DPA .... Diphenylamine
DQO .... Data Quality Objective
DRO .... Diesel Range Organics
ECB .... Environmental Chemistry Branch
ECSM .... Ecological Conceptual Site Model
EDD .... Electronic Data Deliverable
EM .... Engineering Manual
EPA .... US Environmental Protection Agency
EPC .... Exposure Point Concetration
ERA .... Ecological Risk Assessment
ERS .... Environmental Remediation Services
FGOW .... Former Gopher Ordnance Works
FID .... Flame Ionization Detector
FQCC .... Field Quality Control Coordinator
FSP .... Field Sampling Plan
ft .... feet
FUDS .... Formerly Used Defense Site
FWO .... Field Work Order
GCI .... Gas Combustible Indicator
GC/MS .... Gas Chromatograph/Mass Spectrometer
GOCO .... Government Owned and Contractor Operated
gpd .... gallons per day
GRO .... Gasoline Range Organics
GSA .... General Services Administration
HAZWOPER .... Hazardous Waste Operations and Emergency Response
HBV .... Health-Based Value
HHRA .... Human Health Risk Assessment
HLA .... Lifetime Health Advisory
HQ .... Hazard Quotient
HRL .... Health Risk Limit
IDW .... Investigation Derived Waste
ILCR .... Incremental Lifetime Cancer Risk
K_d .... Adsorption Coefficient
K_{oc} .... Organic Carbon Partition Coefficient
K_{ow} .... Octanol-Water Partition Coefficient

LCS/LCSD...... Laboratory Control Sample/Laboratory Control Sample Duplicate
LIMS.............. Laboratory Information Management Systems
LOAEL.......... Lowest Observed Adverse Effect Level
LQM................ Laboratory Quality Manual
MATC............. Maximum Acceptable Toxicant Concentration
MCL................ Maximum Contaminant Level
MDH............... Minnesota Department of Health
MDL................ Method Detection Limits
MPCA............. Minnesota Pollution Control Agency
MQO............... Measurement Quality Objective
MSL................. Mean Sea Level
MS/MSD......... Matrix Spike/Matrix Spike Duplicate
NAWQC.......... National Ambient Water Quality Criteria
NELAC........... National Environmental Laboratory Accreditation Conference
NIST................ National Institute of Standards and Technology
NOAEL........... No Observed Adverse Effect Level
NTS................. Northeast Technical Services
OSHA.............. Occupational Safety and Health Administration
PA.................... Preliminary Assessment
PAHs............... Polynuclear Aromatic Hydrocarbons
PCB................. Polychlorinated Biphenyl
PE.................... Performance Evaluation
PERC............... Perchloroethylene
PID.................. Photoioinization Detector
PMP................. Project Management Plan
POL................. Petroleum, Oil, and Lubricants
PPE.................. Personnal Protection Equipment
PQL................. Practical Quantitation Limit
PRG................. Preliminary Remediation Goals
QA................... Quality Assurance
QAPP............... Quality Assurance Project Plan
QA/QC............ Quality Assurance/Quality Control
QC................... Quality Control
QCD................ Quitclam Deed
QCR................ Quality Control Report
QSM................ Quality Systems Manual
RAGs............... Risk Assessment Guidance
RBSE............... Risk Based Site Evaluation
RCRA.............. Resource Conservation and Recovery Act
RF.................... Response Factor
RfD.................. Reference Dose
RLs.................. Reporting Limits
RPD................. Relative Percent Difference
SAP................. Sampling and Analysis Plan
SARM............. Standard Analytical Reference Materials
SEA................. Site Evaluation Accomplished
SEDD.............. Staged Electronic Data Deliverable
SHM................ Safety and Health Manager
SI..................... Site Inspection
Site.................. Former Gopher Ordnance Works
SLV................. Soil Leaching Value
SOP................. Standard Operating Proceedures
SOS................. Scope of Services
SQT................. Sediment Quality Target
SRV................. Soil Reference Value
SSHO.............. Site Safety and Health Officer
SSHP............... Site Safety and Health Plan
STL................. Severn Trent Laboratories
SVOC.............. Semi-Volatile Organic Compound
TAT................. Turnaround Time
TBD................. To Be Determined
TCE................. Trichloroethylene
UCL................. Upper Confidence Limit
USACE........... US Army Corps of Engineers
USACE PM...... US Army Corps of Engineers Project Manager
UMN............... University of Minnesota
VOA................ Volatile Organic Analysis
VOC................ Volatile Organic Compounds
WD.................. War Department

SAMPLING AND ANALYSIS PLAN

A. INTRODUCTION

Bay West Inc. (Bay West) has prepared this Sampling and Analysis Plan (SAP) which consists of two parts: Part I is the Field Sampling Plan (FSP); and Part II is the Quality Assurance Project Plan (QAPP). Bay West prepared this SAP under its United States Army Corps of Engineers (USACE)-Omaha District Environmental Remediation Services (ERS) Contract W9128F-04-D-0004, Task Order #0021. A Site Safety and Health Plan (SSHP) has also been prepared and submitted under separate cover.

The SAP provides guidance for all field and laboratory work by defining in detail the sampling and field data-gathering methods and laboratory methods to be used in performance of a Focused Site Inspection (SI) of six Areas of Concern (AOC 1 through 6) within the 1947 Quitclaim Deed (QCD) Property and AOC 7, the Steam Plant Area and Associated 26.7 Acres within the 1948 QCD Property at the Former Gopher Ordnance Works (FGOW) site (Site) located in Rosemount, Minnesota.

AOC 1 through AOC 6 were identified in the USACE *Preliminary Assessment Report Final 1947 Quitclaim Property* (PA Report), dated March 2006 (USACE, 2006a), for the FGOW and described in the USACE March 29, 2006 Scope of Services (SOS). On December 28, 2006, the USACE modified Bay West's Task Order to include AOC 7, namely the Steam Plant Area and Associated 26.7 Acres. AOC 7 is described in the USACE December 2006 Revised SOS. As stated in the PA Report, the FGOW was divided into four segments. Segment A contained the manufacturing operations. Figure 1 is a Site location map that presents an outline of the boundaries of Segment A and the approximate locations of the AOCs included in this Focused SI. Figure 2 is an overlay of the AOC locations on an aerial photograph.

The goals of this Focused SI are to obtain and analyze environmental samples, to investigate potential human and environmental exposure to hazardous substances attributed to past DOD activities, and to perform a risk screen for human and ecological risk.

FGOW was a Government Owned Contractor Operated (GOCO) facility on property formerly owned by the Department of Defense (DOD) and falls under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). This Focused SI will be conducted under the authority of the DERP. Compliant with the DERP statute, all actions undertaken shall comply with all applicable Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

This SAP has been developed in accordance with the following documents:

- Bay West Inc. (Bay West). *Site Inspection Proposal, Former Gopher Ordnance Works and accompanying USACE July 2006 Scope of Services*, August 23, 2006 (2006a).
- Bay West Inc. (Bay West). *Revision No. 1 - Site Inspection Proposal, Steam Plant and Associated 26.7 Acres, Former Gopher Ordnance Works and accompanying USACE December 2006 Revised Scope of Services*, December 19, 2006 (2006b).
- Minnesota Pollution Control Agency (MPCA). *Site Response Section Risk Based Site Evaluation (RBSE) Guidance*, 1998.

- U.S. Army Corps of Engineers (USACE). *Requirements for the Preparation of Sampling and Analysis Plans,* EM 200-1-3, February 2001.

- U.S. Environmental Protection Agency (USEPA). *Interim Final Guidance for Performing Site Inspections under CERCLA* (EPA/540-R-92-021), September 1992.

- U.S. Environmental Protection Agency (EPA). *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001, February 2006.

Additional references cited in the SAP are listed in the References section at the end of the document.

B. KEY PERSONNEL AND RESPONSIBILITIES

Table 1 provides a listing of key personnel involved in Site activities and their primary responsibilities. Resumes of key personnel identified in Table 1 can be found in the Bay West October 2006 Final Project Management Plan for the FGOW Site.

Bay West has subcontracted with: EVS Inc. (EVS) to perform the land survey of AOC 7; Northeast Technical Services (NTS) to perform the direct-probe drilling and test trench activities; Severn Trent Laboratories (STL)-Denver to perform the laboratory analysis of environmental samples; and Michael Baker Jr. Inc. (Baker) to perform the screening-level risk assessment.

Table 1. Key Personnel

Position	Name	Company	Phone/email
Program Manager	Martin Wangensteen, PE, PG	Bay West	651-291-3475 martyw@baywest.com
Project Manager	Brenda Winkler, PG	Bay West	651-341-3258 brendaw@baywest.com
Certified Industrial Hygienist (CIH)	Doug Hickey, CIH	Bay West	763-479-3214 dough@baywest.com
Safety and Health Manager (SHM)	Dan Hannan	Bay West	651-291-3417 danh@baywest.com
Site Supervisor/ Superintendent/Site Safety and Health Officer (SSHO)/Field Quality Control Coordinator (FQCC)	Dennis Littfin, PG	Bay West	651-291-3437 dennisl@baywest.com
Chemical Quality Control Officer (CQCO)	Marcia Kuehl	Bay West	920-4699113 makuehl@aol.com
Ecological Risk Lead	John Malinowski	Baker	jmalinowski@mbakercorp.com
Human Health Risk Lead	Karren Wood	Baker	ktwood@mbakercorp.com
Laboratory Project Chemist	Lyn Benkers (1)	STL	303-736-0110 lbenkers@stl-inc.om
Laboratory Quality Control (QC) Manager	Michael Schmitt (1)	STL	303-736-0117 mschmitt@stl-inc.com

Notes: (1) Resumes available upon request.

Program Manager: The Program Manager is responsible for overall management of the ERS Program. The Program Manager serves as the liaison between the Task Order Management team and the Bay West executive team.

Project Manager: The Project Manager has overall responsibility for completion of the project in accordance with contract and regulatory requirements. The Project Manager is responsible for planning and oversight of the project activities and acts as an interface between the field staff and corporate office. The Project Manager has ultimate responsibility for the implementation of the project tasks and the safety/health of project workers. The Project Manager is responsible for development of work plans, field activities, sample analysis and data validation, and Focused SI phases of the Task Order. The Project Manager is responsible for the preparation of submittals, coordination of schedules, cost tracking, and serves as the primary contact.

Certified Industrial Hygienist: The CIH is responsible for the oversight in development and coordination of the SSHP. The CIH is also responsible for: modifications to the SSHP if warranted by changing conditions; determining the level of Personal Protective Equipment (PPE) required; investigation of significant accidents and illnesses and implementation of Corrective Action (CA) plans; establishment of air-monitoring parameters based on expected contaminants; establishment of employee exposure monitoring notifications programs; development of site-specific project emergency response plans based on expected hazards; stopping any operation that threatens the health or safety of the team or surrounding population; upgrading or downgrading levels of protection based on site observations or monitoring results; and serves as a member of the Bay West quality control staff.

Safety and Health Manager: The SHM is responsible for the development, implementation, oversight, and enforcement of the SSHP and overall management of the health and safety program for this project. The SHM provides assistance to Site Supervisor/Superintendent/SSHO as necessary. The SHM is also responsible for: recommending changes to the SSHP if warranted by changing conditions; coordinating modifications to the SSHP with the Site Supervisor/Superintendent/SSHO and the USACE; general safety and health program administration; determining the level of PPE required; confirming each Bay West team member's suitability for work based on physician's recommendation; conducting field safety and health audits to ensure safety and heath plan conformance and Bay West policy compliance; certifying that all workers have proper training as per 29 CFR 1910.120(e); updating equipment or procedures based on information obtained during site operations; investigating significant accidents and illnesses and implementation of CA plans; providing information on accidents to the USACE; establishing air monitoring parameters based on expected contaminants; establishing employee exposure monitoring notification programs; stopping any operation that threatens the health or safety of the team or surrounding population; upgrading or downgrading levels of protection based on site observations or monitoring results; and serving as a member of the Bay West quality control staff.

Site Supervisor/Superintendent/Site Safety Health Officer/Field Quality Control Coordinator: The Site Supervisor/Superintendent is responsible for the completion of site operations in accordance with the approved plans and field work orders. The Site Supervisor/Superintendent has full authorization to stop work and demand CA based on the non-compliance with the level of quality required by the plans.

The SSHO is responsible for the implementation of the SSHP and documenting field quality control. The SSHO has the authority to ensure compliance with the specified safety and health requirements, Federal, State, and Occupational Safety and Health Administration (OSHA) regulations and all aspects of the SSHP including activity hazard analyses, air monitoring, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, spill containment program and preparation of records by performing a daily safety and health inspection, and documenting the results of said inspection on the daily log. The SSHO has full authorization to stop work and demand CA for non-compliance with the level of quality required by the contract plans.

The FQCC will oversee the implementation of QA/QC procedures on a daily basis and will coordinate with the CQCO.

Chemical Quality Control Officer: The CQCO is responsible for overseeing the performance of off-site analyses and Quality Assurance/Quality Control (QA/QC) in accordance with the QAPP. These responsibilities include work plan preparation, data validation and final project reports. The CQCO is responsible for verifying proper sample containers, shipment methods, complete Chain-of-Custody paper work, and laboratory reports including the analytical sample results.

Ecological Risk Lead: The Ecological Risk Lead has overall responsibility for completion of the ecological screening evaluations for the Focused SI, in accordance with contract and regulatory requirements.

Human Health Risk Lead: The Human Health Risk Lead has overall responsibility for completion of the human health risk screening evaluations for the Focused SI in accordance with contract and regulatory requirements.

Laboratory Project Chemist: The Project Chemist is responsible for overseeing the performance of the off site analysis and QA/QC in accordance with the SAP. Duties also include verifying proper sample containers, shipment methods, complete Chain-of-Custody paper work, and laboratory reports including the analytical sample results.

Laboratory QC Manager: The Laboratory QC Manager is responsible for establishing, implementing, maintaining, and documenting a quality system to meet the requirements of State and Federal regulatory programs which deal with the analysis of environmental samples. The Laboratory QC Manager is responsible for the communication of project-specific Quality Assurance (QA) requirements into the laboratory and for the verification that sample analyses were performed in accordance with the SAP.

C. PROJECT SCHEDULE

In accordance with the December 28, 2006 Task Order Modification, the period of performance for the Focused SI work is through April 30, 2009. On January 23, 2007, a revised schedule was submitted to the USACE showing the proposed timeline for completion of all activities under this Task Order. Table 2 presents a summary of the revised schedule.

Table 2. Proposed Schedule (1)

Activity	Proposed Start Date	Proposed Finish Date
Submit Field Work Order (FWO) for Land Survey of Steam Plant	February 5, 2007 (actual)	
Submit Draft SSHP	February 9, 2007 (actual)	
USACE Comment on Draft SSHP	February 21, 2007 (actual)	
Submit Final SSHP	March 3, 2007 (actual)	
Submit Draft Work Plans to USACE (4)	March 13, 2007 (actual)	
USACE Comment on Draft Work Plans	April 9, 2007 (actual)	
Survey of Steam Plant (2) (3)	May 21, 2007	May 25, 2007
Prepare & Submit Draft-Final Work Plans to USACE and MPCA	April 9, 2007	May 9, 2007
USACE/MPCA Review Draft-Final Work Plans	May 9, 2007	July 9, 2007
Prepare & Submit Final Work Plan	July 9, 2007	July 24, 2007
USACE Approval of Final Work Plan	July 24, 2007	July 31, 2007
Field Work, Lab Analysis, and Data Validation	August 6, 2007	December 7, 2007
Prepare and Submit Draft Focused SI Report	December 7, 2007	March 24, 2008
USACE Review of Draft Focused SI Report	March 24, 2008	April 23, 2008
Prepare & Submit Draft-Final Focused SI Report to USACE and MPCA	April 23, 2008	May 23, 2008
USACE/MPCA Review Draft-Final Focused SI Report	May 23, 2008	July 23, 2008
Prepare & Submit Final Focused SI Report	July 23, 2008	August 21, 2008
USACE Approval of Final Focused SI Report	August 21, 2008	September 1, 2008

Notes:
(1) In accordance with the revised SOS the Task Order completion date is April 30, 2009.
(2) Bay West assumes that regulatory review will not be required for the land survey FWO for the steam plant.
(3) This date is approximate/weather dependent. If snow is present, the Land Survey will be delayed until after snowmelt.
(4) The Work Plans include the SAP consisting of the Field Sampling Plan and the QAPP.

D. PROPERTY OWNERS/CONTACT INFORMATION

Prior to mobilizing to the Site, Bay West will coordinate the calling of Gopher State One Call [(800) 252-1166] and current property owners (Table 3) to ensure all utilities are located and property access agreements are obtained prior to Site survey, drilling and excavation activities.

Table 3. Current Site Property Owners

AOC	Name	Contact/Phone	Address
AOC 1	Regents of the University of Minnesota (UMN)	On-site contacts: Gordon Girtz: 651-784-1424 Gene Im: 651-402-1183 Real Estate Office: Kathy Boudreau: 651-423-1118	Site Office: 15325 Babcock Avenue, Rosemount, MN 55068
AOC 1 (north of 170th)	Private Resident	John Hoffman:	606 W 6th Street Hastings, MN 55033
AOC 2	Regents of the UMN	See above	See above
AOC 3	Regents of the UMN	See above	See above
AOC 4	Private Resident	Mark and Susan Theorin:	1106 170th Street West, Farmington, MN 55024
AOC 5	Regents of the UMN	See above	See above
AOC 6	Regents of the UMN	See above	See above
AOC 7	Regents of the UMN	See above	See above

As noted above, the primary property owner is the Regents of the UMN. The Regents of the UMN holds the title to approximately 8,000 of the 12,000 acres (USACE, 2006).

PART I. FIELD SAMPLING PLAN

1.0 INTRODUCTION

This FSP is Part I of a two-part SAP. This FSP provides guidance for all field activities (e.g., sample types, sample locations, etc.) and specifies the procedures for sampling and other field operations to be used in the performance of a Focused SI of seven AOCs at the FGOW Site located in Rosemount, Minnesota. Part II is a QAPP and shall be used in conjunction with this FSP.

2.0 PROJECT MANAGMENT

The key personnel and their project responsibilities are identified in Section B, page x.

2.1 Special Training Requirements/Certifications

In accordance with the SSHP, all Site workers who perform activities which may result in exposure to hazardous contaminants will have received training in accordance with 29 Code of Federal Regulations (CFR) 1910.120 (Hazardous Waste Operations and Emergency Response [HAZWOPER]). All Site personnel must receive training and acknowledge understanding of the contents of the SSHP prior to performing work at the Site. This training will include a review of the project tasks and responsibilities, hazards expected to be encountered, and means of hazard control. This training will be documented as described in the SSHP.

Additional training required of Site workers, as applicable, includes:

- Excavation and Trench Safety.
- Water Safety.
- Fall Protection.
- Hearing Conservation and Protection.
- First Aid and Cardiopulmonary Resuscitation (CPR): Per Engineering Manual (EM) 385-1-1, there is no medical facility or physician accessible within 5 minutes of the Site, therefore at least two persons currently certified in first aid and CPR shall be onsite at all times during Site operations and trained in universal precautions and PPE as described in 29 CFR 1910.1030.
- Excavation Competent Person: At least one project worker shall be trained or qualified as an excavation 'competent' person to inspect and verify compliance of all excavation activities in accordance with OSHA and USACE regulations.
- Excavation Equipment: Operators of excavation equipment shall be trained and qualified to operate the specific equipment to be used.

In accordance with the USACE SOS, a qualified geologist/geotechnical engineer will be on site during all drilling and sampling activities. The drilling contractor will be licensed by the Minnesota Department of Health (MDH).

3.0 PROJECT DESCRIPTION AND BACKGROUND

The following site description and background information was obtained from the PA Report (USACE, 2006a) and the USACE *History of Site & Sampling, Former Gopher Ordnance Works, MN, Steam Plant and Associated 26.7 Acres*, November 2006 (USACE 2006b).

3.1 Site Description and History

FGOW was a GOCO facility. The facility was constructed and operated by the E.I. DuPont de Nemours under Contract W-ORD-642, between 1942 and August 1945, for the production of oleum, smokeless cannon and rifle powder. FGOW was divided into four segments (Appendix 1).

Following World War II, FGOW's Segment A was further informally subdivided into roughly four parts (Appendix 1) with the northwest and southeast parts transferred from the Federal Government to the Regents of the UMN by a QCD dated October 9, 1947; the industrial area in the northeast part transferred from the Federal Government to the Regents of the UMN by a QCD dated March 19, 1948, and the southwest part returned to private ownership throughout 1947.

After gathering historical information, five AOCs were identified within the part of the FGOW facility boundary that was transferred to the Regents of the UMN in the 1947 QCD and one AOC outside the 1947 Quitclaim property for detailed site reconnaissance. A small part of AOC 1 and all of AOC 4 are located on property that is privately owned. AOCs were identified by evaluating operational activities at buildings and on undeveloped land within the site boundary. Any FGOW activities conducted that could pose a potential environmental concern were included as an AOC. On December 19, 2006, USACE revised the SOS and added AOC 7, the Steam Plant and Associated 26.7 Acres which were transferred to the Regents of the UMN by QCD in 1948. Historical descriptions of the seven AOCs are included in Section 3.3 of this FSP.

3.2 General Geology and Hydrogeology

The geology and hydrogeology discussions were obtained from the PA Report (USACE, 2006a) and augmented with the *Geological Atlas C-6, Dakota County, MN*, UMN, 1990 (UMN, 1990) along with well logs within Segment A obtained from the Minnesota County Well Index (CWI) at http://www.health.state.mn.us/divs/eh/cwi/.

3.2.1 Geology

According to the PA Report, the FGOW is located on the southeastern portion of the Twin Cities Basin within the Central Lowland Physiographic Province in northeastern Dakota County, Minnesota, on the south edge of the Minneapolis-St. Paul metropolitan area.

FGOW sits on the Rosemount outwash plain, southeast of the St. Croix moraine. As such, the soils can be expected to be very permeable, mostly sands and gravels. The Soil Survey of Dakota County indicates that the Waukegan-Wadena-Hawick soil group underlies most of FGOW. The Waukegan-Wadena-Hawick is described as level to very steep, well drained and excessively drained soils formed in silty and loamy sediments over sandy outwash: on outwash plains and terraces. Recent alluvium has been deposited along the Mississippi in the upper reach of Spring Lake and along the Vermillion River and its tributaries which received runoff from a disposal ditch at FGOW.

The USGS 7.5 Minute Topographic Map (Figure 1) indicates that ground surface elevation in Segment A is approximately 890 ft above MSL in the southeast to 950 ft above MSL in the northwest. According to the Geologic Atlas, the elevation of the top of bedrock in the northwest corner of the Segment A is approximately 800 ft above MSL and the top of bedrock elevation is between 850 and 900 ft above MSL in the southeast corner of Segment A. A buried bedrock valley is present in the northern half of the Segment A trending northeast between AOC 5 and AOC 6 with an approximate elevation of 750 ft above MSL at its deepest part.

Selected well and boring records within Segment A obtained from the CWI were also reviewed to determine the depth to bedrock. The unconsolidated deposits within Segment A range from: 3 to 25 ft bgs near AOC 1; 111 ft bgs near AOC 2; 47 to 50 ft bgs near AOC 4; 161 to 195 ft bgs near AOC 5; 91 ft bgs between AOC6 and AOC 7; and 71 to 99 ft bgs near AOC 7. The St. Peter Sandstone (0 to 160 feet [ft] thick) appears to underlie most of the southern half of FGOW (AOC 1, AOC 2, AOC 3-DA2, AOC 4). The underlying Prairie Du Chien (dolomite, up to 308 ft thick) appears to be the first bedrock unit to be encountered in most of the northern half of FGOW (AOC 5, AOC 6 and AOC 7).

3.2.2 Hydrology

According to the PA Report, the overburden consists principally of glacial outwash deposits on the main FGOW facility, with some alluvium along the peripheral portions that include major river valleys. At FGOW, the overburden is generally not considered a developable aquifer, except along the Vermillion River and by Spring Lake. There may be some potential for limited water development (domestic, agricultural or livestock wells) in the outwash deposits along the northern portion of the main FGOW facility, and to the west toward Rosemount. At the main FGOW facility, ground water elevation in the overburden is from about elevation 890 ft above MSL at the southwest corner to about 840 ft above MSL on the northeast corner. The typical depth to water measurements are between 50 and 100 ft bgs in the FGOW area.

The bedrock aquifers are the principal source for ground water in the immediate area of FGOW. Of those, the principal shallow bedrock aquifer is the Prairie Du Chien-Jordan Formation. The elevation of the potentiometric surface in the Prairie Du Chien-Jordan aquifer is about 890 ft above MSL in the southwest corner of the main facility to about 830 ft above MSL in the northeast corner, with the levels declining to the northeast.

