Final

Sampling and Analysis Plan
for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers
Addendum No. 1

Ravenna Army Ammunition Plant
Ravenna, Ohio

July 31, 2009

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:

United States Army Corps of Engineers
Louisville District

Prepared by:

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14. ABSTRACT

This sampling and analysis plan outlines the field activities that will be implemented to obtain data in support of the investigation of the Facility-wide Sewers at the Ravenna Army Ammunition Plant (RVAAP). This plan presents the tiered process that will provide a contaminant evaluation within and adjacent to the facility-wide sewer system. Results and data obtained from the sampling activities will be incorporated into remedial investigation report and feasibility study for the Facility-wide Sewers.

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Science Applications International Corporation (SAIC) has completed the Final Sampling and Analysis Plan for Remedial Investigation at the RVAAP-67 Facility-Wide Sewers Addendum No. 1 at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing USACE policy.

M.T. Bogucki

MaryAnn T. Bogucki
Study/Design Team Leader

07-27-09
Date

Jed Thomas

Jed Thomas, P.E.
Independent Technical Review Team Leader

7/28/09
Date

Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader. As noted above, all concerns resulting from independent technical review of the project have been considered.

Scott Armstrong

Scott Armstrong
Principal w/ A-E firm

July 28, 2009
Date

Final

Sampling and Analysis Plan for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers Addendum No. 1

Volume One – Main Report and Attachment
Version 1.0

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
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Prepared For:
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for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers Addendum No. 1
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OHARNG = Ohio Army National Guard
Ohio EPA-NEDO = Ohio Environmental Protection Agency-Northeast District Office
Ohio EPA-SWDO = Ohio Environmental Protection Agency-Southwest District Office
REIMS = Ravenna Environmental Information Management System
RVAAP = Ravenna Army Ammunition Plant
SAIC = Science Applications International Corporation
USACE = United States Army Corps of Engineers
USAEC = Unites States Army Environmental Command

Part I

Field Sampling Plan
for the
Sampling and Analysis Plan
for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers
Addendum No. 1

Ravenna Army Ammunition Plant
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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
BRAC-D	U.S. Army Base Realignment and Closure Division
BGS	Below Ground Surface
Camp Ravenna	Camp Ravenna Joint Military Training Center
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERL	Construction Engineering Research Laboratory
COPC	Chemicals of Potential Concern
CUG	Cleanup Goals
DQO	Data Quality Objective
EU	Exposure Unit
FS	Feasibility Study
FSP	Field Sampling Plan
GIS	Geographical Information System
GPS	Global Positioning System
GSSL	Generic Soil Screening Level
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
IAP	Installation Action Plan
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
km	Kilometer
MARC	Multiple Award Remediation Contract
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Site
NCP	National Contingency Plan
NGB	National Guard Bureau
NGVD	National Geodetic Vertical Datum
Ohio EPA	Ohio Environmental Protection Agency
OHARNG	Ohio Army National Guard
PBA	Performance-Based Acquisition
PCB	Polychlorinated Biphenyl
PP	Proposed Plan
PPE	Personal Protective Equipment
PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RDX	Cyclonite
RI	Remedial Investigation
ROD	Record of Decision
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SAP	Sampling and Analysis Plan
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TNT	2,4,6-trinitrotoluene
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Sampling and Analysis Plan (SAP) Addendum No. 1 addresses the remedial investigation activities for the Facility-Wide Sewers at the Ravenna Army Ammunition Plant (RVAAP-67), (Figures 1-1 and 1-2). This work is being conducted by Science Applications International Corporation (SAIC) as part of the 2008 Performance-Based Acquisition (PBA) for Environmental Investigation and Remediation at the RVAAP under Multiple Award Remediation Contract (MARC) W912QR-04-D-0028, Delivery Order 0001, Task 4 with the U.S. Army Corps of Engineers (USACE), Louisville District. Planning and performance of all elements of this PBA will be in accordance with the requirements of the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders for RVAAP, dated June 10, 2004 (Ohio EPA 2004). The portion of the Ohio EPA Director's Final Findings and Orders pertinent to this PBA is the requirement to develop a Remedial Investigation/Feasibility Study (RI/FS), a Proposed Plan (PP), a Record of Decision (ROD), and a remedy for the facility-wide sewers area of concern (AOC) at the RVAAP in conformance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Contingency Plan (NCP), as well as the Director's Final Findings and Orders.

RVAAP-67, Facility-Wide Sewers, is a new AOC created in 2008 and comprised of Installation Restoration Program (IRP) eligible storm and sanitary sewers located throughout RVAAP. Under IRP policy, eligibility is defined as those sewers within and between AOCs that historically received AOC-related wastewater discharges prior to October 17, 1986. In December 2008, the Army issued an interim policy for Defense Environmental Restoration Program (DERP) eligibility that rescinded the October 17, 1986 cutoff date. The change in IRP policy did not affect the scope and definition of RVAAP-67, as no sewer systems were previously excluded on the basis of the cutoff date. Wastewater treatment plants at RVAAP (e.g., Sand Creek Sewage Treatment Plant, George Road Sewage Treatment Plant, and the Depot Sewage Treatment Plant) were previously closed in the 1990s and are not IRP eligible. Figure 1-2 shows the locations of sewer networks within the facility, based upon available historical documents and engineering drawings.

This SAP Addendum No. 1 for remedial investigation of Facility-Wide Sewers tiers under and supplements the guidance and methods presented in the *Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001). The Facility-Wide SAP provides the general technical procedures and protocols for conducting fieldwork at RVAAP. This SAP Addendum No. 1 includes the sampling and analysis objectives, rationales, planned activities, and technical specifications for the work to be conducted for this investigation. Where appropriate, this SAP Addendum No. 1 references the Facility-Wide SAP for standard procedures and protocols.

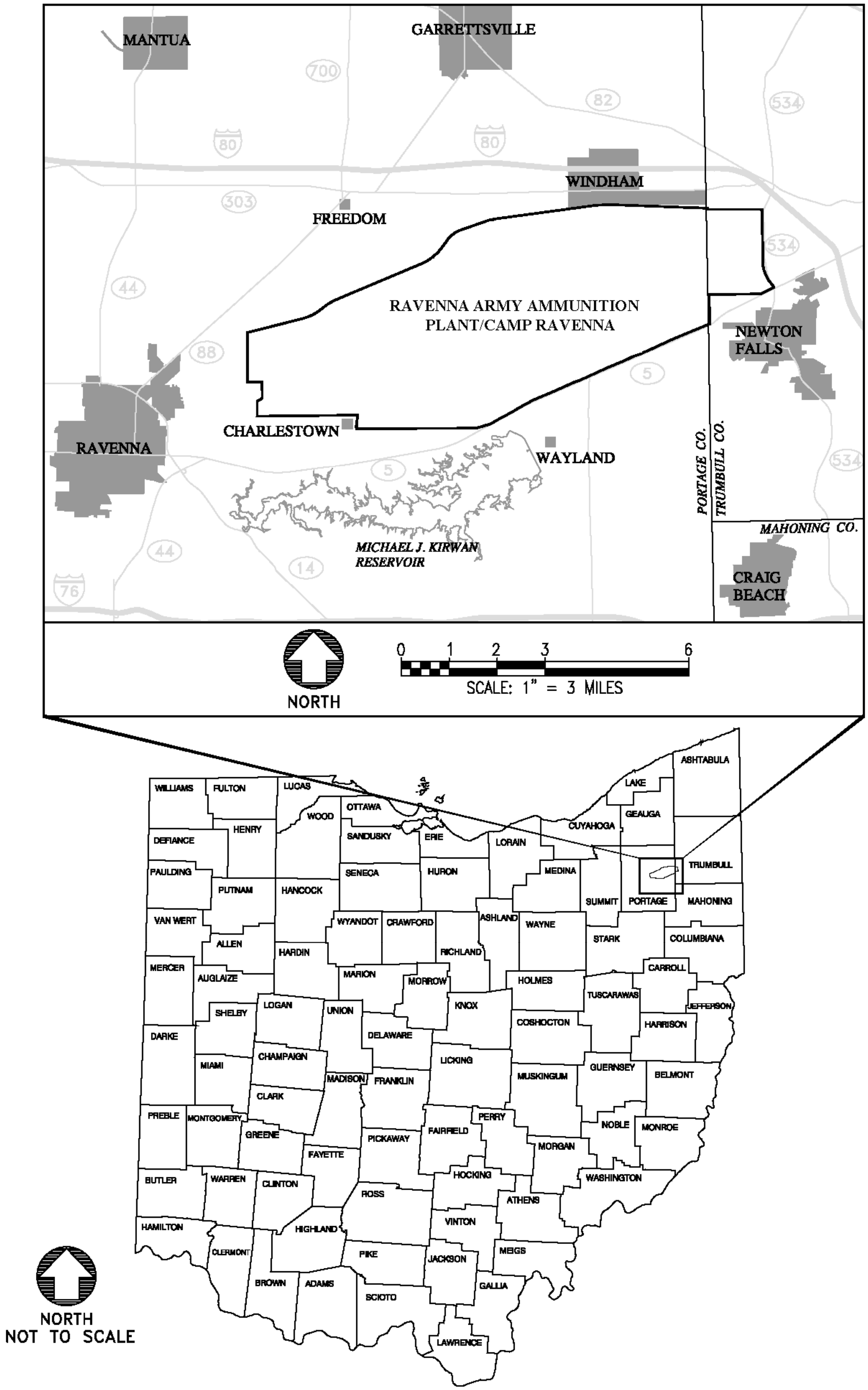

Figure 1-1. General Locations and Orientation of the RVAAP/Camp Ravenna

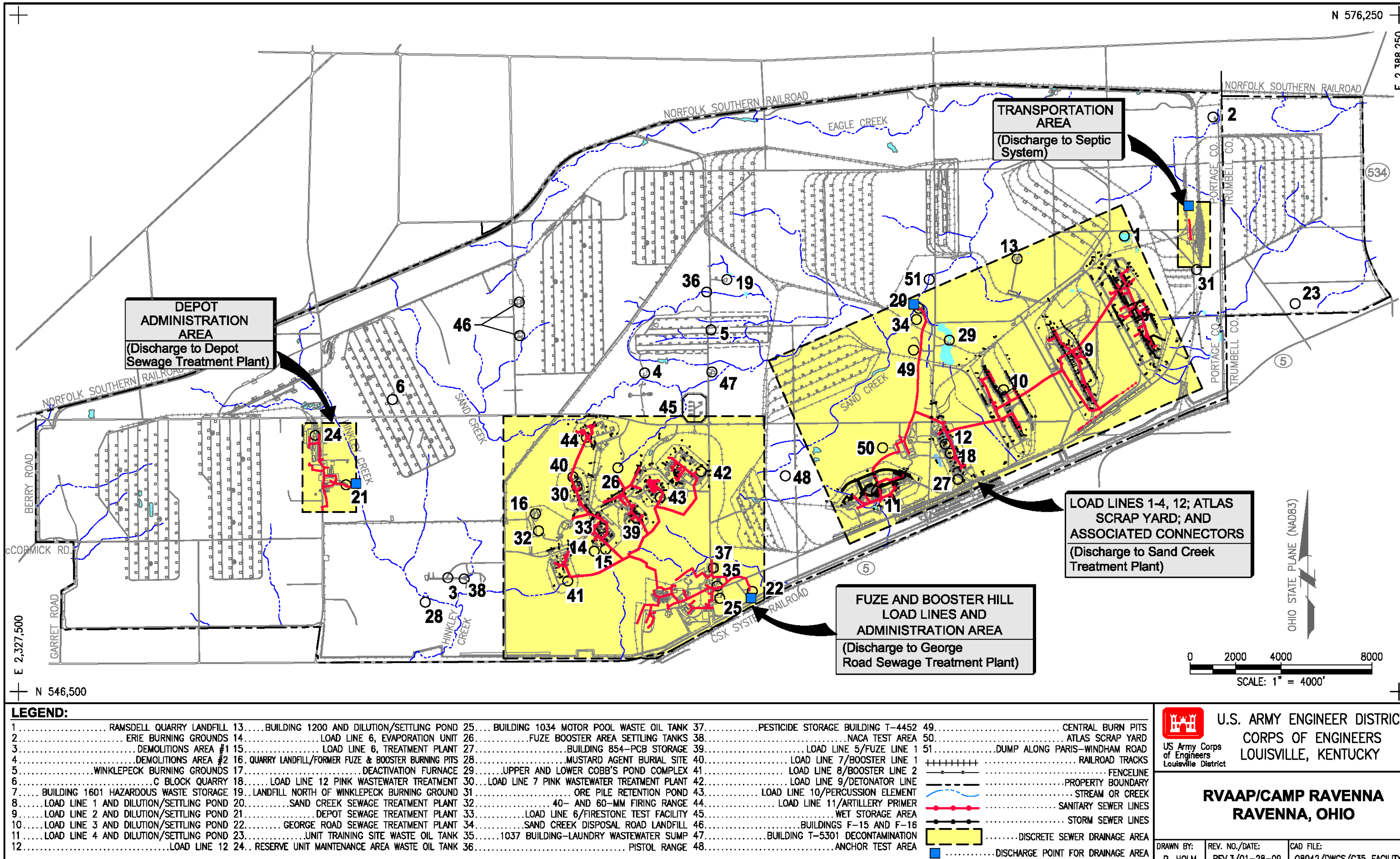

Figure 1-2. Location of Facility-Wide Sewers within RVAAP/Camp Ravenna

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1.2 GENERAL FACILITY DESCRIPTION AND HISTORY

When the RVAAP IRP began in 1989, the RVAAP was identified as a 21,419-acre facility. The property boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a two year period (2002 and 2003), and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683 acre RVAAP have been transferred to the National Guard Bureau (NGB) and subsequently licensed to the OHARNG for use as a military training site, currently designated as the Camp Ravenna Joint Military Training Center (Camp Ravenna). The current RVAAP consists of 1,280 acres in various parcels throughout Camp Ravenna.

Camp Ravenna is located in northeastern Ohio within Portage County and Trumbull County, approximately 3 miles (4.8 kilometers [km]) east-northeast of the city of Ravenna and approximately 1 mile (1.6 km) northwest of the city of Newton Falls. The RVAAP portions of the property are solely located within Portage County. Camp Ravenna is a parcel of property approximately 11 miles (17.7 km) long and 3.5 miles (5.6 km) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (Figures 1-1 and 1-2). Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 6 miles (9.6 km) to the northwest; Newton Falls 1 mile (1.6 km) to the southeast; Charlestown to the southwest; and Wayland 3 miles (4.8 km) to the south.

The entire 21,683-acre parcel was an industrial facility that was government-owned and contractor-operated when the RVAAP was operational (Camp Ravenna did not exist at that time). The RVAAP IRP encompasses investigation and cleanup of past activities over the entire 21,683 acres of the former RVAAP; therefore, references to the RVAAP in this document indicate the historical extent of the RVAAP, which is inclusive of the combined acreages of the current Camp Ravenna and RVAAP, unless otherwise specifically stated.

Industrial operations at the former RVAAP consisted of 12 munitions-assembly facilities referred to as "load lines." Load Lines 1 through 4 were used to melt and load 2,4,6-trinitrotoluene (TNT) and Composition B into large-caliber shells and bombs. The operations on the load lines produced explosive dust, spills, and vapors that collected on the floors and walls of each building. Periodically, the floors and walls were cleaned with water and steam. Following cleaning, the waste water, containing TNT and Composition B, was known as "pink water" for its characteristic color. Scupper systems at the process buildings were used to collect pink water, which was collected in concrete holding tanks, filtered, and pumped into unlined ditches for transport to earthen settling ponds. However, in some instances, pink water was swept from doorways or scupper systems overflowed onto the ground surface. Load Lines 5 through 11 were used to manufacture fuzes, primers, and boosters. Potential contaminants in these load lines include lead compounds, mercury compounds, and explosives. From 1946 to 1949, Load Line 12 was used to produce ammonium nitrate for explosives and fertilizers prior to use as a weapons demilitarization facility.

In 1950, the facility was placed in standby status and operations were limited to renovation, demilitarization, and normal maintenance of equipment, along with storage of munitions. Production activities were resumed from July 1954 to October 1957 and again from May 1968 to August 1972. In addition to production missions, various demilitarization activities were conducted at facilities constructed at Load Lines 1, 2, 3, and 12. Demilitarization activities included disassembly of munitions and explosives melt-out and recovery operations using hot water and steam processes. Periodic demilitarization of various munitions continued through 1992.

In addition to production and demilitarization activities at the load lines, other facilities at RVAAP include AOCs that were used for the burning, demolition, and testing of munitions. These burning and demolition grounds consist of large parcels of open space or abandoned quarries. Potential contaminants at these AOCs include explosives, propellants, metals, and waste oils. Other types of AOCs present at RVAAP include landfills, an aircraft fuel tank testing facility, and various general industrial support and maintenance facilities.

1.3 AREA OF CONCERN DESCRIPTION AND HISTORY

RVAAP-67, Facility-Wide Sewers, is a new AOC created in 2008 and comprised of IRP eligible storm and sanitary sewers located throughout RVAAP, including Load Lines 1-12 and the Administrative Areas. The sewers sometimes received inadvertent discharges of contaminated wastewaters from the manufacturing of munitions, and it is possible that portions of the system may contain accumulated chemical contaminants. Available historical documents do not indicate any incidents or occurrences of intentional dumping or discharging of contaminated wastewaters to the sewers. A 2007 Explosive Evaluation of Sewers showed no accumulations of explosive compounds within the twelve Load Lines or the Administration Area that would present an explosion hazard (Lakeshore Engineering Services, Inc. 2007). However, the Lakeshore sewer effort was conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or conclusions.

The primary sewer systems at the facility are divided into two basins: a western basin and an eastern basin. The western basin includes the combined sanitary and storm sewers draining the Administrative Areas and sanitary sewers at Load Lines 5-11 that terminate at the George Road Sewage Treatment Plant. Also, several short runs of separated storm sewer exist throughout Load Lines 5-11 in the western basin, terminating in ditches and other drainage features. The eastern basin includes the sanitary sewers draining Load Lines 1-4, Load Line 12, and RVAAP-50 Atlas Scrap Yard, and the Inert Storage Area #6, and terminates at the Sand Creek Sewage Treatment Plant. Load Lines 1-4 and Load Line 12 also have separate storm sewer systems terminating in drainage features such as ditches and retention ponds. A smaller and self-contained sanitary sewer system is located at the Depot Administration Area, terminating at the Depot Sewage Treatment Plant. A line of sanitary sewers also exists at the Transportation Storage Area, draining to a septic tank and a sludge basin. The locations of these discrete sewer networks are shown in Figure 1-2. Detailed maps and descriptions of these areas are presented in Appendices A through Q.

Based on digitization of available historical engineering utilities schematics and geographic information system (GIS) analysis, the AOC is estimated to be comprised of 18 miles of sanitary and 6.4 miles of storm sewer lines. Of these structures, it is estimated that approximately 2.5 miles of sanitary and 2.5 miles of storm sewers runs are located at depths less than 4 feet (ft) below ground surface (BGS), or approximately 5 miles of shallow lines in total. The maps generated from the past digitization efforts and analysis of available engineering drawings are located in Appendices A through Q.

No investigation specific to RVAAP-67, Facility-Wide Sewers, has been conducted, as this AOC was newly created in 2008. However, investigations of sewers have been conducted at several load lines as part of RIs specific to each of these AOCs:

- Load Line 1 (USACE 2003);
- Load Line 2 (USACE 2004a);
- Load Line 3 (USACE 2004b);
- Load Line 4 (USACE 2004c);
- Load Line 6 (MKM Engineers 2007b);
- Load Line 9 (MKM Engineers 2007c);
- Load Line 11 (MKM Engineers 2005); and
- Load Line 12 (USACE 2004d).

Analytical samples of sewer sediment and water were also collected as an initial characterization effort at Atlas Scrap Yard and Load Lines 5, 7, 8 and 10 under the *Final Characterization for 14 AOCs* study (MKM Engineers 2007a).

Efforts to investigate whether explosives accumulated in the sewer lines were completed in 2007 (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). These 2007 efforts included visual inspection, additional video surveys, and screening-level field explosives testing. However, this work was conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant reports. Therefore, information from these evaluations will be utilized only in a high-level and qualitative fashion. Locations where explosives field screening methods tested positive for explosives will be noted during the review of historical data, and these locations will be revaluated as potential source areas. However, negative screening results from the Lakeshore Engineering Services, Inc. (2007) report will not be used to eliminate locations from investigation.

An area-specific summary of the investigative history to date for sewers throughout the facility is presented in Table 1-1. Descriptions of the operational and investigative history specific to each of the individual areas of the facility that contain sanitary and/or storm sewers are presented in Appendices A through Q.

Table 1-1. Summary of Previous Sewer Investigations at RVAAP

Area	Sewer Structures Per Area (# manholes/drop inlets)		Analytical Samples (# samples)		Video Survey (linear feet)		Field Screening Tests (# manholes)	(# manholes)
	Sanitary	Storm	Sanitary	Storm	Sanitary	Storm	Sanitary	Storm
Administration Area	67	--	--	--	--	--	26	--
Atlas Scrap Yard	16	--	22 (7 SD/15 SW)	--	--	--	--	--
Depot Administrative Area	35	--	--	--	--	--	--	--
Inert Storage Area #6	15	--	--	--	--	--	--	--
Load Line 1	34	81	3 (2 SD/1 SW)	4 (3 SD/1 SW)	978.7	2,372.25	23	40
Load Line 2	28	54	3 (1 SD/2 SW)	14 (12 SD/2 SW)	451.37	1,099.67	17	43
Load Line 3	31	96	3 (1 SD/2 SW)	5 (5 SD/0 SW)	457.69	1382.84	26	35
Load Line 4	24	119	8 (6 SD/2 SW)	6 (3 SD/3 SW)	567.86	1,430.61	23	56
Load Line 5	13	--	5 (1 SD/4 SW)	--	--	--	14	--
Load Line 6	9	--	2 (0 SD/2 SW)	--	--	--	20	--
Load Line 7	8	--	7 (0 SD/7 SW)	--	--	--	8	--
Load Line 8	9	--	15 (6 SD/9 SW)	--	--	--	10	--
Load Line 9	10	--	4 (2 SD/2 SW)	--	--	--	9	--
Load Line 10	14	--	9 (3 SD/6 SW)	--	--	--	18	--
Load Line 11	12	--	11 (5 SD/6 SW)	--	--	--	2	--
Load Line 12	17	--	7 (3 SD/4 SW)	--	224	--	3	--
Transportation Storage Area	5	--	--	--	--	--	--	--
Trunk/Connectors - George Road Treatment Plant Network	66	--	--	--	--	--	--	--
Trunk/Connectors - Sand Creek Treatment Plant Network	38	--	--	--	--	--	5	--
Facility Total	**451**	**350**	**99** (37 SD/62 SW)	**29** (23 SD/6 SW)	**2,679.62**	**6,285.37**	**204**	**174**

Note: The "Other Areas" category includes predominantly trunk/connector lines and Inert Storage Area #6 (area south of LL4 and LL12).

SD = Sewer sediment samples SW = Sewer water samples.

2.0 PROJECT ORGANIZATION, RESPONSIBILITIES, AND SCHEDULE

2.1 PROJECT ORGANIZATION AND RESPONSIBILITIES

Key personnel and subcontractors implementing this SAP Addendum are listed in Table 2-1. The functional responsibilities of these key personnel are described in Section 2.0 of the Facility-Wide SAP.

Table 2-1. Project Organization for SAP Addendum

Position	Personnel
SAIC Project Manager	Kevin Jago, PG
SAIC Project Engineer	Jed Thomas, PE
SAIC Health & Safety Officer	Steve Davis, CIH, CSP
SAIC QA/QC Officer	Glen Cowart
SAIC Field Operations Manager	Rich Sprinzl
Subcontractor Laboratory QA/QC Manager	TBD
SAIC Laboratory Coordinator	Jenny Vance
SAIC Field Personnel	TBD
Subcontractor Field Personnel	TBD
Analytical Laboratory Services	TBD
OE Avoidance Services	USA Environmental
Waste Disposal Services	TBD

SAIC = Science Applications International Corporation
PG = Professional Geologist
PE = Professional Engineer
CIH = Certified Industrial Hygienist
CSP = Certified Safety Professional
QA/QC = Quality Assurance/Quality Control
TBD = To Be Determined
OE = Ordnance and Explosives

2.2 PROJECT SCHEDULE

Figure 2-1 presents the schedule for completion of this SAP Addendum.

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Develop Sampling and Analysis Plan for Facility-wide Sewers**	**144 days**	**Fri 4/24/09**	**Mon 9/14/09**	
2	Prepare and Submit Draft to Army and Ohio EPA	0 days	Fri 4/24/09	Fri 4/24/09	
3	Army and Ohio EPA Review	45 days	Fri 4/24/09	Sun 6/7/09	2
4	Comment Resolution Meeting	22 days	Mon 6/8/09	Mon 6/29/09	3
5	Prepare and Submit Final to Army and Ohio EPA	54 days	Mon 6/8/09	Fri 7/31/09	3
6	Army and Ohio EPA Review and Approval	45 days	Sat 8/1/09	Mon 9/14/09	5
7	**Implementation of Sampling and Analysis Plan**	**120 days**	**Tue 9/15/09**	**Tue 1/12/10**	
8	Implementation of Sampling and Analysis Plan	120 days	Tue 9/15/09	Tue 1/12/10	6

Figure 2-1. Project Schedule

3.0 PROJECT SCOPE AND OBJECTIVES

3.1 SCOPE AND OBJECTIVES

The scope of this SAP Addendum is to characterize and define the nature of extent of contamination related to RVAAP-67, which includes IRP eligible sanitary and storm sewers throughout RVAAP. As discussed in Section 1.1, IRP eligibility was initially defined in the Performance Work Statement for the 2008 PBA as those sewers within and between AOCs that historically received AOC-related wastewater discharges prior to October 17, 1986. The Army issued interim policy for DERP eligibility in December 2008 that rescinded the October 17, 1986, cutoff date. The change in IRP policy did not affect the scope and definition of RVAAP-67, as no sewer systems were previously excluded on the basis of the cutoff date. Wastewater treatment plants at RVAAP (e.g., Sand Creek Sewage Treatment Plant, George Road Sewage Treatment Plant, and the Depot Sewage Treatment Plant) were previously closed in the 1990s and are not IRP eligible. Based on the definition of IRP eligibility and available RVAAP infrastructure data, the following comprises RVAAP-67:

- Sanitary and storm sewer lines, where present, within Load Lines 1 through 12 (Appendices E through P);
- Sanitary and storm sewer lines, within the Inert Storage Area #6, south of Load Lines 2 and 3 (Appendix A, Plate A-2);
- Sanitary and storm sewer lines, where present, within the Atlas Scrap Yard (Appendix C);
- Sanitary and storm sewer lines, where present, within the Administration Area (Appendix B);
- Sanitary and storm sewer lines, where present, within the Depot Administration Area (Appendix D);
- Sanitary and storm sewer lines, where present, within the Transportation Storage Area (Appendix Q);
- Sanitary sewer connector lines between AOC source areas (e.g., between Load Lines 1, 2, 3, and 12) (shown in the large scale sewer network plates located in Appendix A); and
- Sanitary sewer trunk lines exiting AOC source areas to the former sewage treatment plants (shown in the large scale sewer network plates located in Appendix A).

The following sanitary and storm sewer drainage infrastructure components are *not* included within the scope of the investigation under this SAP Addendum:

- Former wastewater treatment plants and associated discharge lines from these facilities; and

- Conventional drainage culverts (e.g., typical short lines beneath roads, rail lines, and utility right-of-ways) in association with storm water ditches or flowing streams. Within AOC source areas, these conveyances have been or will be addressed through AOC-specific wet or dry sediment scopes.

The primary objectives of this Field Sampling Plan (FSP) Addendum are to:

- Develop a conceptual exposure model for the facility-wide sewers that encompasses all applicable contaminant migration and exposure pathways;

- Assess the condition of the sanitary and storm sewer systems to identify materials of construction, potential contaminant accumulation points, possible groundwater migration pathways, and leakage points;

- Characterize the nature and extent of contamination with respect to accumulated sediment within the lines;

- Characterize the potential for partitioning of contaminants from sediment to water with subsequent migration through the lines to outfall points (e.g., sampling of water at key points within the AOCs, at entry and exit points to each AOC or former functional area, and at outfall points);

- Sample subsurface soil and pipeline trench bedding material (if present), beneath the sewer at potential leakage points from the lines to assess contamination of this media by historical releases; and

- Evaluate existing data from groundwater monitoring wells and subsurface soil borings to determine if groundwater contamination by sewer system releases has occurred and if additional monitoring wells may be required to evaluate nature and extent of contamination.

The data acquired under this FSP Addendum will be evaluated in the RI Report, in conjunction with existing groundwater monitoring data, to determine if groundwater contamination by sewer system releases has occurred. The RI Report will provide recommendations where additional monitoring wells may be required to evaluate nature and extent of groundwater contamination. These project objectives are further detailed in Section 3.2. The scope of this SAP Addendum also includes munitions and explosives of concern (MEC) avoidance within Munitions Response Sites (MRS), and other areas if MEC is suspected, in order to safely conduct investigation activities. MEC avoidance procedures to be followed during the RI are outlined in the MEC Project Work Plan for the RVAAP PBA 2008 (USA Environmental 2009).

3.2 DATA QUALITY OBJECTIVES

The following sections provide the FSP data quality objectives (DQO) for characterization of facility-wide sewers at RVAAP. These objectives include:

- Definition of the problem statement;
- Presentation of a conceptual exposure model;
- Establishment of general decision points;
- Identification of data needs for future decisions;
- Delineation of the spatial boundaries of the investigation; and
- Presentation of the general decision rules and sampling design for the investigation.

The DQOs for the facility-wide sewers presented in this section represent the most current compilation of information and guidance from the RVAAP IRP Team during the 2008 PBA procurement process, as well as discussions during the project kickoff meeting held in August 2008 and a facility-wide sewers DQO planning workshop held in October 2008.

3.2.1 Statement of the Problem and Facility-Wide Sewers Conceptual Model

Figure 3-1 illustrates a preliminary conceptual model for facility-wide sewers based on available data and site knowledge. This model will be refined based on the results of the RI and a final version presented in the RI Report. Previous investigations have shown the presence of accumulated sediment within the sanitary and storm sewers that contains process-related contaminants (metals, explosives, organics). Available data indicate, for those sections of sewer lines investigated, that there are not currently accumulated explosives within the sewer lines in sufficient quantity to be an explosion hazard.

As shown on Figure 3-1, sewer line segments containing residual contaminated sediment accumulations are defined as primary sources. Particle-bound contaminants may migrate through the sewer systems by physical transport of sediment during periods of flow; this migration pathway was active during RVAAP operations as well as under current conditions. During facility operational periods, dissolved-phase contaminants migrated through the sewer systems where process-related effluents were directly introduced into the systems. Also, under past and present conditions, partitioning of contaminants from particle-bound phase to dissolved phase occurs where water is in contact with contaminated sediment. Once in dissolved phase, the contaminants migrate with water flow. Leakage of contaminated effluent or storm water from the lines via cracks or line breaks (both in the past and currently) may contribute contamination to receptor media, such as soil beneath or adjacent to the sewer lines, surface water and sediment (wet and dry) media at outfall points to ditches or surface water conveyances, and groundwater. These receptor media may, in turn, function as secondary sources of contamination. Where the sewer line elevations were below the groundwater table, the pipelines were potentially preferential flow pathways (conduits) for groundwater.

A preliminary field reconnaissance of the sewer lines in December 2008 showed many of storm sewer lines above the water table are still functional and convey water during periods of rainfall. Flowing water, likely sourced from infiltrating groundwater, was observed in some sanitary and storm sewer inverts at elevations below the water table associated with the sanitary sewer system. Portions of the sewer lines, particularly within Load Lines 3, 4, 12, and the Atlas Scrap Yard, were completely water-filled. Therefore, where contaminated sediment and water are still present in the sewer lines, they may still represent ongoing sources of contamination to receptor media and conduits for groundwater flow.

As shown on Figure 3-1, potential human health risk exposure pathways for contaminants related to facility-wide sewers include accumulated wet and dry sediment or water within the lines (direct dermal contact, inhalation of dry sediment, ingestion) if they were to be breached. Other exposure pathways potentially include conventional pathways for receptor media or secondary sources, such as sediment at outfall locations, subsurface soil, or groundwater. Some of these receptor media, such as outfall ditch sediments, at selected AOCs have been addressed as separate exposure units during previous RIs or will be addressed during future RIs.

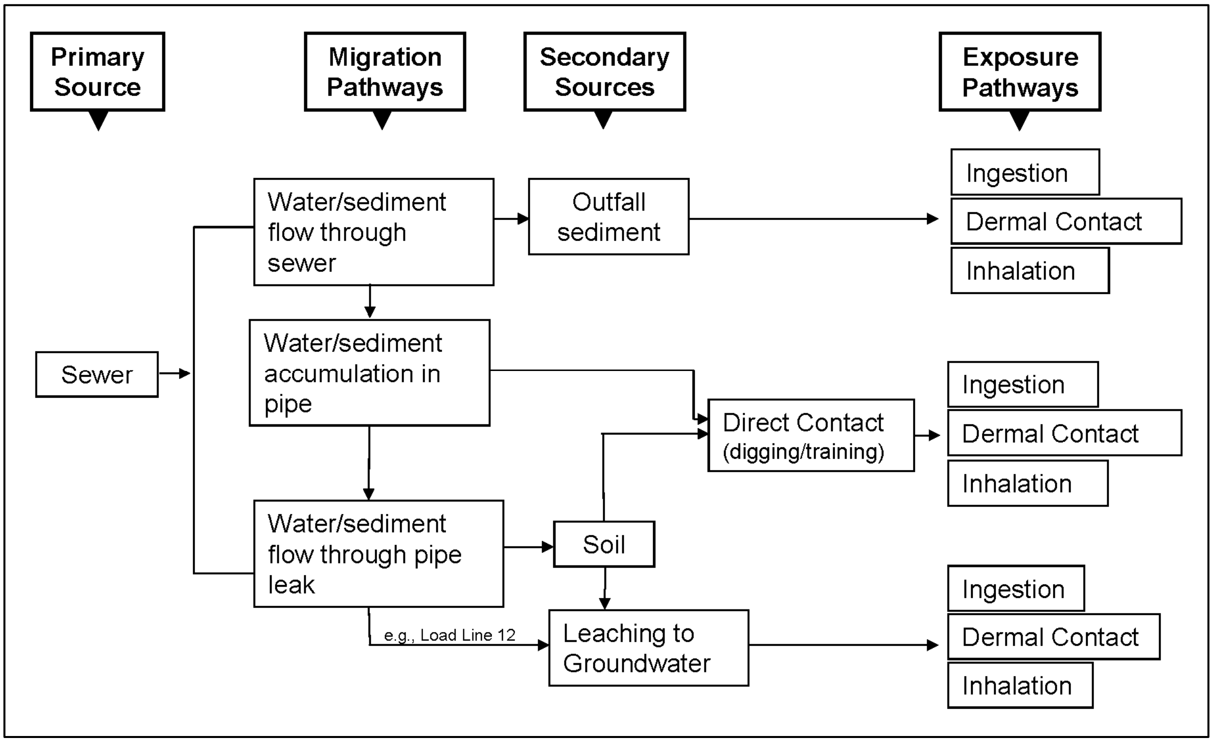


Figure 3-1. Facility-Wide Sewers Conceptual Model

3.2.2 General Decision Points

Data collected under this FSP Addendum will support future risk management decisions, development of remedial alternatives, and ultimately, selection of a final remedy. Key decision points that the data will support include:

- Identification of those sewer line segments requiring remediation based on human health and environmental direct exposure risk concerns;
- Identifying where sewer line segments function as preferential contaminant migration pathways for surface water and/or groundwater;
- Identifying where facility-wide sewer system may have contributed to contamination of receptor media and recommending a path forward for those media; and

- Identification of feasible and appropriate remedial technologies.

Future risk-management and remedial decisions for the facility-wide sewers under CERCLA will not be predicated on physical safety hazards, such as missing manhole covers or non-contaminated pipelines with a high potential for collapse. Physical safety hazards will be addressed separately by the Army and OHARNG. However, visual and video survey data obtained during the RI that pertain to physical safety hazards will be communicated to the Army and OHARNG for their information and any necessary actions.

3.2.3 Data Needs and Decision Inputs

Limited previous investigations have been performed to characterize the storm and sanitary sewer systems at RVAAP. These investigations have focused on Load Lines 1 through 12 and were designed to provide an initial evaluation of the occurrence of contamination rather than to fully assess nature and extent. A summary of available existing data is presented on Table 1-1. Sampling and characterization of accumulated sediment and water within some sanitary sewers, and storm sewers if present, were conducted as part of the following investigations:

- *Load Line 1 Phase II RI* (USACE 2003) – storm and sanitary sewers, video surveys;

- *Load Lines 2, 3, and 4 Phase II RI* (USACE 2004a, 2004b, and 2004c) – storm and sanitary sewers, video surveys;

- *Load Line 12 Phase II RI* (USACE 2004d) – sanitary sewers present only, limited video surveys;

- *Characterization of 14 AOCs at RVAAP* (MKM 2007a) – sanitary sewers at Load Lines 5, 7, 8, 10 and Atlas Scrap Yard;

- *Load Line 6 Phase I RI* (MKM 2007b) – sanitary sewers present only;

- *Load Line 9 Phase I RI (MKM 2007c)* – sanitary sewers present only; and

- *Load Line 11 Phase I RI (MKM 2005)* – sanitary sewers present only.

In addition, two studies commissioned by the U.S. Army Base Realignment and Closure Division (BRAC-D) evaluated the potential for explosive hazards within sanitary and storm sewer lines at Load Lines 1 through 12 and the Administration Area (USACE-CERL 2007 and Lakeshore Engineering Services Inc. 2007). These studies included video camera surveys of sewers lines to determine if visible accumulations of explosives were present. Both studies collected wipe samples of sewer line inverts and video cameras for analysis of TNT and/or cyclonite (RDX) using field test kit methods (e.g., Exspray™ and DropEx™) samples. These studies did not collect samples of accumulated sediment or water within the lines for fixed-based laboratory analysis.

These previous investigations have not fully assessed the condition of the lines and have not defined the nature and extent of contamination within the lines; therefore, additional sampling will be performed. In addition, prior investigations have not considered all potential contaminant release and exposure pathways. Therefore, evaluation of potential leakage points and contamination of receptor media (e.g., dry and wet sediment within conveyances that received discharges from outfalls, subsurface soil, and groundwater) is planned. Available historical data, as well as newly acquired data from ongoing or planned near-term AOC investigations will be incorporated into the evaluation.

Based on the project DQOs, the following types of data inputs are needed to support the project decision points:

- Visual assessment of the current condition of visible portions of the sewer systems (inverts, catch basins, outfalls, etc.), including determining where portions of the system may have been destroyed/removed during building demolition activities or are present, but filled in with debris;
- Video camera surveys of potentially contaminated sewer line segments, as identified through visual assessment and field screening tools, to assess the current condition of piping systems;
- Sampling of sediment and water within the sewer systems and analysis using both field screening tools and fixed-based methods to assess presence and extent of contamination; and
- Compilation of historical data and sampling, as required to assess presence and extent of contamination both within the sewer lines and in receptor media (e.g., outfall sediment, pipeline bedding material, subsurface soil, and groundwater) that may have received contaminants sourced from the sewer systems.

3.2.4 Spatial Boundaries of the Investigation

A formal definition and boundary for AOC number RVAAP-67 has not been established through the RVAAP Installation Action Plan (IAP) process to date. The definition and boundaries of RVAAP-67 presented in Section 3.1 represent the most current compilation of information and guidance from the RVAAP IRP Team during the 2008 PBA procurement process, as well as discussions during the project kickoff meeting and the facility-wide sewers DQO planning workshop. The investigation will address the components of the systems as defined in Section 3.1. Maps depicting sewer lines that fall within the definition and boundaries of RVAAP-67, including trunk lines between AOCs and those leading to former sewage treatment facilities, are included in Appendices A through Q. These appendices also include summaries of available historical data for each component of the AOC.

3.2.5 General Investigation Decision Rules and Sample Design

The general decision rules to be applied for the facility-wide sewers RI are presented in the following sections. The general decision rules outline a tiered, optimized characterization approach for the investigation. Three tiers of investigation will be performed:

- Tier 1 – Investigation of the sewer lines, accumulated sediment and water within the lines, and sediment and water at key outfall and AOC entry/exit points (investigation tools include visual surveys, video camera surveys, collection of samples for field screening and fixed-based laboratory analyses);

- Tier 2 – Collection of pipeline bedding material to characterize direct exposure potential from contaminant releases via pipeline leaks and evaluate if these releases may have impacted the subsurface soil below the pipeline; and

- Tier 3 – Collection of subsurface soil data where needed to characterize direct exposure potential from contaminant releases via pipeline leaks, and evaluate if these releases may have impacted groundwater.

Figure 3-2 illustrates the decision rules and sample design for the facility-wide sewers RI. This SAP Addendum outlines the approach for both tiers of investigation. However, potential bedding material and subsurface soil sampling locations addressed under Tiers 2 and 3, respectively, will not be fully identified until receipt and evaluation of data collected under the preceding Tier of investigation. A Technical Memorandum outlining the Tier 2 and Tier 3 rationales and specific proposed areas for investigation will be prepared and issued to the RVAAP Team following evaluation of data from the preceding Tier of investigation and prior to the commencement of the additional activities.

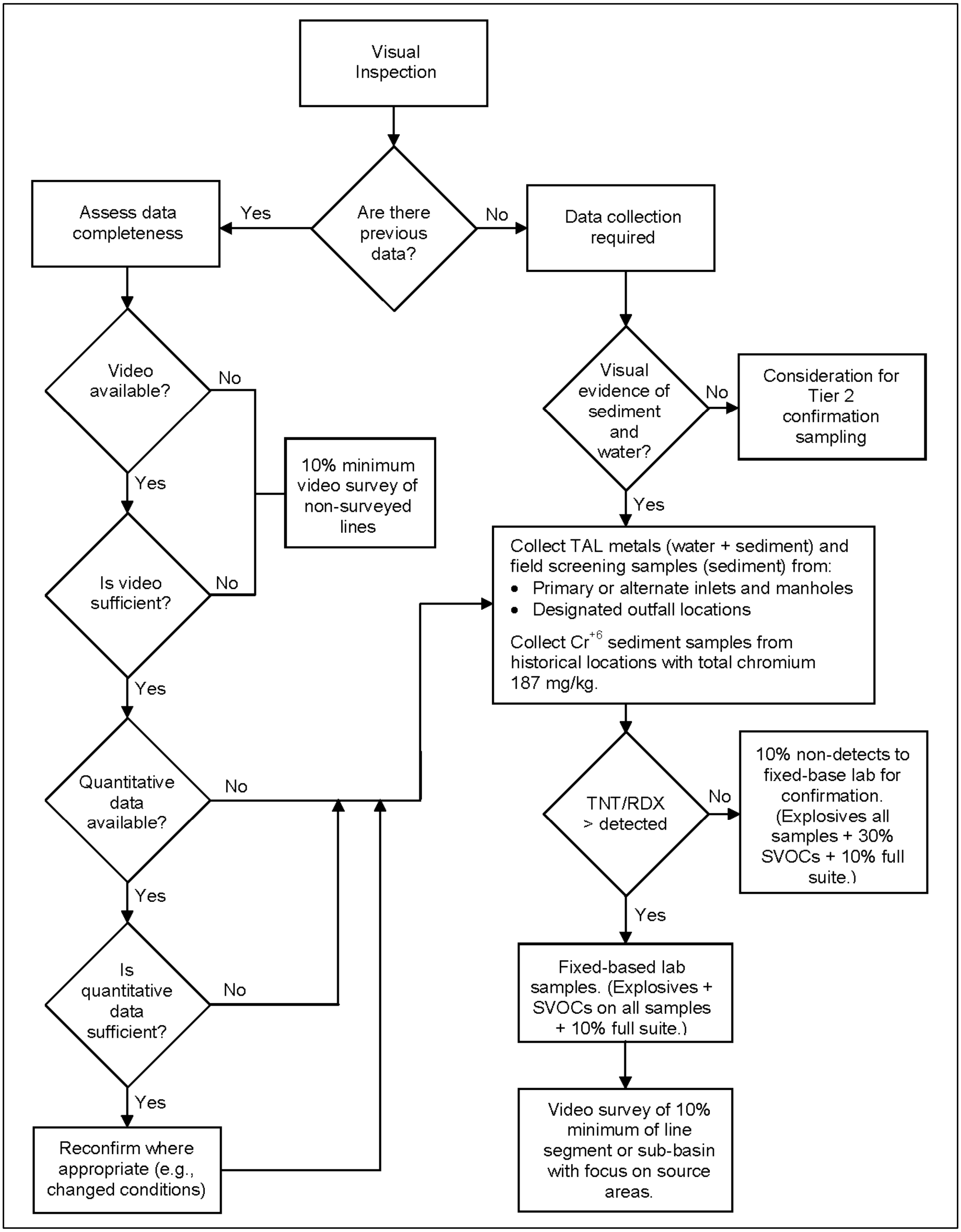


Figure 3-2. Facility-Wide Sewers RI Tier 1 Manholes and Inlets Sampling Decision Flowchart

3.2.5.1 Tier 1 Investigation

Use of Historical Data

Available historical sewer characterization data were used in the development of decision rules and sample design for Tier 1 of the RI as discussed below. Two data sets were evaluated to initially determine where contamination is likely present and where additional characterization of the sewer system is anticipated: 1) field analytical data for wipe samples; and 2) fixed-based analytical laboratory data of accumulated water and sediment (wet and dry) within the sewer lines, as well as sediment (wet and dry) at storm sewer outfall locations.

Previously-collected TNT and RDX field analytical data for wipe samples were used qualitatively to identify where additional sewer line characterization is needed. A "positive" detection for either compound in a specific sewer line segment provided qualitative indication where explosives may be present in any accumulated sediment or water within the lines; therefore, specific focus on these line segments is planned to determine whether these matrices are present and, if so, to characterize them. No sewer line segments were excluded from the investigation on the basis of these historical field analytical data.

Historical fixed-based analytical laboratory data were evaluated to identify segments of the sewers where contaminants in accumulated wet and dry sediment and water were present above risk-based screening levels as defined below. In addition, available data for sediment (wet and dry) at sewer outfall locations were evaluated for indicators where sewers may have previously discharged contaminants. Historical water samples at or near outfall locations represent a transient media and were determined not to be representative of current conditions; therefore, these sample types were not incorporated into the initial data evaluation. Locations of previously-collected fixed-based analytical laboratory samples are depicted on maps in Appendices A through Q.

Accumulated sediment and water within sewer line inverts and pipelines do not have a specific, unique set of risk-based screening levels or background values. In previous RIs, risk-based screening levels for wet sediment and surface water were used for approximation of accumulated sediment and water, respectively, within the sewer lines. This convention was also used for the initial screening of historical analytical data in this SAP Addendum for the facility-wide sewer system. For sediment (dry or wet) at outfall locations, screening levels and background values established for wet sediment were used for initial data screening.

The values and sources for screening levels used in this SAP Addendum to determine exceedances and where additional characterization may be required are presented in Table 3-1. Screening levels used for the initial data evaluation were either RVAAP facility-wide background values or draft facility-wide risk-based cleanup goals (CUGs) established in the Draft Facility-Wide Human Health Cleanup Goals for the RVAAP (USACE 2008), herein referred to as the Draft CUG Report. For those chemicals where CUGs were employed as screening levels, the values for a noncarcinogenic hazard index (HI) of 0.1 and a carcinogenic risk of 1.0E-6 were used. The draft facility-wide CUGs are subject to change as the Draft

CUG Report is reviewed and finalized by the RVAAP Team. Therefore, revised or additional data comparisons for risk management decisions may be required at a later point in the CERCLA process.

The CUG-based screening levels shown in Table 3-1 are a compilation of the lowest values from either the Resident Farmer or National Guard Trainee receptor scenarios outlined in the Draft CUG Report (USACE 2008). This conservatism was incorporated into the initial data screening process to facilitate identification of all sewer line segments having potential contamination that might merit further investigation of nature and extent. During the initial data screening, the presence of inorganic chemicals at concentrations equal to or less than background values were assumed to indicate the absence of contamination. Therefore, if the CUG-based screening level for an inorganic chemical was less than background, then the background value was used to determine exceedances that may require further investigation.

In the Draft CUG Report, CUGs were established only for chemicals determined in previous RI Reports to be facility-wide chemicals of potential concern (COPCs). Designation of COPCs in previous reports was based on the U.S. Environmental Protection Agency (USEPA) Region 9 preliminary remediation goals (PRGs). As detailed in Section 2.0 of the CUG Report, CUGs were not established for chemicals considered to be essential nutrients. Newly acquired data under this investigation will be further evaluated in the RI Report to determine whether any chemicals not currently listed as facility-wide COPCs may require calculation of CUGs for the purposes of sewer line risk management and remedial decision making.

The term “exceedance” within this FSP Addendum refers to an analytical result that is greater than the screening levels presented in Table 3-1 for one or more chemicals. The absence of a screening level for a chemical in Table 3-1 indicates that either a CUG has not been developed or a RVAAP facility-wide background value has not been established. Evaluation using other benchmark criteria (e.g., USAEPA Regional Screening Levels or Safe Drinking Water Act Maximum Contaminant Levels) was not performed for those historically detected chemicals having no CUG-based or facility-wide background screening levels and; therefore, no exceedances are depicted for those chemicals.

Locations where chemicals exceeded their respective screening levels in accumulated sewer line sediment and water, as well as sediment (dry or wet) at outfall locations are shown on maps in Appendices A through Q. If analytical results for a historical sampling location exceeded the screening criteria for one or more chemicals listed in Table 3-1, then further evaluation of the sewer line segment “upstream and downstream” of that location is planned during the facility-wide sewers RI. Table 3-1 also lists draft screening levels for other receptor media to be evaluated under Tier 2 of the RI or within the RI Report. As discussed previously, evaluation of Tier 1 data, along with historical data for subsurface soil and groundwater in the vicinity of the sewer lines, will be performed as part of technical rationale development for Tier 2 of the RI. For these receptor media, the applicable screening levels will be used to identify areas that are potentially impacted by sewer lines releases.

Table 3-1. Historical Data Screening Levels for Facility-Wide Sewers

Chemical[1] (mg/kg or mg/L)	Surface Soil CUG	CUG Type	Subsurface Soil CUG	CUG Type	Groundwater Unconsolidated CUG[2]	CUG Type	Groundwater Bedrock CUG[2]	CUG Type	Surface Water CUG[3]	CUG Type	Wet Sediment CUG[4]	CUG Type
Nitrate	12000	RFC	12000	RFC	1.7	RFC	1.7	RFC	25	RFC	None	N/A
Aluminum	17700	BKG	19500	BKG	1	RFC	1	RFC	15	RFC	13900	BKG
Antimony	2.8	RFC	2.8	RFC	0.00039	RFC	0.00039	RFC	0.0049	RFC	2.8	RFC
Arsenic	15.4	BKG	19.8	BKG	0.0117	BKG	0.000056	RFA	0.0032	BKG	19.5	BKG
Barium	350	NGT	350	NGT	0.2	RFC	0.256	BKG	2.9	RFC	350	NGT
Cadmium	6.4	RFC	6.4	RFC	0.00046	RFC	0.00046	RFC	0.0041	NGT	6.4	RFC
Chromium	17.4	BKG	27.2	BKG	0.0073	BKG	0.0027	RFC	0.025	NGT	18.1	BKG
Chromium, hexavalent	1.6	NGT	1.6	NGT	None[5]	N/A	None	N/A	0.025	NGT	1.6	NGT
Cobalt	10.4	BKG	23.2	BKG	0.021	RFC	0.021	RFC	None	N/A	9.1	BKG
Copper	310	RFC	310	RFC	None	N/A	None	N/A	0.61	RFC	310	RFC
Lead	400	TB	400	TB	0.015	MCL	0.015	MCL	0.015	TB	400	TB
Manganese	1450	BKG	3030	BKG	1.02	BKG	1.34	BKG	0.63	RFC	1950	BKG
Mercury	2.3	RFC	2.3	RFC	None	N/A	None	N/A	0.0044	RFC	2.3	RFC
Nickel	160	RFC	160	RFC	0.021	RFC	0.0834	BKG	0.31	RFC	160	RFC
Silver	39	RFC	39	RFC	None	N/A	None	N/A	0.077	RFC	39	RFC
Thallium	0.61	RFC	0.91	BKG	0.000083	RFC	0.000083	RFC	0.0012	RFC	0.89	BKG
Vanadium	45	RFC	45	RFC	0.0064	RFC	0.0064	RFC	0.057	NGT	45	RFC
Zinc	2300	RFC	2300	RFC	0.31	RFC	0.31	RFC	4.6	RFC	2300	RFC
1,3,5-Trinitrobenzene	230	RFC	230	RFC	None	N/A	None	N/A	None	N/A	None	N/A
1,3-Dinitrobenzene	0.77	RFC	0.77	RFC	0.0001	RFC	0.0001	RFC	None	N/A	None	N/A
2,4,6-Trinitrotoluene	3.7	RFC	3.7	RFC	0.00052	RFC	0.00052	RFC	0.0078	RFC	3.7	RFC
2,4-Dinitrotoluene	0.75	RFA	0.75	RFA	0.00012	RFA	0.00012	RFA	0.002	RFA	0.75	RFA
2,6-Dinitrotoluene	0.77	RFA	0.77	RFA	0.00012	RFA	0.00012	RFA	0.0021	RFA	None	N/A
2-Amino-4,6-Dinitrotoluene	1.5	RFC	1.5	RFC	0.00021	RFC	0.00021	RFC	0.0031	RFC	1.5	RFC
2-Nitrotoluene	3.9	RFC	3.9	RFC	0.00037	RFA	0.00037	RFA	0.0074	RFA	None	N/A
4-Amino-2,6-Dinitrotoluene	1.5	RFC	1.5	RFC	0.00021	RFC	0.00021	RFC	0.0031	RFC	1.5	RFC
4-Nitrotoluene	53	RFC	53	RFC	0.005	RFA	0.005	RFA	0.1	RFA	None	N/A

Table 3-1. Historical Data Screening Levels for Facility-Wide Sewers (continued)

Chemical[1] (mg/kg or mg/L)	Surface Soil CUG	CUG Type	Subsurface Soil CUG	CUG Type	Groundwater Unconsolidated CUG[2]	CUG Type	Groundwater Bedrock CUG[2]	CUG Type	Surface Water CUG[3]	CUG Type	Wet Sediment CUG[4]	CUG Type
HMX	360	RFC	360	RFC	None	N/A	None	N/A	0.78	RFC	360	RFC
Nitrobenzene	None	N/A	None	N/A	0.00052	RFC	0.00052	RFC	None	N/A	None	N/A
Nitroglycerin	53	RFC	53	RFC	0.005	RFA	0.005	RFA	None	N/A	53	RFC
RDX	8	RFC	8	RFC	0.00077	RFA	0.00077	RFA	0.015	RFA	8	RFC
4,4'-DDD	None	N/A	None	N/A	0.000059	RFA	0.000059	RFA	None	N/A	None	N/A
4,4'-DDE	2.6	RFC	2.6	RFC	0.000047	RFA	0.000047	RFA	None	N/A	None	N/A
4,4'-DDT	None	N/A	None	N/A	0.000027	RFA	0.000027	RFA	0.0001	RFA	None	N/A
Aldrin	0.053	RFC	0.053	RFC	0.0000047	RFA	0.0000047	RFA	0.000073	RFA	None	N/A
Dieldrin	0.056	RFC	0.056	RFC	0.0000036	RFA	0.0000036	RFA	None	N/A	0.056	RFC
Endrin	1.1	RFC	1.1	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Endrin aldehyde	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
Heptachlor	0.2	RFC	0.2	RFC	0.000014	RFA	0.000014	RFA	None	N/A	None	N/A
Heptachlor epoxide	0.098	RFC	0.098	RFC	0.0000094	RFA	0.0000094	RFA	0.00019	RFA	None	N/A
Lindane	None	N/A	None	N/A	0.000051	RFA	0.000051	RFA	None	N/A	None	N/A
PCB-1016	0.2	RFA	0.2	RFA	None	N/A	None	N/A	None	N/A	0.2	RFA
PCB-1242	None	N/A	None	N/A	0.00021	RFA	0.00021	RFA	None	N/A	None	N/A
PCB-1248	0.2	RFA	0.2	RFA	None	N/A	None	N/A	None	N/A	None	N/A
PCB-1254	0.12	RFC	0.12	RFC	0.000021	RFC	0.000021	RFC	0.00031	RFC	0.12	RFC
PCB-1260	0.2	RFA	0.2	RFA	0.00021	RFA	0.00021	RFA	None	N/A	0.2	RFA
Toxaphene	None	N/A	None	N/A	0.000048	RFA	0.000048	RFA	None	N/A	None	N/A
alpha-BHC	None	N/A	None	N/A	0.000014	RFA	0.000014	RFA	None	N/A	None	N/A
alpha-Chlordane	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
beta-BHC	0.5	RFC	0.5	RFC	0.000047	RFA	0.000047	RFA	0.00095	RFA	None	N/A
gamma-Chlordane	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
1,4-Dichlorobenzene	None	N/A	None	N/A	None	N/A	None	N/A	0.019	RFA	None	N/A
2,4-Dimethylphenol	None	N/A	None	N/A	None	N/A	None	N/A	0.25	RFC	None	N/A
2-Methylnaphthalene	31	RFC	31	RFC	None	N/A	None	N/A	None	N/A	None	N/A

Table 3-1. Historical Data Screening Levels for Facility-Wide Sewers (continued)

Chemical[1] (mg/kg or mg/L)	Surface Soil CUG	CUG Type	Subsurface Soil CUG	CUG Type	Groundwater Unconsolidated CUG[2]	CUG Type	Groundwater Bedrock CUG[2]	CUG Type	Surface Water CUG[3]	CUG Type	Wet Sediment CUG[4]	CUG Type
4-Chloro-3-methylphenol	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A	None	N/A
4-Methylphenol	None	N/A	None	N/A	None	N/A	None	N/A	0.068	RFC	None	N/A
4-Nitrobenzenamine	None	N/A	None	N/A	0.0031	RFC	0.0031	RFC	None	N/A	None	N/A
4-Nitrophenol	61	RFC	61	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Benz(a)anthracene	0.22	RFA	0.22	RFA	0.0000039	RFA	0.0000039	RFA	0.000014	RFA	0.22	RFA
Benzo(a)pyrene	0.022	RFA	0.022	RFA	0.00000023	RFA	0.00000023	RFA	0.0000008	RFA	0.022	RFA
Benzo(b)fluoranthene	0.22	RFA	0.22	RFA	0.0000023	RFA	0.0000023	RFA	0.0000079	RFA	0.22	RFA
Benzo(k)fluoranthene	2.2	RFA	2.2	RFA	None	N/A	None	N/A	0.023	RFA	2.2	RFA
Bis(2-chloroethoxy)methane	23	RFC	23	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Bis(2-ethylhexyl)phthalate	None	N/A	None	N/A	0.0009	RFA	0.0009	RFA	0.0035	RFA	None	N/A
Carbazole	45	RFC	45	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Chrysene	22	RFA	22	RFA	None	N/A	None	N/A	0.0014	RFA	None	N/A
Dibenz(a,h)anthracene	0.022	RFA	0.022	RFA	0.00000015	RFA	0.00000015	RFA	0.00000052	RFA	0.022	RFA
Dibenzofuran	15	RFC	15	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Fluoranthene	160	RFC	160	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Fluorene	240	RFC	240	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Indeno(1,2,3-cd)pyrene	0.22	RFA	0.22	RFA	0.0000023	RFA	0.0000023	RFA	0.0000078	RFA	0.22	RFA
N-Nitroso-di-n-propylamine	0.12	RFC	0.12	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Naphthalene	120	RFC	120	RFC	None	N/A	None	N/A	None	N/A	None	N/A
Nitrobenzene	None	N/A	None	N/A	0.00052	RFC	0.00052	RFC	None	N/A	None	N/A
Pentachlorophenol	2.1	RFA	2.1	RFA	0.000074	RFA	0.000074	RFA	0.00028	RFA	None	N/A
Pyrene	120	RFC	120	RFC	None	N/A	None	N/A	0.47	RFC	None	N/A
bis(2-Chloroethoxy)methane	23	RFC	23	RFC	None	N/A	None	N/A	None	N/A	None	N/A
1,1,2,2-Tetrachloroethane	None	N/A	None	N/A	0.000069	RFA	0.000069	RFA	0.00039	NGT	None	N/A
1,2-Dichloroethane	None	N/A	None	N/A	0.00016	RFA	0.00016	RFA	None	N/A	None	N/A
1,2-Dichloroethene	None	N/A	None	N/A	None	N/A	None	N/A	0.12	RFC	None	N/A
1,4-Dichlorobenzene	None	N/A	None	N/A	None	N/A	None	N/A	0.019	RFA	None	N/A

Table 3-1. Historical Data Screening Levels for Facility-Wide Sewers (continued)

Chemical[1] (mg/kg or mg/L)	Surface Soil CUG	CUG Type	Subsurface Soil CUG	CUG Type	Groundwater Unconsolidated CUG[2]	CUG Type	Groundwater Bedrock CUG[2]	CUG Type	Surface Water CUG[3]	CUG Type	Wet Sediment CUG[4]	CUG Type
Benzene	None	N/A	None	N/A	0.00043	RFA	0.00043	RFA	None	N/A	None	N/A
Carbon tetrachloride	None	N/A	None	N/A	0.0002	RFA	0.0002	RFA	None	N/A	None	N/A
Chloroform	None	N/A	None	N/A	0.00021	RFA	0.00021	RFA	0.001	NGT	None	N/A
Methylene chloride	None	N/A	None	N/A	0.0053	RFA	0.0053	RFA	0.046	NGT	None	N/A
Tetrachloroethene	None	N/A	None	N/A	0.000098	RFA	0.000098	RFA	0.00083	RFA	None	N/A
Trichloroethene	None	N/A	None	N/A	0.000031	RFA	0.000031	RFA	0.00016	NGT	None	N/A
cis-1,2-Dichloroethene	None	N/A	None	N/A	None	N/A	None	N/A	0.16	RFC	None	N/A

Notes: This table lists all chemicals for which CUGs were developed in the Draft CUG Report (USACE 2008b). Screening levels were based on the CUG for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Values were rounded to two significant figures. When background values were higher than the CUG (HQ=0.1/R=1E-6), the background value became the screening level. Background values were not rounded to two significant figures and were obtained from the April 2001 Phase II Winklepeck Remedial Investigation Report (USACE, 2001b).

Chromium speciation samples will be collected in accordance with Section 4.6 of this SAP to evaluate the concentration ratio of hexavalent chromium to total chromium. These sample results will provide guidance for future remedial decisions and remedial actions at these areas of concern.

[1] Although listed as a COPC in the September 2008 Draft Facility-Wide Human Health Cleanup Goals for RVAAP, iron was not screened against a CUG as this chemical has historically been considered an essential nutrient at RVAAP. The RVAAP Risk Manual identifies iron as one of the essential elements that should not be evaluated as a COPC as long as it is present at low concentrations (e.g., below 100,000 to 180,000 mg/kg). The maximum detection of iron from previous sampling at these subject AOCs is 76,000 mg/kg.

[2] Groundwater CUGs and background values provided are representative of filtered groundwater samples. Unfiltered groundwater samples were not evaluated.

[3] Surface water CUGs and background values are representative of unfiltered water. Filtered surface sample results were not evaluated.

[4] Wet sediment CUG are equal to surface soil CUG with the exception of when background values were greater than CUG screening levels.

[5] "None" indicates the chemical has not been detected or determined as COPC at RVAAP in past investigations. In the event a chemical without a screening value is determined to be a COPC a CUG will be developed (Section 3.2.1).

TB = technology-based screening level
CUG = Cleanup Goal
BKG = Background.
N/A = not applicable
NGT = National Guard Trainee.
RFA = Resident Subsistence Farmer Adult.
RFC = Resident Subsistence Farmer Child.

Visual Inspection

As shown on Figure 3-2, Tier 1 of the RI will begin with a systematic visual inspection of the facility-wide storm and sanitary sewer systems. Information on the condition of sanitary and storm sewer manholes, catch basins, drop inlets, and outfall points will be collected. The inspection will include identifying whether accumulated sediment and water are present in the lines. Visual inspection information will be recorded on a checklist as denoted in Section 4.1.

Visual inspections will include those known sewer lines documented through historical engineering data for RVAAP. During preliminary reconnaissance of the facility-wide sewers in December 2008, undocumented storm sewer systems were discovered in the former RVAAP Administration Area, the Depot Administration Area, and Inert Storage Area #6 (south of Load Lines 2 and 3). Historical engineering or construction records for these systems have not been located to date. Mapping of these systems using visual surveys, smoke tracing, dye tracing, and geophysics (e.g., ground penetrating radar or magnetometer survey), as appropriate, will be conducted during this portion of the investigation.

Assessment of Data Completeness

Historical analytical data and available sewer line video survey information was compiled as part of preparation of this SAP Addendum. This information was evaluated with respect to general condition of the sewer lines and where contamination has been previously documented to exist within the lines. For sewer line segments where site conditions have not changed (e.g., no disturbances due to demolition) and sufficient historical data exist to adequately assess the condition of the lines and determine the nature and extent of contamination for subsequent FS decision making, minimal additional investigation of that line segment will be conducted. Additional data collection will be performed in those cases where historical data are not available, are insufficient, or site conditions have changed substantially (e.g., building demolition or building slab removals) since the time of historical data collection.

For the purposes of this RI, sufficiency of historical data for a sewer line segment is defined as:

- Historical video surveys – survey must have included portions of a sewer line segment or sub-basin adjacent to, or immediately downgradient of, known or suspected sources; along the mid-point reaches of the pipeline; and along portions of the pipeline near the terminus or outfall.

- Historical accumulated sediment and water data – at a minimum, samples collected at or immediately “downstream” of each major suspected contaminant source to the sewer line segment (e.g., production buildings), at a minimum of one midpoint location between the source(s) and terminus of the segment, and at or near the termination point of the segment (e.g., outfall or manhole junction). Additional refinement of the distribution of contamination within a particular sewer line segment may be warranted for the purposes of subsequent FS remedial alternative development and remedial design.

Tier 1 Data Collection

Where historical data are lacking or insufficient, data collection under Tier 1 of the investigation will proceed as discussed below. Figure 3-2 illustrates the Tier 1 investigation decision rules.

<u>Identification of Sewer Lines Segments and Sub-basins</u>

Historical sewer line engineering data were evaluated with respect to potential contaminant inputs (e.g., production buildings), flow directions, and major line junction and outfall points. From this evaluation, individual sewer line segments or groups of lines (sub-basins) were identified in order to optimize Tier 1 sampling. Where possible, the identified sewer line segments or sub-basins isolate a particular known or suspected historical source input and its associated outfall or junction point. Collection of Tier 1 accumulated sediment samples within each line segment or sub-basin are planned at locations near or immediately downstream of the former source, at one or more selected mid-points locations along the segment, and at the outfall or junction point. The approach incorporates flexibility for field decisions to move to adjacent sewer line access points (upstream or downstream) within each line segment in the event a planned location does not contain sufficient sediment for sampling. In some cases, isolation of outfall or junction points with respect to a specific source input was not possible to due to the convergence of multiple lines along the flow routes.

Collection of Tier 1 accumulated water samples is generally planned at: 1) key inlet and exit point locations for the AOCs and functional areas (e.g., Administration Area); or 2) at major potential sources within AOCs and functional areas (e.g., melt-pour building complexes), if isolation of those sources is needed to fill data gaps or determine contaminant nature and extent within a particular portion of the AOC sewer lines. Where historical investigation data possibly no longer represent current conditions due to their age, or site conditions are known to have changed, additional sampling to confirm prior results is also planned.

The Tier 1 data collection approach optimizes the characterization while allowing full nature and extent assessment to be conducted from the source to the endpoint of each line segment. Sewer lines segments or sub-basins, and the rationales for planned sample locations, are illustrated in Appendices A through Q.

Where field inspection shows a sewer line segment is not flooded, video camera surveys to determine the condition of the pipeline will be performed. The video camera surveys will be used to verify whether sediment accumulations exist within the line segment and to identify cracks or separation of pipeline sections where leakage may have occurred. For new video camera data acquisition, the investigation objective is to survey a minimum of 10% of the total length of a sewer line segment of interest where possible. For each sewer line segment, entry points for video surveys will be sufficient to provide a general overall assessment of the pipeline along its reach. Survey entry points for each sewer line segment will, at a minimum, include reaches immediately downstream of source points (e.g., manholes and catch basins at former melt-pour buildings); reaches at the midpoint between the source and terminus, and reaches near the terminus.

Limited access to the lines for video surveys is anticipated in some areas. Available video survey data indicate some sewer line segments are in poor condition with frequent breaks, separation points, root intrusion, and blockages by debris. Building demolition activities, particularly at Load Lines 1 through 4, have resulted in damage to the sewer systems adjacent to former building, in particular storm sewer catch basins. Field reconnaissance conducted in December 2008 at these four load lines showed many catch basins were partially or totally filled in with ballast during grading activities and some basins and lines could not be located and are presumed to have been destroyed. In the event that no surface access via manhole or drop inlet is available at a pipe segment of interest, the use of intrusive methods would be evaluated. Equipment such as a backhoe or excavator would be utilized to expose three points along the pipe segment (i.e., "upstream" end closest to possible contamination sources, midpoint, and "downstream" end) in order to collect a sample of the material within the sewer pipe or conduct video surveys.

Sewer Line Accumulated Sediment and Water Sampling

Where the visual inspection results indicate the presence of sufficient accumulated sediment or water within manholes, drop inlets or catch basins in each sewer line segment, samples of these matrices will be collected during Tier 1 of the investigation. The rationales for sampling within each sewer line segment are outlined in Appendices A through Q.

For accumulated sediment at planned sewer line sampling locations, samples will be collected for TAL metals analyses by fixed-based laboratory and field analyses of TNT and RDX. Additionally, hexavalent chromium samples will be collected at locations where historical total chromium data exceeds the CUG for the resident farmer of 187 mg/kg; these locations are noted in the Appendices for the applicable functional areas. Sediment samples collected from the sewer lines will be discrete samples because collection of random aliquots for MI samples is not feasible from within the pipe lines. Sewer line sediment field screening samples will be analyzed for TNT and RDX using field analytical kits (Section 4.2.2). These TNT and RDX field screening samples will be used to provide semi-quantitative, rapid assessment of the presence and extent of contamination of sediment within each sewer line segment. Field analytical data for TNT and RDX will be evaluated as it is generated during Tier 1 of the investigation. The field analytical data will be used to determine locations where samples will be collected and submitted for fix-based laboratory analysis for explosives and other analyte groups of interest. Where field analytical methods show positive detections for TNT and RDX in accumulated sediment, the following protocol will be employed for fixed-based laboratory analyses:

- 100% of the samples will be submitted for explosives and semivolatile organic compounds (SVOCs) analyses due to the comparatively high historical frequency of detection of these compounds; and

- A minimum of 10% of the samples will be analyzed for a full suite of target analytes, including propellants, volatile organic compounds (VOCs), pesticides/polychlorinated biphenyls (PCBs), and herbicides.

Sediment samples for fixed-based laboratory analyses will also be submitted for a minimum of 10% of the sample locations where field analytical data do not indicate the presence of TNT or RDX contamination. These samples will be used to confirm the absence of contamination. All samples submitted to confirm the absence of contamination will be analyzed for explosives. Additionally, a minimum of 30% of the samples will also be analyzed for SVOCs and 10% of the samples will be analyzed for the full suite of target analytes.

All samples of accumulated water within the sewer lines will be submitted for fixed-based laboratory analyses of TAL metals and explosives. Additionally, a minimum of 30% of the samples will also be analyzed for SVOCs and 10% of the samples will be analyzed for the full suite of target analytes.

In addition, a full suite of fixed-based laboratory analyses will be conducted where visual surveys indicate the likely occurrence of contamination (e.g., visible reddish or white crystalline explosive deposits or evidence of sheens on accumulated water in the pipeline).

Sewer Line Outfall Sediment and Water Sampling

Previous remedial investigations and sewer line engineering data were reviewed to predetermine outfall locations where sediment (wet or dry) and water samples will be collected. These sample locations include outfall points for storm sewers and emergency overflow points for the sanitary sewers (e.g., lift station overflow lines). Previous data exist for some of these outfall locations. Repeat sampling of outfall locations was not planned in cases where site conditions have not changed since the time of historical sampling (e.g., building demolition) and the data were comparatively recent so that they still represent current conditions. Outfall sampling locations and rationales for major segments of the sewer systems within each AOC are tabulated and illustrated in Appendices A through Q.

At all planned sewer line outfall sampling locations, sediment samples will be collected for TAL metals analyses by fixed-based laboratory and field analyses of TNT and RDX. Outfall sediment field screening samples will be analyzed for TNT and RDX using field analytical kits (Section 4.2.2). These TNT and RDX field screening samples will be used to provide rapid assessment of the presence of contamination at the outfall location. The field analytical data will be used to determine locations where samples will be collected and submitted for fixed-based laboratory analysis for explosives and other analyte groups of interest. Discrete samples are planned for all outfall sediment sampling locations in order to be consistent and have comparability with historical data. In addition, sediment samples collected during the RVAAP Facility-wide Surface Water Study were discrete samples; therefore, consistency and comparability is potentially needed to evaluate new outfall data with respect to chemical concentrations at locations sampled further downstream.

Where field analytical methods show positive detections for TNT and RDX in outfall sediment samples, the following protocol will be employed for additional fixed-based laboratory analyses:

- 100% of the samples will be submitted for explosives and for SVOCs analyses, due to the comparatively high historical frequency of detection of these compounds; and

- A minimum of 10% of the samples will be analyzed for a full suite of target analytes, including propellants, volatile organic compounds (VOCs), pesticides/polychlorinated biphenyls (PCBs), and herbicides.

Samples for fixed-based laboratory analyses will also be submitted for a minimum of 10% of the sample locations where field analytical data do not indicate the presence of TNT or RDX contamination. These samples will be used to confirm the absence of contamination. All samples submitted to confirm the absence of contamination will be analyzed for explosives. Additionally, a minimum of 30% of the samples will also be analyzed for SVOCs and 10% of the samples will be analyzed for the full suite of target analytes as noted above.

Planned samples of water emanating from outfall locations will be submitted for fixed-based laboratory analyses of TAL metals and explosives. Additionally, a minimum of 30% of the samples will also be analyzed for SVOCs and 10% of the samples will be analyzed for the full suite of target analytes.

In addition, a full suite of fixed-based laboratory analyses will be conducted where visual surveys of the outfall location indicate the likely occurrence of contamination (e.g., staining of sediments, visible reddish or white crystalline explosive deposits or evidence of sheens on any water emanating from the outfall).

Video Surveys

As real-time visual survey and field sample screening data are compiled during the Tier 1 investigation, video camera surveys of sewer line segments and sub-basins will be identified. Video camera surveys will be conducted where field screening data indicate the potential for contaminated sediment accumulation if those sewer line segments are accessible and not flooded. The video camera surveys will be used to verify whether sediment accumulations exist within the line segment and to identify cracks or separation of pipeline sections where leakage may have occurred. For new video camera data acquisition, the investigation objective is to survey as much of the total length of a sewer line segment of interest as possible, conditions permitting. At a minimum, 10% of the total length will be surveyed and entry points for video surveys will be sufficient to provide an overall assessment of the pipeline segment along its length for risk management and remedial decision-making purposes. Survey entry points for each sewer line segment will focus on reaches adjacent to, or immediately downstream of, source points (e.g., manholes and catch basins near former melt-pour buildings). One or more reaches of sewer line segments at the midpoint between the source and terminus, and reaches near the terminus will also be surveyed. In particular, where contaminated sewer line segments are identified adjacent to former source areas such as production buildings, the goal is to survey as much of these lines as feasible as pipeline breaks in these areas would most likely have resulted in contamination of adjacent subsurface soil.

Limited access to the lines for video surveys is anticipated in some areas. Available video survey data indicate some sewer line segments are in poor condition with frequent breaks, separation points, root intrusion, and blockages by debris. Building demolition activities, particularly at Load Lines 1 through 4, have resulted in damage to the sewer systems adjacent to former buildings, in particular storm sewer catch basins. Field reconnaissance conducted in December 2008 at these four load lines showed many catch basins were partially or totally filled in with ballast during grading activities and some basins and lines could not be located and are presumed to have been destroyed.

3.2.5.2 Tier 2 Investigation

Tier 2 Data Collection

Following completion of Tier 1 RI activities, field data will be compiled and evaluated along with fixed-based laboratory results. These data will be assessed to identify potential leakage points and areas where contaminants have accumulated in the sewer lines. Existing subsurface soil, outfall sediment, and groundwater sample locations in the vicinity of the sewer line segment of interest will be evaluated. Where visual and video survey data show the presence of line breaks and analytical data indicate corresponding contamination within the sewer line segment of interest, sampling of the 1-2 ft interval of bedding material (e.g., native soil, sand, or gravel) immediately underlying the pipeline is planned, as this is the interval most likely to exhibit contamination. The Tier 1 investigation may also reveal potential data gaps, such as undocumented outfall points, the need for additional video survey of certain pipeline segments where Tier 1 analytical results indicate the presence of contaminated segments with insufficient video data (either historical or Tier 1), or collection of chromium speciation samples if Tier 1 data may indicate hexavalent chromium enrichment in sewer line sediment. Therefore, the Tier 2 investigation effort may also include recommendations for collection of additional data to fill these data gaps. Recommendations for subsurface pipeline bedding material sampling, additional video survey, hexavalent chromium samples, or acquisition of other information needed to fill data gaps, will be made in a Technical Memorandum. The Technical Memorandum will outline technical rationales (e.g., major pipeline break) and specify locations for subsurface soil sampling and collection of other data types that may be required to fill data gaps.

The following decision rules will apply for subsurface bedding material sampling under Tier 2 of the RI (Figure 3-3). Where historical and Tier 1 characterization data indicate the presence of accumulated contamination within a sewer line segment of interest, sampling of the 1-2 ft interval of bedding material immediately underlying the sewer line will include the following:

- A minimum of one subsurface boring will be completed in the vicinity of line breaks at or immediately downstream of major sources (e.g., melt-pour or process building that formerly handled large quantities of explosives);

- A minimum of one subsurface boring will be completed at line breaks identified at the midpoint of the sewer line segment between the source(s) and the terminus; and

- A minimum of one subsurface sample will be collected at the terminus of the sewer line segment (e.g., immediately upstream of a manhole junction point or at an outfall location).

Bedding material samples will be submitted for fixed-based laboratory analysis for the suites of contaminants of interest as defined by the results of the Tier 1 sewer line sediment sampling at each location (e.g., TAL metals, if only metals had been observed above screening levels in Tier 1). Additionally, 10% of the bedding material samples will be submitted for the full analytical suite.

If historical and Tier 1 characterization data for accumulated sediment and water within the pipelines, as well as outfall sediment samples, do not indicate the presence of contamination, then one confirmation sample of bedding material will be completed in the vicinity of any identified line breaks at or immediately downstream of major sources (e.g., melt-pour or process building that formerly handled large quantities of process-related chemicals). All confirmatory bedding material samples will be submitted for fixed-based laboratory analysis of TAL metals. All bedding material samples will also be subject to analysis of TNT and RDX using field analytical kits (Section 4.2.2). These TNT and RDX field screening samples will be used to provide rapid assessment of the presence of contamination in the bedding material soil boring. The field analytical data will be used to determine which samples will be submitted for fixed-based laboratory analysis for explosives and other analyte groups of interest. Samples will be submitted for fixed-based analytical laboratory analyses of explosives and SVOCs where field samples show positive detections for TNT or RDX. Additionally, 10% of the bedding material samples with positive detections for TNT or RDX will be submitted for the full analytical suite. A minimum of 10% of samples with field analytical results for TNT or RDX less than detection limits will also be submitted for fixed-based lab analyses (TAL metals and explosives for all samples, 30% of samples for SVOC analyses, and 10% for the RVAAP full suite of analyses).

Under Tier 2, hexavalent chromium samples will be collected from sewer line sediment and bedding material based upon the analytical results of the Tier 1 sediment sampling as follows:

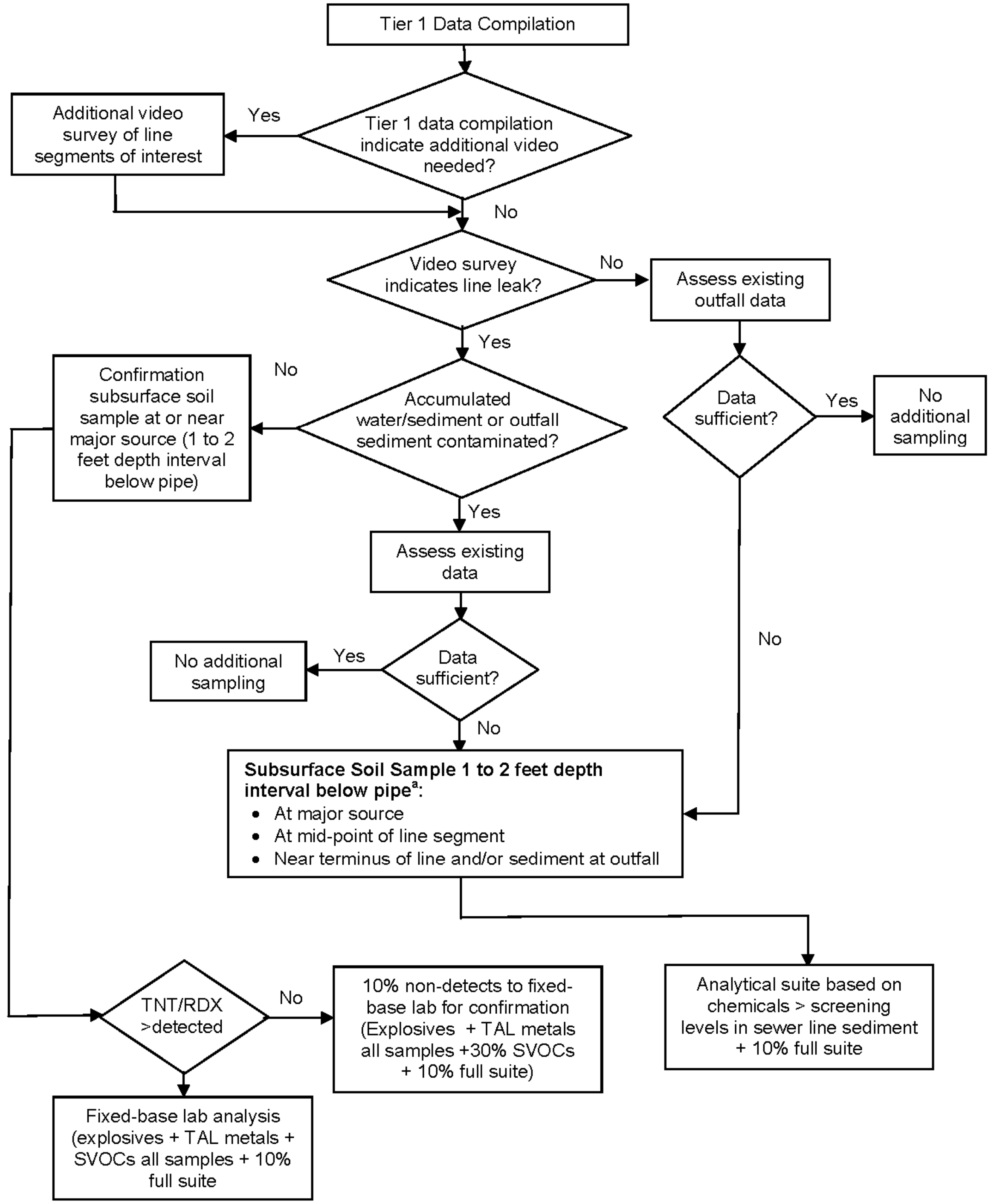
- If either historical data or Tier 1 sewer line sediment samples collected for TAL metals indicated concentrations of total chromium in excess of the resident farmer CUG of 187 mg/kg, sediment samples would be collected from these locations and analyzed for hexavalent chromium.

- Bedding material subsurface samples collected adjacent to sewer line sediment locations (historical samples or Tier 1 samples) having hexavalent chromium enrichment would also be submitted for hexavalent chromium analysis. Additionally, hexavalent chromium bedding material samples will be collected at a representative set of locations where the total chromium was detected at low, medium and high ranges of concentrations within each functional area (e.g., AOCs or other administrative area) in order to provide speciation data, as described in Section 4.6.

3.2.5.3 Tier 3 Investigation

Tier 3 Data Collection

Following completion of Tier 2 RI activities, the fixed-based laboratory results from the subsurface bedding material samples will be evaluated. These data will be assessed to identify the locations where contaminants have exited the sewer lines and accumulated in the bedding material directly below the pipe, or have potentially migrated to the underlying soils. Therefore, the Tier 3 investigation effort will include recommendations for collection of subsurface soil data to define the vertical and lateral nature and extent of contamination in the soil surrounding the sewer line. Recommendations for additional subsurface soil sampling locations will be made in a Technical Memorandum based upon the screening of the analytical data acquired from the subsurface sampling of the bedding material conducted under Tier 2.



[a] All samples to be submitted for TAL metals analysis by fixed-base laboratory. Tier 1 sampling locations with total chromium concentrations greater than 187 mg/kg will be sampled for Cr^{+6}.

Figure 3-3. Facility-Wide Sewers RI Tier 2 Sampling Decision Flowchart

3.3 HUMAN HEALTH RISK ASSESSMENT

As indicated in the conceptual model (Figure 3-1), there are three contaminant source types associated with the facility-wide sewers:

- Sediments within the sewer that become re-suspended during storms and migrate to the sewer outfall;
- Sediments that are contained within the sewers and may only be accessible if excavation activities results in a release; and
- Contaminated soils associated with leak sites, some which may not be identified unless future digging occurs.

Due to the extent of the storm and sewer systems at the RVAAP, an underlying assumption in the risk assessment and risk management process for this AOC is that the OHARNG will have to maintain some level of institutional controls on excavation and digging in the areas of underground sewers for safety reasons and to manage potential future encounters with contaminants (e.g., excavation/penetration requirements).

For each of the three potential sources types we have identified a process for assessing risks:

- Outfall Sediments – the risk assessment will evaluate potential exposures and risk at each of the sewer outfalls separately. Available data at a single outfall will be evaluated as a single exposure unit (EU). Receptors to these source materials will include:
    - Security Guard Maintenance Worker;
    - National Guard Engineering School Instructor;
    - Adult and Child Resident Farmer;
    - National Guard Trainee;
    - Fisher/Recreator; and
    - Adult and Juvenile Trespasser.
- Sediments Contained within the Sewers - the risk assessment will evaluate potential exposures and risk at known locations in the sewers where contaminated sediments have accumulated and data are available. Where these locations exist, data will be compared to appropriate CUGs to be identified in the RI Report on a location by location basis. Only receptors who may excavate to depth are evaluated for this source type:
    - National Guard Trainee;
    - National Guard Engineering School Instructor (if the sewer lines fall within a designated instructional area); and
    - Adult and Child Resident Farmer.

- Sewer Leak Site Soils - as indicated in Section 3.2.5.3, where potential leak sites are identified, historical soil data will be compiled and additional characterization of subsurface soil will be recommended and implemented. If a leak site is found to have affected subsurface soils, the same receptors as identified for sediments contained the sewers will be evaluated. Each identified sewer leak site will be evaluated separately with two exceptions: 1) where contamination from several leak sites comingle to form a single area of soil contamination; and 2) separate leak sites are close enough together to dictate treating them as a single exposure unit. However, where applicable, future risk management decisions and remedial actions for these receptor media may be integrated with concurrent CERCLA activities being conducted on an AOC-wide basis. Subsurface soil data will be compared to USEPA GSSLs that are based on leaching to groundwater to determine the need for potential groundwater characterization or if soil excavation is warranted to protect groundwater. Characterization and risk assessment related to groundwater would be integrated with and addressed under the facility-wide groundwater AOC.

3.4 SCREENING ECOLOGICAL RISK ASSESSMENT

The facility-wide sewer system does not constitute a conventional ecological habitat. Conventional ecological habitat means a place, locality, territory, or natural setting that provides the food and cover or shelter required for an organism to make its home. Habitat also means a unit of nature in which not just one organism can live temporarily, but other organisms of the same species live near each other to assure propagation and interaction with yet other species, such as in food chains. Further, organisms are known to spend most or all of their life cycle in conventional and viable habitat. Ultimately, the habitat needs to contain significant ecological resources to justify much study leading to any remedial action. By contrast, the facility-wide sewer networks consist of about 24 miles or approximately 126,000 ft of underground horizontal drains and pipes.

The majority of the sewer lines in both the storm and sanitary system are 6” or 8” in diameter; and many of these lines typically occur at depths greater than 4 ft BGS (approximately 63%). Larger diameter pipes on the order of 10” or 12” occur predominantly as sanitary connector/trunk lines and at major storm outfalls, and these lines typically occur at depths at or greater than 10 ft BGS. Thus, the pipe diameters could accommodate several species of smaller animals (e.g., mice, ground squirrels, opossums, rabbits, and snakes), but almost all the system is below-ground and has very limited access. The facility-wide sewers are a man-engineered system designed to serve a far different function from providing pseudo-habitat to organisms; neither the underground sewer system, nor the few entrances to it constitute conventional ecological habitat. Both by design and circumstance, there is lack of ecological sources (e.g., lack of light, food sources, and low chance of finding a mate). Therefore, the lack of suitability of the sewers as an ecological habitat is not as much a function of the dimensions of the pipes as the inhospitable internal conditions.

The average depth BGS is about 7 ft. The majority of the deeply-buried sewer lines have only occasional access points from the surface of the soil and have little to no light. Manholes, catch basins, and drop inlets consist of vertical pipes or steep-sided inverts and are not typically viable access points for wildlife. Some wildlife may be able to enter a small portion of the storm sewer system through outfall pipe locations; such entry would be an occasional event to seek temporary cover from weather conditions or to escape from a predator. Thus, from the viewpoint of viable/significant habitat, including the ability to support the life cycles of organisms, the facility-wide sewer network falls very short of being anything but a fleeting place for occasional organisms in a small part of the network. In summary, there is inadequate and non-significant habitat in terms of place and time, little to no light to see, and no provision of permanent food and cover; therefore, organisms would not live and propagate in this subterranean system of drains and pipes.

Considering that the facility-wide sewers are not a viable habitat, there is no planned ecological risk assessment to address accumulated sediment and water within the pipe lines. With the lack of permanent habitat and receptors, there is no exposure pathway and no ecological risk. The lack of possible risk can be determined by logical deduction and mathematical computation is not needed. Although quantitative ecological risk assessment is not planned for the facility-wide sewers, qualitative scientific weight-of-evidence may be appropriate in the RI Report to further explain that remedial actions would not be necessary to protect ecological receptors.

With respect to potential contamination of subsurface soil and groundwater adjacent to the sewer lines (e.g., through leaks or line breaks), ecological risk assessment is not planned. The majority of biological activity occurs in the upper few inches of soil. Virtually the entire facility-wide sewer lies below the active biological zone and over half of it occurs at depths greater than 7 ft. Under the RVAAP Facility-wide Ecological Risk Assessment Manual, subsurface soil and groundwater are typically not addressed as an exposure medium. Likewise, groundwater is not addressed as a direct exposure medium for ecological risk assessments.

During RVAAP operations, water and effluent flowed through the facility-wide sewers. Infiltrating groundwater and storm water still flow through many portions of the lines. Storm sewer systems discharged to outfalls at ditch lines. The sanitary sewer systems were largely contained, although emergency overflow outlets to ditch lines or small streams were located at several lift stations. The storm water, sanitary water, and even groundwater could emerge into a ditch, stream, or pond, along with any entrained contaminated sediment. If the emerging water and sediment were contaminated, aquatic and other life at these outfalls could be exposed. However, ecological risks for these media have been, or are currently being, evaluated as part of sediment and surface water ecological risk evaluations under specific RI/FS tasks at most of the primary source AOCs (e.g., Load Lines 1 through 12, Atlas Scrap Yard). If contamination of sewer lines is discovered during the RI at facilities not designated as AOCs, some additional ecological weight of evidence for outfall sediment or surface water may be required for outfall sediment and surface water (e.g., Inert Warehouse Storage Area #6, Administration Area, Depot Administration Area, and Transportation Storage Area). If a location(s) is identified with high contaminant exposure potential and the presence of significant ecological resources, including viable habitat and receptors, one or more of the six elements from the weight-of-evidence outlined in the SAP Addendum for the PBA 2008 RI (Section 4.8), would be applied (USACE 2009).

4.0 FIELD ACTIVITIES

All field activities and sampling procedures will be conducted in accordance with Section 4.0 of the Facility-Wide SAP. Where changes or unique elements not addressed in the Facility-Wide SAP have been identified, they are provided in the following sections.

The general rationale for sample types, quantities and locations is provided in Section 3.2 of this SAP Addendum, following the methodologies presented in Figures 3-2 (sewer water and sediment) and 3-3 (subsurface soil). A generalized discussion of functional area-specific sampling objectives and rationales are presented in Appendices B through Q, as based upon analysis of available data and operational history, and proposed manhole/drop inlet sample locations and recommended alternates are presented. However, due to the nature of the facility-wide sewers, specific actual sample locations cannot be established in advance due to factors such as: 1) issues locating and accessing structures; 2) condition of structures preventing access to the system (i.e., demolished or deteriorated); 3) the presence or absence of potential sampling media; and 4) locations where pipeline integrity has been compromised are currently unknown until after the video survey.

4.1 VISUAL SURVEY PROCEDURES

Before the inception of sampling activities, a comprehensive visual survey will be conducted of the facility-wide storm and sanitary sewer systems structures (i.e., manholes, drop inlets, catch basins, and potential outfall points). A *Visual Inspection Form* will be completed for each structure surveyed, and the results will be documented on the visual inspection form shown in Figure 4-1.

The objectives of the visual inspection will be to document:

- Assess the overall condition of the system (i.e., determine which structures are intact and which have been destroyed during building demolition or other activities);
- Identify locations where potential sample media is present (i.e., accumulations of sediment and water in the structures);
- Determine potential access points for subsequent sampling/video survey, and note areas where access may be prohibited by deteriorated conditions or infilling by debris;
- Identify locations where physical conditions may pose a safety hazard (e.g., missing or offset lids);
- Document flow conditions within the system and note where flooding/infiltration is occurring;
- Ground-truth the historical maps by documenting the lines entering and exiting each structure and noting where this differs from the available historical engineering drawings for RVAAP (e.g., additional pipe runs not shown on the maps);

- Document areas without existing available historical engineering drawings (i.e., storm sewer systems within the Depot Administration Area, Administration, Inert Storage Area #6, and other small isolated areas); and

- Note any other anomalies and items of interest.

During previous sewer evaluation efforts at RVAAP, difficulty was encountered in locating sewer structures (Lakeshore Engineering Services, Inc. 2007), necessitating the use of smoke tracing. Smoke tracing and dye tracing may be utilized during the visual survey phase of the investigation, if deemed necessary, in order to locate structures that are difficult to find or to identify outfalls from the sewer system.

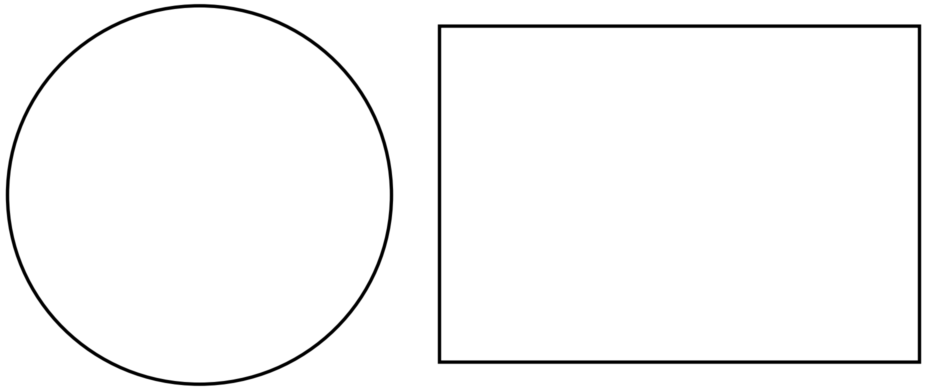
Visual Inspection Form for Facility-Wide Sewers at RVAAP

Location: ______________________________ **System Type:** Storm Sanitary

MH/CB #: ______________________________ **Lid Present?:** Yes No

Evidence of free product, coal tar, or petroleum? Yes No Other_________________________

Diagram of Sewer Structure: *(Sketch location of pipes/features of interest inside manhole or box inlet)*



Invert Depth:

____

Line 1 Description		***Line 2 Description***	
Size/Type		**Size/Type**	
Pipe depth		**Pipe depth**	
Water Flow?	Yes No Flow N/A-Dry	**Water Flow?**	Yes No Flow N/A-Dry
Water Entering or Leaving MH		**Water Entering or Leaving MH**	
Sediment/Debris		**Sediment/Debris**	
Notes		**Notes**	
Line 3 Description		***Line 4 Description***	
Size/Type		**Size/Type**	
Pipe depth		**Pipe depth**	
Water Flow?	Yes No Flow N/A-Dry	**Water Flow?**	Yes No Flow N/A-Dry
Water Entering or Leaving MH		**Water Entering or Leaving MH**	
Sediment/Debris		**Sediment/Debris**	
Notes		**Notes**	

Manhole/Inlet Condition and Observations:

____

____

____

Other Comments:

____

____

Recorded by: ________________________________ **Date:** ____________________

Figure 4-1. Sewer Visual Inspection Form

4.2 SEWER AND OUTFALL SEDIMENT

Where the visual inspection results indicate the presence of accumulated sediment within manholes, drop inlets or catch basins, samples will be collected for real-time in-field analyses. In addition to sediment collected within the sewer systems, samples will also be collected from outfalls where sewer sediments may have been washed out of the system and accumulated at these locations.

At all planned sewer and outfall sediment sampling locations, sediment samples will be collected for TAL metals analyses by fixed-based laboratory and field analyses of TNT and RDX using field analytical kits (Section 4.2.2). These field screening samples will provide semi-quantitative, rapid assessment of the presence and extent of contamination within the sewer lines segment.

4.2.1 Sample Collection for Field and Laboratory Analysis

Sewer and outfall sediment samples will be collected in accordance with the Facility-Wide SAP, using either a hand-held stainless steel trowel or scoop for outfalls or shallow sewer structures (Section 4.5.2.2.1of the Facility-Wide SAP), or a hand core or remote (Eckman) sampler method for deeper sewer structures that are not readily or safely accessible (Section 4.5.2.2.2 of the Facility-Wide SAP). In the event that thin deposits of sewer sediment are encountered in the deeper structures, a stainless steel trowel or scoop on an extendable pole will be used to gently scrape a sufficient sample volume. Within the sewer structures, sampling will be limited to loose sediments; fixed scale or calcified deposits on the pipe/invert surfaces will not be scraped, as this may cause damage to the sewer structures since many are comprised of old vitrified clay and tile material.

Wherever collocated sewer or outfall sediment and water samples are to be collected, the water samples will be collected first. The order of analyte collection at each location will be: 1) explosives; 2) metals; 3) SVOCs; and 4) all remaining analyses as part of the 10% full suite.

In the event that the primary sampling location does not yield sufficient sediment sample volume, media for the subsequent analyses will be collected from the next immediately adjacent alternate location. For example, if the primary location only contains enough sediment for the explosives analysis, the metals sample will then be collected from the first alternate location. The source locations for sample collection will be clearly documented in the logbook. Primary and alternate sample locations for each functional area are prescribed in Appendices B through Q.

In the event that surficial access to a sewer segment of interest via drop inlet or manhole is not possible due to collapse or infilling, the use of intrusive methods will be evaluated. Equipment such as a backhoe/excavator or portable power auger will be utilized to expose three points along the segment ("upstream" end closest to possible contamination sources, midpoint, and "downstream" end) in order to collect samples of the material within the sewer pipe.

4.2.2 Field Analysis of Explosives

All sewer sediment samples will be subject to in-field analysis of the explosives TNT and RDX via the EnSys® (Strategic Diagnostics, Inc.) field test kits (Appendix R). The EnSys® field kits are a commercially available colorimetric immunoassay method (EPA SW-846 Method # 8510 and #8515 for RDX and TNT, respectively) able to provide rapid and quantitative results. The range of the TNT test is between 1 and 30 mg/kg, well below the preliminary draft Facility-Wide CUG of 36.5 mg/kg for TNT. The TNT test is also able to detect trinitrobenzene and dinitrotoluene compounds. The RDX test is also able to achieve a detection range between 1 and 30 mg/kg, well below the preliminary draft Facility-Wide CUG of 80.3 mg/kg, and also is able to detect octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX). The TNT and RDX EnSys® test kits were successfully used as a field screening method at RVAAP during the recent remediation of soil and dry sediments at Load Lines 1 through 4. Information on the use of the TNT and RDX EnSys® test kits is presented in Appendix R.

All positive TNT and RDX EnSys® test kit detections will be submitted for off-site laboratory analysis of explosives and TAL metals in order to provide confirmation of the field results, as well as SVOCs due to the comparatively high frequency of detection for these compounds. In addition, a minimum of 10% of the sediment samples showing detects for TNT or RDX will be sent to the off-site laboratory for analysis the full suite of target analytes (VOCs, pesticides/PCBs, herbicides, and propellants).

Samples for fixed-based laboratory analyses will also be collected from a minimum of 10% of the sediment sample locations where field analytical data do not indicate the presence of contamination. These samples will be used to confirm the absence of contamination. All samples submitted to confirm the absence of contamination will be analyzed for explosives and TAL metals. Additionally, a minimum of 30% of the samples will be analyzed for SVOCs and 10% of the samples will be analyzed for the full suite of target analytes. In addition, a full suite of fixed-based laboratory analyses will be conducted where visual surveys indicate the likely occurrence of contamination (e.g., visible explosive deposits or evidence of sheens on accumulated water in the pipes).

Hexavalent chromium sediment samples would be collected at locations where either historical or Tier 1 analytical results for TAL metals indicate total chromium concentrations in excess of the resident farmer CUG of 187 mg/kg.

The sample decision methodology summarized above is detailed in Section 3.2.5.1 and depicted by flowchart in Figure 3-2.

4.3 SEWER AND OUTFALL WATER

Water samples will be collected from sanitary and storm sewer system manholes and drop inlets and from outfalls from the system. Samples of accumulated water will be co-located with sediment samples at the outfalls and at designated locations within the sewer systems (noted in Appendices B through Q) where possible 1) to assess the potential for contaminant migration in sewer water; 2) to evaluate potential contaminant accumulation areas; 3) to evaluate if residual contamination is partitioning to water and if these structures are acting as secondary sources; and 4) to determine if contaminants are partitioning from sewer sediment or sludge and potentially contributing to shallow groundwater or surface water contamination. Selection of sampling locations will follow the methodology presented in Figure 3-2.

Sewer and outfall water samples will be collected in accordance with Section 4.6.2.1 of the Facility-Wide SAP, using either a hand-held bottle method for shallow structures (Section 4.6.2.1.1 of the Facility-Wide SAP), or the dipper and pond sample method for deeper structures that are not readily or safely accessible (Section 4.6.2.1.2 of the Facility-Wide SAP). Field measurements will be performed in accordance with Section 4.6.2.3 of the Facility-Wide SAP and will include the determination of pH, conductivity, dissolved oxygen, turbidity, and temperature. All field measurements will be recorded in the sampling logbooks.

Wherever collocated sewer or outfall sediment and water samples are to be collected, the sewer water samples will be collected first. The order of analyte collection at each location will be: 1) explosives; 2) metals; 3) SVOCs; and 4) all remaining analyses as part of the 10% full suite.

In the event that the primary sampling location does not yield sufficient water sample volume, media for the subsequent analyses will be collected from the next immediately adjacent alternate location. For example, if the primary location only contains enough sediment for the explosives analysis, the metals sample will then be collected from the first alternate location. The source locations for sample collection will be clearly documented in the logbook. Primary and alternate sample locations for each functional area are prescribed in Appendices B through Q.

4.4 VIDEO CAMERA SURVEY

Video camera surveys will be performed of sections of the existing storm and sanitary sewer lines in order to evaluate the overall condition of the system, to determine the presence of residual explosives compounds, to assess the integrity of the pipe and its potential for releasing contaminants to the environment, and to provide data for the evaluation of remedial alternatives. Selection of video survey locations will follow the methodology presented in Figure 3-2. During the December 2008 field reconnaissance effort, sewer lines were observed which did not correlate with the available historical drawings (e.g., an extra pipe exiting a manhole which was indicated as a segment terminus on the map). As they are identified during the visual survey, such segments may also be selected for video survey to assess these unknown areas.

For new video camera data acquisition, the investigation objective is to survey as much of the total length of a sewer line segment of interest where possible, with a target minimum of 10%. For each sewer line segment, entry points for video surveys will be sufficient to provide a general overall assessment of the pipeline along its reach. The video survey at each manhole or drop inlet selected for assessment will continue to the maximum specified extent or until an obstruction prevents further movement. Conditions in the field may prevent access to some selected entry points; in this event, a determination will be made in the field as to alternate locations (e.g., attempting to reach a segment from an adjacent manhole or inlet).

The camera survey of storm and sanitary sewer lines will follow the standard operating procedures of the subcontracted video surveyor. The survey will be conducted with a television camera and cable that are specifically designed and constructed for pipe inspection. Lighting for the camera will allow a clear picture for the entire periphery of an 8-inch or 10-inch pipe. The following general procedures will apply:

-
- The camera shall be moved through the line in either direction at a uniformly slow rate. Precautions shall be taken to minimize the chances of the camera becoming stuck in the pipe.

- A suitable means of communication shall be established between the winches and the monitor control.

- Television inspection of the pipe shall be color videotaped or recorded on compact disk. When blockages, ruptures, or other significant features are noted, the camera shall be stopped to observe the condition, record the information, and, if necessary, take photographs.

- Television logs shall be prepared and shall include identification of the section of pipe and pipe size. Records shall also include locations of reference points, points of entry, observed obstructions, ruptures, cracks, and other evidence of potential problems. These will be brought to the attention of the SAIC field manager while the survey is in progress.

The camera survey subcontractor shall prepare and submit a final report that will include, at a minimum, all field logbooks, copies of the video recordings on a suitable archival medium (e.g., files on CD-ROM) and a listing and sketch map of all identified or potential problem areas or anomalies.

4.5 SUBSURFACE SOIL AND BEDDING MATERIAL

Subsurface samples will be collected to assess whether compromises to sewer line integrity (e.g., resulting from stress cracking, joint separation, and root intrusion) have resulted in the release of contaminants to bedding material and soils adjacent to or underlying the sewer system pipeline traces. Locations for bedding material and subsurface soil samples along sewer line traces will be designated in Technical Memoranda pending evaluation of the analytical results from the preceding Tier of investigation. For the Tier 2 Technical Memorandum, data would be evaluated for media collected within the sewer system and the video camera survey logs collected during the first tier of the investigation. Selection of sampling locations or additional video camera surveying for Tier 2 will follow the methodology presented in Figure 3-3. The Tier 3 Technical Memorandum would be based upon an evaluation of the analytical results for the bedding material collecting during Tier 2 of the investigation.

Where the target soil sample depth does not exceed 4 ft BGS, hand auguring methods will be used for sample collection; a portable power auger may be employed to assist in reaching target depths. For sample collection in excess of 4 ft BGS, hydraulic direct-push methods (i.e., Geoprobe) will be utilized as the primary sample collection method. Procedures for hand auguring and hydraulic direct-push sampling are presented in Sections 4.4.2.1.4 and 4.4.2.1.5 of the Facility-Wide SAP, respectively.

4.6 CHROMIUM SPECIATION

Previous sewer samples have been analyzed for total chromium. In this SAP Addendum, the total chromium screening level was used to determine exceedances in historical data. The use of the total chromium screening level is based on the assumption that chromium exists predominantly in the trivalent state, rather than the more toxic hexavalent state. In order to confirm this assumption and appropriately evaluate risk, chromium speciation samples will be collected to determine the ratio of hexavalent chromium to total chromium as described in Sections 3.2.5.1 (Tier 1) and 3.2.5.2 (Tier 2).

Chromium speciation evaluates the concentration ratio of hexavalent chromium to total chromium. This ratio will be calculated by collecting and analyzing a set of three soil borings at a representative set of locations where total chromium was detected at low, medium and high ranges of concentrations within each functional area (e.g., AOCs or other administrative area) in order to provide speciation data. If analytical data indicate that the ratio of hexavalent chromium to total chromium is 1:6 (i.e., 14%) or less, the CUG for total chromium will be used for subsequent risk calculations. This process has been previously approved and utilized at RVAAP.

4.7 FIELD QC SAMPLING PROCEDURES

Sediment Quality Assurance/Quality Control (QA/QC) samples will be collected during the implementation of this SAP Addendum for Facility-Wide Sewers. QC duplicate samples will be collected at a frequency of 10% (1 per 10 environmental samples) for each medium (sewer sediment, sewer water, subsurface soil). Matrix spike/matrix spike duplicate samples will be collected at a rate of 5% (1 per 20 environmental samples) of the total samples per medium. QA split samples will be submitted to the USACE contract laboratory for independent analyses at a frequency specified by USACE. Duplicate and split samples will be derived from the same sampling station, selected on a random basis, and submitted for the sample analyses as the environmental samples. One rinsate blank will be collected for soil/sediment equipment per week. Trip blanks will accompany all shipments containing aqueous VOCs samples.

One source blank will be collected from the potable water source to be used for all potable wash and rinse water for equipment decontamination during the implementation of this SAP Addendum. One source blank will also be collected from the deionized/distilled (American Society of Testing and Materials Type I) water source used. The source blanks will be analyzed for a full suite of analyses.

Section 5.0 and the QAPP addendum (Section 4.0) summarize the QA/QC sampling requirements. However, the quantities of QA/QC samples to be cannot yet be determined since the number of primary environmental samples to be collected is unknown (i.e., availability and accessibility of sampling media within the sewer system). All efforts will be made to collect QA/QC samples at the designated frequency. However, during previous sewer sampling efforts, difficulty was encountered in obtaining sufficient media sample volumes to submit the requisite number of QA/QC samples.

4.8 DECONTAMINATION PROCEDURES

Decontamination procedures for sampling activities will follow the protocols presented in the Facility-Wide SAP for the following media: sediment (Section 4.5.2.8 of the Facility-Wide SAP), surface water (Section 4.6.2.6 of the Facility-Wide SAP) and subsurface soil (Section 4.4.2.8 of the Facility-Wide SAP). A final decontamination inspection of any equipment leaving RVAAP at the end of field activities will be conducted to ensure proper decontamination. Although the Facility-Wide SAP specifies the use of a methanol decontamination rinse, isopropanol will be used instead as per the direction of the USACE.

4.9 SITE SURVEY

Following sample collection activities, the horizontal coordinates of all sampling locations will be determined to within 0.3 meters (m) (1 ft). The ground elevations at the sewer structure locations or discrete sediment or soil sample stations (i.e., outfall locations and soil boring) will be determined to within 0.06 m (0.2 ft).

All locations will be conveyed in Ohio State Plane Coordinates (NAD83). The vertical datum for all elevations will be 1929 National Geodetic Vertical Datum (NGVD). All coordinates and elevations will be recorded on the boring logs upon receipt of quality assured survey results. In addition, electronic results will be provided to USACE and RVAAP in ASCII format.

4.10 MUNITIONS AND EXPLOSIVES OF CONCERN

The scope of this SAP Addendum also includes MEC avoidance within MRSs, and other areas if MEC is suspected, in order to safely conduct investigation activities. Sewer systems are located within the following MRS locations and will require MEC technician support during investigative activities:

- Load Line 1 (MRS RVAAP-008-R-01);
- Load Line 6/Firestone Test Facility (MRS RVAAP-033-R-01); and
- Atlas Scrap Yard (MRS RVAAP-050-R-01).

MEC avoidance procedures to be followed during the RI are outlined in the MEC Project Work Plan for the RVAAP PBA 2008 (USA Environmental 2009).

4.11 SESOIL AND ANALYTICAL GROUNDWATER TRANSPORT MODELING

SESOIL is a 1-D vertical transport model for unsaturated soil which simultaneously evaluates water transport, sediment transport, and pollutant fate. The results will be used as a screening tool to assess contaminant fate and transport for risk analysis.

The SESOIL modeling will utilize data collected during the subsurface soil sampling along sewer traces where a compromise in pipe integrity may have resulted in contamination to receptor media, such as soil beneath or adjacent to the sewer lines. The SESOIL model will be constructed to evaluate any potential future impacts from chemicals in soil migrating to groundwater.

The SESOIL model will predict the rate of contaminant migration through the unsaturated zone to the water table based on leaching from contaminated soils to groundwater. The results of the SESOIL modeling may be used in groundwater transport to simulate lateral transport of contaminants from source areas (i.e., locations of sewer line breaches) to receptor locations. An analytical groundwater model, such as ATI123D, will be used to predict the migration of contaminants in groundwater and assess contaminant transport under one-dimensional groundwater flow. Fate and transport simulations can include advection, dispersion, diffusion, adsorption and biological decay.

5.0 SAMPLE CHAIN OF CUSTODY/DOCUMENTATION

5.1 FIELD LOGBOOK

All field logbook information will follow structures identified in Section 5.1 of the Facility-Wide SAP.

5.2 PHOTOGRAPHS

Information regarding the documentation of photographs during AOC-specific investigations is presented in Section 4.3.2.4.3 of the Facility-Wide SAP. Representative photographs will be taken of the investigative measures and any significant observations that are made during the field effort. Photographs will be suitable for presentation in a public forum, as well as for documenting scientific information.

5.3 SAMPLE NUMBERING SYSTEM

The sample numbering system that will be used to identify samples collected during the groundwater sampling is explained in Section 5.3 and Figure 5-1 of the Facility-Wide SAP. Specific sample identifying information that will be used to implement the sampling scheme is presented in Figure 5-1 of this FSP. Samples will be identified sequentially using the identification number system consistent with the remedial investigations. If a sample is not collected or is reassigned to another location, a specific reason and notation will be written in the project field books.

5.4 SAMPLE DOCUMENTATION

All sample label, logbook, field record, and field form information will follow structures identified in Chapter 5.0 of the Facility-Wide SAP.

5.5 DOCUMENTATION PROCEDURES

Documentation and tracking of samples and field information will follow the series of steps identified in Section 5.5 of the Facility-wide SAP.

5.6 CORRECTIONS TO DOCUMENTATION

Any corrections to documentation will follow guidance established in Section 5.6 of the Facility-Wide SAP.

5.7 MONTHLY REPORTS

Monthly reports are submitted as part of implementation of SAIC's PBA. This monthly report will be submitted on the 10th day of each month to both the USACE and Ohio EPA. The content of the reports will have content similar to that specified in Section 5.7 of the Facility-Wide SAP.

Sample Station Location Identification: XXXmm-NNN(nn)-####-tt

XXX = Area Designator

ADM =Administration Area	LL6 = Load Line 6
ASY = Atlas Scrap Yard	LL7 = Load Line 7
DEP = Depot Administration Area	LL8 = Load Line 8
ISA = Inert Storage Area #6	LL9 = Load Line 9
LL1 = Load Line 1	LL10 = Load Line 10
LL2 = Load Line 2	LL11 = Load Line 11
LL3 = Load Line 3	LL12 = Load Line 12
LL4 = Load Line 4	TRN = Transportation Area
LL5 = Load Line 5	

GRL = Trunk/Connector lines outside of previously listed functional areas that ultimately discharge to George Road Treatment Plant

SCL = Trunk/Connector lines outside of previously listed functional areas that ultimately discharge to Sand Creek Treatment Plant

mm = Sample Location Type

sd = Sediment	sw = Sewer Water
so = Soil	pb = Pipe Bedding Material

NNN = Sequential Sample Location Number

Unique, sequential number for each sample location beginning with the following number from the last number used from previous investigation stations and extending into any subsequent investigative phases (i.e., 001 – 999)

nn = Special Identifier

sn = Sanitary Sewer	st = Storm Sewer

= Sequential Sample Identification Number

Unique, sequential number for each sample beginning with the following number from the last number used from previous investigation stations and extending into any subsequent investigative phases (i.e., 001 – 999)

tt = Sample Type

er = equipment rinsate	sd = sediment sample
fb = field blank	sw = sewer water sample
so = soil sample	tb = trip blank

Figure 5-1. Facility-Wide Sewers Sample Identification System

6.0 SAMPLE PACKAGING AND SHIPPING REQUIREMENTS

Sample packaging and shipping shall follow procedures in Chapter 6.0 of the Facility-Wide SAP.

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7.0 INVESTIGATION-DERIVED WASTE

All investigation-derived waste (IDW), including personal protective equipment (PPE), disposable sampling equipment, and decontamination fluids, will be properly handled, labeled, characterized, and managed in accordance with Section 7.0 of the Facility-Wide SAP. At the conclusion of field activities, a letter report will be submitted to the USACE and RVAAP Facility Manager documenting the characterization and classification of the wastes. Upon approval of the IDW classification report, all solid and liquid IDW will be removed from the site and disposed of by a licensed waste disposal contractor. All shipments of IDW off-site will be coordinated through the RVAAP Facility Manager.

The following types of IDW are anticipated:

- Decontamination fluids, including those derived from decontamination of sampling, video and drilling equipment;
- Excess sediment and water derived from the inlet/manhole and outfall sampling activities;
- Soil from the unconsolidated surficial material derived during soil boring activities;
- Field laboratory wastes, including spent reagents and decontamination water; and
- Expendables/solid wastes, including PPE and disposable sampling equipment.

Characterization and classification of the different types of IDW will be based on the specific protocols described below. The estimated quantities for each type will be included in the Final version of this FSP. Expendable solid waste will be not sampled for characterization purposes.

- **Decontamination Fluids:** Decontamination fluids will be placed in drums or a polytank up to 1,500 gallons in size as needed. Disposition of decontamination liquid will be based on the collection and analysis of toxicity characteristic leaching procedure (TCLP) liquid sample(s).
- **Soils:** Drill cuttings will be placed in 55-gallon drums. Disposition of the drummed soil will be based on analytical results from TCLP samples collected.
- **Field Laboratory Wastes:** Liquid wastes, including spent reagents and decontamination water will be contained in 55-gallon drums. If generated, all known potentially hazardous liquid IDW streams (e.g., acetone wastes from the field laboratory) will be containerized separately in 55-gallon drums.
- **Solid Waste:** Trash, gloves and other expendable solid waste will be placed in sanitary waste containers for removal from the site in coordination with the RVAAP Facility Manager.

Drummed soil, sediment, and IDW water will be transported to a location designated by the RVAAP Facility Manager, where it will be placed in separate steel drums and staged on wooden pallets. Decontamination fluids and field laboratory wastes will also be staged at the identified location within secondary containment structures. To avoid potential rupture due to freezing conditions, drums containing liquid IDW will be filled only to 75% capacity.

8.0 REFERENCES

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APPENDIX A
George Road and Sand Creek Plant Sewer Networks

A.0 GEORGE ROAD AND SAND CREEK TREATMENT PLANT SEWER NETWORKS

A.1 AREA DESCRIPTION

The primary sanitary sewer systems at RVAAP are the George Road and Sand Creek Treatment Plant sewer networks.

The George Road Sewer network drains the Fuze and Booster Hill Load Lines (Load Lines 5 through 11) and the Administration Area before discharging to the former George Road Treatment Plant, located near the southern boundary of the facility. The complete George Road sanitary sewer network, inclusive of all trunk and connector lines, is shown in Plate A-1. An inventory of all known George Road system sanitary sewer structures and their known historical data are presented in Table A-1.

The Sand Creek Treatment Plant sewer network drains Load Lines 1 through 5, Load Line 12, and passes through Atlas Scrap Yard as it drains northward towards the former Sand Creek Sewage Treatment Plant. The complete Sand Creek sanitary sewer network, inclusive of all trunk and connector lines, is shown in Plate A-2. An inventory of all known Sand Creek system sanitary sewer structures and their known historical data are presented in Table A-2.

A.2 PREVIOUS INVESTIGATIONS

Descriptions of previous investigations conducted at specific areas within the sanitary networks are presented in Appendices B through Q.

A.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the trunk line between Atlas Scrap Yard and the Sand Creek Treatment Plant are presented in Table A-1, and shown in Figure A-3.

Table A-1. Summary of Proposed Sampling Locations at the Trunk Line to Sand Creek Treatment Plant

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	Overflow Outfall East of MH-29	None	Outfall Water	Presumed overflow pipe not shown in historical maps was observed to run east from MH-29 during December 2008 sewer reconnaissance.
			Outfall Sediment	
Sanitary	MH-24	MH-23, MH-22	Sewer Sediment	Provides representation of trunk line upstream of Central Burn Pits
Sanitary	MH-28	MH-27, MH-26, MH-25	Sewer Sediment	Provides representation of trunk line downstream of Central Burn Pits
Sanitary	MH-29	MH-30, MH-31, MH-32, MH-33	Sewer Sediment	Provides representation of trunk line entering treatment plant

During the visual survey phase, inspection forms will be completed for the noted above areas of interest to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Administration Area	MH-1	2355416.098	550281.263	1078.71	1073.60	5.11
Sanitary	Administration Area	MH-101	2357064.985	549966.115	1053.50	1047.48	6.02
Sanitary	Administration Area	MH-11	2355598.905	549985.153	1081.34	1077.40	3.94
Sanitary	Administration Area	MH-1-1	2358529.490	551596.944	1019.21	1009.20	10.01
Sanitary	Administration Area	MH-11-1	2357814.486	551649.691	1025.57	1019.70	5.87
Sanitary	Administration Area	MH-11-1A	2357594.372	551885.350	1026.49	1022.49	4.00
Sanitary	Administration Area	MH-11-1B	2357371.287	551727.512	1032.13	1027.08	5.05
Sanitary	Administration Area	MH-11-1C	2357200.034	551966.344	1037.54	1033.72	3.82
Sanitary	Administration Area	MH-11-1E	2356700.129	551636.459	1049.51	1045.24	4.27
Sanitary	Administration Area	MH-11-1F	2356511.591	551487.354	1056.01	1051.09	4.92
Sanitary	Administration Area	MH-12	2355712.606	550286.364	1074.56	1069.00	5.56
Sanitary	Administration Area	MH-1-2	2358372.879	551594.250	1020.43	1010.15	10.28
Sanitary	Administration Area	MH-1-3	2358089.076	551663.957	1022.92	1011.20	11.72
Sanitary	Administration Area	MH-1-4	2358034.532	551731.621	1022.52	1011.01	11.51
Sanitary	Administration Area	MH-1-5	2358014.429	552057.714	1019.73	1015.50	4.23
Sanitary	Administration Area	MH-1-6	2357967.450	552228.047	1022.21	1015.21	7.00
Sanitary	Administration Area	MH-2	2355119.706	550276.164	1086.10	1079.29	6.81
Sanitary	Administration Area	MH-2-1	2358085.326	550924.131	1015.79	1011.55	4.24
Sanitary	Administration Area	MH-2-2	2358091.213	550581.873	1017.35	1012.86	4.49
Sanitary	Administration Area	MH-2-3	2357972.334	550579.827	1023.00	1013.40	9.60
Sanitary	Administration Area	MH-2-4	2357978.021	550249.225	1022.65	1014.69	7.96
Sanitary	Administration Area	MH-2-5	2357752.263	550234.299	1032.20	1024.43	7.77
Sanitary	Administration Area	MH-2-6	2357519.037	550222.221	1041.33	1033.60	7.73
Sanitary	Administration Area	MH-2-7	2357247.831	550178.488	1058.01	1046.30	11.71
Sanitary	Administration Area	MH-2-8	2357131.179	550328.901	1057.96	1047.18	10.78
Sanitary	Administration Area	MH-2-9	2357330.555	550502.117	1057.95	1048.20	9.75
Sanitary	Administration Area	MH-3	2354915.737	549740.177	1085.57	1080.78	4.79
Sanitary	Administration Area	MH-3-1	2357805.684	551221.413	1029.30	1020.50	8.80
Sanitary	Administration Area	MH-4	2374311.319	559324.386	1085.91	1081.62	4.29
Sanitary	Administration Area	MH-4-1	2357000.963	550747.125	1061.06	1055.00	6.06
Sanitary	Administration Area	MH-4-2	2356824.934	550884.347	1063.42	1058.50	4.92
Sanitary	Administration Area	MH-5-1	2356049.598	550723.637	1063.90	1054.36	9.54

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Administration Area	MH-5-2	2355761.768	550633.240	1067.71	1058.69	9.02
Sanitary	Administration Area	MH-5-3	2355560.768	550766.548	1071.63	1060.73	10.90
Sanitary	Administration Area	MH-5-4	2355558.173	550917.446	1072.26	1062.02	10.24
Sanitary	Administration Area	MH-6	2355358.205	549903.982	1082.38	1078.51	3.87
Sanitary	Administration Area	MH-6-1	2356332.201	551186.854	1064.47	1058.29	6.18
Sanitary	Administration Area	MH-6-2	2356467.634	551189.184	1064.48	1059.00	5.48
Sanitary	Administration Area	MH-7	2355551.775	549731.082	1081.26	1076.15	5.11
Sanitary	Administration Area	MH-7-1	2357906.494	550921.055	1022.71	1012.23	10.48
Sanitary	Administration Area	MH-8	2355463.340	549454.975	1083.40	1077.04	6.36
Sanitary	Administration Area	MH-8-1	2358154.366	550252.259	1019.81	1015.25	4.56
Sanitary	Administration Area	MH-9	2355336.712	549303.021	1080.92	1077.70	3.22
Sanitary	Administration Area	MH-9-1	2357840.305	550442.205	1026.60	1017.50	9.10
Sanitary	Administration Area	MH-O1	2359666.486	551385.366	1010.20	1004.10	6.10
Sanitary	Administration Area	MH-O10	2357560.259	550904.249	1045.10	1035.65	9.45
Sanitary	Administration Area	MH-O11	2357268.048	550734.448	1056.11	1044.43	11.68
Sanitary	Administration Area	MH-O12	2357003.806	550581.843	1059.86	1046.31	13.55
Sanitary	Administration Area	MH-O13	2356690.604	550470.329	1054.51	1048.32	6.19
Sanitary	Administration Area	MH-O13A	2356467.408	550406.077	1053.70	1049.63	4.07
Sanitary	Administration Area	MH-O13B	2356185.276	550269.953	1060.19	1051.00	9.19
Sanitary	Administration Area	MH-O13C	2356183.669	550363.384	1061.20	1052.00	9.20
Sanitary	Administration Area	MH-O13D	2356187.189	550158.765	1062.50	1053.89	8.61
Sanitary	Administration Area	MH-O14	2356536.380	550630.749	1057.94	1049.78	8.16
Sanitary	Administration Area	MH-O15	2356338.966	550793.630	1060.23	1051.13	9.10
Sanitary	Administration Area	MH-O16	2356334.563	551049.574	1063.94	1052.76	11.18
Sanitary	Administration Area	MH-O17	2356033.281	551000.961	1065.40	1054.40	11.00
Sanitary	Administration Area	MH-O18	2355840.696	551080.138	1066.17	1055.65	10.52
Sanitary	Administration Area	MH-O19	2355696.577	551077.659	1069.85	1059.22	10.63

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Administration Area	MH-O2	2359529.848	551630.182	1010.73	1005.05	5.68
Sanitary	Administration Area	MH-O3	2359204.067	551686.796	1010.77	1005.93	4.84
Sanitary	Administration Area	MH-O4	2358953.965	551622.261	1015.96	1006.58	9.38
Sanitary	Administration Area	MH-O5	2358821.770	551398.008	1018.32	1007.64	10.68
Sanitary	Administration Area	MH-O6	2358498.075	551193.365	1016.75	1008.40	8.35
Sanitary	Administration Area	MH-O7	2358228.424	551188.726	1016.75	1008.40	8.35
Sanitary	Administration Area	MH-O8	2357972.831	551184.329	1025.63	1017.54	8.09
Sanitary	Administration Area	MH-O9	2357775.118	551038.591	1031.60	1026.52	5.08
Sanitary	Load Line 5	MH-IF1	2355071.796	553652.654	1114.570	1100.890	13.68
Sanitary	Load Line 5	MH-IF10	2354969.045	554207.459	1123.690	1115.075	8.62
Sanitary	Load Line 5	MH-IF11	2354219.002	554702.406	1125.550	1116.900	8.65
Sanitary	Load Line 5	MH-IF12	2354091.382	554837.717	1122.100	1110.705	11.40
Sanitary	Load Line 5	MH-IF13	2353964.022	554972.752	1117.060	1102.450	14.61
Sanitary	Load Line 5	MH-IF2	2354952.027	553899.423	1121.060	1105.670	15.39
Sanitary	Load Line 5	MH-IF3	2354806.309	554050.638	1124.650	1109.670	14.98
Sanitary	Load Line 5	MH-IF4	2354660.590	554201.853	1125.220	1113.185	12.04
Sanitary	Load Line 5	MH-IF5	2354466.371	554403.544	1126.480	1117.545	8.93
Sanitary	Load Line 5	MH-IF6	2354498.224	554577.002	1126.590	1064.030	62.56
Sanitary	Load Line 5	MH-IF7	2354605.442	554680.325	1126.860	1121.840	5.02
Sanitary	Load Line 5	MH-IF8	2354371.955	554297.584	1126.810	1120.745	6.07
Sanitary	Load Line 5	MH-IF9	2354533.209	554079.103	1127.520	1118.620	8.90
Sanitary	Load Line 6	MH-1B1	2353319.441	553345.674	1123.350	1106.440	16.91
Sanitary	Load Line 6	MH-1B2	2353402.950	553427.564	1123.340	1107.100	16.24
Sanitary	Load Line 6	MH-1B3	2353399.799	553677.169	1125.780	1107.730	18.05
Sanitary	Load Line 6	MH-2F1	2352870.852	553225.320	1113.000	1100.060	12.94
Sanitary	Load Line 6	MH-2F10	2352749.668	553412.710	1126.020	1117.760	8.26
Sanitary	Load Line 6	MH-2F2	2353719.656	552665.127	1117.710	1101.670	16.04
Sanitary	Load Line 6	MH-2F3	2353526.245	552847.015	1120.070	1103.770	16.30
Sanitary	Load Line 6	MH-2F4	2353334.015	553028.904	1118.600	1104.760	13.84
Sanitary	Load Line 6	MH-2F5	2353163.451	553191.896	1118.040	1105.680	12.36
Sanitary	Load Line 7	MH-1B10	2352270.342	554736.043	1129.47	1113.99	15.48
Sanitary	Load Line 7	MH-1B11	2352162.685	555004.355	1126.700	1114.490	12.21
Sanitary	Load Line 7	MH-1B12	2352054.251	555271.175	1126.340	1115.525	10.81

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 7	MH-1B13	2351976.038	555462.503	1127.100	1116.415	10.68
Sanitary	Load Line 7	MH-1B14	2351883.208	555691.066	1125.880	1117.115	8.77
Sanitary	Load Line 7	MH-1B15	2351790.335	555914.046	1124.990	1105.580	19.41
Sanitary	Load Line 7	MH-1B16	2352168.477	554774.048	1130.920	1124.650	6.27
Sanitary	Load Line 7	MH-1B17	2352193.227	554706.249	1130.480	1119.115	11.37
Sanitary	Load Line 8	MH-2B10	2351683.948	551766.316	1114.930	1107.625	7.31
Sanitary	Load Line 8	MH-2B11	2351596.760	551986.731	1114.460	1108.570	5.89
Sanitary	Load Line 8	MH-2B12	2351511.957	552202.610	1116.320	1110.025	6.29
Sanitary	Load Line 8	MH-2B13	2351610.365	552242.113	1116.560	1110.025	6.53
Sanitary	Load Line 8	MH-2B14	2351546.623	552400.523	1116.390	1110.635	5.76
Sanitary	Load Line 8	MH-2B15	2351638.060	552435.391	1116.640	1111.160	5.48
Sanitary	Load Line 8	MH-2B16	2351700.238	552635.881	1119.170	1112.350	6.82
Sanitary	Load Line 8	MH-2B17	2351357.341	552060.358	1114.750	1109.520	5.23
Sanitary	Load Line 8	MH-2B18	2351115.799	552137.918	1116.850	1110.550	6.30
Sanitary	Load Line 9	MH-D1	2357190.425	556004.337	1130.870	1121.370	9.50
Sanitary	Load Line 9	MH-D11	2356500.873	555775.470	1130.600	1125.730	4.87
Sanitary	Load Line 9	MH-D2	2357013.008	556147.636	1122.900	1122.360	0.54
Sanitary	Load Line 9	MH-D3	2356833.529	556290.935	1133.700	1123.275	10.43
Sanitary	Load Line 9	MH-D4	2356696.857	556400.213	1134.800	1123.970	10.83
Sanitary	Load Line 9	MH-D5	2356475.086	556575.471	1133.230	1124.810	8.42
Sanitary	Load Line 9	MH-D6	2356258.473	556749.698	1133.010	1125.955	7.06
Sanitary	Load Line 9	MH-D7	2356301.796	556355.883	1136.870	1126.730	10.14
Sanitary	Load Line 9	MH-D8	2356584.424	556255.883	1135.040	1126.665	8.38
Sanitary	Load Line 9	MH-D9	2356659.723	556071.347	1132.900	1124.220	8.68
Sanitary	Load Line 10	MH-P1	2355665.906	554790.588	1120.320	1104.645	15.68
Sanitary	Load Line 10	MH-P10	2354855.388	555430.134	1125.080	1116.800	8.28
Sanitary	Load Line 10	MH-P11	2355620.573	555788.428	1130.830	1120.147	10.68
Sanitary	Load Line 10	MH-P12	2355474.247	555397.042	1123.090	1115.760	7.33
Sanitary	Load Line 10	MH-P13	2355419.309	555342.134	1122.290	1116.300	5.99
Sanitary	Load Line 10	MH-P2	2355779.446	554999.782	1122.810	1108.250	14.56
Sanitary	Load Line 10	MH-P3	2355855.777	555231.820	1124.550	1111.015	13.53
Sanitary	Load Line 10	MH-P4	2355762.751	555325.895	1122.840	1112.570	10.27
Sanitary	Load Line 10	MH-P5	2355611.247	555476.658	1124.170	1114.115	10.06

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 10	MH-P5A	2355523.518	555564.338	1126.760	1116.310	10.45
Sanitary	Load Line 10	MH-P6	2355460.512	555627.482	1128.680	1118.560	10.12
Sanitary	Load Line 10	MH-P7	2355280.411	555807.418	1130.090	1122.350	7.74
Sanitary	Load Line 10	MH-P8	2355304.670	555471.133	1128.27	1124.01	4.26
Sanitary	Load Line 10	MH-P9	2354676.327	555478.866	1124.560	1106.915	17.65
Sanitary	Load Line 11	MH-1A1	2352522.086	557670.688	1094.200	1077.810	16.39
Sanitary	Load Line 11	MH-1A2	2352649.681	557772.253	1091.200	1077.865	13.34
Sanitary	Load Line 11	MH-1A3	2352773.596	557871.914	1091.100	1078.465	12.64
Sanitary	Load Line 11	MH-1A4	2352707.675	558022.449	1089.500	1079.100	10.40
Sanitary	Load Line 11	MH-1A5	2352642.588	558170.899	1087.59	1083.01	4.58
Sanitary	Load Line 11	MH-1A6	2352606.651	557573.455	1095.43	1089.81	5.62
Sanitary	Load Line 11	MH-1A7	2352699.783	557466.371	1101.840	1091.070	10.77
Sanitary	Load Line 11	MH-2A1	2352451.021	557838.082	1089.090	1077.895	11.19
Sanitary	Load Line 11	MH-2A2	2352378.508	558004.491	1089.810	1078.705	11.11
Sanitary	Load Line 11	MH-2A3	2352263.752	557953.192	1085.640	1079.410	6.23
Sanitary	Load Line 11	MH-2A4	2352110.396	557883.125	1084.930	1080.100	4.83
Sanitary	Load Line 11	MH-3A1	2352789.867	558143.794	1085.590	1079.765	5.82
Sanitary	Trunk/Connector Line	MH-1B4	2353395.072	553919.687	1126.900	1108.495	18.41
Sanitary	Trunk/Connector Line	MH-1B5	2353172.905	554040.159	1125.030	1109.400	15.63
Sanitary	Trunk/Connector Line	MH-1B6	2352946.799	554161.418	1125.240	1110.300	14.94
Sanitary	Trunk/Connector Line	MH-1B7	2352718.724	554282.677	1125.170	1111.165	14.01
Sanitary	Trunk/Connector Line	MH-1B8	2352600.549	554294.488	1126.720	1111.850	14.87
Sanitary	Trunk/Connector Line	MH-1B9	2352437.265	554530.869	1126.750	1112.560	14.19
Sanitary	Trunk/Connector Line	MH-2B1	2354105.453	552299.488	1112.700	1095.340	17.36
Sanitary	Trunk/Connector Line	MH-2B2	2353842.217	552155.547	1112.110	1097.400	14.71
Sanitary	Trunk/Connector Line	MH-2B3	2353579.701	552012.000	1107.930	1098.595	9.34
Sanitary	Trunk/Connector Line	MH-2B4	2353307.533	551863.175	1113.610	1099.805	13.80
Sanitary	Trunk/Connector Line	MH-2B5	2353061.573	551727.211	1114.320	1101.075	13.24
Sanitary	Trunk/Connector Line	MH-2B6	2352774.849	551640.411	1114.920	1102.365	12.56
Sanitary	Trunk/Connector Line	MH-2B7	2352446.741	551603.286	1113.800	1103.625	10.18
Sanitary	Trunk/Connector Line	MH-2B8	2352104.294	551573.102	1113.310	1104.960	8.35
Sanitary	Trunk/Connector Line	MH-2B9	2351774.003	551537.190	1113.890	1106.380	7.51
Sanitary	Trunk/Connector Line	MH-2F1	2353914.249	552481.600	1113.000	1098.430	14.57