According to the quaternary hydrology map in the Geologic Atlas, the water table aquifer in the unconsolidated deposits is approximately 900 ft above MSL in the western portion of Segment A to 825 ft above MSL in the northeast, near AOC 7. Ground water contours indicate that ground water flow in the unconsolidated deposits trends east – northeast, towards Spring Lake/Mississippi River. The map also identifies areas where the unconsolidated aquifer may be confined or yield little water. The potentiometric contours in the Du Chien-Jordan bedrock show that ground water is approximately 880 ft above MSL in the southwest to 840 ft above MSL in the northeast within Segment A. Ground water contours indicate that ground water flow in the bedrock aquifer trends to the northeast, towards Spring Lake/Mississippi River.

Well and boring records from the CWI did not contain information on wells completed in the unconsolidated deposits. Well and boring records did indicate static ground water levels in the bedrock wells as follows: 8.8 to 35 ft bgs near AOC 1; 101 ft near AOC 2; 52 ft bgs in AOC 4; 75 ft in AOC 5; 70 ft bgs between AOC 6 and AOC 7; 80 and 85 ft bgs near AOC 7.

3.3 Areas of Concern and Potential Hazardous Substances

Seven AOCs will be evaluated in this Focused SI. Limited analytical data are available relative to these AOCs to indicate the presence or absence of contamination. A brief historical summary for each of the seven AOCs, along with the potential hazardous substances and pathways are provided below. The location of each AOC is shown on Figure 2. AOC 1 through 7 are shown in greater detail on Figures 3 through 9, respectively.

Bay West conducted Site visits on October 10, 2006 and February 21, 2007. Selected photographs from each Bay West Site visit and from the PA Report are included in Appendix 3.

3.3.1 AOC 1, Waste Disposal Ditch, Primary and Secondary Settling Ponds

This AOC begins at 160th Street with the Waste Disposal Ditch and continues south to the outfall of the Secondary Settling Pond. The areas surrounding the waste disposal ditch and the settling ponds are now used for agricultural purposes. A segment just south of 160th Street is located on private property and another segment (from 170th Street north to the segment on private property) is on the Regents of the UMN property and is not included in this AOC or Focused SI work.

According to the PA Report, a portion of AOC 1, just south of 170th is the location of the former Coates Dump (a landfill that may have been used by the public). Appendix G of the PA Report contains copies of figures from a Preliminary Groundwater Report at 170th, dated August 26, 2005. The figures show a perched ground water table at approximately 40 ft bgs with ground water flowing to the east-northeast. The figures also identify a perchloroethylene (PERC), and trichloroethylene (TCE) contaminant plume.

According to the PA Report, the ditch itself only contains water seasonally during rain events. The ditch is man-made, with sides up to 20 ft in height in the area south of 170th Street. The ditch enters the primary settling basin at its northeast corner.

During operation of FGOW, underground Laminex Woodbox sewers were designed to collect 100,000,000-gallons-per-day (gpd) of process water. The process water came from the acid/oleum production areas as well as the nitrocellulose production facilities where large amounts of fresh water were used to break down cotton fibers, neutralize acid and remove impurities from the nitrated cotton. This process water was released into the Waste Disposal Ditch along the east boundary of the FGOW. The Laminex Woodbox sewers, located on property transferred to the Regents of the UMN in 1948, are not part of this AOC or Focused SI work. Two acid neutralization systems were installed at FGOW: the first was located to treat the process water from the acid manufacturing area; and the second was located at the outfall of the secondary settling basin.

The sanitary sewers were designed to collect 300,000 gpd of wastewater from laundries and personal hygiene facilities as well as shop maintenance operations and also carried sewage to the wastewater treatment facility located in the northeast part of FGOW. After chlorination and dilution to meet the state's Biological Oxygen Demand (BOD) standard the treated wastewater was released into the Waste Disposal Ditch.

According to the PA Report, DuPont production operations in the northeast (industrial) part of FGOW's Segment A may have contributed the following potential hazardous substances to the Waste Disposal Ditch:

- Nitrocellulose from production operations.
- Dinitrotoluene (DNT) from the production of rifle powder.
- Diphenylamine (DPA) that was added as a stabilizer to nitrocellulose (between 0.9 and 1.1% in the finished product).
- Industrial solvents and degreasers used to remove grease and oil during the cleaning of parts in locomotive and railcar repair, vehicle maintenance and in the production machinery shops.
- Petroleum, Oil, and Lubricants (POLs) from fuel storage areas as well as vehicle maintenance operations.
- Mercury from leaking trickling filter bearings at the wastewater treatment facility.
- Mercury (impurity) from the coal burned at the steam plant producing both smoke and ash waste streams.
- Polynuclear Aromatic Hydrocarbons (PAHs) from the coal stored at the steam plant yard.
- Heavy metals (such as chromates and lead) from processes in the sandblasting and paint shops.
- Metals (such as brass, copper, zinc, aluminum, lead, tin and nickel) from metal forming operations in the machinery maintenance shops.
- DNT or nitrocellulose from the clothing worn by FGOW workers released during laundering.
- Oleum as well as sulfuric and nitric acids from the nitrating process.

Media of potential concern include: surface and subsurface soil, ground water, sediment, and surface water. The UMN, Dakota County Environmental Management (DCEM) and the MPCA collected soil samples in the settling basins in 2003 (Peer, 2003). Mercury, chromium, 2,4-DNT, 2,6-DNT and o-nitrotoluene were detected. DCEM collected ground water samples in 1992. Metals, PERC, and TCE were detected.

During the Bay West Site visits surface water was only observed in AOC 1 below the former dam/weir structure at the southern end of the secondary settling pond (Photograph 1, Appendix 3). However, Bay West did not walk the entire AOC. The low areas of AOC 1 may be wet making access difficult. Photographs 2 through 5 (Appendix 3) show additional features of AOC 1.

3.3.2 AOC 2, Shipping/Storage Buildings

This AOC is bounded by 170th Street, Station Trail Road (which follows the perimeter road around the critical fence line of the FGOW facilities), and Blaine Avenue. This AOC was privately farmed prior to acquisition by the War Department (WD). Shortly following the closure of FGOW AOC 2 was returned to agriculture.

Ninety-six shipping houses, each approximately 54 ft by 64 ft in size, were laid out in rows and used during operations at FGOW. Forty-eight of the buildings were built to hold 500,000 pounds of powder and the other forty-eight buildings were built to hold 250,000 pounds of powder. During production operations at FGOW, zinc containers holding between 100 and 140 pounds of finished cannon powder were stored in these buildings to await shipment. Historical schematic drawings show that the buildings were constructed on piers over a gravel bed and that the floors of the buildings were made from creosote-treated lumber. There are no known reports of spills or leaks of product at these locations but according to TM 9-2900, Military Explosives, leaky powder cans were to be expected. In addition, an inspection report dated April 23, 1947, indicates that small quantities of smokeless powder were observed in and around these buildings, particularly in the floor joints. The buildings are no longer present but the former building locations are still visible in the 2003 aerial photographs.

According to the PA Report, DuPont production operations at FGOW may have contributed the following potential hazardous substances at the Shipping and Storage Buildings:

- Nitrocellulose (final product).
- DNT (used during the production of rifle powder).
- DPA (added as a stabilizer to nitrocellulose).

Media of potential concern include surface and subsurface soil, and ground water. No sampling has been conducted in this AOC.

During the October 2006 Site visit, Bay West photographed areas of AOC 2 (see Photographs 6 and 7, Appendix 3). The possible location of a former shipping building is visible in Photograph 7.

3.3.3 AOC 3, Miscellaneous Drainage Areas

Several drainage areas or depressions that apparently held drainage/runoff water from various storage and shipment building areas were identified in the PA Report. The following two drainage areas will be evaluated in the Focused SI:

1) AOC 3-DA1 south and adjacent to AOC 5.
2) AOC 3-DA2 south of 170th Street, between the AOC 2 and AOC 4.

No structures were placed in these drainage areas as part of FGOW operations. The drainage areas were part of privately owned farms prior to acquisition by the WD. The areas are now surrounded mainly by agricultural land belonging either to private owners or the Regents of the UMN. Vegetation observed during the PA site reconnaissance was noted to be healthy in both areas with no signs of distress.

According to the PA Report, shipping cases dropped either inside or outside the shipping/storage houses may have contributed the following potential hazardous substances at the Miscellaneous Drainage Areas:

- Nitrocellulose.
- DNT (used during the production of rifle powder).
- DPA (added as a stabilizer to nitrocellulose).

Media of potential concern include surface and subsurface soil, ground water, and possibly seasonal accumulations of surface water and associated sediment. No sampling has been conducted in these areas.

Photograph 8 (Appendix 3) shows the AOC 3-DA1, south of AOC 5. Bay West did not observe surface water in either of the two drainage areas during the Site visits.

3.3.4 AOC 4, Sanitary Buildings

This AOC is in the southwest part of FGOW (between 170th Street and Patrol Road). Documentation of activities at this AOC was not found during the PA. A 1945 aerial photograph and building key (Appendix 1) identify the following buildings:

- 107-T Time Office.
- 108-T Sanitary Building.
- 109-T Sanitary House.
- 110-T Boiler House.
- 200-T Toilets (sixty-five small rectangular structures).

This AOC was privately farmed prior to acquisition by the WD. A short time following the closure of FGOW the site was returned to private ownership. No records were found to identify when the buildings were demolished. Site reconnaissance conducted for the PA noted that some of the site is now used as agriculture land while the remainder supports trees and shrubs.

According to the PA Report, DuPont operations may have generated either PAHs from coal or POLs from the boiler house, no documentation was found to show the type of fuel (coal or heating oil) the boiler house used to generate heat.

Media of potential concern include surface and subsurface soil, and ground water. No sampling has been conducted in this area.

Access to AOC 4 was not obtained prior to Bay West's Site visit. However, as shown in Photograph 9 (Appendix 3) taken from 170th Street, the previous AOC 4 structures do not appear to be present. A private residence and a building with the sign "Interstate Batteries" are currently located to the east of AOC 4.

3.3.5 AOC 5, Dinitrotoluene Storage Bunkers

AOC 5 is located in the western part of FGOW, east of Station Trail Road and south of 160th Street. The bunkers were intended to store DNT. According to the PA Report, FGOW production records do not indicate that DNT was ever stored in the bunkers and there are no FGOW operations records that record spills or leaks of DNT at the site. In April 1944, the land where these bunkers stand was leased to Raymond Laboratories, Inc. of St. Paul, MN for the purpose of storing explosives. No records were found to indicate how long these bunkers were used or what type of explosives may have been stored in the bunkers. A letter from the Office of Real Property Disposal to the UMN dated September 13, 1946, indicates that the buildings were used to store DNT and DPA. An inspection report dated April 23, 1947, indicates that a small quantity of smokeless powder was observed in the floor drain of one of these buildings, while small quantities of DNT were observed in the floor drain of two of the buildings.

This area was privately farmed prior to acquisition by the WD. Seven of the eight original bunkers are still present and appear to be in use by the UMN for storage of a variety of materials including chemicals (such as fertilizers, paints, and petroleum products), machinery, scrap wood, and metal. Five of the bunkers have been rehabilitated by UMN, with new metal roofs and siding. All that remains of the other two bunkers are the concrete floors and sides; these bunkers contain the scrap wood and metal.

According to the PA Report, DuPont production operations at FGOW or Raymond Laboratories, Inc. storage operations may have contributed the following hazardous substances at the DNT Storage Bunkers:

- Nitrocellulose.
- DNT (used during the production of rifle powder).
- DPA (added as a stabilizer to nitrocellulose).

Media of potential concern include surface and subsurface soil, and ground water. No sampling has been conducted in this area.

During the Site visit Bay West took several photographs of AOC 5. A few of these photos are included in Appendix 3 (Photographs 10 through 12). Photographs 10 and 12 are of the storage bunkers, while Photograph 11 shows a drainage area that continues on into AOC3-DA1 (Photograph 8). Bay West also entered storage bunker 607. The concrete walls and floor appear to be in good condition with minimal cracking. Some oil was noted on the floor, possibly from machinery stored/recent activities conducted within the building. The interior of the building had a strong mothball odor.

3.3.6 AOC 6, 154th Street Disturbed Area

Three disturbed areas were identified in the PA Report. The disturbed areas are visible in 1945 aerial photographs. These areas were privately farmed prior to acquisition by the WD. All of the areas are now overgrown with weeds, brush, and trees, and are surrounded by agriculture fields.

The two smaller areas, located south of 154th Street, appear to be borrow areas. The PA Report concluded that these two smaller areas require no further investigation. Therefore, they are not included in this AOC.

The area between 154th and 155th Street is a football-field-size depression containing large amounts of surface and buried construction debris. Debris including rebar, concrete, and asphalt were visible on the ground surface. Although no records were found to indicate the date the debris was deposited, the site may have been in use during demolition and dismantlement activities during and immediately following the operation of FGOW. It is also possible that some debris may have been placed at the site more recently. There was no sign of distressed vegetation at the site.

According to the PA Report, DuPont operations at FGOW may have contributed the following potential hazardous substances at the 154th Street Disturbed Area:

- PAHs (asphalt and creosote).
- Metals (iron rebar and scrap metal).

Media of potential concern include surface and subsurface soil, and ground water. No sampling has been conducted in this area.

Photograph 13 (Appendix 3) shows the 154th Street Disturbed Area..

3.3.7 AOC 7, Steam Plant and Associated 26.7 Acres

AOC 7 is located in the northeast corner of FGOW, east of 70th Street. In addition to the Steam Plant Building 401A, other FGOW-facility support structures were also located on the 26.7-acres. Construction of the FGOW facility began in 1942. Records indicate that the Steam Plant became operational in mid-

1943. Production operations finally began in January 1945, but production only occurred on lines A, B, and C with final operations ending in September 1945. Lines D, E, and F were never completed or made operational. Dismantlement and decontamination of FGOW facilities was conducted in 1945 and 1946.

The 26.7-acre site surrounding the Steam Plant was conveyed from the Federal government to the Regents of the UMN in a QCD dated March 17, 1948, along with other industrial properties to the west and south of this 26.7-acre parcel. As allowed in that QCD, the title to the property reverted from the Regents of the UMN to the National Industrial Reserve Division of the General Services Administration (GSA) on June 27, 1951 and then returned to the UMN from the Federal Government on March 9, 1961.

Since that time, no records were found to describe the use of the property by the UMN. The legal boundaries of the 26.7 acre property are included in Appendix 1 along with some historical maps and aerial photographs of AOC 7.

There are many buildings and features within AOC 7. For the purposes of this Focused SI, AOC 7 will be subdivided into four sections to facilitate the investigation activities and to more accurately represent operations and potential exposure areas (Figure 9). However, the physical boundaries have not been accurately drawn on available maps. Therefore, the first phase of the Focused SI is to complete a Land Survey of AOC 7. A draft list of buildings and features believed to be within AOC 7 is provided in the following subsections. Historical information from the *History of Site & Sampling* (USACE 2006b) and historical maps provided by the DCEM, were used to identify potential hazardous substances and potential sampling locations. Selected historical maps are included in Appendix 1. The building and feature list and AOC 7 sub-areas may be updated, if warranted, after completion of the Land Survey. Photographs 14 through 23 (Appendix 3) show selected features in AOC 7.

3.3.7.1 AOC 7A-Northwest Quadrant

AOC 7A is located in the northwest quadrant of AOC 7 and is detailed on Figure 9A. The main historical features and/or buildings in this area are:

- 402-A Water Reservoir including:
    - 412-A Water Pump (attached to the south side of Bldg 402-A).
    - Transformer Pads, south of Bldg 412-A.
    - Water Inlet House (attached to the north side of Bldg 402-A)
- 53-TC47 Boiler House.

Operations at FGOW may have contributed the following potential hazardous substances at AOC 7A:

- PCBs (transformers and electrical equipment).
- Industrial solvents and degreasers (maintenance and repair of machinery).
- POLs (maintenance and repair of machinery).
- Heavy metals (maintenance and repair of machinery).

Media of potential concern in AOC 7A include surface and subsurface soil, and ground water. Sampling has not been conducted in this area.

Photograph 14 (Appendix 3) shows concrete pads on the south side of the Pump House which may have been the location of transformers. Photograph 15 (Appendix 3) shows the Water Inlet House.

3.3.7.2 AOC 7B-Northeast Quadrant

AOC 7B is located in the northeast quadrant of AOC 7 and is detailed on Figure 9B. The main historical features and/or buildings in this area are:

- 406-A Salt Dissolving Pit.
- 151-TC3 Field Office.
- 52-TC4 Storage.
- Dry Chemical Storehouse.
- Drainage ditch running alone rail the line passing by the Dry Chemical Storehouse.

Operations at FGOW may have contributed the following potential hazardous substances at AOC 7B:

- Industrial solvents and degreasers (drainage ditch, maintenance and repair of machinery).
- POLs (drainage ditch, maintenance and repair of machinery).
- Heavy metals (drainage ditch, maintenance and repair of machinery).

Media of potential concern in AOC 7B include surface and subsurface soil, and ground water. Sampling has not been conducted in this area.

Photograph 16 (Appendix 3) shows AOC 7B to be well graded. No historical features are currently visible in this area. According to discussions with UMN representatives during the February 21, 2007 Site visit, the 49th Operating Engineers Union extensively reworked subsurface soils in AOC 7B as part of their training. The topsoil was removed and stockpiled on the south side of AOC 7C and AOC 7D. Excavations may have extended down as far as 30 feet bgs. All of the underground utilities, including culverts used to transport wastewater, were reportedly removed. The culverts are currently being stored in AOC 7D, south of Building 401-A.

3.3.7.3 AOC 7C-Southeast Quadrant

AOC 7C is located in the southeast quadrant of AOC 7 and is detailed on Figure 9C. The main historical features and/or buildings in this area are:

- Coal Storage.
- Crusher House Conveyor Houses/Towers.
- 55-T Field Office.
- 54-TC25 Toilet.
- Drainage Ditch. As shown on the Figures in Appendix 1, the surface water drainage ditch network provided storm water drainage for approximately 150 acres of the east-central portion of Segment A including surface water runoff from the nitrocellulose processing area. This network runs through AOC7C and AOC7D.

In addition to the historical features, stockpiled topsoil reportedly removed from AOC 7B is also present in the southwest corner of AOC 7C and the south side of AOC 7D.

Operations at FGOW may have contributed the following potential hazardous substances at AOC 7C:

- Nitrocellulose (drainage ditch).
- DNT (drainage ditch).
- DPA (drainage ditch).
- Industrial solvents and degreasers (drainage ditch, maintenance and repair of machinery).
- POLs (drainage ditch, maintenance and repair of machinery).

- Mercury (drainage ditch, coal storage).
- Heavy metals (drainage ditch, maintenance and repair of machinery, coal storage).
- Oleum as well as sulfuric and nitric acids (drainage ditch).
- SVOCs (including PAH) (maintenance and repair of machinery, coal storage).

Media of potential concern in AOC 7C include surface and subsurface soil, and ground water. If surface water is found to be present, surface water and sediment will also be considered a media of concern. Sampling has not been conducted in this area.

Photograph 17 (Appendix 3) shows the location of the former Coal Storage Area. According to discussions with UMN representatives during the February 21, 2007 Site visit, the 49th Operating Engineers Union may have extensively reworked the subsurface soils in this area. Photograph 18 shows a culvert located in the northeast corner of AOC 7C. Surface water may be present in this low-lying area.

3.3.7.4 AOC 7D-Southwest Quadrant

AOC 7D is located in the southwest quadrant of AOC 7 and is detailed on Figure 9D. The main historical features and/or buildings in this area are:

- 401-A Steam Plant A (also referred to as Power House).
  - 401-AA Flash Mixer.
  - 401-AA1 Precipitators.
- Drainage Ditch. See AOC 7C for discussion.
- 405-A Electrical Substation (Transformer pads).
- Fuel Oil Tanks.
- 410-A Ash Disposal Pit and Sump.
- Secondary Containment Reservoir.
- Soft Water Tank (Water Tower).

In addition to the historical features, stockpiled topsoil reportedly removed from AOC 7B is also present in the southwest corner of AOC 7C and the south side of AOC 7D.

Operations at FGOW may have contributed the following hazardous substances at AOC 7D:

- Nitrocellulose (drainage ditch).
- DNT (drainage ditch).
- DPA (drainage ditch).
- Industrial solvents and degreasers (drainage ditch, maintenance and repair of machinery).
- POLs (fuel storage, drainage ditch, maintenance and repair of machinery).
- Mercury (coal storage and burning, drainage ditch).
- SVOCs (including PAHs) (coal storage, drainage ditch, maintenance and repair of machinery).
- Heavy metals (coal storage, drainage ditch, maintenance and repair of machinery).
- Oleum as well as sulfuric and nitric acids (drainage ditch).
- PCBs (transformers).

Media of potential concern in AOC 7D include surface and subsurface soil, and ground water. If surface water is found to be present, surface water and sediment will also be considered a media of concern. According to the SOS, limited sampling has been conducted in AOC7D. *The History of Site & Sampling,* (USACE, 2006) summarized historical sampling conducted in this area. Analysis of soil samples collected from the stockpiled soil indicated the presence of metals. However, the metal concentrations were below regulatory levels. Analysis of soil samples collected near the former transformers indicated the presence of PCBs. However, the PCB concentrations were below regulatory levels. Analysis of soil samples collected within the underground water holding tank located to the west of building 401A identified the presence of metals, naphthalene, SVOCs, PCBs, asbestos and DRO above regulatory levels.

Photographs 19 through 23 (Appendix 3) show selected features in AOC 7D. Photograph 19 is of the stockpiled soil on the south side of the AOC 7D. Photograph 20 shows the former location of Building 401-A and the culverts from AOC 7B. Photograph 21 shows the former Fuel Oil Tank location east of Building 401-A. Photograph 22 shows the former Ash Disposal Pit. Photograph 23 shows concrete pads that may have been the location of transformers.

4.0 DATA QUALITY OBJECTIVES AND QUALITY ASSURANCE/QUALITY CONTROL

The first step in the Focused SI is to identify the overall objectives in order to tailor a plan that meets the specific needs of this Site through the Data Quality Objectives (DQOs) process. The emphasis will be on collecting adequate data, while keeping in mind cost-effectiveness, and rapid progress. Field QA/QC and laboratory QA/QC are also addressed in this section. The DQOs were developed in accordance with EPA's *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4; EPA/240/B-06/001, dated February 2006.

4.1 Data Quality Objectives

DQOs are qualitative and quantitative statements that clarify the study objectives, define the most appropriate type of data to collect, determine the appropriate conditions from which to collect the data, and specify tolerable limits on decision errors, which will be used as the basis for establishing the quantity and quality of the data needed to support the decision. The seven steps to the DQO process and how they relate to this Site are outlined below.

4.1.1 Step 1. State the Problem

Concise Description of the Problem: Historical activities conducted at the FGOW may have released hazardous substances that could pose a potential risk to human health and the environment. A complete description of each AOC and associated potential hazardous substances is summarized in Section 3.3 of this FSP.

Primary Decision Maker and Members of the Planning Team: The primary decision maker will be the USACE Project Manager, Taunya Howe. The members of the Planning Team include Bay West's Program Manager, Project Manager, Site Supervisor, QCO, and Laboratory Officers. See Section 2.0 of the SAP for additional information and descriptions of roles and responsibilities.

Conceptual Site Model (CSM): A CSM is based on the Site history and an initial Site reconnaissance. The CSM provides sufficient detail to direct the sampling efforts to ensure receptor populations, exposure pathways, and routes are evaluated. Table 4, obtained from the MPCA RBSE Guidance, was used to identify and summarize the potential receptors and pathways based on the current and surrounding land use at the Site. For the purposes of this evaluation, Bay West assumed that future land use will remain similar to current land use. The CSM, including potential exposure pathways and receptors, will be further evaluated during development of the screening-level risk assessments (see Section 12.0).

Table 4. Potential Pathways and Receptors

Source/Pathway (Exposure Route)	Human Receptors	Ecological Receptors
Soil Exposure (Inhalation, dermal/direct contact, ingestion, root uptake)	X	X
Soil Leaching to Ground Water (Ingestion)	X	
Ground Water (Ingestion)	X	
Sediment (Dermal/direct contact, Ingestion)	X	X
Surface Water (Dermal/direct contact, Ingestion)	X	X
Terrestrial and Aquatic Food Chain (Ingestion)	X	X

In summary, potential human exposures associated with this Site include: ingestion, dermal contact, and inhalation exposures to contaminants in soil by recreational users, casual trespassers in secured areas, and workers on the property (agricultural/commercial/industrial short-term worker exposure scenarios); ground water ingestion exposures; terrestrial food chain exposures due to surface soil contamination (plant uptake); and, dermal contact and ingestion exposures to contaminants in surface water and sediment that have migrated to surface water with ground water and/or surface water run-off. Potential human exposure routes are further discussed in Section 12.1.