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Trunk/Connector Line	MH-2F6	2353001.943	553357.103	1122.530	1105.575	16.95
Sanitary	Trunk/Connector Line	MH-2F7	2352840.365	553520.878	1126.220	1113.535	12.68
Sanitary	Trunk/Connector Line	MH-2F8	2352871.614	553701.413	1126.260	1117.980	8.28
Sanitary	Trunk/Connector Line	MH-2F9	2352970.695	553798.155	1125.600	1120.390	5.21
Sanitary	Trunk/Connector Line	MH-BH1	2354173.699	555399.587	1111.100	1097.055	14.04
Sanitary	Trunk/Connector Line	MH-BH2	2354434.087	555556.088	1116.080	1098.980	17.10
Sanitary	Trunk/Connector Line	MH-BH3	2354534.820	555758.782	1117.040	1099.830	17.21
Sanitary	Trunk/Connector Line	MH-BH4	2354632.185	555954.099	1112.770	1100.600	12.17
Sanitary	Trunk/Connector Line	MH-BH5	2354729.658	556136.188	1108.510	1101.390	7.12
Sanitary	Trunk/Connector Line	MH-BH6	2354830.355	556343.292	1109.540	1102.335	7.20
Sanitary	Trunk/Connector Line	MH-CO	2352079.576	556706.511	1100.620	1077.810	22.81
Sanitary	Trunk/Connector Line	MH-MP1	2354135.199	555140.973	1112.850	1097.275	15.57
Sanitary	Trunk/Connector Line	MH-MP2	2354096.824	555205.401	1112.700	1097.510	15.19
Sanitary	Trunk/Connector Line	MH-MP3	2353923.388	555102.099	1113.340	1098.655	14.68
Sanitary	Trunk/Connector Line	MH-MP4	2353751.043	554999.447	1112.560	1100.560	12.00
Sanitary	Trunk/Connector Line	MH-MP5	2353563.798	554922.845	1110.860	1101.950	8.91
Sanitary	Trunk/Connector Line	MH-MP6	2353378.053	554846.856	1115.410	1103.905	11.51
Sanitary	Trunk/Connector Line	MH-O32	2354892.192	553022.801	1106.450	1096.310	10.14
Sanitary	Trunk/Connector Line	MH-O33	2354992.747	553254.184	1108.020	1097.095	10.93
Sanitary	Trunk/Connector Line	MH-O34	2355191.185	553406.669	1109.090	1097.840	11.25
Sanitary	Trunk/Connector Line	MH-O35	2355389.436	553558.973	1111.000	1098.595	12.41
Sanitary	Trunk/Connector Line	MH-O36	2355543.087	553768.777	1111.040	1099.300	11.74
Sanitary	Trunk/Connector Line	MH-O37	2355696.180	553977.872	1113.300	1100.075	13.22
Sanitary	Trunk/Connector Line	MH-O38	2355598.039	554260.127	1112.440	1100.910	11.53
Sanitary	Trunk/Connector Line	MH-O39	2355499.145	554544.544	1111.910	1101.780	10.13
Sanitary	Trunk/Connector Line	MH-O40	2355559.094	554624.145	1113.680	1102.430	11.25
Sanitary	Trunk/Connector Line	MH-O41	2355911.233	554555.084	1114.820	1103.380	11.44
Sanitary	Trunk/Connector Line	MH-O42	2356219.969	554460.359	1120.010	1104.585	15.43
Sanitary	Trunk/Connector Line	MH-O43	2356506.161	554361.488	1119.370	1105.780	13.59
Sanitary	Trunk/Connector Line	MH-O44	2356768.919	554272.546	1117.150	1106.955	10.20
Sanitary	Trunk/Connector Line	MH-O45	2356963.373	554525.116	1122.640	1108.140	14.50
Sanitary	Trunk/Connector Line	MH-O46	2357157.712	554763.584	1120.940	1109.445	11.50
Sanitary	Trunk/Connector Line	MH-O47	2357324.588	554993.985	1120.910	1110.785	10.13

Table A-2. Inventory of Structures within the George Road Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Trunk/Connector Line	MH-O48	2357270.881	555263.098	1123.600	1112.265	11.33
Sanitary	Trunk/Connector Line	MH-O49	2357217.243	555535.264	1125.190	1114.135	11.06
Sanitary	Trunk/Connector Line	MH-O50	2357294.897	555698.820	1130.570	1116.625	13.94
Sanitary	Trunk/Connector Line	MH-O51	2357370.936	555858.976	1128.720	1119.505	9.21
Sanitary	Trunk/Connector Line	MH-WW1	2352368.929	554237.008	1130.840	1118.940	11.90
Sanitary	Trunk/Connector Line	MH-WW2	2352143.561	554190.387	1137.150	1126.130	11.02
Sanitary	Trunk/Connector Line	MH-WW3	2351905.765	554121.844	1139.360	1130.775	8.58
Sanitary	Trunk/Connector Line	MH-O20	2355608.909	551528.785	1073.87	1063.79	10.08
Sanitary	Trunk/Connector Line	MH-O21	2355520.175	551829.125	1076.220	1065.960	10.26
Sanitary	Trunk/Connector Line	MH-O22	2355141.927	551989.656	1081.280	1071.465	9.82
Sanitary	Trunk/Connector Line	MH-O23	2355139.440	552134.232	1089.790	1076.665	13.13
Sanitary	Trunk/Connector Line	MH-O24	2354885.189	552285.488	1087.950	1080.205	7.75
Sanitary	Trunk/Connector Line	MH-O27	2354625.870	552368.230	1107.530	1090.650	16.88
Sanitary	Trunk/Connector Line	MH-O28	2354387.932	552444.150	1107.580	1092.267	15.31
Sanitary	Trunk/Connector Line	MH-O29	2354345.911	552539.814	1104.480	1094.100	10.38
Sanitary	Trunk/Connector Line	MH-O30	2354560.688	552642.478	1102.970	1094.705	8.27
Sanitary	Trunk/Connector Line	MH-O31	2354780.134	552740.475	1106.150	1095.480	10.67

ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ID = Identification designator.
NAD = North American Datum

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Atlas Scrap Yard	MH-1	2366683.078	556965.737	1011.67	975.27	36.40
Sanitary	Atlas Scrap Yard	MH-10	2366198.221	557221.904	Unknown	975.47	Unknown
Sanitary	Atlas Scrap Yard	MH-11	2366552.409	557781.232	Unknown	973.54	Unknown
Sanitary	Atlas Scrap Yard	MH-12	2366658.106	558050.895	Unknown	972.65	Unknown
Sanitary	Atlas Scrap Yard	MH-13	2366715.670	558294.145	978.39	972.05	6.34
Sanitary	Atlas Scrap Yard	MH-14	2366816.815	558462.794	977.10	971.56	5.54
Sanitary	Atlas Scrap Yard	MH-3	2366586.601	557202.701	Unknown	974.79	Unknown
Sanitary	Atlas Scrap Yard	MH-4	2366528.359	557315.431	Unknown	974.21	Unknown
Sanitary	Atlas Scrap Yard	MH-5	2366487.974	557521.010	978.27	974.07	4.20
Sanitary	Atlas Scrap Yard	MH-6	2366367.955	557478.183	Unknown	974.55	Unknown
Sanitary	Atlas Scrap Yard	MH-7	2366324.167	557616.477	Unknown	975.27	Unknown
Sanitary	Atlas Scrap Yard	MH-8	2366270.584	557742.724	Unknown	975.28	Unknown
Sanitary	Atlas Scrap Yard	MH-9	2366115.859	557359.226	Unknown	975.92	Unknown
Sanitary	Atlas Scrap Yard	MH-HD1	2366243.384	557044.945	Unknown	977.98	Unknown
Sanitary	Atlas Scrap Yard	MH-HD2	2366005.233	556971.739	Unknown	978.15	Unknown
Sanitary	Atlas Scrap Yard	MH-HD3	2365807.525	556892.854	Unknown	979.02	Unknown
Sanitary	Inert Storage Area #6	MH-315	2376668.660	560066.374	991.25	982.98	8.27
Sanitary	Inert Storage Area #6	MH-316	2376515.623	559945.015	991.12	981.90	9.22
Sanitary	Inert Storage Area #6	MH-317	2376322.795	559807.453	991.23	980.95	10.28
Sanitary	Inert Storage Area #6	MH-318	2376098.140	559647.188	992.43	979.82	12.61
Sanitary	Inert Storage Area #6	MH-319	2375848.966	559504.847	991.350	978.930	12.42
Sanitary	Inert Storage Area #6	MH-320	2375643.342	559353.699	990.770	977.870	12.90
Sanitary	Inert Storage Area #6	MH-321	2375442.714	559206.222	991.190	976.740	14.45
Sanitary	Inert Storage Area #6	MH-322	2375288.833	559093.077	991.080	976.060	15.02
Sanitary	Inert Storage Area #6	MH-323	2375061.394	558925.892	987.520	975.010	12.51
Sanitary	Inert Storage Area #6	MH-324	2374145.467	558006.004	990.76	985.70	5.06
Sanitary	Inert Storage Area #6	MH-325	2374303.473	558126.969	990.56	983.11	7.45
Sanitary	Inert Storage Area #6	MH-326	2374522.990	558292.103	990.70	980.50	10.20
Sanitary	Inert Storage Area #6	MH-327	2374686.504	558409.848	990.89	978.23	12.66
Sanitary	Inert Storage Area #6	MH-328	2374905.061	558574.349	990.64	977.20	13.44
Sanitary	Inert Storage Area #6	MH-329	2375166.131	558780.129	990.45	975.84	14.61
Sanitary	Load Line 1	MH-1X	2376066.317	562991.378	Unknown	1006.52	Unknown
Sanitary	Load Line 1	MH-201	2377443.335	561631.295	994.350	987.950	6.40
Sanitary	Load Line 1	MH-201A	2377572.310	561701.573	994.370	988.885	5.48
Sanitary	Load Line 1	MH-202	2377336.281	561827.989	994.280	987.150	7.13

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 1	MH-202A	2377286.041	561920.190	994.400	986.550	7.85
Sanitary	Load Line 1	MH-203	2377222.175	562037.593	994.950	985.450	9.50
Sanitary	Load Line 1	MH-204	2377133.766	562317.631	1006.240	984.200	22.04
Sanitary	Load Line 1	MH-205	2377043.562	562604.797	1006.970	982.500	24.47
Sanitary	Load Line 1	MH-206	2376944.844	562919.770	998.400	980.700	17.70
Sanitary	Load Line 1	MH-207	2376803.513	563178.711	1001.240	979.010	22.23
Sanitary	Load Line 1	MH-208	2376661.703	563438.530	997.500	977.370	20.13
Sanitary	Load Line 1	MH-209	2376515.991	563735.541	993.270	976.462	16.81
Sanitary	Load Line 1	MH-210	2376394.427	564036.248	989.710	975.782	13.93
Sanitary	Load Line 1	MH-210A	2376284.995	564307.250	986.220	974.740	11.48
Sanitary	Load Line 1	MH-211	2376127.718	564910.199	989.840	976.610	13.23
Sanitary	Load Line 1	MH-212	2375994.439	564837.115	988.780	975.770	13.01
Sanitary	Load Line 1	MH-213	2376119.042	564609.886	988.260	974.740	13.52
Sanitary	Load Line 1	MH-214	2375569.445	563965.600	995.700	990.250	5.45
Sanitary	Load Line 1	MH-214A	2375716.013	564044.741	994.650	989.340	5.31
Sanitary	Load Line 1	MH-215	2375827.219	564104.805	994.000	988.290	5.71
Sanitary	Load Line 1	MH-216	2375970.129	564181.839	993.400	986.865	6.54
Sanitary	Load Line 1	MH-217	2375858.549	564388.659	994.100	988.700	5.40
Sanitary	Load Line 1	MH-218	2376087.228	563964.791	995.000	981.067	13.93
Sanitary	Load Line 1	MH-219	2375987.307	563301.458	995.700	989.750	5.95
Sanitary	Load Line 1	MH-220	2376265.032	563453.042	993.500	988.150	5.35
Sanitary	Load Line 1	MH-221	2376386.743	563288.455	993.500	982.760	10.74
Sanitary	Load Line 1	MH-222	2376492.507	563094.908	996.000	988.300	7.70
Sanitary	Load Line 1	MH-223	2376204.035	562937.527	993.300	990.150	3.15
Sanitary	Load Line 1	MH-224	2376624.046	562131.915	995.820	991.100	4.72
Sanitary	Load Line 1	MH-225	2376876.357	562269.254	993.430	988.350	5.08
Sanitary	Load Line 1	MH-226	2376795.176	562469.593	993.800	985.650	8.15
Sanitary	Load Line 1	MH-227	2377025.943	563548.472	994.600	988.350	6.25
Sanitary	Load Line 1	MH-228	2377130.384	563357.119	996.290	983.900	12.39
Sanitary	Load Line 1	MH-229	2377232.861	563166.060	999.340	988.350	10.99
Storm	Load Line 1	A1	2376037.220	564322.610	987.5	984.4	3.10
Storm	Load Line 1	A10	2375497.750	564804.780	992.7	991.2	1.50
Storm	Load Line 1	A11	2376055.030	564000.550	994.0	992.0	2.00
Storm	Load Line 1	A12	2376215.260	563713.940	993.9	993.0	0.90
Storm	Load Line 1	A14	2375815.440	564485.780	992.8	989.8	3.00

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 1	A17	2375806.740	564689.020	993.9	992.4	1.50
Storm	Load Line 1	A18	2375858.410	564589.810	993.9	992.4	1.50
Storm	Load Line 1	A2	2375892.750	564083.080	992.9	988.8	4.10
Storm	Load Line 1	A3	2375969.070	563931.370	992.3	989.3	3.00
Storm	Load Line 1	A4	2376040.760	563806.900	992.3	989.8	2.50
Storm	Load Line 1	A5	2376117.800	563665.960	992.7	991.0	1.70
Storm	Load Line 1	A6	2375782.800	564286.570	992.8	989.5	3.30
Storm	Load Line 1	A7	2375689.460	564456.540	991.9	989.8	2.10
Storm	Load Line 1	A8	2375623.820	564575.780	992.3	990.6	1.70
Storm	Load Line 1	A9	2375560.790	564690.280	992.4	990.9	1.50
Storm	Load Line 1	B1	2377113.870	563390.820	992.9	991.1	1.80
Storm	Load Line 1	B10	2376881.550	563003.600	993.4	992.2	1.20
Storm	Load Line 1	B11	2376936.950	562898.480	993.7	992.3	1.40
Storm	Load Line 1	B12	2376647.100	563318.540	994.2	991.9	2.30
Storm	Load Line 1	B13	2376299.510	563576.760	993.8	991.0	2.80
Storm	Load Line 1	B2	2376320.850	563437.690	992.6	988.9	3.70
Storm	Load Line 1	B3	2376480.580	563227.520	992.7	989.5	3.20
Storm	Load Line 1	B4	2376527.220	563139.910	992.7	990.1	2.60
Storm	Load Line 1	B5	2376593.220	563018.290	992.9	990.6	2.30
Storm	Load Line 1	B5A	2376667.590	562882.820	992.7	991.0	1.70
Storm	Load Line 1	B6	2376719.730	562786.120	992.9	991.4	1.50
Storm	Load Line 1	B7	2376237.520	563527.590	992.7	990.5	2.20
Storm	Load Line 1	B8	2376692.110	563341.500	994.1	992.2	1.90
Storm	Load Line 1	B9	2376673.410	563331.160	994.1	992.4	1.70
Storm	Load Line 1	C1	2377345.430	562962.160	992.7	989.4	3.30
Storm	Load Line 1	C2	2377403.710	562853.200	992.6	990.0	2.60
Storm	Load Line 1	C3	2377465.600	562742.570	992.7	990.6	2.10
Storm	Load Line 1	C4	2377533.030	562612.040	992.8	991.4	1.40
Storm	Load Line 1	C5	2377115.380	563032.240	996.7	993.0	3.70
Storm	Load Line 1	C6	2377092.480	563074.460	996.8	993.8	3.00
Storm	Load Line 1	C7	2377172.900	563282.030	992.7	993.0	-0.30
Storm	Load Line 1	CB-4	2376673.300	563440.990	Unknown	Unknown	Unknown
Storm	Load Line 1	D1	2377132.230	561985.230	993.4	988.2	5.20
Storm	Load Line 1	D10	2377183.020	561761.950	992.7	990.2	2.50
Storm	Load Line 1	D11	2377256.020	561623.890	992.5	990.7	1.80
Storm	Load Line 1	D12	2377265.880	561893.280	993.8	991.4	2.40

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 1	D13	2377302.510	562078.770	992.7	987.4	5.30
Storm	Load Line 1	D14	2377397.160	561904.520	993.6	990.4	3.20
Storm	Load Line 1	D2	2377200.440	561858.400	993.0	990.0	3.00
Storm	Load Line 1	D3	2377369.890	561705.900	993.8	992.1	1.71
Storm	Load Line 1	D4	2377021.300	562051.810	992.5	988.9	3.60
Storm	Load Line 1	D5	2376939.940	562197.630	992.8	989.8	3.00
Storm	Load Line 1	D6	2376889.980	562294.070	992.7	990.3	2.40
Storm	Load Line 1	D7	2376834.540	562403.530	993.1	990.9	2.20
Storm	Load Line 1	D8	2376979.170	562338.360	993.4	991.0	2.40
Storm	Load Line 1	D9	2377072.410	561953.460	992.5	989.4	3.10
Storm	Load Line 1	E1	2377484.040	561500.300	994.0	989.7	4.30
Storm	Load Line 1	E2	2377383.830	561395.390	992.7	987.5	5.20
Storm	Load Line 1	E3	2377465.810	561350.240	988.3	985.1	3.20
Storm	Load Line 1	F1	2375668.030	563382.090	1010.3	1007.20	3.10
Storm	Load Line 1	F10	2375969.240	562842.210	1012.9	1010.63	2.27
Storm	Load Line 1	F11	2375998.030	562787.290	1013.69	1010.76	2.93
Storm	Load Line 1	F12	2376026.820	562732.380	1012.8	1010.86	1.94
Storm	Load Line 1	F13	2376055.600	562677.470	1013.1	1010.94	2.16
Storm	Load Line 1	F14	2376084.830	562622.810	1013.1	1010.7	2.40
Storm	Load Line 1	F2	2375707.560	563312.540	1010.1	1007.56	2.54
Storm	Load Line 1	F3	2375738.200	563258.640	1010.8	1007.91	2.89
Storm	Load Line 1	F4	2375768.840	563204.740	1011.0	1008.28	2.76
Storm	Load Line 1	F5	2375799.480	563150.840	1011.5	1008.83	2.67
Storm	Load Line 1	F6	2375830.120	563096.940	1011.6	1009.39	2.21
Storm	Load Line 1	F7	2375851.560	563025.970	1012.7	1009.97	2.73
Storm	Load Line 1	F8	2375873.000	562955.000	1013.0	1010.9	2.10
Storm	Load Line 1	F9	2375921.120	562898.600	1013.3	1010.39	2.91
Storm	Load Line 1	MH	2376283.180	564338.980	987.0	974.7	12.30
Storm	Load Line 1	MHA1	2376219.000	564624.000	984.7	979.4	5.30
Storm	Load Line 1	MHA2	2375962.580	564198.860	993.2	987.0	6.20
Storm	Load Line 1	MHA3	2375897.750	565210.790	992.4	987.6	4.80
Storm	Load Line 1	MHB1	2376960.130	563670.320	993.7	983.4	10.30
Storm	Load Line 1	MHB2	2376877.790	563628.550	991.4	986.1	5.30
Storm	Load Line 1	MHB3	2376570.360	563563.700	996.6	988.0	8.60
Storm	Load Line 1	MHB4	2376394.820	563474.990	999.2	988.8	10.40
Storm	Load Line 1	MHC1	2377284.920	563072.740	993.2	989.4	3.80

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 1	MHD1	2377718.910	562029.490	991.2	982.6	8.60
Storm	Load Line 1	MHD2	2377451.520	562160.770	997.2	986.8	10.40
Storm	Load Line 1	MHE1	2377537.520	561187.240	984.4	977.4	7.00
Storm	Load Line 1	UN-1	2376196.140	563751.260	Unknown	Unknown	Unknown
Sanitary	Load Line 2	MH-301	2373085.841	562386.486	1014.500	999.400	15.10
Sanitary	Load Line 2	MH-301A	2373093.447	562372.409	1014.500	998.870	15.63
Sanitary	Load Line 2	MH-302	2373218.922	562121.185	1010.700	1003.030	7.67
Sanitary	Load Line 2	MH-303	2373367.061	561850.010	1010.700	1001.120	9.58
Sanitary	Load Line 2	MH-304	2373616.865	561627.702	1013.700	999.590	14.11
Sanitary	Load Line 2	MH-305	2373901.487	561428.625	1011.900	998.200	13.70
Sanitary	Load Line 2	MH-306	2374043.586	561168.508	1010.500	997.005	13.50
Sanitary	Load Line 2	MH-307	2374185.109	560909.444	1012.400	995.765	16.64
Sanitary	Load Line 2	MH-308	2374259.581	560566.446	1014.500	994.365	20.14
Sanitary	Load Line 2	MH-309	2374371.553	560245.989	1014.82	993.71	21.11
Sanitary	Load Line 2	MH-310	2374482.452	559928.605	1010.400	992.005	18.40
Sanitary	Load Line 2	MH-310A	2374417.164	559927.373	1010.870	993.750	17.12
Sanitary	Load Line 2	MH-311	2374566.905	559774.191	1010.600	991.160	19.44
Sanitary	Load Line 2	MH-312	2374710.127	559506.951	1009.800	987.630	22.17
Sanitary	Load Line 2	MH-313	2374843.997	559257.162	994.120	982.290	11.83
Sanitary	Load Line 2	MH-314	2374944.150	559104.548	989.760	977.500	12.26
Sanitary	Load Line 2	MH-331	2374219.279	561264.487	1009.600	1000.350	9.25
Sanitary	Load Line 2	MH-332	2372844.016	561916.379	1011.800	1006.020	5.78
Sanitary	Load Line 2	MH-333	2373095.445	562053.731	1010.900	1004.620	6.28
Sanitary	Load Line 2	MH-334	2373326.065	561155.694	1014.900	1006.865	8.03
Sanitary	Load Line 2	MH-335	2373425.264	560917.442	1011.800	1006.725	5.07
Sanitary	Load Line 2	MH-336	2373375.264	560890.167	1013.100	1005.620	7.48
Sanitary	Load Line 2	MH-337	2373426.076	560615.935	1013.100	1004.330	8.77
Sanitary	Load Line 2	MH-338	2373839.997	560130.611	1011.800	1008.255	3.55
Sanitary	Load Line 2	MH-339	2373776.601	560090.541	1019.900	1001.200	18.70
Sanitary	Load Line 2	MH-340	2373607.207	560355.050	1016.600	1005.730	10.87
Sanitary	Load Line 2	MH-341	2374252.080	561528.961	1010.900	1002.650	8.25
Sanitary	Load Line 2	MH-342	2374458.914	561148.108	1010.800	1002.635	8.17
Storm	Load Line 2	B1A	2373449.910	561664.350	1009.8	1005.0	4.80
Storm	Load Line 2	C2	2374348.090	559974.140	1009.8	1006.7	3.10
Storm	Load Line 2	C3	2374407.790	559864.320	1009.6	1007.0	2.60
Storm	Load Line 2	C4	2374462.260	559893.920	1009.7	1007.4	2.30

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 2	DA1	2373366.110	562792.420	1008.8	1005.8	3.00
Storm	Load Line 2	DA10	2374171.020	561718.570	1008.9	1005.7	3.20
Storm	Load Line 2	DA11	2374237.060	561596.260	1008.9	1005.6	3.30
Storm	Load Line 2	DA12	2374327.620	561430.370	1008.8	1005.2	3.60
Storm	Load Line 2	DA13	2374415.310	561269.750	1008.7	1005.9	2.80
Storm	Load Line 2	DA14	2374503.010	561109.130	1008.8	1006.6	2.20
Storm	Load Line 2	DA15	2374573.450	560980.110	1008.8	1007.2	1.60
Storm	Load Line 2	DA16	2374646.760	560845.820	1008.9	1007.8	1.10
Storm	Load Line 2	DA17	2374728.240	560696.620	1008.8	1007.7	1.10
Storm	Load Line 2	DA18	2374800.620	560564.090	1008.9	1007.2	1.70
Storm	Load Line 2	DA19	2374880.890	560432.660	1008.6	1006.4	2.20
Storm	Load Line 2	DA2	2373437.010	562657.970	1008.8	1005.8	3.00
Storm	Load Line 2	DA20	2374938.190	560298.380	1008.8	1005.9	2.90
Storm	Load Line 2	DA21	2374953.830	560305.050	1008.7	1005.4	3.30
Storm	Load Line 2	DA3	2373513.250	562545.350	1008.8	1006.4	2.40
Storm	Load Line 2	DA4	2373630.020	562433.060	1008.8	1007.2	1.60
Storm	Load Line 2	DA5	2373751.490	562346.770	1008.8	1007.5	1.30
Storm	Load Line 2	DA6	2373857.590	562249.410	1008.8	1007.8	1.00
Storm	Load Line 2	DA7	2373944.400	562138.300	1009.0	1007.1	1.90
Storm	Load Line 2	DA8	2374024.690	561989.590	1008.6	1006.7	1.90
Storm	Load Line 2	DA9	2374098.800	561852.320	1008.6	1006.2	2.40
Storm	Load Line 2	DB1	2372844.540	562626.000	1009.0	1005.3	3.70
Storm	Load Line 2	DB10	2373557.970	561399.590	1008.7	1007.0	1.70
Storm	Load Line 2	DB11	2373642.100	561277.820	1008.6	1006.1	2.50
Storm	Load Line 2	DB12	2373710.700	561152.350	1008.8	1004.9	3.90
Storm	Load Line 2	DB13	2373777.380	561030.390	1008.8	1005.1	3.70
Storm	Load Line 2	DB14	2373847.930	560899.150	1008.8	1006.0	2.80
Storm	Load Line 2	DB15	2373917.530	560769.670	1008.8	1006.5	2.30
Storm	Load Line 2	DB16	2373980.600	560598.950	1008.9	1007.1	1.80
Storm	Load Line 2	DB17	2374036.460	560434.160	1008.8	1007.4	1.40
Storm	Load Line 2	DB18	2374120.290	560276.000	1008.8	1007.1	1.70
Storm	Load Line 2	DB19	2374207.680	560115.220	1008.8	1006.4	2.40
Storm	Load Line 2	DB2	2372935.810	562457.080	1008.8	1006.3	2.50
Storm	Load Line 2	DB20	2374298.890	559947.400	1008.8	1006.2	2.60
Storm	Load Line 2	DB21	2374417.670	559728.870	1008.8	1004.7	4.10
Storm	Load Line 2	DB22	2374389.550	559713.590	1008.7	1004.4	4.30

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 2	DB3	2373019.480	562302.230	1008.7	1006.9	1.80
Storm	Load Line 2	DB4	2373077.950	562194.020	1008.6	1007.5	1.10
Storm	Load Line 2	DB5	2373145.920	562068.210	1008.9	1007.5	1.40
Storm	Load Line 2	DB6	2373214.330	561944.910	1008.7	1006.9	1.80
Storm	Load Line 2	DB7	2373299.820	561787.640	1008.5	1006.1	2.40
Storm	Load Line 2	DB8	2373385.770	561629.490	1009.2	1005.5	3.70
Storm	Load Line 2	DB9	2373462.190	561508.620	1009.0	1007.5	1.50
Storm	Load Line 2	DC1	2374548.050	560018.380	1008.1	1006.2	1.90
Storm	Load Line 2	DG1	2373021.100	562489.030	1010.67	1007.17	3.50
Storm	Load Line 2	MHB1	2373625.630	561759.860	1014.7	1004.5	10.20
Storm	Load Line 2	MHB2	2373858.260	561695.530	1012.7	1003.6	9.10
Storm	Load Line 2	MHB3	2374055.310	561347.440	1010.2	1001.7	8.45
Storm	Load Line 2	UN-2	2374609.180	559905.910	Unknown	Unknown	Unknown
Storm	Load Line 2	UN-3	2373098.860	562345.120	1008.0	Unknown	Unknown
Sanitary	Load Line 3	MH-401	2371765.305	559596.219	1008.400	995.975	12.43
Sanitary	Load Line 3	MH-402	2371307.750	559817.774	1006.040	996.790	9.25
Sanitary	Load Line 3	MH-403	2371408.255	559633.614	1006.370	995.960	10.41
Sanitary	Load Line 3	MH-404	2371506.125	559454.282	1005.400	994.980	10.42
Sanitary	Load Line 3	MH-405	2371330.041	559358.185	1004.90	994.58	10.32
Sanitary	Load Line 3	MH-406	2370958.487	559621.821	1005.500	997.090	8.41
Sanitary	Load Line 3	MH-407	2371056.559	559442.120	1006.560	995.940	10.62
Sanitary	Load Line 3	MH-408	2371154.616	559262.446	1003.800	993.160	10.64
Sanitary	Load Line 3	MH-409	2370882.897	559114.156	1001.700	990.490	11.21
Sanitary	Load Line 3	MH-410	2370687.264	559007.389	995.010	986.500	8.51
Sanitary	Load Line 3	MH-411	2370179.336	560586.628	1007.500	978.480	29.02
Sanitary	Load Line 3	MH-412	2370415.475	560140.125	1003.600	996.960	6.64
Sanitary	Load Line 3	MH-413	2370289.389	560378.424	1009.390	996.085	13.30
Sanitary	Load Line 3	MH-414	2370186.481	560324.028	1002.760	995.690	7.07
Sanitary	Load Line 3	MH-414A	2370178.980	560338.218	1002.830	993.035	9.80
Sanitary	Load Line 3	MH-415	2369879.490	560175.520	996.850	989.775	7.08
Sanitary	Load Line 3	Mh-415A	2370071.420	559908.712	995.100	988.580	6.52
Sanitary	Load Line 3	MH-416	2370173.279	559658.446	994.220	987.470	6.75
Sanitary	Load Line 3	MH-417	2370274.779	559409.060	994.600	986.930	7.67
Sanitary	Load Line 3	MH-417A	2370314.420	559331.955	987.000	986.390	0.61
Sanitary	Load Line 3	MH-418	2370383.697	559163.180	995.300	985.220	10.08
Sanitary	Load Line 3	MH-419	2370493.010	558901.375	990.540	983.550	6.99

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 3	MH-420	2370585.791	558679.167	990.070	981.875	8.20
Sanitary	Load Line 3	MH-421	2371601.835	558062.657	1007.910	997.080	10.83
Sanitary	Load Line 3	MH-422	2371502.195	558246.205	1005.160	996.160	9.00
Sanitary	Load Line 3	MH-423	2371385.498	558461.173	1006.240	995.040	11.20
Sanitary	Load Line 3	MH-424	2371237.193	558734.365	1002.360	994.060	8.30
Sanitary	Load Line 3	MH-425	2371079.817	558648.932	1002.320	991.250	11.07
Sanitary	Load Line 3	MH-426	2370864.329	558532.357	995.560	984.920	10.64
Sanitary	Load Line 3	MH-427	2370678.048	558459.559	987.870	979.090	8.78
Sanitary	Load Line 3	MH-428	2370476.724	559213.575	995.800	987.900	7.90
Storm	Load Line 3	B1	2370917.500	559695.620	1004.2	1000.7	3.50
Storm	Load Line 3	C1	2371264.460	559828.020	1005.7	1004.1	1.60
Storm	Load Line 3	C2	2371099.440	559737.950	1004.4	1002.9	1.50
Storm	Load Line 3	C3	2370933.540	559647.410	1003.0	1000.4	2.60
Storm	Load Line 3	C4	2370948.860	559619.320	1003.0	1000.3	2.70
Storm	Load Line 3	C5	2370847.030	559563.750	1003.5	999.9	3.60
Storm	Load Line 3	D1	2371731.080	557784.780	1003.0	1001.5	1.50
Storm	Load Line 3	D2	2371633.080	557963.700	1003.0	1001.1	1.90
Storm	Load Line 3	D3	2371537.000	558139.110	1003.2	1000.0	3.20
Storm	Load Line 3	D4	2371498.160	558118.440	1002.6	999.7	2.90
Storm	Load Line 3	E1	2369882.130	559561.870	985.8	982.8	3.00
Storm	Load Line 3	E2	2369911.270	559508.280	985.8	982.7	3.10
Storm	Load Line 3	E3	2369939.940	559455.570	985.8	982.9	2.90
Storm	Load Line 3	E4	2369967.650	559404.620	985.8	982.9	2.90
Storm	Load Line 3	E5	2369996.790	559351.030	985.8	982.4	3.40
Storm	Load Line 3	E6	2370024.500	559300.080	985.8	982.0	3.80
Storm	Load Line 3	E7	2370054.030	559246.530	986.3	982.6	3.70
Storm	Load Line 3	E8	2370066.070	559192.870	985.6	982.1	3.50
Storm	Load Line 3	E9	2370114.020	559137.040	985.7	982.4	3.30
Storm	Load Line 3	EA1	2370949.000	560576.890	1001.2	999.9	1.30
Storm	Load Line 3	EA10	2371570.000	559432.520	1001.1	998.3	2.80
Storm	Load Line 3	EA11	2371689.860	559213.130	1001.0	998.3	2.70
Storm	Load Line 3	EA12	2371747.400	559107.830	1001.1	998.7	2.40
Storm	Load Line 3	EA13	2371803.490	559005.150	1001.1	999.1	2.00
Storm	Load Line 3	EA14	2371862.470	558897.210	1000.9	999.4	1.50
Storm	Load Line 3	EA15	2371925.190	558779.930	1002.1	999.9	2.20
Storm	Load Line 3	EA2	2371018.120	560449.420	1001.1	999.6	1.50

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 3	EA3	2371086.750	560322.830	1001.0	999.5	1.50
Storm	Load Line 3	EA4	2371155.390	560196.240	1001.3	999.3	2.00
Storm	Load Line 3	EA5	2371224.500	560068.770	1001.0	999.1	1.90
Storm	Load Line 3	EA6	2371293.610	559941.300	1001.5	998.8	2.70
Storm	Load Line 3	EA7	2371362.250	559814.710	1001.1	998.8	2.30
Storm	Load Line 3	EA8	2371431.840	559686.360	1001.1	998.6	2.50
Storm	Load Line 3	EA9	2371500.470	559559.770	1000.9	998.4	2.50
Storm	Load Line 3	EB1	2369975.250	560685.530	1001.9	999.8	2.10
Storm	Load Line 3	EB10	2370595.700	559638.880	1000.5	999.0	1.50
Storm	Load Line 3	EB11	2370655.920	559552.870	1001.0	997.9	3.10
Storm	Load Line 3	EB12	2370708.110	559457.170	1001.5	999.2	2.30
Storm	Load Line 3	EB14	2370810.940	559266.090	1001.0	999.8	1.20
Storm	Load Line 3	EB15	2371150.890	558554.380	1002.2	999.9	2.30
Storm	Load Line 3	EB16	2371234.050	558398.130	1001.0	999.5	1.50
Storm	Load Line 3	EB17	2371316.750	558242.770	1001.1	999.3	1.80
Storm	Load Line 3	EB18	2371397.090	558091.820	1001.0	998.9	2.10
Storm	Load Line 3	EB2	2370047.210	560552.780	1001.0	999.5	1.50
Storm	Load Line 3	EB3	2370118.210	560421.780	1001.1	999.2	1.90
Storm	Load Line 3	EB4	2370189.690	560289.910	1000.9	998.0	2.90
Storm	Load Line 3	EB5	2370263.030	560159.060	1001.1	999.2	1.90
Storm	Load Line 3	EB6	2370334.880	560025.120	1001.4	999.4	2.00
Storm	Load Line 3	EB7	2370401.200	559901.950	1001.1	999.9	1.20
Storm	Load Line 3	EB8	2370459.830	559802.920	1001.4	999.5	1.90
Storm	Load Line 3	EB9	2370529.600	559719.180	1001.8	999.2	2.60
Storm	Load Line 3	ED1	2370926.550	560565.850	1001.8	999.8	2.00
Storm	Load Line 3	ED10	2371548.900	559419.950	1001.8	998.3	3.50
Storm	Load Line 3	ED2	2370996.140	560437.500	1001.8	999.7	2.10
Storm	Load Line 3	ED3	2371064.300	560311.790	1001.9	999.5	2.40
Storm	Load Line 3	ED4	2371133.410	560184.320	1001.6	999.3	2.30
Storm	Load Line 3	ED5	2371202.520	560056.850	1001.7	999.1	2.60
Storm	Load Line 3	ED6	2371271.640	559929.380	1001.1	998.9	2.20
Storm	Load Line 3	ED7	2371341.220	559801.040	1002.0	998.8	3.20
Storm	Load Line 3	ED8	2371410.810	559672.690	1002.0	998.5	3.50
Storm	Load Line 3	ED9	2371479.380	559547.200	1001.6	998.3	3.30
Storm	Load Line 3	EF1	2371665.410	559206.700	1001.8	998.4	3.40
Storm	Load Line 3	EF2	2371723.900	559099.640	1001.8	998.7	3.10

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 3	EF3	2371779.040	558998.720	1001.7	999.0	2.70
Storm	Load Line 3	EF4	2371841.370	558884.630	1001.8	999.4	2.40
Storm	Load Line 3	EF5	2371903.610	558767.100	1001.3	999.8	1.50
Storm	Load Line 3	EG2	2370180.350	560553.290	1004.1	1000.1	4.00
Storm	Load Line 3	EH1	2370004.000	560722.730	1001.6	1000.6	1.00
Storm	Load Line 3	EH10	2370492.500	559831.980	1001.7	1000.2	1.50
Storm	Load Line 3	EH11	2370565.510	559744.360	1001.9	999.9	2.00
Storm	Load Line 3	EH12	2370635.450	559659.390	1001.8	999.5	2.30
Storm	Load Line 3	EH13	2370695.420	559574.420	1001.8	998.0	3.80
Storm	Load Line 3	EH14	2370747.610	559478.730	1001.9	999.6	2.30
Storm	Load Line 3	EH15	2370798.790	559383.630	1001.9	1000.0	1.90
Storm	Load Line 3	EH16	2370851.090	559286.860	1001.9	1000.5	1.40
Storm	Load Line 3	EH17	2371177.370	558568.470	1002.4	1000.8	1.60
Storm	Load Line 3	EH18	2371240.800	558449.300	1001.8	1000.3	1.50
Storm	Load Line 3	EH19	2371304.230	558330.130	1001.9	1000.0	1.90
Storm	Load Line 3	EH2	2370064.040	560611.950	1001.9	1000.4	1.50
Storm	Load Line 3	EH20	2371367.190	558211.840	1001.8	999.8	2.00
Storm	Load Line 3	EH21	2371436.370	558085.550	1002.1	999.2	2.90
Storm	Load Line 3	EH22	2371592.500	557800.500	1002.9	997.0	5.90
Storm	Load Line 3	EH23	2371629.970	557732.090	1001.6	1000.0	1.60
Storm	Load Line 3	EH3	2370115.030	560517.880	1002.1	1000.0	2.10
Storm	Load Line 3	EH4	2370171.260	560414.140	1001.2	999.7	1.50
Storm	Load Line 3	EH5	2370227.490	560310.400	1002.0	999.3	2.70
Storm	Load Line 3	EH6	2370278.160	560220.730	1001.2	999.7	1.50
Storm	Load Line 3	EH7	2370327.310	560129.070	1002.1	999.9	2.20
Storm	Load Line 3	EH8	2370380.410	560030.460	1001.8	1000.3	1.50
Storm	Load Line 3	EH9	2370438.730	559922.170	1002.0	1000.6	1.40
Storm	Load Line 3	EHa	2370031.700	560826.970	1001.5	999.5	2.00
Storm	Load Line 3	EHb	2369996.760	560809.260	1001.2	999.2	2.00
Storm	Load Line 3	EHc	2369955.350	560788.260	1001.5	998.9	2.60
Storm	Load Line 3	UN-4	2370809.530	559636.700	Unknown	Unknown	Unknown
Storm	Load Line 3	UN-5	2370281.570	559304.850	990.8	Unknown	Unknown
Storm	Load Line 3	UN-6	2370274.610	559332.920	990.9	Unknown	Unknown
Sanitary	Load Line 4	MH-15+00	2365220.654	556434.780	983.960	976.083	7.88
Sanitary	Load Line 4	MH-7+50	2365283.828	555735.230	984.250	973.920	10.33
Sanitary	Load Line 4	MH-E1	2365659.144	555072.189	986.700	971.295	15.41

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 4	MH-E2	2365842.652	555147.073	989.700	972.940	16.76
Sanitary	Load Line 4	MH-E3	2365948.806	555281.122	987.500	973.695	13.80
Sanitary	Load Line 4	MH-E4	2366047.833	555408.445	987.100	974.280	12.82
Sanitary	Load Line 4	MH-E5	2365998.414	555529.551	987.200	974.855	12.35
Sanitary	Load Line 4	MH-E6	2365896.781	555778.612	986.100	975.655	10.45
Sanitary	Load Line 4	MH-E6-1	2365713.430	555833.882	988.680	976.810	11.87
Sanitary	Load Line 4	MH-E6-2	2365386.595	555700.512	984.700	978.340	6.36
Sanitary	Load Line 4	MH-E7	2366114.658	555867.469	984.750	976.580	8.17
Sanitary	Load Line 4	MH-E8	2366264.483	555928.557	984.750	977.120	7.63
Sanitary	Load Line 4	MH-E9	2366363.038	555957.080	984.900	977.945	6.95
Sanitary	Load Line 4	MH-W1	2365474.523	554996.852	981.000	967.405	13.60
Sanitary	Load Line 4	MH-W2	2365236.758	554899.828	979.800	965.235	14.56
Sanitary	Load Line 4	MH-W3	2364998.436	554802.577	978.100	965.235	12.87
Sanitary	Load Line 4	MH-W3-1	2364862.554	554966.605	986.300	969.680	16.62
Sanitary	Load Line 4	MH-W3-2	2364734.071	555234.376	983.700	974.400	9.30
Sanitary	Load Line 4	MH-W4	2364824.926	554731.774	976.910	966.210	10.70
Sanitary	Load Line 4	MH-W4-1	2364607.790	554798.303	976.600	967.380	9.22
Sanitary	Load Line 4	MH-W4-2	2364429.016	554933.269	977.110	967.380	9.73
Sanitary	Load Line 4	MH-W4-3	2364250.243	555068.236	980.000	968.775	11.23
Sanitary	Load Line 4	MH-W5	2364620.492	554648.351	983.500	970.860	12.64
Sanitary	Load Line 4	MH-W6	2364422.261	554567.461	989.100	983.270	5.83
Storm	Load Line 4	A-1	2364431.150	555744.920	982.21	979.98	2.23
Storm	Load Line 4	A-2	2364474.650	555638.030	981.13	979.29	1.84
Storm	Load Line 4	A-3	2364531.180	555499.090	980.42	978.58	1.84
Storm	Load Line 4	A-4	2364578.600	555357.000	980.35	977.84	2.51
Storm	Load Line 4	A-5	2364602.280	555299.260	980.33	977.51	2.82
Storm	Load Line 4	A-6	2364638.250	555252.050	980.31	977.14	3.17
Storm	Load Line 4	A-7	2364551.750	555216.570	980.43	976.33	4.10
Storm	Load Line 4	B-1	2364455.070	555789.050	982.35	980.21	2.14
Storm	Load Line 4	B-2	2364512.660	555652.280	981.31	979.46	1.85
Storm	Load Line 4	B-3	2364570.530	555514.870	980.46	978.81	1.65
Storm	Load Line 4	B-4	2364635.880	555381.410	980.37	978.17	2.20
Storm	Load Line 4	B-5	2364659.330	555324.230	980.39	977.84	2.55
Storm	Load Line 4	B-6	2364667.910	555264.220	980.59	977.35	3.24
Storm	Load Line 4	C-1	2364790.130	555507.200	981.99	979.05	2.94
Storm	Load Line 4	C-2	2364729.460	555389.180	980.82	978.24	2.58

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 4	D-1	2364836.970	555507.250	981.57	978.70	2.87
Storm	Load Line 4	D-2	2364769.200	555373.440	981.16	978.04	3.12
Storm	Load Line 4	D-3	2364701.430	555239.620	979.81	977.20	2.61
Storm	Load Line 4	E-1	2364998.090	555125.050	981.22	978.35	2.87
Storm	Load Line 4	E-2	2364857.060	555167.920	981.23	977.65	3.58
Storm	Load Line 4	E-3	2364713.040	555211.960	979.80	976.93	2.87
Storm	Load Line 4	E-3	2364724.790	555176.230	980.02	976.37	3.65
Storm	Load Line 4	F-1	2364968.780	555095.180	981.67	978.31	3.36
Storm	Load Line 4	F-2	2364847.550	555134.350	980.84	977.66	3.18
Storm	Load Line 4	G-1	2365203.430	555598.880	983.42	979.39	4.03
Storm	Load Line 4	GA-1	2366508.050	555990.180	984.05	978.67	5.38
Storm	Load Line 4	GA-10	2366111.380	556199.900	983.90	981.21	2.69
Storm	Load Line 4	GA-12	2365819.730	556255.970	983.64	981.14	2.50
Storm	Load Line 4	GA-13	2365669.950	556258.120	983.56	980.35	3.21
Storm	Load Line 4	GA-14	2365520.660	556255.970	983.48	979.64	3.84
Storm	Load Line 4	GA-15	2365375.700	556220.640	983.29	978.96	4.33
Storm	Load Line 4	GA-16	2365235.800	556163.020	983.41	978.14	5.27
Storm	Load Line 4	GA-17	2365098.310	556106.390	983.84	977.84	6.00
Storm	Load Line 4	GA-18	2364991.970	556062.600	983.20	979.79	3.41
Storm	Load Line 4	GA-19	2365969.820	556210.610	983.75	981.63	2.12
Storm	Load Line 4	GA-2	2366370.630	556047.770	984.63	979.45	5.18
Storm	Load Line 4	GA-20	2365832.950	556230.520	983.64	980.95	2.69
Storm	Load Line 4	GA-21	2365683.340	556238.150	983.59	980.14	3.45
Storm	Load Line 4	GA-22	2365534.430	556227.340	983.58	979.41	4.17
Storm	Load Line 4	GA-23	2365388.230	556193.360	983.46	978.63	4.83
Storm	Load Line 4	GA-24	2365250.000	556136.420	983.49	977.86	5.63
Storm	Load Line 4	GA-25	2365109.820	556078.690	983.72	977.68	6.04
Storm	Load Line 4	GA-26	2365004.590	556035.350	983.27	978.66	4.61
Storm	Load Line 4	GA-27	2364879.470	556016.260	983.33	980.22	3.11
Storm	Load Line 4	GA-28	2364709.790	555946.380	982.91	979.87	3.04
Storm	Load Line 4	GA-29	2364598.740	555900.640	982.26	979.33	2.93
Storm	Load Line 4	GA-3	2366231.180	556106.210	984.60	980.17	4.43
Storm	Load Line 4	GA-30	2364461.890	555844.280	981.67	978.86	2.81
Storm	Load Line 4	GA-31	2364322.220	555786.750	981.42	978.33	3.09
Storm	Load Line 4	GA-32	2364182.350	555730.240	981.31	977.87	3.44
Storm	Load Line 4	GA-33	2364048.950	555669.710	981.38	977.41	3.97

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 4	GA-34	2363928.750	555586.850	981.19	976.92	4.27
Storm	Load Line 4	GA-35	2364890.900	555988.520	983.27	979.86	3.41
Storm	Load Line 4	GA-36	2364721.220	555918.640	982.33	978.87	3.46
Storm	Load Line 4	GA-37	2364614.880	555874.840	982.25	979.33	2.92
Storm	Load Line 4	GA-38	2364477.110	555818.100	981.74	978.86	2.88
Storm	Load Line 4	GA-39	2364332.900	555758.710	981.47	978.33	3.14
Storm	Load Line 4	GA-4	2366093.940	556163.730	984.45	980.66	3.79
Storm	Load Line 4	GA-40	2364194.550	555711.630	981.33	977.87	3.46
Storm	Load Line 4	GA-41	2364058.440	555647.450	981.30	977.41	3.89
Storm	Load Line 4	GA-42	2363938.790	555563.780	981.06	976.92	4.14
Storm	Load Line 4	GA-5	2366799.540	555915.500	983.73	980.48	3.25
Storm	Load Line 4	GA-6	2366662.940	555971.950	984.64	979.81	4.83
Storm	Load Line 4	GA-7a	2366524.400	556029.210	984.17	978.98	5.19
Storm	Load Line 4	GA-7b	2366502.290	556121.030	985.00	981.80	3.20
Storm	Load Line 4	GA-8	2366389.750	556084.860	984.61	979.67	4.94
Storm	Load Line 4	GA-9	2366242.620	556145.660	984.65	980.46	4.19
Storm	Load Line 4	GB-1	2365986.780	555570.840	983.76	979.51	4.25
Storm	Load Line 4	GB-2	2365977.410	555593.590	983.68	979.92	3.76
Storm	Load Line 4	GC-1	2365960.060	555705.730	984.59	979.09	5.50
Storm	Load Line 4	GH-1	2364064.180	554912.770	979.46	975.46	4.00
Storm	Load Line 4	GH-2	2364201.970	554969.470	978.99	974.81	4.18
Storm	Load Line 4	GH-3	2364060.380	554922.010	978.77	975.50	3.27
Storm	Load Line 4	GH-4	2364198.160	554978.720	978.98	974.72	4.26
Storm	Load Line 4	GV-1	2364029.650	554994.060	978.72	975.12	3.60
Storm	Load Line 4	GV-2	2364168.360	555051.140	980.11	974.21	5.90
Storm	Load Line 4	H-1	2365041.920	555639.740	982.26	977.91	4.35
Storm	Load Line 4	H-2	2364990.240	555618.190	982.45	978.20	4.25
Storm	Load Line 4	H-3	2364875.790	555570.460	982.46	979.04	3.42
Storm	Load Line 4	H-4	2364904.630	555498.910	982.42	978.74	3.68
Storm	Load Line 4	H-5	2365020.180	555547.100	982.48	978.36	4.12
Storm	Load Line 4	J-1	2365214.180	555170.340	982.57	978.14	4.43
Storm	Load Line 4	J-2	2365181.740	555157.200	982.53	978.21	4.32
Storm	Load Line 4	J-3	2365064.980	555109.700	982.64	979.04	3.60
Storm	Load Line 4	J-4	2365035.500	555182.430	982.48	979.42	3.06
Storm	Load Line 4	J-5	2365151.250	555229.610	982.55	978.83	3.72
Storm	Load Line 4	K-7	2365171.000	556046.640	983.70	980.27	3.43

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Storm	Load Line 4	K-8	2365194.820	556045.510	983.97	980.41	3.56
Storm	Load Line 4	L-1	2365678.050	555578.330	983.24	971.98	11.26
Storm	Load Line 4	L-2	2365808.530	555632.290	983.71	972.69	11.02
Storm	Load Line 4	M-0	2365422.500	555576.370	983.47	979.94	3.53
Storm	Load Line 4	M-1	2365514.350	555614.360	983.21	979.38	3.83
Storm	Load Line 4	M-2	2365537.050	555559.460	983.21	979.08	4.13
Storm	Load Line 4	M-3	2365605.210	555587.650	983.28	979.46	3.82
Storm	Load Line 4	M-4	2365719.990	555635.110	983.67	980.12	3.55
Storm	Load Line 4	M-5	2365836.330	555683.220	983.98	980.71	3.27
Storm	Load Line 4	M-6	2365947.780	555729.310	984.39	981.49	2.90
Storm	Load Line 4	MH1	2364149.330	555097.380	979.27	973.97	5.30
Storm	Load Line 4	MH10B2	2365127.630	556035.830	983.24	977.12	6.12
Storm	Load Line 4	MH11	2365404.970	555465.410	984.14	971.14	13.00
Storm	Load Line 4	MH12	2365550.980	555525.780	983.80	971.41	12.39
Storm	Load Line 4	MH13	2365939.200	555686.320	984.15	973.40	10.75
Storm	Load Line 4	MH14	2366199.790	555794.090	984.53	974.50	10.03
Storm	Load Line 4	MH15	2366466.220	555890.390	983.95	976.07	7.88
Storm	Load Line 4	MH2B	2364592.090	555120.500	980.55	976.06	4.49
Storm	Load Line 4	MH3	2365197.970	555238.440	982.90	975.80	7.10
Storm	Load Line 4	MH4	2365222.760	555281.050	982.65	969.71	12.94
Storm	Load Line 4	MH5	2365350.640	555499.120	984.35	974.45	9.90
Storm	Load Line 4	MH6	2365197.980	555539.130	983.40	975.18	8.22
Storm	Load Line 4	MH7	2365055.690	555579.470	983.32	975.67	7.65
Storm	Load Line 4	MH8	2365273.900	555683.810	983.75	974.85	8.90
Storm	Load Line 4	MH9	2365195.930	555871.460	983.61	975.61	8.00
Storm	Load Line 4	N-2	2366332.370	555946.130	984.50	979.62	4.88
Storm	Load Line 4	N-3	2366516.820	555955.680	983.64	980.26	3.38
Storm	Load Line 4	UN-10	2366274.070	556001.750	984.96	980.88	4.08
Storm	Load Line 4	UN-11	2365442.260	555493.740	969.00	Unknown	Unknown
Storm	Load Line 4	UN-7	2363800.980	554877.530	Unknown	Unknown	Unknown
Storm	Load Line 4	UN-8	2363835.800	554926.400	Unknown	Unknown	Unknown
Storm	Load Line 4	UN-9	2363886.630	554994.520	Unknown	Unknown	Unknown
Sanitary	Load Line 12	MH-501	2369104.244	556427.597	980.700	974.245	6.46
Sanitary	Load Line 12	MH-501A	2369155.967	556450.335	980.340	974.970	5.37
Sanitary	Load Line 12	MH-502	2369013.341	556387.633	980.120	973.675	6.45
Sanitary	Load Line 12	MH-503	2368891.959	556530.396	980.000	973.200	6.80

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Load Line 12	MH-503A	2368897.591	556581.084	979.990	972.985	7.01
Sanitary	Load Line 12	MH-504	2368790.740	556712.422	979.900	971.950	7.95
Sanitary	Load Line 12	MH-504A	2368843.866	556615.862	980.070	972.635	7.44
Sanitary	Load Line 12	MH-505	2368699.381	556917.164	981.260	971.150	10.11
Sanitary	Load Line 12	MH-505A	2368671.160	556707.051	979.460	971.965	7.50
Sanitary	Load Line 12	MH-506	2368675.357	557099.330	978.780	970.350	8.43
Sanitary	Load Line 12	MH-507	2368586.212	557300.691	978.520	969.500	9.02
Sanitary	Load Line 12	MH-508	2368499.664	557501.755	978.560	968.705	9.85
Sanitary	Load Line 12	MH-509	2368414.246	557698.406	978.320	967.815	10.51
Sanitary	Load Line 12	MH-510	2368340.790	557867.174	978.580	966.935	11.65
Sanitary	Load Line 12	MH-511	2368241.707	558097.725	977.950	966.075	11.88
Sanitary	Load Line 12	MH-511A	2367987.029	557813.543	977.910	968.750	9.16
Sanitary	Load Line 12	MH-512	2368156.571	558294.099	976.870	965.670	11.20
Sanitary	Trunk/Connector Line	MH-14A	2366873.619	558605.325	Unknown	970.68	Unknown
Sanitary	Trunk/Connector Line	MH-15	2366938.826	558815.168	976.510	970.040	6.47
Sanitary	Trunk/Connector Line	MH-16	2366992.070	559158.307	979.050	969.255	9.79
Sanitary	Trunk/Connector Line	MH-17	2367044.093	559490.416	977.310	968.405	8.90
Sanitary	Trunk/Connector Line	MH-18	2367072.498	559787.529	976.780	967.625	9.15
Sanitary	Trunk/Connector Line	MH-19	2367074.245	560051.270	976.040	966.935	9.11
Sanitary	Trunk/Connector Line	MH-2	2366629.634	557090.388	1009.070	975.160	33.91
Sanitary	Trunk/Connector Line	MH-20	2367087.173	560371.293	976.550	966.285	10.27
Sanitary	Trunk/Connector Line	MH-21	2367079.351	560617.993	975.130	965.615	9.51
Sanitary	Trunk/Connector Line	MH-22	2367092.024	560845.010	972.930	964.810	8.12
Sanitary	Trunk/Connector Line	MH-23	2367136.986	561191.440	971.970	964.055	7.92
Sanitary	Trunk/Connector Line	MH-24	2367184.851	561422.745	971.080	963.175	7.91
Sanitary	Trunk/Connector Line	MH-25	2367225.862	561838.575	969.490	962.235	7.26
Sanitary	Trunk/Connector Line	MH-26	2367243.757	562191.622	967.500	962.235	5.26
Sanitary	Trunk/Connector Line	MH-27	2367292.414	562431.147	969.050	963.900	5.15
Sanitary	Trunk/Connector Line	MH-28	2367368.376	562611.062	966.040	960.360	5.68
Sanitary	Trunk/Connector Line	MH-29	2367437.910	562784.113	969.170	960.360	8.81
Sanitary	Trunk/Connector Line	MH-30	2367316.049	563194.935	Unknown	959.31	Unknown
Sanitary	Trunk/Connector Line	MH-31	2367204.012	563311.408	Unknown	958.91	Unknown
Sanitary	Trunk/Connector Line	MH-32	2367024.122	563326.970	Unknown	957.92	Unknown
Sanitary	Trunk/Connector Line	MH-33	2366860.999	563470.654	Unknown	953.42	Unknown
Sanitary	Trunk/Connector Line	MH-350	2373150.544	560470.327	1011.600	1003.010	8.59
Sanitary	Trunk/Connector Line	MH-351	2372952.600	560384.132	1009.680	1001.690	7.99

Table A-3. Inventory of Structures within the Sand Creek Treatment Plant Sewer Network (continued)

Structure Type	Area	Structure ID	Latitude (Ohio State Plane, ft NAD83)	Longitude (Ohio State Plane, ft NAD83)	Top of Structure Elevation (ft amsl)	Invert Elevation (ft amsl)	Approximate Depth (ft bgs)
Sanitary	Trunk/Connector Line	MH-352	2372610.364	560175.009	1008.200	1000.315	7.88
Sanitary	Trunk/Connector Line	MH-353	2372315.406	559959.371	1006.960	998.830	8.13
Sanitary	Trunk/Connector Line	MH-354	2372089.381	559805.872	1006.400	997.315	9.08
Sanitary	Trunk/Connector Line	MH-429	2370384.593	558396.058	982.920	976.725	6.19
Sanitary	Trunk/Connector Line	MH-430	2370114.793	558337.650	981.690	975.850	5.84
Sanitary	Trunk/Connector Line	MH-431	2369820.556	558274.364	980.400	974.950	5.45
Sanitary	Trunk/Connector Line	MH-432	2369527.983	558211.438	981.800	974.050	7.75
Sanitary	Trunk/Connector Line	MH-433	2369235.444	558148.554	982.000	973.150	8.85
Sanitary	Trunk/Connector Line	MH-434	2368941.983	558085.402	980.100	971.850	8.25
Sanitary	Trunk/Connector Line	MH-435	2368747.722	558041.548	979.300	970.150	9.15
Sanitary	Trunk/Connector Line	MH-436	2368570.424	557965.546	978.700	968.310	10.39
Sanitary	Trunk/Connector Line	MH-CO-#1	2375464.255	563463.866	1006.000	997.365	8.63
Sanitary	Trunk/Connector Line	MH-CO-#2	2374749.264	562382.335	1009.070	1006.900	2.17
Sanitary	Trunk/Connector Line	MH-CO-#3	2374068.128	561559.096	1011.300	1009.415	1.88
Sanitary	Trunk/Connector Line	MH-CO-#5	2367544.505	558576.768	978.300	971.305	7.00

ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ID = Identification designator.
NAD = North American Datum

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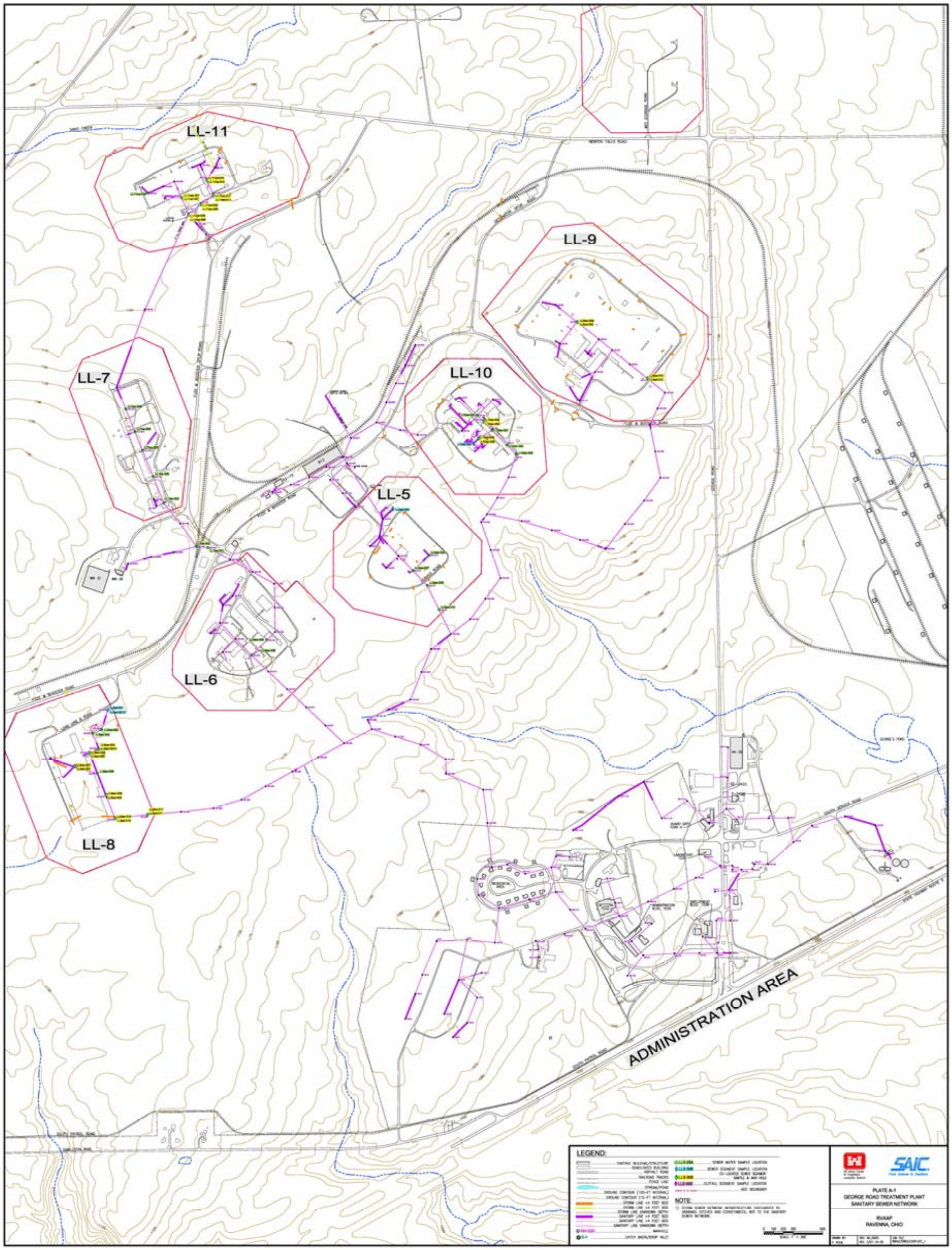
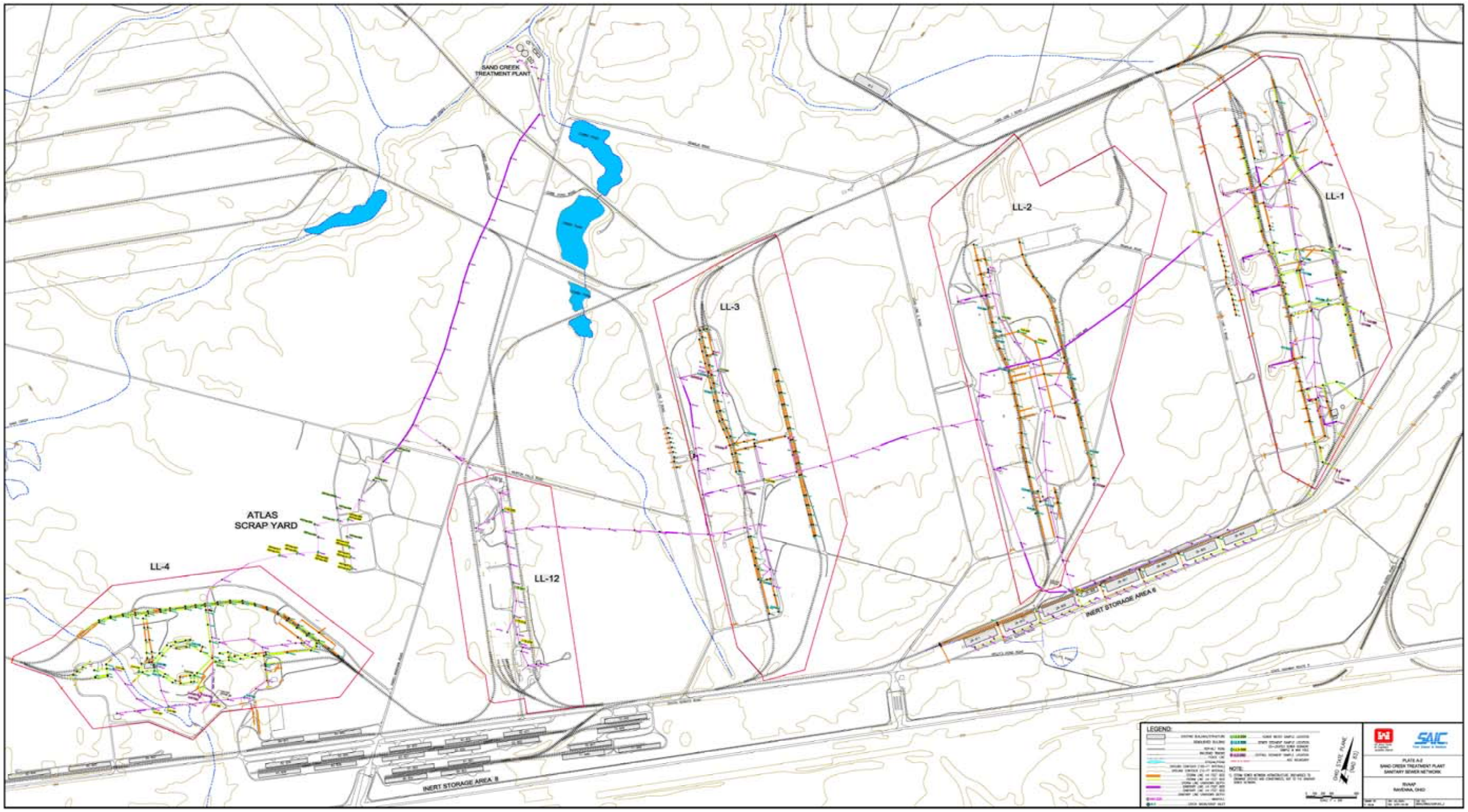

LL-11
LL-9
LL-7
LL-10
LL-5
LL-6
LL-8
ADMINISTRATION AREA
LEGEND:
NOTE:
PLATE A-1
GEORGE ROAD TREATMENT PLANT
SANITARY SEWER NETWORK
RVAAP
RAVENNA, OHIO


SAND CREEK TREATMENT PLANT
LL-1
LL-2
LL-3
LL-12
ATLAS SCRAP YARD
LL-4
INERT STORAGE AREA 6
INERT STORAGE AREA 8
LEGEND:
NOTE:
OHIO STATE PLANE
SAIC
PLATE A-2
SAND CREEK TREATMENT PLANT
SANITARY SEWER NETWORK
RVAAP
RAVENNA, OHIO

APPENDIX B
Administrative Area

B.0 ADMINISTRATION AREA

B.1 AREA DESCRIPTION

The Administration Area is located on the south boundary of the facility and is comprised of a number of buildings and warehouses which were used for various support operations (Figure B-1). The western side of this area at one time contained a hospital, dormitory, a staff circle containing fifteen homes, and amenities to support the workers in residence. The eastern side included a chemical laboratory with facilities for explosives analysis, a laundry for explosives-contaminated clothing, and both general and automotive maintenance and repair shops.

The Administration Area was supported by an extensive sanitary sewer system, which is part of the George Road Treatment Plant network (shown in Plate A-1). A preliminary reconnaissance effort in December 2008 observed the presence of an extensive storm sewer network which was not indicated on the available historical engineering drawings.

B.2 PREVIOUS INVESTIGATIONS

During the *Explosive Evaluation of Sewers* investigation, twenty-six sanitary sewer manholes were evaluated via DropEx™ field screening for explosives, none of which indicated the presence of trace explosives residue (Lakeshore Engineering Services, Inc., 2007). The Lakeshore investigation also noted that a number of manholes within the Administration Area were inaccessible due to having been paved over with asphalt or concrete. The Lakeshore sewer effort was conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions.

B.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Administration Area are presented in Table B-1, and shown in Figure B-2.