Potential ecological exposures associated with this Site include: dermal/direct contact exposures to contaminants in soil (root uptake by plants); dermal/direct contact exposures to contaminants in surface water and sediment (root uptake by rooted aquatic plants); ingestion of contaminants in surface soil, surface water, and sediment; terrestrial food web exposures to contaminants in soil; and aquatic food web exposures to contaminants in surface water and sediment that have bioaccumulated in prey items. Potential ecological exposure routes are further discussed in Section 12.2.1.4.

Available Resources and Relevant Deadlines: Bay West will work under the PMP approved by the USACE. Deadlines are specified in the PMP and summarized in Section C, page xiii of this SAP.

4.1.2 Step 2. Identify the Goal of the Study

Principal Study Question: Has a release and migration of hazardous substances to the ground water, surface water, soil and/or sediment occurred as a result of activities performed in the seven AOCs? If a release has occurred, does it pose a potential risk to human health and the environment?

Alternative outcomes or actions that can occur upon answering the question(s): Alternative outcomes or actions are summarized in Table 5.

Table 5. Principal Study Question and Alternative Actions

Principal Study Question	Alternative Action
Has a release and migration of hazardous substances to the ground water, surface water, soil and/or sediment occurred as a result of activities performed in the seven AOC?	No Further Action.
	Evaluate nature and extent of the release.
If a release has occurred does it pose a potential risk to human health and the environment?	No Further Action.
	Evaluate nature and extent of the release and risks to human health and the environment.

Decision Statement(s): Determine whether an AOC can be removed from further consideration or whether additional studies are necessary to determine the nature and extent of contamination and risks to human health and the environment.

4.1.3 Step 3. Identify Information Inputs

Types and Sources of Information Needed to Resolve Decisions: To resolve the decision statement(s), soil, ground water, sediment, and surface water samples will be collected and analyzed for Contaminants of Potential Concern (COPCs).

Information Needed to Establish the Action Level: In accordance with the MPCA RBSE Manual, COPC analytical results will be compared to the background levels and regulatory screening criteria, if available. Preliminary regulatory screening criteria to be used are specified in the MPCA RBSE Guidance, which includes the following:

- Soil Criteria:
  - Tier 1 (Residential/Unrestricted Land Use) Soil Reference Values (SRVs).
  - USEPA Region 9 Preliminary Remediation Goals (PRGs).

- Soil-to-Ground Water Screening Criteria:
  - Tier 1 Soil Leaching Values (SLVs).

- Ground Water Criteria:
  - Health Risk Limits (HRL).
  - If no HRLs established, use Maximum Contaminant Levels (MCLs), Health-Based Values (HBVs), or Lifetime Health Advisory (HLA) limits as specified in the MPCA Drinking Water Criteria tables.
  - USEPA Region 9 PRGs.

- Surface Water Criteria:
  - Tier 1 Surface Water Screening Criteria based on Minnesota Rules Chapter 7050.

- Sediment Criteria:
  - Sediment Quality Targets (SQTs), Table 14, provided by the MPCA on February 22, 2007, available at: http://www.pca.state.mn.us/water/sediments/sqt-tables.pdf.

Appendix 4, Tables A4-1a through A4-1d, summarize the target parameters, methods, Reporting Limits (RLs), and regulatory screening criteria. Preliminary screening criteria will be further developed and refined during the Risk Assessment process.

Sampling and Analytical Methods for Generating the Information: Sampling methods are described in Section 5.0 of the FSP. Analytical measurements proposed for the Focused SI work are generally able to detect the COPCs at or below regulatory screening criteria, with a few exceptions for analytes with very low regulatory limits, as discussed in Section 3.3 of Part II, QAPP of this SAP. Appendix 4, Table A4-1a through A4-1d, summarize the target parameters, methods, RLs, and regulatory screening criteria.

4.1.4 Step 4. Define the Boundaries of the Study

Define the Target Population of Interest and its Relevant Spatial Boundaries: The populations of interest that will be the focus of the investigation are soil, ground water, surface water, and sediments. Surface soil samples will be collected from 0 to 6 inches bgs. Subsurface soil samples will be collected at depths no greater than 10 ft bgs. If one subsurface sample is targeted for collection from a boring, the samples will be collected from 2 to 4 ft bgs. If more than one subsurface soil sample is collected from a boring, the samples will be collected from 2 to 4 ft bgs and 8 to 10 ft bgs. If visible contamination is present, a sample from that interval will be selected in place of the intervals specified above. Surface soil samples and the shallow (2 to 4 ft bgs) subsurface soil samples will be used in the ecological and human health screening risk evaluations.

Sediment samples will be collected from 0 to 4 inches bgs. Organic matter (leaves, sticks, etc.) will be removed from sediment samples prior to placing in the sample jars. Surface water samples will be collected right below the water surface; and efforts will be made to minimize sediment suspension/collection during sample collection. Ground water samples will be collected from direct-push borings.

A general overview of the boundaries of each AOC is shown in Figures 1 and 2. Figures 3 through 9, present the detailed boundaries of each AOC.

<u>Specify Temporal Boundaries and Other Practical Constraints Associated with Sample/Data Collection:</u> Sampling is scheduled to begin in July 2007 and sample collection should be competed within an eight week time period. Sample collection could be delayed due to weather and may be difficult in low lying areas if a wet season is observed.

<u>Specify the Smallest Unit on Which Decisions Will Be Made:</u> Since this is a Focused SI, decisions will be made based on the analytical results of each sample and by directly comparing those results to the regulatory screening criteria.

4.1.5 Step 5. Develop the Analytical Approach

<u>Specify Appropriate Population Parameters and Action Levels for Making Decisions:</u> Analytical results will be directly compared to the regulatory screening criteria. The regulatory screening criteria include, but may not be limited to, Federal and State-promulgated standards and criteria and are specified in Appendix 4, Tables A4-1a through A4-1d.

<u>Develop a Decision Rule ("if..then.. statement):</u>

- If contaminants are detected in the soil in exceedance of the regulatory screening criteria then a release of a hazardous substance has occurred.
- If contaminants are detected in the ground water in exceedance of the screening criteria then a release of a hazardous substance has occurred.
- If contaminants are detected in the sediment in exceedance of the regulatory screening criteria then a release of a hazardous substance has occurred.
- If contaminants are detected in the surface water in exceedance of the regulatory screening criteria then a release of a hazardous substance has occurred.

If analytical results show that a release has occurred in exceedance of the regulatory screening criteria, additional actions may be necessary.

4.1.6 Step 6. Specify Tolerable Limits on Decision Errors

The goal of this process is to provide data sufficient to determine, with reasonable confidence, whether a release of the COPCs has occurred. The sampling design was developed in accordance with historical information and guidance specified in Section A, page ix of this SAP, along with other Minnesota and Federal rules, statues, and guidance and is considered adequate and appropriate to address the problem definition.

4.1.7 Step 7. Optimize the Design for Obtaining Data

The outputs from the previous six steps are consistent with the Site needs. The most resource-effective data collection and analysis design for generating data that are expected to satisfy the DQOs are contained in the subsequent sections of this FSP and the QAPP (Part II).

4.2 Summary of Environmental Sampling and Quality Assurance/Quality Control

4.2.1 Summary of Sample Types by Media, Quantities, and Field QA/QC

Table 6 presents an overview of the proposed sample types by media, laboratory analytical parameters, estimated number of samples, and field QA/QC samples by AOC. Field Duplicate samples will be collected at a rate of approximately 1 in 10 samples or 10%. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a rate of approximately 1 in 20 samples or 20%. Trip Blanks will be collected at a rate of one per cooler for aqueous VOC analysis only. The number of QA/QC samples is based on the total number samples collected at the FGOW Site, not by AOC. Therefore, Field Duplicate and/or MS/MSD columns may show no QA/QC sample for a specific AOC.

Table 6. Summary of Sample Types by Media and Sample Quantities and Field QA/QC Sample Collection for Each AOC

Laboratory Analytical Parameter to be Performed in each AOC (1) (2)	Media (2)	Estimated Number of Samples	QA/QC Samples		
			Blind Field Duplicate	MS/MSD	Trip Blank(3)
AOC 1, Waste Ditch and Settling Ponds					
VOCs, SVOCs, RCRA Metals, DNT, and nitrocellulose	Soil/Sediment	26 (12 Surface) (12 Subsurface) (2 Sediment)	3	3/3	(3)
	Water	8 (6 Ground Water) (2 Surface Water)	1	1/1	(3)
AOC 2, Shipping/Storage Buildings					
DNT, DPA, and nitrocellulose	Soil	6 (2 Surface) (4 Subsurface)	1	1/1	NA
	Water	2 (2 Ground Water)	0	0	NA
AOC 3, Miscellaneous Drainage Ares					
DNT, DPA, and nitrocellulose	Soil/Sediment	12 (5 Surface) (4 Subsurface) (3 Sediment)	1	1/1	NA
	Water	5 (2 Ground Water) (3 Surface Water)	0	0	NA
AOC 4, Sanitary Buildings					
PAHs, DRO, GRO, mercury	Soil	8 (4 Surface) (4 Subsurface)	1	1/1	NA

Table 6. Summary of Sample Types by Media and Sample Quantities and Field QA/QC Sample Collection for Each AOC

Laboratory Analytical Parameter to be Performed in each AOC (1) (2)	Media (2)	Estimated Number of Samples	QA/QC Samples		
			Blind Field Duplicate	MS/MSD	Trip Blank(3)
	Water	2 (2 Ground Water)	0	0	NA
AOC 5, DNT Storage Bunkers					
DNT, DPA, nitrocellulose, RCRA metals, PAHs, DRO, GRO, organochlorine pesticides	Soil	24 (12 Surface) (12 Subsurface)	2	2/2	NA
DNT, DPA, nitrocellulose, PAHs, DRO, GRO, mercury	Water	2 (2 Ground Water)	1	1/1	NA
AOC 6, 154th Street Disturbed Area					
RCRA metals, PAHs	Soil	12 (6 Surface) (6 Subsurface)	1	1/1	NA
AOC 7, Steam Plant and Associated 26.7 Acres					
AOC 7A-Northwest Quadrant					
VOCs, SVOCs, RCRA Metals, PCBs	Soil	18 (11 Surface) (7 Subsurface)	1	1/1	(3)
	Water	2 (2 Ground Water)	1	1	(3)
AOC 7B-Northeast Quadrant					
VOCs, SVOCs, RCRA Metals, DRO	Soil	10 (3 Surface) (7 Subsurface)	2	1/1	(3)
	Water	2 (2 Ground Water)	0	0	(3)
AOC 7C-Southeast Quadrant					
VOCs, SVOCs, RCRA Metals, DNT, DPA, nitrocellulose	Soil/Sediment	26 (16 Surface) (8 Subsurface) (2 Sediment)	2	1/1	(3)
	Water	6 (4 Ground Water) (2 Surface Water)	1	1	(3)
AOC 7D-Southwest Quadrant					
VOCs, SVOCs, RCRA Metals, DNT, DPA, PCBs, DRO, nitrocellulose	Soil/Sediment	32 (18 Surface) (13 Subsurface) (1 Sediment)	3	1/1	(3)
	Water	5 (4 Ground Water) (1 Surface Water)	0	0	(3)
Background Samples					
RCRA metals	Soil/Sediment	28 (14 Surface)	2	1/1	NA

Table 6. Summary of Sample Types by Media and Sample Quantities and Field QA/QC Sample Collection for Each AOC

Laboratory Analytical Parameter to be Performed in each AOC (1) (2)	Media (2)	Estimated Number of Samples	QA/QC Samples		
			Blind Field Duplicate	MS/MSD	Trip Blank(3)
		(14 Subsurface)			
	Water	3 (3 Ground Water)		0/0	NA

(1) Only selected parameters will be analyzed for each sample collected in AOC 7. See detailed breakdown, for parameters per media in Section 5.1.7.
(2) PAH 8270 SIM and RCRA 6020 will be performed on selected surface water samples. PAH 8270 SIM will be performed on selected sediment samples. These analyses will replace SVOCs 8270C or PAH 8270.
(3) One trip blank per cooler for aqueous samples only.
VOCs - Volatile Organic Compounds
SVOCs - Semi-Volatile Organic Compounds
RCRA Metals - Resource Conservation and Recovery Act metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver)
DNT – Dinitrotoluene
DPA – Diphenylamine
PAH – Polyaromatic Hydrocarbons
DRO - Diesel Range Organics
GRO - Gasoline Range Organics
PCB – Polychlorinated Biphenyls

A brief overview of the field QA/QC samples is provided below.

Field Duplicates: A field duplicate sample is a second sample collected at the same location as the original sample. Duplicate samples are collected in immediate succession, using identical recovery techniques, and treated in an identical manner during storage, transportation, and analysis. The sample containers are assigned a unique identification number in the field by Bay West field staff. For water samples, samples and duplicate volumes are taken successively using the same sampling technique (e.g. peristaltic pumping through designated tubing that is used for both the sample and the duplicate). For soil and sediment samples, duplicates for grab samples are taken successively from the same area or depth interval, as practical given the volume of sample recovered and the volume of sample required. For composite samples, duplicates are taken sequentially from the same composited sample volume (e.g. from the same stainless steel bowl using the same stainless steel scoop, without decontamination of the equipment in between sample and duplicate collection).

MS/MSD: MS/MSDs will be collected at a frequency of 1 per 20 or less environmental samples. Samples for MS/MSDs will be designated as such on the Chain-of-Custody and will consist of additional volume of selected environmental samples that will be spiked with target analytes by the laboratory and used to assess site-specific matrix affects in addition to the MQOs discussed in Section 3.3, Part II QAPP, of this SAP.

Trip Blank: A trip blank will accompany each cooler that contains samples for VOC aqueous analysis. The trip blank is provided by the laboratory. Gas Chromatograph/Mass Spectrometer (GC/MS) Volatile Organic Analysis (VOA) Trip Blanks are prepared by the laboratory on a daily basis. The Bottle Preparation Technician uses the same source of organic free water that is used in the laboratory's GC/MS VOA Group for Method Blanks. This water has been boiled and purged with Nitrogen. Preserved VOA vials are filled with the water and one vial is retained by the laboratory for any needed future testing. The laboratory also uses this same water source for in-house refrigerator monitoring.

4.2.2 Laboratory QA/QC

STL will be performing the laboratory analysis on the samples collected. Laboratory QA/QC is presented in Part II QAAP of this FAP. Sensitivities required for this investigation will be set by Bay West based on State and Federal action levels. The method practical quantitation limit will be equal to or lower than the project sensitivity level specified and will be included in each laboratory analytical report.

5.0 FIELD ACTIVITIES

Bay West will secure right-of-entry (access) to all properties in order to complete the work outlined in this FSP. Gopher State One-Call will be contacted to have all utilities located/cleared in the field prior to intrusive activities. Field activities include mobilization of Bay West personnel and subcontractors, investigative activities, decontamination of equipment, health and safety monitoring, investigative waste management, and QC oversight. The field investigation activities include a land survey of AOC 7, test pit excavation, soil borings, soil sampling, ground water sampling, surface water sampling, and/or sediment sampling at each AOC and the background sample areas.

The Bay West Project Manager or Site Supervisor, in consultation with the Project Manager, will stake the proposed sample locations (with the exception of the surface water samples) at each AOC immediately prior to or during initiation of sampling activities. Sample locations may be modified by the Site Supervisor, in consultation with the Project Manager, if necessary. Field investigation procedures to be used for land surveying and sample collection, including sample depths, are described in Sections 5.2 through 5.10.

A summary of the analytical parameters, media to be sampled, estimated number of samples, and QA/QC samples for each AOC is presented in Table 6. The analytical methods are cited in Part II QAPP of this SAP and will be conducted according to the laboratory SOPs. The investigation procedures presented in this FSP are also based on the requirements in the General Geology Scope of Services, Appendix A of the SOS (Appendix 5).

5.1 Sample Rationale/Design for Each AOC

This Focused SI sample locations are strategically planned to identify the substances present, determine whether hazardous substances are being released to the environment, and determine whether hazardous substances have impacted specific targets. Proposed sample locations may need to be adjusted in the field based on access and locations of structure. Soil sample locations may also be adjusted in the field to bias the sample locations towards low lying or possible depositional areas, unless otherwise noted. With the exception of AOC 7B soil samples will not be collected for chemical analysis below 10 ft bgs. Ground water samples will be collected from the direct-push sample locations if ground water is encountered within 100 ft bgs, or refusal, whichever is shallower. The sampling rational/design for each AOC are discussed below. Sample methods for the different media are described in the subsequent subsections.

5.1.1 AOC 1, Waste Ditch and Settling Ponds

Proposed sample locations for AOC 1 are shown on Figures 3A-Northern Section, 3B-Middle Section, and 3C-Southern Section. Detail on sampling locations for each section is discussed below.

<u>AOC 1-Northern Section (Figure 3A):</u> This area is a section of the drainage/waste ditch located north of 170th on private property (see Table 3). Based on the existing topography, the northern half of the waste ditch in this section appears to have been filled in. Samples are not targeted for the fill area since the fill placement likely occurred after DOD operations. Samples will be collected in AOC 1-Northern Section as follows:

- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push boring at the southern most end of the waste ditch. This sample location was selected to provide information on COPCs that may have been transported out of this

area and as a baseline to determine potential impacts that may have occurred down-stream from the Coates dump.
- One additional surface soil grab sample will be collected at the northern end of the existing waste ditch to provide information on COPCs that may have been deposited in this area.

AOC 1-Middle Section (Figure 3B): This section is south of 170th and includes the former Coates dump, the primary settling basin, and drainage/waste ditch above the secondary settling basin. Samples will not be collected within the perimeter of the former Coates dump since the dump activities occurred after DOD operations. Samples will be collected in AOC 1-Middle Section as follows:
- Three surface soil samples, six subsurface soil samples, and three ground water samples will be collected from three direct-push borings in this section. As specified in the SOS two of the direct-push borings will be placed in the primary settling basin. One direct-push boring will be targeted for the head of the primary settling basin to provide information on COPCs that may have settled out immediately upon entering the basin area. The analytical results will also be compared to samples collected upstream of the Coates dump. The second direct-push boring will be targeted at the toe of the primary settling basin to provide information on COPCs that may have migrated further downstream, prior to exiting basin area. The third direct-push boring will be targeted for the southern portion section of the drainage/waste ditch in this section to provide information on COPCs that may have been transported further downstream.
- Two additional surface soil grab samples will also be collected. One surface soil sample will be targeted for the northern end of the existing drainage/waste ditch, at the toe of the Coates dump, to provide information on COPCs that may have entered this area through surface water runoff. The second surface soil sample will be targeted for the drainage/waste ditch south of the dam/weir structure for the primary settling basin to provide information on COPCs that may have been transported further downstream.

AOC 1-Southern Section (Figure 3C): This section includes the secondary settling basin and outfall area. A number of historical buildings/features were located near the toe of the secondary settling basin (Appendix 1). Samples will be collected in AOC 1-Southern Section as follows:
- Three surface soil samples, three subsurface soil samples, and two ground water samples will be collected from two direct-push borings in this section. As specified in the SOS two of the direct-push borings will be placed in the secondary settling basin. Similar to the primary settling basin, one direct-push boring will be targeted near the head of the secondary settling basin and the second direct-push boring near the toe of the secondary settling basin to provide information on COPCs that may have migrated to these areas.
- Three additional surface soil grab samples will also be collected. One surface soil sample will be targeted within the former contact/mixing basin, a second near the former chemical storehouse building, and the third near the former still-well.
- Two sediment samples will be co-located with two surface water samples collected below the dam/weir structure. The surface water and sediment samples will be targeted for the center most point at the inflow (head) and outflow (toe) of the water body to provide information on COPCs that may have settled out in these areas and determine if contaminants may have migrated further downstream. The first sample will be collected from the furthest down-gradient point of AOC 1 and the second sample will be collected within approximately two to three feet of the weir structure. Based on the Site visit, surface water was only observed below the dam/weir structure. If surface water is observed in other areas of AOC 1 during the field work, the most down-gradient sample location will be replaced with a sample located within the surface water body.

Analytical parameters: Based on the USACE SOW and PA, samples collected from AOC 1 will be analyzed as follows:

- Soil and ground water samples will be analyzed for VOCs, SVOCs, RCRA metals, DNT, and nitrocellulose.
- Surface water samples will be analyzed for VOCs, PAHs SIM, RCRA metals (6020), DNT, and nitrocellulose.
- Sediment samples will be analyzed for VOCs, PAHs SIM, RCRA metals, DNT, and nitrocellulose.

5.1.2 AOC 2, Shipping/Storage Buildings

Proposed sample locations for AOC 2 are shown on Figure 4. Samples will be collected in AOC 2 as follows:

- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push boring located within the perimeter of a former shipping/storage building to provide information on COPCs that may have been released from materials stored within the building.
- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push boring targeted for a drainage area within AOC 2 to provide information on COPCs that may have been released as a result of historical DOD activities conducted in AOC 2.

Analytical parameters: Based on the USACE SOW and PA, soil and ground water samples will be analyzed for DNT, DPA, and nitrocellulose.

5.1.3 AOC 3, Miscellaneous Drainage Areas

Two separate drainage areas will be investigated in the Focused SI: AOC 3-DA1 and AOC 3-DA2. These areas are shown on Figure 5. Details on sampling locations for each area are discussed below. Based on the Site visit, surface water was not observed in AOC 3 drainage areas. If surface water is found to be present during the field investigation work, up to three surface water and three associated sediment sample will be collected from the drainage areas. Surface water and sediment samples will be co-located and targeted for the center most point of the water body.

AOC 3-DA1: This drainage area is located south of AOC 5. Samples will be collected to provide information on COPCs that may have migrated into or out of this drainage area from AOC 5. Proposed sample locations are shown on Figure 5A. Samples will be collected in AOC 3-DA1 as follows:

- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push location.
- One additional surface soil grab sample will also be collected in this drainage area.

AOC 3-DA2: This drainage area is located between AOC 2 and AOC 4. Samples will be collected to provide information on COPCs that may have migrated into this drainage area. Proposed sample locations are shown on Figure 5B. Samples will be collected in AOC 3-DA2 as follows:

- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push location.
- Two additional surface soil grab samples will also be collected will also be collected in this drainage area.

Analytical parameters: Based on the USACE SOW and PA, soil/sediment and water samples will be analyzed for DNT, DPA, and nitrocellulose.

5.1.4 AOC 4, Sanitary Buildings

Sample locations have been selected to provide information on COPCs that may have been released near these historical buildings/features or migrated into drainage areas as a result of historical DOD activities. Proposed sample locations for AOC 4 are shown on Figure 6. Samples will be collected in AOC 4 as follows:

- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from each of the two direct-push locations targeted for drainage areas on the south side of this AOC.
- Two additional surface soil grab samples will also be collected. One surface soil sample will be targeted near the former toilets and one near the former boiler house.

Analytical parameters: Based on the USACE SOW and PA, soil/sediment and water samples will be analyzed for PAHs SIM, DRO, GRO, and mercury.

5.1.5 AOC 5, Dinitrotoluene Storage Bunkers

Sample locations are targeted near or adjacent to the entrance of each DNT storage bunker and in potential surface water drainage areas to provide information on COPCs that may have been released as a result of historical DOD activities. Proposed sample locations for AOC 5 are shown on Figure 7. Samples will be collected in AOC 5 as follows:

- One surface soil sample and one subsurface soil sample will be collected from each of the twelve direct-push locations in this AOC.
- Ground water samples will be collected from two of the direct-push locations.

Analytical parameters: Based on the USACE SOW and PA, soil and ground water samples will be analyzed for DNT, DPA, nitrocellulose, RCRA metals, PAHs SIM, DRO, and GRO. Soil samples will also be analyzed for organochlorine pesticides in addition to the analytes listed above.

5.1.6 AOC 6, 154th Street Disturbed Area

Proposed test pit locations were randomly selected within the AOC and are shown on Figure 8. Samples will be collected within the test pits as follows:

- One surface soil sample and one subsurface soil sample will be collected from each of the six test pit locations. Samples will be collected in fill material if visible.

Test pit and sample locations may be adjusted in the field to bias the samples locations towards visible fill material, lower areas, or possible depositional areas. Soil sample locations may be adjusted based on visual observations during test pit operations. The contents of the disturbed areas will also be noted during test pit operations.

Analytical parameters: Based on the USACE SOW and PA, soil samples will be analyzed for RCRA metals and PAHs SIM.

5.1.7 AOC 7, Steam Plant and Associated 26.7 Acres

As previously discussed, for the purposes of this Focused SI, AOC 7 has been subdivided into four sub-areas as shown of Figure 9. Proposed sampling for each quadrant is discussed in the following subsections. Historical features have been added to the figures and can also be found on historical figures included in Appendix 1. Sample locations were targeted near historical process areas or potential drainage areas to provide information on COPCs that may have been released as a result of historical DOD activities conducted in or adjacent to these areas. The proposed sampling may be modified after completion of the Land Survey, if warranted.

5.1.7.1 AOC 7A-Northwest Quadrant

Proposed sample locations are shown of Figure 9A. Samples will be collected in AOC 7A as follows:
- Two surface soil samples, two subsurface soil samples, and one ground water sample will be collected from two direct-push borings located near the former transformer pads, south of the Building 412-A.
- Four randomly selected surface soil grab samples will also be located near the transformer pads. Sample locations will be selected by the field staff in areas that appear to have staining or stressed vegetation. In the absence of physical signs of a potential release, samples will be collected at regular intervals around the transformer pads. The randomly selected grab sample locations are not shown on Figure 9A.
- Two surface soil samples, two subsurface soil samples, and one ground water sample will be collected from two push-probe borings located near the water inlet house on the north side of Building 402-A.
- One surface soil sample and one subsurface soil sample will be collected from one push-probe borings located near the low lying area identified as Building 53-TC47.
- Two surface soil samples and two subsurface soil subsurface samples will be collected near the southwest and southeast corner of the Building 402A where historical photographs show heavier use compared to other areas within AOC 7A.

<u>Analytical parameters</u>: Samples collected from AOC 7A will be analyzed as follows:
- All of the soil and ground water samples from the seven direct-push borings (fourteen soil samples and two ground water samples) will be analyzed for VOCs, SVOCs (including PAHs SIMs), and RCRA metals.
- Four soil samples (two surface soil and two subsurface soil) and one ground water sample collected from two direct-push borings located near the former transformer pads will be analyzed for PCBs. In addition, the four randomly selected surface soil samples near the former transformer pads will be analyzed for PCBs.

5.1.7.2 AOC 7B-Northeast Quadrant

Since this area has been extensively reworked a slightly different sampling approach has been developed to provide information on COPCs that may have been released as a result of historical DOD activities. Proposed sample locations are shown of Figure 9B. Samples will be collected in AOC 7B as follows:
- One direct-push boring will be placed in this area to native soils or a depth of approximately 40 feet, whichever is shallower near the former Building EAA. Soil samples will be collected from this direct-push boring at the following intervals: 0-6 inches bgs; 2 to 4 ft bgs; and native soil.

- Two additional direct-push borings will be placed for the collection of soil and ground water samples near the Salt Dissolving Pit and the former drainage/waste ditch. These direct-push borings are proposed to extend to native soils which may be as deep as 40 ft bgs. If necessary, push-probe borings will extend deeper to reach ground water (no deeper than 100 ft bgs or bedrock refusal, which ever is shallower). Soil samples will be collected in these direct-push borings at the following intervals: 0-6 inches bgs; and native soil. Proposed sample locations are shown on Figure 9B.

Without the presence of remnants of historical physical features, locating the sampling points near the former structures will be challenging. During Bay West's Site visit, UMN representatives indicated they will attempt to locate the former buildings/features, with assistance from the DCEM, prior to initiation of field work. If the former building/feature locations are not marked prior to field work, Bay West field staff will use historical figures and/or a hand held GPS to estimate their locations.

Analytical parameters: Soil and water samples collected from AOC 7B will be analyzed for VOCs, SVOCs (including PAHs SIM), RCRA metals, and DRO.

5.1.7.3 AOC 7C-Southeast Quadrant

Proposed sample locations are shown of Figure 9C. Samples will be collected in AOC 7C as follows:

- One surface soil sample and one subsurface soil sample will be collected from one direct-push borings within the stockpile soil in the southwest corner of this area.
- Three surface soil samples, three subsurface soil samples, and one ground water sample will be collected from three direct-push borings located within the former coal stockpile area.
- Three surface soil samples, three subsurface soil samples, and one ground water sample will be collected from three direct-push borings located along the former coal conveyor belt towers.
- One surface soil sample and one subsurface soil sample will be collected from one direct-push borings within the drainage ditch that received waste water from the FGOW facility.
- Eight randomly selected surface soil grab samples will also be located along the drainage ditch. Sample locations will be selected by the field staff in areas that appear to have staining or stressed vegetation. In the absence of physical signs of a potential release, samples will be collected at regular intervals along the drainage/waste ditch. The random samples locations are not shown on Figure 9A.
- Based on the Site visit, surface water may be present in the northwest corner of AOC 7C. If surface water is found to be present, up to two surface water and two associated sediment samples will be collected. Surface water and sediment samples will be co-located and targeted for the center-most point of the water body. If surface water is not present, surface soil samples will be collected from these locations.

Analytical parameters: Samples collected from AOC 7C will be analyzed as follows:

- All of the soil and ground water samples from the eight direct-push borings (sixteen soil samples and four ground water samples) will be analyzed for VOCs, SVOCs (including PAHs), RCRA metals.
- Four soil samples and two ground water samples will also be analyzed for DNT, DPA, and nitrocellulose. These samples will be selected from areas targeted for the low-lying areas and the drainage ditch. The randomly selected eight surface soil samples in the drainage areas will also be analyzed for DNT, DPA, and nitrocellulose.

- Surface water samples will be analyzed for VOCs, SVOCs, PAHs SIM, and RCRA metals (6020), DNT, DPA, and nitrocellulose.
- Sediment samples will be analyzed for VOCs, SVOCs, PAHs SIM, and RCRA metals, DNT, DPA, and nitrocellulose.

5.1.7.4 AOC 7D-Southwest Quadrant

Proposed sample locations are shown of Figure 9D. Samples will be collected in AOC 7D as follows:

- Two surface soil samples and three subsurface soil samples from two direct-push borings will be collected within the stockpiled soil in the southern portion of this area.
- Two surface soil samples, three subsurface soil samples, and one ground water sample will be collected from two direct-push borings near the former transformer pads.
- Two randomly selected surface soil grab samples will also be located near the transformer pads. Sample locations will be selected by the field staff in areas that appear to have staining or stressed vegetation. In the absence of physical signs of a potential release, samples will be collected at regular intervals around the transformer pads. The random samples are not shown on Figure 9D.
- One surface soil sample and two subsurface soil samples will be collected from one direct-push boring near/within the secondary containment reservoir.
- Three surface soil samples, four subsurface soil samples, and one ground water sample will be collected from three direct-push borings located within the drainage ditch that received waste water from the FGOW facility.
- Two randomly selected surface soil grab samples will be also located within the drainage/waste ditch. Sample locations will be selected by the field staff in areas that appear to have staining or stressed vegetation. In the absence of physical signs of a potential release, samples will be collected at regular intervals along the drainage/waste ditch. The randomly-selected grab sample locations are not shown on Figure 9D.
- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push boring located near the entrance to the 401-AA Flash Mixer, 401-AA1 Precipitators building.
- One surface soil sample, two subsurface soil samples, and one ground water sample will be collected from one direct-push boring located within the 410-A Ash Disposal Pit and Sump.
- One surface soil sample, one subsurface soil sample, and one ground water sample will be collected from one direct-push boring located within/near the Former Fuel Oil Tanks. Because the Former Fuel Oil Tanks are surrounded by a concrete containment wall, this sample may need to be collected with a hand auger probe.
- Based on the Site visit, surface water was not observed in AOC 7. However, if during sampling work surface water is found to be present, one surface water sample and one sediment sample will be collected. Surface water and sediment samples will be co-located and targeted for the center most point of the water body.

<u>Analytical parameters</u>: Samples collected from AOC 7D, will be analyzed as follows:

- All of the soil and ground water samples from the eleven direct-push borings (twenty-seven soil samples and four ground water samples) will be analyzed for VOCs (including PAHs SIM), SVOCs, and RCRA metals.
- Eight (four surface soil and four subsurface soil) and one ground water samples will also be analyzed for DNT, DPA, and nitrocellulose. These samples will be taken from push-probe borings located within the drainage ditch. The four randomly selected surface soil samples in the drainage areas will also be analyzed for DNT, DPA, and nitrocellulose.

- Ten soil samples and four ground water samples will be selected for DRO analysis. The location of the DRO samples will be the five direct-push soil borings targeted nearest the former Fuel Oil Tanks. All ground water samples will be analyzed for DRO.
- Seven soil samples (three surface soil and four subsurface soil samples), and one ground water sample collected from three direct-push borings located near the former transformer pads and secondary containment reservoir will be analyzed for PCBs. The five randomly selected surface soil samples near the former transformer pads will be analyzed for PCBs.
- The surface water sample will be analyzed for VOCs, SVOCs, PAHs SIM, and RCRA metals (6020), DNT, DPA, nitrocellulose, and PCBs.
- The sediment sample will be analyzed for VOCs, SVOCs, PAHs SIM, and RCRA metals, DNT, DPA, nitrocellulose, and PCBs.

5.1.8 Background Samples

One surface soil sample and one subsurface soil sample will be collected from each of 14 direct-push background locations. Ground water samples will be collected from three of the direct-push locations. Proposed sample locations for the background samples are shown on Figure 10.

Surface and Subsurface Soil: Soil sample locations have been selected to represent unbiased background locations. Sample locations may be adjusted in the field to reflect the physical setting of samples collected in each AOC. Samples will be targeted for agricultural areas, wooded areas, and ditches that do not appear to be runoff areas associated with FGOW operations.

Ground water: Ground water samples will be collected from three of the direct-push sample locations as shown on Figure 10. Based on the general hydrogeology in the area, ground water flow is expected to be to the northeast. Therefore, samples locations were selected on the southwest, upgradient side of the Site. Ground water samples will not be collected from direct-push borings placed in suspected drainage areas.

Analytical parameters: Soil and ground water samples will be analyzed for RCRA metals to determine background concentrations of the metals in areas likely to be unaffected by past FGOW or UMN activities.

5.2 Land Survey of AOC 7

Bay West will contract with a Minnesota-licensed surveyor to complete the land survey of the Steam Plant and Associated 26.7 acre property. The survey will at a minimum conform to requirements specified below.

The datum for vertical will be the North American Vertical Datum of 1988 (NAVD 88), the control point will be the North American Datum of 1983 (NAV83), the horizontal datum will be NAV83, and the survey will be tied into the Local State Plane Coordinate System.

Coordinates will be established for each boundary corner. The coordinates will be to the closest one foot and referenced to the State Plane Coordinate System. All positions and coordinates of all permanent points within the control traverse will be shown.

At each site, all above ground and where possible, evidence of underground physical features (such as manhole covers), will be either verified with previous mapping or be determined if required. All above ground physical features will be located/verified to the nearest foot. Permanent control monuments will be placed in accessible locations within the limits of the work if existing permanent monuments are not located within 1000 feet of a site. One set of monuments will be allowable for adjacent sites. These monuments will be set no closer than 500 feet to each other.

The location, identification, coordinates and elevations of the monuments, underground and above ground features will be plotted on maps in AutoCAD 2001 compatible format with a scale large enough to show their locations with reference to other structures within the survey area. A tabulated list of the monuments, copies of all field books, and all computations sheets will be prepared. The tabulations will consist of the designated number of the monuments, the underground/above ground features, the X and Y coordinates, and all the elevations.

Bay West will submit the land survey data to the USACE once completed. Selected results of the land survey will be included in the Focused SI Report. The initial submittal will include:

- AutoCAD 2001 compatible Map files on a CD.
- Three, plots of final copies of the survey area including all site features.
- All computations (in folder).
- All field books (reduced and checked).
- CD of all raw field data and final coordinate data.

5.3 Soil Sampling: Surface and Direct-push Borings

Procedures for surface, subsurface, and composit soil samples are described in this section. Surface samples, subsurface samples, and associated QA/QC samples will be collected for laboratory analysis at a rate specified in Table 6 from the locations shown on Figures 3 through 10, and described in Section 5.1. The use of direct-push borings will allow Bay West to: 1) define the characteristics of the unconsolidated sediments below the Site; 2) characterize the relationship between the subsurface stratigraphy and potential pathways of contamination; 3) allow for the collection of soil samples at discrete intervals for physical identification, field analysis, and chemical analysis; and 4) allow for the collection of ground water samples for analytical laboratory chemical analyses.

Immediately after collection of discrete or composite samples and completion of bottle label information each sample container will be packed for shipment and the Chain-of-Custody will be completed in accordance with Section 7 and Section 8. Non-dedicated sampling equipment will be decontaminated in accordance with Section 5.7, prior to moving to the next sampling location. Sample containers and preservation techniques are discussed in Section 4.1 of Part II QAPP, of this SAP.

Surface Soil Samples: Surface soil samples will be collected with stainless steel tools (i.e. hand auger or bucket and trowel), dedicated sampling equipment or direct-push sampling methods. If dedicated sampling equipment is not used, sample tools will be decontaminated between each sample location as specified in Section 5.7. All surface soil samples will be collected from 0 to 0.5 ft bgs.

All VOC, SVOCs, PAHs, DRO and nitrocellulose samples will be collected as discrete aliquots from the middle of the interval without homogenization, using a stainless steel spoon or disposable syringe. Sample containers designated for discrete samples will be filled so that minimal headspace is present in the containers. All remaining samples will be collected from homogenized soil over the depth interval.

Subsurface Soil Samples: Subsurface soil samples will be collected at depths no greater than 10 ft bgs, unless otherwise specified. If one subsurface sample is targeted for collection from a boring, the samples will be collected from 2 to 4 ft bgs. If more than one subsurface soil sample is collected from a boring, the samples will be collected from 2 to 4 ft bgs and 8 to 10 ft bgs. If visible contamination is present, a sample from that interval will be selected in place of the intervals specified above.

Soil borings using direct-push technology will be completed using a vehicle-mounted Geoprobe ® sampling unit. Borings will be conducted in general accordance with the NTS Geoprobe SOP, in Appendix 6, and as described below. All soil samples will be logged by a Bay West geologist in the field on the USACE Drilling Log Form found in the Geology Supplement to the SOS (Appendix 5). Soil samples for lithologic logging will be collected continuously for the first 10 ft and then every 5 ft for the remaining depth of each boring. Samples will be retrieved with a macro-core sampler (or optionally a large bore sampler). The probe rods and sampling units will be advanced by the static weight of the carrier vehicle and hydraulic hammer percussion. Sample cores will be collected with removable clear plastic liners. Upon retrieval of the sampling device, the percentage of recovery will be recorded and the contained soil core will be split in half lengthwise using a stainless steel knife. Samples designated for laboratory analysis will be collected from the core using disposable syringes. The syringe will either be used to retrieve an isolated section(s) of the soil core or will be run lengthwise down the core to collect a sample representative of the entire core interval.

All VOC, SVOCs, PAHs, DRO, and nitrocellulose samples will be collected as discrete aliquots from the middle of the interval, without homogenization, using a stainless steel spoon or disposable syringe. Sample containers designated for discrete samples will be filled so that minimal headspace is present in the containers. All remaining samples will be collected from homogenized soil over the depth interval. After each sample is collected, the soil core sampling equipment will be washed in an alconox/water mixture and rinsed with water. Plastic liners will be discarded after each sample is collected and a new liner will be used for the collection of the next sample.

All soil samples will be screened for organic vapors using a Flame Ionization Detector (FID) or Photoionization Detector (PID). Headspace analysis will be performed in general accordance with the MPCA Fact Sheet 3.22 "Soil Sample Collection and Analysis Procedures" and the Geology Supplement to the SOS (Appendix 5). Headspace readings will be collected using a FID/PID. The FID/PID will be calibrated prior to drilling activities using an isobutylene standard.

Composite Sampling: The first step of the compositing process will involve assembly of the bottles containing the discrete samples to be composited. (Note: At this point, samples for VOC, SVOCs, PAHs, DRO, and nitrocellulose analysis have been previously collected. These samples will not be collected from composited or homogenized sample volumes). Next, an equal quantity of each discrete sample will be placed into a decontaminated stainless steel container. The total quantity of the discrete samples selected for compositing will be sufficient to perform all required laboratory analyses. The soil placed into the bowl will be mixed thoroughly in the center in the bowl, using a stainless steel spoon, until the single composite sample has a consistent physical appearance. Upon completion of the compositing process, the sample will be filled by retrieving sample material from the container.

5.4 Direct-push Ground Water Sampling

Ground water samples and associated QA/QC samples will be collected for laboratory analysis at a rate specified in Table 6, at locations shown on Figures 3 through 10, and described in Section 5.1. Ground water samples will be collected from the water table, estimated to be between 50 and 100 ft bgs. Ground water samples will be collected from the direct-push sample locations if ground water is encountered within 100 ft bgs, or refusal, whichever is shallower. After the completion of the direct-push borings described above, the bore holes may remain open for approximately 24 hour, if needed, to allow the water level to stabilize. Prior to sample collection, an electric water level indicator will be lowered into the direct-push rod to record the depth to ground water.

Ground water samples will be collected from each specified borehole using a peristaltic pump and factory fresh silicon tubing. Ground water sampling techniques are further described in the NTS SOP (Appendix 6). The samples will be transferred to the appropriate glassware and preserved (when required). Immediately after sample collection and completion of bottle label information, each sample container will be packed for shipment and the Chain-of-Custody will be completed in accordance with Sections 7 and Section 8. Non-dedicated sampling equipment will be decontaminated in accordance with Section 5.7 prior to moving to another sampling location. Sample containers and preservation techniques are discussed in Section 4.1 of Part II QAPP, of this SAP. When water sampling is completed, the direct-push borings will be abandoned in accordance with the MDH well code by placing a bentonite grout slurry seal from the bottom of the borehole to grade.

5.5 Surface Water and Sediment Sampling

Surface water samples, sediment samples, and associated QA/QC samples will be collected for laboratory analysis at a rate specified in Table 6, at locations shown on Figures 3 through 10, and described in Section 5.1 above. Surface water and sediment samples will be co-located. Based on the site visits, surface water was only observed in AOC 1 below the secondary settling basin dam/weir structure. If surface water is observed in other areas of AOC 1, AOC 3 or AOC 7 during field sampling operations, surface water sampling locations may be modified with approval of the Bay West Project Manager.

The samples will be transferred to the appropriate glassware and preserved (when required). Immediately after sample collection and completion of bottle label information, each sample container will be packed for shipment and the Chain-of-Custody will be completed in accordance with Section 7 and Section 8. Non-dedicated sampling equipment will be decontaminated in accordance with Section 5.7 prior to moving to another sampling location. Sample containers and preservation techniques are discussed in Section 4.1 of Part II QAPP, of this SAP.

<u>Surface Water:</u> Surface water samples shall be collected first to minimize sediment entrainment in the water sample. If more than one sample is collected from a water body, the furthest down-gradient surface water sample will be collected first. Surface water samples will be obtained using dedicated equipment and factory-fresh disposable sampling equipment. One of the following procedures will be used depending on the characteristics of the water body.

> <u>Direct Fill:</u> Collection of surface water samples using the direct fill hand-held bottle method will be accomplished by submerging the appropriate sample container with the cap in-place into the body of water. The container will then be slowly and continuously filled using the cap to regulate the rate of sample entry into the container. The sample container will be filled, such that a minimum of bubbling (and volatilization) occurs. The sampler will make every effort to not disturb the sediments and minimize sediment entrainment in the water sample. The sample container will be retrieved from the water body with minimal disturbance to the sample. Immediately after collection of the sample, chemical preservative, if needed, will be added. Upon completion of bottle label information, each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

Dipper and Pond: Dipper and pond samplers perform similar functions and vary only in the length of the handle attached to the sampling vessel (usually a beaker). Before beginning sampling, a handle of appropriate length is attached to the dipper or pond sampler. Collection of surface water samples using the dipper or pond sampler method will then be accomplished by slowly submerging the device into the water so that the open end of the device is facing upstream. The sampler will make every effort to not disturb the sediments and minimize sediment collection in the water sample. The sampler device will be retrieved from the water body with minimal disturbance to the sample, which will then be transferred into appropriate sample containers. Immediately after collection of the sample and completion of bottle label information each sample container will be placed into a sealable plastic bag and then will be placed into an ice-filled cooler to ensure preservation.

Sediment Sampling: Sediment samples will be collected 0 to 4 inches bgs with a drop core or ponar dredge, depending on conditions in the field. Organic debris (leaf litter, sticks, etc.) will be removed prior to placing sample into laboratory containers. Non-dedicated sampling equipment will be decontaminated between each sample location.

5.6 Test Pit Excavations and Soil Sampling

Test pits will be conducted using an excavator to collect surface soil and subsurface soil samples in AOC 6. Test pits excavations will extend to native soils or no greater than 10 ft bgs. Excavations greater than 5 ft in depth will include sloping and benching to guard against cave-in. An excavation competent person will observe all test trenching activities. An excavation competent person is "One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them." Test pit observations will be recorded on the Bay West Excavation Inspection Form included in Appendix 7.

At no time will any person enter the excavations. Soil samples will be collected as described in the surface soil sampling procedures in Section 5.3. All surface soil samples will be collected from 0 to 0.5 ft bgs from the sidewalls of the test pits. Subsurface soil samples will be collected directly from the excavator bucket. The field sampler will direct the excavator to excavate soil from the sidewall at a specified depth. The samples will be collected in fill material, if encountered.

5.7 Decontamination Procedures

All reusable equipment (non-dedicated) used to collect, handle, or measure samples will be decontaminated before coming into contact with any sample. Decontamination of equipment will occur either at the central decontamination station or at portable decontamination stations set up at the sampling location, excavation and/or drill sites. The decontamination station will be located at the time of field mobilization and/or to each AOC. The decontamination pad will be designed so that all decontamination liquids are contained from the surrounding environment and can be recovered for disposal as Investigation Derived Waste (IDW). Decontamination equipment and procedures that will be followed are specified Appendix 8, Bay West SOP, for Field Equipment Decontamination At Nonradioactive Sites.

5.8 Equipment List

A list of sampling equipment for the Focused SI includes, but is not limited to, the following items:

General equipment and materials needed for all sampling efforts:

- Sample containers/glassware.
- Sample gloves.
- Coolers.
- Chain-of-Custody materials.
- Documentation materials (markers, rulers, field book, field data sheets, boring and excavation logs).
- Alconox.
- Decontamination bucket.
- Scrub brush.
- Shipping materials (clear tape, scale, packing peanuts, labels, custody seals).
- Paper towels/Kem-wipes.
- 4-foot stakes/laths for flagging sample locations.
- Rain gear.
- Jersey gloves.
- Cell phone.
- Walking wheel.
- Tyvek.
- Safety vest.
- Trash bags.
- Five gallon buckets.
- Duct tape.
- Flash light.
- Tool box.
- Digital camera.
- Stainless Steel Bowl.
- Stainless Steel Trowel.
- Soil scale.

Additional equipment needed for direct-probe soil sampling:

- Disposable syringes.
- FID/PID.
- Zip loc baggies.

Additional equipment needed for direct-push water sampling:

- Water level indicator.
- Peristaltic pump.
- Silicon tubing.

Additional equipment needed for surface water:

- Extension rod.
- Flotation device.

- Waders.

Additional equipment needed for sediment sampling:

- Ponar Dredge.
- Drop Core.
- Disposable scoops/syringes.
- Waders.
- Flotation device.

5.9 Grab or Homogenization of Sample

Aqueous Media: Aqueous media and samples that require grab techniques (e.g., VOA) are field replicates obtained from multiple grab samples, collected separately, and placed directly into sample containers. Theoretically, each grab sample equally represents the medium at a given time and location.

Homogenized field replicates: Field replicates of solid matrices whose subsequent analysis allows homogenization of the media are obtained from one location in sufficient volume to fill all sample containers. The medium is homogenized and divided into equal quadrants, and equal aliquots from each quadrant are used to fill the sample containers.

5.10 Sample Collection Order

VOCs, SVOCs, PAHs, DRO, and nitrocellulose soil samples will not be homogenized. The general order of sample collection for soil/water sampling will be as follows:

1) VOCs.
2) PAHs and SVOCs.
3) Pesticides.
4) Nitrocellulose.
5) DRO.
6) Sample for Headspace Analysis.
7) Homogenize remaining sample.
8) DNT.
9) DPA.
10) RCRA Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver).

PAHs, SVOCs, and pesticides can be collected in one container. DPA and RCRA metals can also be collected in one container.