Table B-1. Summary of Proposed Sampling Locations at the Administration Area

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-1-2	MH-1-3	Sewer Sediment	Isolates segment at northern portion of area
Sanitary	MH-1-4	None	Sewer Sediment	Key junction downstream of maintenance, equipment repair, powerhouse and firehouse buildings
Sanitary	MH-1-5	MH-1-6	Sewer Sediment	Isolates maintenance building segment
Sanitary	MH-2-1	MH-UN (2) around shop building through MH-O7	Sewer Sediment	Shop building represents potential source area
Sanitary	MH-2-8	MH-2-9	Sewer Sediment	Isolates administration/telephone building segment
Sanitary	MH-3-1	MH-O8	Sewer Sediment	Isolates laboratory building segment
Sanitary	MH-4-1	MH-4-2	Sewer Sediment	Isolates Key & Scale Shop and Dorm buildings segment
Sanitary	MH-9-1	MH-2-4	Sewer Sediment	Isolates garage building segment
Sanitary	MH-11-1A	MH-11-1B, MH-11-1C, MH-11-1E, MH-11-1F	Sewer Sediment	Isolates segment at north-central portion of area
Sanitary	MH-12	MH-1, MH-2, MH-6, MH-11, MH-7, MH-3, MH-4, MH-10, MH-8, MH-9, MH-5	Sewer Sediment	Isolates segment encompassing former recreation fields
Sanitary	MH-101	MH-2-7, MH-2-6, MH-2-5	Sewer Sediment	Isolates parking area segment
Sanitary	MH-O6	MH-O7 through unknown line ("MH-UN") at shop building	Sewer Sediment Sewer Water	Isolates segment leading to treatment plant
Sanitary	MH-O13A	MH-O13B, MH-O13C, MH-O13D	Sewer Sediment	Isolates recreation buildings segment
Sanitary	MH-O13	None	Sewer Water	Characterize sewer water at key junction point within area
Sanitary	MH-O15	MH-5-1, MH-5-2, MH-5-3, MH-5-4	Sewer Sediment	Isolates residential area segment
Sanitary	MH-O16	MH-6-1, MH-6-2	Sewer Sediment	Isolates hospital segment
Sanitary	MH-O20	MH-O21, MH-O22, MH-O23, MH-O24, MH-O27	Sewer Sediment Sewer Water	Characterizes conditions upstream of Administration Area
Sanitary	MH-P1	MH-O1, MH-O2, MH-03, MH-O4	Sewer Sediment Sewer Water	Characterizes conditions downstream of Administration Area and prior to entering treatment plant
Sanitary	MH-UN (southwest corner of shop building)	MH-UN immediately north of southwest corner of shop building	Sewer Sediment	Shop building represents potential source area
Sanitary	Outfall south of George Road Treatment Plant, if present	None	Outfall Sediment Outfall Water	May be a potential outfall at terminus of sanitary line following demolition of the treatment plant
Storm	Selection of representative outfalls and catch basins as necessary	Multiple representative	Multiple outfall/sewer sediment and water samples	Condition and extent of storm network unknown, and representative sample points will need to be determined in the field

Additional sewer characterization objectives for the Administration Area include the following:

- Locate and assess the condition of the key sanitary sewer junction points within the system, such as manholes MH-O5, MH-O8, MH-O15, MH-1-4, and MH-2-4. Documenting the location coordinates of these manholes will also assist in the correction of the existing sanitary system map layer, as some discrepancies were noted during the preliminary reconnaissance effort in December 2008.

- Evaluate and document the storm sewer network. The layout of this system is unknown, as historical drawings showing its layout are not available. Visual survey and Global Positioning System (GPS) data collection will be utilized to generate a storm system map layer; smoke tracing will be utilized, if necessary, to locate the unknown storm structures. Accumulated sediment will be collected from representative locations within the storm system.

- Locate and sample representative (1) outfall locations from the storm sewer system and (2) catch basins at potential source areas (e.g.: shop building, laboratory) where accumulation of sediment is evident (refer to Figure B -2).

During the visual survey phase, inspection forms will be completed for structures within the Administration Area to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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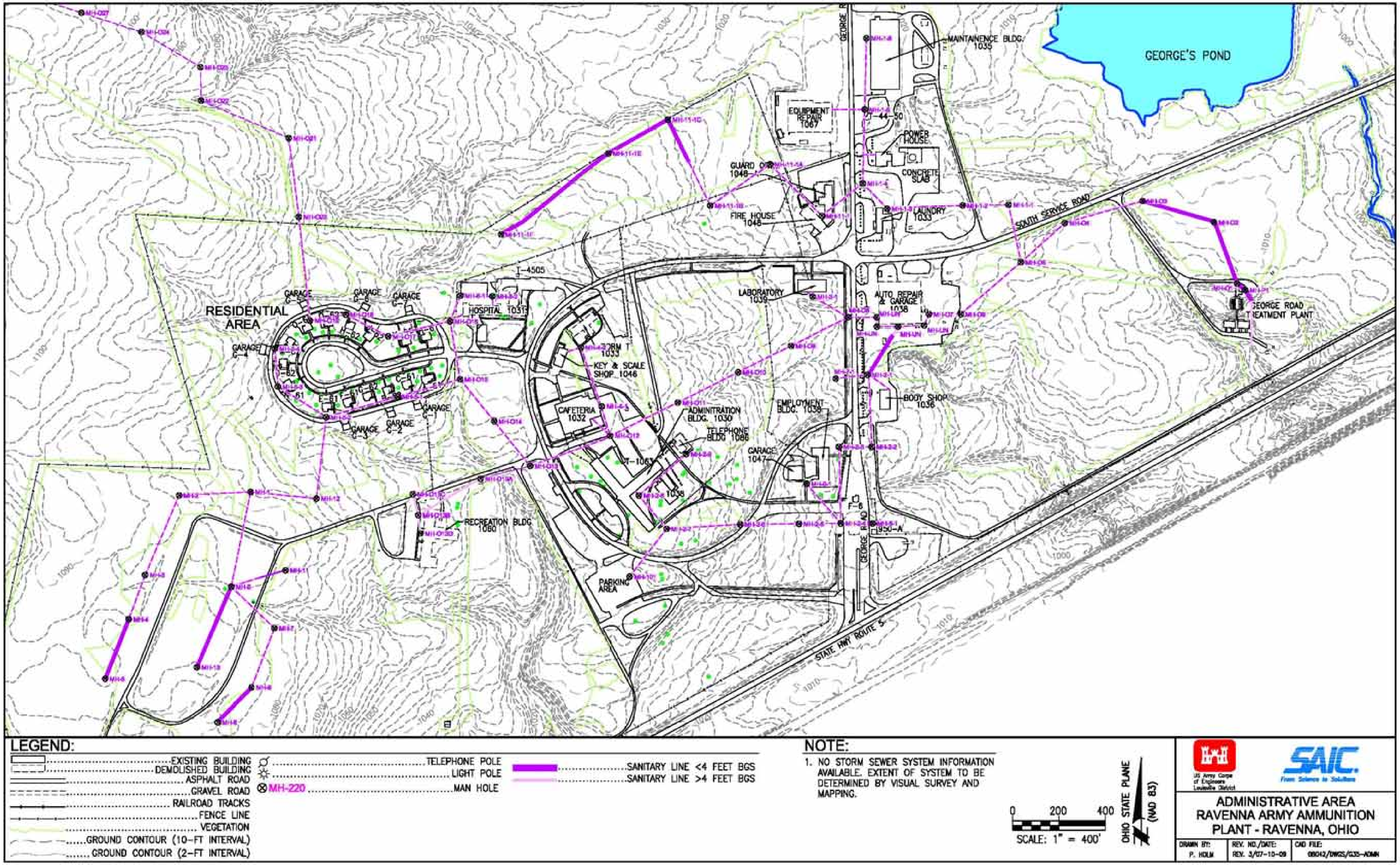

Figure B-1. Administrative Area Sewers

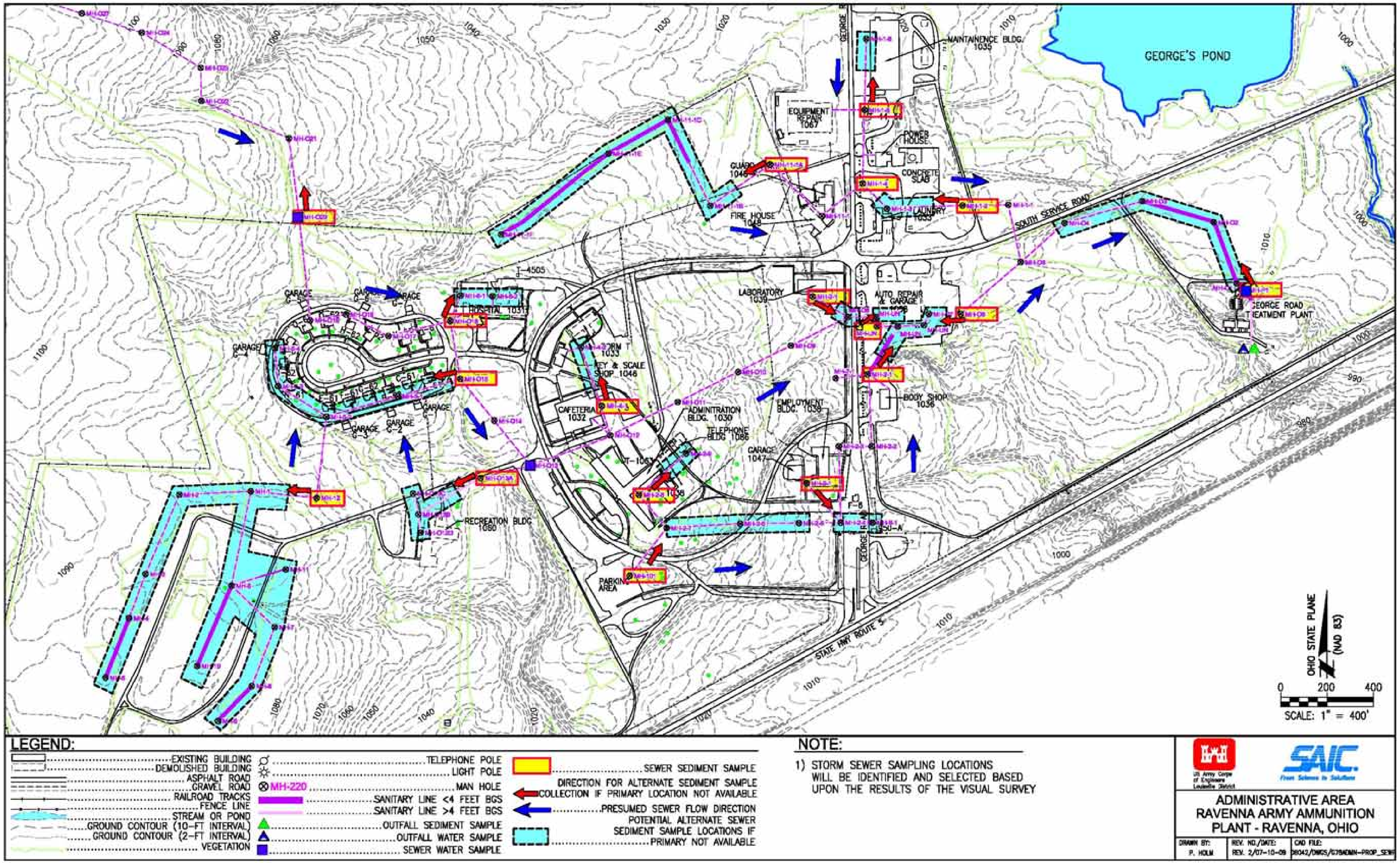

Figure B-2. Proposed Sewer Sampling Locations at the Administrative Area

APPENDIX C
Atlas Scrap Yard

C.0 ATLAS SCRAP YARD

C.1 AREA DESCRIPTION

Atlas Scrap Yard was a former construction camp built to house workers during the construction of RVAAP (Figure C-1). Following demolition of the facilities following World War II, the area was used as a scrap yard for non-explosive scrap materials, MEC scrap, and wooden ammunition boxes, in addition to housing the Roads and Grounds Maintenance Area. The RVAAP-50-R-01 MRS encompasses about 66 acres within the IRP AOC boundary. A MEC removal action was completed in 2003, wherein removal of above-grade MEC and ammunition boxes was completed. Currently, the area is covered by thick grass, and miscellaneous non-explosive scrap material including pipes, railroad ballast, railroad ties, concrete rubble and chipped ammunition boxes are staged at the AOC.

The sanitary sewer system at Atlas Scrap Yard is part of the Sand Creek Treatment Plant network (shown in Plate A-2). In addition to sanitary sewers, an underground storm water drainage system existed in the eastern portion of the Atlas Scrap Yard; however, a preliminary reconnaissance effort in December 2008 did not observe any remnants of this former storm system.

C.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at the Atlas Scrap Yard in 2004 as part of the *Final Characterization of 14 AOCs* investigation (MKM Engineers, Inc. 2007a). In total, samples were collected from fifteen manhole stations; collocated sediment and water samples were collected at seven locations, and only sewer water could be collected at eight locations (Figure C-1). At the time of sample collection, one of the sewer manholes was not able to be located (MH-11) and another was found to be filled with railroad ties and other debris (MH-13). The investigation indicated that a tarry organic odor and visual coal tar contamination was present at three sewer locations (MH-1, MH-2 and MH-3), and analytical samples indicated elevated levels of diesel range organic compounds. No visual evidence of coal tar contamination was observed during a preliminary reconnaissance effort in December 2008.

The analytical results indicated that multiple metals exceeded screening levels in sewer sediment at Atlas Scrap Yard (Figure C-2). Screening level exceedances of several polyaromatic hydrocarbons were also observed in sewer media. These exceedances are summarized in Table C-1. The explosive 4-amino-2,6-dinitrotoluene and the propellant nitroglycerin were detected once apiece in sewer water, and the explosive 2-amino-4,6-dinitrotoluene was detected in one sediment sample, all at low estimated concentrations well below the screening levels.

Table C-1. Chemicals Exceeding Screening Levels in Sewer Media at Atlas Scrap Yard

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Aluminum	mg/kg	7/7	5,100	15,000	10,100	13,900
	Arsenic	mg/kg	7/7	8	29	14.3	19.5
	Barium	mg/kg	7/7	84	570	191	350
	Chromium	mg/kg	7/7	17	30	21.6	18.1
	Cobalt	mg/kg	7/7	6.8	79	19.1	9.1
	Manganese	mg/kg	7/7	170	34,000	5,400	1,950
	Mercury	mg/kg	7/7	0.05	5.2	0.96	2.3
	Vanadium	mg/kg	7/7	20	56	31.8	45
	Benz(a)anthracene	mg/kg	1/1	─	─	10	0.22
Sewer Water	Benzo(a)pyrene	mg/L	1/15	─	─	0.0001	0.0000008
	Indeno(1,2,3-cd)pyrene	mg/L	1/15	─	─	0.0002	0.0000078

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
─ Not applicable.

C.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for Atlas Scrap Yard are presented in Table C-2, and shown in Figure C-3.

Table C-2. Summary of Proposed Sampling Locations at Atlas Scrap Yard

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-15	MH-14A, MH-14, MH-13, MH-12, MH-11	Sewer Water Sewer Sediment	Representative of conditions at downstream end of Atlas Scrap Yard.
Sanitary	MH-1	Locations south, if present	Sewer Sediment	December 2008 sewer reconnaissance observed line exiting MH-1 to the south that was not indicated on historical maps. ***In addition to Tier 1 sampling procedures, collect SVOC sample due to historical observation of visual "coal tar" contamination.***
Sanitary	MH-2	None	Sewer Sediment	Confirmatory purposes due to previously high manganese concentrations in sediment. ***In addition to Tier 1 sampling procedures, collect SVOC sample due to historical observation of visual "coal tar" contamination.***
Sanitary	MH-2	None	Sewer Sediment	***Collect SVOC sample due to historical observation of visual "coal tar" contamination.***
Sanitary	MH-HD3	MH-HD2	Sewer Sediment	Representative of conditions at upstream end of Atlas Scrap Yard.

Additional characterization objectives for Atlas Scrap Yard include the following:

- Visual evaluation of conditions at sanitary sewer locations MH-1, MH-2 and MH-3. These manholes are where the 2004 characterization effort indicated visual coal tar contamination and elevated total petroleum hydrocarbon concentrations were observed. If sewer sediment is available at these three locations, collect an SVOC sample at each location.

- Assess if additional sanitary sewer system structures are present south of MH-1. The sanitary sewer map layer based upon the historical drawings indicate that MH-1 is the southernmost terminal manhole in the line, but the preliminary reconnaissance effort in December 2008 observed a pipe exiting MH-1 to the south. The building map layer indicates that there were buildings across the road at one time which the sanitary sewer system presumably serviced.

- Evaluate conditions at MH-15, which is the junction point with the force main draining the major load lines and the trunk leading to Sand Creek Treatment Plant.

During the visual survey phase, inspection forms will be completed for the noted above areas of interest to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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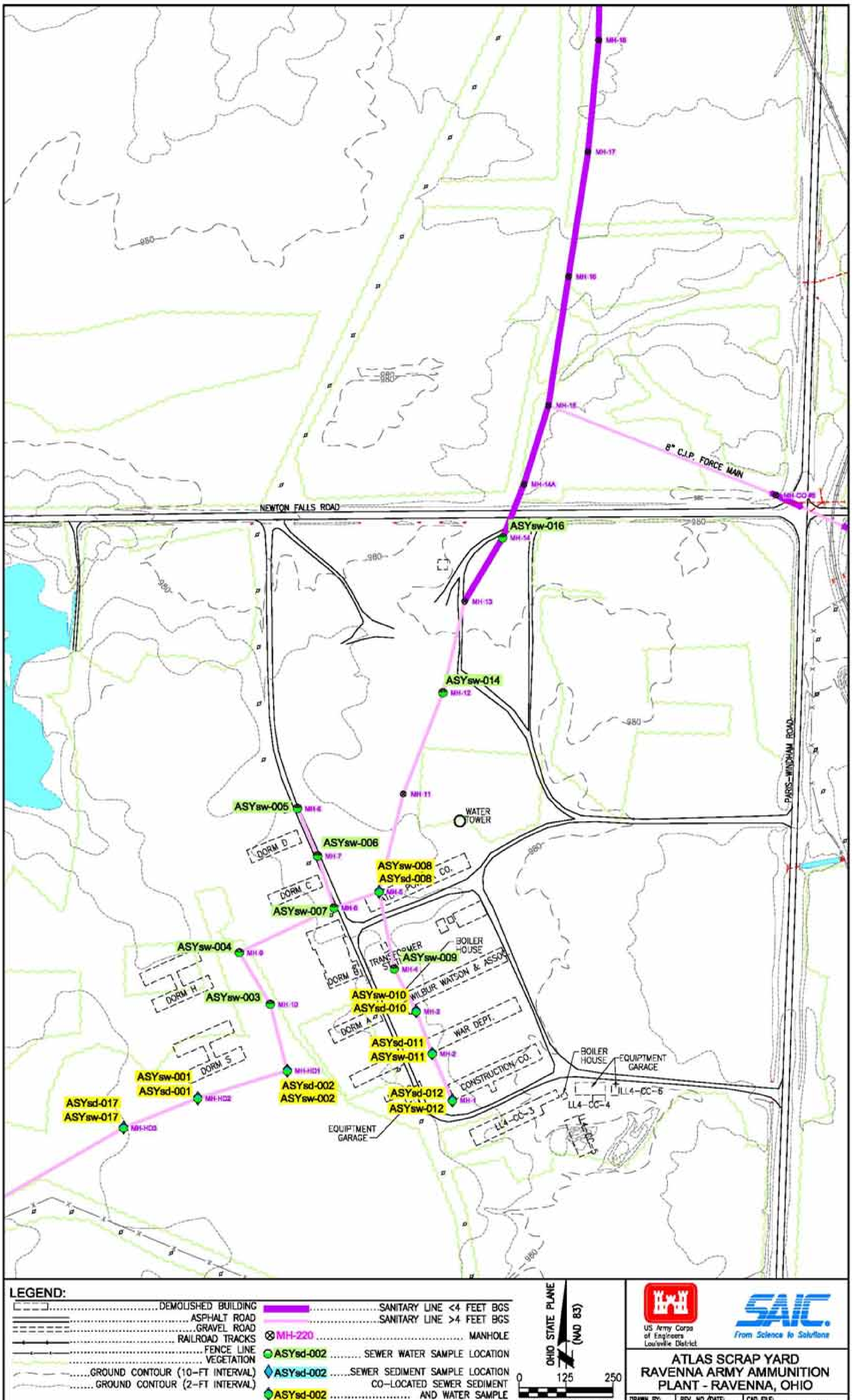

Figure C-1. Historical Sewer Sampling Locations at Atlas Scrap Yard

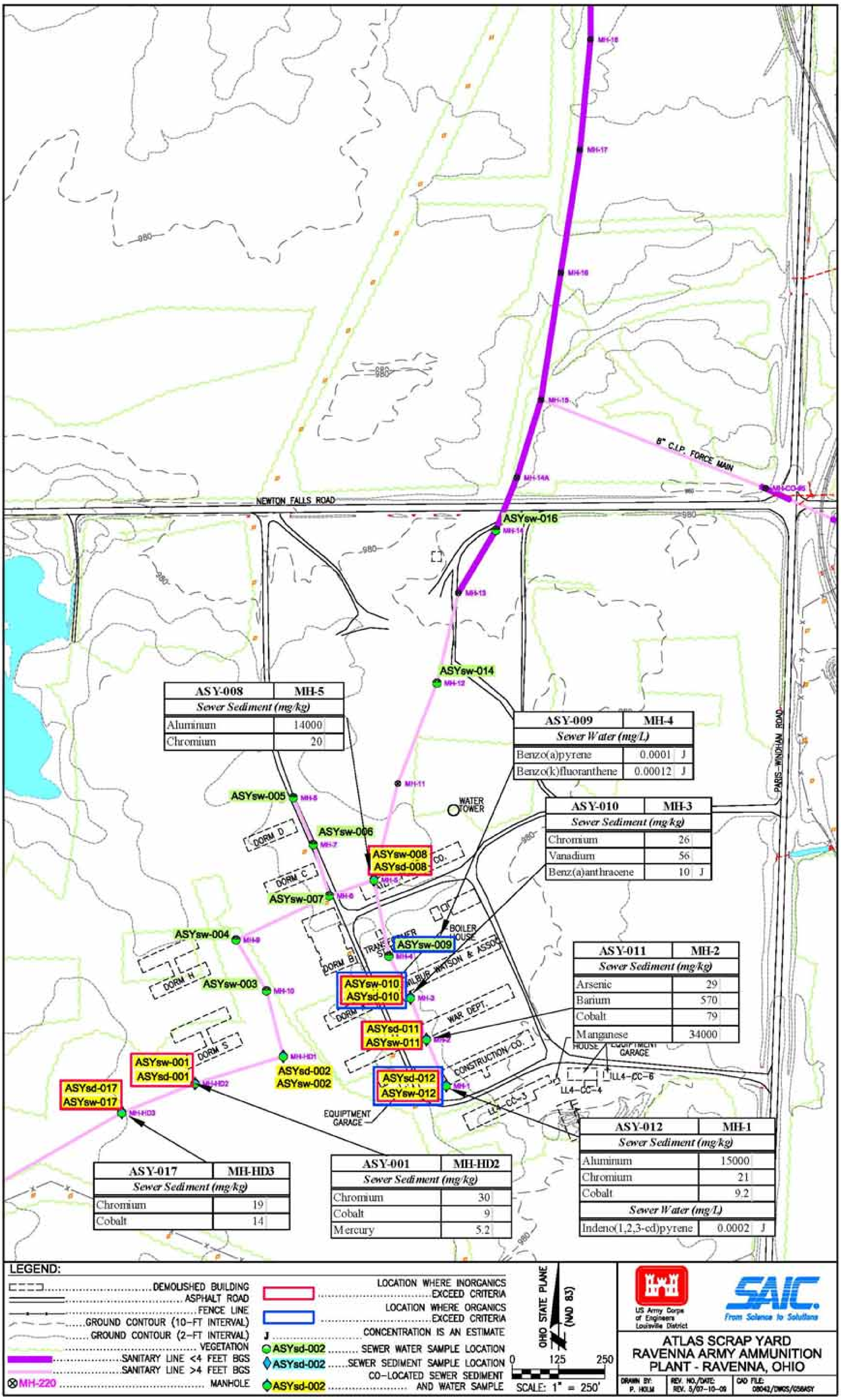

Figure C-2. Historical Exceedances for Sewer Samples at Atlas Scrap Yard

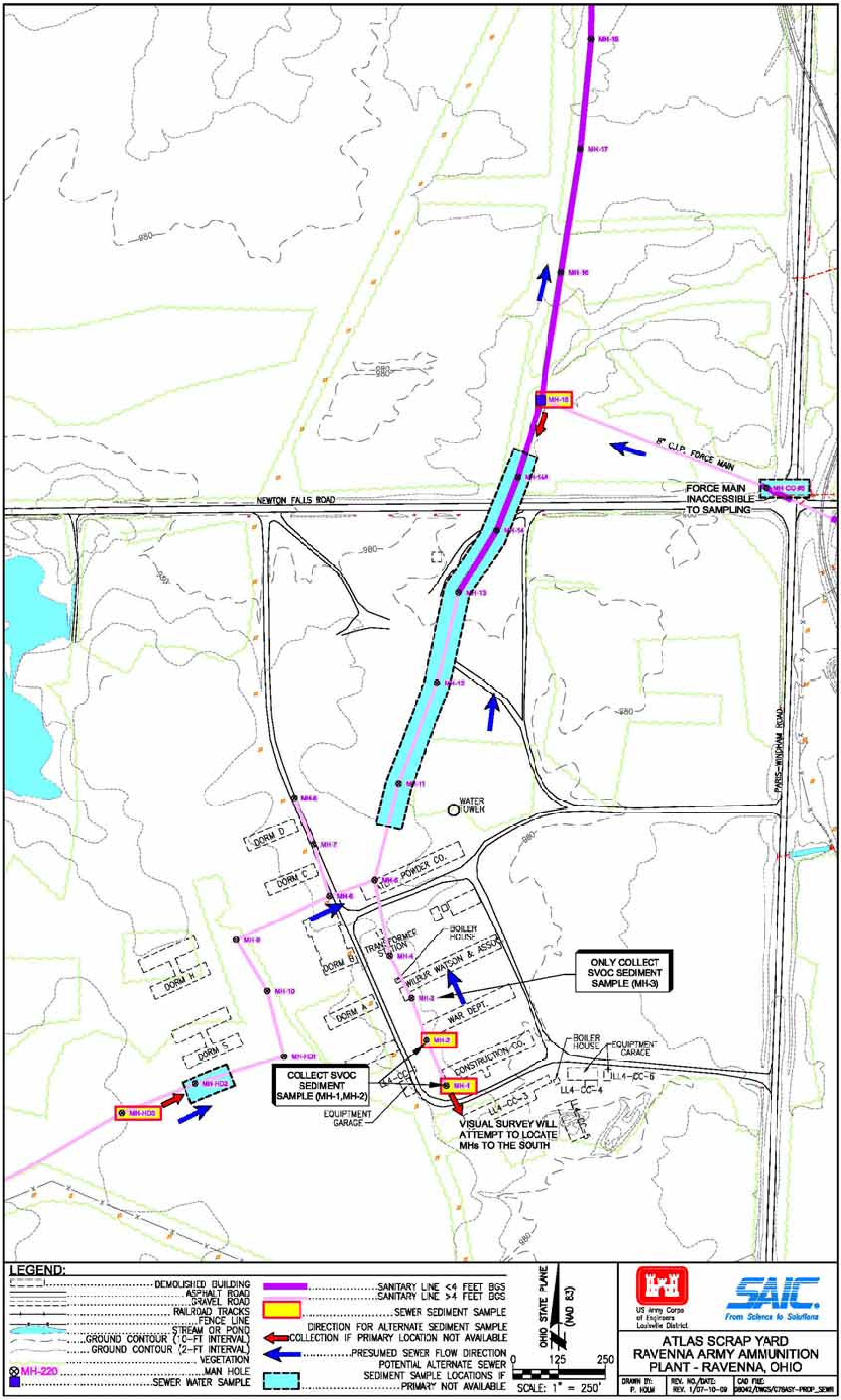

Figure C-3. Proposed Sewer Sampling Locations at Atlas Scrap Yard

APPENDIX D
Depot Administration Area

D.0 DEPOT ADMINISTRATION AREA

D.1 AREA DESCRIPTION

The Depot Administration Area is located on the western end of the facility and contained a large number of warehouses and storage buildings. As limited historical information has been located for this area, specific building utilization is unknown. Due to this remote location of this area from the larger sanitary sewer networks, the Depot Administration Area had its own sanitary sewer network, terminating at the Depot Sewage Treatment Plant which was operational until 1983. The preliminary sewer reconnaissance effort in December 2008 noted the existence of an extensive storm sewer network throughout the Depot Administration Area. However, as historical engineering drawings of this area have not been located, the layout and full extent of this storm sewer system is largely unknown. Based on the preliminary reconnaissance survey, it was determined that the likely location of the primary outfall from this storm sewer system is near the former Depot Sewage Treatment Plant, at the southern end of the Depot Administration Area. At the time of the survey, it was noted that many of the warehouse and shed buildings throughout the area are intact and in use. The railroad tracks at the northern portion of the area have since been removed.

D.2 PREVIOUS INVESTIGATIONS

No former sewers investigations are known to have been conducted at the Depot Administration Area.

D.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Depot Administration Area are presented in Table D-1, and shown in Figure D-2.

Table D-1. Summary of Proposed Sampling Locations at the Depot Administration Area

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-D2	MH-D1, MH-D3	Sewer Sediment	Isolates segment at northwest reach of warehouse area.
Sanitary	MH-D5	MH-D4	Sewer Sediment Sewer Water	Isolates northern reach of warehouse area.
Sanitary	MH-D9	MH-D7, MH-D6	Sewer Sediment Sewer Water	Represents key junction point draining northern half of area
Sanitary	MH-D13	MH-D14, MH-D15, MH-D16	Sewer Sediment	Isolates reach in vicinity of former waterworks
Sanitary	MH-D11	MH-D10, MH-D12, MH-D17, MH-D18	Sewer Sediment	Isolates potential source area at central warehouses.
Sanitary	MH-D25	MH-D26	Sewer Sediment	Isolates potential source area at central warehouses.
Sanitary	MH-D22	MH-D21, MH-D20	Sewer Sediment	Isolates reach south of former sub-station.
Sanitary	MH-D19	MH-D28, MH-D29	Sewer Sediment Sewer Water	Represents key junction and isolates southern portion of area
Sanitary	MH-D33	MH-D34, MH-D35	Sewer Sediment	Isolates southern terminal segment of area
Sanitary	MH-D32	MH-D31, MH-D30, MH-D23	Sewer Sediment	Characterizes influent conditions in reach draining to the former treatment plant.
Sanitary	Outfall at treatment plant terminal end of sanitary line, if present	None	Outfall Sediment Outfall Water	May be a potential outfall at terminus of sanitary line following demolition of the treatment plant
Storm	Selection of representative outfalls and catch basins as necessary	Multiple representative	Multiple outfall/sewer sediment and water samples	Condition and extent of storm network unknown, and representative sample points will need to be determined in the field

Additional sewer characterization objectives for the Depot Administration Area include the following:

- Ground-truth and document the configuration of the sanitary sewer network. During the preliminary reconnaissance effort in December 2008, the location of manhole structures in the field was observed to differ substantially from what was reflected in the maps based upon the digitization of historical facility drawings (Figure D-1 and D-2 have been manually corrected to the degree possible based upon the observations of the preliminary survey. Documenting the location coordinates of key junction point manholes (i.e.; MH-D12, MH-D17, MH-D19 and MH-D23) will assist in the correction of the existing sanitary system map layer.

- Evaluate and document the storm sewer network. The extent of this system is unknown, as historical drawings showing its layout are not available. Visual survey and GPS data collection will be utilized to generate a storm system map layer; smoke tracing will be utilized, if necessary, to locate the unknown storm structures. Accumulated sediment will be collected from representative locations within the storm system.

- Locate and sample (1) outfall locations from the storm sewer system and (2) catch basins in potential source areas where accumulation of sediment is evident.

During the visual survey phase, inspection forms will be completed for structures at the Depot Administration Area to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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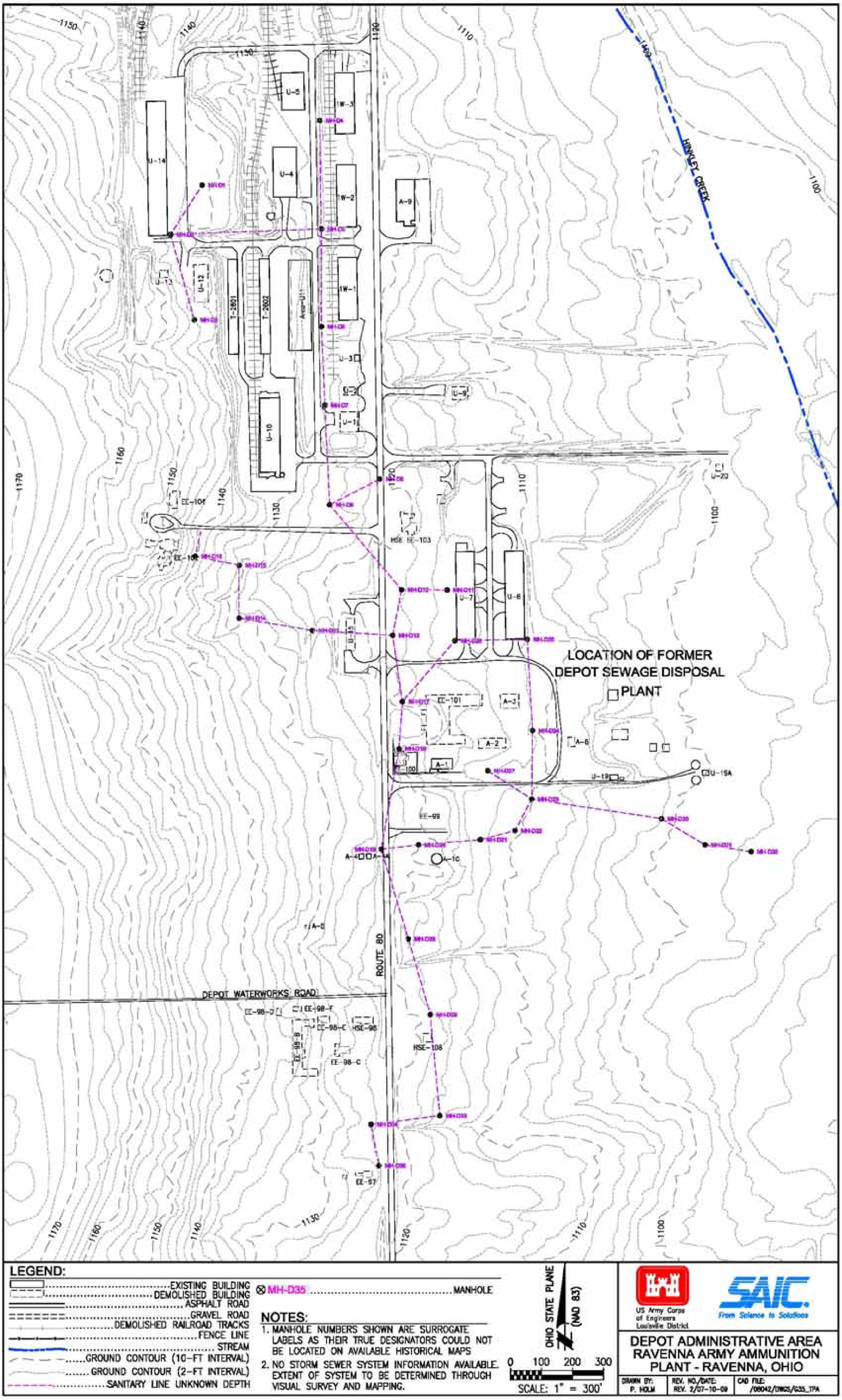


Figure D-1. Depot Administration Area Sewers

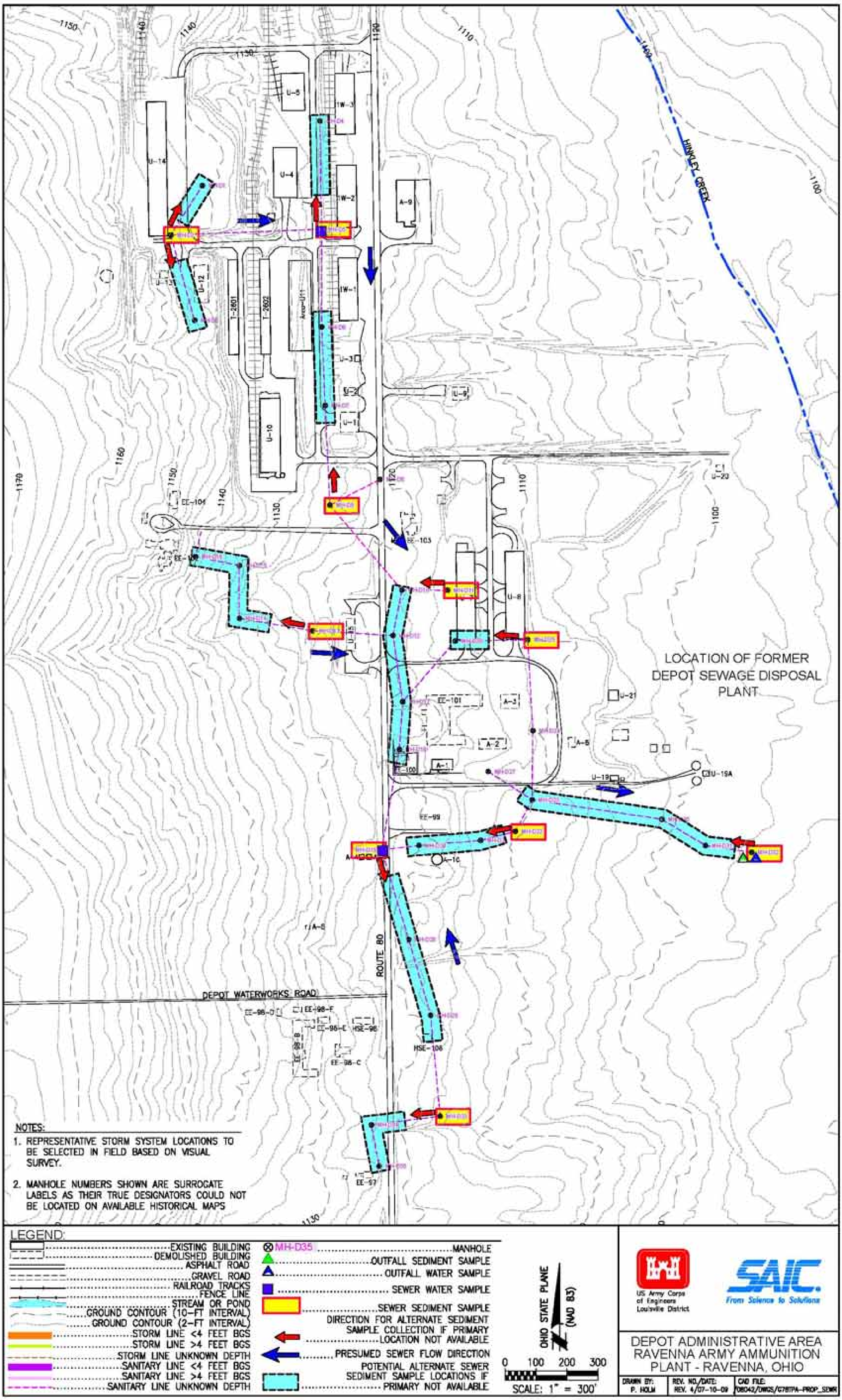


Figure D-2. Proposed Sewer Sampling Locations at the Depot Administration Area

APPENDIX E
Load Line 1

E.0 LOAD LINE 1

E.1 AREA DESCRIPTION

Load Line 1 is located in the southeastern portion of the facility and was in operation from 1941 until 1971 (Figure E-1). During World War II (1941 through 1945) and from 1951 through 1957, Load Line 1 was used to melt and load TNT and Composition B explosives into large-caliber shells which took place at the major melt-pour buildings (CB-4 and CB-4A). During 1961 to 1967, Load Line 1 was the site of munitions rehabilitation activities and the demilitarization of primers. During this time, Buildings CB-13 and CB-14 were used for activities such as dismantling, replacing of components, and repainting of mines. Wash-down water and wastewater from the load line operations were collected in concrete sumps, pumped through sawdust filtration units and then discharged to a 1 acre unlined settling pond. Water from the impoundment was discharged to a surface stream that exited the installation. Load Line 1 was rehabilitated in 1951 to remove and replace soils contaminated with accumulated explosives and to remove and replace waste water lines, particularly at Buildings CB-4 and CB-4A. However, many contaminated storm drain lines remained after 1951.

Load Line 1 contains separate storm and sanitary sewer systems. The sanitary sewer system at Load Line 1 is part of the Sand Creek Treatment Plant network (shown in Plate A-2). Sanitary effluent exited Load Line 1 through an ejector station located at the north end of the load line. The storm sewer network is unique to Load Line 1, and discharged to a series of surface drainage conveyances throughout the load line. The storm sewer and sanitary sewer system infrastructures largely remain in place, although portions of the systems have sustained significant damage or have been obstructed with debris during building demolition activities.

E.2 PREVIOUS INVESTIGATIONS

The *Phase II Remedial Investigation for Load Line 1* included sewer water and sediment sampling and a video camera survey of the sewer lines (USACE 2003). During the initial examination of the catch basins and manholes, it was noted that there were locations where sediment had accumulated. Sediment samples were collected from outfalls locations where storm sewer lines discharged to surface drainage conveyances. Also, the majority of the Load Line 1 sewers were above the water table and relatively dry, limiting collection of water samples. Previous sewer and outfall sample locations are shown in Figure E-1.

The analytical results indicated that metals (antimony, arsenic, chromium, cobalt, copper, vanadium and zinc), explosives (2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene), benzo(a)pyrene and PCB-1254 exceeded the screening levels in sewer sediment. In sewer water, manganese and several explosives (2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene) exceeded the screening levels at Load Line 1. Outfall sediment data indicated screening level exceedances of multiple metals (antimony, arsenic, total and hexavalent chromium, cobalt, copper, and manganese), benzo(a)pyrene and PCB-1254. These screening level exceedances are summarized in Table E-1 and the sample locations with screening level exceedances are shown in Figure E-2. Explosives and propellants were detected in all of the sewer sediment samples collected, but only exceeded the screening levels at MH-208, located at the corner of melt-pour complex Building CB-4. The sewer water screening level exceedances of explosives compounds were observed in the sample collected from a storm inlet east and downstream of the melt-pour complex. Manganese in sewer water was the only analyte in excess of the screening levels at MH-CO-#1, a major collection point for sanitary effluent from the load line; no exceedances of screening levels for sediment were observed at this location.

A total of 3,350.95 linear feet of Load Line 1 sewers have been video surveyed (978.7 and 2372.25 linear feet of sanitary and storm sewer, respectively) to assess the integrity of the lines and their potential to release contaminants to the environment. Video survey locations and findings for the sanitary and storm sewers at Load Line 1 are presented in Figures E-3 and E-4, respectively (USACE 2003; Lakeshore Engineering Services, Inc. 2007). Several survey runs were conducted in the vicinity of melt-pour building CB-4 and at the main exit points from the two systems. During the survey, multiple sewer inlet or manhole locations were obstructed with debris (ballast, slag, and dirt that had sloughed into the inlets; brush; some inert demolition debris, such as brick or concrete), or could not be accessed because of broken or rusted covers. Obstructions such as soil, ballast/slag basins, brush/leaves, and some minor inert demolition debris (brick, concrete) were common near the inlet and outlet ends of several pipes. The pipes were found to be dry and generally in good to excellent condition, although hairline cracks, calcium deposits, and root filaments were commonly observed. However, multiple sections of broken pipe were observed in the vitrified clay pipe in locations between inlets B3 and B8, A2 and A3, and between A1 and the headwall east of the load line. A deformed section of pipe was observed between manholes B3 and B2, underneath the road immediately north of Building CB-4. Overall, the camera surveys revealed no visual evidence of accumulated explosives residues, ordnance and explosive waste, or other sediment in any of the pipes evaluated.

Inspections and explosives field screening tests were conducted at Load Line 1 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. During the USACE- Construction Engineering Research Laboratory (CERL) (2007) investigation, RDX was found near melt-pour building CB-4A. A total of 23 DropEx™ samples from Load Line 1 sanitary sewer manholes, none of which tested positive for explosives residue. Of the 33 screening tests in total conducted at the storm sewer drop inlets, six DropEx™ samples at inlets associated with the melt-pour Buildings CB-4 and CB-4A tested positive for explosives residue. The video surveys conducted at Load Line 1 during these 2007 investigations also involved subsequent swabbing and Expray™ testing of the camera for explosives residue; no trace explosives were detected from the eight camera runs.

Table E-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 1

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	2-Amino-4,6-Dinitrotoluene	mg/kg	2/5	0.44	1.5	0.97	1.5
	4-Amino-2,6-Dinitrotoluene	mg/kg	2/5	0.75	1.7	1.3	1.5
	Antimony	mg/kg	3/5	0.67	185	62.5	2.8
	Arsenic	mg/kg	5/5	7.9	39	19	19.5
	Chromium	mg/kg	5/5	16.6	72.8	42.3	18.1
	Cobalt	mg/kg	5/5	6.4	11.1	9.12	9.1
	Copper	mg/kg	5/5	41.6	638	214	310
	Vanadium	mg/kg	5/5	14.8	49.5	24	45
	Zinc	mg/kg	5/5	172	2,480	994	2,300
	Benzo(a)pyrene	mg/kg	1/1	─	─	0.12	0.022
	PCB-1254	mg/kg	1/1	─	─	2.1	0.12
Sewer Water	2,4,6-Trinitrotoluene	mg/L	1/2	─	─	0.079	0.0078
	2-Amino-4,6-Dinitrotoluene	mg/L	1/2	─	─	0.026	0.0031
	4-Amino-2,6-Dinitrotoluene	mg/L	1/2	─	─	0.046	0.0031
	Manganese	mg/L	2/2	0.12	0.79	0.46	0.63
Outfall Sediment	Antimony	mg/kg	5/6	1.2	2.6	5.1	2.8
	Arsenic	mg/kg	6/6	8.4	21	12.6	19.5
	Chromium	mg/kg	6/6	9.4	40.5	19.6	18.1
	Chromium, hexavalent	mg/kg	2/2	5.4	11	8.2	1.6
	Cobalt	mg/kg	6/6	5.2	13.7	7.8	9.1
	Copper	mg/kg	6/6	16.1	1,020	228	310
	Manganese	mg/kg	6/6	277	2,750	1,065	1,950
	Benzo(a)pyrene	mg/kg	2/2	0.084	0.098	0.091	0.022
	PCB-1254	mg/kg	2/2	0.61	0.87	0.74	0.12

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
─ Not applicable.

E.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 1 are presented in Table E-2, and shown in Figures E-5 (sanitary) and E-6 (storm).

Table E-2. Proposed Sewer Sampling Locations at Load Line 1

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-CO-#1	MH-CO-#2	Sewer Water Sewer Sediment	Clean-out manhole represents major potential accumulation point. This sanitary manhole is the first location downstream of Load Line 1 after exiting the west boundary of the load line and draining towards Load Line 2. This location previously exhibited manganese above its screening level in water.
Sanitary	MH-218	MH-210	Sewer Sediment	Isolates segment draining northwest quadrant of load line
Sanitary	MH-210A	MH-213, MH-212, MH-211	Sewer Sediment	Isolates segment draining northeast quadrant of load line
Sanitary	MH-215	MH-214, MH-214A	Sewer Sediment	Isolates segment draining Bldg. CB-12
Sanitary	MH-204	MH-203, MH-202A, MH-202, MH-201, MH-201A	Sewer Sediment	Isolates segment draining southeast portion of load line
Sanitary	MH-226	MH-225, MH-224	Sewer Sediment	Isolates segment draining Bldg. CB-22
Sanitary	MH-221	None	Sewer Sediment	Immediately adjacent to process building CB-4
Sanitary	MH-208	None	Sewer Sediment	Immediately adjacent to process building CB-4. Previous sampling indicated multiple screening level exceedences of organics and inorganics.
Sanitary	MH-207	MH-228, MH-229, MH-228	Sewer Sediment	Isolates segment draining shaker buildings CA-6 and CA-6A
Sanitary	MH-206	None	Sewer Sediment	Immediately adjacent to process building CB-4A
Sanitary	Outfall east of MH-210A	None	Outfall Sediment Outfall Water	Presumed overflow outfall from sanitary system
Storm	A6	A7 through A10	Sewer Sediment	Isolates segment at Buildings CB-13, CB-13A, and CB-13B
Storm	CB-MHA2	None	Sewer Sediment	Clean-out manhole represents major potential accumulation point downstream of melt-pour building area
Storm	A3	A4	Sewer Sediment	Provides characterization at Building CB-10 western segment
Storm	A5	A4	Sewer Sediment	Provides characterization at Building CB-10 western segment
Storm	A12	"UN" on east side of Bldg CB-10	Sewer Sediment	Provides characterization at Building CB-10 eastern segment
Storm	A11	"UN" on east side of Bldg CB-10	Sewer Sediment	Provides characterization at Building CB-10 eastern segment

Table E-2. Proposed Sewer Sampling Locations at Load Line 1 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	CB-MHB3	CB-MHB4	Sewer Sediment	Clean-out manhole represents major potential accumulation point downstream of melt-pour building area
Storm	CB-MHB2	CB-MHB1	Sewer Sediment	Clean-out manhole represents major potential accumulation point downstream of melt-pour building area
Storm	CB-4	None	Sewer Sediment	Represents major potential accumulation point downstream of melt-pour building area
Storm	B3	B12, B9, B8	Sewer Sediment	Provides characterization at possible major source area (melt-pour building CB-4). Drop inlets at this building tested positive for explosives residue in 2007, and historical results indicated elevated chromium.
Storm	B-5A	B-5, B-4	Sewer Sediment	Provides characterization at possible major source area (melt-pour building CB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	B6	None	Sewer Sediment	Provides characterization at possible major source area (melt-pour building CB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	B11	C5	Sewer Sediment	Provides characterization at possible major source area (melt-pour building CB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	B10	C6	Sewer Sediment	Provides characterization at possible major source area (melt-pour building CB-4A). Drop inlets at this building tested positive for explosives residue in 2007, and historical results indicated inorganics above screening levels.
Storm	D9	D4, D5	Sewer Sediment	Isolates Building CB-3 and south end of load line.
Storm	D1	D13, CB-MHD2, CB-MHD1	Sewer Sediment	Isolates Building CB-3 and south end of load line
Storm	E2	D11 or E1, D10 or D3	Sewer Sediment	Isolates Building CB-801 and south end of load line

Table E-2. Proposed Sewer Sampling Locations at Load Line 1 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	CB-MHA3	Outfall north of CB-MHA3	Outfall Sediment Outfall Water	Represents storm drainage from Building CB-14
Storm	Outfall north of CB-MHA1	None	Outfall Sediment Outfall Water	Represents key storm outfall draining northwest quadrant of load line
Storm	Outfall northeast of CB-MH	None	Outfall Sediment Outfall Water	Outfall "A". Historical sampling indicated inorganics above screening levels.
Storm	Outfall north of F1	None	Outfall Sediment Outfall Water	Outfall from culvert line at west end of the load line
Storm	Outfall south of F14	None	Outfall Sediment Outfall Water	Outfall from culvert line at west end of the load line
Storm	Outfall south of C4	None	Outfall Sediment Outfall Water	Outfall of drainage to south end of load line
Storm	Outfall northeast of CB-4	None	Outfall Sediment Outfall Water	Outfall of drainage from melt-pour Bldg. CB-4
Storm	Outfall east of CB-MHB1	None	Outfall Sediment Outfall Water	Outfall "B". Historical sampling indicated organics above screening levels.
Storm	Outfall south of B1/B9 location	None	Outfall Sediment Outfall Water	Outfall of drainage from melt-pour Bldg. CB-4
Storm	Outfall east of CB-MHC1	None	Outfall Sediment Outfall Water	Outfall "C". Historical sampling indicated organics above screening levels.
Storm	Outfall east of CB-MHD1	None	Outfall Sediment Outfall Water	Outfall "D".
Storm	Outfall east of CB-MHE1	None	Outfall Sediment Outfall Water	Outfall "E." Provides confirmation of previous inorganic screening level exceedances.

Additionally, investigation activities will involve ground-truthing and documenting the configuration of the storm sewer network at the former melt pour buildings CB-4 and CB-4A complex. During the preliminary reconnaissance effort in December 2008, the location of inlet structures in the field was observed to differ from what was reflected in the maps based upon the digitization of historical facility drawings, likely due to the rehabilitation of these lines in the 1950s.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 1 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

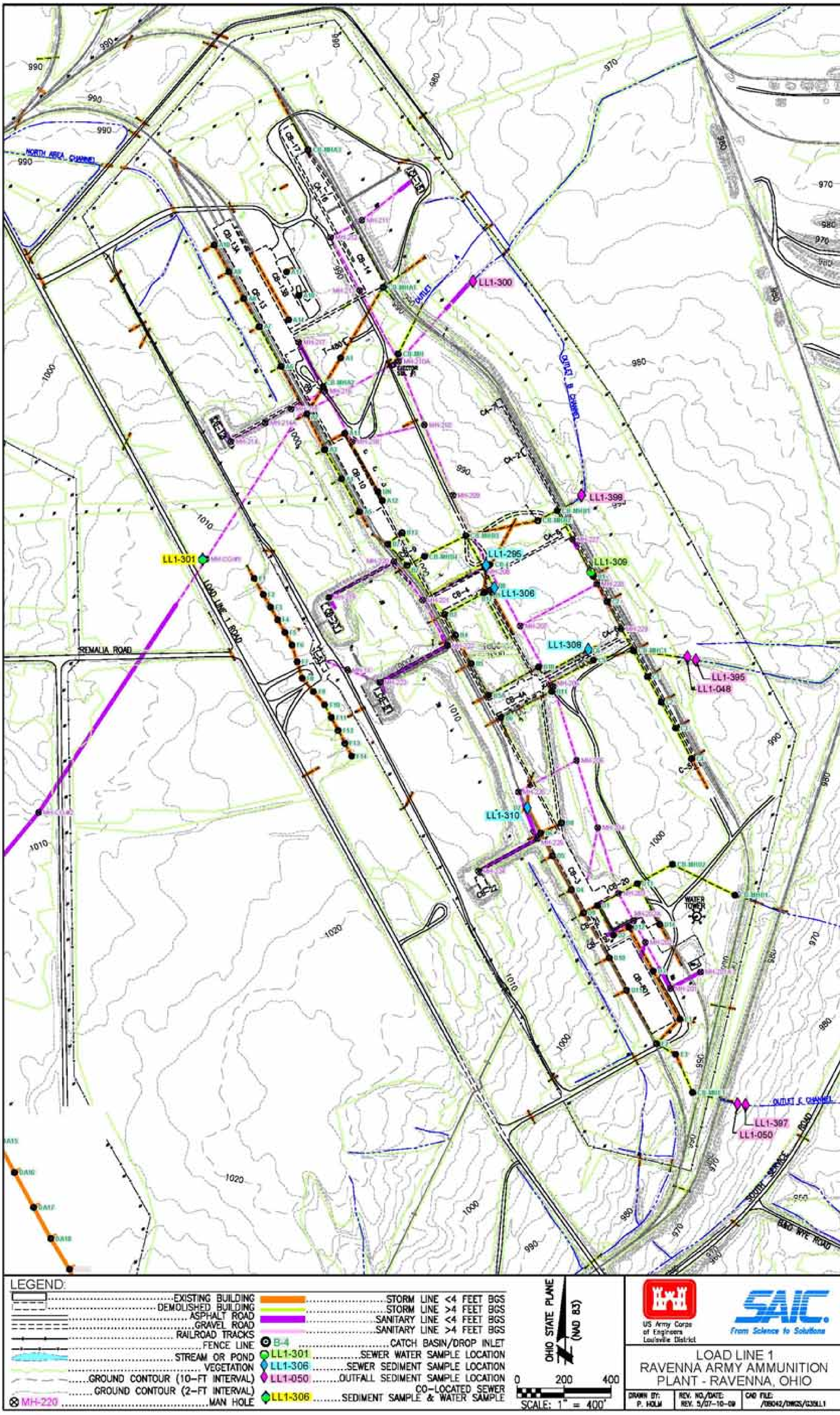
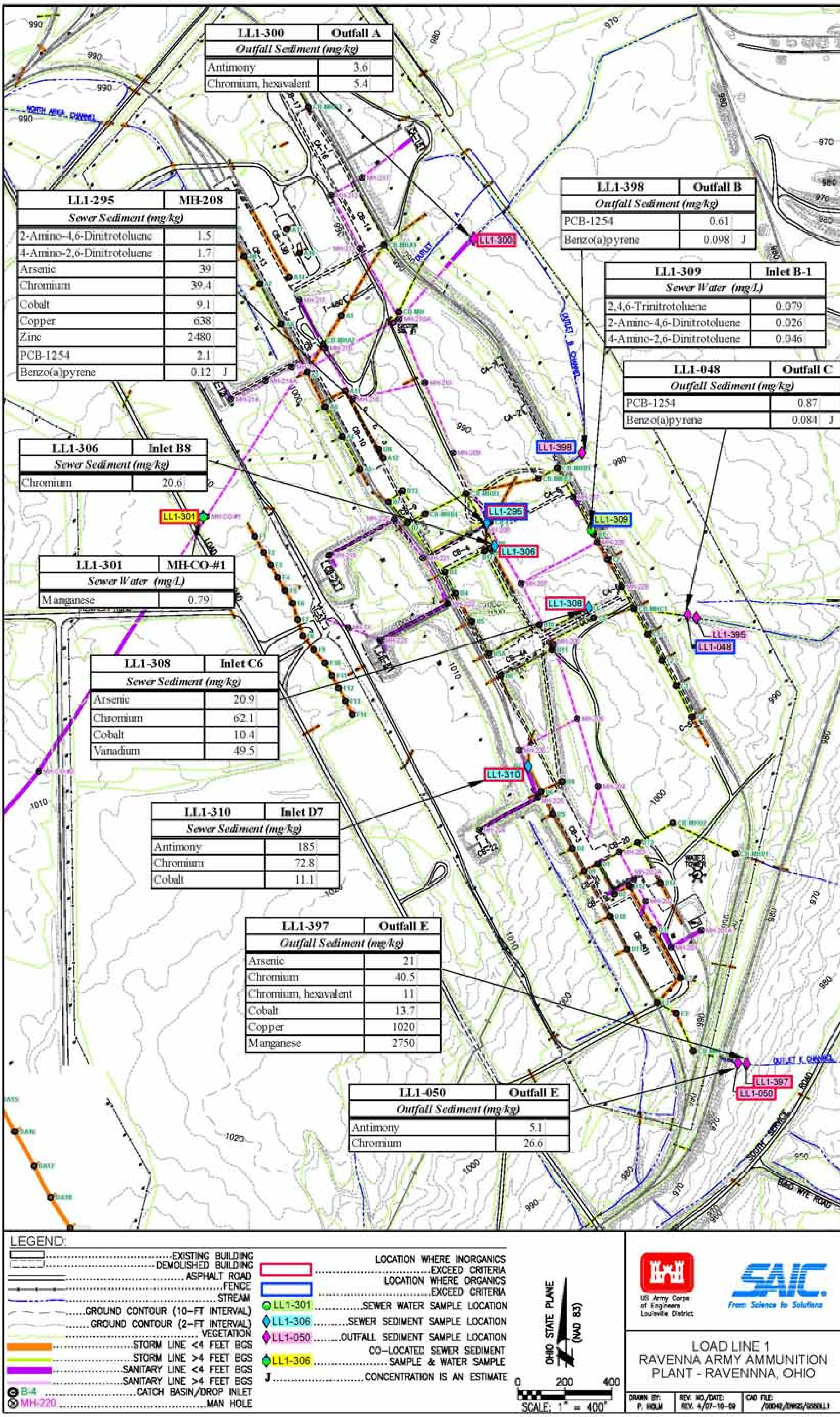


Figure E-1. Historical Sewer Sampling Locations at Load Line 1



LL1-300	Outfall A	
Outfall Sediment (mg/kg)		
Antimony	3.6	
Chromium, hexavalent	5.4	

LL1-398	Outfall B	
Outfall Sediment (mg/kg)		
PCB-1254	0.61	
Benzo(a)pyrene	0.098	J

LL1-295	MH-208	
Sewer Sediment (mg/kg)		
2-Amino-4,6-Dinitrotoluene	1.5	
4-Amino-2,6-Dinitrotoluene	1.7	
Arsenic	39	
Chromium	39.4	
Cobalt	9.1	
Copper	638	
Zinc	2480	
PCB-1254	2.1	
Benzo(a)pyrene	0.12	J

LL1-309	Inlet B-1
Sewer Water (mg/L)	
2,4,6-Trinitrotoluene	0.079
2-Amino-4,6-Dinitrotoluene	0.026
4-Amino-2,6-Dinitrotoluene	0.046

LL1-048	Outfall C	
Outfall Sediment (mg/kg)		
PCB-1254	0.87	
Benzo(a)pyrene	0.084	J

LL1-306	Inlet B8
Sewer Sediment (mg/kg)	
Chromium	20.6

LL1-301	MH-CO-#1
Sewer Water (mg/L)	
Manganese	0.79

LL1-308	Inlet C6
Sewer Sediment (mg/kg)	
Arsenic	20.9
Chromium	62.1
Cobalt	10.4
Vanadium	49.5

LL1-310	Inlet D7
Sewer Sediment (mg/kg)	
Antimony	185
Chromium	72.8
Cobalt	11.1

LL1-397	Outfall E
Outfall Sediment (mg/kg)	
Arsenic	21
Chromium	40.5
Chromium, hexavalent	11
Cobalt	13.7
Copper	1020
Manganese	2750

LL1-050	Outfall E
Outfall Sediment (mg/kg)	
Antimony	5.1
Chromium	26.6

Figure E-2. Historical Exceedances for Sewer Samples at Load Line 1

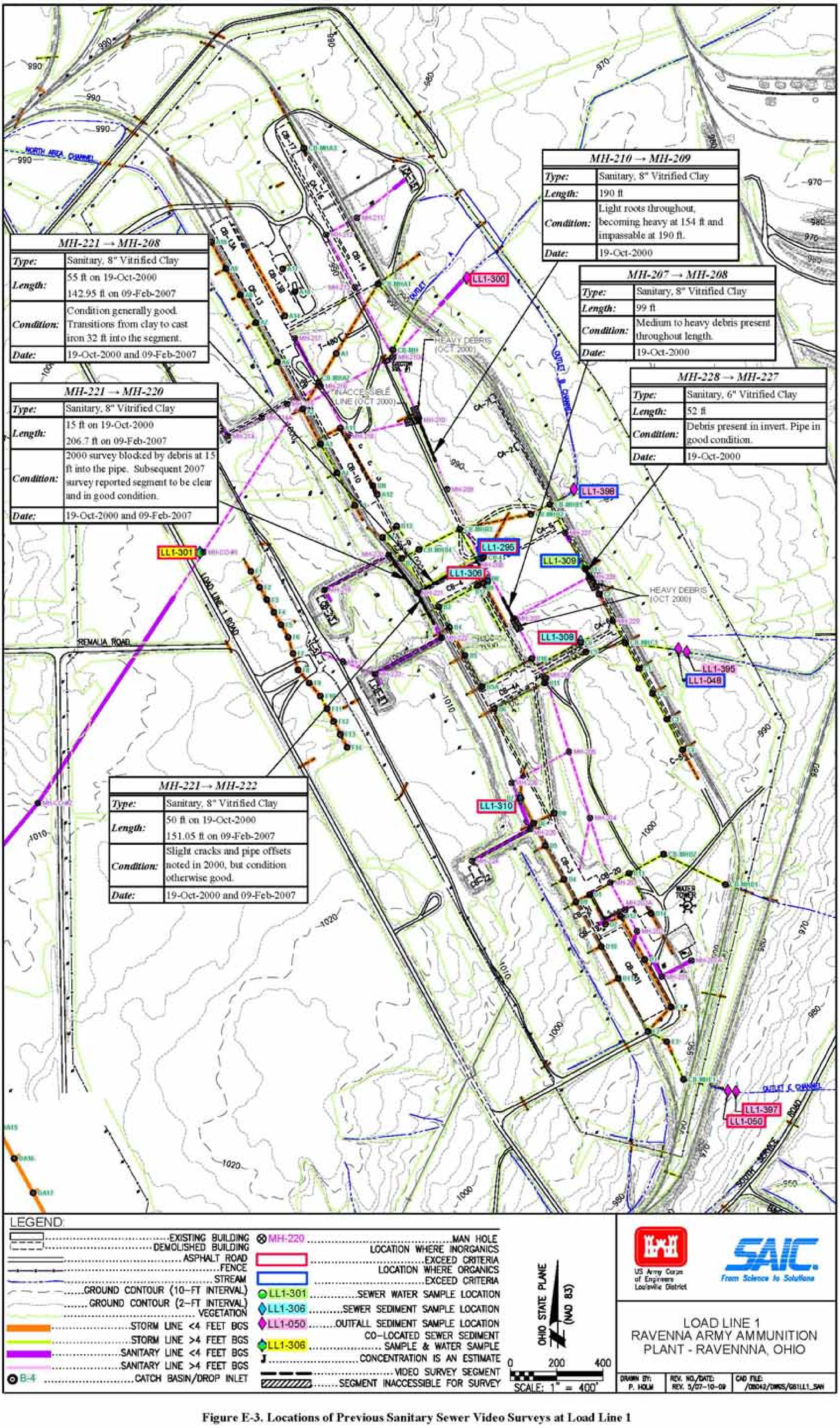


Figure E-3. Locations of Previous Sanitary Sewer Video Surveys at Load Line 1

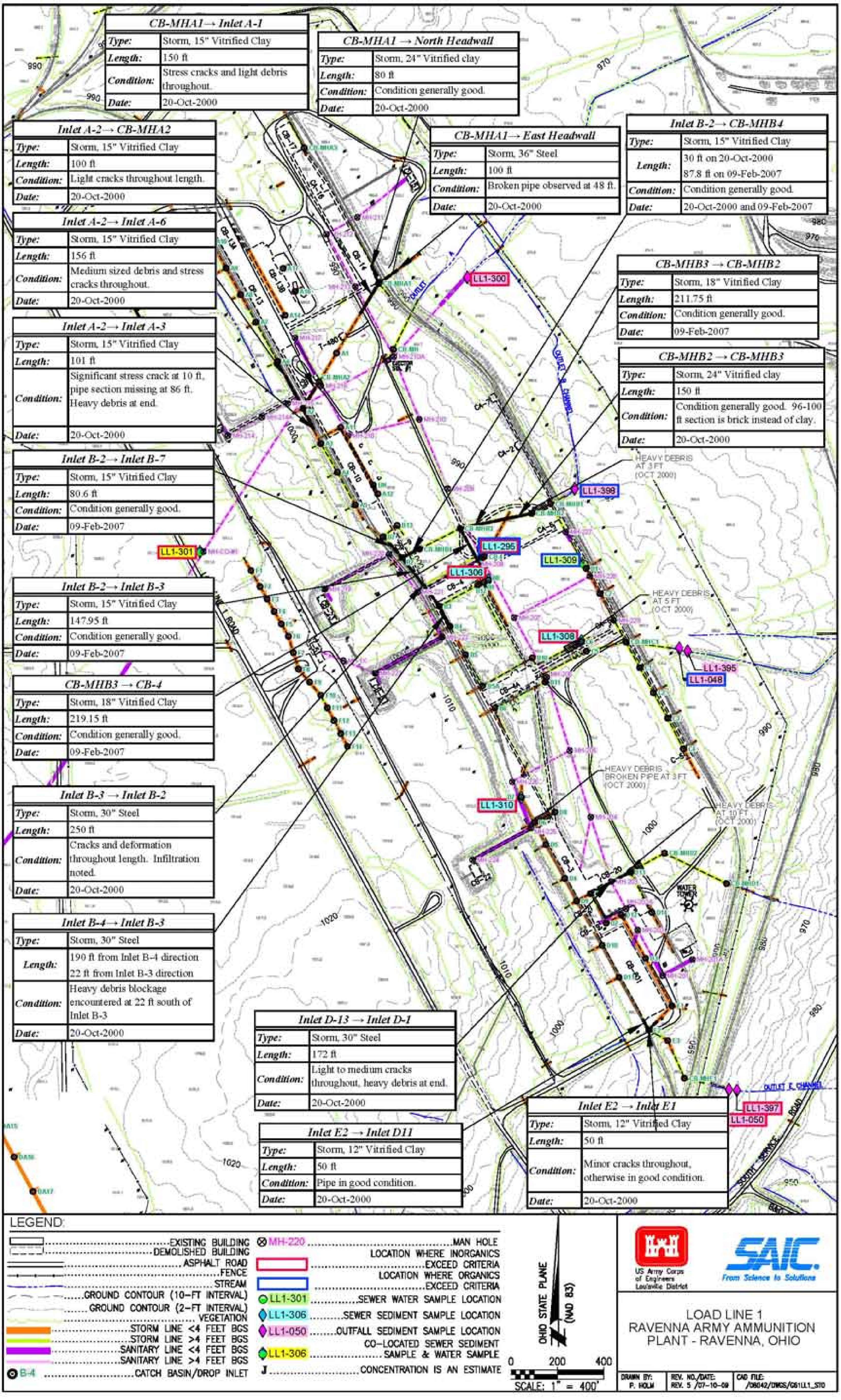


Figure E-4. Locations of Previous Storm Sewer Video Surveys at Load Line 1

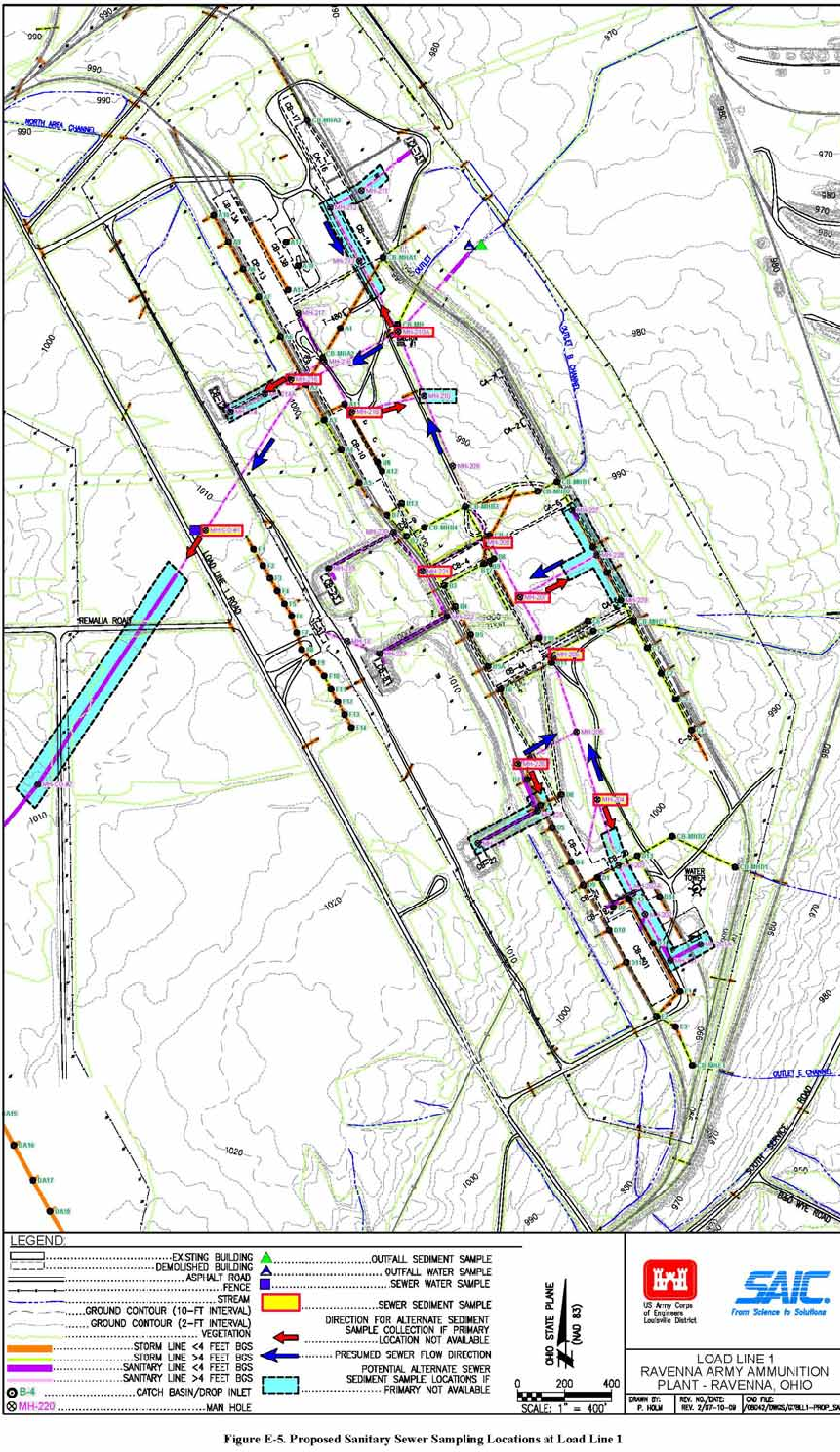


Figure E-5. Proposed Sanitary Sewer Sampling Locations at Load Line 1

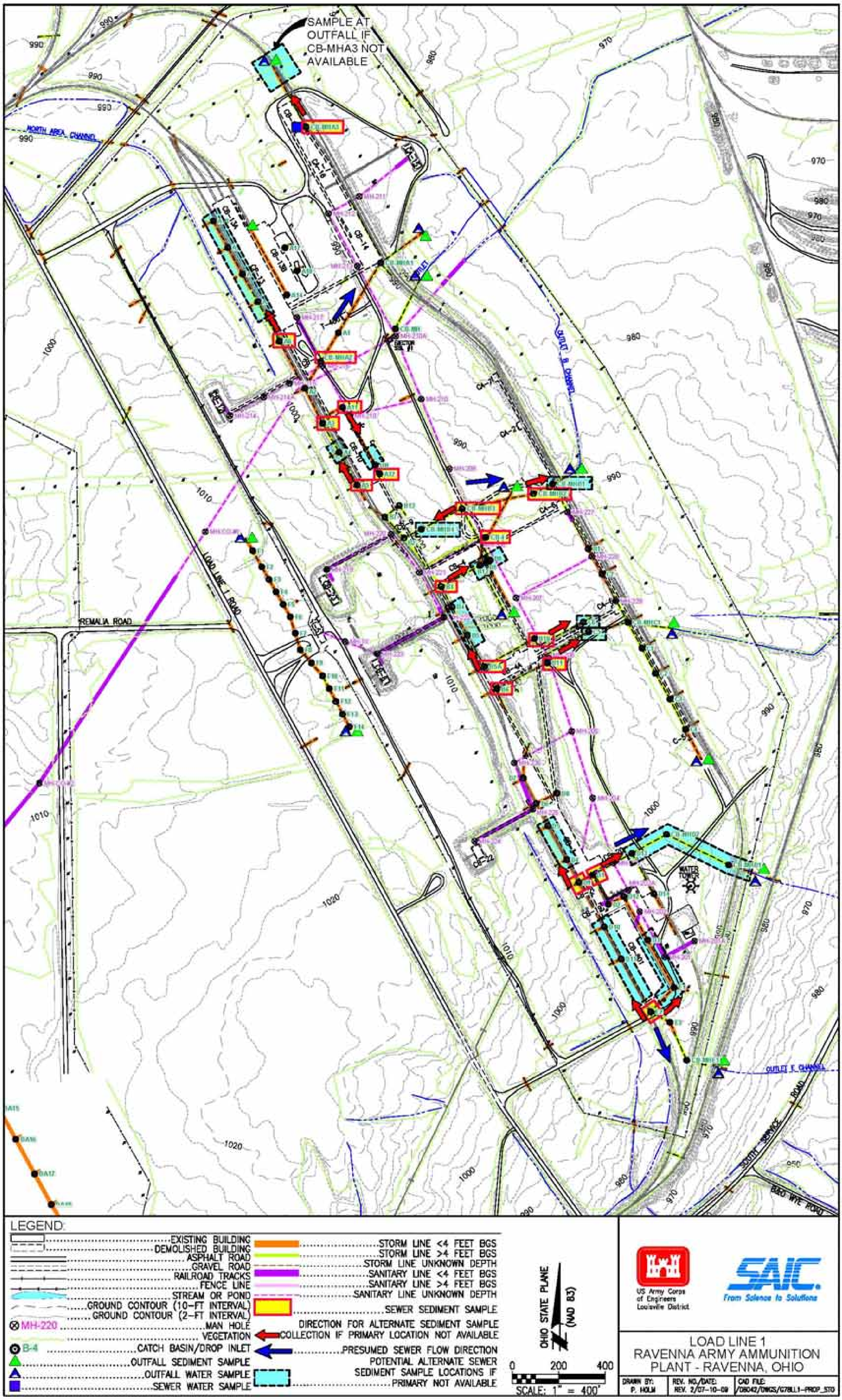


Figure E-6. Proposed Storm Sewer Sampling Locations at Load Line 1

APPENDIX F
Load Line 2

F.0 LOAD LINE 2

F.1 AREA DESCRIPTION

Load Line 2 was used to melt and load TNT and Composition B into large-caliber shells and bombs (Figure F-1). During its operational history, bulk TNT and HMX were offloaded at Buildings DA-6 and DA-6A for screening and preparation before being transported to the melt-pour buildings (DA-4 and DA-4A) for processing and loading into shells. Upon completion of primary charge loading, shells were transported to Building DB-10 for drilling operations for booster charges or other preparation processes. Quality assurance of the primary charge was conducted in Building DB-26. Shell preparation operations, including cleaning and painting, were contained in Building DB-3. Bulk explosive carrier washout activities were conducted in Building DB-25. Buildings DB-13A, DB-13B, and DB-13C housed packaging and shipping operations. Building DB-802 was used for receiving, inert storage and shell preparation. Chromic acid was used in Building DB-802 in shell-preparation processes and was stored in an above-grade tank on concrete pedestals located along the eastern side of the building. Some effluents containing chromic acid were reportedly discharged from Building DB-802 into the large central drainage ditch that, ultimately, discharges to Kelly's Pond.

The line operated during World War II, from 1951 to 1957 for munitions-demilitarization activities (washout was conducted at Building DB-4A), and again from 1969 to 1971. During the entirety of its operational history, Load Line 2 produced about 10 million munitions, and approximately 1.8 million kg (4 million lbs) of TNT was salvaged during demilitarization activities. When the facility was at full capacity, Load Line 2 generated approximately 3,192,000 liters (842,700 gallons) of pink water per month from wash-down and steam decontamination of equipment. Building wash-down water and wastewater from the load line operations were collected in concrete sumps, pumped through sawdust filtration units, and ultimately discharged to a 2 acre settling pond. Water from the impoundment was discharged to a surface stream that exited the facility. The buildings and structures at Load Line 2 have been demolished.

Load Line 2 contains separate storm and sanitary sewer systems. The sanitary sewer system at Load Line 2 is part of the Sand Creek Treatment Plant network (shown in Plate A-2). The storm sewer network discharged to a series of surface drainage conveyances throughout the load line. The storm sewer and sanitary sewer system infrastructures largely remain in place, although portions of the systems have sustained significant damage or have been obstructed with debris during building demolition activities.

F.2 PREVIOUS INVESTIGATIONS

The *Phase II Remedial Investigation* for Load Line 2 included sewer water and sediment sampling and a video camera survey of the sewer lines (USACE 2004a). During the initial examination of the catch basins and manholes, it was noted that very few structures contained sufficient volumes of sewer water for sample collection. Sediment samples were collected from both sewer structures and outfalls locations where storm sewer lines discharged to surface drainage conveyances. Previous sewer and outfall sample locations are shown in Figure F-1.

The analytical results indicated that eleven metals, four explosives (2,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene and RDX), two SVOCs (benzo(a)pyrene and benzo(b)fluoranthene) and PCB-1254 exceeded screening levels in sewer sediment and Load Line 2. Four explosives (,4,6-trinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene and RDX), antimony and PCB-1254 exceeded the screening levels in sewer water at Load Line 2. In outfall sediment, nine metals, benzo(a)pyrene and PCB-1254 exceeded screening criteria in the historical data. These screening level exceedances are summarized in Table F-1 and the sample locations with exceedances are shown in Figure F-2. Eight explosives compounds in total were detected in sewer sediment collected from the storm sewer system, with locations near melt-pour building DB-4 containing the highest number and concentrations of explosives, although only four explosive compounds were observed above the screening levels. PCB-1254 was detected in 10 of the 12 storm sewer sediment samples, exceeding its screening level at 9 of these sample locations. PCB-1254 was also observed above its screening level in both sediment outfall samples.

A total of 1,551.04 linear feet of Load Line 2 sewers have been video surveyed (451.37 and 1,099.67 linear ft of sanitary and storm sewer, respectively) to assess the integrity of the lines and their potential to release contaminants to the environment. Video survey locations and findings for the sanitary and storm sewers at Load Line 2 are presented in Figures F-3 and F-4, respectively (USACE 2004a). The video survey locations were biased to portions of the system located near former production areas and at main exit points from the two systems. Initial evaluation and investigations at the AOC to date indicated that most of the storm and sanitary sewer systems at Load Line 2 were above the water table and were dry. At the time of the video survey, several of the planed entry points were obstructed with debris such as leaves, sticks, rocks and sediments. Overall, the sanitary and storm sewer system were found to be largely intact, but exhibiting frequent cracks, mineral deposits indicating infiltrating water, and debris deposits. No evidence of explosives accumulation was observed.

Inspections and explosives field screening tests were conducted at Load Line 2 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. During the USACE-CERL investigation, traces of TNT were noted near one of the melt-pour buildings (USACE -CERL 2007). A total of 18 DropEx™ samples from Load Line 2 sanitary sewer manholes were collected, none of which tested positive for explosives residue. Of the 43 DropEx™ screening tests conducted at storm sewer drop inlets, six DropEx™ samples at five inlets associated with the melt-pour Buildings DB-4 and DB-4A tested positive for explosives residue (Inlets DB11 through DB15).

Table F-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 2

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	2,4,6-Trinitrotoluene	mg/kg	4/6	0.74	21	8.1	3.7
	2-Amino-4,6-Dinitrotoluene	mg/kg	5/6	0.1	8.9	3.1	1.5
	4-Amino-2,6-Dinitrotoluene	mg/kg	5/6	0.11	22	6.3	1.5
	RDX	mg/kg	2/6	0.17	13	6.6	8
	Antimony	mg/kg	9/12	1.4	7,150	890	2.8
	Arsenic	mg/kg	12/12	5.8	29.4	12.6	19.5
	Barium	mg/kg	12/12	33.7	2.030	289	350
	Cadmium	mg/kg	12/12	0.33	11.2	3.9	6.4
	Chromium	mg/kg	12/12	7.9	2,380	294	18.1
	Cobalt	mg/kg	12/12	4.1	58.5	14.9	9.1
	Copper	mg/kg	12/12	17.4	2,540	387	310
	Lead	mg/kg	12/12	26.6	14,600	2,030	400
	Manganese	mg/kg	12/12	203	5,840	1,278	1,950
	Mercury	mg/kg	11/12	0.019	2.3	0.57	2.3
	Silver	mg/kg	8/12	0.23	393	49.8	39
	Benzo(a)pyrene	mg/kg	1/1	—	—	0.26	0.022
	Benzo(b)fluoranthene	mg/kg	1/1	—	—	0.34	0.22
	PCB-1254	mg/kg	10/12	0.11	31	6.77	0.12
Sewer Water	2,4,6-Trinitrotoluene	mg/L	4/4	0.00027	0.37	0.13	0.0078
	2-Amino-4,6-Dinitrotoluene	mg/L	4/4	0.00074	0.19	0.067	0.0031
	4-Amino-2,6-Dinitrotoluene	mg/L	4/4	0.00069	0.26	0.096	0.0031
	RDX	mg/L	4/4	0.0011	0.69	0.26	0.015
	Antimony	mg/L	2/4	0.0048	0.0053	0.0051	0.0049
	Trichloroethene	mg/L	1/1	—	—	0.0021	0.00016
Outfall Sediment	Antimony	mg/kg	1/2	—	—	8,120	2.8
	Arsenic	mg/kg	2/2	6.9	36.5	22	19.5
	Barium	mg/kg	2/2	36.5	1,060	550	350
	Chromium	mg/kg	2/2	800	4,000	2,004	18.1
	Cobalt	mg/kg	2/2	8	115	62	9.1
	Copper	mg/kg	2/2	16.7	721	370	310
	Lead	mg/kg	2/2	31.5	24,800	12,400	400
	Mercury	mg/kg	2/2	0.012	2.8	1.4	2.3
	Thallium	mg/kg	2/2	0.3	0.93	0.62	0.89
	Benzo(a)pyrene	mg/kg	1/1	—	—	0.18	0.022
	PCB-1254	mg/kg	2/2	0.47	5.7	3.1	0.12

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
— Not applicable.

F.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 2 are presented in Table F-2, and shown in Figures F-5 (sanitary) and F-6 (storm).

Table F-2. Summary of Proposed Sampling Locations at Load Line 2

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-CO-#3	None	Sewer Sediment	Clean-out manhole represents major potential accumulation point. This sanitary manhole is the first location downstream of Load Line 1 entering the east boundary of the load line.
Sanitary	MH-4	None	Sewer Sediment	Represents conditions immediately downstream of ejector station.
Sanitary	MH-301	MH-301A	Sewer Sediment	Isolates segment at Buildings DB-13 and DB-13A.
Sanitary	MH-304	MH-303	Sewer Sediment	Isolates segment at Buildings DB-9 and DB-10.
Sanitary	MH-306	MH-305	Sewer Sediment	Represents conditions immediately downstream of potential source area at melt-pour building DB-4.
Sanitary	MH-307	MH-308	Sewer Sediment	Represents conditions immediately downstream of potential source area at melt-pour building DB-4A.
Sanitary	MH-310	MH-311	Sewer Sediment	Represents conditions immediately downstream of Bldgs. DB-3, and DB-19, DB-20A.
Sanitary	MH-312	None	Sewer Sediment	Represents conditions immediately downstream of building complex at south end of the load line.
Sanitary	MH-314	MH-313	Sewer Sediment	Represents conditions at downstream end of Load Line 2 and immediately prior to entering ejector station.
Sanitary	MH-322	MH-321, MH-320, MH-319, MH-318, MH-317, MH-316, MH-315	Sewer Sediment	Isolates segment at east end of Inert Storage Area #6.
Sanitary	MH-323	None	Sewer Sediment Sewer Water	Represents conditions downstream of Inert Storage Area #6 before draining into the south end of Load Line 2. Historical samples indicated screening level exceedances of inorganics and organics in water and sediment.
Sanitary	MH-329	MH-328, MH-327 , MH-326, MH-325, MH-324	Sewer Sediment	Isolates segment at west end of Inert Storage Area #6.
Sanitary	MH-333	MH-332	Sewer Sediment	Isolates segment at Bldg. DB-8A.
Sanitary	MH-337	MH-350, MH351	Sewer Sediment Sewer Water	Represents conditions at downstream end of Load Line 2 before draining west towards Load Line 3.
Sanitary	MH-341	MH-331	Sewer Sediment	Characterizes potential source area at former shaker building.
Sanitary	MH-342	MH-331	Sewer Sediment	Characterizes potential source area at former shaker building.

Table F-2. Summary of Proposed Sampling Locations at Load Line 2 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	C4	C3	Sewer Sediment	Represents conditions immediately downstream of Bldgs. DB-3, and DB-19, DB-20A. Historical sampling indicated organics and inorganics above screening levels. ***In addition to Tier 1 sampling procedures, collect hexavalent chromium sample for speciation data; historical chromium concentrations elevated.***
Storm	CB-MHB1	None	Sewer Sediment	Clean-out manhole represents major potential accumulation point downstream of northern portion of load line. Historical sampling indicated multiple organics and inorganics above screening levels in sediment and water.
Storm	CB-MHB2	None	Sewer Sediment	Clean-out manhole represents major potential accumulation point downstream of northern portion of load line. Historical sampling indicated organics and inorganics above screening levels in sediment and water.
Storm	CB-MHB3	DA12	Sewer Sediment	Storm clean-out manhole represents major potential accumulation point downstream of melt-pour building area.
Storm	DA7	DA6, DA5, DA4, DA3. DA2, DA1	Sewer Sediment	Isolates storm segment at northeast of load line.
Storm	DA11	DA10, DA9, DA8	Sewer Sediment	Isolates segment downstream of potential source area at shaker building DA-6.
Storm	DA14	DA15, DA16, DA17, DA18, DA19, DA20	Sewer Sediment	Isolates segment downstream of potential source area at shaker building DA-6A. An inlet in this line (DA18) previous exhibited organics above screening levels.
Storm	DB1	Outfall to north	Sewer Sediment Sewer Water	Represents drainage to northwest end of load line
Storm	DB7	DB6, DB5, DB4, DB3, DB2	Sewer Sediment	Isolates segment at northwest of load line. Historical results at multiple inlets indicated inorganic and organic screening level exceedances.

Table F-2. Summary of Proposed Sampling Locations at Load Line 2 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	DB11	Any representative alternate at west side of Bldg. DB-4	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4) and provides confirmation of historical results of organics and inorganics above screening levels. Drop inlets at this building tested positive for explosives residue in 2007.
Storm	DB12	Any representative alternate at west side of Bldg. DB-4	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	DB15	Any representative alternate at west side of Bldg. DB-4A	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	DB20	None	Sewer Sediment	Represents conditions downstream of Bldg. DB-3 and provides confirmation of previous historical results of inorganics and organics above screening levels. ***In addition to Tier 1 sampling procedures, collect hexavalent chromium sample for speciation data; historical chromium concentrations elevated.***
Storm	DB21	None	Sewer Sediment	Represents conditions at Bldg. DB-802 and provides confirmation of previous historical results of inorganics and organics above screening levels. ***In addition to Tier 1 sampling procedures, collect hexavalent chromium sample for speciation data; historical chromium concentrations elevated.***
Storm	Representative inlet at northeast side of Bldg. DB-4	Any representative alternate at Bldg. DB-4	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	Representative inlet at southeast side of Bldg. DB-4	Any representative alternate at Bldg. DB-4	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4). Drop inlets at this building tested positive for explosives residue in 2007.

Table F-2. Summary of Proposed Sampling Locations at Load Line 2 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	Representative inlet at northeast side of Bldg. DB-4A	Any representative alternate at Bldg. DB-4A	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	Representative inlet at southeast side of Bldg. DB-4A	Any representative alternate at Bldg. DB-4A	Sewer Sediment	Provides characterization at possible major source area (melt-pour building DB-4A). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	Outfall east of Building DB-802	None	Outfall Sediment Outfall Water	Represents storm drainage from Bldg. C-1.
Storm	Outfall south of Bldg. DB-802	None	Outfall Sediment Outfall Water	Represents storm drainage from building complex at south end of load line.
Storm	Outfall south of inlets DA20/DA21	None	Outfall Sediment Outfall Water	Represents drainage to southeast end of load line. ***In addition to Tier 1 sampling procedures, collect hexavalent chromium sample for speciation data; historical chromium concentrations elevated.***
Storm	Outfall south of CB-MHB3	None	Outfall Sediment Outfall Water	Represents major storm outfall at the load line immediately downstream of the melt-pour buildings. Historical results indicated organics above screening levels.
Storm	Outfall north of inlet DA1	None	Outfall Sediment Outfall Water	Represents drainage to northeast end of load line.
Storm	Outfall at east terminus of Inert Storage Area #6	None	Outfall Sediment Outfall Water	Represents major drainage outfall at Inert Storage Area #6 observed in the field in Dec. 2008.
Storm	Outfall at Inert Storage Area #6, above Kelly's Pond	None	Outfall Sediment Outfall Water	Represents major drainage outfall below Inert Storage Area #6.
Storm	Representative outfall (#1) at Inert Storage Area #6	Any representative at Inert Storage Area #6	Outfall Sediment Outfall Water	Inert Storage Area #6 storm system not previously characterized.
Storm	Representative outfall (#2) at Inert Storage Area #6	Any representative at Inert Storage Area #6	Outfall Sediment Outfall Water	Inert Storage Area #6 storm system not previously characterized.

Additionally, investigation activities will include ground-truthing and documenting the configuration of the storm sewer network at the former melt pour buildings DB-4 and DB-4A complex. During the preliminary reconnaissance effort in December 2008, the location of inlet structures in the field was observed to differ from what was reflected in the maps based upon the digitization of historical facility drawings, likely due to the rehabilitation of these lines in the 1950s.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 2 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

Several historical sampling locations were observed to have sewer sediment total chromium concentrations in excess of the cleanup goal for the residential farmer (187 mg/kg). Hexavalent chromium sewer sediment samples will be collected at these locations to provide chromium speciation data. These locations are:

- Inlet C4 (storm);
- Inlet DB20 (storm);
- Inlet DB21 (storm); and
- Outfall south of Inlets DA20 and DA21 (storm).

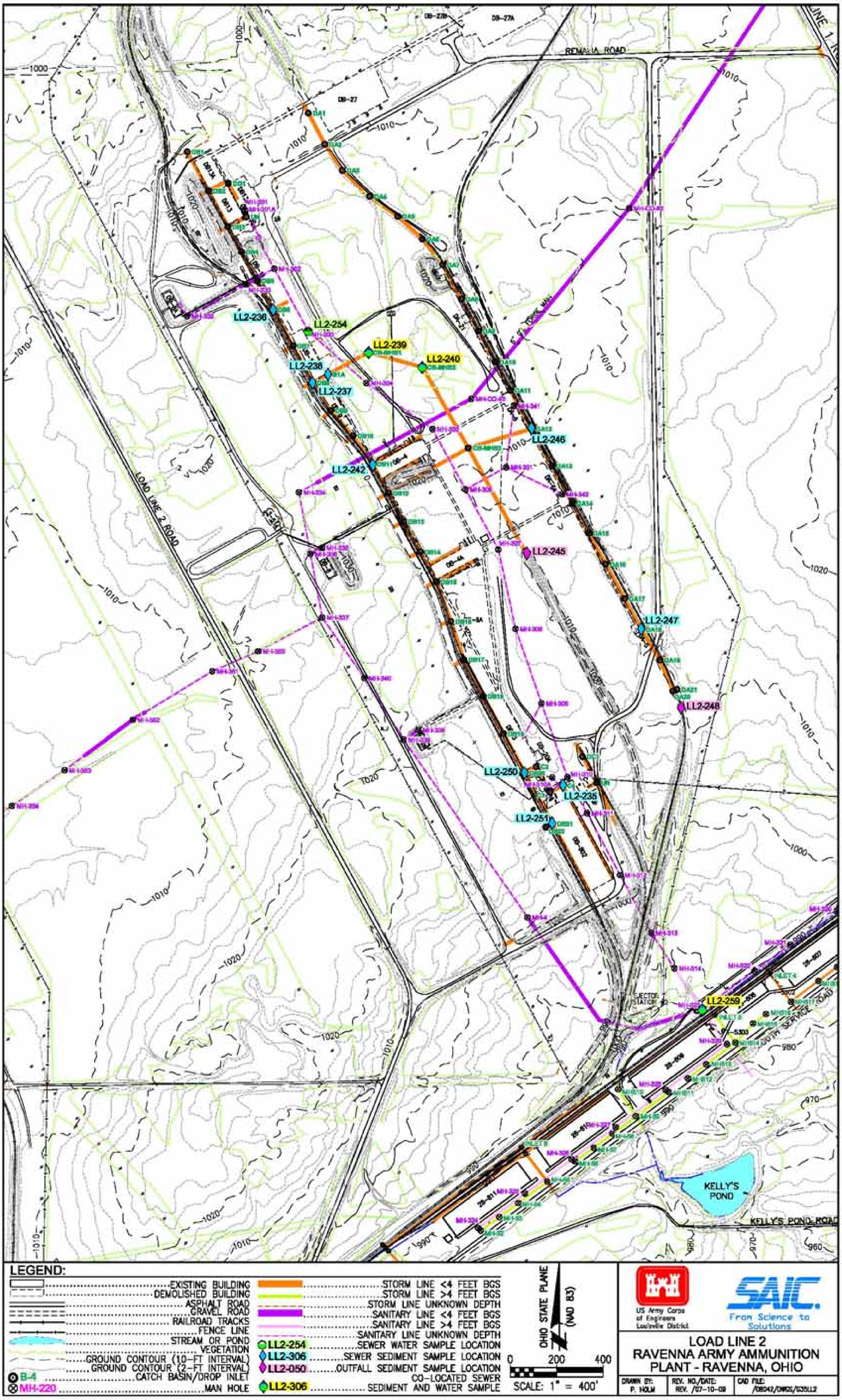


Figure F-1. Historical Sewer Sampling Locations at Load Line 2

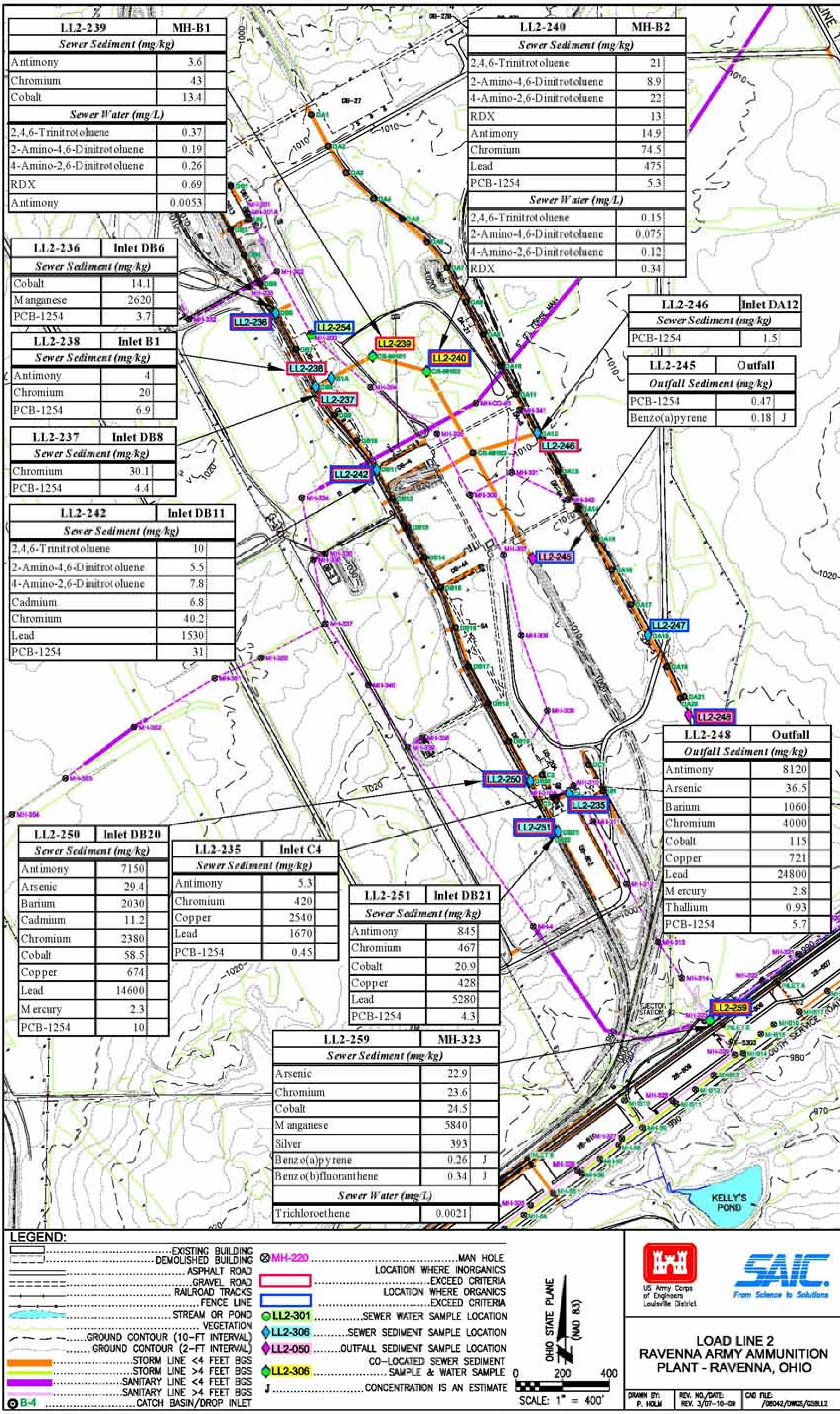


Figure F-2. Historical Exceedances for Sewer Samples at Load Line 2

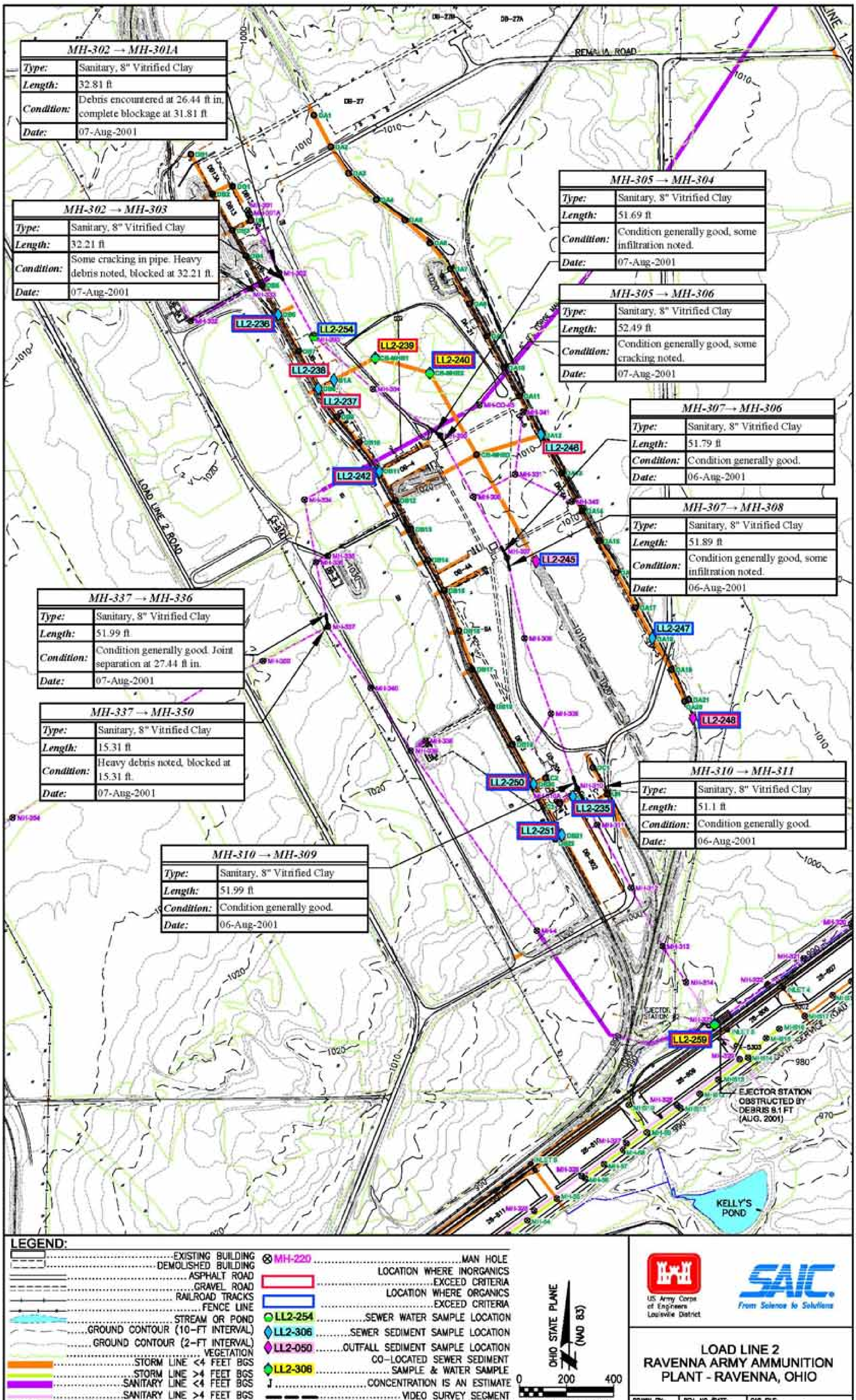


Figure F-3. Location of Previous Sanitary Sewer Video Surveys at Load Line 2

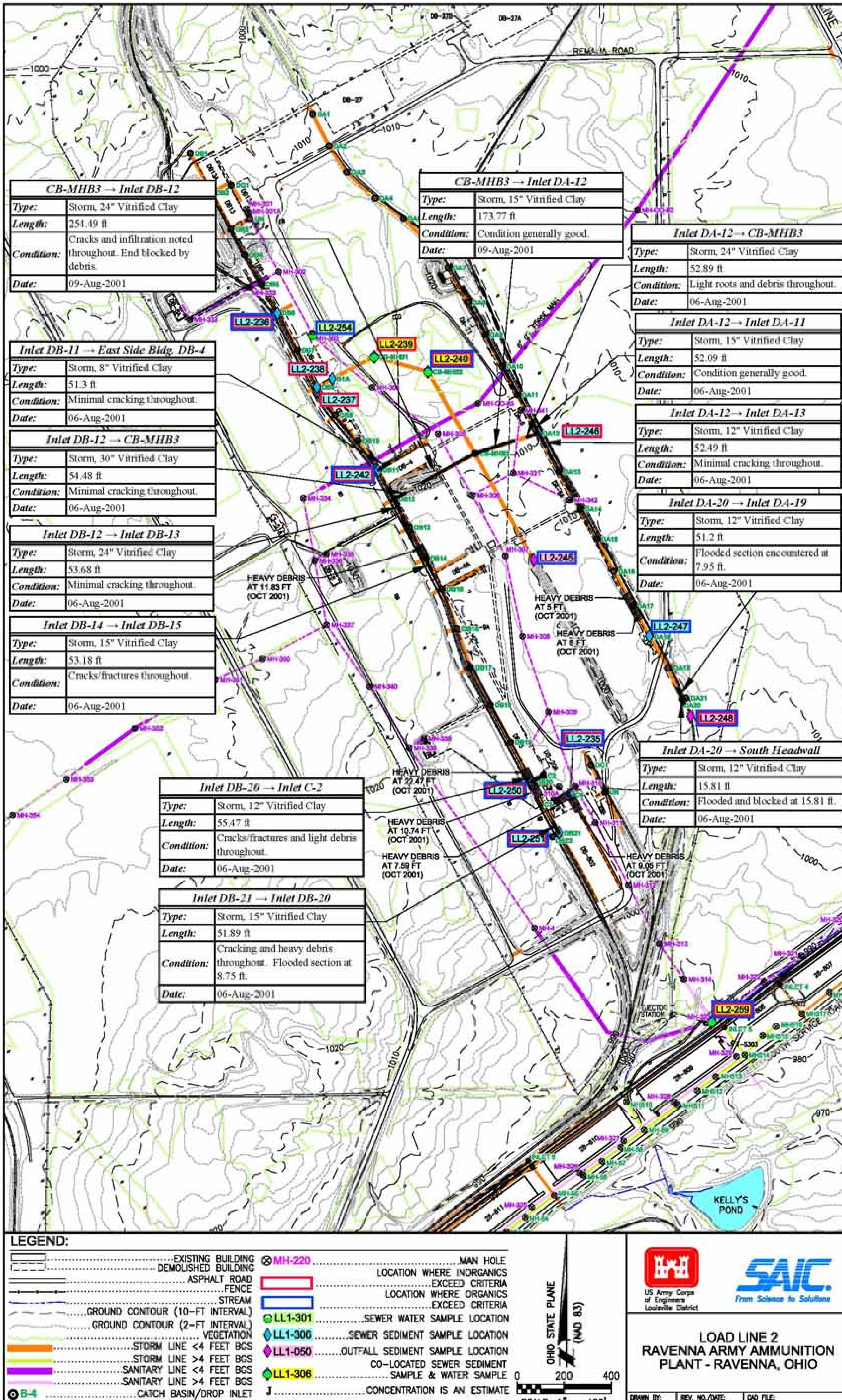


Figure F-4. Locations of Previous Storm Sewer Video Surveys at Load Line 2

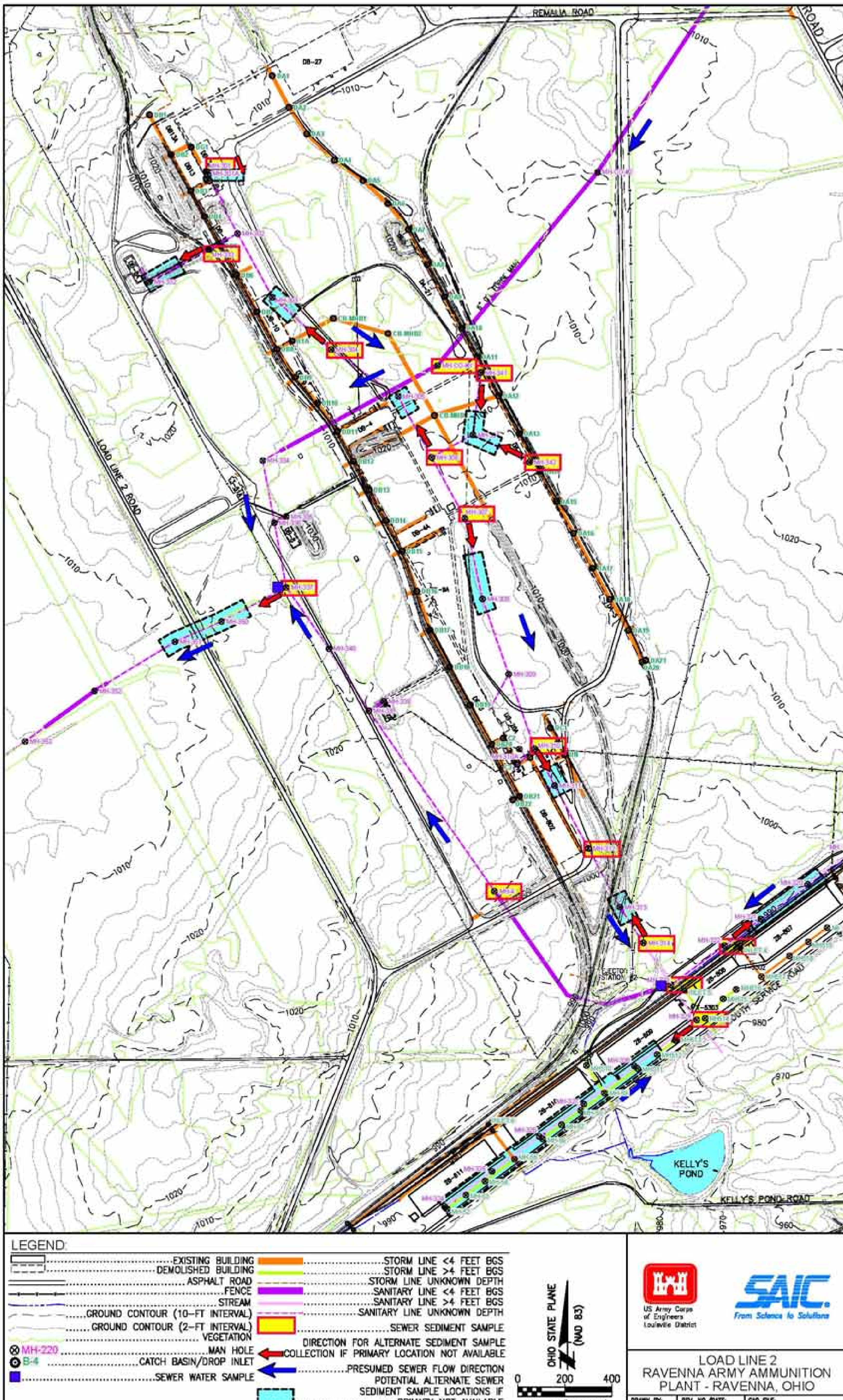


Figure F-5. Proposed Sanitary Sewer Sampling Locations at Load Line 2

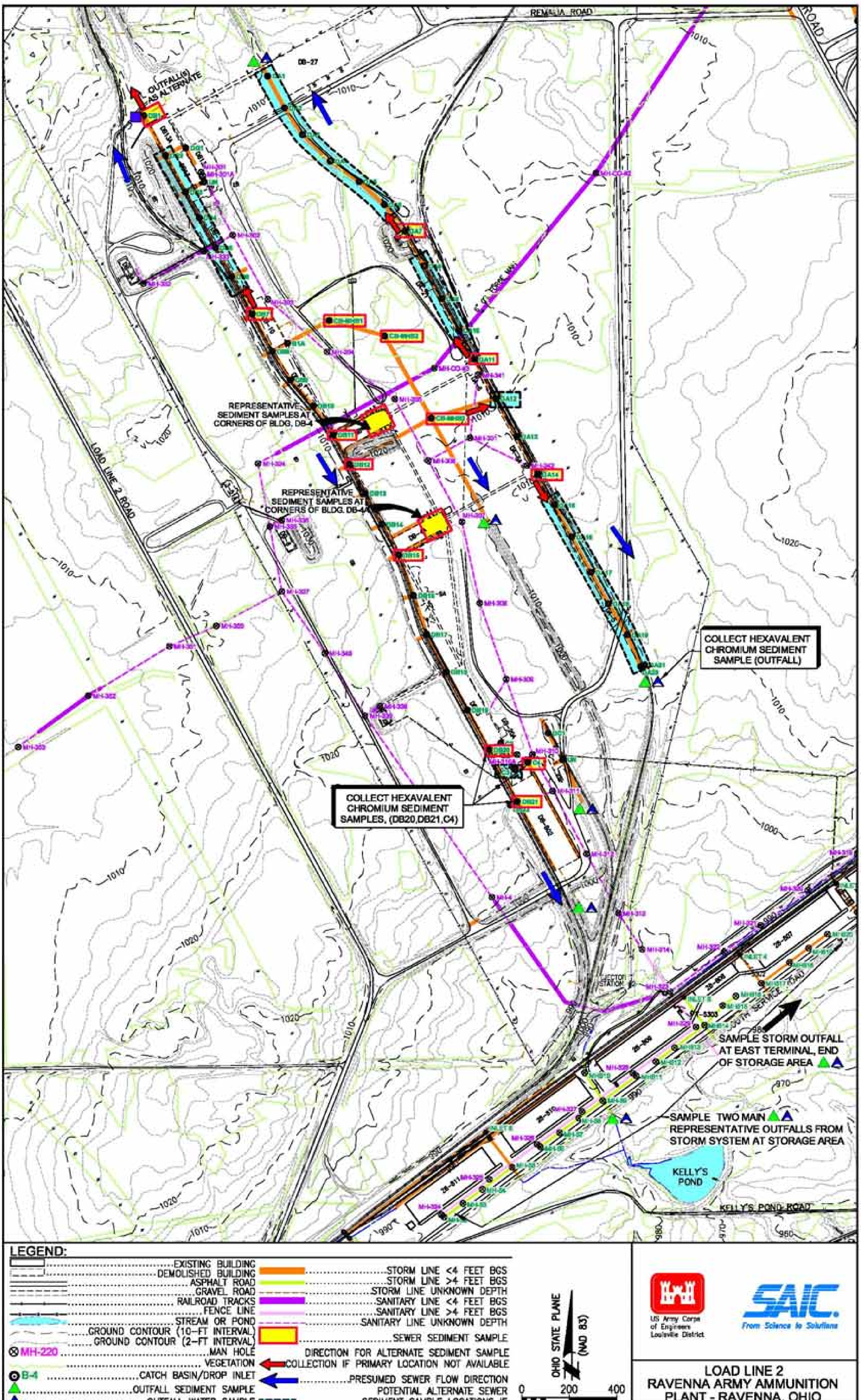


Figure F-6. Proposed Storm Sewer Sampling Locations at Load Line 2

APPENDIX G
Load Line 3

G.0 LOAD LINE 3

G.1 AREA DESCRIPTION

Load Line 3 was used to melt bulk explosives and load Composition B into large-caliber shells and bombs (Figure G-1). During the operation of Load Line 3, bulk TNT and HMX was offloaded at Buildings EA-6 and EA-6A for screening and preparation before being transported to the melt-pour Building EA-4 and EA-4A for processing and loading into shells. Upon completion of primary charge loading, shells were transported to Building EB-10 for drilling operations or other preparation steps prior to transfer to Building EB-10A for quality assurance inspections. Buildings EB-13A, EB -13B, and EB-13C housed packaging and shipping operations. Shell receiving and preparation operations, including cleaning and painting, were contained in Building EB-3. Bulk explosive carrier washout activities were conducted in Building EB-25. Inert material receiving and storage was conducted at Building EB-803. The line operated during World War II, from 1951 to 1957, and again from 1969 to 1971.

During its operational history, Load Line 3 produced about 6.5 million munitions. Demilitarization activities were conducted between 1951 and 1957 during which time approximately 228,000 munitions were processed at the load line. Building wash-down water and wastewater from the load line operations were collected in concrete sumps, pumped through sawdust filtration units, and ultimately discharged to a drainage ditch leading to a settling pond. The buildings and structures at Load Line 3 have been demolished.

Load Line 3 contains separate storm and sanitary sewer systems. The sanitary sewer system at Load Line 3 is part of the Sand Creek Treatment Plant network (shown in Plate A-2). The storm sewer network discharged to a series of surface drainage conveyances throughout the load line. The storm sewer and sanitary sewer system infrastructures largely remain in place, although portions of the systems have sustained significant damage or have been obstructed with debris during building demolition activities.

G.2 PREVIOUS INVESTIGATIONS

The *Phase II Remedial Investigation* for Load Line 3 included sewer water and sediment sampling and a video camera survey of the sewer lines (USACE 2004b). At the time of sampling, visual inspection indicated that most of the storm and sanitary sewer systems at Load Line 3 were above the water table and were dry. However, limited portions of the sanitary sewer system were found to be flooded. Only two sewer water samples could be collected, both of which were from sanitary sewer manholes A total of six sewer sediment samples were collected, five of which were obtained from storm sewer inlet locations. Three outfall sediment samples were collected from locations where storm sewer lines discharged to surface drainage conveyances. Previous sewer and outfall sample locations are shown in Figure G-1.

The analytical results indicated that eight metals, two explosives (2,4,6-trinitrotoluene and 2-amino-4,6-dinitrotoluene) and PCB-1254 exceeded screening levels in sewer sediment at Load Line 3. The only analytes to exceed screening levels in sewer water were the metal thallium and the explosive 2-amino-4,6-dinitrotoluene. In outfall sediments, seven metals, two explosives (2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene) and PCB-1254 exceeded their respective screening levels. These screening level exceedances are summarized in Table G-1 and the sample locations with exceedances are shown in Figure G-2. PCB-1254 was identified in all the storm and sanitary sewer sediment samples collected, with the highest concentrations observed at the storm inlets draining the areas in the vicinity of buildings EB-10, EB-4 and EB-803.

A total of 1,840.53 linear feet of Load Line 3 sewers have been video surveyed (457.69 and 1,382.84 linear feet of sanitary and storm sewer, respectively) to assess the integrity of the lines and their potential to release contaminants to the environment. Video survey locations and findings for the sanitary and storm sewers at Load Line 3 are presented in Figures G-3 and G-4, respectively (USACE 2004b; Lakeshore Engineering Services, Inc. 2007). During the surveys, multiple sewer inlet or manhole locations were observed to be obstructed with debris such as leaves, sticks, rocks and sediment. Heavy debris and significant root growth was observed throughout the sanitary and storm sewer system, hindering survey efforts. Some portions of the system were characterized by medium levels of corrosion, holes, cracks and fractures. In one segment of line south of sanitary manhole MH-419, a hole in the pipe and complete collapse was observed.

Inspections and explosives field screening tests were conducted at Load Line 3 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. During the USACE-CERL (2007) investigation, no visual evidence of trace explosives was observed. A total of 26 DropEx™ samples were collected at Load Line 3 sanitary sewer manholes, none of which tested positive for explosives residue. Of the 35 screening tests in total conducted at the storm sewer drop inlets, six DropEx™ samples at inlets associated with the melt-pour Buildings EB-4 and EB-4A tested positive for explosives residue. The video surveys conducted at Load Line 3 during the Lakeshore (2007) investigation also involved subsequent swabbing and Expray™ testing of the camera for explosives residue. All three storm sewer runs at segments adjacent to building EB-4 tested positive for trace explosives, and the one sanitary sewer camera run yielded negative results.

Table G-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 3

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	2,4,6-Trinitrotoluene	mg/kg	3/5	0.16	68	22.9	3.7
	2-Amino-4,6-Dinitrotoluene	mg/kg	2/5	0.69	2.2	1.45	1.5
	Antimony	mg/kg	3/6	1.9	756	320	2.8
	Arsenic	mg/kg	6/6	8.7	24.4	13.6	19.5
	Barium	mg/kg	6/6	37.4	2,010	413	350
	Cadmium	mg/kg	6/6	0.35	9.3	3.76	6.4
	Chromium	mg/kg	6/6	10.7	464	120	18.1
	Cobalt	mg/kg	6/6	5.5	21.1	10.2	9.1
	Copper	mg/kg	6/6	23.5	1,340	304	310
	Lead	mg/kg	6/6	55	3,930	875	400
	PCB-1254	mg/kg	6/6	0.056	15	4.2	0.12
Sewer Water	4-Amino-2,6-Dinitrotoluene	mg/L	2/2	0.0017	0.0034	0.0026	0.0031
	Thallium	mg/L	1/2	–	–	0.0019	0.0012
Outfall Sediment	2-Amino-4,6-Dinitrotoluene	mg/kg	3/3	0.12	5	1.8	1.5
	4-Amino-2,6-Dinitrotoluene	mg/kg	3/3	0.23	6.5	2.5	1.5
	Antimony	mg/kg	1/3	–	–	177	2.8
	Arsenic	mg/kg	3/3	13	20.7	14.7	19.5
	Chromium	mg/kg	3/3	18.7	114	52	18.1
	Cobalt	mg/kg	3/3	7	10.9	9.1	9.1
	Copper	mg/kg	3/3	29.6	1,070	391	310
	Lead	mg/kg	3/3	87.8	873	351	400
	PCB-1254	mg/kg	3/3	0.86	36	12.6	0.12

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
– Not applicable.

G.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 3 are presented in Table G-2, and shown in Figures G-5 (sanitary) and G-6 (storm).

Table G-2. Summary of Proposed Sampling Locations at Load Line 3

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-401	None	Sewer Sediment Sewer Water	Represents upstream conditions prior to drainage from Load Lines 1 and 2 entering the east boundary of Load Line 3.
Sanitary	MH-402	None	Sewer Sediment	Represents conditions at potential source area (shaker building EA-6).
Sanitary	MH-404	MH-403	Sewer Sediment	Represents conditions at potential source area (shaker building EA-6A).
Sanitary	MH-406	None	Sewer Sediment	Represents conditions at melt-pour building EB-4.
Sanitary	MH-408	MH-405, MH-407	Sewer Sediment	Represents conditions at and downstream of potential major source area (melt pour and shaker buildings complex). Historical sediment data at this location indicated inorganics above screening levels.
Sanitary	MH-413	MH-412	Sewer Sediment	Isolates segment servicing buildings EB-10A, EB-11 and EB-13. This location previously exhibited screening level exceedances of inorganics and organics in water; no sediment was collected.
Sanitary	MH-418	MH-417A, MH-417, MH-416, MH-415A, MH-415	Sewer Sediment	Isolates segment at northwest portion of the load line servicing Bldg. EB-8A.
Sanitary	MH-419	MH-410, MH-409	Sewer Sediment	Represents conditions immediately downstream of melt-pour building EB-4A.
Sanitary	MH-421	MH-422	Sewer Sediment	Isolates segment at the building complex at south end of load line.
Sanitary	MH-424	MH-423	Sewer Sediment	Isolates segment at the building complex at south end of load line.
Sanitary	MH-427	MH-429, MH-430, MH-431, MH-432, MH-433, MH-434	Sewer Sediment Sewer Water	Represents last major junction point within Load Line 3 before exiting the boundaries of the load line at the west and draining towards Load Line 12.
Storm	C1	None	Sewer Sediment	Represents conditions immediately downstream of melt-pour complex and at shaker building.
Storm	C3	C4, B1, C2	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4). Drop inlets at this building tested positive for explosives residue in 2007.

Table G-2. Summary of Proposed Sampling Locations at Load Line 3 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	D3	D2, D1	Sewer Sediment	Isolates segment on east side of Bldg. EB-803. Historical data for drop inlets at this building indicated organics and inorganics above screening levels.
Storm	ED1	Outfall to north of ED1	Sewer Sediment	Represents drainage to northeast end of load line.
Storm	ED6	ED5, ED4, ED3, ED2	Sewer Sediment	Isolates segment at northeast of load line.
Storm	ED10	EF1, EF2, EF3, EF4	Sewer Sediment	Represents conditions at or downstream of shaker building.
Storm	EF5	Outfall to south of EF5	Sewer Sediment	Represents drainage to southeast end of load line.
Storm	EH3	EG2	Sewer Sediment	Represents conditions at Bldg. EB-13.
Storm	EH13	EH12, EH11, EH10	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4). Drop inlets at this building tested positive for explosives residue in 2007. Historical results indicated screening level exceedances for organics.
Storm	EH14	EH15, EH16	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4). Drop inlets at this building tested positive for explosives residue in 2007, and histortical data exceeded screening levels for organics..
Storm	EH19	EH18, EH17	Sewer Sediment	Isolates segment at west side of Bldg. EB-3A.
Storm	EH21	EH20	Sewer Sediment	Isolates segment downstream of Bldgs. EB-2 and EB-79. Historical data for this location indicated organics and inorganics above screening levels. ***In addition to Tier 1 sampling procedures, collect hexavalent chromium sample for speciation data; historical chromium concentrations elevated.***
Storm	EH233	Outfall at terminus of segment, if present	Sewer Sediment	Represents outfall downstream of building complex at south end of load line. Historical data at an adjacent drop inlet indicated organics and inorganics above screening levels.

Table G-2. Summary of Proposed Sampling Locations at Load Line 3 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	Bldg. EB-4A, northwest corner	Any representative inlet at corner	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4A). Drop inlets at this building tested positive for explosives residue in 2007, and historical data for a storm outfall at this building indicated inorganics and organics above screening levels.
Storm	Bldg. EB-4A, southwest corner	Any representative inlet at corner	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4A). Drop inlets at this building tested positive for explosives residue in 2007, and historical data for a storm outfall at this building indicated inorganics and organics above screening levels.
Storm	Bldg. EB-4A, northeast corner	Any representative inlet at corner	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4A). Drop inlets at this building tested positive for explosives residue in 2007, and historical data for a storm outfall at this building indicated inorganics and organics above screening levels.
Storm	Bldg. EB-4A, southeast corner	Any representative inlet at corner	Sewer Sediment	Provides characterization at possible major source area (melt-pour building EB-4A). Drop inlets at this building tested positive for explosives residue in 2007, and historical data for a storm outfall at this building indicated inorganics and organics above screening levels.
Storm	Outfall at northwest corner of Bldg. EB13	None	Outfall Sediment Outfall Water	Represents potential major outfall at northeast portion of load line.
Storm	Outfall to west of inlet EB11	None	Outfall Sediment Outfall Water	Represents potential major outfall at melt pour complex. Historical data for this location indicated inorganics and organics above screening levels.
Storm	Outfall to west of inlet EB4	None	Outfall Sediment Outfall Water	Represents potential major outfall at northwest quadrant of load line. Historical data for this location indicated inorganics and organics above screening levels.
Storm	Potential outfall between inlets ED10 and EF1	None	Outfall Sediment Outfall Water	Represents potential major drainage outfall downstream of shaker buildings.

Additionally, investigation activities will involve ground-truthing and documenting the configuration of the storm sewer network at the former melt pour buildings EB-4 and EB-4A complex. During the preliminary reconnaissance effort in December 2008, the location of inlet structures in the field was observed to differ from what was reflected in the maps based upon the digitization of historical facility drawings, likely due to the rehabilitation of these lines in the 1950s.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 3 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

During historical sampling, the sediment result for storm system Inlet EH21 was observed to have total chromium concentrations in excess of the cleanup goal for the residential farmer (187 mg/kg). A hexavalent chromium sewer sediment sample will be collected at this locations to provide chromium speciation data.

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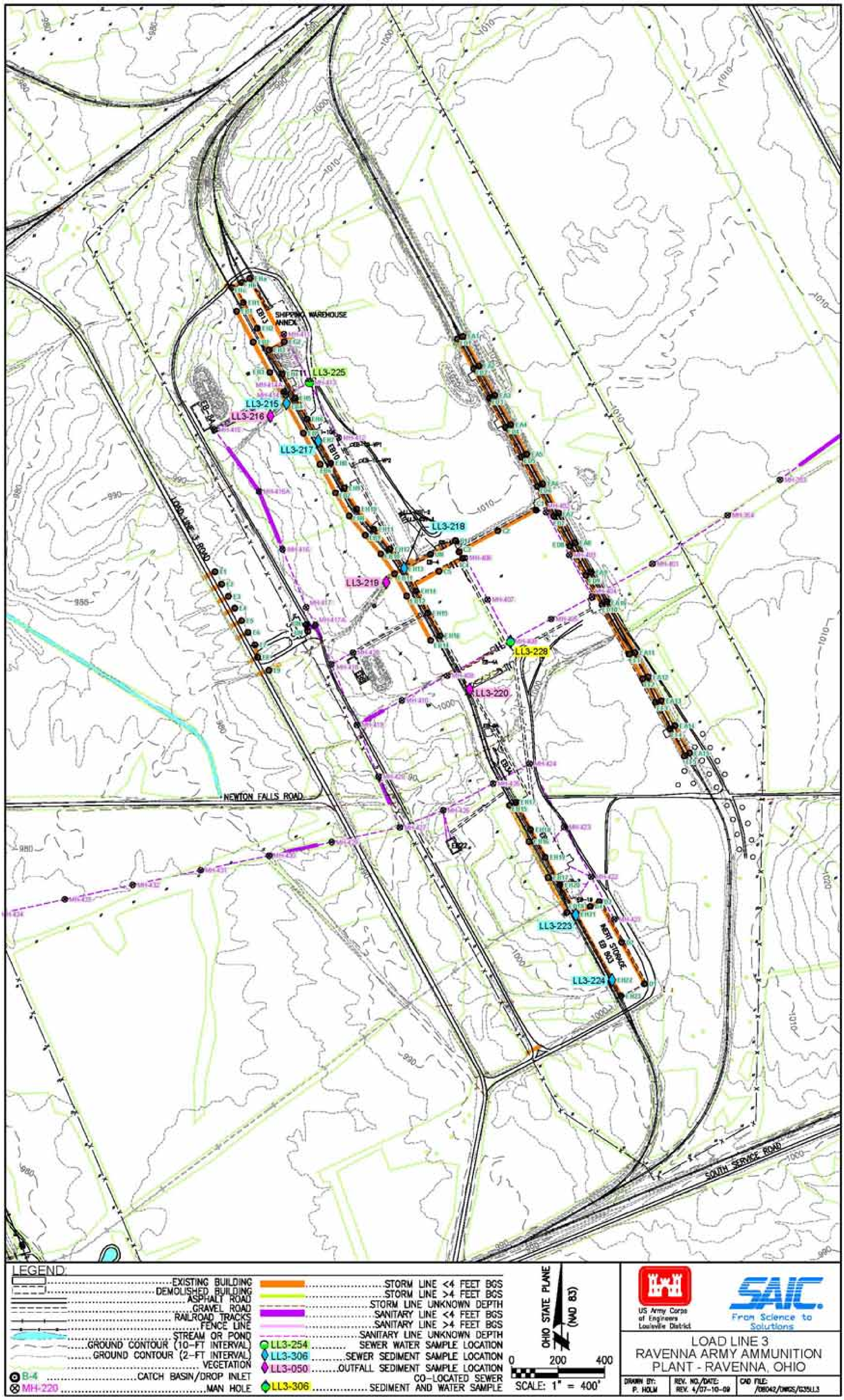