6.0 FIELD OPERATIONS DOCUMENTATION

Requirements for field operations documentation is described below.

6.1 Daily Quality Control Reports

During the field investigation Bay West will prepare daily Quality Control Reports (QCR), dated and signed by the Site Supervisor, and sent to USACE at the end of each work week. The reports will include or contain attachments with the following information:

- Weather information at the time of sampling.
- Field instrument measurements.
- Calibrations.
- Identification of all field and control samples taken.
- Copies of Chain-of-Custody forms.
- Departures from the approved SAP.
- Any problems encountered.
- Forms that are generated and instructions from Government personnel.

Any deviations that may affect DQOs will be immediately conveyed to the USACE PM by the Bay West Project Manager. An example QCR form is included in Appendix 9.

6.2 Field Logbook and Documentation

Hardcover bound field logbooks with sequentially numbered pages will be used to document field investigation activities. Permanently bound field books with waterproof paper will be used as field logbooks due to their compact size, durability, and secure page binding. The pages of the logbook should be numbered consecutively and will not be removed for any reason. Field logbooks will be identified by the project name and a project-specific number. Field log books will be stored in the field project files when not in use.

The logbooks will contain the actual field data, or references to other field documents that contain a specific description of the activities that have occurred in the field on any given day. All entries into the logbook will be legible and signed and dated by the person making the entry. In general, all documents will be completed in black ink. Errors will be corrected by crossing out with a single line and then dating and initialing the correction. The use of correction fluid will not be permissible. The following is a partial list of the types of information to be recorded:

- Date and time of entry.
- Names of personnel on Site.
- Number of samples taken.
- Sample collection methods.
- Description of sampling points.
- Date and time of collection.
- Sample identification numbers.
- Sample start and finish times.
- Site temperature and atmospheric pressure.
- Photograph references and Site sketches.
- Off-set distance to permanent structure, if available, of sample location.
- Summary of field task related to sampling.

- Decontamination procedures.
- Records of telephone conversations.
- Calibration of equipment used.
- Field CAs taken.

6.3 Photographic Records

Photographs will be recorded in the appropriate logbook section or in additional sections as needed. Information to be recorded includes frame number, time, date, photographer, location, subject, significant feature, and names of any personnel included in the photograph. All pertinent information will be transferred to a digital file.

6.4 Sample Documentation

Field sampling personnel will properly identify all samples taken in the field with an adhesive sample label attached to each sample container. An example sample label is included in Appendix 10. The sample label will contain the Site name, field identification number, date, time, location of the sample collected, and identification of preservatives used. Sample information will be legibly printed with waterproof ink. The sample identification numbers will be used on field sheets, Chain-of-Custody forms, and other documentation records. Examples of the sample identification numbers for each sample type are as follows:

- Surface soil sample identification is FGOW-AOC3D2A-1-SS-GP1(0-6").
- Direct-push soil sample identification is FGOW-AOC2-S-GP1(4-6').
- Direct-push water sample identification is FGOW-AOC1-W-GP1.
- Surface water sample identification is FGOW-AOC1-W-S1.
- Sediment sample identification is FGOW-AOC2-Sed-Sed1(0-4").
- QC sample identification for Trip Blank is FGOW-W-TB(date).
- QC sample identification for Field Equipment Blank FGOW-W-FB(date).

The first letter character group identifies the Site as the Former Gopher Ordnance Works. The second letter character group identifies the AOC. The third letter character group signifies matrix sampled. The fourth set of number characters signifies the sample number and the depth of the sample is in parenthesis.

Blind duplicate samples will be designated with a false sample identification such as a false boring number or false depth interval to prevent the laboratory from knowing that the samples are duplicates. The location of all samples and numbers of all duplicates will be listed in the field logbook. No indication that ties the duplicate to a particular sample will be provided on the sample label or Chain-of-Custody form. The sample collection time will be altered on the Chain-of-Custody to mask identification of the duplicate pair.

6.5 Chain-of-Custody Documentation

Sample custody procedures and documentation are described in Section 7.0.

6.6 Field Analytical Records

Field headspace analysis will be the only field analysis to be performed. The field headspace analysis results will be included on the USACE Drilling Log Form.

6.7 Data Management and Retention

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. All computer-acquired/generated data will be stored on magnetic tape, floppy disk, or other required media format and hard copies will be kept on file by the laboratory for 10 years. The file for the sampling and analytical effort will be maintained by Bay West for a period of 10 years after the final report is issued.

7.0 CHAIN OF CUSTODY REQUIREMENTS

Verifiable sample custody is an integral part of all field and laboratory operations associated with documenting sampling activities at this Site. The primary purpose of the Chain-of-Custody procedure is to document the possession of the samples from collection through storage and then analysis to reporting. Chain-of-Custody forms will become the permanent record of sample handling and shipment.

Field sampling personnel are responsible for the care and security of samples from the time the samples are collected until they have been turned over to the laboratory. A sample is considered to be in one's custody if it is in plain view at all times, in the physical possession of the sampler, or stored in a locked place where tampering is prevented. Chain-of-Custody will be initiated at the time of each sample's collection. Chain-of-Custody forms will be completed for each sample batch sent to the project laboratory.

Chain-of-Custody procedures implemented for the investigations will provide documentation of the handling of each sample from the time of collection until completion of laboratory analysis. The Chain-of-Custody form serves as a legal record of possession of the sample. A sample is considered to be under custody if one or more of the following criteria are met:

(1) The sample is in the sampler's possession.
(2) The sample is in the sampler's view after being in possession.
(3) The sample was in the sampler's possession and then was placed into a locked area to prevent tampering.
(4) The sample is in a designated secure area.

Custody will be documented throughout the site-specific investigation field sampling activities by the Chain-of-Custody form initiated for each day during which samples are collected. This record will accompany the samples from the Site to the laboratory and will be returned to the Project Manager with the final analytical report. All personnel with sample custody responsibilities will be required to sign, date, and note the time on the Chain-of-Custody form when relinquishing samples from their immediate custody (except in the cases where samples are placed into designated secure areas for temporary storage before shipment). Bills of lading or airbills will be used as custody documentation during times when the samples are being shipped from the Site to the laboratory and they will be retained as part of the permanent sample custody documentation.

Chain-of-Custody forms will be used to document the integrity of all samples collected. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory, Chain-of-Custody forms will be filled out for sample sets as determined appropriate during the course of fieldwork. An example of the STL Chain-of-Custody form to be used for this Site is included in Appendix 11. The following information will be recorded on all Chain-of-Custody forms:

- sample number (for each sample in the shipment).
- collection date and time (for each sample in the shipment).
- number of containers for each sample.
- sample description (i.e., environmental medium).
- sample type (discrete or composite).
- analyses required for each sample.
- sample preservation technique(s).
- Chain-of-Custody or shipment number.
- shipping address of the laboratory.

- date, time, method of shipment, courier, and airbill number.
- spaces to be signed as custody is transferred between individuals.

The individual responsible for shipping the samples from the field to the laboratory will be responsible for completing the Chain-of-Custody form and noting the date and time of shipment. This individual will also inspect the form for completeness and accuracy.

After the form has been inspected and determined to be satisfactorily complete, the responsible individual will sign, date, and note the time of transfer to the approved shipping company on the form. In the event that samples are shipped to a laboratory in the local area, samples just collected and stored on ice may not have sufficient time to cool to the required temperature of 4°C (± 2°C). The responsible individual will make note of this on the Chain-of-Custody form. The Chain-of-Custody form will then be placed in a sealable plastic bag and placed inside the cooler used for sample transport after the field copy of the form has been detached. If local courier service is used, the documentation can be given to the courier directly. The field copy of the form will be appropriately filed and kept at the site for the duration of the Site activities.

In addition to the Chain-of-Custody form, custody seals will also be placed on each cooler used for sample transport. These seals will consist of a tamper-proof adhesive material placed across the lid and body of the coolers in such a manner that if the cooler is opened the seals will be broken. The custody seals will be used to ensure that no sample tampering occurs between the time the samples are placed into the coolers and the time the coolers are opened for analysis at the laboratory. Cooler custody seals will be signed and dated by the individual responsible for completing the Chain-of-Custody form contained within the cooler. The signature and date will be written on both the cooler lid and cooler body portions of the seals.

8.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample containers will be packaged according to requirements for preservation in transit to laboratories. Samples will be packaged in thermally insulated rigid-body coolers. Empty coolers containing ice or ice substitute will be available at the study area for use each day in the field. Samples collected during the day will be stored in shipping coolers at the time of collection. The coolers will be locked inside the field vehicle when sampling personnel are not present. Packaging and shipping procedures to be utilized for environmental samples collected during the AOC investigations will include the following:

- Sample containers will be adequately identified with sample labels placed onto each container.
- All bottles, except those containing samples designated for volatile organic analyses, will be taped shut. Electrical tape will not be used to tape the sample containers.
- All glass sample bottles will be placed in bubble wrap sleeves.
- Each sample bottle will be placed into a separate plastic bag that will then be sealed. For ground water samples, each of the vials for an individual sample will be placed into the same plastic bag. Trip blank containers will be wrapped and placed in the bag with the aqueous volatile organic analyte vials. As much air as possible will be squeezed from the sample container bags before sealing.
- Regular ice will be placed in all shipping coolers. Ice will be double-bagged in zip-lock bags and be kept in the coolers during the day as samples are collected. Double-bagged ice will be changed out with new bags before shipment at the end of the day.
- All of the sample containers will be placed upright in the shipping coolers along with ice, which will be placed around, among, and on top of the sample containers. Before initial placement of samples into a rigid-body cooler, the cooler drain plug will be taped shut from both the inside and outside, and the cooler will be lined with a large plastic bag.
- Additional inert packing material will be placed into the cooler, if required, to prevent shifting of the sample containers during transport. The plastic bag will be sealed.
- All required laboratory paperwork, including the Chain-of-Custody form(s), will be placed inside a plastic bag and taped to the inside of the cooler lid.
- Upon completion of the packing process, the cooler lid will be closed and two signed/dated custody seals will be placed on the cooler, one across the front and one across the side.
- Rigid-body coolers will be sealed by applying strapping tape directly to the cooler body.
- The airbill, if required for the shipment, will be completed and attached to the top of the shipping box/cooler which will then be transferred to the courier for delivery to the laboratory.

STL will document the condition of the environmental samples upon receipt at the laboratory. This documentation will be accomplished using a cooler receipt checklist. STL's name, address and laboratory point of contact to be used for each project will be identified in the field work order to the SAP.

All environmental and QC samples collected during the project will be shipped no later than 48 hrs after the time of collection. During the time period between collection and shipment all samples will be stored in ice-filled coolers or refrigerators and maintained in a secure area. All coolers containing investigation samples will be shipped overnight to the laboratory by Federal Express or a similar courier.

Each cooler containing aqueous (environmental) samples for volatile organic analysis will contain a trip blank from the time those environmental samples are placed in the cooler for storage and/or shipment. STL will analyze this trip blank for volatile organics upon receipt and compare results to analyses of corresponding environmental samples.

9.0 INVESTIGATION-DERIVED WASTES

IDW includes all materials generated during the performance of the Focused SI work that cannot be effectively re-used, recycled or decontaminated in the field. IDW consists of materials that could potentially pose a risk to human health and the environment (e.g., sampling and decontamination wastes) as well as materials that have little potential to pose risk to human health and the environment (e.g., sanitary solid wastes). Two types of IDW will be generated during the implementation of field activities: indigenous and non-indigenous. Indigenous IDW expected to be generated during the investigation of the AOCs includes soil drill cuttings and ground water from purging direct-push borings. Non-indigenous IDW is expected to consist of decontamination rinse fluids and miscellaneous trash including PPE (gloves, Tyvek, paper towels, etc.). Procedures to be utilized for the collection, storage, characterization and proper disposal of all IDW are described in Sections 9.1 through 9.3, and will be in accordance with General Geology Scope of Work, Appendix A of the SOS (Appendix 5).

9.1 IDW Collection

An estimated 10 drums of cuttings will be generated, assuming one deep boring will generate one-half drum full of cuttings. The level of contamination associated with each AOC is unknown. However, the majority of the soil volume will be from four to fifty ft bgs, where soil samples will not be taken for laboratory analysis and is presumed to be non-hazardous pending the results of the shallower soil samples from the Focused SI. Material from test pits will be returned to the test pits.

All indigenous solid IDW (soil cuttings) generated from soil borings will be collected and segregated by AOC from which they were generated. All indigenous solid IDW will be contained in labeled U. S. Department of Transportation (DOT)-approved open-top 55-gal drums equipped with plastic drum liners and sealed with bung-top lids.

All liquid indigenous (ground water) IDW generated from water sampling will be segregated by AOC. All liquid indigenous IDW will be collected in labeled DOT-approved, 55-gal closed-top drums.

All solid non-indigenous (expendable sampling equipment and trash) IDW will be segregated as non-contaminated and potentially contaminated material. Potentially contaminated and non-contaminated solid non-indigenous IDW will be identified in the field on the basis of visual inspection (e.g., soiled versus non-soiled), usage of the waste material (e.g., outer sampling gloves versus glove liners), and field screening of the material using available field instrumentation (e.g., organic vapor analyzer). All non-indigenous, non-contaminated IDW will be segregated from potentially contaminated non-indigenous IDW. Potentially contaminated non-indigenous IDW will be consolidated with the indigenous IDW. Non-contaminated debris will be double bagged and disposed of as non-hazardous waste.

9.2 Labeling and Storage

All liquid non-indigenous (decontamination rinse water) IDW will be contained in labeled DOT-approved 55-gal closed-top drums. All drums will be labeled immediately before and continuously during their use to ensure proper management of the contained wastes. The following procedure will be used for waste container labeling:

> Weather-resistant commercial EPA hazardous waste stickers or non-hazardous waste sticker labels will be affixed and located on the top and two sides on the upper one-third of each storage container. Additional label information may be recorded directly on a clean, dry drum surface

using an indelible white or silver paint marker. All containers, including empty ones, will be properly identified labeled. Each sticker and/or label will be placed on a smooth part of the container and will not be affixed across drum bungs, seams, ridges, or dents. Information to be recorded on each container label will include the following:

- Container number.
- Contents.
- Source of waste.
- Source location (AOC and sample location number).
- Project name and site identification.
- Physical characteristic of the waste.
- Generation date(s).

All information documented on the container labels will be recorded with a permanent marker or paint pen and recorded in the field logbook. All container labels will be protected in a manner to prevent damage or degradation of the recorded information.

Subject to the review and approval of USACE before the start of a project, the Site Supervisor will designate an on-site area for storage of IDW pending characterization and disposal.

9.3 IDW Characterization and Classification for Disposal

Actual testing and disposal of IDW will be based on the results of the Focused SI sampling and analysis. IDW testing will likely only be required if high levels of COPCs are found. Disposal will be consistent with applicable Federal, State, and local regulations or guidance. Bay West will obtain approval from USACE PM on all decisions regarding IDW disposition.

If characterization of IDW is necessary, all indigenous IDW (soil cuttings and ground water) will be characterized for disposal on the basis of analytical results from environmental samples or from direct analysis of composite IDW samples.

Non-indigenous IDW, except for PPE and expendable sampling equipment, will be characterized for disposal on the basis of composite samples collected from segregated waste stream storage containers. Composite waste samples will be submitted for laboratory analysis to characterize each waste stream for disposal.

10.0 FIELD ASSESSMENT/THREE-PHASE INSPECTION PROCEDURES

10.1 Contractor Quality Control

Bay West will maximize Contractor Quality Control (CQC) by retaining program, project, and Site management functions. Bay West will execute this Task Order using subcontractor contractual arrangements with team members, including risk assessment, drilling, laboratory, and transportation and disposal subcontractors.

Subcontracts will be carefully formulated by the Project Manager to reflect detailed scope, realistic performance objectives, and specifications. Provisions of the basic contract, health and safety requirements, and QA/QC requirements will be 'Flowed-down', as appropriate. Other provisions will install strict procedures for implementing change orders, expediting disputes, and implementing CAs. The performance baseline will be developed jointly with key team subcontractors and discrete tasks and milestones will be formally entered into the management control system. Performance against the fiscal and project schedule baseline will be monitored informally by the Project Manager on a weekly basis and formally each month as part of the total project status review.

The field performance of all subcontractors will be monitored at all times by the Site Supervisor/SSHO who will record observations of progress in a formal daily log and discuss project status daily with the Project Manager. Deviations from the baseline will be closely monitored. Negative performance trends will instigate an interim performance review and discussions with Bay West contract management personnel. As required, a CA plan will be developed to bring schedule/cost performance back in line with the baseline.

10.2 Sampling Apparatus and Field Instrumentation Operation and Maintenance

Proper maintenance, calibration, and operation of each field device will be the responsibility of the Site Supervisor assigned to the project. All instruments and equipment used during the field activities will be maintained, calibrated, and operated according to the manufacturer's guidelines and recommendations. When appropriate, field equipment will be calibrated prior to use in the field.

Manufacture manuals accompany all field equipment that contains the calibration procedures for each field meter. Copies of the instrument manuals will be maintained in the field vehicle. A record of field calibration of analytical instruments will be maintained by field personnel on the instrument calibration log and the Site logbook. In addition, any notes on unusual results, changing of standards, battery charging, and operation and maintenance will be included in the logbook.

All instruments are to be stored, transported, and handled with care in accordance with the handling instructions in the operating manuals to preserve equipment accuracy. Damaged instruments will be taken out of service immediately and not used again until a qualified technician repairs and recalibrates the instruments.

Section 9.3 of the SSHP describes the monitoring equipment and calibration frequency. In summary, the following monitoring equipment will be used at the Site: Gas Combustible Indicator (GCI) with Oxygen Sensor; PID or FID; and a Particulate/Dust Monitor. A summary of operating directions and model numbers for these instruments can be found in Appendix 8 of the SSHP.

11.0 NONCONFORMANCE/CORRECTIVE ACTIONS

CA is dictated by the type and extent of nonconformance. When errors, deficiencies or out-of-control situations exist, the quality assurance program provides systematic procedures, called CAs, to resolve problems and restore proper functioning to the measurement system. A CA may be initiated and carried out by non-supervisory staff but final approval and data review by management is necessary before reporting any information. All potentially affected data must be thoroughly reviewed for acceptance or rejection. A summary of possible CAs is presented in the Table 7.

Field Activities: Field personnel who identify a nonconformance should report the condition immediately to the Site Supervisor. The Site Supervisor will document the nonconformance on a NCR (Appendix 12) and initiate immediate CA. If the CA represents a significant deviation from the SAP the Bay West Site Supervisor will immediately alert the Bay West Project Manager. The Bay West Project Manager will discuss the work plan deviation with the USACE Project Manager to receive approval prior to initiating the CA. Upon completion of the approved CA the Bay West Site Supervisor will verify the implementation.

Laboratory Activities: Laboratory CAs range from flagging the data to re-preparation and re-analysis of the affected samples depending on the severity of the nonconformance and the effect on data quality. The laboratory will notify Bay West of any nonconformance which impact data quality so that it may be involved in the CA process. Laboratory CA procedures are detailed within the STL-Denver Laboratory Quality Manual (LQM) Section 9.0, Quality Assessment and Response.

Table 7. Corrective Action Summaries

QC Sample Type	Frequency	Acceptance Limits	Corrective Action
Field Duplicate	As specified in the SAP (in general a 10% frequency).	See measurement quality objectives tables; Appendix 4.	Qualify data according to data validation requirements.
Field Equipment Blank	1 per day of aqueous sampling, per non-disposable aqueous sampling equipment. Minimum of 1 per 10.	< PQL.	Identify source of contamination if feasible. Bay West data qualification according to validation criteria regarding data usability(1).
Temperature Blank	1 blank per sample cooler.	4 +/- 2 degrees Celsius.	Laboratory action taken per sample receipt protocol including Bay West notification. Bay West data qualification according to validation criteria regarding data usability(1).
Laboratory Control Sample	1 in every analytical batch of up to 20 samples.	See measurement quality objectives tables.	Laboratory action taken per method SOP which may include up to re-extraction and re-analysis of entire analytical batch. Bay West data qualification according to validation criteria regarding data usability (1).

Table 7. Corrective Action Summaries

QC Sample Type	Frequency	Acceptance Limits	Corrective Action
MS/MSD	MS/MSD pair in every analytical batch of up to 20 samples.	See measurement quality objectives tables; Appendix 4.	Laboratory action taken per method SOP which may include data qualification, but typically not re-extraction and re-analysis. Bay West data qualification according to validation criteria regarding data usability(1).
Surrogate	Surrogates used in each sample and QC sample.	See method SOPs.	Laboratory action taken per method SOP which may include up to re-extraction and re-analysis of entire analytical batch. Bay West data qualification according to validation criteria regarding data usability(1).
Internal Standards and Retention Time Windows	Internal standards used VOC, SVOC, and PAH analysis.	Response area counts and retention times within SOP specified ranges.	Laboratory action taken per method SOP which may include re-analysis of entire analytical batch. If laboratory CA not acceptable, Bay West data qualification according to validation criteria regarding data usability(1).
Laboratory Method Blank	1 MS/MSD pair in every analytical batch of up to 20 sample.	< PQL.	Laboratory action taken per method SOP which may include up to re-extraction and re-analysis of entire analytical batch. Bay West data qualification according to validation criteria regarding data usability(1).

Notes:
(1) Bay West data qualification will be based on professional judgment using the National Functional Guidelines, MPCA data validation guidelines, and the data qualifiers presented in Section 6.2, of Part II QAPP, of this SAP. Data may be unqualified, qualified and flagged, or rejected depending on the results.

As necessary, reports documenting the QA assessments/audits will be submitted to the USACE as specified in Table 8. These assessments will include Field and Laboratory Analytical Data Package Technical Reviews. Observed nonconformance(s) will be recorded on NCRs. All QA activities, assessments, documentation, CAs, changes in personnel, modifications to the SAP, and any other issues potentially affecting data quality will be summarized and detailed in the investigation report.

Table 8. Summary of QA Management Reports

Type of Report	Frequency	Person responsible for Report Preparation	Report Recipients	Comments
NCR	As necessary and immediately upon recognition.	Lab – Lab staff recognizing nonconformance.	Lab – Lab QA Officer and the Bay West Project and CQCO.	NCRs included in Report to USACE PM as deemed appropriate by the Bay West Project and CQCO.
		Field – Field staff recognizing nonconformance	Field – Bay West Project and CQCO.	
CA Reports	As necessary and upon resolution of non-conformance.	Lab – Direct Supervisor responsible for identified function	Lab – CAR received and approved by Lab CQCO.	CARs included in Report to USACE PM as deemed appropriate by the Bay West Project and CQCO.
		Field - Direct Supervisor responsible for identified function.	Field - CAR received and approved by Bay West CQCO.	
Analytical Data Package Technical Review	Lab – Upon receipt of each deliverable.	Bay West CQCO.	Bay West Project Manager.	Included in Report to USACE PM.
	Field – Upon completion of each sampling round.			

12.0 DATA EVALUATION AND RISK CHARACTERIZATION ACTIVITIES

The screening level risk assessment will be conducted in accordance with the Screening-Level Risk Assessment Scope of Work, Appendix D of the SOS (Appendix 13). The screening level risk assessment will be subdivided into two sections, Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA). The screening level risk assessment will be used to evaluate each AOC to see if it can be eliminated from further concern.

Section 4.1.1 includes a preliminary CSM based on the Site history and an initial Site reconnaissance. The CSM provides sufficient detail to direct the sampling efforts to ensure receptor populations, exposure pathways, and routes are evaluated.

12.1 Screening-Level Human Health Risk Assessment

This section provides an overview of the screening-level HHRA process that will be implemented for seven AOCs located at FGOW. The screening-level HHRA will be conducted based on guidance from the *Risk Assessment Guidance for Superfund (RAGS), Part A, Human Health Evaluation Manual (USEPA, 1989)* and will contain the following primary steps, which are described in the subsections below:

- Exposure assessment.
- Health-based screening levels.
- Risk screening.
- Characterization of uncertainty.
- Results of the screening-level HHRA.

12.1.1 Exposure Assessment

The two primary elements of the exposure assessment are identifying the appropriate receptor group or groups and selecting appropriate exposure point concentrations.

Potential Human Receptors: The potential human receptors and exposure routes to be evaluated at the Site were selected considering current and future potential land use and MPCA RBSE Guidance. For the purposes of this evaluation, Bay West assumed that future land use will remain similar to current land use. Based on information available regarding the physical features, site setting, site historical activities, and current and expected land uses, three potential human receptors have been selected for evaluation at the Site. These include:

- Recreational Users.
- Casual Trespassers in Secured Areas.
- Agricultural/Commercial/Industrial Workers.