Figure G-1. Historical Sewer Sampling Locations at Load Line 3

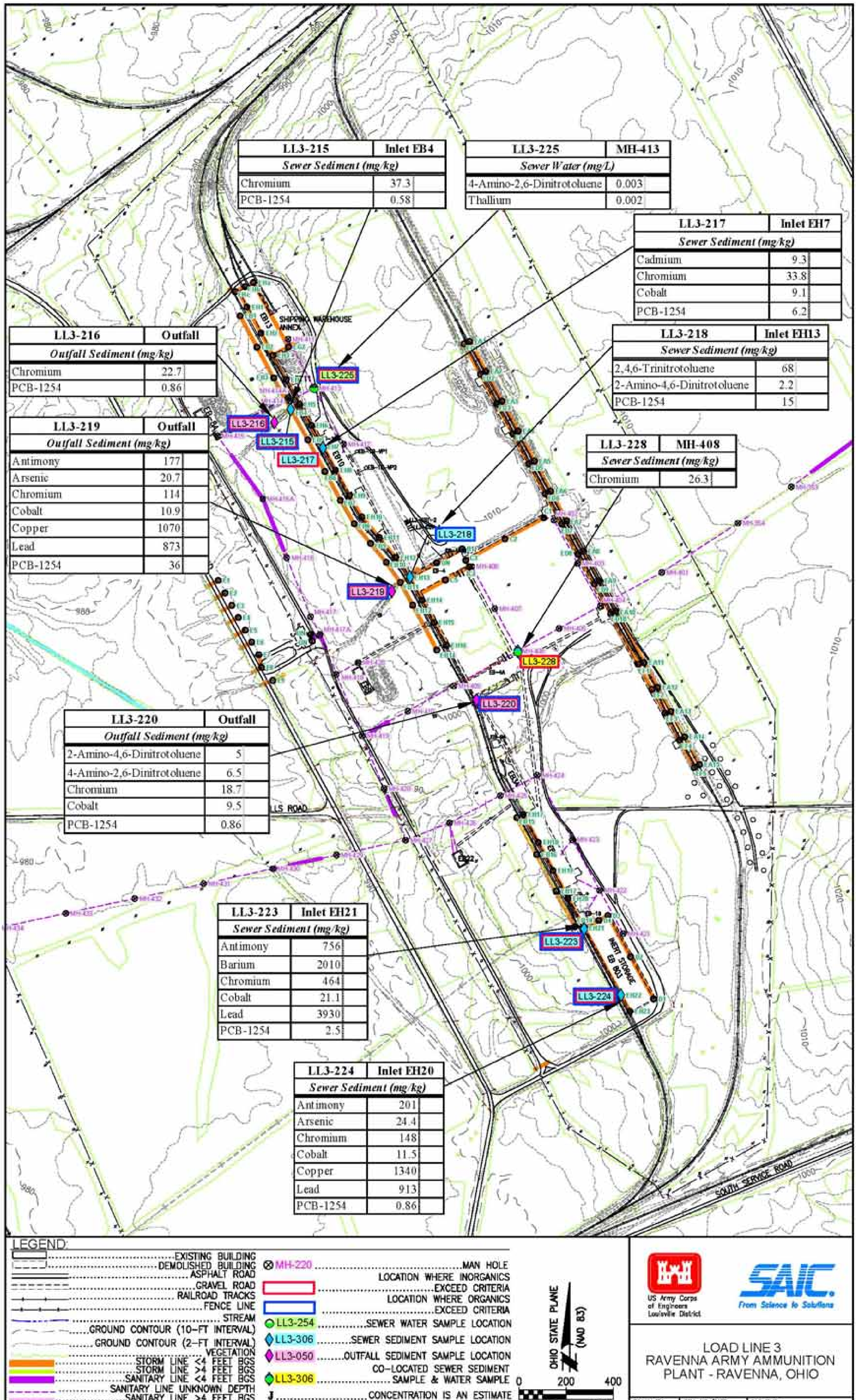

Figure G-2. Historical Exceedances for Sewer Samples at Load Line 3

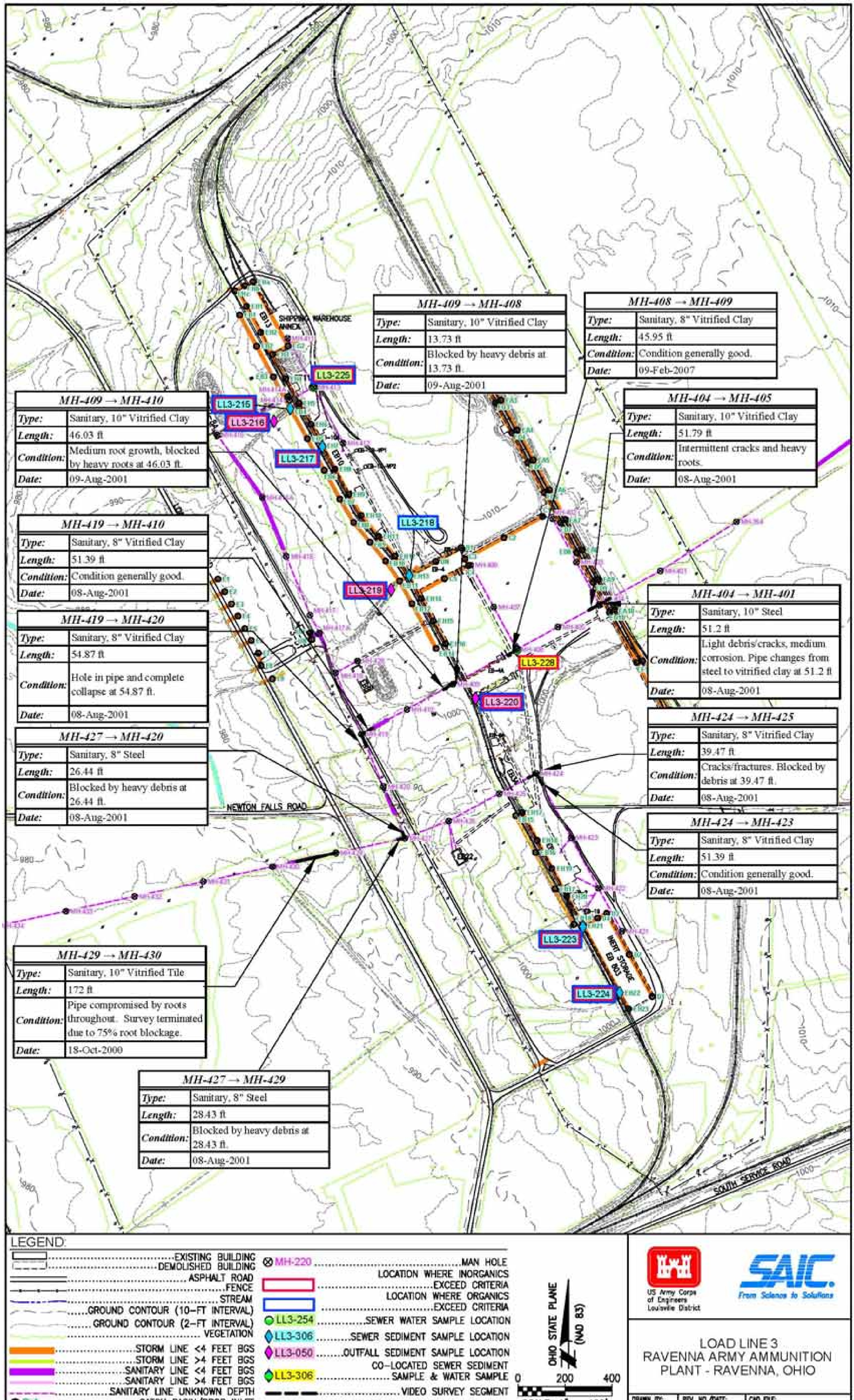

Figure G-3. Locations of Previous Sanitary Sewer Video Surveys at Load Line 3

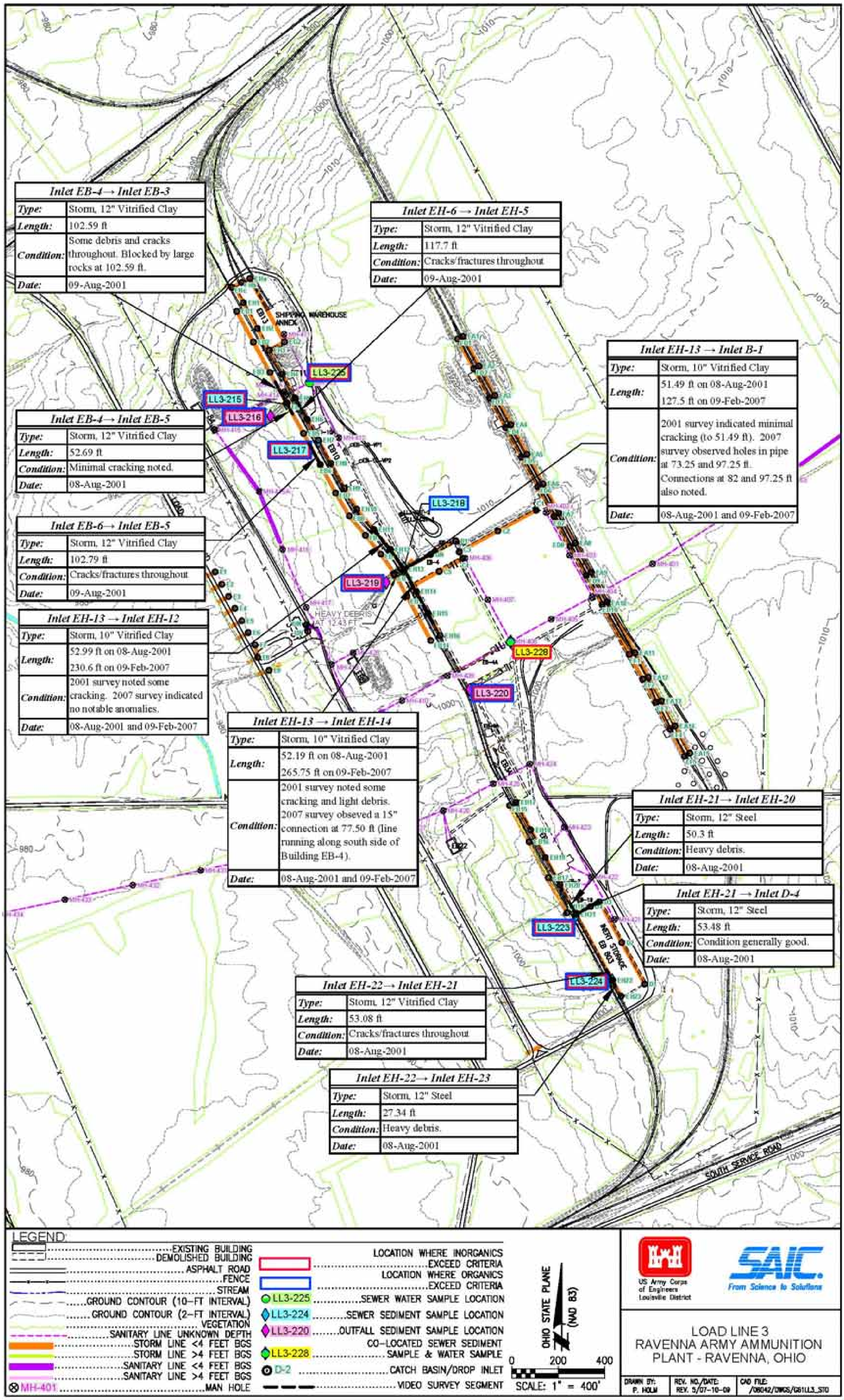

Figure G-4. Locations of Previous Storm Sewer Video Surveys at Load Line 3

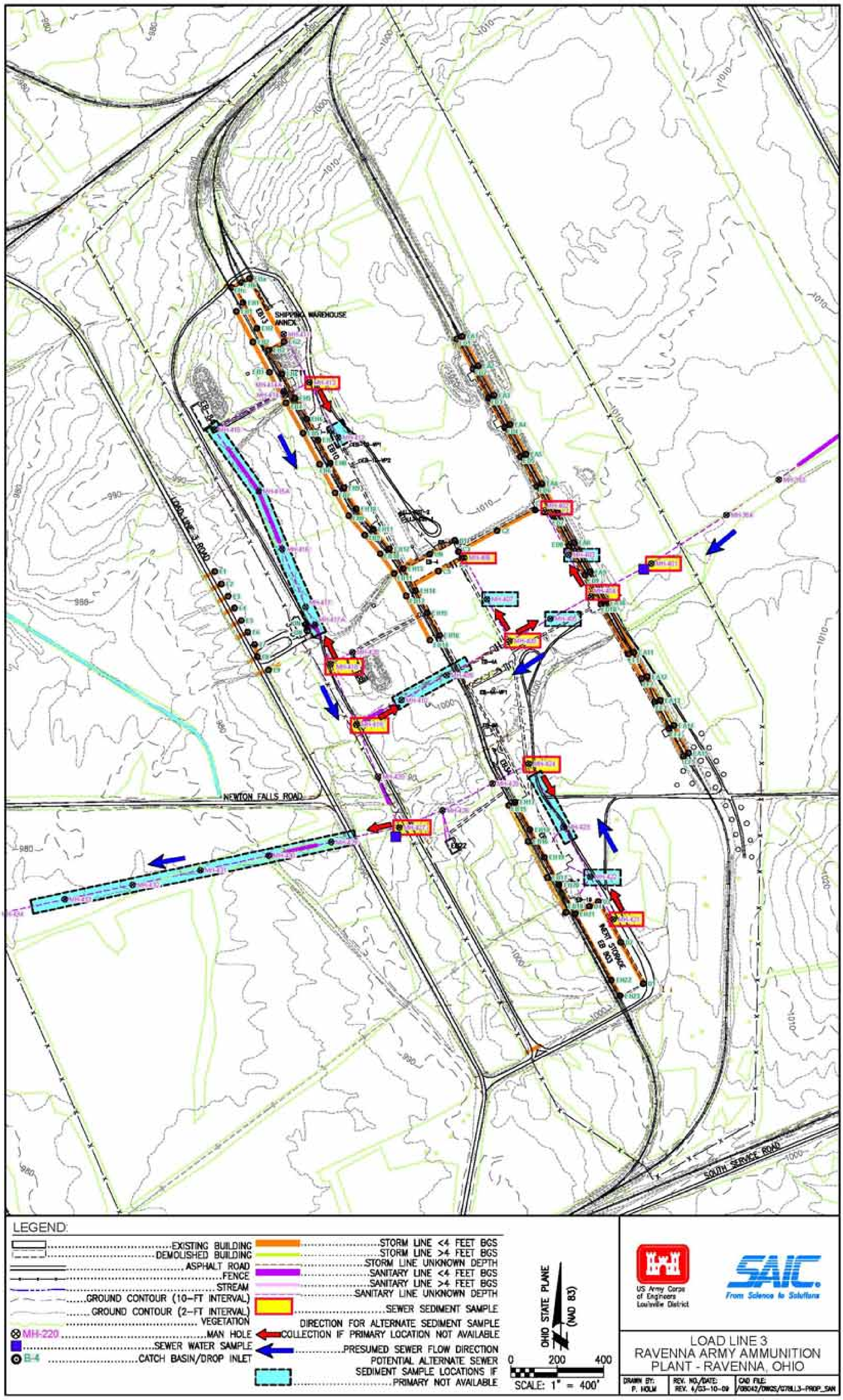

Figure G-5. Proposed Sanitary Sewer Sampling Locations at Load Line 3

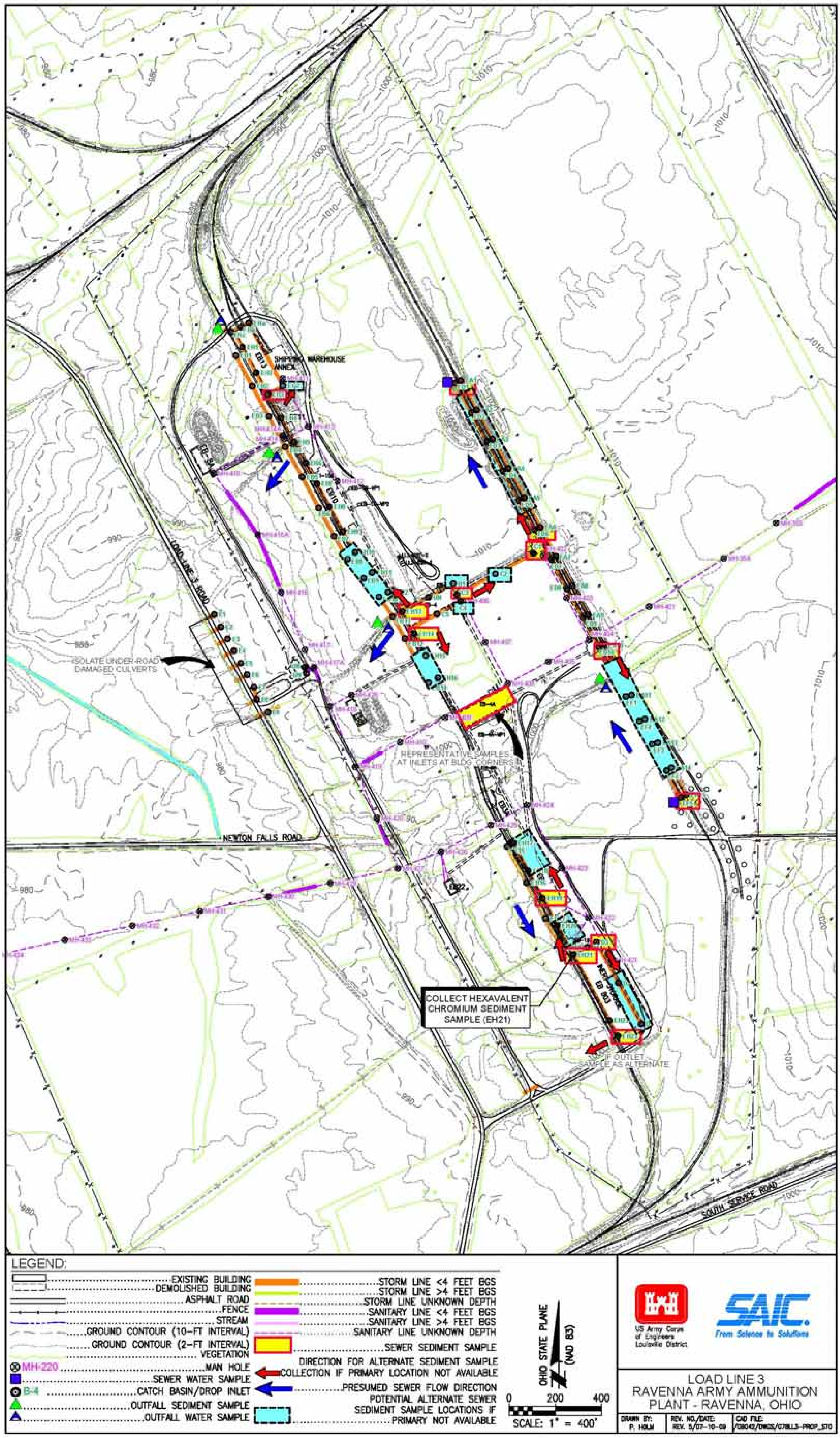

Figure G-6. Proposed Storm Sewer Sampling Locations at Load Line 3

APPENDIX H
Load Line 4

H.0 LOAD LINE 4

H.1 AREA DESCRIPTION

Load Line 4 was used to melt and load TNT into large-caliber shells, bombs, and antitank mines (Figure H-1). Bulk TNT was offloaded at Building G-16, transported to G-11 for screening, and subsequently to Buildings G-10 or G-15 for additional preparation. Following preparation, bulk explosives were transported to the melt-pour building (G-8) for processing and loading into shells. Once the primary TNT charge was loaded into the shells, they were transported to Buildings G-12 and G-12A for cooling. Funnel removal, face off operations, and drilling operations for booster charges or other preparation steps were conducted in Building G-13, before quality assurance of the primary charge was conducted in Building G-13A. Buildings G-18, G-19, and G-19A housed packing and shipping operations, and Building G-9 was used as a magazine. Inert material was received and warehoused at Buildings G-1, G-1A, G-2, and G-3. The line operated briefly during World War II and again from 1951 to 1957.

During its operational history, Load Line 4 produced about 1.2 million munitions. Pink water generated during operations was collected in concrete sumps and pumped via an overhead 6-in. diameter cast iron flume to a settling basin and sawdust filtration unit located southwest of Building G-8. Effluent from the filtration unit was discharged to an unlined drainage ditch that flows into a 2 acre pond which discharged to a surface stream that exits the facility at a point south of the load line. When the facility was at full capacity, Load Line 4 generated approximately 3,390,000 L (895,000 gal) of pink water per month from washdown and steam decontamination of equipment. The buildings and structures at Load Line 4 have been demolished.

Load Line 4 contains separate storm and sanitary sewer systems. The sanitary sewer system at Load Line 4 is part of the Sand Creek Treatment Plant network (shown in Plate A-2). The storm sewer network discharged to a series of surface drainage conveyances throughout the load line. The storm sewer and sanitary sewer system infrastructures largely remain in place, although portions of the systems have sustained significant damage or have been obstructed with debris during building demolition activities.

H.2 PREVIOUS INVESTIGATIONS

The *Phase II Remedial Investigation* for Load Line 4 included sewer water and sediment sampling and a video camera survey of the sewer lines (USACE 2004c). At the time of sampling, visual inspection indicated that most of the storm and sanitary sewer systems at Load Line 4 were above the water table and were dry. In total, sewer sediment samples were collected at three storm inlets and six sanitary manholes. Sewer water samples were collected from three storm cleanout manholes and two sanitary manholes. Three outfall sediment samples were collected from locations where storm sewer lines discharged to surface drainage conveyances in the vicinity of the melt-pour buildings. Previous sewer and outfall sample locations are shown in Figure H-1.

The analytical results indicated that five metals (arsenic, barium, cobalt, manganese and thallium), five polyaromatic hydrocarbons (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene and indeno(1,2,3-cd)pyrene) and PCB-1254 exceeded their respective screening levels in sewer sediment at Load Line 4. No screening level exceedances were observed for sewer water or outfall sediment samples. The screening level exceedances are summarized in Table H-1 and the sample locations with exceedances are shown in Figure H-2. No explosives compounds were detected in either sewer or outfall sediment at Load Line 4. Trace levels of RDX, 2-amino-4,6-DNT, and 4-amino-2,6-DNT were detected in sewer water collected from three of the seven manholes sampled, none of which exceeded their respective screeening levels. Concentrations of polyaromatic hydrocarbons above screening levels were observed in sediment samples at two sanitary sewer manholes on the south side of the load line.

A total of 1,998.47 linear feet of Load Line 4 sewers have been video surveyed (567.86 and 1,430.61 linear feet of sanitary and storm sewer, respectively) to assess the integrity of the lines and their potential to release contaminants to the environment. Video survey locations and findings for the sanitary and storm sewers at Load Line 4 are presented in Figures H-3 and H-4, respectively (USACE 2004c; Lakeshore Engineering Services, Inc. 2007). Initial visual inspection during the spring of 2001 indicated that some of the storm and sanitary sewer systems were dry and above the water table. However, several of the storm sewers contained standing or flowing water indicative of groundwater influx. During the video survey, the sanitary sewer system was found to be largely flooded and several of the planned entry points were obstructed with debris such as leaves, sticks and sediment. The portions of the sanitary and storm sewer system that were accessible for video survey were observed to be cracked and filled with heavy debris, mineral deposits and roots throughout. Some portions of the system were heavily flooded, and breaks in the pipe connections were noted.

Inspections and explosives field screening tests were conducted at Load Line 4 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. During the USACE-CERL (2007) investigation, RDX was observed in a storm manhole next to the melt-pour Building G-8. A total of 23 DropEx™ samples were collected at Load Line 4 sanitary sewer manholes, none of which tested positive for explosives residue. Of the 56 screening tests in total conducted at the storm sewer drop inlets, five DropEx™ samples tested positive for explosives residue. Four of these detections were at storm structures surrounding building G-8 (cleanout manhole CB-MH5, and drop inlets M-1 and M-2), and the fifth was adjacent to building G-9 (drop inlet GA-35). The video surveys conducted at Load Line 4 during the Lakeshore (2007) investigation also involved subsequent swabbing and Expray™ testing of the camera for explosives residue. Two out of four storm sewer runs tested positive for trace explosives, both of which began at drop inlet GA-35 adjacent to building G-9.

Table H-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 4

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Arsenic	mg/kg	9/9	2.4	157	27	19.5
	Barium	mg/kg	9/9	14.8	600	132	350
	Cobalt	mg/kg	9/9	2.4	45.6	10.4	9.1
	Manganese	mg/kg	9/9	155	30,500	4,120	1,950
	Thallium	mg/kg	9/9	0.25	3.6	1.17	0.89
	Benz(a)anthracene	mg/kg	2/3	1.8	3.2	2.5	0.22
	Benzo(a)pyrene	mg/kg	2/3	1.3	3.5	2.4	0.022
	Benzo(b)fluoranthene	mg/kg	2/3	1.7	5.5	3.6	0.22
	Dibenz(a,h)anthracene	mg/kg	2/3	0.15	0.51	0.33	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	2/3	0.51	1.8	1.16	0.22
	PCB-1254	mg/kg	1/9	–	–	0.67	0.12
Sewer Water	*No exceedances*	mg/L	–	–	–	–	–
Outfall Sediment	*No exceedances*	mg/kg	–	–	–	–	–

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
– Not applicable.

H.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 4 are presented in Table H-2, and shown in Figures H-5 (sanitary) and H-6 (storm).

Table H-2. Summary of Proposed Sampling Locations at Load Line 4

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-7+50	None	Sewer Sediment	Represents conditions and potential accumulation point immediately downstream of ejector station.
Sanitary	MH-15+00	None	Sewer Sediment Sewer Water	Represents conditions immediately downstream of Load Line 4 and before entering Atlas Scrap Yard to the north.
Sanitary	MH-E2	MH-E3, MH-E4, MH-E5	Sewer Sediment	Isolates segment draining process buildings G-4 and G-5. Historical data for this manhole indicated inorganics above screening levels.
Sanitary	MH-E6-1	MH-E6-2	Sewer Sediment	Isolates segment servicing Bldg. G-10.
Sanitary	MH-E7	MH-E8, MH-E9	Sewer Sediment	Isolates segment servicing building complex at east side of the load line.
Sanitary	MH-W1	None	Sewer Sediment	Represents key junction point draining the entirety of the western half of Load Line 4 and is last manhole prior to the ejector station. Historical samples collected at this manhole indicated screening level exceedances of organics and inorganics.
Sanitary	MH-W3-1	MH-W3-2	Sewer Sediment	Isolates segment draining process buildings G-13 and G-13A. Historical data for MH-W3-2 on this segment indicated inorganics above screening levels.
Sanitary	MH-W4-1	MH-W4-2, MH-W4-3	Sewer Sediment	Isolates segment servicing building complex at west side of the load line. Historical sampling indicated high concentrations of inorganics above screening levels at upstream portion of this reach.
Sanitary	MH-W5	MH-W6	Sewer Sediment	Isolates segment servicing Bldg. G-6A at southwest portion of load line. Location is immediately upstream of a junction point at which inorganics and organics were detected above screening levels.
Sanitary	Overflow outfall south of MH-W1	None	Outfall Sediment Outfall Water	Presumed overflow outfall from sanitary system. Historical screening level exceedances for both inorganics and organics were observed at MH-W1, immediately upstream of this overflow outfall.

Table H-2. Summary of Proposed Sampling Locations at Load Line 4 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	A-5	A-4, A-3, A-2, A-1	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	A-7	None	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	B-5	B-4, B-3, B-2, B-1	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	B-6	None	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	CB-MH1	GV-2, GH-4, GH-3	Sewer Sediment	Represents major junction point downstream of Bldg G-319. Storm clean-out manhole is potential accumulation point.
Storm	CB-MH12	CB-MH11	Sewer Sediment	Provides characterization at possible major source area (process building G-8). Storm clean-out manhole is potential accumulation point.
Storm	CB-MH13	None	Sewer Sediment	Represents major junction point downstream of Bldg G-3. Storm clean-out manhole is potential accumulation point.
Storm	CB-MH15	CB-MH14	Sewer Sediment	Represents major junction point downstream of Bldgs G-1 and G-1A complex. Storm clean-out manhole is potential accumulation point.
Storm	CB-MH2B	None	Sewer Sediment	Represents major junction point downstream of process building source area. Storm clean-out manhole is potential accumulation point.
Storm	CB-MH3	CB-MH4	Sewer Sediment	Represents major junction point downstream of process building source area. Storm clean-out manhole is potential accumulation point.
Storm	CB-MH5	None	Sewer Sediment	Provides characterization at possible major source area (process building G-8). CB-MH5 tested positive for explosives residue in 2007.
Storm	CB-MH7	CB-MH6	Sewer Sediment	Represents major junction point downstream of process building source area. Storm clean-out manhole is potential accumulation point. Historical data for this location indicated screening level exceedances of inorganics.

Table H-2. Summary of Proposed Sampling Locations at Load Line 4 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	D-3	D-2, D-1	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	E3 (corner of Bldg. G13)	None	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	E3 (south of Bldg. G13)	None	Sewer Sediment	Provides characterization at possible major source area (process building G-13).
Storm	GA12	GA13, GA14, GA15	Sewer Sediment	Isolates segment upstream of Bldg. G-1 and G-1A complex.
Storm	GA16	GA15, GA14, GA13	Sewer Sediment	Isolates segment downstream of Bldg. G-11.
Storm	GA19	GA20, GA21, GA22, GA23	Sewer Sediment	Isolates segment upstream of Bldg. G-1 and G-1A complex.
Storm	GA24	GA23, GA22, GA21, GA20	Sewer Sediment	Isolates segment downstream of Bldg. G-11.
Storm	GA27	None	Sewer Sediment	Provides characterization at possible major source area (process building G-9). Drop inlets and storm lines at this building tested positive for explosives residue in 2007.
Storm	GA30	None	Sewer Sediment	Provides characterization at possible major source area (process building G-16).
Storm	GA31	None	Sewer Sediment	Provides characterization at possible major source area (process building G-16).
Storm	GA35	None	Sewer Sediment	Provides characterization at possible major source area (process building G-9). Drop inlets and storm lines at this building tested positive for explosives residue in 2007.
Storm	GA38	None	Sewer Sediment	Provides characterization at possible major source area (process building G-16).
Storm	GA39	None	Sewer Sediment	Provides characterization at possible major source area (process building G-16).
Storm	H-2	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12A).
Storm	H-3	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12A).
Storm	H-4	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12A).

Table H-2. Summary of Proposed Sampling Locations at Load Line 4 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	H-5	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12A).
Storm	J-2	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12).
Storm	J-3	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12).
Storm	J-4	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12).
Storm	J-5	None	Sewer Sediment	Provides characterization at possible major source area (process building G-12).
Storm	M-0	None	Sewer Sediment	Provides characterization at possible major source area (process building G-8). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	M-1	None	Sewer Sediment	Provides characterization at possible major source area (process building G-8). Drop inlet M-1 tested positive for explosives residue in 2007.
Storm	M-2	None	Sewer Sediment	Provides characterization at possible major source area (process building G-8). Drop inlet M-2 tested positive for explosives residue in 2007.
Storm	M-3	None	Sewer Sediment	Provides characterization immediately downstream of possible major source area (process building G-8). Drop inlets at this building tested positive for explosives residue in 2007.
Storm	Northeast-most "UN" at Bldg G19	Two "UN" to southwest	Sewer Sediment	Represents segment to northwest of Bldg. G-19.
Storm	1st major outfall south of Bldg. G12	None	Outfall Sediment Outfall Water	Major storm outfall downstream of main process buildings complex.
Storm	2nd major outfall south of Bldg. G12 (south of CB-MH4)	None	Outfall Sediment Outfall Water	Major storm outfall downstream of main process buildings complex.
Storm	Outfall at bridge, southwest of GA-34	None	Outfall Sediment Outfall Water	Major storm outfall draining northern portion of the load line.
Storm	Outfall at bridge, southwest of GA-42	None	Outfall Sediment Outfall Water	Major storm outfall draining northern portion of the load line.
Storm	Outfall east of Bldg G4	None	Outfall Sediment Outfall Water	Potential storm outfall draining east portion of load line.

Table H-2. Summary of Proposed Sampling Locations at Load Line 4 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Storm	Outfall east of GA-5	None	Outfall Sediment	Major storm outfall draining northeast portion of load line.
			Outfall Water	
Storm	Outfall north of Bldg. G19, inline with "UN" inlets	None	Outfall Sediment	Major storm outfall to the northwest of Bldg. G-19.
			Outfall Water	
Storm	Outfall north of GA-31	None	Outfall Sediment	Storm outfall associated with process building-16.
			Outfall Water	
Storm	Outfall northeast of CB-MH1	None	Outfall Sediment	Major storm outfall draining Bldg. G-19.
			Outfall Water	
Storm	Outfall southwest of Bldg. G5	None	Outfall Sediment	Potential storm outfall draining east portion of load line.
			Outfall Water	
Storm	Outfall southwest of CB-MH2B	None	Outfall Sediment	Major storm outfall draining the Bldgs G-13 and G-13A complex.
			Outfall Water	
Storm	Outfall west of GA-10	None	Outfall Sediment	Potential storm outfall draining Bldgs G-1 and G-1A.
			Outfall Water	

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 4 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

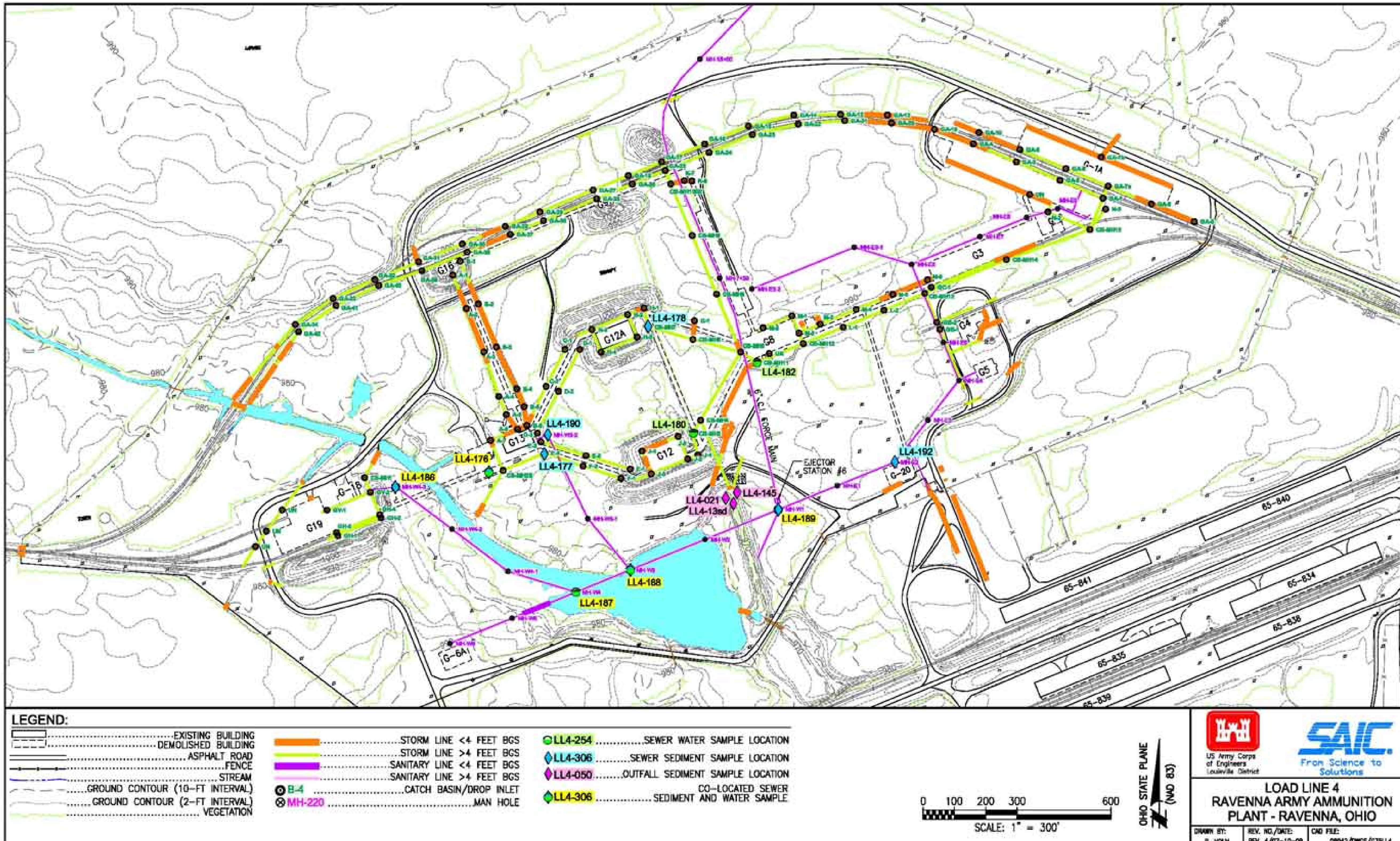

Figure H-1. Historical Sewer Sampling Locations at Load Line 4

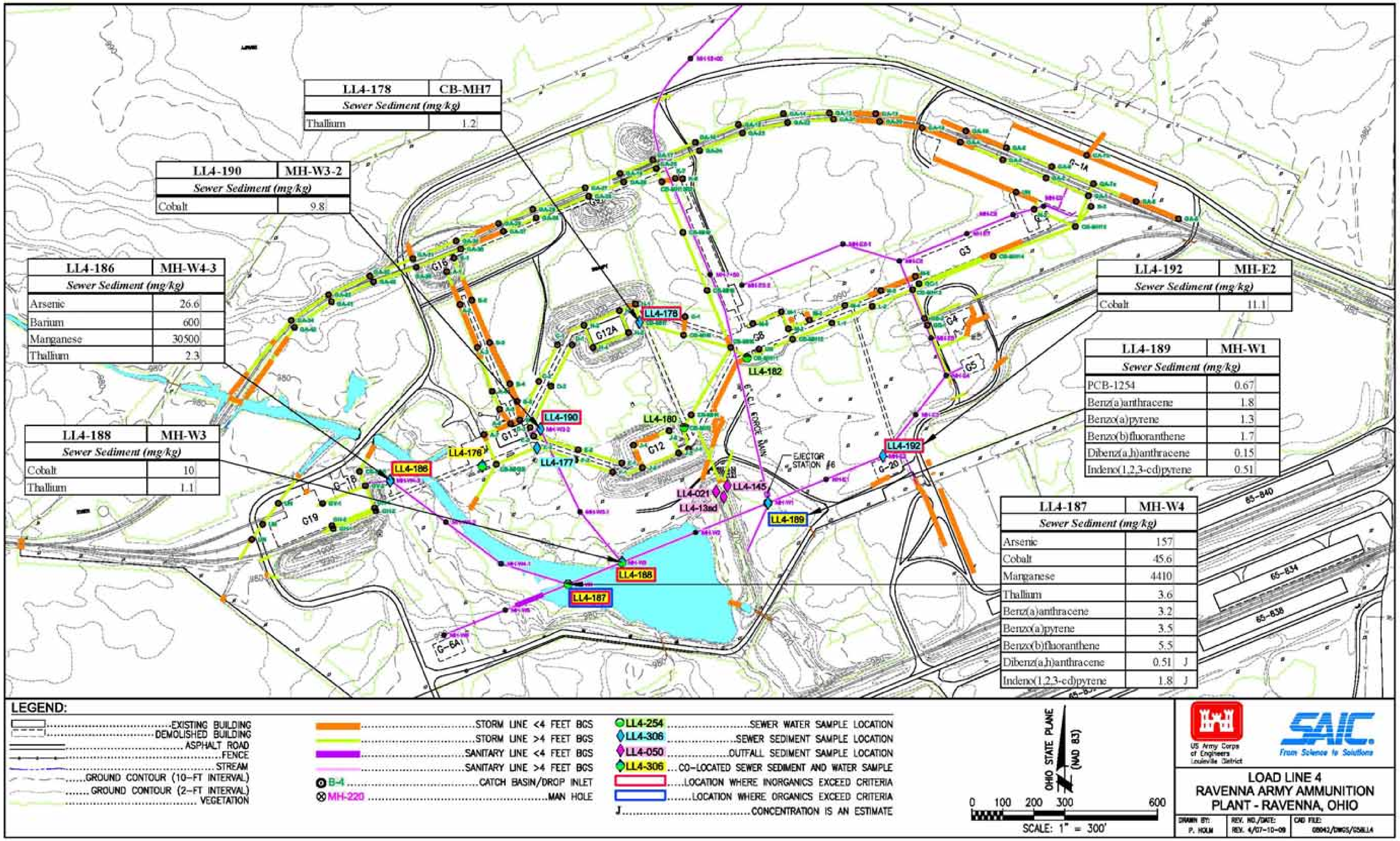

Figure H-2. Historical Exceedances for Sewer Sampling Locations at Load Line 4

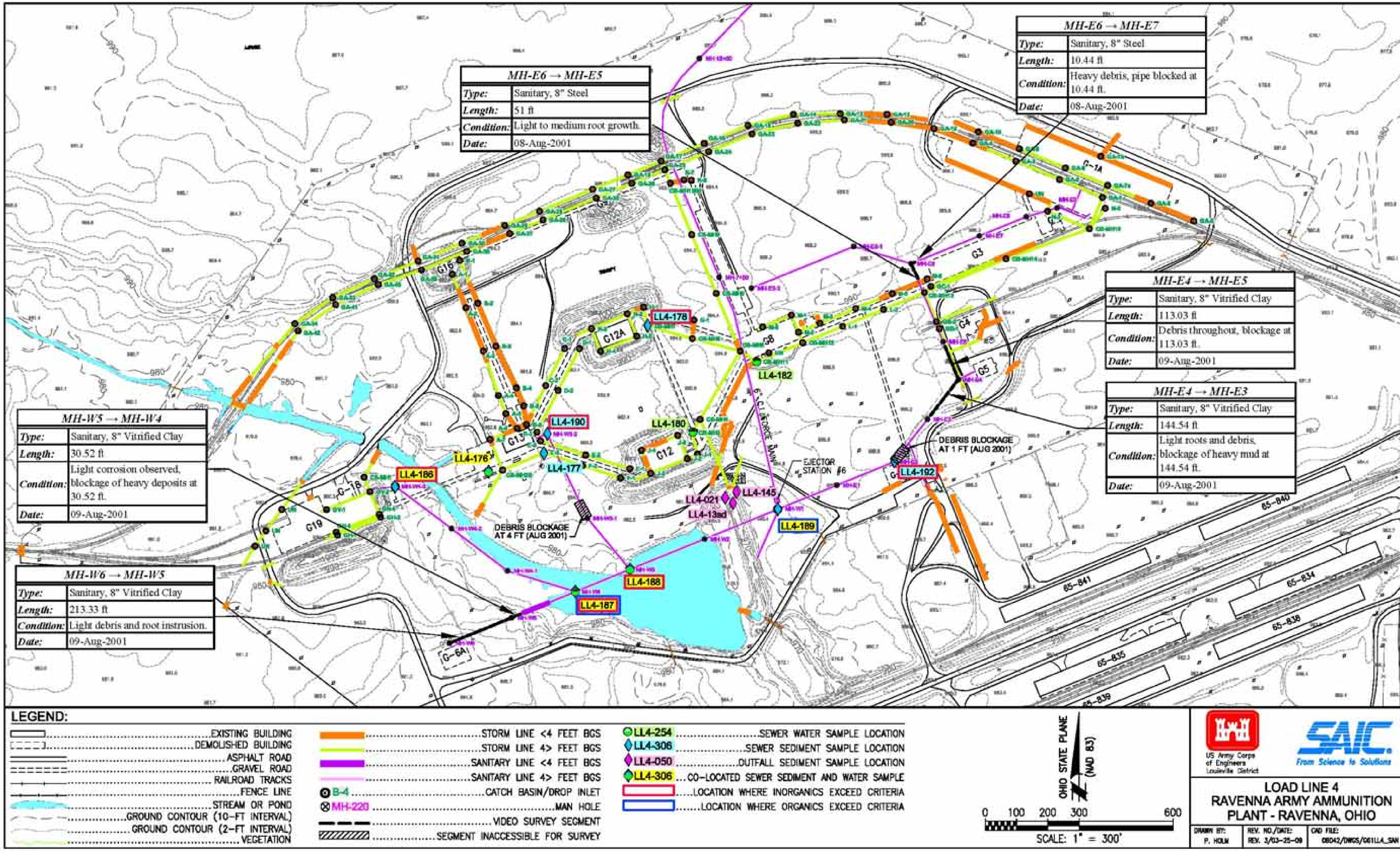

Figure H-3. Locations of Previous Sanitary Sewer Video Surveys at Load Line 4

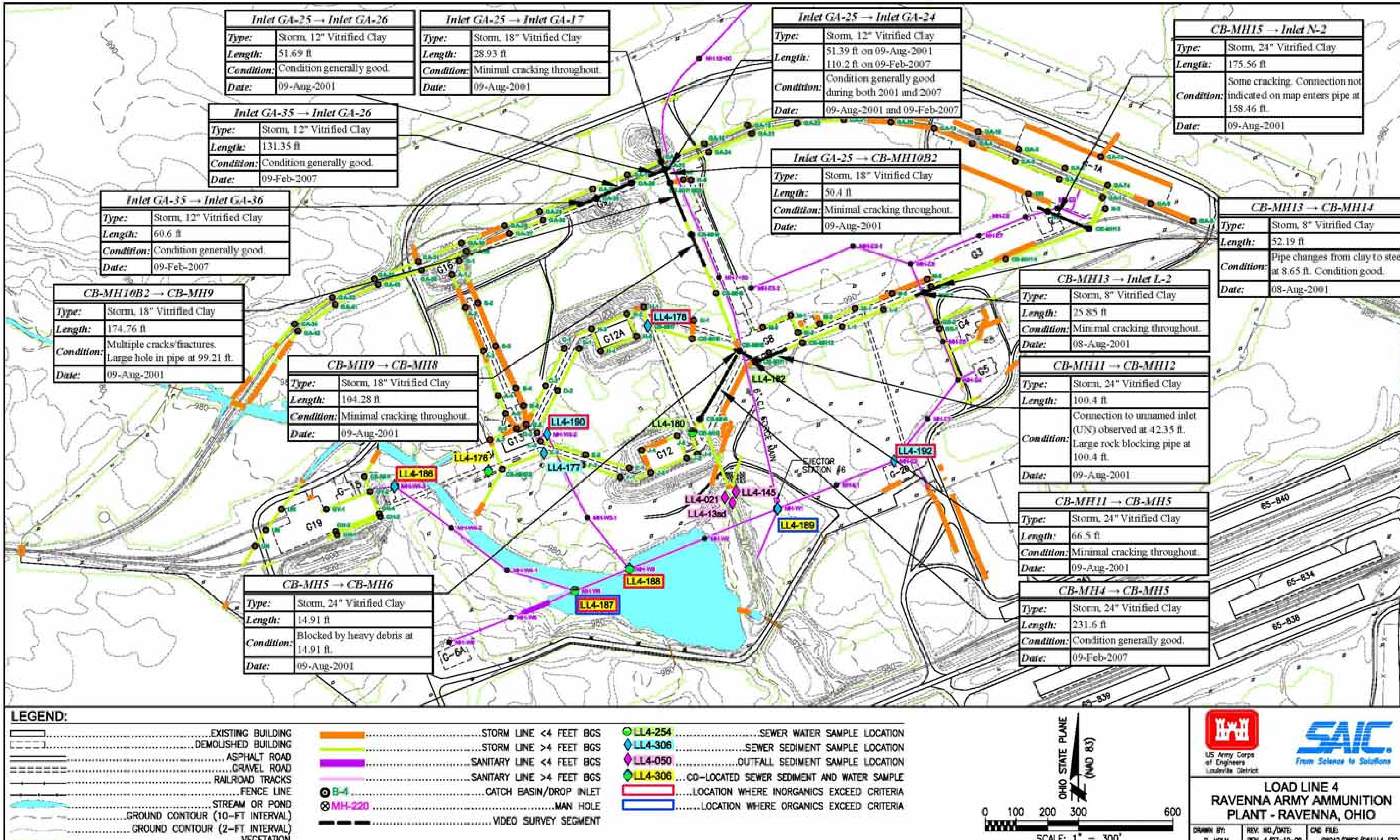

Figure H-4. Locations of Previous Storm Sewer Video Surveys at Load Line 4

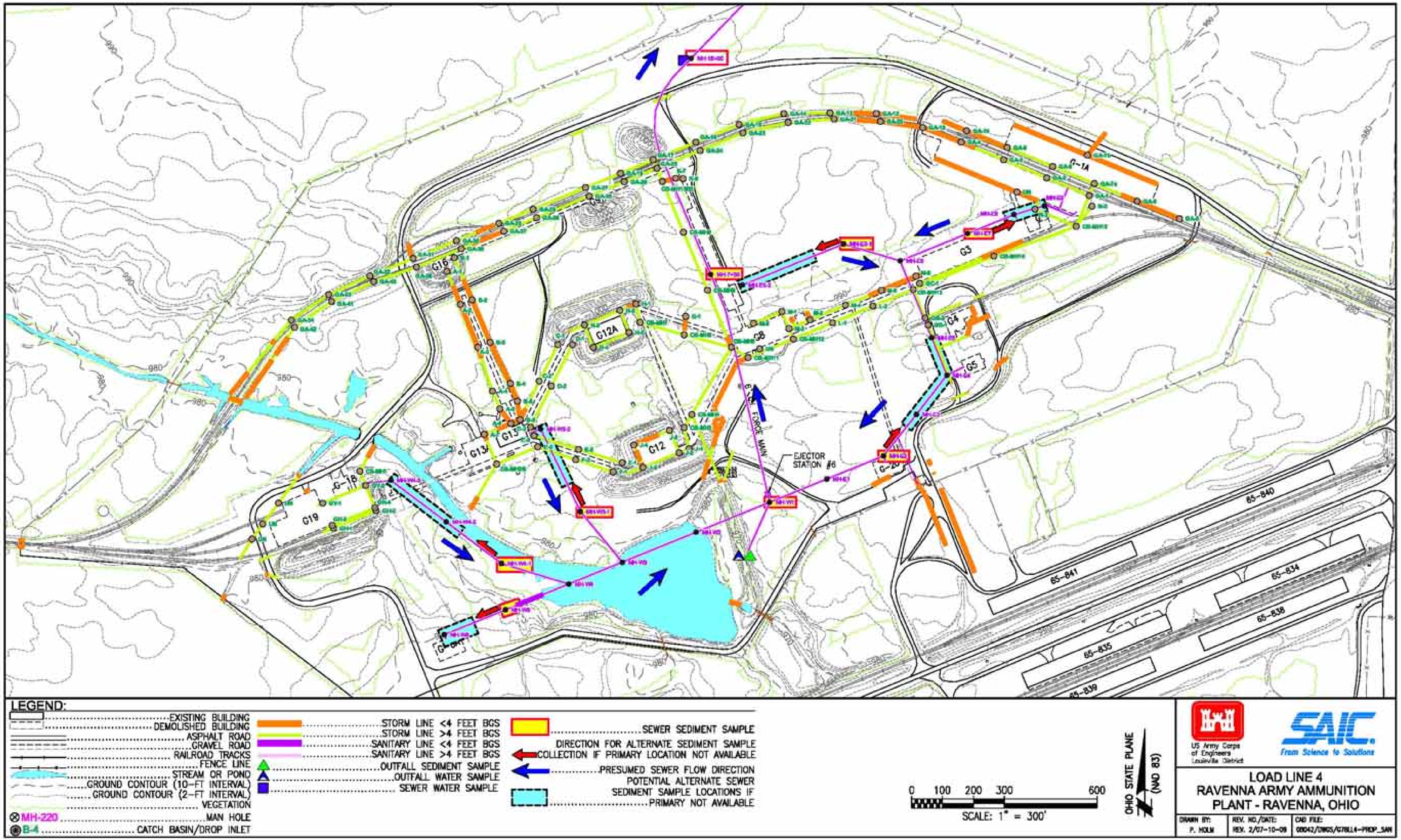

Figure H-5. Proposed Sanitary Sewer Sampling Locations at Load Line 4

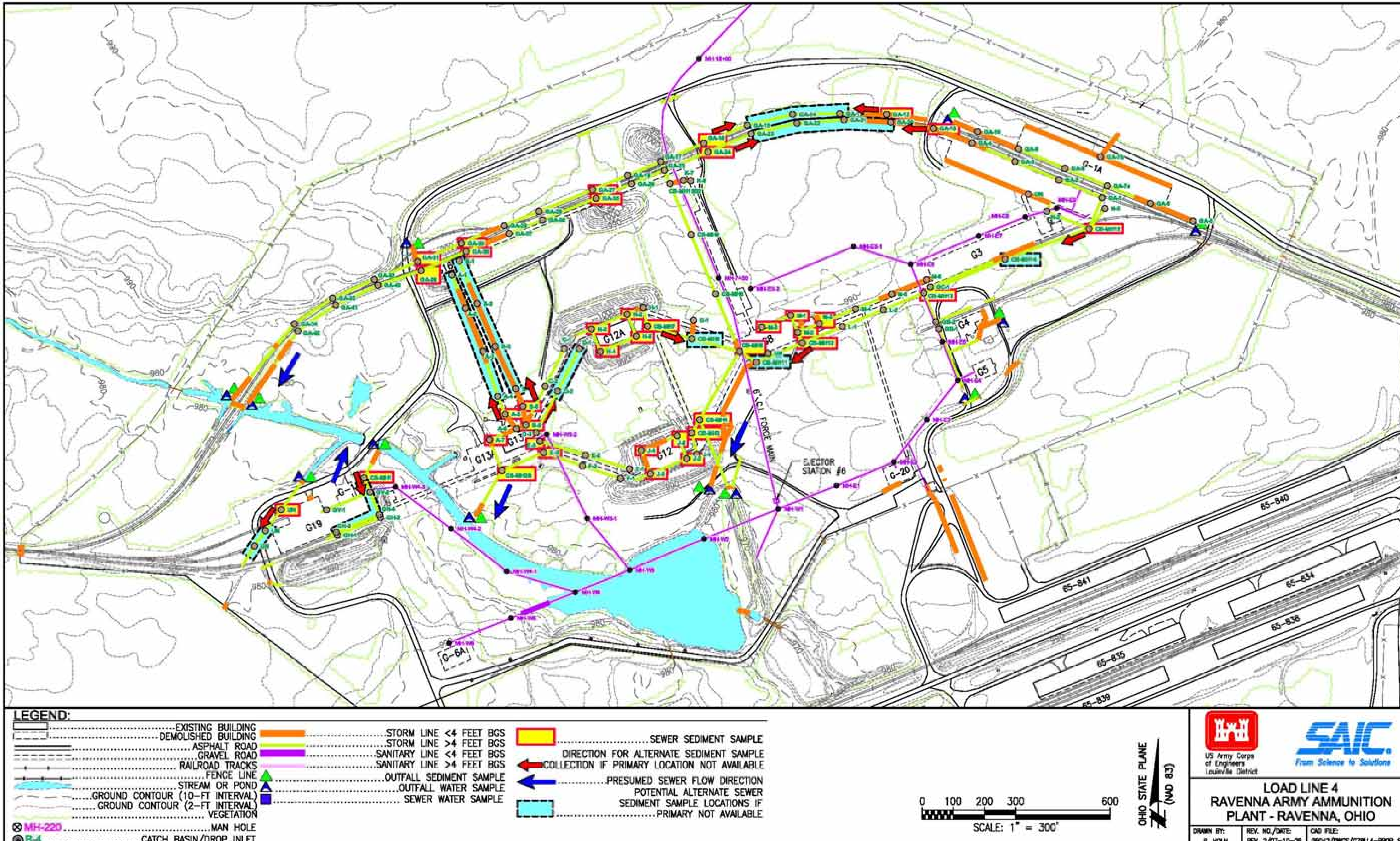

Figure H-6. Proposed Storm Sampling Locations at Load Line 4

APPENDIX I
Load Line 5

I.0 LOAD LINE 5

I.1 AREA DESCRIPTION

Load Line 5 is a 39-acre AOC that consisted of 18 process buildings (Figure I-1). The AOC operated as a finished product assembly line from 1941 to 1945 to produce fuzes for artillery projectiles. Operations were discontinued at the end of World War II and process equipment was removed in 1945. Load Line 5 has been inactive for more than 50 years and is overgrown with vegetation consisting of young trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

During its operational history, buildings at Load Line 5 were utilized for primer manufacturing (1F-1, 1F-3, 1F-4, 1F-9 and 1F-18), delay component manufacturing (1F-6, 1F-7, 1F-8, 1F-19 and 1F-20), assembly and testing (1F-11 and 1F-12), and as a detonator service magazine (1F-10). There is no documented historical evidence that bulk handling of primary explosives occurred within the boundaries of Load Line 5, except the black powder which was used in the manufacture of delay components at this line and the mercury fulminate primer which was loaded and assembled within the line. All other primary explosives were delivered and handled as sealed and finished sub-assemblies.

The sanitary sewer system at Load Line 5 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

I.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at Load Line 5 in 2004 as part of the *Final Characterization of 14 AOCs* investigation (MKM Engineers, Inc. 2007a). At the time of sample collection, only four of the ten sewers surveyed contained sufficient water for sample collection. Only one of the ten sewer locations contained enough sewer sediment for sample collection. The only analytes in the sediment sample to exceed screening levels were the metals chromium and cobalt. Nitrate and three polyaromatic hydrocarbons (benz(a)anthracene, bis(2-ethylhexyl)phthalate and indeno(1,2,3-cd)pyrene) were detected above screening levels in sewer water. These exceedances are summarized in Table I-1 and the sample locations with exceedances are shown in Figure I-2. No explosive compounds or nitrate were detected in the sewer sediment samples, but elevated nitrate concentrations were observed in all four sewer water samples, exceeding the screening level for nitrate at two locations within the load line. Trace concentrations of the propellant nitroglycerine was detected in one sewer water sample well below its screening level.

Inspections and explosives field screening tests were conducted at Load Line 5 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 5 lacks any significant storm management structures. During the USACE-CERL (2007) investigation, no visual evidence of trace explosives was observed. A total of 14 DropEx™ samples were collected at Load Line 5 sanitary sewer manholes, none of which tested positive for explosives residue.

Table I-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 5

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Chromium	mg/kg	1/1	—	—	20	18.1
	Cobalt	mg/kg	1/1	—	—	9.1	9.4
Sewer Water	Benz(a)anthracene	mg/L	1/4	—	—	0.00012	0.000014
	Bis(2-ethylhexyl)phthalate	mg/L	1/4	—	—	0.01	0.0035
	Indeno(1,2,3-cd)pyrene	mg/L	1/4	—	—	0.0002	0.0000078
	Nitrate	mg/L	4/4	0.11	2600	1,275	25

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.

I.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 5 are presented in Table I-2, and shown in Figure I-3.

Table I-2. Summary of Proposed Sampling Locations at Load Line 5

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-BH3	MH-BH4, MH-BH5, MH-BH6	Sewer Sediment	Isolates one of two segments northeast and outside the boundaries of the load line.
Sanitary	MH-IF2	MH-IF1	Sewer Sediment	Represents conditions immediately downstream of the load line and before joining with the main trunk line draining Load Lines 9 and 10. Sewer water at this location previously exhibited organics above screening levels; sediment was not collected.
			Sewer Water	
Sanitary	MH-IF3	None	Sewer Sediment	Represents segment draining Building IF3. Also provides confirmation for high nitrate concentrations above screening levels observed in previous sewer water samples.
			Sewer Water	

Table I-3. Summary of Proposed Sampling Locations at Load Line 5 (continued)

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-IF4	MH-IF9	Sewer Sediment Sewer Water	Isolates segment draining Buildings IF4, IF6, and IF7.
Sanitary	MH-IF8	None	Sewer Sediment	Characterizes conditions at Building IF13.
Sanitary	MH-IF10	None	Sewer Sediment Sewer Water	Represents segment draining buildings on east side of the load line. Also provides confirmation for high nitrate concentrations above screening levels observed in previous sewer water samples.
Sanitary	MH-IF13	MH-IF12, MH-IF11	Sewer Sediment	Isolates one of two segments northwest and outside the boundaries of the load line.
Sanitary	MH-MP1	None	Sewer Sediment Sewer Water	Represents conditions immediately upstream of Load Line 5.
Sanitary	MH-MP3	MH-MP4, MH-MP5, MH-MP6	Sewer Sediment	Isolates one of two segments northwest and outside the boundaries of the load line (former sub-station).
Sanitary	MH-MP9	MH-MP10	Sewer Sediment	Isolates one of two segments northeast and outside the boundaries of the load line.
Sanitary	Outfall to north of MH-BH1	None	Outfall Sediment Outfall Water	Represents potential sanitary system overflow outfall.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 5 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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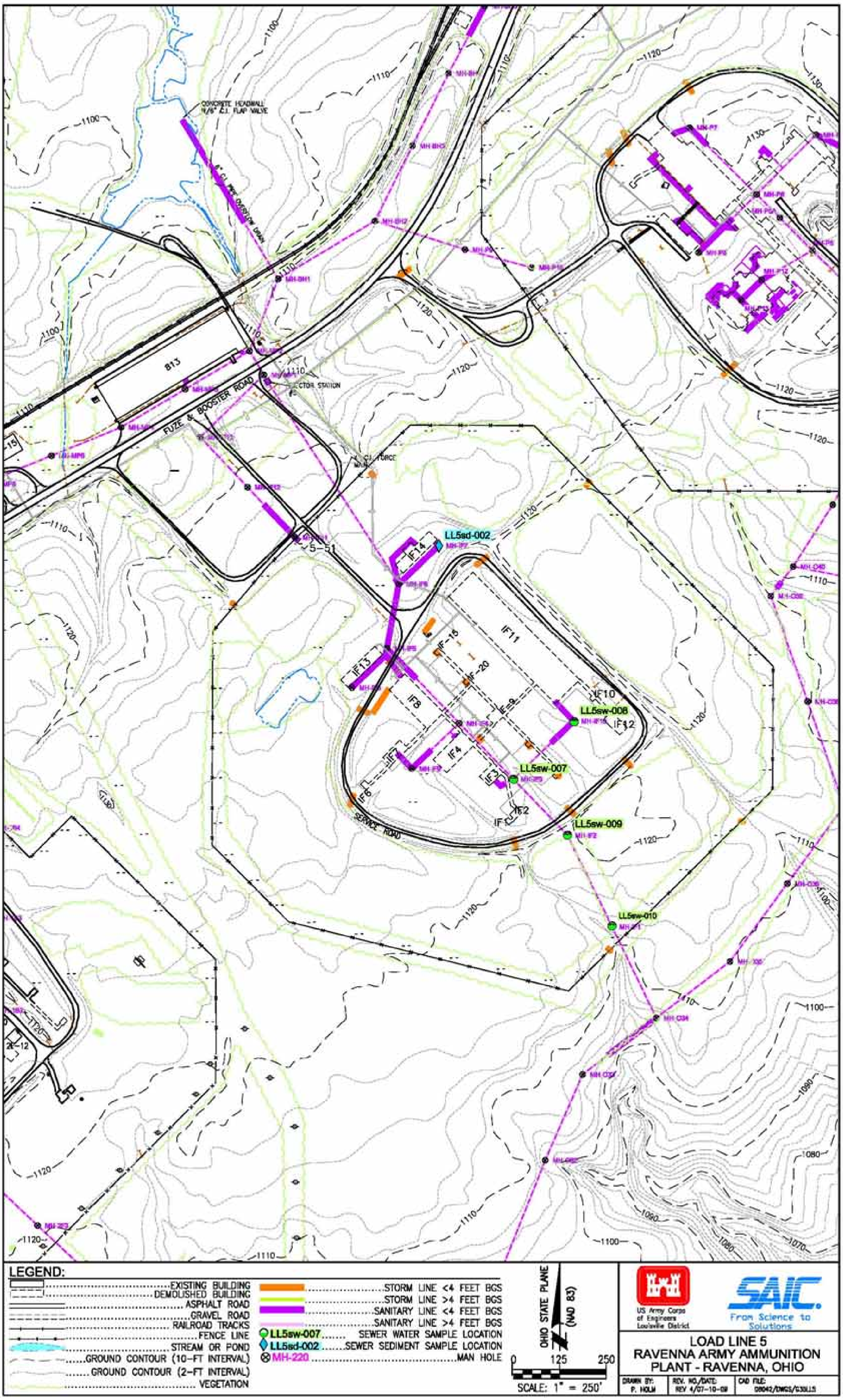

Figure I-1. Historical Sewer Sampling Locations at Load Line 5

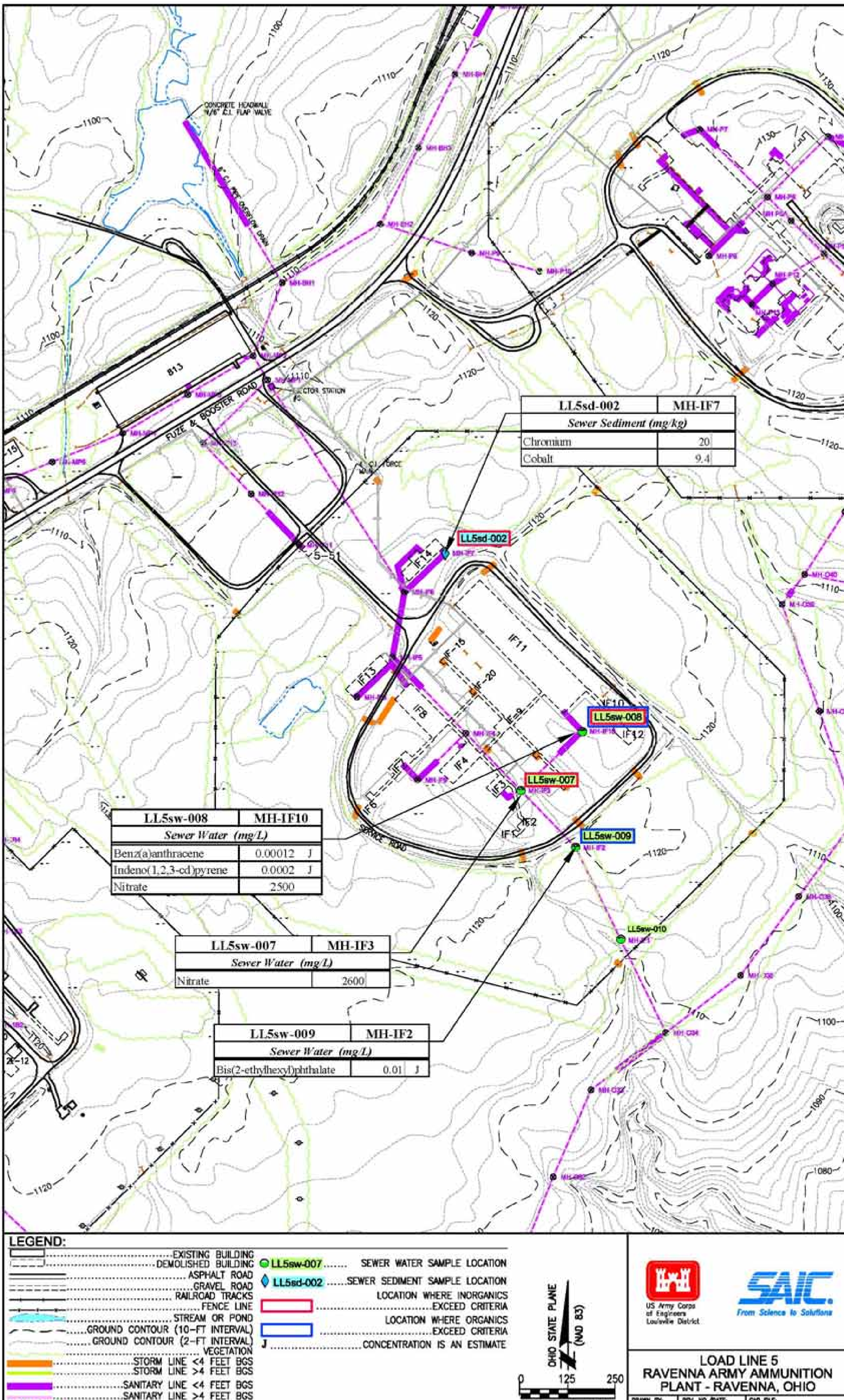

Figure I-2. Historical Exceedances for Sewer Samples at Load Line 5

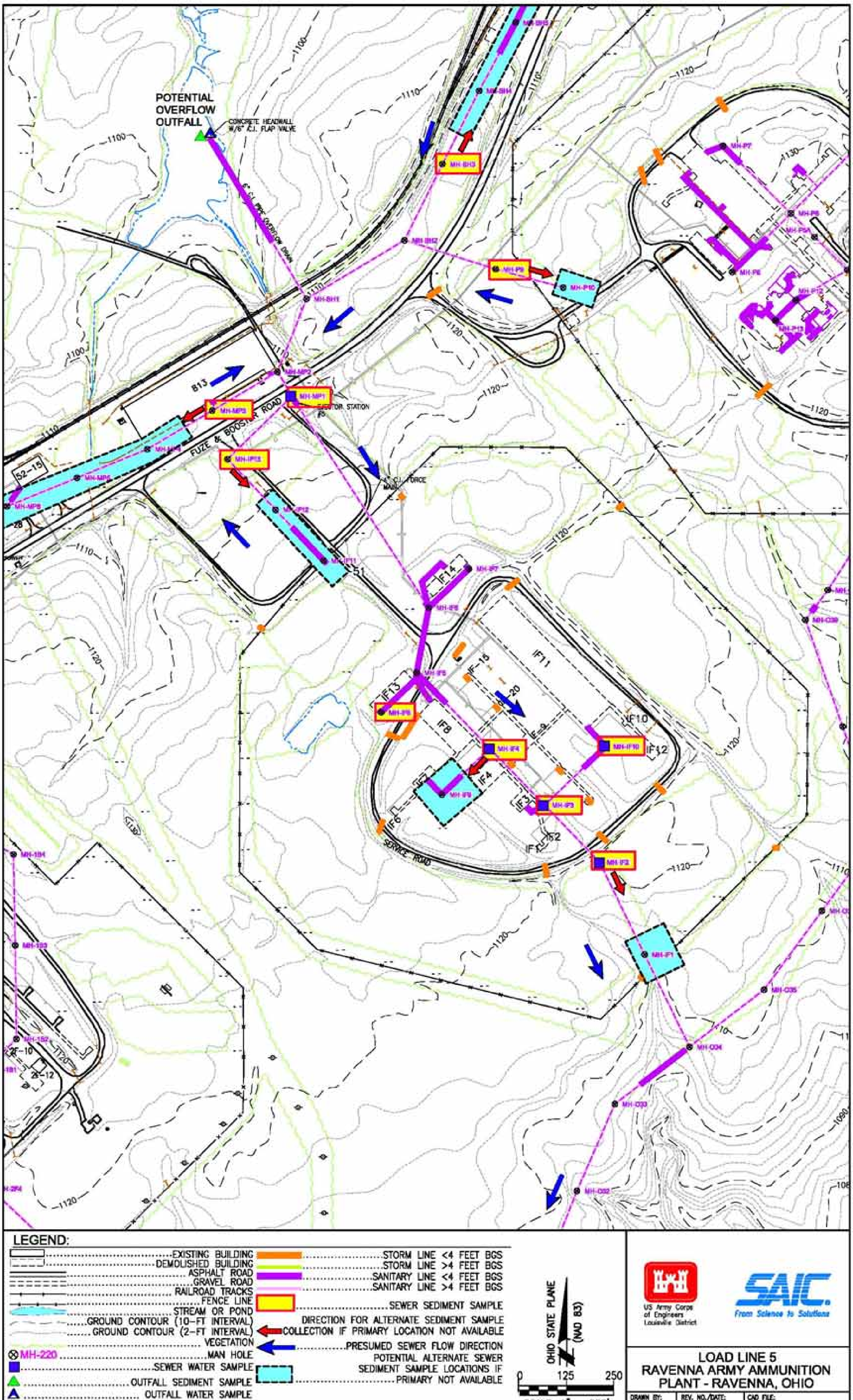

Figure I-3. Proposed Sewer Sampling Locations at Load Line 5

APPENDIX J
Load Line 6

J.0 LOAD LINE 6

J.1 AREA DESCRIPTION

Load Line 6 is approximately 51 acres in size (Figure J-1). From 1941 to 1945, Load Line 6 operated primarily as a fuze assembly line; however, Buildings 2F-1 and 2F-3 were used as mercury fulminate dry house and mixing building, respectively. During its operational history, buildings at Load Line 6 were used for primer loading and storage (2F-4, 2F-9, 2F-18, 2F-34), powder pelleting and storage (2F-6, 2F-7, 2F-19, 2F-33), delay storage and loading (2F-8, 2F-20, 2F-31), fuze assembly and testing (2F-11, 2F-12, 2F-32) and detonator service (2F–10). In the 1950s, Load Line 6 was utilized by Firestone Defense Research for the research and development of various kinds of charges for armor penetration (e.g., shaped, fragmenting disc). Load Line 6 was again used by Firestone Defense Corporation during the late 1970s for applied research and development of shaped charges for the Department of Defense. All buildings at the AOC have since been demolished, and only the test chamber foundation and concrete blocks around the test pond remain at the AOC. A Munitions Response Site (designated RVAAP-33-R-01) associated with a portion of the former Firestone Test Facility exists within the southernmost portion of Load Line 6.

The sanitary sewer system at Load Line 6 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

J.2 PREVIOUS INVESTIGATIONS

Sewer water samples were collected from the sanitary sewer manholes at Load Line 6 in 2003 as part of the *Final Remedial Investigation for Load Line 6* (MKM Engineers, Inc. 2007b). Only two manholes contained enough water for sample collection, and no sewer sediment samples could be collected due to the absence of recoverable quantities of sediment. The explosive RDX was observed at concentrations above screening levels in both of the sewer water samples collected. These exceedances are summarized in Table J-1 and the sample locations with exceedances are shown in Figure J-2. The explosive HMX was also detected in both of the sewer water samples collected, although at concentrations below its screening level.

Inspections and explosives field screening tests were conducted at Load Line 6 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 6 lacks any significant storm management structures. A total of 20 DropEx™ samples were collected at Load Line 6 sanitary sewer manholes, two of which tested positive for RDX residue (manholes MH-2F5 and MH-2F6).

Table J-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 6

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Water	RDX	mg/L	2/2	0.014	0.015	0.0145	0.015

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.

J.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 6 are presented in Table J-2, and shown in Figure J-3.