Potential human exposure pathways associated with this Site include: ingestion, dermal contact, and inhalation exposures to contaminants in soil by recreational users, casual trespassers in secured areas, and workers on the property (agricultural/commercial/industrial short-term worker exposure scenarios); ground water ingestion exposures, terrestrial food chain exposures due to surface soil contamination (plant uptake), and dermal contact and ingestion exposures to contaminants in surface water and sediment that have migrated to surface water with ground water and/or surface run-off.

Exposure Point Concentrations (EPCs): The highest detected chemical concentration in a medium shall be used as the EPC unless the range of concentrations detected as well as the number of samples collected allows a 95% Upper Confidence Limit (UCL) to be calculated. In those cases where a 95% UCL can be calculated the following application will be used.

USEPA's most recent guidance, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (USEPA, 2002)*, provides tools to calculate upper confidence limits to be used as EPCs in risk assessments. The USEPA 2002 guidance recommends the use of the software package, ProUCL (USEPA, 2004b), to calculate upper confidence limits for use in risk assessments. The most recent version of ProUCL will be used.

The ProUCL software has been developed by USEPA to compute an appropriate 95% UCL of the unknown population mean. All upper confidence limit computation methods contained in the USEPA guidance documents are available in ProUCL, Version 3.00.02. ProUCL tests for normality, lognormality, and a gamma distribution of the data set, and computes a conservative and stable 95% UCL of the unknown population mean (assuming the data set consists of points from a single population) (USEPA, 2004b). Several parametric and distribution-free non-parametric methods are included in ProUCL. The upper confidence limit computation methods in ProUCL cover a wide range of skewed data distributions arising from the various environmental applications.

12.1.2 Health-Based Screening Levels

In accordance with the MPCA RBSE Manual, COPC analytical results will be compared to the background levels and regulatory screening criteria, if available. Preliminary regulatory screening criteria to be used are specified in the MPCA RBSE Guidance and the USEPA Region 9 PRG Table (USEPA, 2004). A more detailed description of these criteria is presented in Section 4.1.3 and the USEPA Region 9 PRGs are described below. It should be noted that preliminary screening criteria will be further evaluated and refined during the Risk Assessment process.

USEPA Region 9 PRGs: The USEPA Region 9 PRGs are tools for determining preliminary COPCs for human health risk assessments as part of evaluating and cleaning up contaminated sites. They are risk based concentrations derived from standardized equations (representing ingestion, dermal contact, and inhalation exposure pathways), combining exposure information assumptions and USEPA toxicity data. The PRGs contained in the Region IX PRG Table are generic; they are calculated without site-specific information. Region IX PRGs should be viewed as USEPA guidelines, not legally enforceable standards. The PRGs for potentially carcinogenic chemicals are based on a target Incremental Lifetime Cancer Risk (ILCR) of 1x10-6. The PRGs for noncarcinogens are based on a target hazard quotient of 1.0. For potential carcinogens, the toxicity criteria applicable to the derivation of PRG values are oral and inhalation Cancer Slope Factors (CSFs); for noncarcinogens, they are chronic oral and inhalation reference doses (RfDs). These toxicity criteria are subject to change as more updated information and results from the most recent toxicological/epidemiological studies become available. The PRG table is updated annually to reflect such changes. It should be noted that the most recent update was in October 2004 (USEPA, 2004a).

12.1.3 Risk Screening

The risk screening process will select chemicals detected at the Site on a medium-specific basis for which the potential for the occurrence of adverse effects to human receptors following exposure are qualitatively estimated. The selection of these chemicals will be based on the information provided in USEPA's RAGS, Part A (USEPA, 1989).

The first step taken in risk screening will be comparing the maximum detected concentration in soil, ground water, surface water, and/or sediment to the screening criteria. In conjunction with concentration comparisons to the screening criteria, a comparison to concentrations of chemicals detected in field and laboratory blanks will be also conducted to ensure that only site-related contaminants were evaluated in the qualitative estimation of human health effects. The maximum detected inorganic concentrations will also be compared to background or naturally-occurring (anthropogenic) levels specific to the Site. Furthermore, those inorganic constituents considered essential nutrients (which have relatively low toxicity) will not be evaluated.

In order to account for cumulative risk from multiple chemicals in a medium, the noncarcinogenic PRGs (or other health-based screening criteria, if applicable) will be divided by ten (yielding a hazard index of 0.1) or by the number of noncarcinogenic chemicals in a medium, whichever is more conservative. For carcinogens, eliminated chemicals will be reviewed to ensure the cumulative risk of these chemicals is less than the cancer risk level of 1 x 10-05.

12.1.4 Characterization of Uncertainty

Uncertainties are encountered throughout the process of performing a screening-level HHRA including, but not limited to, the following elements of the evaluation:

- Sampling and analysis.
- Limited chemical database for the Site.
- Use of maximum chemical concentrations for exposure point concentrations.
- Use of highest exposure receptors.
- The application of the health-based screening value and the inherent assumptions used in its derivation.

These potential sources of uncertainty, as well as others that may be identified, will be addressed in the screening-level HHRA.

12.1.5 Results of the Screening-Level HHRA

This section will summarize the results of the screening-level HHRA, indicating its strengths and weaknesses. This section will also discuss the range of chemical concentrations detected, how far the health-based screening levels have been exceeded, effects of multiple chemicals, and the appropriateness of the values themselves. This information will be used in the process of determining if a site should be eliminated from further concern.

12.2 Screening-Level Ecological Risk Assessment

This section presents the technical approach (described in general terms) for conducting screening-level ERAs at the seven AOCs at FGOW.

The ERA process at each AOC will be conducted in accordance with the Screening-Level Risk Assessment Scope of Work, Appendix D of the SOS (Appendix 13) and the *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA, 1997). The EPA ERA guidance consists of eight steps. The first two steps in this eight-step process represent the screening-level ERA:

- Screening-level problem formulation and ecological effects evaluation (Step 1).
- Screening-level exposure estimate and risk calculation (Step 2).

12.2.1 Screening-Level Problem Formulation

The screening-level problem formulation is the first phase of the ERA process and establishes the goals, scope, and focus of the screening-level ERA. Major components of the screening-level problem formulation includes:

- Environmental Setting: A general description of the site history and site features, with emphasis on the habitats and ecological receptors known or likely to be present on or near the site. This description is typically based on existing information and mapping.
- Existing Analytical Data: A summary of existing analytical chemistry data for ecologically relevant media at the site.
- Contaminant Fate and Transport Mechanisms: A characterization of known or potential contaminant sources and the likely transport mechanisms (if any) to ecological habitats based on the fate properties of the source-related chemicals. The mechanisms of toxicity for these chemicals are also considered.
- Exposure Routes and Pathways: An evaluation of potential exposure routes and a determination of the existence of any potentially complete exposure pathways.
- Conceptual Model: The screening-level problem formulation culminates in the development of a conceptual model, which describes how chemicals associated with the site may come into contact with ecological receptors.
- Endpoint Selection: Assessment and measurement endpoints to be evaluated in the screening-level ERA are selected for potentially complete exposure pathways identified in the conceptual model.
- Selection of Receptors: Receptor species are selected at each AOC based on the environmental setting and the selected assessment endpoints.

These major components of the screening-level problem formulation are described in more detail in the following sections. This phase of the ERA process is intended to answer two main questions: (1) do complete exposure pathways exist at the site; and (2) are sufficient data available to conduct the screening-level ERA?

12.2.1.1 Environmental Setting

As described above, the description of the environmental setting focuses on the AOC history (how the AOCs were used in the past and how they are currently being used), physical features, habitats, and biota, and the existing analytical chemistry data for ecologically relevant media.

Information on the site history provides an indication of the types of chemicals possibly used by DOD expected on the site and the media in which they are likely to be present. The physical features of the site including geological (e.g., soils), hydrogeological (e.g., surface water and ground water flow patterns), and climatologic (e.g., precipitation) parameters are important in determining how chemicals from source areas could be transported to ecological habitats. Sources of this information may include: site-specific documents, facility personnel, available mapping, soil survey documents, weather records, and site visits. Much of this information is included in Section 3.1.

Descriptions of the habitat types and ecological receptors known or likely to be present on the site are an important part of describing the environmental setting. This can encompass aquatic habitats (e.g., creeks) and receptors (e.g., fish), wetland habitats (e.g., marshes) and receptors (e.g., amphibians), and/or terrestrial habitats (e.g., forests) and receptors (e.g., wildlife and vegetation). Sources of this information may include facility-specific documents, available mapping, the literature, and site visits.

12.2.1.2 Existing Analytical Data

The existing analytical data for ecologically relevant media will be compiled and evaluated. The evaluation will consider such factors as sample size, sample location, analytical parameters, and reporting limits to determine if the available data are adequate to conduct the screening-level ERA.

12.2.1.3 Contaminant Fate and Transport Mechanisms

In the absence of measured values of chemicals within biotic media, the transport and partitioning of constituents into particular environmental compartments, and their ultimate fate in those compartments, can be predicted from key physical-chemical characteristics. The physical-chemical characteristics that are most relevant for exposure modeling in this assessment include water solubility, adsorption to solids, and octanol-water partitioning. These characteristics are defined below.

The water solubility of a compound influences it's partitioning to aqueous media. Highly water-soluble constituents, such as most VOCs, have a tendency to remain dissolved in the water column rather than partitioning to sediment (Howard 1991). Compounds with high water solubility also generally exhibit a lower tendency to bioconcentrate in aquatic organisms and a greater likelihood of biodegradation, at least over the short term (Howard 1991).

Adsorption is a measure of a compound's affinity for binding to solids, such as soil or sediment particles. Adsorption is expressed in terms of partitioning, either adsorption coefficient (Kd) (a unitless expression of the equilibrium concentration in the solid phase versus the water phase) or as organic carbon partition coefficient (Koc) (Kd normalized to the organic carbon content of the solid phase; again unitless) (Howard 1991). For a given organic chemical, the higher the Koc or Kd, the greater the tendency for that chemical to adhere strongly to soil or sediment particles. Koc values can be measured directly or can be estimated from either water solubility or the octanol-water partition coefficient using one of several available regression equations (Howard 1991).

Octanol-water partitioning indicates whether a compound is hydrophilic or hydrophobic. The Octanol-water partition coefficient (Kow) expresses the relative partitioning of a compound between octanol (lipids) and water. A high affinity for lipids equates to a high Kow and vice versa. As discussed above, Kow has been shown to correlate well with Bioconcentration Factors (BCFs) in aquatic organisms, adsorption to soil or sediment particles, and the potential to bioaccumulate in the food chain (Howard 1991).

12.2.1.4 Exposure Routes and Pathways

An exposure pathway links a source of contamination with one or more receptors through exposure to one or more ecologically relevant media. Exposure, and thus potential risk, can only occur if complete exposure pathways exist.

An exposure route describes the specific mechanism(s) by which a receptor is exposed to a chemical present in an environmental medium. The most common exposure routes are dermal contact, direct uptake, ingestion, and inhalation. Terrestrial vegetation may be exposed to chemicals present in surface soils through their root surfaces during water and nutrient uptake. Unrooted, floating aquatic plants, rooted submerged aquatic plants, and algae may be exposed to chemicals directly from the water or for rooted plants from sediments. Terrestrial and aquatic invertebrates may be exposed to chemicals in surface soil, sediment, or surface water through dermal adsorption and ingestion. Much of the toxicological data available for terrestrial and aquatic invertebrates are based on in-situ studies that represent both pathways. Therefore, both pathways are typically considered together. Invertebrates also present a link between soil/sediment chemicals and invertebrate consumers through food web transfer. As such, they are typically included as prey items for upper trophic level dietary exposures.

Birds and mammals may be exposed to chemicals through: (1) the inhalation of gaseous chemicals or chemicals adhered to particulate matter; (2) the incidental ingestion of contaminated abiotic media (e.g., soil or sediment) during feeding or cleaning activities; (3) the ingestion of contaminated water; (4) the ingestion of contaminated plant and/or animal tissues for chemicals that have entered food webs; and/or (5) dermal contact with contaminated abiotic media. Their relative importance depends in part on the chemical being evaluated. For chemicals having the potential to bioaccumulate (e.g., PCBs), the greatest exposure to wildlife is likely to be from the ingestion of prey. For chemicals having a limited potential to bioaccumulate (e.g., aluminum), the exposure of wildlife to chemicals is likely to be greatest through the direct ingestion of abiotic media, such as soil or sediment.

12.2.1.5 Conceptual Model

The conceptual model is designed to diagrammatically relate potentially exposed receptor populations with potential contaminant source areas based on the physical nature of the AOCs and potential exposure pathways. Important components of the conceptual model are the identification of potential sources of contaminants, transport pathways, exposure media, potential exposure routes, and potential receptor groups. Actual or potential exposures of ecological receptors associated with a given AOC will be determined by identifying the most likely pathways of contaminant release and transport. A complete exposure pathway has four components: (1) a source of chemicals that can be released to the environment; (2) a release and transport mechanism to move the chemicals from the source to an exposure point; (3) an exposure point where ecological receptors could contact the affected media; and (4) an exposure route whereby chemicals can be taken up by ecological receptors.

The main objective of the conceptual model in Step 1 of the ERA process is to identify any complete exposure pathways present at a site. The site-specific ERAs will provide conceptual models that relate directly to the AOCs under consideration.

12.2.1.6 Endpoints and Risk Hypotheses

The screening-level problem formulation includes the selection of ecological endpoints. Endpoints in the screening-level ERA define ecological attributes that are to be protected (assessment endpoints) and a measurable characteristic of those attributes (measurement endpoints) that can be used to gauge the degree of impact that has or may occur (EPA, 1992b, 1997, and 1998). Assessment endpoints most often relate to attributes of biological populations or communities, and are intended to focus the risk assessment on particular components of the ecosystem that could be adversely affected by chemicals attributable to the site (EPA, 1997). Assessment endpoints contain an entity (e.g., red-tailed hawk) and an attribute of that entity (e.g., survival rate). Individual assessment endpoints usually encompass a group of species or populations (the receptor) with some common characteristic, such as specific exposure route or contaminant sensitivity, with the receptor then used to represent the assessment endpoint in the risk evaluation.

The considerations for selecting assessment and measurement endpoints are summarized in EPA (1992b and 1997) and discussed in detail in Suter II (1989, 1990, and 1993). Assessment and measurement endpoints may involve ecological components from any level of biological organization, from individual organisms to the ecosystem (EPA, 1992b). Effects on individuals are important for some receptors, such as rare and endangered species, but population and community-level effects are typically more relevant to ecosystems. Population and community-level effects are usually difficult to evaluate directly without long-term and extensive study. However, measurement endpoint evaluations at the individual level, such as an evaluation of the effects of chemical exposure on reproduction, can be used to predict effects on an assessment endpoint at the population or community-level. In addition, use of criteria values designed to protect the vast majority (e.g., 95 percent) of the components of a community (e.g., National Ambient Water Quality Criteria [NAWQC] for the Protection of Aquatic Life) can be useful in evaluating potential community and/or population-level effects.

The most appropriate generic assessment endpoint for ERAs will be the maintenance of receptor populations. Therefore, the specific objective of the ERA will be to determine if exposure to site-related chemicals present in surface water, sediment, and/or surface soil are likely to result in declines in ecological receptor populations. Declines in populations could result in a shift in community structure and possible elimination of resident species.

Measurement endpoints are used in ERAs because it is often difficult or impossible to directly assess whether the environmental value that is to be protected (the assessment endpoint) is being impacted. For example, an assessment endpoint may involve a decline in a particular population or a shift in the structure of a community. While these things might be quantifiable, the necessary studies would generally be time-consuming and difficult to interpret. However, measurement endpoints indicative of observed adverse effects on individuals are relatively easy to measure in toxicity studies and can be related to the assessment endpoint. For example, contaminant concentrations that lead to decreased reproductive success or increased mortality of individuals in toxicity tests could, if found in the environment, result in shifts in population structure, potentially altering the community composition associated with a site.

Risk hypotheses are testable hypotheses about the relationship among the assessment endpoints and their predicted responses when exposed to chemicals. Although EPA (1997) prescribes that risk hypotheses be developed in Step 3 (screening level risk assessment problem formulation), it is generally useful to develop preliminary risk hypotheses as part of the screening-level problem formulation.

12.2.1.7 Selection of Receptors

Because of the complexity of natural systems, it is generally not possible to directly assess the potential impacts to all ecological receptors present within an area. Therefore, receptor species (e.g., red-tailed hawk) or species groups (e.g., terrestrial invertebrates) are often selected as surrogates to evaluate potential risks to larger components of the ecological community (guilds; e.g., insectivorous birds) represented in the assessment endpoints (e.g., survival and reproduction of insectivorous birds). Selection criteria typically include those species that:

- Are known to occur, or are likely to occur, at the site.
- Have a particular ecological, economic, or aesthetic value.
- Are representative of taxonomic groups, life history traits, and/or trophic levels in the habitats present at the site for which complete exposure pathways are likely to exist.
- Can, because of toxicological sensitivity or potential exposure magnitude, be expected to represent potentially sensitive populations at the site.
- Have sufficient ecotoxiological information available on which to base an evaluation.

Upper trophic level receptor species will be chosen for dietary exposure modeling based on the criteria listed above, the general guidelines presented in EPA (1992b), the environmental setting (e.g., habitats), and the assessment endpoints selected at each AOC.

Lower trophic level receptor species (e.g., terrestrial and aquatic invertebrates and plants) are generally evaluated in screening-level ERAs based on those taxonomic groupings for which screening values have been developed. These groupings and screening values are used in most ecological risk assessments. As such, specific species of lower trophic level biota will not be chosen as receptor species because of the limited information available for specific species and because these biota are dealt with on a community level via a comparison to media-specific screening values.

12.2.2 Screening-Level Problem Formulation Decision Point

As discussed in Section 12.2.1 the screening-level problem formulation is intended to answer two main questions: (1) do complete exposure pathways exist at the AOC; and (2) are sufficient data available to conduct the screening-level ERA? Complete exposure pathways from a source area are likely to exist if all of the following are present:

- Habitat that supports ecological receptor populations (note that ecological habitat may be absent due to chemical contamination or habitat alteration).
- Contaminant transport pathways to ecologically relevant media. Although a site may contain no or marginal ecological habitat, it will be assessed if site-related chemicals have the potential to migrate to areas containing more extensive or more viable habitat. A site of this nature may contribute to overall contamination in the watershed in which it exists.
- Complete exposure routes.

If no complete exposure pathways exist at a site the ERA process will terminate at the screening-level problem formulation with a conclusion of negligible risk. If one or more complete exposure pathways are known or likely to exist, the ERA process will continue to the screening-level ecological effects evaluation, screening-level exposure estimation, and screening-level risk calculation but will only evaluate those pathways that have been determined to be complete.

12.2.3 Screening-Level Ecological Effects Evaluation

The purpose of the screening-level ecological effects evaluation is the establishment of chemical exposure levels (screening values) that represent conservative thresholds for adverse ecological effects. One set of screening values is typically developed for each of the selected assessment endpoints. The completed screening-level ERA will contain tables listing the screening values selected by medium.

Two types of screening values (media-specific screening values and ingestion-based screening values) will be developed. Media-specific screening values will be developed for ecologically relevant media at each AOC (e.g., surface soil). Media-specific screening values will be developed for ecologically relevant media at each AOC (e.g., surface soil). Potential sources of toxicological benchmarks that will be used to develop the media-specific screening values are listed below. Additional sources will be investigated during preparation of the screening-level ERA.

- State and Federal Ambient water Quality Criteria.
- USEPA, National Oceanic and Atmospheric Administration (NOAA), and Ontario sediment criteria and guidelines.
- USEPA Ecological Soil Screening Levels (Eco-SSLs) available at http://www.epa.gov/ecotox/ecossl/.
- USEPA online databases (e.g., ECOTOX).
- Oak Ridge national Laboratory benchmarks (Efroymson et al, 1997a and 1998).
- U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM).
- USEPA Region or state benchmarks or guidance values.

Ingestion-based screening values for dietary exposures will be derived for each receptor species and chemical evaluated for food web exposures. Toxicological information from the literature for wildlife species most closely related to the receptor species will be used if available. This information will be supplemented by laboratory studies of non-wildlife species (e.g., laboratory mice) when necessary.

Chronic No Observed Adverse Effect Levels (NOAELs) based on growth or reproduction will be preferentially used as ingestion-based screening values for upper trophic level receptors. NOAELs represent the highest dose of a chemical at which an effect being measured in a toxicity test does not occur. If several chronic toxicity studies are available from the literature for a given chemical, the most appropriate study will be selected for each receptor species based on study design, study methodology, study duration, study endpoint, and test species. When chronic NOAEL values are unavailable, estimates will be derived or extrapolated from chronic Lowest Observed Adverse Effect Levels (LOAELs) or acute values (LD50). LOAELs represent the lowest dose of a chemical at which an effect being measured in a toxicity test occurs, while an LD50 represents the dose of a chemical at which half of the organisms being tested die. An uncertainty factor of 10 will be used to convert a reported LOAEL to a NOAEL, while an uncertainty factor of 100 will be used to convert the acute LD50 to a chronic NOAEL (i.e., the LD50 will be multiplied by 0.01 to obtain the chronic NOAEL).

Not all chemicals analyzed in ecologically relevant media will be evaluated for food web exposures. The specific chemicals evaluated for food web exposures will be limited to those identified as important bioaccumulative chemicals in *Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment, Status and Needs* (EPA, 2000).

12.2.4 Screening-Level Exposure Estimation

This portion of the screening-level ERA involves the identification of the data to be used to represent concentrations of chemicals to which ecological receptors may be exposed to in various media and the derivation of EPCs from those data (typically the maximum detected concentration). Exposure assumptions, exposure models, and model input parameters are also presented and discussed.

12.2.4.1 Selection Criteria for Analytical Data

Available analytical data for ecologically relevant media will be selected for use in the screening-level ERA based on a set of selection criteria that will include:

- Data must be validated by a qualified data validator using acceptable data validation methods. Rejected (R) values will not be used in the ERA. Unqualified data and data qualified as J will be treated as detected. Data qualified as U or UJ will be treated as non-detected.
- Maximum reporting limits will be conservatively used to estimate exposure for non-detected chemicals.
- In some instances, duplicate samples may be collected in the field. The maximum concentration of each chemical in the original or duplicate sample will be used as a conservative estimate of chemical concentrations at a particular sampling point.
- For surface soil, analytical data for samples collected from the surface to a maximum depth of one foot bgs will be used since this depth range is the most active biological zone (Suter II, 1995).
- For surface water, total (unfiltered) metal concentrations will be used for comparison to surface water screening values.

12.2.4.2 Exposure Point Concentrations – Abiotic Media

Maximum detected concentrations in abiotic media (e.g., surface soil) will be used to conservatively estimate potential chemical exposures for the ecological receptors selected to represent the assessment endpoints. For conservatism, the maximum detection limit for chemicals that were analyzed but not detected also will be compared to medium-specific screening values and (where applicable) used for food web exposure modeling. This will be done to ensure that detection limits were similar to, or less than, chemical concentrations at which potential adverse effects to ecological receptors may occur. For samples with duplicate analyses, the higher of the two concentrations will be used in the screening (when both values were detects or both values were non-detects). In cases where one result is a detection and the other a non-detect, the detected value will be used in the assessment.

12.2.4.3 Exposure Point Concentrations – Prey items

Exposures for upper trophic level receptor species via the food web will be determined by estimating the chemical-specific concentrations in each dietary component using uptake and food web models. Ingestion of abiotic media, if appropriate, will also be included when calculating the total level of exposure. As indicated previously, maximum measured concentrations in abiotic media will be used in all calculations to provide a conservative assessment.

Estimates for food web exposures will be based on bioaccumulation factors developed from the literature. The uptake of chemicals from the abiotic media into these food items will be based on conservative (e.g., maximum or 90th percentile) BCFs or bioaccumulation factors (BAFs). Default factors of 1.0 (dry weight to dry weight) will be used only where data are unavailable for a chemical in the literature. The completed screening-level ERAs for each AOC will contain tables listing the BAFs/BCFs selected for each prey item. The methodology and models used to derive these estimates will also be included within the completed screening-level ERAs.