Table J-2. Summary of Proposed Sampling Locations at Load Line 6

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-1B2	MH-1B3	Sewer Sediment	Isolates the segment draining Building 2-F-32. Manhole immediately downstream of this location exhibited RDX above screening levels in water; sediment was not collected.
Sanitary	MH-1B4	MH-1B5, MH-1B6	Sewer Sediment	Isolates the building complex segment upstream of the main body of the load line.
Sanitary	MH-2F1	None	Sewer Sediment	Isolates the segment draining Buildings 2-F-7 and 2-F-31. Two structures immediately downstream of these reaches tested positive for trace explosives.
Sanitary	MH-2F4	MH-2F3, MH-2F2, MH-2F1	Sewer Sediment Sewer Water	Represents conditions downstream of Load Line 6 before connecting with the trunk line draining Load Line 8.
Sanitary	MH-2F5	None	Sewer Sediment	Represents conditions downstream of Building 2-F-3.
Sanitary	MH-2F8	MH-2F9	Sewer Sediment	Isolates the segment draining Buildings 2-F-14 and 2-F-36. Two structures immediately downstream of these reaches tested positive for trace explosives.
Sanitary	MH-2F10	None	Sewer Sediment	Isolates the segment draining Building 2-F-13. Two structures immediately downstream of these reaches tested positive for trace explosives.
Sanitary	MH-O28	MH-O27, MH-O24, MH-O23, MH-O22, MH-O21	Sewer Sediment Sewer Water	Represents conditions at the confluence of the lines from Load Line 6 and 8 and the remainder of the Fuze and Booster load lines before the combined trunk drains towards the Administration Area.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 6 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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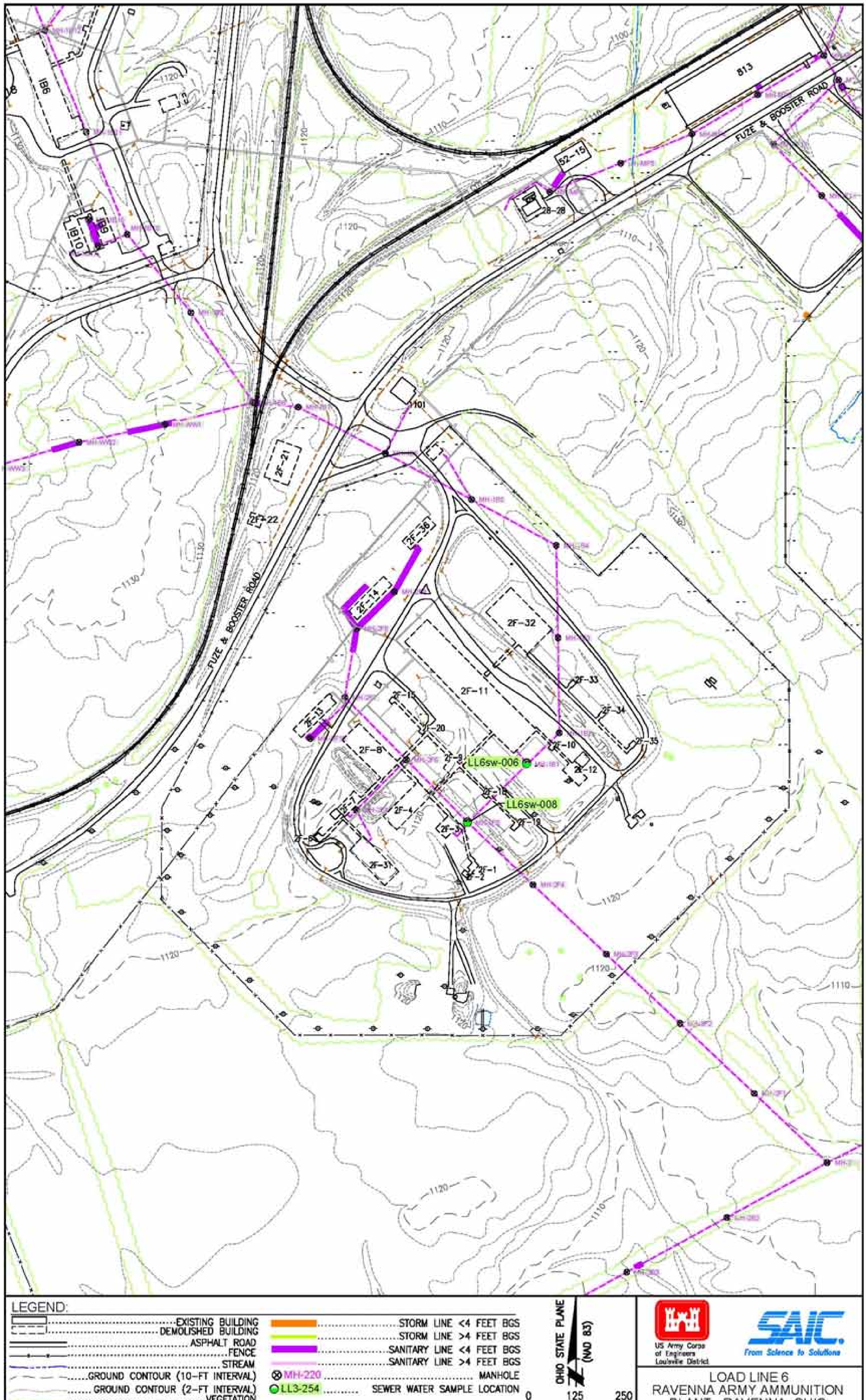

Figure J-1. Historical Sewer Sampling Locations at Load Line 6

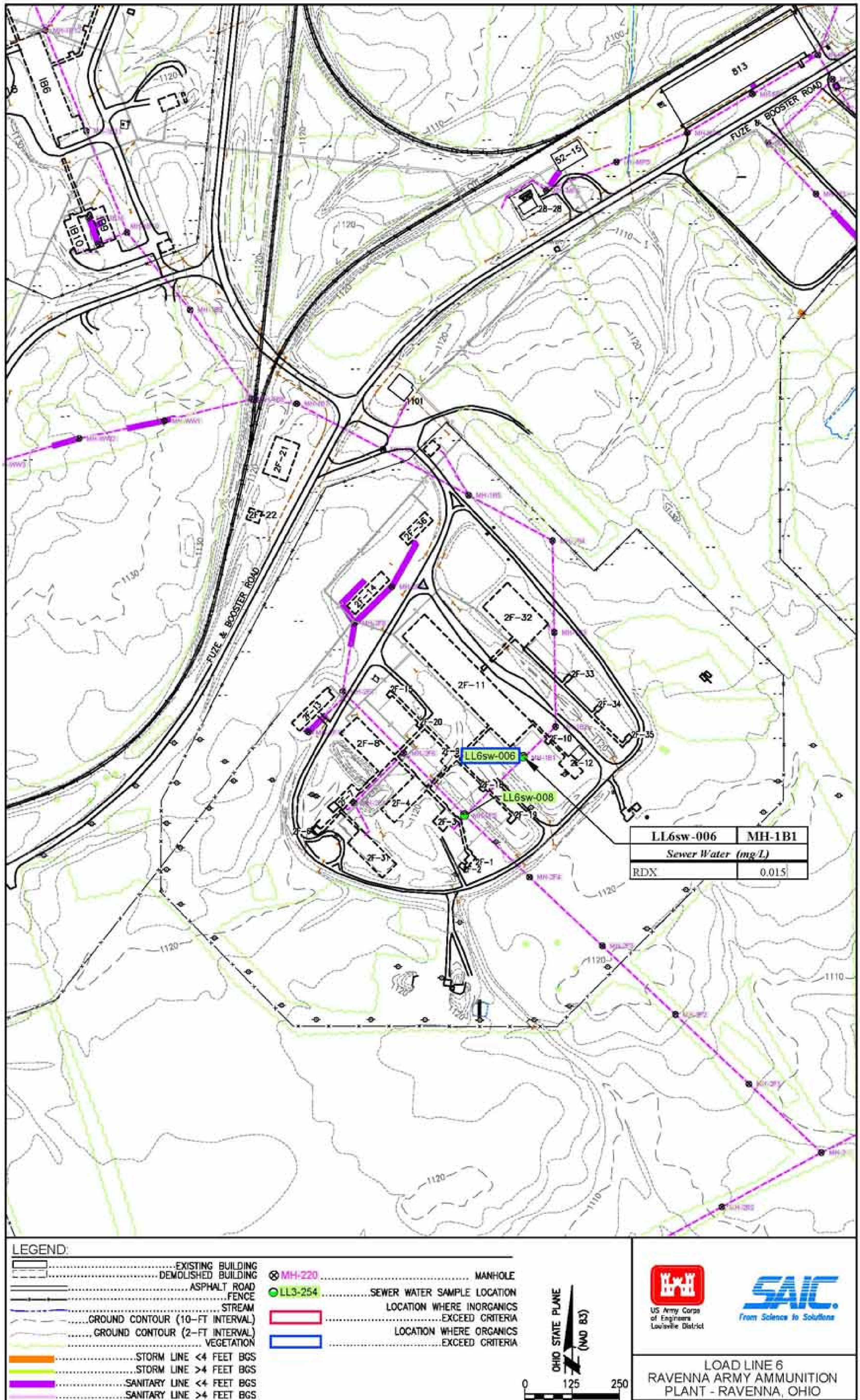

Figure J-2. Historical Exceedances for Sewer Samples at Load Line 6

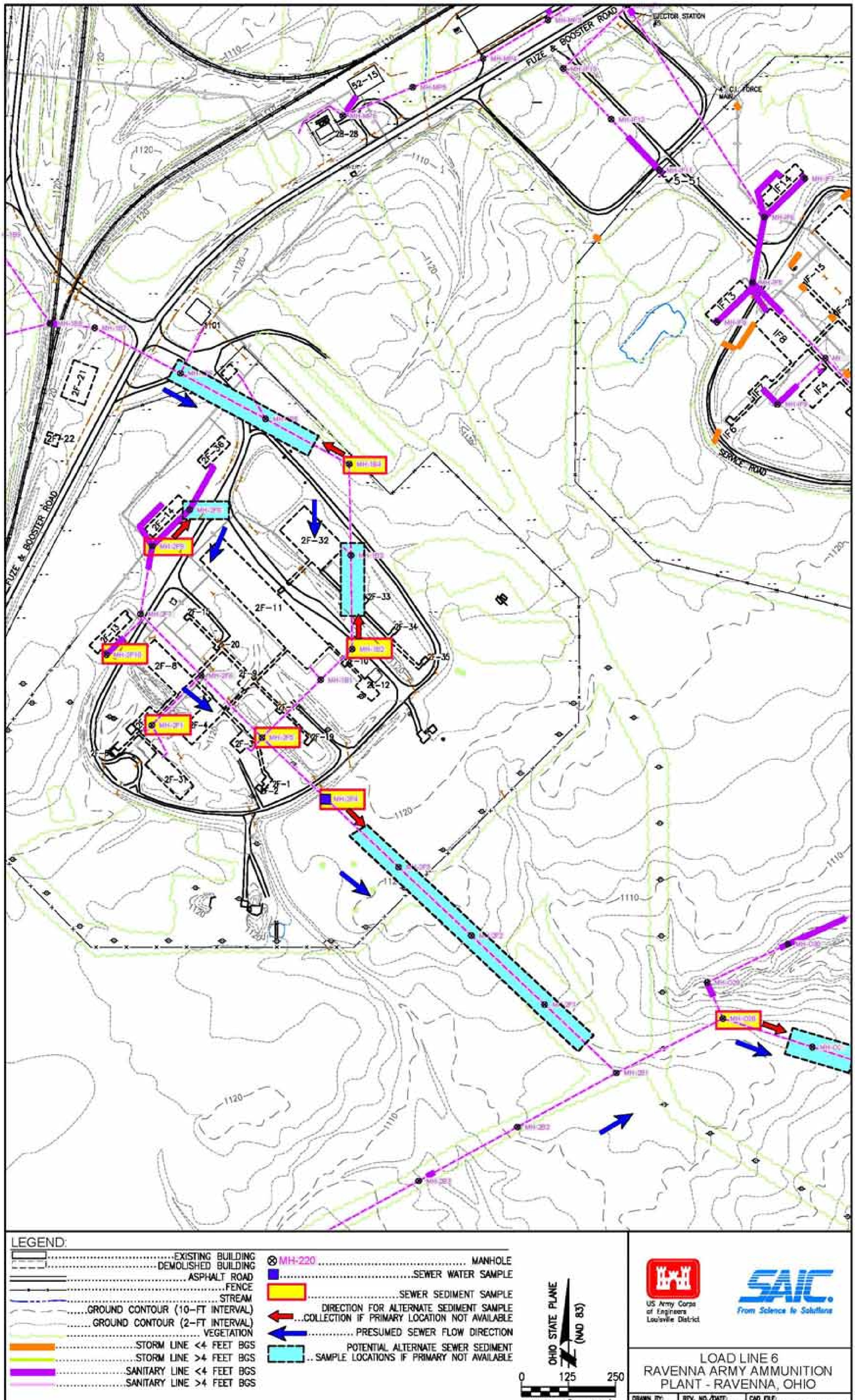

Figure J-3. Proposed Sewer Sampling Locations at Load Line 6

APPENDIX K
Load Line 7

K.0 LOAD LINE 7

K.1 AREA DESCRIPTION

Load Line 7 is a 37-acre AOC formerly used as a booster loading and assembly line for artillery projectiles (Figure K-1). Operations occurred from 1941 until the end of World War II; the booster process equipment was removed in 1945. During this phase in the operational history of the load line, buildings were utilized for explosive processing (1B-1, 1B-2, 1B-3), pellet manufacturing and processing (1B-4, 1B-17, 1B-12, 1B-13), testing (1B-7 and 1B-18), detonator storage (1B-5), booster storage, propellant storage, and assembly and shipping (1B-6). Detonators used in the assembly of the finished product would have been received at Load Line 7 as a sealed unit and primers as a sealed finished sub-assembly.

In 1968, the line was modified to produce M-406 High Explosive and M-407A1 practice 40 mm rounds. During this operational era, buildings were utilized for booster storage (1B-1), pellet magazine (1B-18), main charge storage (1B-2), melt pour and curing (1B-4 and 1B-6A), primer storage and case assembly (1B-12 and 1B-13), fuze storage (1B-17), propellant storage (1B-22), and assembly and shipping (1B-6). A total of 16,000,000 (40-mm) projectiles were assembled at Load Line 7 from 1969-1970, at which time the line was deactivated and the equipment removed. The line was reactivated for the research and development of high explosive shape charges until 1993. From 1989 through 1993, pink water associated with TNT processing was treated at the Load Line 7 treatment plant operating under an Ohio wastewater discharge permit. Load Line 7 has been inactive since 1993 and is overgrown with young trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

The sanitary sewer system at Load Line 7 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

K.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at Load Line 7 in 2003 as part of the *Final Characterization of 14 AOCs* investigation (MKM Engineers, Inc. 2007a). Seven of the ten sanitary sewer manholes contained enough water for sample collection; no water was present in two sewer locations, and one sewer could not be located. These sample locations are shown in Figure K-1. Sewer sediment samples could not be collected at any of the ten manhole locations evaluated since none contained sufficient quantities of recoverable sediment. The analytical results indicated that six polyaromatic hydrocarbons, the explosive RDX and lead exceeded their screening levels in the sewer water samples. These screening level exceedances are summarized in Table K-1 and the sample locations with exceedances are shown in Figure K-2. Five out of the seven sewer water samples exhibited RDX concentrations in excess of its screening limit. Lead exceeded its screening level at two locations, and all six of the polyaromatic hydrocarbons were detected at and exceeded their screening levels at only one location (MH-1B11). The explosives HMX and RDX were detected in all seven of the sewer water samples, and 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene were detected in five of the seven samples. However, no analytes were detected above their screening levels in sewer sediment.

Inspections and explosives field screening tests were conducted at Load Line 7 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 7 lacks any significant storm management structures. A total of 8 DropEx™ samples were collected at Load Line 7 sanitary sewer manholes, none of which tested positive for trace explosive residue.

Table K-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 7

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	*No samples collected*	mg/kg	—	—	—	—	—
Sewer Water	RDX	mg/L	7/7	0.0038	0.054	0.031	0.015
	Lead	mg/L	5/7	0.0074	2.2	0.45	0.015
	Benz(a)anthracene	mg/L	1/7	—	—	0.0014	0.000014
	Benzo(a)pyrene	mg/L	1/7	—	—	0.0018	0.0000008
	Benzo(b)fluoranthene	mg/L	1/7	—	—	0.002	0.0000079
	Chrysene	mg/L	1/7	—	—	0.0016	0.0014
	Dibenz(a,h)anthracene	mg/L	1/7	—	—	0.00042	0.00000052
	Indeno(1,2,3-cd)pyrene	mg/L	1/7	—	—	0.001	0.0000078

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
— Not applicable.

K.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 7 are presented in Table K-2, and shown in Figure K-3.

Table K-2. Summary of Proposed Sampling Locations at Load Line 7

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-1B7	None	Sewer Sediment Sewer Water	Represents conditions downstream of Load Line 7 and the building complex south of the load line before the trunk drains towards Load Line 6. This location previously exhibited inorganics above screening levels.
Sanitary	MH-1B9	None	Sewer Sediment Sewer Water	Represents conditions immediately downstream of Load Line 7 itself.
Sanitary	MH-1B10	MH-1B11, MH-1B17, MH-1B16	Sewer Sediment	Represents conditions at the process buildings on the south segment of the load line. This location previously exhibited RDX above screening levels in water; sediment was not collected.
Sanitary	MH-1B12	MH-1B13, MH-1B14	Sewer Sediment	Represents conditions at the process buildings on the north segment of the load line. This location previously exhibited RDX and multiple other organics above screening levels in water; sediment was not collected.
Sanitary	MH-1B15	None	Sewer Sediment Sewer Water	Represents conditions at the upstream end of the load line.
Sanitary	MH-WW1	MH-WW2, MH-WW3	Sewer Sediment	Isolates the building complex segment south of the load line.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 7 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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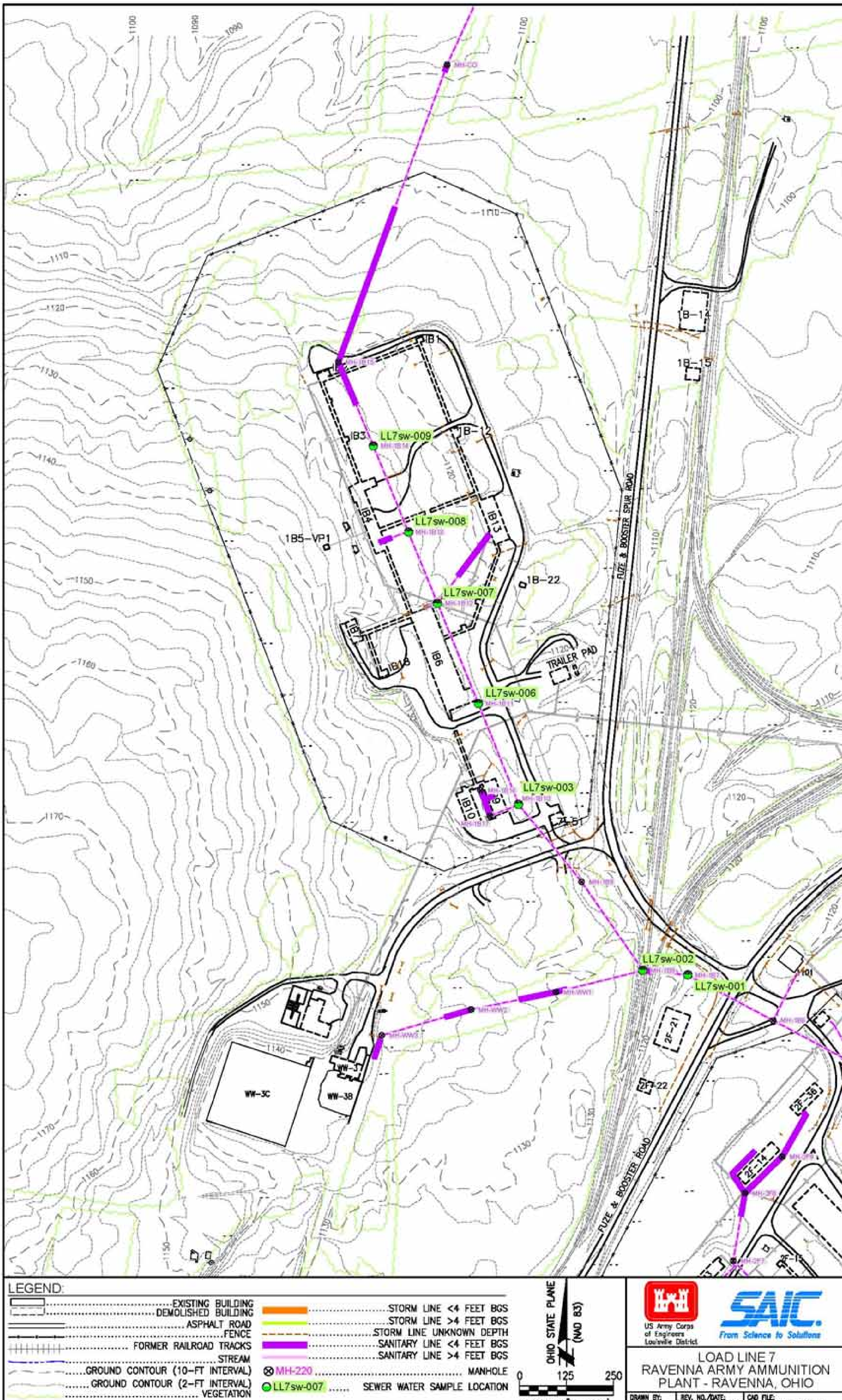

Figure K-1. Historical Sewer Sampling Locations at Load Line 7

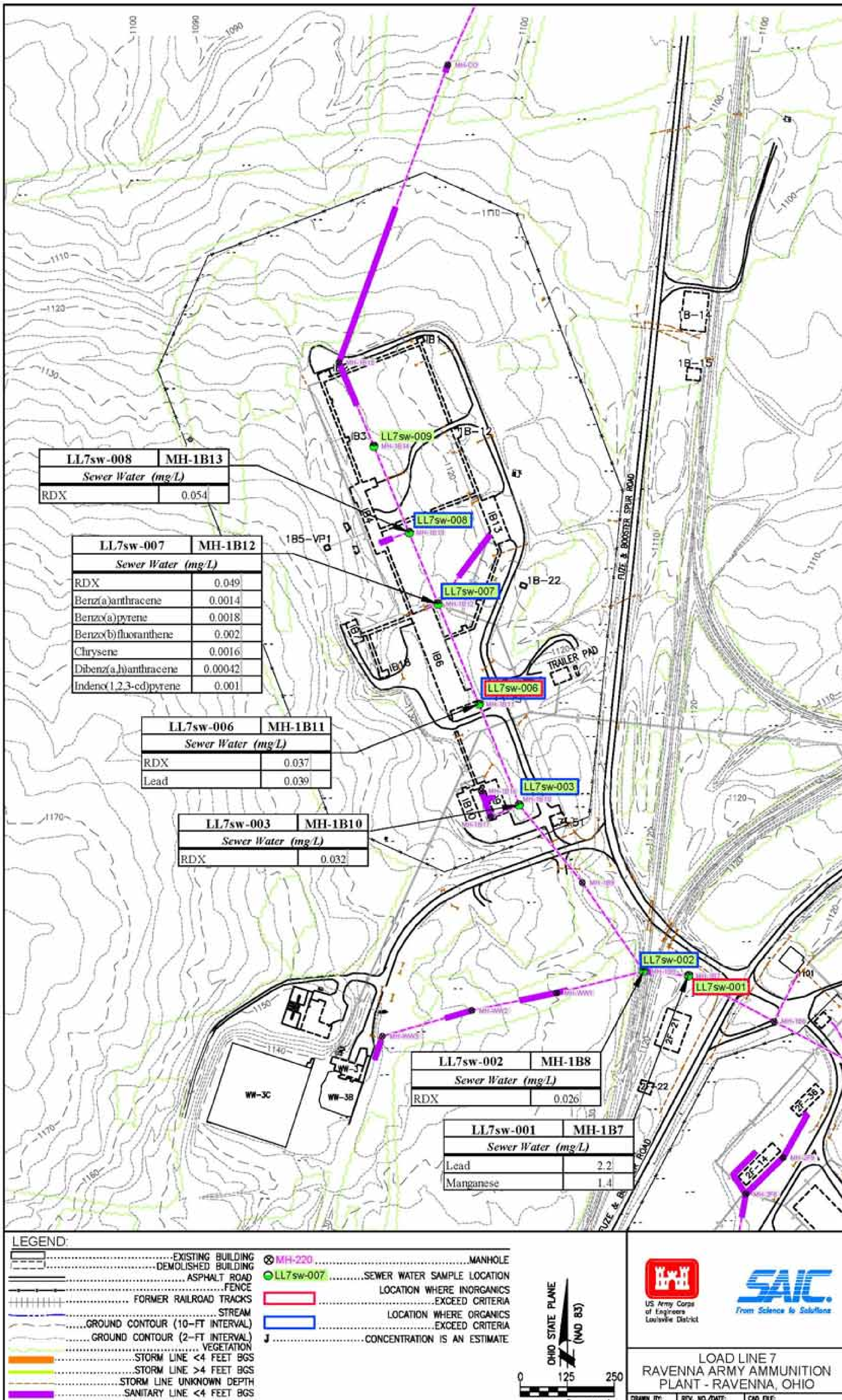

Figure K-2. Historical Exceedances for Sewer Samples at Load Line 7

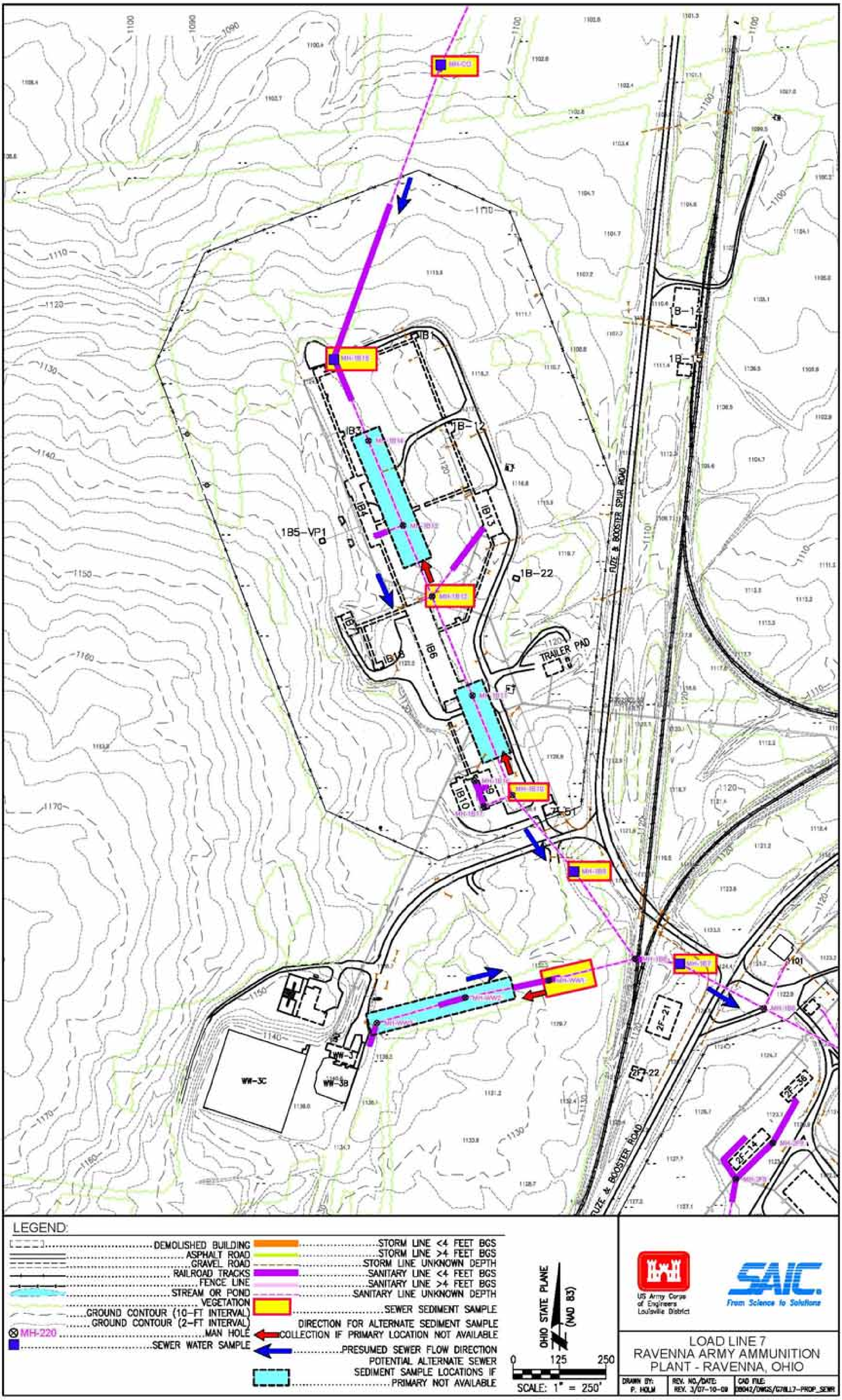

Figure K-3. Proposed Sewer Sampling Locations at Load Line 7

APPENDIX L
Load Line 8

L.0 LOAD LINE 8

L.1 AREA DESCRIPTION

Load Line 8 is a 44-acre AOC that operated as a booster loading and assembly line from 1941 to 1945 (Figure L-1). During its operational history, buildings at Load Line 8 were utilized for explosive processing (2B-1, 2B-2 and 2B-3), pellet manufacturing and processing (2B-4, 2B-17, 2B-12 and 2B-13), testing (2B-7 and 2B-18), detonator storage (2B-5), and assembly and shipping (2B-6 and 2B-21). Detonator components and all primary explosives arrived containerized at Load Line 8 as sealed finished sub-assemblies, and were stored at the load line until utilized in the assembly process. Operations were discontinued at the end of World War II and the process equipment was removed in 1945. The AOC consisted of 15 process buildings, which have since been removed. Load Line 8 has not been used since 1945 and is overgrown by trees and scrub vegetation.

The sanitary sewer system at Load Line 8 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

L.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at Load Line 8 in 2004 as part of the *Final Characterization of 14 AOCs* investigation (MKM Engineers, Inc. 2007a). Sewer water samples were collected at nine of the eleven manholes evaluated; the other two sewer manhole locations were dry. Six of the ten sewer manholes evaluated contained sufficient sediment volume for sample collection. These sampling locations are shown in Figure L-1. The analytical results indicated that five metals (arsenic, barium, chromium, cobalt and manganese) exceeded their screening levels at multiple sewer sediment locations. These screening level exceedances are summarized in Table L-1 and the sample locations with exceedances are shown in Figure L-2. No analytes were detected above their respective screening levels in sewer water at Load Line 8. No explosives or propellants were detected in any of the sewer water samples; 2-amino-4,6-dinitrotoluene was detected in one sediment sample below its screening level.

Inspections and explosives field screening tests were conducted at Load Line 8 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 8 lacks any significant storm management structures. A total of 10 DropEx™ samples were collected at Load Line 8 sanitary sewer manholes, none of which tested positive for trace explosive residue.

Table L-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 8

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Arsenic	mg/kg	6/6	13	56	23.5	19.5
	Barium	mg/kg	6/6	54	680	274	350
	Chromium	mg/kg	6/6	7.9	22	17.2	18.1
	Cobalt	mg/kg	6/6	11	20	16.3	9.1
	Manganese	mg/kg	6/6	800	30,000	9,530	1,950
Sewer Water	*No exceedances*	mg/L	—	—	—	—	—

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
— Not applicable.

L.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 8 are presented in Table L-2, and shown in Figure L-3.

Table L-2. Summary of Proposed Sampling Locations at Load Line 8

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-2B8	MH-2B7, MH-2B6, MH-2B5, MH-2B4, MH-2B3, MH-2B2	Sewer Sediment	Represents conditions downstream of Load Line 8 before exiting towards Load Line 6. This location also exhibited high concentrations of inorganics above screening levels.
			Sewer Water	
Sanitary	MH-2B13	MH-2B14, MH-2B15, MH-2B16	Sewer Sediment	Represents a major junction point draining the northwest segment of the load line. The manhole immediately downstream had high concentrations of inorganics above screening levels.
Sanitary	MH-2B17	MH-2B18	Sewer Sediment	Represents a major junction point draining Buildings 2B21 and 2B3 at the western segment of the load line. This location also exhibited cobalt above screening levels.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 8 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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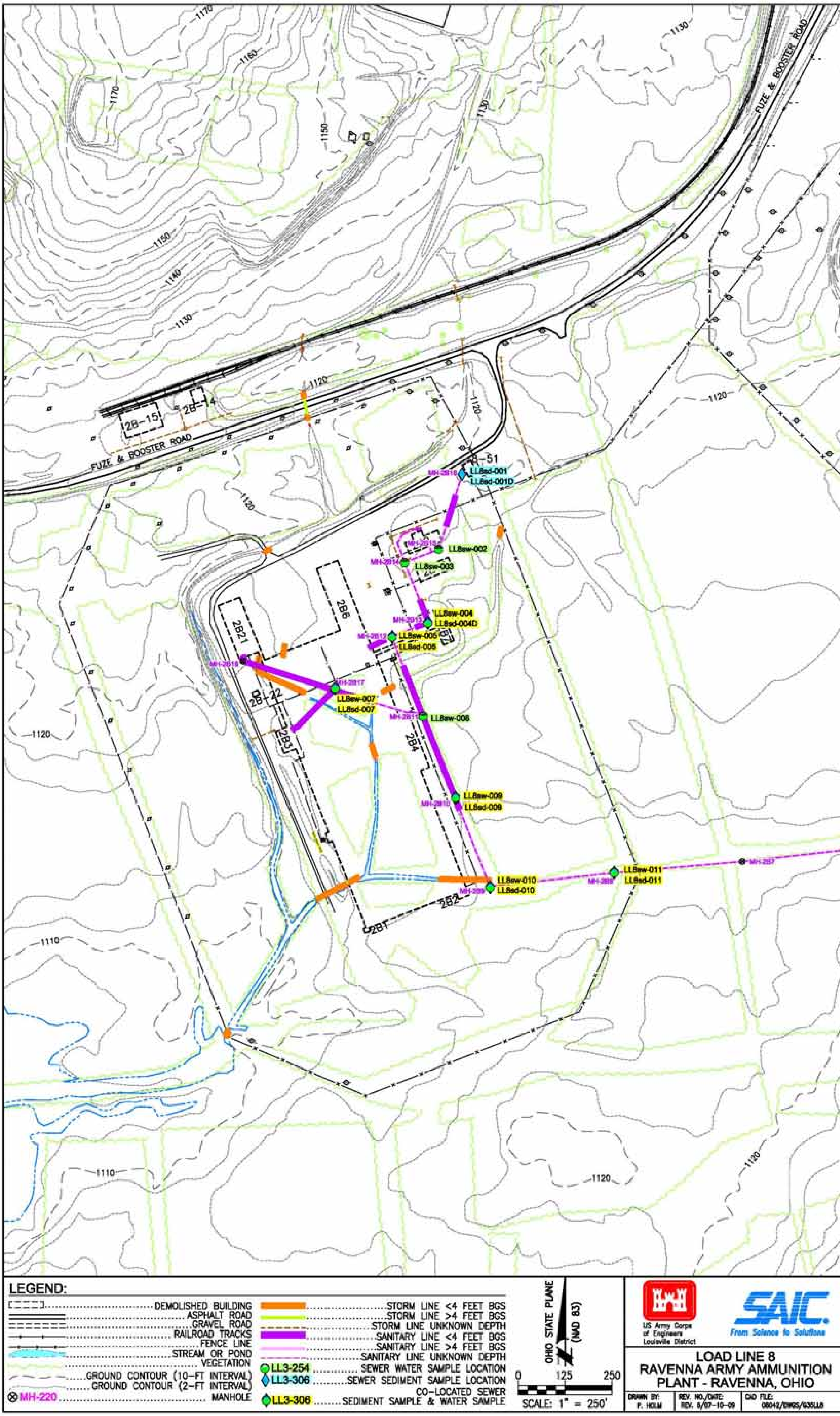

Figure L-1. Historical Sewer Sampling Locations at Load Line 8

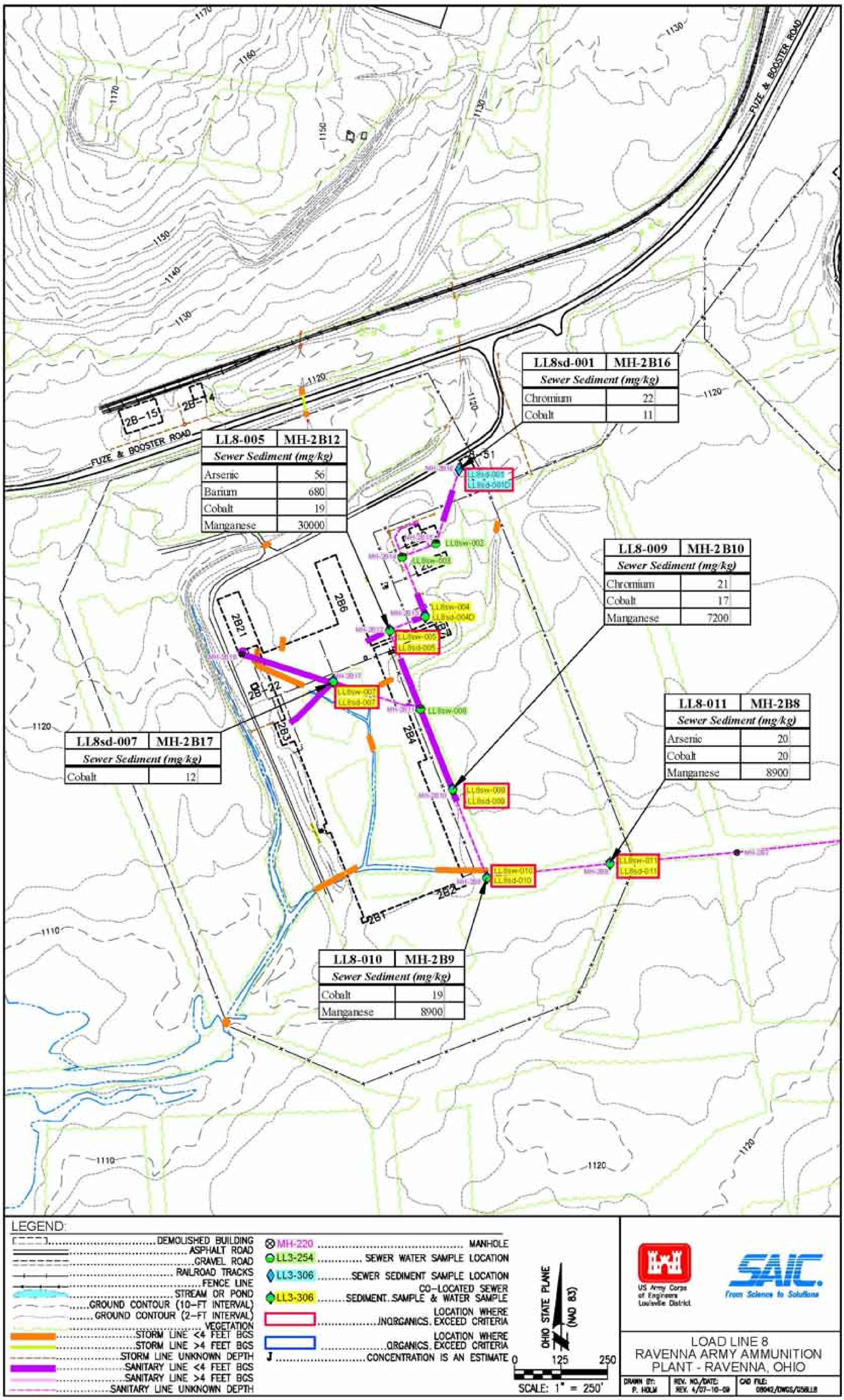

Figure L-2. Historical Exceedances for Sewer Samples at Load Line 8

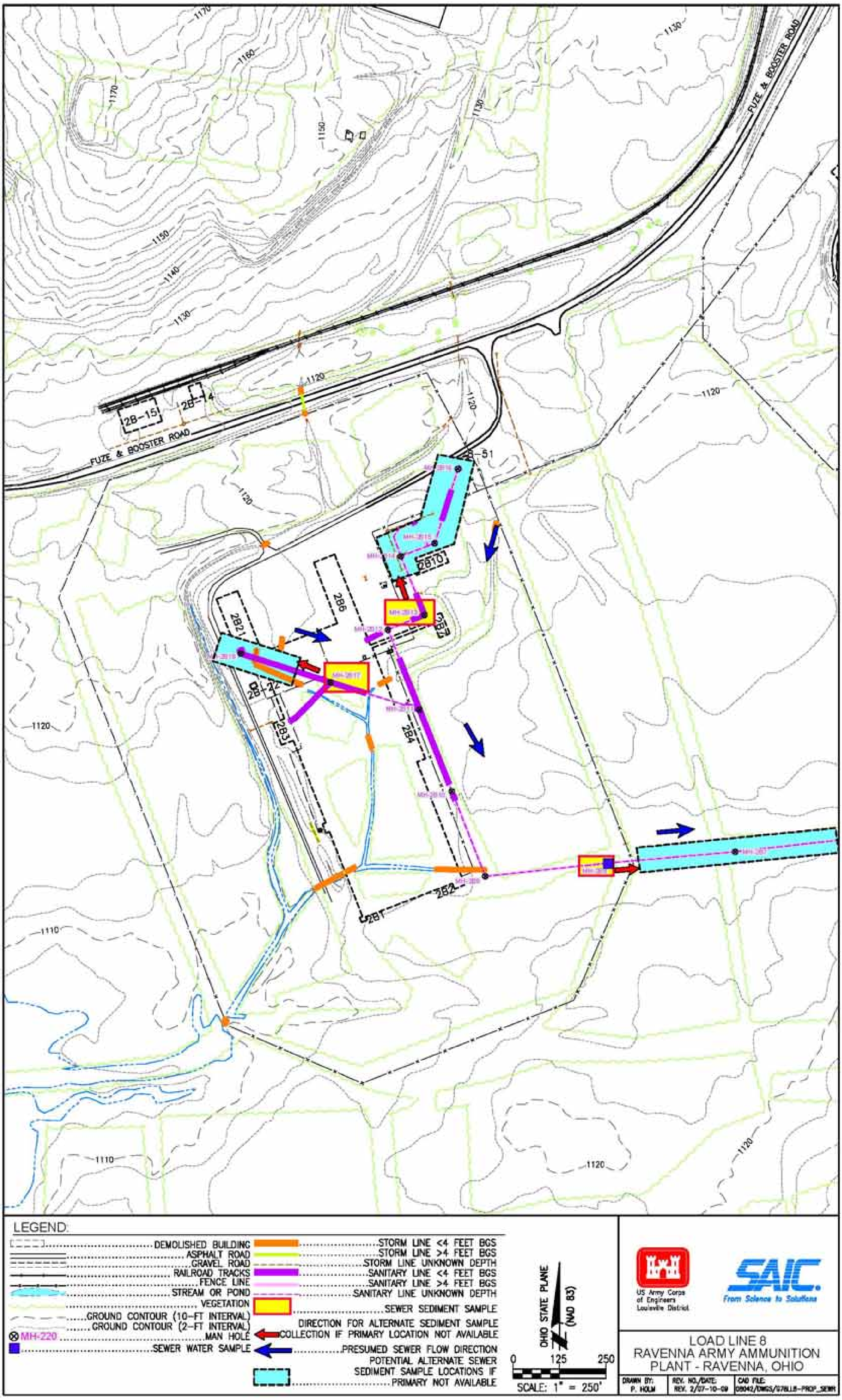

Figure L-3. Proposed Sewer Sampling Locations at Load Line 8

APPENDIX M
Load Line 9

M.0 LOAD LINE 9

M.1 AREA DESCRIPTION

Load Line 9 is a 69-acre AOC located in the south-central portion of RVAAP (Figure M-1). From 1941 to 1945, Load Line 9 produced detonators. During the operational history of Load Line 9, buildings were utilized for the following functions: mercury fulminate prep, screening, mixing and drying (DT–1, DT–2, DT–3, DT–25); lead azide prep, screening, mixing, and drying (DT–4, DT–5, DT–6, DT–7, DT–8, DT–9, DT–11, DT–19); tetryl screening, blending, pelleting and storage (DT–23, DT–24, DT–26, DT–27); loading (DT–20, DT–21, DT–22); detonator assembly, testing, storage and destruction (DT–14, DT–15, DT–16, DT–18, DT–18A, DT–34); and final inspection, packing and shipping (DT–13). In 1945, the load line was deactivated, and the equipment removed. There are no documented activities at Load Line 9 since 1945. Infrastructure at Load Line 9 consists mainly of a gravel road following the perimeter of main production area. The buildings at Load Line 9 were thermally decontaminated and demolished to 2 ft below ground surface in 2003, and the removal of all remaining slabs and foundations was completed in 2007. The concrete and brick were crushed to maintain the roads at RVAAP. An unused water tower is the only structure remaining at Load Line 9.

The sanitary sewer system at Load Line 9 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

M.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from sanitary sewer manholes at Load Line 9 in 2003 as part of the *Final Remedial Investigation for Load Line 9* (MKM Engineers, Inc. 2007c). Collocated sewer water and sediment samples were collected at two manhole locations, shown in Figure M-1. Samples could not be collected from other manholes at the load line because they contained insufficient water and sediment. The analytical results indicated that three metals (arsenic, cobalt and mercury) and five polyaromatic hydrocarbons (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene) exceeded their respective screening levels in sewer sediment. Lead was the only analyte detected above screening levels in sewer water samples. These screening level exceedances are summarized in Table M-1 and the sample locations with exceedances are shown in Figure M-2. The propellants nitrocellulose and nitroguanidine were detected in one of the sewer water samples at concentrations below the screening levels. No explosives or propellants were detected in the sewer sediment samples from Load Line 9.

Inspections and explosives field screening tests were conducted at Load Line 9 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 9 lacks any significant storm management structures. A total of 9

DropEx™ samples were collected at Load Line 9 sanitary sewer manholes, none of which tested positive for trace explosive residue. A historical review of maps conducted for the investigation were observed to indicate an underground line of indeterminate purpose which ran from building DT-2 (Fulminate Mix House) to DT-5 (Azide Mix House), and to the northeast where they converged at a point within the woods outside of the LL9 fenceline (USACE-CERL 2007). A walk-down was conducted during the investigation, and no outlet was found. Although these lines were designated as sanitary lines on the historical maps, their operational purpose was unknown (USACE-CERL 2007). Based upon their configuration, it is likely that these were process lines rather than sewer lines; as such, investigation of these structures will be conducted as part of the remedial investigation for Load Line 9 (RVAAP-42) rather than under the Facility-Wide Sewers AOC.

Table M-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 9

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Arsenic	mg/kg	2/2	15	25	20	19.5
	Cobalt	mg/kg	2/2	7.6	9.1	8.4	9.1
	Mercury	mg/kg	2/2	6	110	58	2.3
	Benz(a)anthracene	mg/kg	1/1	─	─	2.1	0.000014
	Benzo(a)pyrene	mg/kg	1/1	─	─	2.2	0.0000008
	Benzo(b)fluoranthene	mg/kg	1/1	─	─	2.5	0.0000079
	Dibenz(a,h)anthracene	mg/kg	1/1	─	─	0.61	0.00000052
	Indeno(1,2,3-cd)pyrene	mg/kg	1/1	─	─	0.61	0.0000078
Sewer Water	Lead	mg/L	2/2	0.036	0.046	0.041	0.015

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
─ Not applicable.

M.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 9 are presented in Table M-2, and shown in Figure M-3.

Table M-2. Summary of Proposed Sampling Locations at Load Line 9

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-D1	None	Sewer Sediment	Confirmatory sample; previous results at this manhole exhibited high mercury concentrations and other inorganics above screening levels.
Sanitary	MH-D6	None	Sewer Sediment	Isolates segment draining Building DT-1; downstream manhole MH-D5 exhibited elevated organics and inorganics above screening criteria.
Sanitary	MH-D7	None	Sewer Sediment	Isolates potential source area segment draining multiple process buildings; downstream manhole MH-D5 exhibited elevated organics and inorganics above screening criteria.
Sanitary	MH-D8	MH-D4, MH-D3, MH-D2	Sewer Sediment	Isolates potential source area segment draining multiple process buildings; downstream manhole MH-D1 exhibited inorganics concentrations above screening levels.
Sanitary	MH-D9	MH-D11	Sewer Sediment	Isolates potential source area segment draining multiple process buildings; downstream manhole MH-D1 exhibited inorganics concentrations above screening levels.
Sanitary	MH-O51	MH-O50, MH-O49, MH-O48, MH-O47, MH-O46, MH-O45, MH-O44, MH-O43, MH-O42	Sewer Sediment Sewer Water	Represents conditions at the downstream end of the load line and before connecting with the trunk line draining Load Line 10.

During the visual survey phase, inspection forms will be completed sewer structures at Load Line 9 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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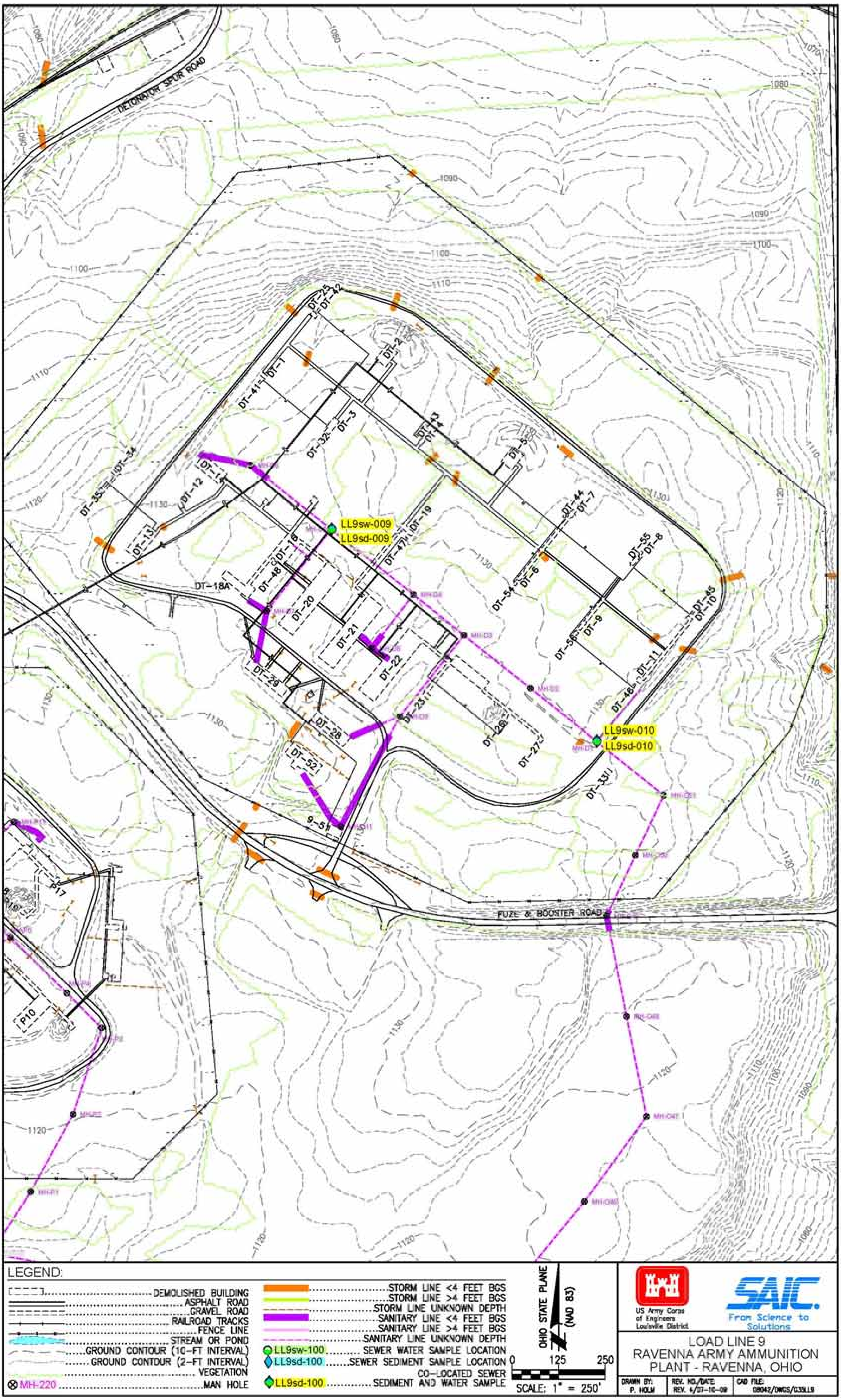

Figure M-1. Historical Sewer Sampling Locations at Load Line 9

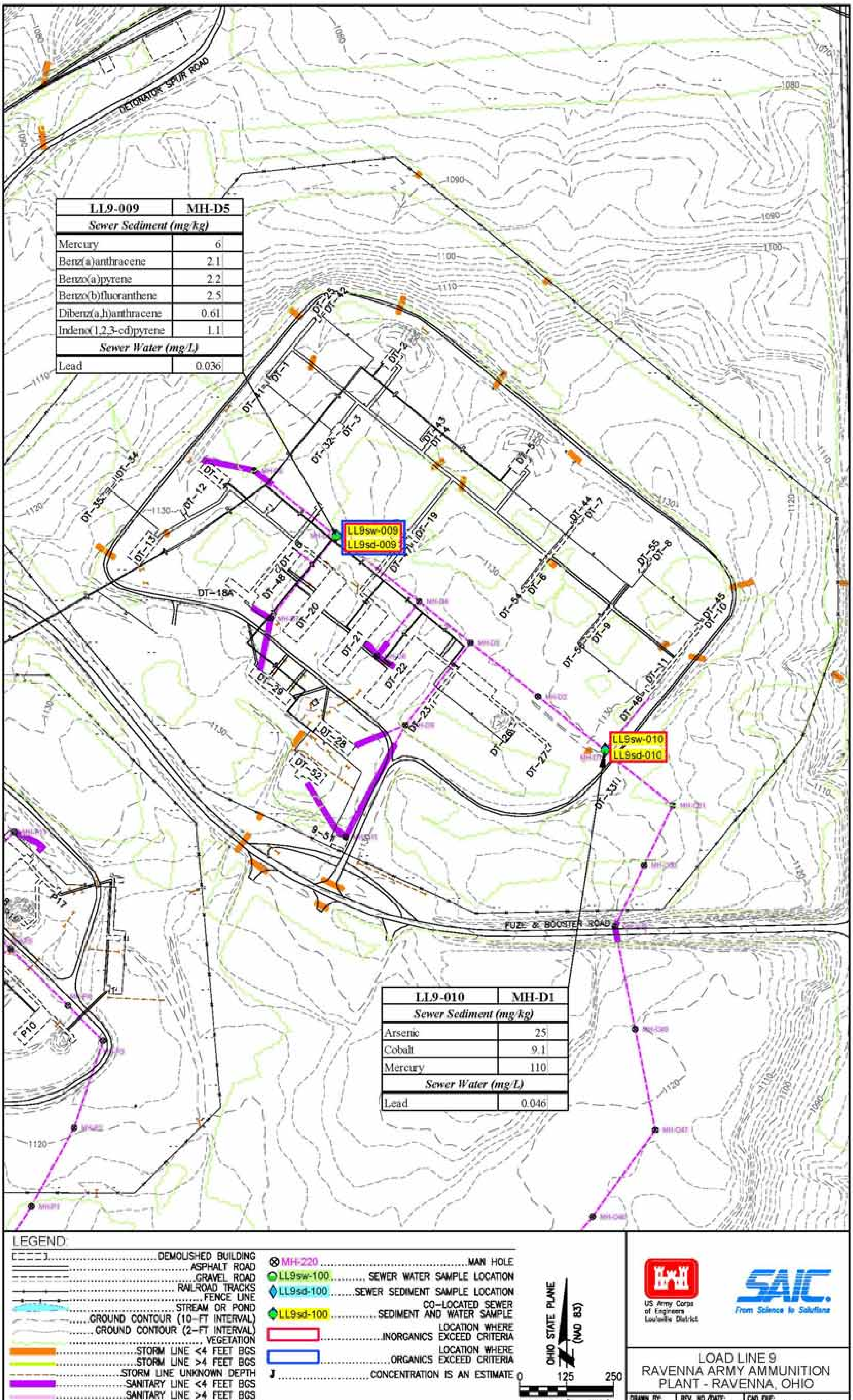

Figure M-2. Historical Exceedances for Sewer Samples at Load Line 9

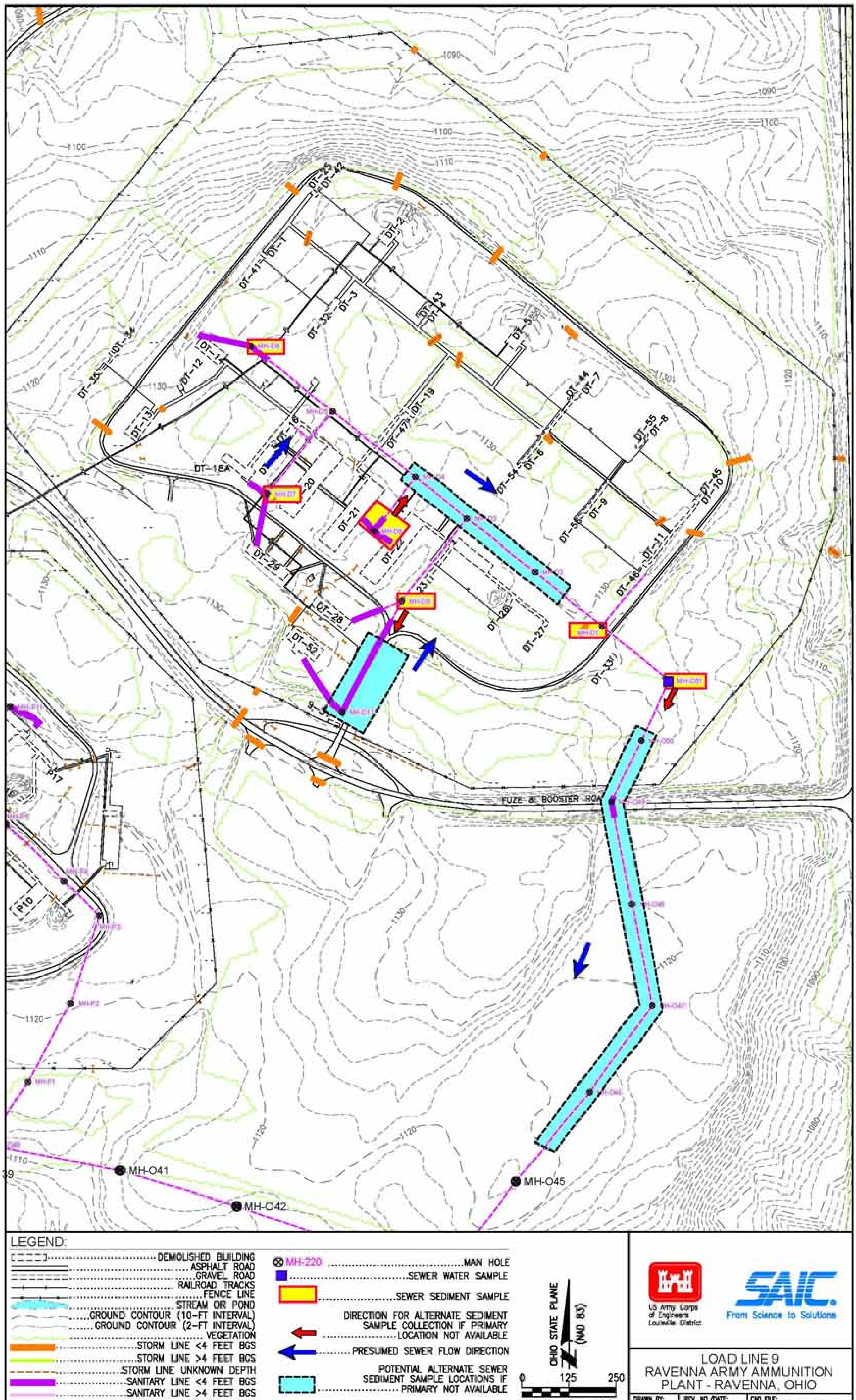

Figure M-3. Proposed Sewer Sampling Locations at Load Line 9

APPENDIX N
Load Line 10

N.0 LOAD LINE 10

N.1 AREA DESCRIPTION

Load Line 10 is a 43-acre AOC, formerly known as the Percussion Element Manufacturing Line, which operated as an initiator blending and loading line from 1941 to 1945 (Figure N-1). During this phase in the operational history of Load Line 10, buildings were utilized for initiator processing (PE-12 and PE-18), primer component processing (PE-17, PE-19 and PE-13), pentaerythritol tetranitrate processing (PE-28 and PE-29), and primer mix processing (PE-1, PE-4, PE-5, PE-6, PE-7, PE-9, PE-14, PE-15, PE-21 and PE-22). At the end of World War II, the process equipment and production line was placed on standby status. The line was reactivated in 1951 and used to produce primers and percussion elements until it was again placed on standby status in 1956.

The line was activated again in 1969 to produce primers. Between 1969 and 1971, buildings at Load Line 10 were utilized for initiator processing (PE-18 and PE-28), fuel compound blending and storage (PE-12, PE-13, PE-19, PE-19, PE-29A and PE-29B), binder blending (PE-16), and mix/percussion element processing and packing (PE-1, PE-14, PE-5, PE-6, PE-4, PE-9 and PE-10). In1971, the line was deactivated permanently and the production equipment removed. The AOC is currently overgrown by trees and scrub vegetation. The buildings, including slabs and foundations, have since been removed.

The sanitary sewer system at Load Line 10 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

N.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at Load Line 10 in 2004 as part of the *Final Characterization of 14 AOCs* investigation (MKM Engineers, Inc. 2007a). At the time of sampling, water was present in six of the ten sewer locations evaluated. Only three sewer manholes contained enough sediment for sample collection. These sample locations are shown in Figure N-1. The analytical results indicated that four metals (arsenic, chromium, cobalt and lead) and the polyaromatic hydrocarbon benzo(a)pyrene exceeded their screening levels in sewer sediment. Four polyaromatic hydrocarbons (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene) exceeded their screening levels in one of the seven sewer water samples (MH-P12). These screening level exceedances are summarized in Table N-1 and the sample locations with exceedances are shown in Figure N-2. The explosives 2,6-dinitrotoluene and tetryl were detected in one sewer sediment sample at concentrations below their respective screening levels. No explosive compounds were detected in sewer water.

Inspections and explosives field screening tests were conducted at Load Line 10 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL

2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 10 lacks any significant storm management structures. A total of 18 DropEx™ samples were collected at Load Line 10 sanitary sewer manholes, none of which tested positive for trace explosive residue.

Table N-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 10

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Arsenic	mg/kg	3/3	12	20	16.6	19.5
	Chromium	mg/kg	3/3	13	54	31.7	18.1
	Cobalt	mg/kg	3/3	8.3	10	9.0	9.1
	Lead	mg/kg	3/3	310	640	433	400
	Benzo(a)pyrene	mg/kg	1/1	─	─	0.048	0.022
Sewer Water	Benz(a)anthracene	mg/L	1/6	─	─	0.0004	0.000014
	Benzo(a)pyrene	mg/L	1/6	─	─	0.00045	0.0000008
	Benzo(b)fluoranthene	mg/L	1/6	─	─	0.00064	0.0000079
	Indeno(1,2,3-cd)pyrene	mg/L	1/6	─	─	0.00032	0.0000078

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
─ Not applicable.

N.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 10 are presented in Table N-2, and shown in Figure N-3.

Table N-2. Summary of Proposed Sampling Locations at Load Line 10

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-O40	MH-O39, MH-O38, MH-O37, MH-O36, MH-O35	Sewer Sediment	Represents conditions downstream of the confluence point of the Load Line 9 and 10 trunk lines.
			Sewer Water	
Sanitary	MH-O41	MH-O42, MH-O43, MH-O44, MH-O45, MH-O46, MH-O47, MH-O48, MH-O49, MH-O50	Sewer Sediment	Represents conditions upstream of Load Line 10 (i.e: trunk line draining from Load Line 9 towards 10).
			Sewer Water	
Sanitary	MH-P4	MH-P3, MH-P2, MH-P1	Sewer Sediment	Represents conditions at the downstream end of the load line and prior to the confluence with other trunk lines.
Sanitary	MH-P5A	None	Sewer Sediment	Confirmatory sample; previous results indicated high lead concentrations above its screening level.
Sanitary	MH-P7	None	Sewer Sediment	Characterizes potential source area at Building P1; downstream junction manhole MH-P5A exhibited high lead concentrations above its screening level.
Sanitary	MH-P8	None	Sewer Sediment	Characterizes potential source area at Building P3; downstream junction manhole MH-P5A exhibited high lead concentrations above its screening level.
Sanitary	MH-P11	None	Sewer Sediment	Characterizes potential source area at building complex at northeast of load line; downstream junction manhole MH-P5A exhibited high lead concentrations above its screening level.
Sanitary	MH-P12	MH-P13	Sewer Sediment	Isolates and characterizes potential source area segment of sewers at Buildings P4, P5 and P6. Provides confirmation of previously screening level exceedances in sediment (inorganics) and water (organics) at this location.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 10 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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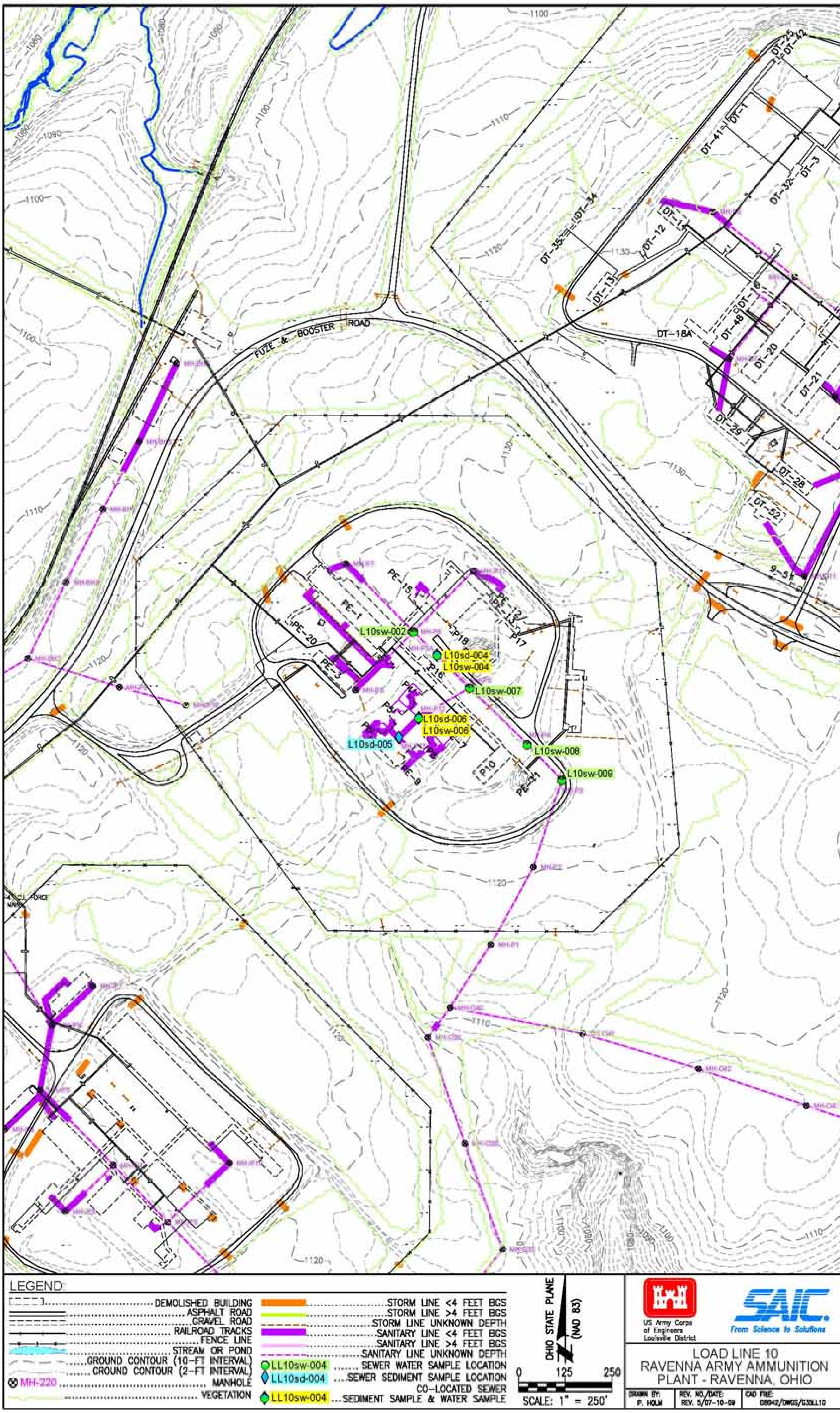

Figure N-1. Historical Sewer Sampling Locations at Load Line 10

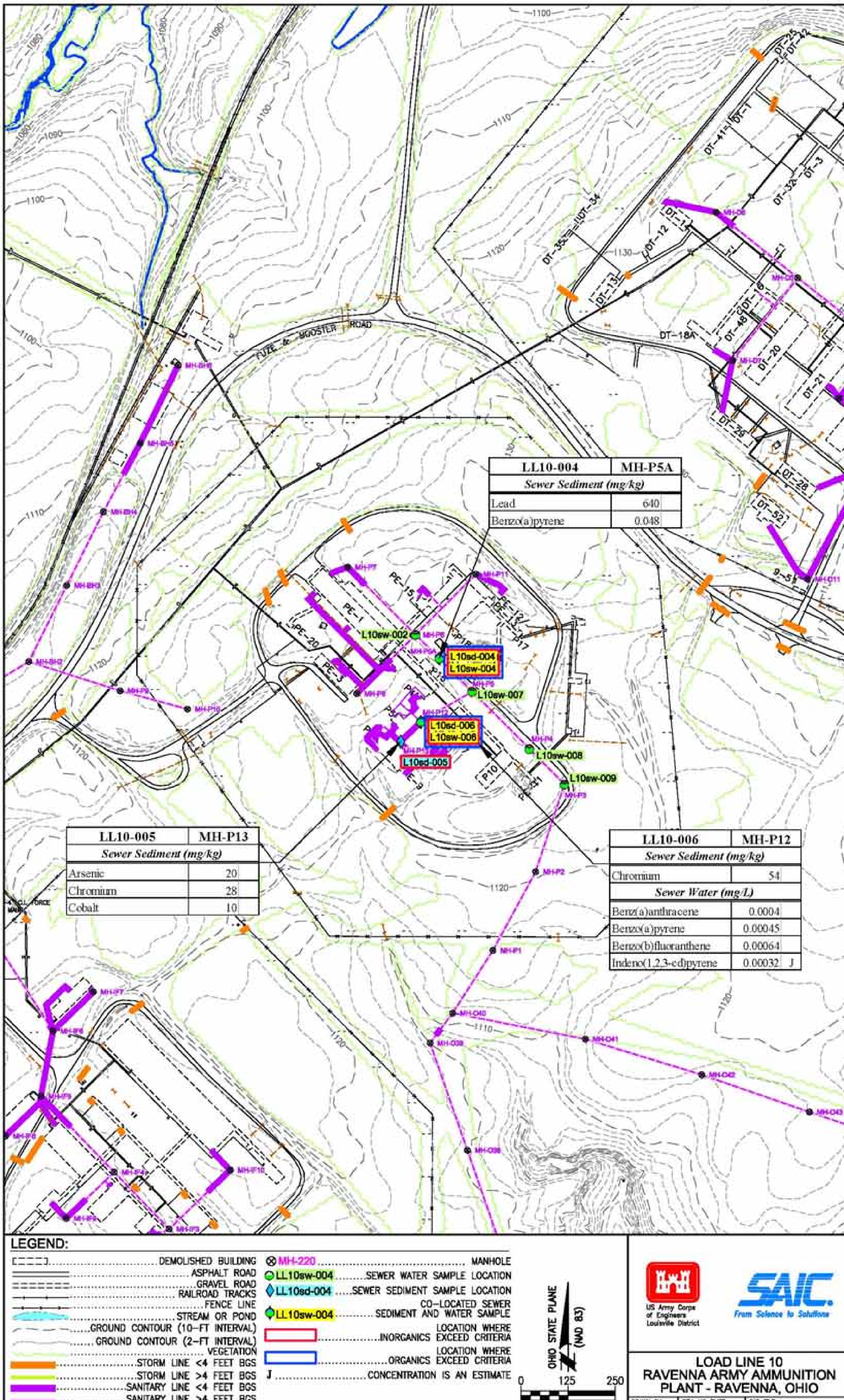

Figure N-2. Historical Exceedances for Sewer Samples at Load Line 10

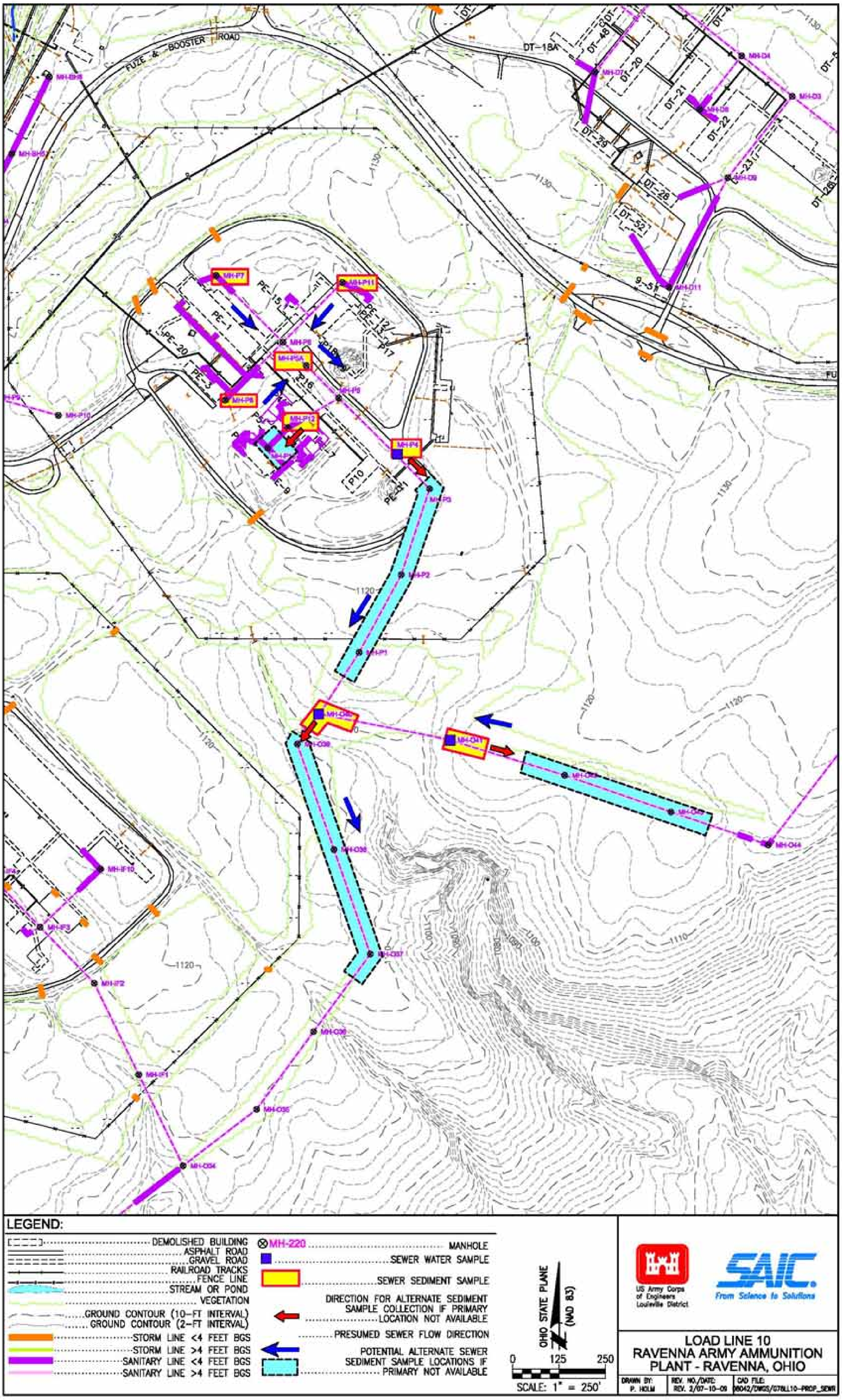

Figure N-3. Proposed Sewer Sampling Locations at Load Line 10

APPENDIX O
Load Line 11

O.0 LOAD LINE 11

O.1 AREA DESCRIPTION

Load Line 11 is approximately 40 acres in size and was utilized primarily for the production of artillery primers and fuzes (Figure O-1). During the period from 1941 to 1945, Load Line 11 operated at full capacity to produce primers for artillery projectiles. After being placed on standby status in 1945, the load line was reactivated twice, once during the 1951 to 1957 time frame to produce primers, and then again from 1969 to 1971 to produce fuzes in support of the Southeast Asia Conflict. During its operational history, buildings at Load Line 11 were used for the following functions: black powder staging areas for primer charging (AP-1, AP-4, AP-7 and AP-10); black powder screening (AP-2 and AP-3); black powder processing (AP-5 and AP-6); primer loading (AP-8); charging operations and primer assembly (AP-11); testing (AP-20); palletizing and shipping finished products (AP-9 and AP-16).