Dietary intakes for each upper trophic level receptor species selected to represent the assessment endpoints will be calculated using the following formula (modified from EPA [1993]):

$$DI_x = \frac{[[\sum_i [(FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)] + [(WIR)(WC_x)]][AUF]}{BW}$$

Where:

DIx	=	Dietary intake for chemical x (mg chemical/kg body weight/day)
FIR	=	Food ingestion rate (kg/day, dry weight)
FCxi	=	Concentration of chemical x in food item i (mg/kg, dry weight)
PDFi	=	Proportion of diet composed of food item i (dry weight basis)
SCx	=	Concentration of chemical x in soil/sediment (mg/kg, dry weight)
PDS	=	Proportion of diet composed of soil/sediment (dry weight basis)
WIR	=	Water ingestion rate (L/day)
WCx	=	Concentration of chemical x in water (mg/L)
BW	=	Body weight (kg, wet weight)
AUF	=	Area Use Factor (unitless)

It is noted that ingestion of water will be only be considered at those AOCs with a drinking water source. As discussed in EPA (1997), exposure parameter values used in this food web model will be selected to provide for a conservative evaluation in the screening-level ERA. Examples of these conservative assumptions include:

- All of the dietary items consumed by the receptor are obtained from the site (i.e., an Area Use Factor [AUF} of one will be assumed) at the point of maximum concentrations.
- Chemicals are assumed to be 100 percent bioavailable.
- Maximum ingestion rates will be used (calculated maximum ingestion rates are based on the maximum body weight).
- Minimum body weights will be used.

12.2.5 Screening-Level Risk Calculation

The screening-level risk calculation is the final step in a screening-level ERA. In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper trophic level receptor species) are compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of ecological COPCs for each medium-pathway-receptor combination evaluated or a conclusion of negligible risk.

Ecological COPCs will be selected using the hazard quotient (HQ) method. HQs are calculated by dividing the maximum chemical concentration in the medium being evaluated, by the corresponding medium-specific screening value or, in the case of upper trophic level receptors, by dividing the exposure dose, by the corresponding ingestion-based screening value. Chemicals with HQs greater than or equal to 1.0 will be considered ecological COPCs in the screening-level ERA.

The following conservative methodology will be used to identify ecological COPCs for abiotic media:

- The maximum detected concentration in each ecologically relevant media will be used to calculate media-specific HQs. For a given medium, chemicals with HQs greater than or equal to 1.0, based on maximum detected concentrations will be identified as ecological COPCs for that medium.
- For chemicals not detected in any samples of a particular medium, the maximum reporting limit will be used to calculate media-specific HQs. For a given medium, non-detected chemicals with HQs greater than or equal to 1.0 based on maximum reporting limits will be identified as ecological COPCs for that medium.
- Chemicals (detected and non-detected) without screening values for a given medium will be identified as ecological COPCs for that medium.

To select ecological COPCs by evaluating food web exposures, maximum chemical concentrations in ecologically relevant abiotic media will be used to estimate dietary doses for each receptor. All inorganics (excluding cyanide) and all organic chemicals with a log Kow greater than or equal to 3.0 will be evaluated for food web exposures. HQs will be calculated with NOAELs, LOAELs, and Maximum Acceptable Toxicant Concentrations (MATCs) (the geometric mean of the NOAEL and LOAEL). NOAELs provide the most conservative risk estimate, while calculations with LOAELs provide the least conservative risk estimate. Calculations with MATCs provide realistic risk estimates since the MATC represents an estimation of the threshold concentration (i.e., the concentration above which a toxic effect on the test endpoint is produced). For the screening-level ERA, chemicals (detected and non-detected) with NOAEL-based HQs greater than or equal to 1.0 will be identified as ecological COPCs. Identical to the media-specific screening, chemicals without ingestion-based screening values will also be retained as ecological COPCs for upper trophic level receptors.

HQs exceeding 1.0 indicate the potential for risk since the chemical concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates are derived using intentionally conservative assumptions such that HQs greater than or equal to 1.0 do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies chemical-pathway-receptor combinations requiring further evaluation. Following the same reasoning, HQs that are less than 1.0 indicate that risks are very unlikely, enabling a conclusion of no unacceptable risk to be reached with high confidence.

12.2.6 Uncertainties

Once the screening-level ERA is complete, the results will be evaluated to identify the type and magnitude of uncertainty associated with the risk conclusions. Reliance on results from a risk assessment can be misleading without a consideration of uncertainties, limitations, and assumptions inherent in the process. Uncertainties are present in all risk assessments, because of the limitations of the available data and the need to make certain assumptions and extrapolations based on incomplete information.

12.2.7 Screening-Level ERA Decision Point

The results of the ERA will be used to evaluate the status of each AOC, in terms of potential ecological risk. Possible decision points following completion of the screening-level ERA are:

- No further action is warranted: This decision is appropriate if the screening-level ERA indicates that sufficient data are available on which to base a conclusion of no unacceptable risk (HQ values for each media-pathway-receptor combination is less than one).
- Further evaluation is warranted: This decision is appropriate if the screening-level ERA indicates that there is the potential for unacceptable risk for one or more media-pathway-receptor combinations. In this instance, the ERA process will proceed to Step 3 (baseline risk assessment problem formulation, [EPA, 1997]).
- Further data are required: This decision is appropriate if the screening-level ERA indicates that there is insufficient data on which to base a risk estimate. This decision may also be appropriate if the potential for unacceptable risks is identified following the screening-level ERA and additional data are needed to refine these estimates in Step 3a.
- Take remedial action: This decision may be appropriate for sites in which the potential for unacceptable risks was identified following the screening-level ERA but these potential risks could be best addressed through remedial action (e.g., presumptive remedy, soil removal) rather than additional study.

13.0 PROJECT REPORTING ACTIVITIES

Bay West will prepare the Focused SI Report in general accordance with EPA *Interim Final Guidance for Performing Site Inspections under CERCLA* (EPA, 1992) and the MPCA *Site Response Section RBSE Guidance* (MPCA, 1997). The Focused SI Report will contain the following items:

- Introduction.
- Site Description and History (Location, Regulatory and Operational History, and Waste Characteristics).
- Geology and Hydrogeology.
- Waste/Source Sampling (Sample Locations, Analytical Results, and Conclusions).
- Ground Water Pathway (Hydrogeology, Sample Locations, Analytical Results, and Conclusions).
- Surface Water Pathway (Hydrology, Sample Location, Analytical Results, and Conclusions).
- Soil Exposure and Air Pathway (Physical Conditions, Soil and Air Targets, Soil Sample Locations, Soil Analytical Results, Air Monitoring, and Conclusions).
- Screening-Level Risk Assessment.
- Summary and Conclusions.

The Focused SI report will include details on geology, hydrology, sample locations and analytical results for all media, conclusions, and a discussion of all relevant potential migration pathways. The Final Focused SI report will be a revision of the Draft-Final Focused SI Report with the inclusions of the responses to the comments.

PART II. QUALITY ASSURANCE PROJECT PLAN

1.0 INTRODUCTION

This QAPP is Part II of a two part SAP. Part I is the FSP and shall be used in conjunction with this QAPP. This QAPP contains necessary technical detail and directions such that field and laboratory personnel understand all project sample analysis, quality control, and data reporting requirements to be used in the performance of a Focused SI of seven AOCs at the FGOW Site. This includes detailed descriptions of analytical methods for various analyses, method-required detection limits, method-required QC requirements, data validation, and reporting requirements.

A complete description of the Project can be found in Section 3.0 of Part I FSP, of this SAP.

This QAPP defines the QA/QC procedures to be observed by the field sampling team and the laboratory to implement the scope of work detailed in the SOS. The QAPP and the procedures described therein will comply with the Chemistry Scope of Work, Appendix B of the SOS. Bay West will provide the USACE PM with documentation of the qualifications of the Contract Laboratory to be identified in the QAPP including National Environmental Laboratory Accreditation Conference (NELAC) accreditation, self-declaration of compliance with the most recent version of the DOD Quality Systems Manual (QSM), LQM, SOPs, Method Detection Limits (MDL) documentation, RLs, performance evaluation studies, and any other pertinent information.

The QAPP will also contain the necessary technical detail and directions such that laboratory personnel will understand all project sample analysis, quality control, data analyses, method-required detection limits, method-required quality control requirements, data validation, and reporting requirements in accordance with State and Federal requirements.

A level III data package will be prepared for this project. The components of a level III data package generally include sample results, QC summaries, CLP-forms, and supporting information such as a case narrative as detailed in Section 7.0 of Part II QAPP.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

A QA/QC program has been designed by Bay West to ensure that appropriate QA/QC procedures will be implemented during all stages of the project. The key personnel assigned to this project are identified in Section A of the SAP. Additional information on roles and responsibilities for the key QA/QC personal are described below.

Bay West has subcontracted STL-Denver to provide the off-site analytical services required for this project. STL-Denver developed a LQM to ensure that the clients receive high-quality analytical and environmental services that are timely, reliable, and meet the intended purpose in a cost-effective manner. The Table of Contents to the April 2005 STL-Denver's LQM, Revision 1, is included in Appendix 14. STL-Denver will subcontract nitrocellulose to the STL-Sacramento facility, and GRO and DRO to the STL-North Canton facility. The subcontracting is required to meet the project requirements because nitrocellulose is a special modified method that STL-Denver does not run and STL-North Canton is certified by the MDH for GRO and DRO, whereas STL-Denver is not.

2.1 Chemical Quality Control Officers

Responsibilities of the CQCO and support staff will include, but not be limited to, the following:

- Ensuring compliance with specified DQOs.
- Maintaining QA management of laboratory chemical data.
- Providing guidance and direction to the FQCC.
- Initiating, reviewing, and following up on CAs, as necessary.
- Consulting with the Program Manager as necessary on appropriate QC measures and CAs.

2.2 Field Quality Control Coordinator

The FQCC will oversee the implementation of QA/QC procedures on a daily basis and will coordinate with the CQCO to identify and resolve any issues potentially affecting the quality of chemical data and to ensure the DQOs of this project are met. In the event that the FQCC or CQCO cannot resolve an issue, the CQCO will report to the Bay West Project Manager.

Responsibilities of the FQCC will include, but not be limited to, the following:

- Consulting with the CQCO as necessary on appropriate QC measures and CAs.
- Serving as sample custodian.
- Initiating and following up on CAs.
- Completing Daily Chemical Quality Control Reports (DCQCRs).

2.3 Special Training Requirements/Certifications

All analytical work be performed by a NELAC - accredited laboratory and be DOD QSM compliant. Training for field personnel is presented in Section 2.1 of Part I FSP, of this SAP.

3.0 DATA QUALITY OBJECTIVES

The first step in the Focused SI is to identify the overall objectives in order to tailor a plan that meets the specific needs of this Site. This is called the DQOs process. The DQOs are included in Section 4.0 of Part I FSP, of this SAP. Additional laboratory DQOs are presented below.

3.1 Problem Definition

Historical activities conducted at the FGOW may have released COPCs that could pose a potential risk to human health and the environment. A complete description of each AOC is summarized in Section 3.3 and a list of COPCs is summarized in Section 5.0 of Part I FSP, of this SAP.

3.2 Instructions for Project/Task Description and Schedule

Field activities, including tasks and analytical parameters, are detailed in Section 5.0 of Part I of this SAP. The DQO process, including the schedule, is detailed in Section 4.1 of Part I FSP, of this SAP.

3.3 Measurement Quality Objectives for Chemical Data Measurement

Acceptance criteria for laboratory QC samples and RLs measuring accuracy, precision, and sensitivity are tabulated for the project analytes in Appendix 4, Table A4-2. These and other Measurement Quality Objectives (MQOs) and QC samples are discussed in more detail in the following sections.
Precision: Precision is a measurement of mutual agreement (or variability) among individual measurements of the same property, usually under prescribed similar conditions. The following equation will be used to evaluate the precision:

$$\text{Relative Percent Difference (RPD)} = \frac{(S-D)}{(S+D)/2} \times 100$$

S = first sample value
D = second sample value

Possible QC samples indicative of precision are listed in Table 9.

Table 9. QC Sample for Precision Evaluation

QC Sample Type	Components of Variability Captured (applicable to field and fixed laboratory processes)
Instrument replicate	Instrument response.
Laboratory QC sample duplicates (MS/MSD, LCS/LCSD)	Instrument response, sub-sampling and sample preparation, spiking technique, plus laboratory homogenization.
Laboratory split or (laboratory sample duplicate analysis)	Instrument response, sub-sampling and sample preparation, plus laboratory homogenization.
Field Split or Replicate	Instrument response, sub-sampling and sample preparation, laboratory homogenization, plus sample handling and field homogenization.
Co-located samples or (field duplicate samples)	Instrument response, sub-sampling and sample preparation, laboratory homogenization, plus sample handling, plus field sample acquisition and small scale spatial variability (site).
MS – Matrix Spike LCS – Laboratory Control Sample	MSD – Matrix Spike Duplicate LCSD – Laboratory Control Sample Duplicate

Precision is usually expressed in terms of the relative standard deviation or relative percent difference, but can be expressed in terms of the variance, range or other statistical parameters. For this project precision will be measured as laboratory sample duplicate analysis and field sample replicates analysis.

Accuracy: Accuracy is a measure of the bias in a system or the degree of agreement of a measurement, X (or an average of measurements of the same parameter) with an accepted reference or true value, T. Accuracy is typically expressed as a percentage of the ratio of measurement and accepted value (X/T) 100. Accuracy will be measured using procedures prescribed in the analytical methods.

Possible QC samples indicative of accuracy are listed in the Table 10.

Table 10. QC Sample for Accuracy Evaluation

Sample Type	Accuracy/Bias Indicator For
Blank spike	Instrument contamination, calibration.
MS	Instrument contamination, calibration, and effectiveness of sample preparation.
Reference Material analysis or Performance Evaluation (PE) sample	Instrument contamination, calibration, and effectiveness of sample preparation. Most representative of performance when the PE sample is of similar matrix.
LCS	Instrument contamination, calibration, and effectiveness of sample preparation on clean lab matrix.
Surrogate standards	The role of surrogates is to mimic the behavior of target analytes and as such provides indications of instrument contamination, calibration, sample preparation, and matrix effects.
Calibration blank	Instrument contamination, calibration.
Preparation blank (method blank)	Instrument contamination, calibration, and laboratory contamination.
Field blank (equipment/trip)	Instrument contamination, calibration, and laboratory/field/transport/storage contamination.

Where applicable, recovery of MS/MSD, LCS/LCSD, surrogates and laboratory method blanks will be used to measure accuracy and bias.

Sensitivity: Sensitivity indicators of primary interest to environmental projects are those related to detection and quantification capabilities otherwise known as MDLs and Practical Quantitation Limits (PQLs), respectively. Sensitivity issues can play a critical role in achieving the DQOs. The MDLs must be lower than the RLs for each target compound. The RLs must be equal to or less than 40% of the project action levels, if feasible. The action levels for this project are considered to be the screening levels presented in Appendix 4, Tables A4-1a through A4-1d, although additional action levels may be incorporated during the screening level risk assessment. The COPCs, CAS numbers, analytical methods, and target quantitation limits for soil, ground water, surface water, and sediment samples are presented in Appendix 4, Tables A4-1a through A4-1d and A4-2. Because some of the conservative MPCA Tier 1 screening criteria are so low, reporting limits do not meet the 40% requirement cited above. However, in many cases the MDLs do meet this requirement although the data reported down to this level would be estimated. Cases in which the MDLs are still above the screening levels are as follows:

- MDLs are above the Tier 1 surface water criteria for silver, mercury, 1,2-dibromo-3-chloropropane, 1,2-dibromoethane, PCBs, dieldrin, endrin, heptachlor, heptachlor epoxide, toxaphene, and 4,4-DDT.
- MDLs are above the SQT for sediments for toxaphene, acenaphthene, and acenaphthylene.

- MDLs are above the SLVs for soil for 1,2-dibromoethane, pentachorophenol, dinitrotoluenes, 1,4-dinitrophenol, and bis(2-Chloroethyl) ether.
- MDLs are above the drinking water criteria for bis(2-chloroethyl)ether, 3,3'-dichlorobenzidine, nitrotoluenes, hexachlorobenzene, 1,2-dibromo-3-chloropropane, PCBs, and heptachlor epoxide.

In general, the most technically feasible SW-846 methods were selected for this project with the following exceptions:

- 6020 and 8270 SIM for surface water.
- 8270 SIM for sediments.

These methods have lower reporting limits. Soil and ground water will be analyzed by 6010 and standard 8270, as approved by the USACE in the Bay West proposal and subsequent negotiations.

As stated in Part I Section 4.1.5 of this SAP, screening level criteria will be the project action levels. The risk-based criteria include, but may not be limited to, Federal and State promulgated standards and criteria and are specified in Appendix 4, Tables A4-1a through A4-1d.

Completeness: Completeness is the amount of valid data including QC sample data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal operations. It is usually expressed as a percentage. Completeness for usable data is defined as the percentage of the usable data out of the total amount of data generated. The goal for laboratory completeness is 90% and the goal for overall analytical completeness is 90%.

Representativeness: Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition or an environmental condition. The characteristics of representativeness are usually not quantifiable. Subjective factors to be taken into account are as follows:

- Degree of homogeneity of a Site.
- Degree of homogeneity of a sample taken from one point in a Site.
- Available information on which a sampling plan is based.

Field duplicates are also used to assess representativeness. Two samples collected at the same location and at the same time are considered to be equally representative of this condition, at a given point in space and time. To maximize representativeness of results, sampling techniques, sample size, and sample location will be carefully chosen so they provide laboratory samples representative of the Site and the specific area. For this project it is expected that the chosen sampling design will reflect a high degree of representativeness. Samples exhibiting obvious non-homogeneity should not be used as replicates. Within the laboratory precautions are taken to extract from the sample container an aliquot representative of the whole sample. Collection of field duplicates is discussed in more detail in Part I Section 4.2.1 of the SAP.

Comparability: Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured through the use of established and approved sample collection techniques and analytical methods, consistency in the basis of analysis, consistency in reporting units, and analysis of standard reference materials.

The use of standard methods to collect and analyze samples, along with instruments calibrated against Standard Analytical Reference Materials (SARM) which are National Institute of Standard and Technology (NIST) traceable standards, will also ensure comparability.

3.4 Laboratory QA/QC Samples

Analytical QC comprises the QC procedures, checks, samples, and their respective acceptance limits that will be used during the project to monitor the quality of various aspects of the sampling events. Laboratory QC samples (e.g., method blanks and LCS) shall be included in the preparation batch with the field samples. An analytical batch is a number of samples (not to exceed 20 environmental samples plus the associated laboratory QC samples) that are similar in composition (matrix) and that are extracted at the same time and with the same lot of reagents. MS/MSD count as environmental samples. The identity of each analytical batch shall be clearly reported with the analyses so that a reviewer can identify the QC samples and the associated environmental samples. The QC procedures employed at STL-Denver laboratory are detailed in the LQM. STL-Denver is the primary sub-contract laboratory and will be responsible for overall QA of laboratory data. The type of QC and the scheduled QA analysis include the following:

LCS: The LCS is analyte-free solid matrix (sand) or water spiked with all analytes listed in the QC acceptance criteria in the laboratory method SOP. If not otherwise specified, each analyte in the LCS shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. The midpoint is defined as the median point in the curve not the middle of the range. The LCS shall be carried through the complete sample preparation and analysis procedure.

The LCS is used to evaluate each analytical batch and to determine if the method is in control. The LCS cannot be used as the continuing calibration verification.

One LCS shall be included in every analytical batch. If more than one LCS is analyzed in an analytical batch results from all LCSs analyzed shall be reported. A QC failure of an analyte in any of the LCSs shall require appropriate CA including qualification of the failed analyte in all of the samples as required. If the LCS recovery is out of limit high and the samples are undetected for the analyte no action is needed.

MS/MSD: MS and MSD is an aliquot of an actual sample spiked with known concentrations of all analytes listed in the method and/or project-specific QC acceptance limits. The spiking occurs prior to sample preparation and analysis. If not otherwise specified, each analyte in the MS and MSD shall be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. The MS/MSD sample will be site-specific and designated on the chain of custody by Bay West field personnel. If an analytical batch is run without an MSD, an LCSD or a sample duplicate will be run to assess precision. The MS/MSD results and any data qualifiers may be associated or related to samples that are collected from the same site. If appropriate, during data validation Bay West will further qualify any additional samples collected from the same site. Additional sample volume is required to be collected in the field for MS/MSDs for certain analytes, such as semivolatiles or other extractables in water or GRO and DRO in soil.

The MS/MSD results and any data qualifiers must be associated or related to samples that are collected from the same site. Therefore, if an MS/MSD causes qualification of the data the laboratory shall qualify all associated samples within the analytical batch. If appropriate, during data validation Bay West will further qualify any additional samples collected from the same site that were not included in the analytical batch.

The MS/MSD is used to document the accuracy/bias of a method due to the sample matrix associated with the project. MS/MSDs will be analyzed at a rate of 5% (one spike per 20 samples and one spike duplicate per 20 samples). The performance of the MS and MSD is evaluated against the method and project-specific QC acceptance limits and appropriate analytes (in all related samples) shall be qualified according to the data qualification criteria. The MS recoveries from samples that contain significant native background levels of the target analytes will be evaluated using the professional judgment of the Bay West CQCO for acceptance. Significant native background level is defined as an amount equal to or above that concentration which the laboratory spiked into the sample.

Matrix spike recoveries and relative percent differences will be computed and reported for all laboratory spike pairs along with any analyte/matrix specific control limits.

Surrogates: Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process but are not normally found in environmental samples. Surrogates will be used for all organic methods (GRO, DRO, VOCs, PAHs, SVOCs, Explosives, PCBs, and pesticides).

Method Blank: A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as used in sample processing. The method blank shall be carried through the complete sample preparation and analytical procedure. The method blank is included in every analytical batch and used to document contamination resulting from the analytical process.

The presence of analytes in a method blank at concentrations greater than RL indicates a need for CA. If the method blank concentration exceeds one half the RL, the laboratory shall evaluate whether reprocessing of the samples are necessary to meet the requirements of the QSM. CA shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated all samples containing the analyte(s) found in the method blank >RL shall be reprepared and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. Any detects above the reporting limit will be considered unacceptable for blank samples. When an analyte is detected in the method blank and in the associated samples and CAs are not performed or are ineffective, the appropriate qualification flag shall be applied to the sample results. Samples will be flagged U, undetected, by the reviewer if the value in the sample is within 5 times the value in the blank, when corrected for dilution or other factors, or within 10 times the value in the blank for analytes that are common laboratory contaminants, per the Functional Guidelines.

Field Duplicates: As stated in Section 4.2.1 of Part I FSP, of this SAP, the field duplicate sample is a second sample collected at the same location as the original sample. Field duplicate sample RPD results shall be calculated and used to evaluate overall field and laboratory precision.

Evaluative procedures will be used to assess the overall measurement error, data usability, and to reconcile the data with the project DQOs. The measurement and evaluative procedures for the above analytical QC are detailed in Section 3.3 of the QAPP. The evaluative measurements to be employed include Precision, Accuracy, Sensitivity, Completeness, Representativeness, and Comparability as discussed in Section 3.5. Acceptance criteria are summarized in Appendix 4, Table A4-2.

4.0 SAMPLE HANDLING

The sample custody procedures are detailed in Section 5.0 of Part I FSP, of this SAP. Sample containers, preservation, and holding times are described in the following subsections.

4.1 Sample Container Type and Preservation

Table 11 describes the preservation and sample volume requirements associated with each analytical procedure and media for this project. Additional volume (triple the normal sample volume) will be collected for MS/MSDs for VOCs, GRO, and DRO in soil/sediment and all water samples except metals and nitrocellulose. Other additional volumes may be obtained if required by the laboratory depending on the specific analytes analyzed for each sample.

Table 11. Sampling Container Type and Preservations

Analysis	Matrix	Analytical Methods	Container type* and Preservation
VOCs	Soil/Sediment	8260B	Three aliquots of approximately 5 g of soil collected using a Terracore kit, preserve with sodium bisulfate (2x) and methanol (1x) for low and high level VOC analysis, respectively, or collect 3 Encores to be preserved at the lab, Cool to 4 °C ± 2.
SVOCs	Soil/Sediment	8270C	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
RCRA Metals	Soil/Sediment	6010B/7471A	4-oz wide-mouth plastic/no chemical preservative, Cool to 4 °C ± 2.
DNT	Soil/Sediment	8330	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
Nitrocellulose	Soil/Sediment	Method 353.2 modified	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
DPA	Soil/Sediment	8270C	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
PAHs	Soil/Sediment	8270C or 8270 SIM	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
GRO	Soil/Sediment	WI GRO	Pre-weighed 2-oz jar filled to with approximately 25 g, preserve with methanol. Additional jar is used for % moisture.
DRO	Soil/Sediment	WI DRO	3 Pre-weighed 4-oz jars filled to with approximately 25 g or 3 Encores. Additional jar/Encore is used for % moisture.
Mercury	Soil/Sediment	7471A	4-oz wide-mouth plastic/no chemical preservative, Cool to 4 °C ± 2.
Pesticides	Soil/Sediment	8081A	4-oz wide-mouth glass/no chemical preservative, Cool to 4 °C ± 2.
VOCs	Water	8260B	(3) 40-ml glass vials, Teflon septum. zero headspace., Cool to 4 °C ± 2, HCL to pH <2.
SVOCs	Water	8270C	(2) 1 Liter glass amber, Teflon lined cap Cool to 4 °C ± 2.

Table 11. Sampling Container Type and Preservations

Analysis	Matrix	Analytical Methods	Container type* and Preservation
RCRA Metals	Water	6010B/7470A or 6020/7470A	(1) 250-ml plastic preserved with 5mls of 20% HNO3, Cool to 4 °C ± 2.
DNT	Water	8330	(2) 1 Liter glass amber, Teflon lined cap Cool to 4 °C ± 2.
Nitrocellulose	Water	Method 353.2 modified	(2) 250-ml glass container with Teflon lined cap, Cool to 4 °C ± 2.
DPA	Water	8270C	(2) 1 Liter glass amber, Teflon lined cap Cool to 4 °C ± 2.
PAHs	Water	8270C or 8270 SIM	(2) 1 Liter glass amber, Teflon lined cap Cool to 4 °C ± 2.
GRO	Water	WI GRO	(3) 40-ml glass vials, Teflon septum. zero headspace., Cool to 4 °C ± 2, HCL to pH <2.
DRO	Water	WI DRO	(2) 1 Liter glass amber, Teflon lined cap Cool to 4 °C ± 2.
Mercury	Water	7470A	(1) 250-ml plastic preserved with 5mls of 20% HNO3, Cool to 4 °C ± 2.

*typical container for this analysis – some analyses can be drawn from the same container (e.g. RCRA metals and mercury). Check with laboratory when placing bottle order.

4.2 Holding Times

Holding times for the individual analytes are summarized in Table 12.

Table 12. Holding Times

Analyte	Matrix	Holding Time (Days)
VOCs	Soil/Sediment	14 days after preservation in field (7 days before preservation if held in Encore).
SVOCs	Soil/Sediment	14 days from collection to extraction, 40 days from extraction to analysis.
RCRA Metals	Soil/Sediment	6 months.
DNT	Soil/Sediment	14 days from collection to extraction, 40 days from extraction to analysis.
Nitrocellulose	Soil/Sediment	28 days from collection to analysis (recommended).
DPA	Soil/Sediment	14 days from collection to extraction, 40 days from extraction to analysis.
PAHs	Soil/Sediment	14 days from collection to extraction, 40 days from extraction to analysis.
GRO	Soil/Sediment	14 days after preservation in field (7 days before preservation if held in Encore).
DRO	Soil/Sediment	10 days until lab preserves, 47 days extraction/analysis.
Mercury	Soil/Sediment	28 days.
Pesticides	Soil/Sediment	14 days from collection to extraction, 40 days from extraction to analysis.
VOCs	Water	14 days.
SVOCs	Water	7 days extraction; 40 days analysis.
RCRA Metals	Water	6 months.
DNT	Water	7 days extraction; 40 days analysis.
Nitrocellulose	Water	28 days from collection to analysis (recommended).
DPA	Water	7 days extraction; 40 days analysis.
PAHs	Water	7 days extraction; 40 days analysis.
GRO	Water	14 days.
DRO	Water	7 days extraction; 40 days analysis.
Mercury	Water	28 days.

4.3 Laboratory Verification/Documentation of Cooler Receipt Condition

Samples are received and logged in at STL-Denver by a designated sample custodian or other properly trained associate. The sample custodian will:

- Examine the shipping containers to verify that the custody tape is intact.
- Examine all sample containers for damage.
- Determine if the temperature required by the requested testing program has been maintained during shipment. Document the shipping container temperature on the Chain-of-Custody.

- Compare samples received against those listed on the Chain-of-Custody.
- Verify that sample holding times have not been exceeded.
- Examine all shipping records for accuracy and completeness.
- Determine sample pH (if required for the scheduled analysis and except VOA samples) and record on the Chain-of-Custody.
- Sign and date the Chain-of-Custody immediately (only after shipment is accepted) and attach the waybill.

For additional information refer to Section 8.5.3 of the LQM.

4.4 Laboratory CA for Incoming Samples

A Condition Upon Receipt (CUR) Report or an equivalent form/system is generated by sample control during the sample log-in process to document anomalies identified upon the receipt of samples in the laboratory. These anomalies are outside of laboratory control and do not require CAs to be taken within the laboratory. The Laboratory Project Chemist or designee will notify Bay West of all the CURs generated for their samples. The Laboratory Project Manager is responsible for resolving with Bay West how to proceed with the samples and documenting the decision to proceed with the analysis of compromised samples. CURs must be resolved prior to sample preparation and analysis. The completed CUR form shall be stored in the project file. The report narrative will include an explanation of sample receiving related anomalies. For additional information refer to Section 8.5.3 of the LQM.

5.0 ANALYTICAL PROCEDURES

The laboratory SOP numbers associated with each analytical procedure identified for this project are summarized in Table 13. Laboratory SOPs are on file at Bay West and available upon request.

Table 13. Sampling Handling

Analysis	Matrix	Analytical Methods	Laboratory SOP
VOCs	Soil/Sediment	8260B	DEN-MS-0010, Rev.2
SVOCs	Soil/Sediment	8270C	DEN-MS-0011, Rev. 3
RCRA Metals	Soil/Sediment	6010B/7471A	DEN-MT-0012, Rev. 1.1 DEN-MT-0016, Rev. 1
DNT	Soil/Sediment	8330	DEN-LC-0002, Rev. 8
Nitrocellulose	Soil/Sediment	Method 353.2 modified	SAC-WC-0050, Rev. 2.0
DPA	Soil/Sediment	8270C	DEN-MS-0011, Rev. 3
PAHs	Soil/Sediment	8270C	DEN-MS-0011, Rev. 3
PAHs (SIM)	Water	8270C SIM	DEN-MS-0002, Rev. 4
GRO	Soil/Sediment	WI GRO	NC-GC-0031, Rev. 1
DRO	Soil/Sediment	WI DRO	NC-GC-0013, Rev. 2.1
Mercury	Soil/Sediment	7471A	DEN-MT-0016, Rev. 1.1
PCBs	Soil/Sediment	8082	DEN-GC-0021, Rev.1
Pesticides	Soil/Sediment	8081A	DEN-GC-00020, Rev. 2
VOCs	Water	8260B	DEN-MS-0010, Rev.2
SVOCs	Water	8270C	DEN-MS-0011, Rev. 3
RCRA Metals	Water	6010B/7470A	DEN-MT-0012, Rev. 1.1 DEN-MT-0015, Rev. 1
RCRA Metals (low level 6020)	Water	6020	DEN-MT-0002, Rev. 7
DNT	Water	8330	DEN-LC-0002, Rev. 8
Nitrocellulose	Water	Method 353.2 modified	SAC-WC-0050, Rev. 2.0
DPA	Water	8270C	DEN-MS-0011, Rev. 3
PAHs	Water	8270C	DEN-MS-0011, Rev. 3
PAHs (SIM)	Water	8270C SIM	DEN-MS-0002, Rev. 4
GRO	Water	WI GRO	NC-GC-0031, Rev. 1
DRO	Water	WI DRO	NC-GC-0013, Rev. 2.1
Mercury	Water	7470A	DEN-MT-0015, Rev. 1.1
PCBs	Water	8082	DEN-GC-0021, Rev.1

STL's analytical certification/accreditation letters are included in Appendix 15, including the DOD QSM self-certification.

5.1 Preventive Maintenance

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

On-Site Equipment: On-site equipment for field measurements includes an PID or FID and a GCI for site characterization and/or personnel safety. The maintenance activities and additional information are discussed in Section 9.2 of Part I FSP, of this SAP. Additional information, including instrument manuals and SOPs, is included in the SSHP.

Laboratory Facilities: The STL-Denver facility and other subcontract laboratories within the STL network will be adequately maintained with a safe and clean environment. The maintenance activities include appropriate engineering controls such as proper ventilation, lighting, dust control, hoods, air flow, protection from extreme temperatures, waste disposal, and a source of stable power. Preventative maintenance procedures to minimize laboratory equipment downtime are detailed in each analytical method SOP.

5.2 Calibration Procedures and Frequency

On-site Equipment: Proper maintenance, calibration, and operation of the PID/FID and GCI will be the responsibility of the field personnel assigned to the project. All instruments and equipment used during the field activities will be maintained, calibrated, and operated according to the manufacturer's guidelines and recommendations. When appropriate, field equipment will be calibrated prior to use in the field.

Copies of the instrument manuals will be maintained in the field vehicle. A record of field calibration of analytical instruments will be maintained by field personnel on the appropriate field logs. In addition, any notes on unusual results, changing of standards, battery charging, and operation and maintenance will be included in the logbook.

All instruments are to be stored, transported, and handled with care in accordance with the handling instructions in the operating manuals to preserve equipment accuracy. Damaged instruments will be taken out of service immediately and not used again until a qualified technician repairs and recalibrates the instruments.

Laboratory Equipment: Calibration procedures for STL-Denver laboratory are included in their LQM and method-specific analytical SOPs. Each type of instrumentation is calibrated prior to sample analysis according to method criteria. Method-specific criteria for instrument calibrations must be met before samples may be processed. The specific criteria for calibration are written in each method SOP.

CA must be taken to remedy any out-of-control situations prior to analysis of any samples. Deviations from stated criteria are not acceptable. Hard copy records of all instrument calibrations are maintained in the individual laboratories and must be made available to Bay West upon request. These records are reviewed by the laboratory department managers and/or supervisors and are frequently included in audits performed by the laboratory QA department.

Analytical instruments at the laboratories shall be calibrated using traceable standards in accordance with specified analytical methods and manufacturers' procedures. Calibration procedures include the equipment to be calibrated, reference standards used for calibration, calibration techniques and sequential actions, acceptable performance tolerances, frequency of calibration, and calibration documentation format. Records of standard preparation and instrument calibration shall be maintained. The analysis logbook maintained for each analytical instrument will include the date and time of calibration, the initials of the person performing the calibration, the calibrator reference number, and concentration. Project laboratory calibration procedures, frequency, and associated CAs are further detailed in the method-specific SOPs and the laboratory LQM.

5.3 Laboratory QC Procedures

Specific laboratory internal QC checks and frequencies are included in STL-Denver's laboratory LQM and the specific analytical SOPs.

5.4 Performance and System Audits

Performance and system audits are a component of both internal laboratory QA policy and procedures and external certification processes. Performance and system audits continue to be performed on an ongoing basis. However, project-specific audits will not be performed.

5.5 Nonconformance/CAs

A nonconformance is an unplanned deviation from an established protocol or plan. The deviation may be the result of the actions of STL, Bay West or the result of events beyond the control of any of these parties. Nonconformances include the following situations:

- Holding item violations due to laboratory error, shipping delays, or other factors.
- Calibrations errors.
- Deviations from SOPs.
- QC sample results outside established limits.
- Elevated RLs.
- Errors in reports.

CAs range from flagging the data to re-preparation and re-analysis of the affected samples depending on the severity of the nonconformance and the effect on data quality. The laboratory will notify Bay West of any nonconformance which may impact data quality so that it may be involved in the CA process.

6.0 DATA REDUCTION/CALCULATION OF DATA QUALITY INDICATORS

Data review procedures, defined as a set of computerized and manual checks applied at appropriate levels of the measurement process, are defined for all measurement systems in the LQM. Data review will begin with the reduction or processing of data and will continue through verification of the data and the reporting of analytical results.

Calculations will be checked in the field and at STL-Denver laboratory from the raw data to the final value prior to reporting results for each group of samples. Data reduction will be performed by the analyst who obtained the data or by another analyst. Data verification will start with the analyst who will perform a 100% review of the data to ensure the work was done correctly the first time.

The complete chemistry data package will be provided to Bay West within 30 days after sample receipt.

6.1 Data Reduction and Verification

Data reduction and verification may be performed by more than one analyst depending upon the analytical method employed. The preparation and analytical data may be reviewed independently by different analysts. In these instances, each item may not be applicable to the subset of the data verified or an item may be applicable in both instances. It is the responsibility of the analyst to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation information is correct and complete including documentation of standard identification, sample amounts, etc.
- Analysis information is correct and complete including proper identification of analysis output.
- Analytical results are correct and complete including calculation or verification or instrument calibration, QC results, and qualitative and quantitative sample results with appropriate qualifiers.
- The appropriate SOPs have been followed and are identified in the project records.
- Proper documentation procedures have been followed.
- All non-conformances have been documented.
- Special sample preparation and analytical requirements have been met.
- The data generated have been reported with the appropriate number of significant figures as defined by the analytical methods in the Laboratory Information Management Systems (LIMSs) or otherwise specified by the client.

In general, data will be processed by an analyst in one of the following ways:

- Manual computation of results directly on the data sheet or on calculation pages attached to the data sheets.
- Input of raw data for computer processing.
- Direct acquisition and processing of raw data by a computer.

If data are manually processed by an analyst, all steps in the computation shall be provided including equations used and the source of input parameters such as response factors (RFs), dilution factors, and calibration constants. If calculations are not performed directly on the data sheet they may be attached to the data sheets.

For data that are input by an analyst and processed using a computer, a copy of the input shall be kept and uniquely identified with the project number and other information as needed. The samples analyzed must be clearly identified.

If data are directly acquired from instrumentation and processed, the analyst must verify that the following are correct:

- Project sample numbers.
- Calibration constants and RFs.
- Units.
- Numerical values used for RLs.

Analysis-specific calculations for methods are provided in SOPs. In cases where computers perform the calculation, software must be validated or verified before it is used to process data.

The data reduction is documented, signed, and dated by the analyst completing the process. Initial verification of the data reduction by the same analyst is documented on a data review checklist, signed, and dated by the analyst.

6.2 Second Level Data Verification

Following the completion of the initial verification by the analyst performing the data reduction, a systematic second-level verification of the data is performed by an experienced peer, supervisor, or designee. The second-level reviewer examines the data signed by the analyst. This review includes an evaluation of all items required in the raw data package. Any exceptions noted by the analyst must be reviewed. Included in this review is an assessment of the acceptability of the data with respect to:

- Adherence of the procedure used to the requested analytical method SOP.
- Correct interpretation of data.
- Correctness of numerical input when computer programs are used (checked randomly).
- Correct identification and quantitation of constituents with appropriate qualifiers.
- Numerical correctness of calculations and formulas (checked randomly).
- Acceptability of QC data.
- Documentation that instruments were operating according to methods specifications (calibrations, performance checks, etc.).
- Documentation of dilution factors, standard concentrations, etc.
- Sample holding time assessment.

A case narrative to accompany the final report will be finalized by the laboratory Project Manager. This narrative will include relevant comments collected during the earlier reviews.

7.0 LABORATORY OPERATIONS DOCUMENTATION

Data reporting procedures and formats are presented in Section 8.0 of the LQM, Work Processes and Operations.

The following items are included in the data reporting methodology:

- Data Reports: STL-Denver laboratory is capable of developing a variety of data deliverable reports. In general, data reports contain:
  - Cover Letter/Case Narrative: Information on sample types, tests performed, any problems encountered, and other general comments are provided. Additionally, the case narrative will summarize the following project QC elements:
    - Sample condition upon receipt in the laboratory.
    - Holding times.
    - Instrument initial and continuing calibration.
    - Method blanks.
    - Surrogate spike recoveries.
    - MS and laboratory control samples.
    - Laboratory sample duplicates.

  The laboratory will provide Level III data packages for this project. This level of data reporting provides the following information in the data package:
  - Cover/Signature Page.
  - Table of Contents.
  - Report Narrative.
  - Executive Summary.
  - Method Summary.
  - Method/Analyst Summary.
  - Sample Summary.
  - QA Association Summary.
  - CLP Forms (separated by method/batch), including cover page and forms 1-14, in order, as applicable.
  - Client COC.
  - Sample Receipt Checklist.
  - Interlab COC, where applicable.
  - Internal COC, if required.

- Analytical Data: Data are reported by sample or by test with the appropriate significant figures and RLs, and have been adjusted for dilution, if appropriate. Pertinent information including dates sampled, received, prepared, extracted, and analyzed are provided.

- Methodology: Reference for analytical methodology used is cited.

The following specific information will be included in the data package:

- Laboratory name and location (city and state).
- Project name and unique ID number.
- Field sample ID number as written on Chain-of-Custody.
- Sample description, laboratory sample ID number, and matrix.
- Sample preservation or condition at receipt.

- Date sample collected, received, extracted/prepared, and analyzed.
- Analysis time when holding time limit is less than 48 hours.
- Method (and SOP) numbers for all preparation, cleanup, and analysis procedures employed.
- Preparation, analysis, and other batch numbers.
- Analyte or parameter.
- Method RLs adjusted for sample-specific factors.
- Method detection and quantitation limits.
- Analytical results with correct number of significant figures.
- Any data qualifiers assigned.
- Concentration units.
- Dilution factors (report both diluted and undiluted runs).
- Percent moisture or percent solids (report solids on dry weight basis).
- Chromatograms, as needed.
- Sample final extract volume and aliquot analyzed.
- Sample management records (Chain-of-Custody and other records generated to document sample custody, transfer, analysis, and disposal).

Verbal Results: If Bay West requests analytical results to be communicated verbally or by facsimile prior to final review, they will be clearly identified as "Preliminary" results. Bay West understands that the data may not have undergone the complete levels of verification and review required and may change.

Reporting Analytical Results: Sample results are reported according to analytical method SOP. The laboratory will normally report results within the calibration. However, any reported results outside of the calibration range will be flagged and documented in the final report.

7.1 Sample Management Records

The information for each sample is entered in the laboratory sample login book and/or the LIMS which contains the following information at a minimum:

- Project name or identification number.
- Unique sample numbers (both client and internal laboratory).
- Type of samples.
- Required tests.
- Date and time of laboratory receipt of samples.
- Field ID supplied by field personnel.
- The PM and appropriate Group/Team Leader(s) are notified of sample arrival.
- The completed Chain-of-Custody, waybills, and any additional documentation are placed in the project file.

The sample custody documentation includes the following minimum requirements:

- Name of associate taking custody of the sample from the sample storage area for preparation or analysis.
- Dates sample removed from and returned to the sample storage area.
- Identification of tests to be performed on the sample aliquot(s) selected by the associate.
- Sample matrix.
- Laboratory sample numbers.
- Sample storage location.

Access to the STL-Denver facility is restricted to prevent any unauthorized contact with samples, extracts, or documentation. Samples transferred to a laboratory different from the original receiving facility are transferred under Chain-of-Custody. The Chain-of-Custody is maintained whether the laboratory is another STL facility or a subcontracted laboratory. For additional information on sample management refer to Section 8.5.3 of the LQM.

7.1.1 Electronic Deliverables

All data will be submitted as an Electronic Data Deliverable (EDD). Corps of Engineers Northwestern Division Omaha District (CENWO) has adopted the Staged Electronic Data Deliverable (SEDD) minimum of stage 2, for all FUDS projects. The SEDD version 2A required for this project includes all the sample results and QC results data (blanks, LCS, MS/MSD, Duplicates, surrogates) but no instrument calibration data.

7.2 Data Management Procedures

7.2.1 Laboratory Turnaround Time

The standard Turnaround Time (TAT) for hardcopy reporting is 21-23 calendar days (10-15 business days) from sample receipt. Preliminary results may be available via email, fax, or verbally. Standard turn around time for level III is a 10 business day preliminary, 15–20 business day hard copy.

7.2.2 Data Archival/Retention Requirements

Data storage procedures are documented in Section 3.5 of the LQM, Document and Record Storage, Retention, and Disposal. Analytical data (i.e. raw data, chromatograms, etc.) will be stored by SLT for 5 years. Drinking water data is held for 10 years. Business records are held for 7 years. Most data is held at a secured off-site storage facility.

8.0 DATA ASSESSMENT AND REVIEW

All chemical data generated will have their quality assessed prior to use. STL-Denver laboratory will perform 100% data verification as described in Section 6.2 of this QAPP, prior to release of data. Data verification will ensure the data package is complete, correct, consistent and compliant with the QAPP requirements.

Upon receipt of the interim data package including sample and QC sample results, the Bay West CQCO will conduct a data review as described in Section 8.1. Data review will assess the summary QC data provided by the laboratory to ascertain the corresponding project sample data quality. If the data verification and review indicate that the chemical data quality meets the project quality objectives, the data will be used as appropriate to support the project.

Data validation, as described in Section 8.2 of the QAPP, will be completed within thirty days of completing work at the Site.

8.1 Data QC Review

Data review determines and documents possible effects on the data that result from various QC failures. The following elements of data review will aid the CQCO in assessing whether the data are of acceptable quality:

- Chain-of-Custody forms, analysis requested, sample description/ID.
- Sample handling procedures, holding times, preservation.
- Confirmation of laboratory data package verification.
- Identification of QC samples that may include:
  - Laboratory sample duplicates.
  - Blind field duplicates.
  - Method blanks, Trip blanks and Equipment blanks.
  - LCS/LCSD.
  - MS/MSD.
  - Surrogate recoveries.
- Examination of QC sample data against Precision, Accuracy, Representation, Completeness, Comparability, and Sensitivity objectives.

8.2 Data Verification/Validation

Sample analysis and data validation includes sample analysis and initial verification of the data by the laboratory and validation of the laboratory data by Bay West as well as QC oversight of the analytical laboratory by Bay West in accordance with the PMP and QAPP.

Bay West will assess the integrity and usability of all field and laboratory data generated. The level of this data assessment will be based on the intended use and DQOs as detailed within the SAP/QAPP per *EPA G-8, Guidance on Environmental Data Verification and Data Validation* (USEPA, 2002). At a minimum, this will include an evaluation of the sample's condition upon receipt, the analytical instrument's calibration, various method quality control samples, and general continuity of sample results within the CSM and ECSM.

For this project data verification will be performed on 100% of the analytical packages and data packages. Bay West will perform data validation on 10% of the analytical data packages in accordance with the guidance within the *EPA Contract Laboratory Program National Functional Guidelines for or Organic Data Review and EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA, 1999; USEPA, 2004) and the DOD QSM (www.denix.osd.mil).

The results of the data verification and validation will be summarized including an assessment of the QC practices of the sampling and analyses and any impact to the data's usability. The data review and validation summary will be included in the Focused SI Report.

Data Validation, according to EPA's definition, is an evaluation of the technical usability of the verified data with respect to the planned objectives or intention of the project. In addition, data validation can provide a level of overall confidence in the reporting of the data based on the methods used.
The data validation process will consist of:

- Assembling planning documents, laboratory data to be validated and data review documentation.
- Review verified data and reported sample results collectively for the data set as a whole including laboratory applied data qualifiers against the requirements the laboratory was expected to meet.
- Summarize data and QC deficiencies and evaluate the impact on the overall data quality. Additionally, given information obtained during the course of the project, an assessment of certain performance criteria may be made.
- Assigning validation qualifiers as appropriate to individual data values giving an indication of potential bias or uncertainty discovered during the validation process. Data qualification will be performed with consideration given to the importance and level of deviation from performance standards.
- Preparation of analytical data validation report.

All data qualifiers assigned as a result of the data validation process will be consistent with the guidelines and will also reflect the project-specific DQOs. Typical data validation qualifiers can be found in Table 14. Data qualification will be based on the National Functional Guidelines.

Table 14. Data Qualifier Definitions

B	The analyte was found in an associated blank as well as in the sample. This indicates possible blank contamination and warns the user to take appropriate action while assessing the data.
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
Q	Data requires usability review due to the exceedance of method-specific holding times, calibration, or batch QC data associated with the samples does not meet stated measurement quality objectives.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.

8.3 DQO Reconciliation

DQO reconciliation will consist of verifying that the DQOs described in Part I Section 4.1 of the SAP were met. Verification that the general DQOs were met will involve assessment of specific DQO elements such as:

- Were contaminants of interest identified?
- Were media of interest assessed?
- Were required locations and depths sampled?
- Were sample numbers adequate?
- Were sample results of sufficient quality to be usable?
- Were concentrations and RLs sufficiently low to meet action levels?
- Were correct sampling and analysis methods used?

If data are determined to be inadequate for the intended data use, the source or cause for the missed DQO and its significance will be determined by the project team.

8.4 Project Completeness Assessment

The project completeness assessment will follow from the DQO reconciliation. Completeness for usable data is defined as the percentage of the usable data out of the total amount of data generated, specified as 90% minimum for this project. However, project completeness will be determined using a broader definition that will consider all the DQOs to determine of the overall goal of the study was met.

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