Several buildings at the load line were connected to the sewer mains of the facility through sets of drains and sumps (i.e.: Building AP-3, AP-5, AP-6, and AP-8), many of which were lead-lined and connected via lead piping. An interim remedial action at the AOC was conducted in 2001, consisting of removal of lead/asbestos-lined sumps, lead-contaminated sediment, and solvent-contaminated soil. During these activities, some of the sewer lines and manholes located at the exit and entrance of the sewer system at Load Line 11 were permanently plugged with grout to prevent the potential movement of contaminants in sewer residues from the load line. During these removal actions, it was observed that groundwater infiltration into the sewer and sump system was significant enough to impede activities, as portions of the sewer occurred below the water table. The buildings, including slabs and foundations, have since been demolished.

The sanitary sewer system at Load Line 11 is part of the George Road Treatment Plant network (shown in Plate A-1). Storm system infrastructure at the load line occurs predominantly as under-road culverts.

O.2 PREVIOUS INVESTIGATIONS

Sewer water and sediment samples were collected from the sanitary sewer manholes at Load Line 11 in 2001 as part of the *Final Remedial Investigation for Load Line 11* (MKM Engineers, Inc. 2005). Six sewer water and five sediment samples were collected from sanitary manholes at Load Line 11. These sample locations are shown in Figure O-1. One set of collocated samples was collected at the manhole at the sewer ejector station located near Building AP-14 and downgradient of the entire Load Line 11 sanitary sewer system (MH-1A1). The analytical results indicated that a total of eight metals exceeded their respective screening levels in sewer sediment at Load Line 11. The only analyte detected above its screening level in sewer water was the metal manganese. These screening level exceedances are summarized in Table O-1 and the sample locations with exceedances are shown in Figure O-2. No explosive compounds were detected in either the sewer water or sediment samples.

Inspections and explosives field screening tests were conducted at Load Line 11 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc. 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 11 lacks any significant storm management structures. A total of 6 DropEx™ samples were collected at Load Line 11 sanitary sewer manholes, none of which tested positive for trace explosive residue.

Table O-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 11

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Aluminum	mg/kg	5/5	3,950	16,500	8,730	13,900
	Arsenic	mg/kg	5/5	9.9	69.5	35.3	19.5
	Chromium	mg/kg	5/5	5.3	30.5	13.6	18.1
	Cobalt	mg/kg	5/5	4.4	18	11.0	9.1
	Copper	mg/kg	5/5	8.7	330	79.8	310
	Lead	mg/kg	5/5	23.6	1,770	517	400
	Manganese	mg/kg	5/5	173	19,900	10,010	1,950
	Vanadium	mg/kg	5/5	7.3	55.7	21.8	45
Sewer Water	Manganese	mg/L	5/6	0.0076	3.17	0.71	0.63

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
─ Not applicable.

O.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 11 are presented in Table O-2, and shown in Figure O-3.

Table O-2. Summary of Proposed Sampling Locations at Load Line 11

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-CO	None	Sewer Water	Represents conditions immediately downstream of the load line. Clean-out manhole is a potential accumulation point.
			Sewer Sediment	
Sanitary	MH-1A1	None	Sewer Sediment	Represents major junction and potential accumulation point within the load line, with five lines entering the invert.
Sanitary	MH-1A5	None	Sewer Sediment	Isolates and characterizes potential source area at upstream of MH-1A4 and MH-1A3 which exhibited high inorganics concentrations above screening levels.
Sanitary	MH-1A6	MH-1A7	Sewer Sediment	Isolates reach on southern side of load line.
Sanitary	MH-2A2	MH-2A3, MH-2A4	Sewer Sediment	Isolates and characterizes potential source area upstream of MH-2A1 which exhibited high inorganics concentrations above screening levels.
Sanitary	MH-3A1	None	Sewer Sediment	Isolates and characterizes potential source area at upstream of MH-1A4 and MH-1A3 which exhibited high inorganics concentrations above screening levels.

During the visual survey phase, inspection forms will be completed for the sewer structures at Load Line 11 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

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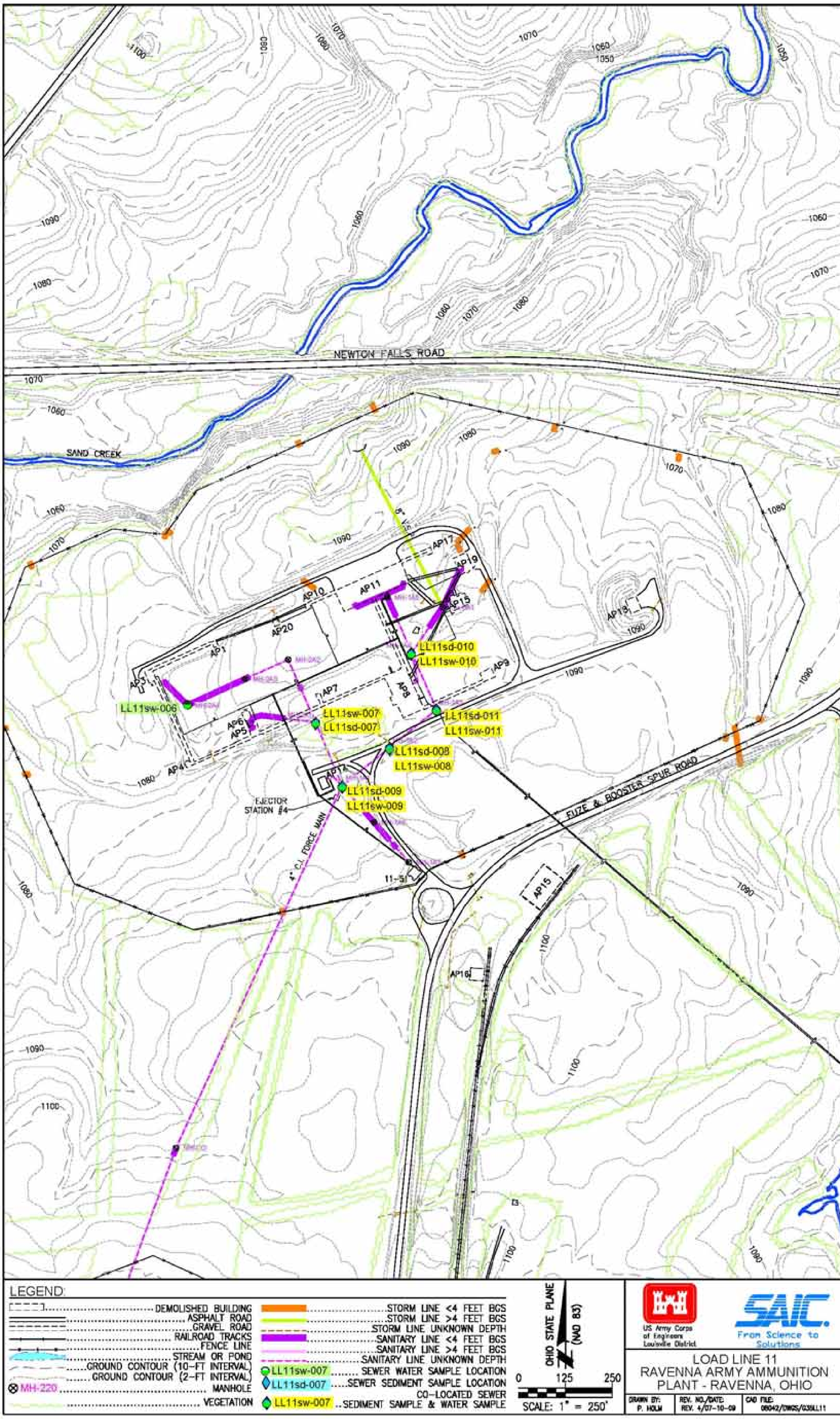


Figure O-1. Historical Sewer Sampling Locations at Load Line 11

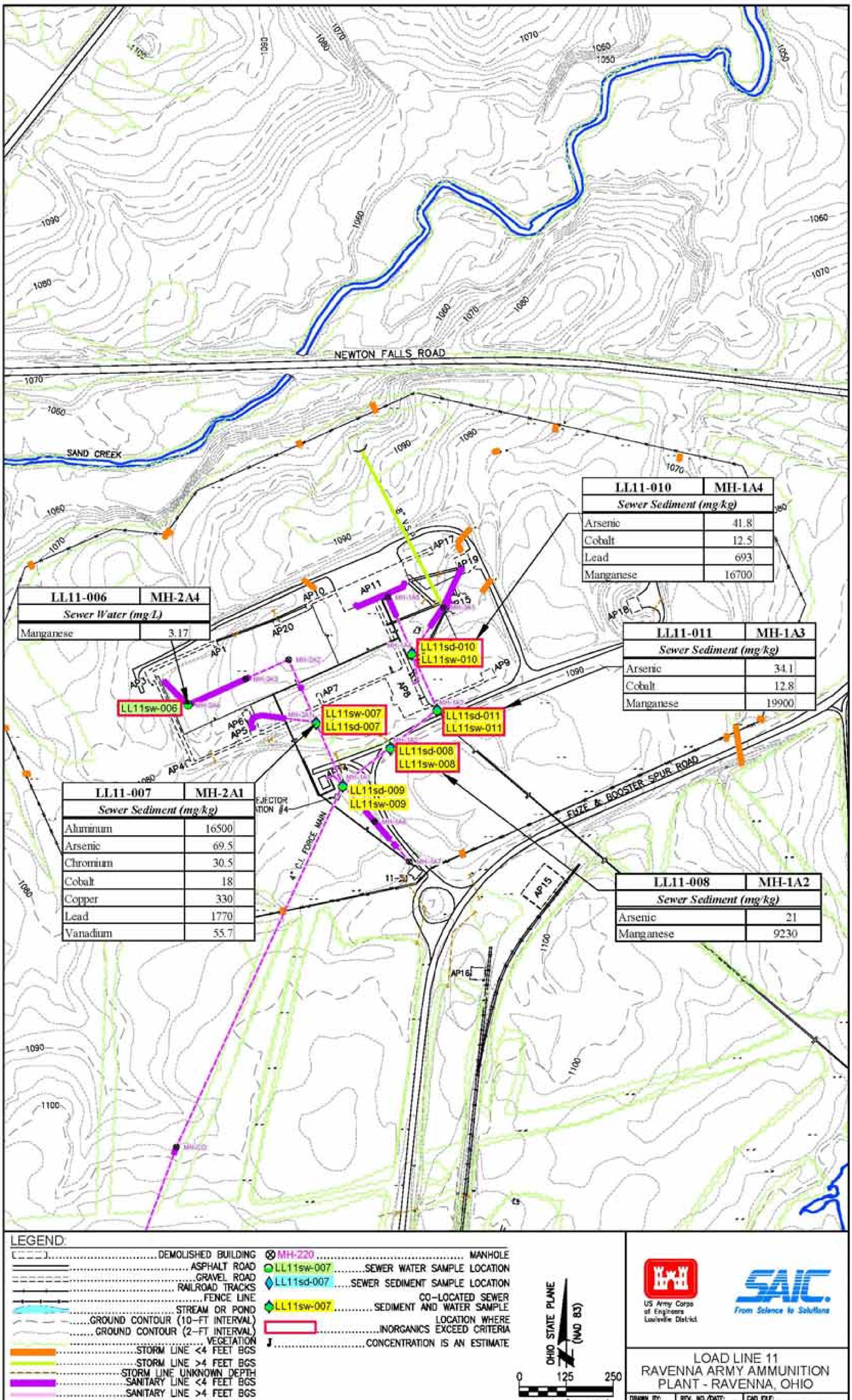


Figure O-2. Historical Exceedances for Sewer Samples at Load Line 11

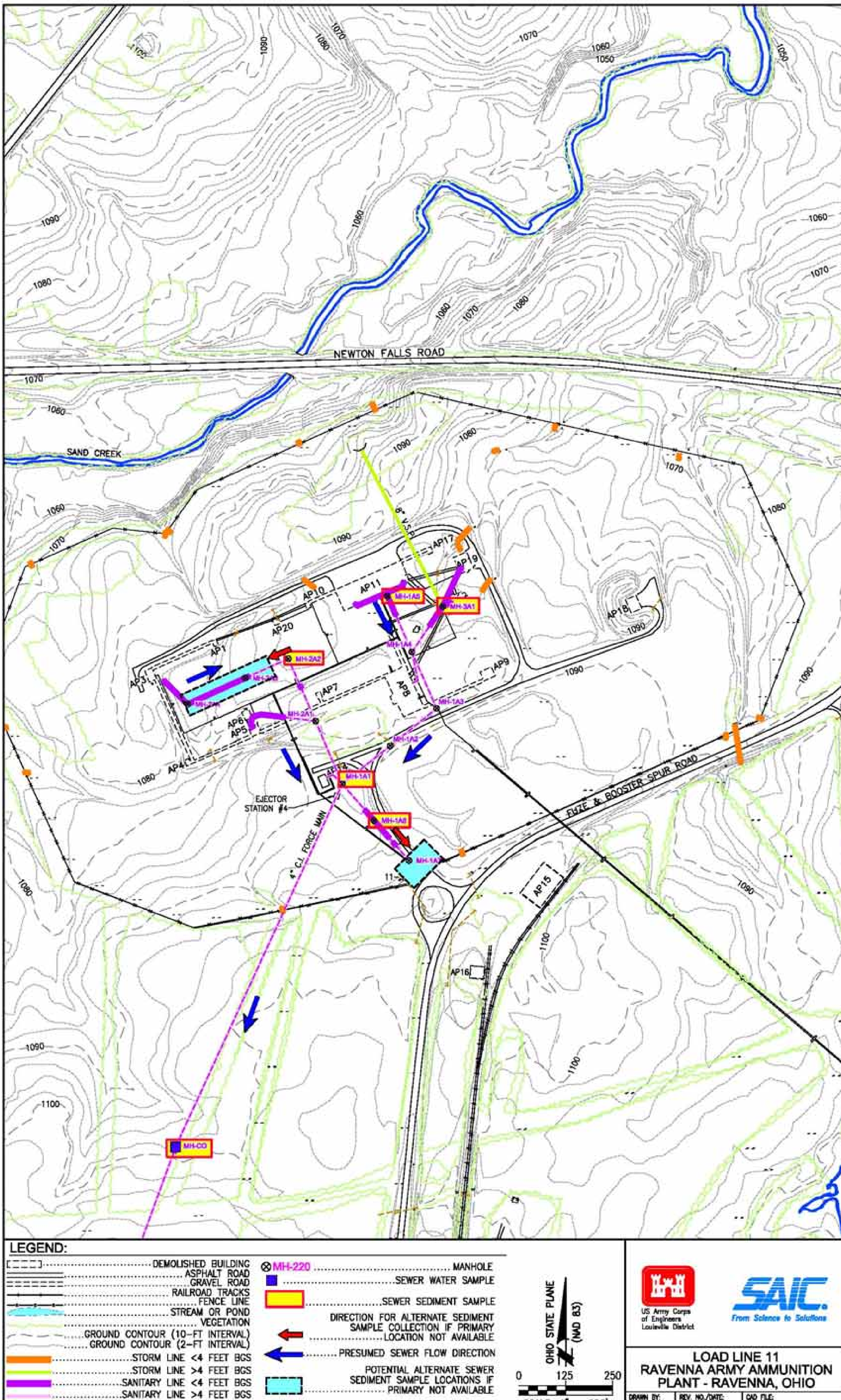


Figure O-3. Proposed Sewer Sampling Locations at Load Line 11

APPENDIX P
Load Line 12

P.0 LOAD LINE 12

P.1 AREA DESCRIPTION

Load Line 12 is an 80-acre former ammonium nitrate manufacturing facility operational from 1941 to 1946 (Figure P-1). From 1941 to 1943, explosive grade ammonium nitrate was manufactured at Load Line 12. During its operational history, granular ammonium nitrate was prepared through an evaporation and crystallization procedure of neutral liquor that was brought into the plant in tank cars and off-loaded at the Neutral Liquor Building (FE-19) before being transferred to one of seven evaporation/crystallization units (Buildings 900, 901, 902, 903, 904, 905, and 906).

Various production, renovation, and demilitarization operations were performed at a number of locations at Load Line 12 after the termination of ammonium nitrate production in 1943. Load Line 12 was leased by the Silas Mason Company from 1946 to 1949 to manufacture fertilizer grade ammonium nitrate. Building 904 was used for demilitarization work and bomb melt out from 1949 to 1993. An Ohio EPA-permitted pink water treatment plant located near Building 904 was taken out of service in 2000. From 1965 to 1967, Hercules Alcor, Inc. leased Building FF-19 to produce aluminum chloride. A former steam plant located in the southern portion of the AOC used fuel oil and coal at various times over the years as fuel (Building FE-17). All buildings have been demolished to grade. An explosives composting pilot study in 1999 involved removal of about 1,500 ft^3 of soil from four pits near Building 904 and composting at RVAAP Load Line 4 Building G-4 Warehouse.

The sanitary sewer system at Load Line 12 remains in place (approximately 4,700 linear ft) and may represent an accumulation point for contaminants introduced to the system via building floor and sink drains during the operational history of the load line (shown in Plate A-2). Additionally, a sanitary effluent line from Load Lines 1, 2 and 3 intersected the Load Line 12 system near the center of the load line via a connector line. From this confluence point, sanitary effluent from all four load lines exited Load Line 12 through an ejector station at the north end of the load line and traveled to the Sand Creek Treatment Plant. Storm system infrastructure at the load line occurs predominantly as under-road culverts.

P.2 PREVIOUS INVESTIGATIONS

The *Phase II Remedial Investigation* for Load Line 12 included sewer water and sediment sampling and a video camera survey of the sanitary sewer lines (USACE 2004d). During visual examination, portions of the sanitary sewer system within the load line were observed to be flooded either due to infiltrating groundwater or accumulated stormwater. A total of three sewer sediment and four sewer water samples were collected from Load Line 12 manholes located downgradient of Building FF-19. Additional sewer sediment samples could not be obtained because most accessible manholes did not contain sufficient volumes for sample collection. Previous sewer sample locations are shown in Figure P-1.

The analytical results indicated that ten metals, five polyaromatic hydrocarbons and PCB-1254 exceeded their respective screening levels in sewer sediment at Load Line 12. In sewer water, screening level exceedances of three explosives (2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene and 4-amino-2,6-dinitrotoluene), two metals (lead and manganese) and the pesticide heptachlor epoxide were observed. These screening level exceedances are summarized in Table P-1 and the sample locations with exceedances are shown in Figure P-2. Nitrate was detected in all four sewer water samples, indicating that some degree of potential connection with groundwater may exist at the load line, although none of these detections exceeded the screening level.

A total of 224 linear feet of Load Line 12 sanitary sewers have been video surveyed to assess the integrity of the lines and their potential to release contaminants to the environment. Video survey locations and findings for the sanitary sewers at Load Line 12 are presented in Figure P-3 (USACE 2004d). Only a small fraction of the Load Line 12 system could be accessed because the system was found to be mostly flooded and several of the planned entry points were obstructed with debris such as leaves, sticks, and sediment. Although attempts were made to survey flooded lines, the depth of water in several entry points exceeded the design depth of the camera, and in other locations placement of the camera in the lines caused sediment to be re-suspended, preventing video observation. As a result of these conditions, only 52 ft of the main 8-inch sanitary sewer line could be accessed for survey within Load Line 12. Several inches of sediment had accumulated within the sewer line between MH-507 and MH-508, and video quality was poor due to sediment disturbance. Since the sewer system could not be readily surveyed within the load line, the large sewer line that drains from Load Line 3 into the Load Line 12 system was examined to identify conditions within the connector line draining the three major melt-pour lines. Entry was made at MH-429 which was observed to be dry, and the camera was tracked toward MH-430 until terminated due obstruction by heavy root growth. The video survey showed light accumulations of vegetation debris and silt/sand material. Although roots were observed to have penetrated the line at many locations, the overall condition of the line was good.

Inspections and explosives field screening tests were conducted at Load Line 12 during the *Explosive Evaluation of Sewers* investigations (Lakeshore Engineering Services, Inc., 2007; USACE-CERL 2007). However, these sewer efforts were conducted without Ohio EPA regulatory oversight or review of the associated work plans and resultant completion report or its conclusions. These investigations were limited to the sanitary sewer, as Load Line 12 lacks any significant storm management structures. Additionally, since the south end of the load line was flooded at the time of inspection, only a limited number of sanitary manholes could be located and sampled. A total of 11 DropEx™ samples were collected at Load Line 12 sanitary sewer manholes, none of which tested positive for trace explosive residue.

Table P-1. Chemicals Exceeding Screening Levels in Sewer Media at Load Line 12

Media	Analyte	Units	Detection Frequency	Minimum Detection	Maximum Detection	Average Result	Screening Level[a]
Sewer Sediment	Aluminum	mg/kg	3/3	12,700	21,600	17,600	13,900
	Antimony	mg/kg	3/3	1.4	12.3	5.4	2.8
	Arsenic	mg/kg	3/3	13.1	96.1	43.0	19.5
	Chromium	mg/kg	3/3	19.4	67.5	47.4	18.1
	Cobalt	mg/kg	3/3	6.1	35.5	25.6	9.1
	Copper	mg/kg	3/3	31.2	486	275	310
	Manganese	mg/kg	3/3	1,030	4,630	2,700	1,950
	Mercury	mg/kg	3/3	0.12	16	5.5	2.3
	Silver	mg/kg	3/3	0.26	50.7	17.2	39
	Thallium	mg/kg	3/3	0.69	2.2	1.3	0.89
	Benz(a)anthracene	mg/kg	2/3	0.59	0.76	0.68	0.22
	Benzo(a)pyrene	mg/kg	3/3	0.11	0.68	0.43	0.022
	Benzo(b)fluoranthene	mg/kg	3/3	0.17	0.95	0.63	0.22
	Dibenz(a,h)anthracene	mg/kg	1/3	—	—	0.071	0.022
	Indeno(1,2,3-cd)pyrene	mg/kg	2/3	0.25	0.43	0.34	0.22
	PCB-1254	mg/kg	2/3	0.07	0.19	0.13	0.12
Sewer Water	2,4-Dinitrotoluene	mg/L	3/4	0.000085	0.0028	0.001	0.002
	2-Amino-4,6-Dinitrotoluene	mg/L	3/4	0.00061	0.0052	0.0026	0.0031
	4-Amino-2,6-Dinitrotoluene	mg/L	3/4	0.0017	0.0089	0.0053	0.0031
	Lead	mg/L	1/4	—	—	0.039	0.015
	Manganese	mg/L	4/4	0.029	2	1.3	0.63
	Heptachlor epoxide	mg/L	3/4	0.00026	0.00075	0.00055	0.00019

[a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.
— Not applicable.

P.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Load Line 12 are presented in Table P-2, and shown in Figure P-4.

Table P-2. Summary of Proposed Sampling Locations at Load Line 12

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	MH-436	MH-435, MH-434, MH-433, MH-432, MH-431	Sewer Sediment	Represents conditions entering Load Line 12 from the reach draining Load Lines 1, 2 and 3.
			Sewer Water	
Sanitary	MH-502	MH-501, MH-501A	Sewer Sediment	Isolates tail segment at south of load line, in vicinity of water treatment plant.
Sanitary	MH-505	MH-504, MH-504A, MH-503A, MH-503	Sewer Sediment	Provides characterization of MH-505 isolates the reach downstream of the former powerhouse. Data collected in 2001 indicated screening level exceedances at this manhole (inorganics and organics).
Sanitary	MH-511A	None	Sewer Sediment	Isolates Building 904 complex on west side of load line. Provides confirmation of elevated metals above screening levels at manhole immediately upstream.
Sanitary	MH-512	None	Sewer Sediment	Represents last location within the load line available for sampling before exiting the boundaries of the load line at the north and entering the 8" force main towards Sand Creek Treatment Plant.

During the visual survey phase, inspection forms will be completed for sewer structures at Load Line 12 to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

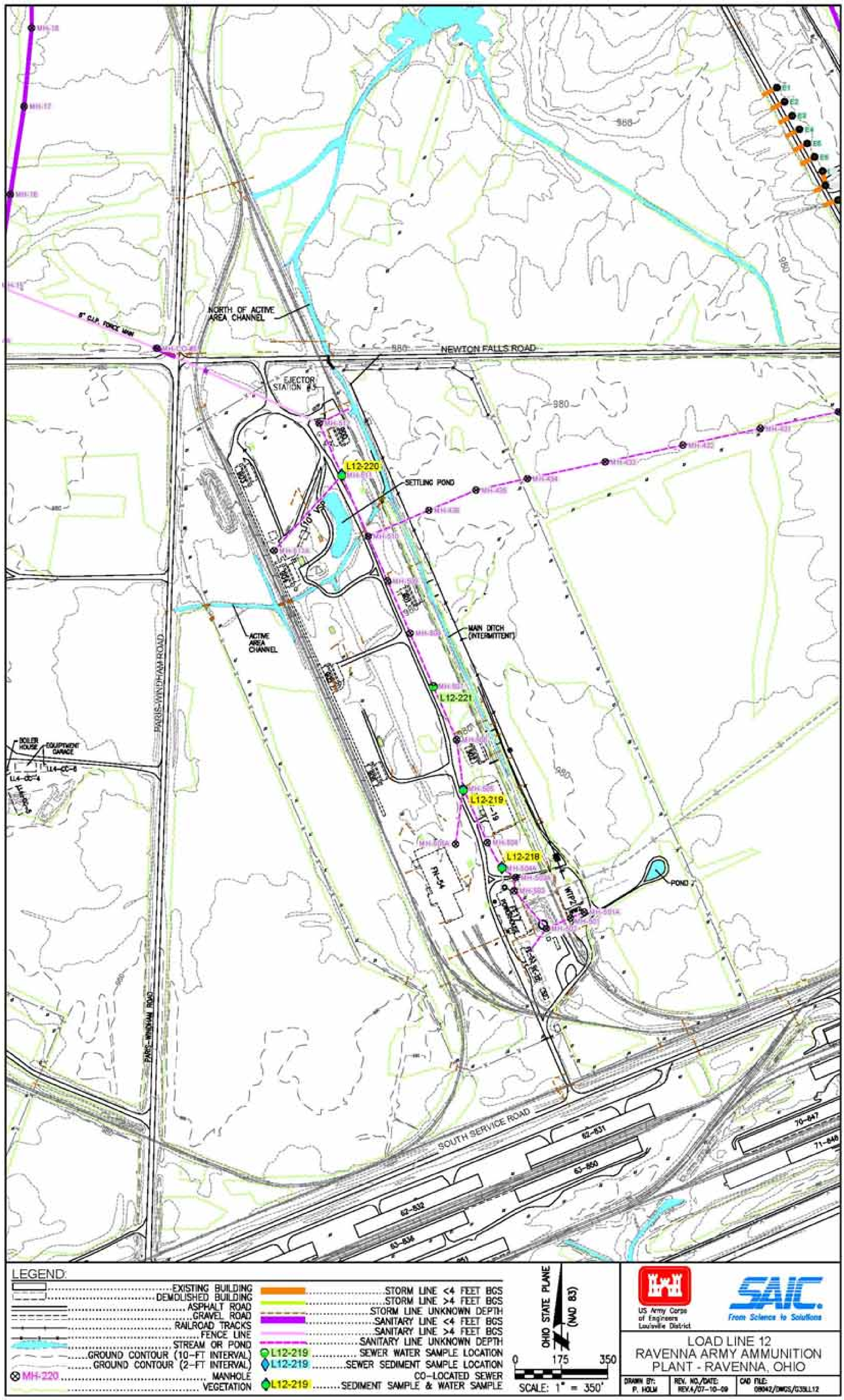
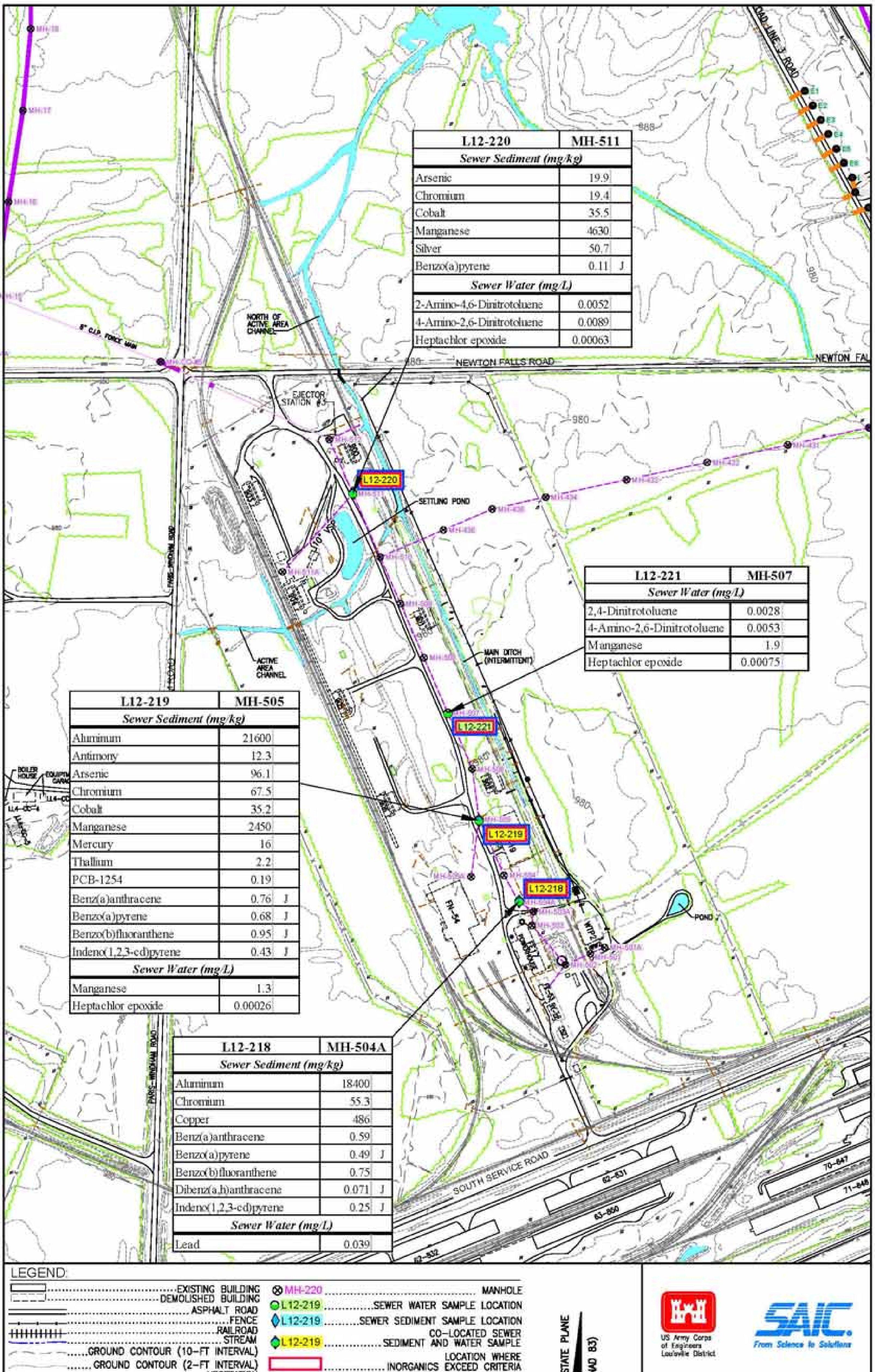


Figure P-1. Historical Sewer Sampling Locations at Load Line 12



L12-220	MH-511	
Sewer Sediment (mg/kg)		
Arsenic	19.9	
Chromium	19.4	
Cobalt	35.5	
Manganese	4630	
Silver	50.7	
Benzo(a)pyrene	0.11	J
Sewer Water (mg/L)		
2-Amino-4,6-Dinitrotoluene	0.0052	
4-Amino-2,6-Dinitrotoluene	0.0089	
Heptachlor epoxide	0.00063	

L12-221	MH-507	
Sewer Water (mg/L)		
2,4-Dinitrotoluene	0.0028	
4-Amino-2,6-Dinitrotoluene	0.0053	
Manganese	1.9	
Heptachlor epoxide	0.00075	

L12-219	MH-505	
Sewer Sediment (mg/kg)		
Aluminum	21600	
Antimony	12.3	
Arsenic	96.1	
Chromium	67.5	
Cobalt	35.2	
Manganese	2450	
Mercury	16	
Thallium	2.2	
PCB-1254	0.19	
Benz(a)anthracene	0.76	J
Benzo(a)pyrene	0.68	J
Benzo(b)fluoranthene	0.95	J
Indeno(1,2,3-cd)pyrene	0.43	J
Sewer Water (mg/L)		
Manganese	1.3	
Heptachlor epoxide	0.00026	

L12-218	MH-504A	
Sewer Sediment (mg/kg)		
Aluminum	18400	
Chromium	55.3	
Copper	486	
Benz(a)anthracene	0.59	
Benzo(a)pyrene	0.49	J
Benzo(b)fluoranthene	0.75	
Dibenz(a,h)anthracene	0.071	J
Indeno(1,2,3-cd)pyrene	0.25	J
Sewer Water (mg/L)		
Lead	0.039	

Figure P-2. Historical Exceedances for Sewer Samples at Load Line 12

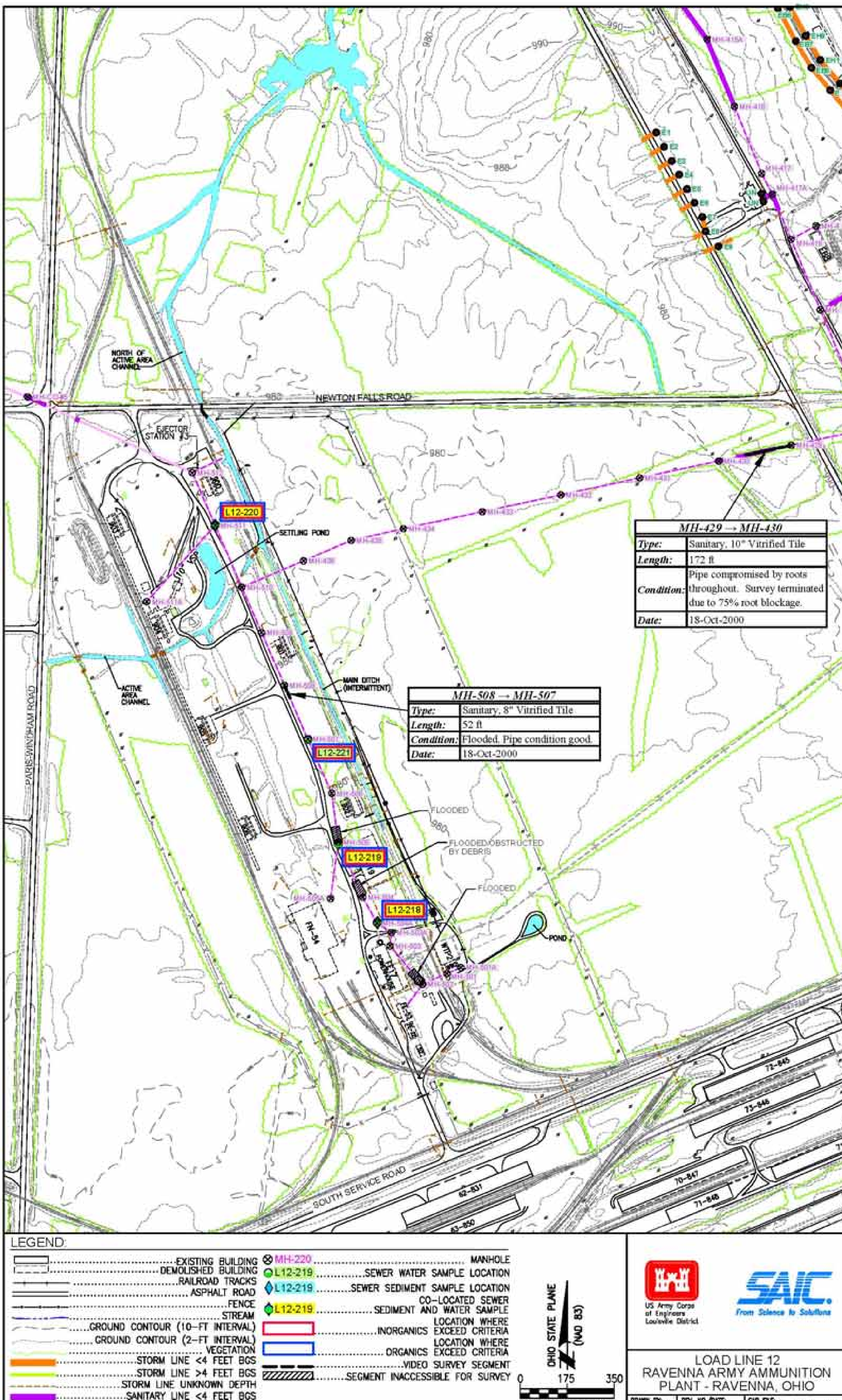


Figure P-3. Locations of Previous Sewer Video Surveys at Load Line 12

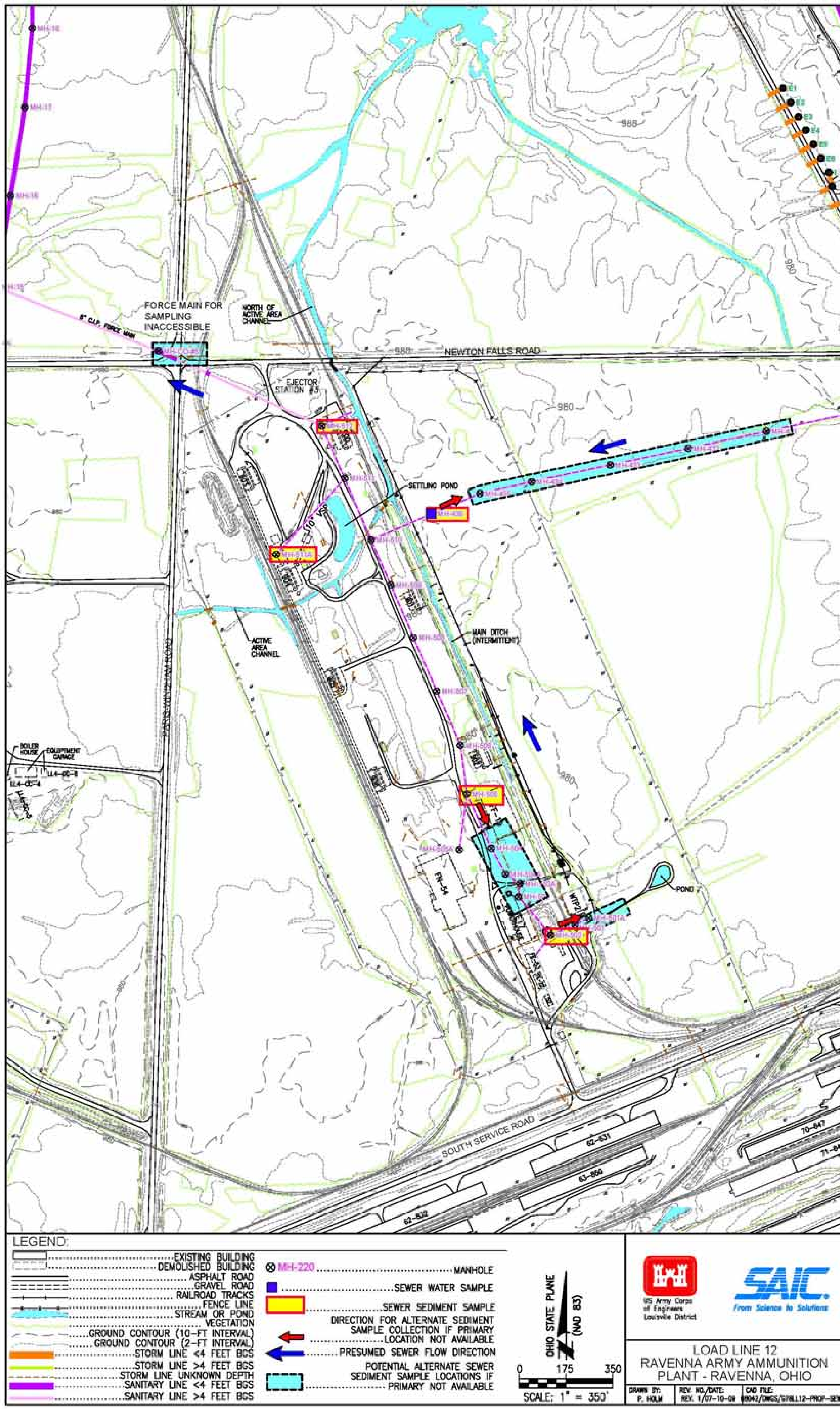


Figure P-4. Proposed Sewer Sampling Locations at Load Line 12

APPENDIX Q
Transportation Storage Area

Q.0 TRANSPORTATION STORAGE AREA

Q.1 AREA DESCRIPTION

Located on the eastern side of the facility, the Transportation Storage Area at one time controlled railroad operations for the entirety of RVAAP (Figure Q-1). The Transportation Storage Area contains 21.1 miles of the total 131 miles of railroad track in the facility, with a 21-track yard possessing an 870-car capacity. The area also contains several office and support buildings, including a locomotive repair shop.

As the Transportation Storage Area is remote to the larger sewer networks at the facility, a small sanitary sewer system supported the area, terminating at a sludge basin and septic tank. Historical maps indicate a run of sewer line extending from these structures and ultimately discharging to a surface drainage conveyance. A preliminary sewer reconnaissance effort in December 2008 indicated that the sludge basin was still intact, but that the lid of the adjacent septic tank had apparently collapsed. A limited storm sewer network is also present at the Transportation Storage Area.

Q.2 PREVIOUS INVESTIGATIONS

No former investigations are known to have been conducted at the Transportation Storage Area.

Q.3 PROPOSED SAP ADDENDUM INVESTIGATION OBJECTIVES

The general approach for investigation activities for Facility-Wide Sewers as a whole is presented in Section 3.2 of the FSP. However, certain areas of the system should be targeted for assessment based on the evaluation of existing historical data, results of previous investigations, anomalies identified during visual survey, or potential to have accumulated contaminants based on their location within the system and proximity to source areas. Although actual sampling locations cannot be established in advance since sufficient volume of media for sample collection may be unavailable and because site conditions may preclude access to portions of the system, primary and alternate sampling recommendations for the Transportation Storage Area are presented in Table Q-1, and shown in Figure Q-2.

Table Q-1. Summary of Proposed Sampling Locations the Transportation Storage Area

Sewer Type	Primary Sample Location	Alternate Sample Locations (In Order of Precedence)	Media Type	Comments/Rationale
Sanitary	Outfall Location From System	None.	Outfall Sediment Outfall Water	Represents terminal discharge end from the sanitary system
Sanitary	Within Former Sludge Basin For Sanitary System	None	Sewer Sediment	Represents location for potential accumulation of sediments.
Storm	Catch basin at Locomotive Service Building	Representative location at building	Sewer Sediment	Service Building represents a key potential source area
Storm	Catch basin at Boiler House/Coal bin Building	Representative location at building	Sewer Sediment	Boilerhouse represents a key potential source area

Additionally, during the investigation, the storm sewer network will be inspected and documented. Storm sewer inlets not shown on the maps were observed during the preliminary reconnaissance effort in December 2008, and available historical drawings for this area are limited. Additional samples not described in Table Q-2 may be collected at storm structures or conditions are encountered in the fields that warrant evaluation, such as observation of significant outfalls or sediment accumulation points.

During the visual survey phase, inspection forms will be completed for sewer structures at the Transportation Storage Area to document their condition and accessibility for subsequent investigative activities (i.e., sample media collection or video survey). Actual locations of sample collection, video surveys will be presented in the RI report.

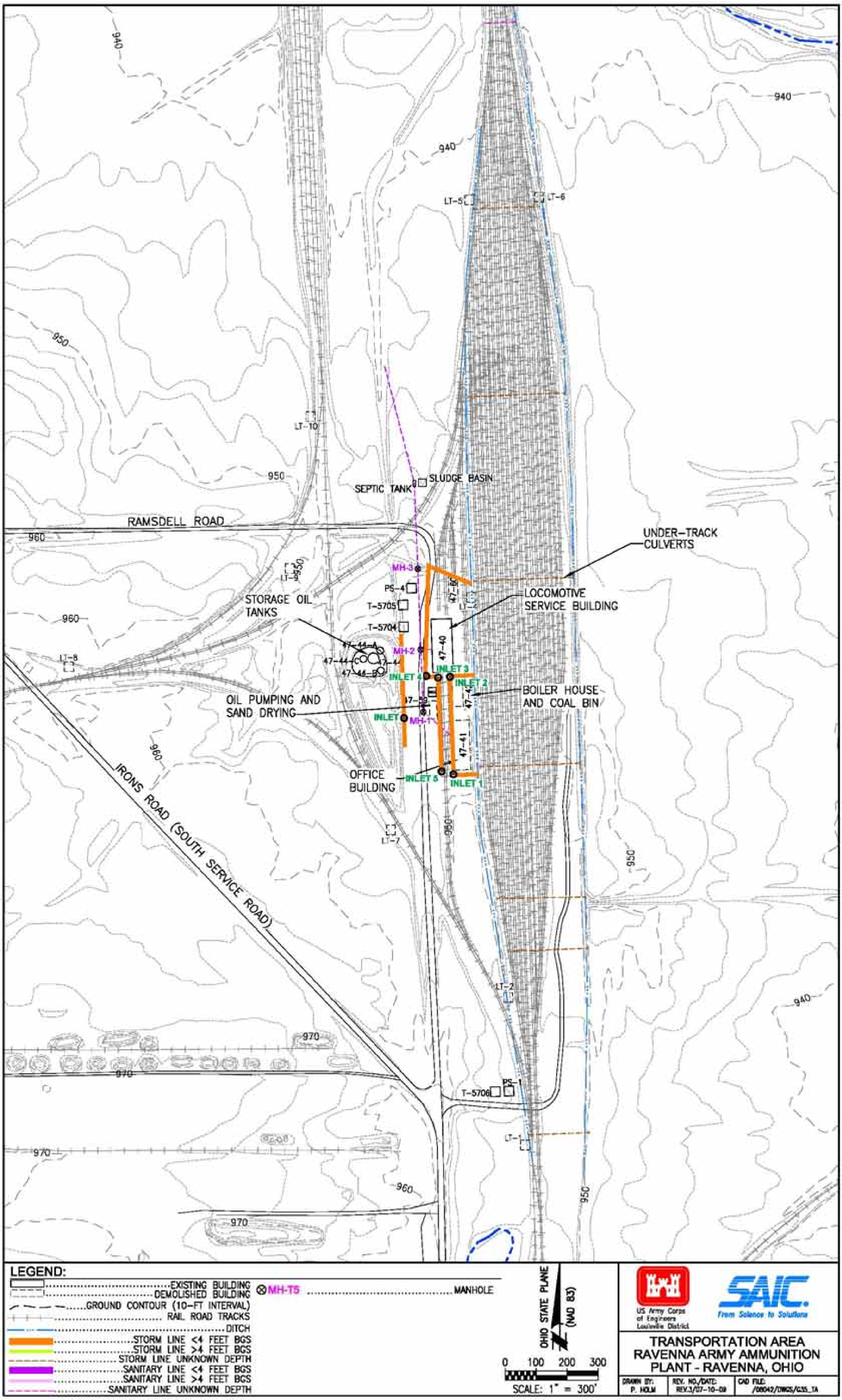


Figure Q-1. Transportation Storage area Sewers

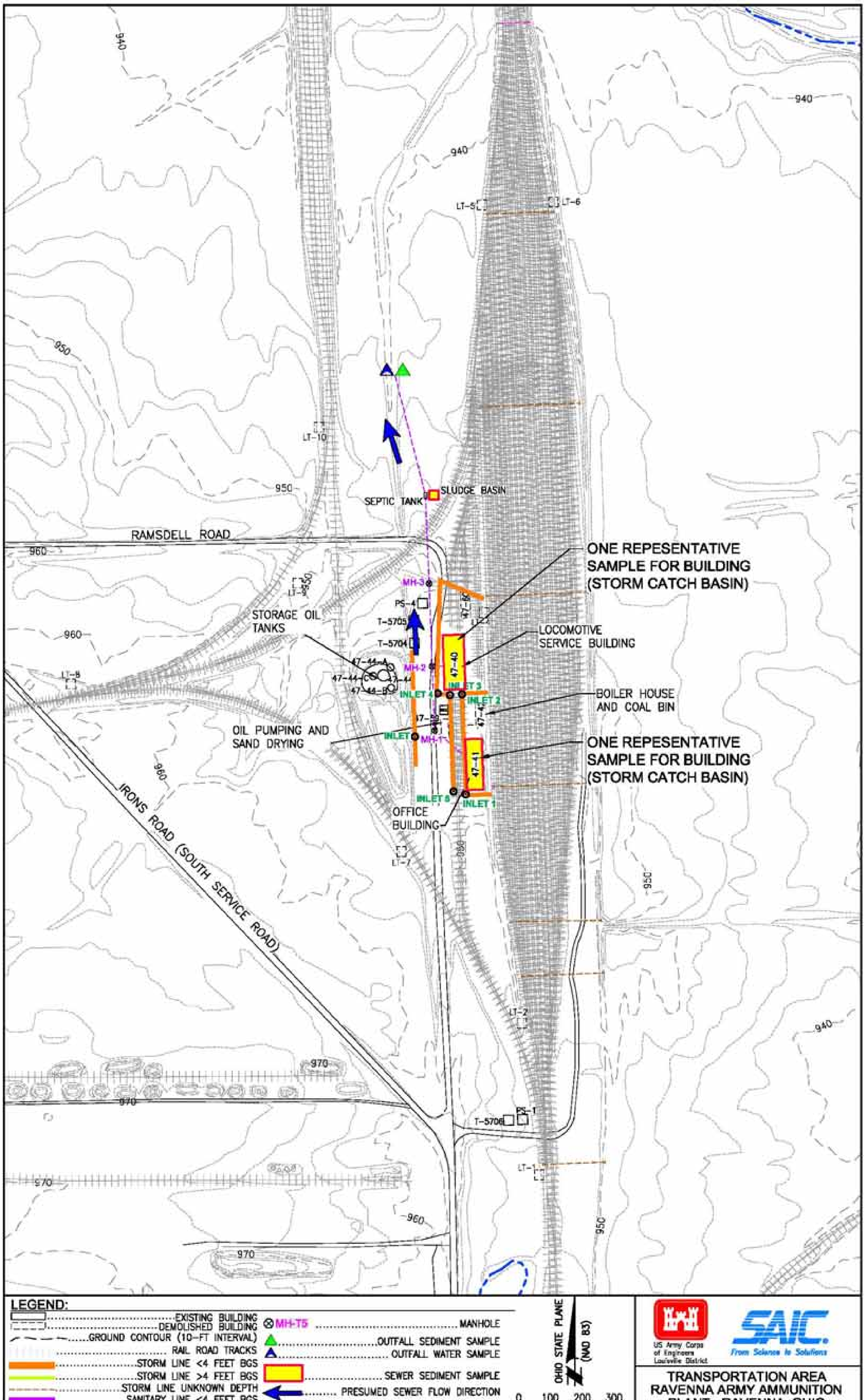


Figure Q-2. Proposed Sewer Sampling Locations at the Transportation storage Area

APPENDIX R
Procedure for Field Explosives Screening

STRATEGIC DIAGNOSTICS INC.

TNT EnSys® SOIL TEST SYSTEM

RAPID FIELD SCREEN

User's Guide

IMPORTANT NOTICE

The range of this test is between 1 and 30 ppm TNT/TNB/DNT. The relative standard deviation is 8% The least detectable concentration is 0.7 ppm (TNT).

This test system should be used only under the supervision of a technically qualified individual who is capable of understanding any potential health and environmental risks of this product as identified in the product literature. The components must only be used for the analysis of soil samples for the presence of TNT. After use, the kits must be disposed of in accordance with applicable federal and local regulations.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

ITEMS INCLUDED IN TEST KIT

- ☐ 2 Cuvette stopper plugs
- ☐ 1 Ampule cracker
- ☐ 20 Syringe filters
- ☐ 20 Wooden spatulas
- ☐ 20 Extraction jars
- ☐ 1 Bulb pipette
- ☐ 1 Developer solution
- ☐ 1 - 50mL graduated conical tube
- ☐ 1 TNT control ampule
- ☐ 20 - 30cc syringes
- ☐ 20 Weigh boats

ITEMS NOT INCLUDED IN TEST KIT

- ☐ 2 matched HACH cuvettes
- ☐ Paper towels
- ☐ Disposable gloves
- ☐ Acetone
- ☐ Hach DR/2000 or DR/2010
- ☐ Calculator
- ☐ Waste container
- ☐ Balance

READ BEFORE PROCEEDING

- For some matrices, air drying the soil samples may result in better TNT recovery or more reproducible data.
- A slightly modified protocol should be used if the primary analyte of concern is DNT. Please refer to the modification outlined on page 6.
- It is recommended that a control be run each day. See page **8** for instructions.
- SDI's EnSys® TNT Soil Test System is designed for use with either of Hach models **DR/2000** or the newer **DR/2010** spectrophotometers. Protocols for use of both instruments are provided in this User's Guide. Ensure the instrument protocol followed is appropriate for the instrument being used.
- The Hach DR/2000 is designed to turn off after a few minutes of inactivity. Press the "READ/ENTER" key every few minutes to prevent DR/2000 from turning off. If DR/2000 turns off, use Reference cuvette to rezero. Newer DR/2000 models and the DR/2010 have an overide "constant on" feature that allows the machine to run indefinitely. Refer to the Instrument Operation: Spectrophotometer Setup section of the HACH DR/2000 or DR/2010 User's manuals.

If you are using the TNT test in conjunction with the RDX test it is important to save your sample extracts. They will be used in the RDX test. Remember to cap the extracts tightly after use. An RDX kit without extraction set-ups can be purchased specifically for this purpose.

PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

CLEAN CUVETTES

1a Fill 2 Hach matched cuvettes with approximately 5 mL water.

1b Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1c Empty into waste container.

1d Fill cuvettes with approximately 5 mL acetone.

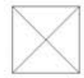
1e Cap each with cuvette stopper plug and, holding plug in place, shake vigorously for 3 seconds.

1f Empty into waste container.

1g Repeat acetone wash (steps 1d - 1f).

1h Wipe outside of cuvette with paper towels. Take care to especially clean the side labeled "25 mL" and the side opposite.

Cuvette



Cuvette stopper

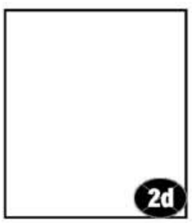
PHASE 1 TEST PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Designate a "Reference" and "Sample" cuvette.

SPECTROPHOTOMETER PREPARATION



2a1 Turn on Hach **DR/2000**. The instrument will read "SELF-TEST" followed by "Method?". Select Method "0" and press the "READ/ENTER" key.

or

2a2 Turn on the Hach **DR/2010**. The instrument will read "Self-Test V.xx", then "Enter Program #". Press the [Shift] key (do not hold) and then the [ABS/8] key. Note: Select Program # "0" may also be used to select absorbance mode on the **DR/2010**.

2b Rotate the wavelength dial until the small display shows: 540 nm.

2c Fill both cuvettes with acetone to the 25 mL line.

2d Insert "Reference" cuvette into cell holder on Hach DR/2000 or DR/2010 with side marked "25 mL" on the right.

Cuvette

2e1 Close light shield of the **DR/2000** and press "CLEAR/ZERO" key to establish the reference. The display will read "WAIT" and then "0.000 Abs.".

or

2e2 Close the light shield of the **DR/2010** and press the [ZERO] key. The display will read "Zeroing..." then "0.000 Abs.".

2f Remove the "Reference" cuvette and place the "Sample" cuvette in the cell holder.

2g1 On the **DR/2000**, press the "READ/ENTER" key and record the absorbance on the worksheet as "$\text{Abs}_{\text{background}}$".

or

2g2 On the **DR/2010**, press the [READ] key and record the absorbance on the worksheet as "$\text{Abs}_{\text{background}}$".

2h If reading is greater than 0.002 in magnitude (+ or -), clean cuvettes and redo steps 2a - 2g.

2i Empty acetone from "Sample" cuvette into waste container.

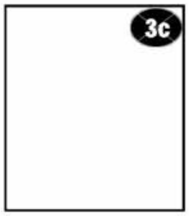
PHASE 2 SAMPLE EXTRACTION & PREPARATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

READ BEFORE PROCEEDING

- Sample should be mixed to ensure a homogeneous sample.

WEIGH SAMPLE



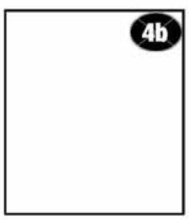
3a Place an unused weigh boat on pan balance.

3b Press ON/MEMORY button on pan balance. Balance will beep and display 0.0.

3c Weigh out 10+/- 0.1 grams of soil.

3d If balance turns off prior to completing weighing, use empty weigh boat to retare, then continue.

EXTRACT TNT



4a Measure 50 mL acetone in the 50mL graduated conical tube.

4b Pour acetone into an extraction jar.

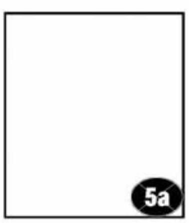
4c Using wooden spatula, transfer 10 grams of soil from weigh boat into extraction jar.

4d Recap extraction jar tightly and shake vigorously for three minutes.

4e Allow to settle for five minutes.

Repeat steps 3a - 4e for each sample to be tested.

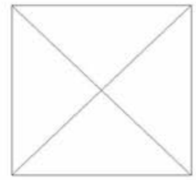
FILTER SAMPLE



5a Place tip of 30 cc syringe into liquid above the sediment layer in the extraction jar and draw up 25 mL of the sample.

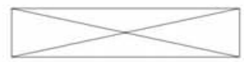
5b Screw the syringe filter onto the end of the syringe.

5c Press the plunger firmly and dispense the sample into the "Sample" cuvette.



Weigh Boat

Pan balance



Wooden spatula

50mL Graduated Conical Tube

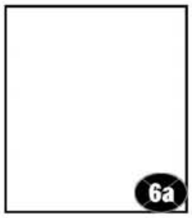
Extraction jar

30 cc syringe

Syringe filter

Cuvette

READ SAMPLE



6a Place the "Sample" cuvette in the cell holder.

6b Press the "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{initial}$".

6c Remove the "Sample" cuvette from the cell holder.

6d Add 1 drop of Developer Solution.

6e Cap the "Sample" cuvette and shake vigorously for 3 seconds.

Cuvette

DNT Analysis Note:

For analysis of samples containing DNT, and/or where DNT concentration is of concern, samples must be allowed to develop for 10 minutes before reading sample absorbance. This will not effect color development for other nitroaromatics.

6f Remove the cuvette stopper and place the "Sample" cuvette in the cell holder.

6g Press the "READ/ENTER" key and record the absorbance on the worksheet as "Abs_{sample}".

6h Clean cuvette between samples using procedure in steps 1a - 1h.

PHASE 4 INTERPRETATION

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

INTERPRETATION OF RESULTS

7a Multiply the "$Abs_{Initial}$" value for each sample by 4. Enter these values on the worksheet.

7b Subtract this value from the "Abs_{sample}" values for each sample and record on the worksheet.

$$TNT_{(ppm)} = \frac{Abs_{sample} - (Abs_{initial} x 4)}{0.0323}$$

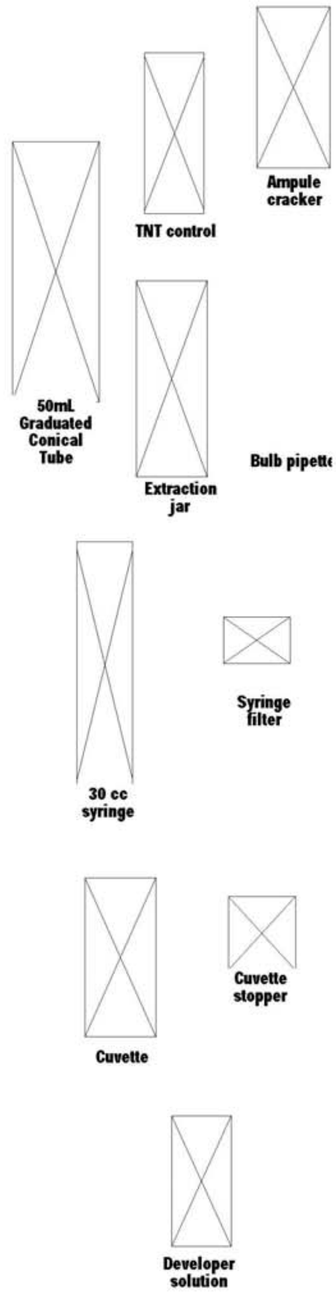
7c Divide the adjusted sample value by 0.0323 and record on the worksheet. This value is the TNT concentration of the sample in parts per million.

Note: For sample concentrations greater than 30ppm the sample extract should be diluted with acetone and reanalyzed. Remember to multiply the result by the dilution factor in order to determine the correct concentration.

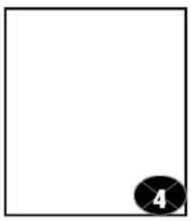
CONTROL (QA/QC) CHECK

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

- **The TNT control is optional, but it is recommended that it be run daily.**

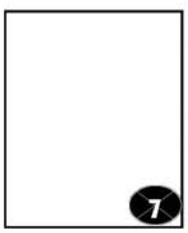


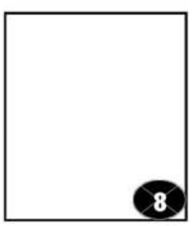
PREPARE CONTROL



1 Measure 50 mL acetone in the 50mL graduated conical tube.
2 Pour into extraction jar.
3 Open TNT control ampule by slipping ampule cracker over top, and then breaking tip at scored neck.
4 Transfer entire contents of TNT control ampule into extraction jar using bulb pipette.
5 Cap extraction jar and shake vigorously for 3 seconds.

ANALYZE THE CONTROL





7 Place tip of 30 cc syringe in extraction jar and draw up 25 mL.
8 Attach syringe filter and dispense into "Sample" cuvette.
9 Add 1 drop of developer solution.
10 Cap the cuvette and shake vigorously for 3 seconds.
11 Remove the cuvette stopper and place in the cell holder.
12 Press "READ/ENTER" key and record the absorbance on the worksheet as "$Abs_{control}$".
Absorbance must be between 0.307 - 0.373 for the test to be in control.
If test is not in control, clean "Sample" cuvette, and then redo steps 7-12 using the remaining liquid from the extraction jar.
13 If test is in control clean "Sample" cuvette before proceeding with samples.

QUALITY CONTROL

READ ALL INSTRUCTIONS BEFORE PROCEEDING WITH THE TEST

System Description

Each SDI EnSys® TNT Soil Test System contains enough material to perform twenty complete tests.

The TNT Soil Test is divided into four phases. The instructions and notes should be reviewed before proceeding with the test.

Hotline Assistance

If you need assistance or are missing necessary Test System materials, call toll free: 1-800-544-8881.

Validation Information

Product claims are based on validation studies carried out under controlled conditions. Data has been collected in accordance with valid statistical methods and the product has undergone quality control tests of each manufactured lot.

Strategic Diagnostics Inc. does not guarantee that the results with the TNT Soil Test System will always agree with instrument-based analytical laboratory methods. All analytical methods, both field and laboratory, need to be subject to the appropriate quality control procedures.

How It Works

Controls, Samples, and color-change reagents are added to cuvettes. The concentration of TNT in an unknown **Sample** is determined by evaluating how much color is developed.

Quality Control

Standard precautions for maintaining quality control:

- Do not use reagents or components from one Test System with reagents or components from another Test System.
- Do not use the Test System after its expiration date.
- The sample must be analyzed immediately after adding the Developer Solution.
- Results may not be valid if DR/2000 reading for **Control** is outside of the range of 0.307 - 0.373.

Storage and Handling Precautions

- Wear protective gloves and eye wear.
- Store kit at room temperature and out of direct sunlight (less than 80°F).
- If acetone comes into contact with eyes, wash thoroughly with cold water and seek immediate medical attention.
- Operate test at temperatures greater than 4° C/40° F and less than 39° C/100° F.
- After use, dispose of kit components in accordance with applicable federal and local regulations.

ON-SITE QUALITY CONTROL/QUALITY ASSURANCE RECOMMENDATIONS SDI EnSys® TEST SYSTEM

Please read the following before proceeding with field testing.

SAMPLING

The result of your screening test is only as valid as the sample that was analyzed. Samples should be homogenized thoroughly to ensure that the 10 grams you remove for field testing is representative of the sample as a whole. All other applicable sample handling procedures should be followed as well.

PRIOR TO TESTING SAMPLES

Carefully follow the instructions in the User's Guide included with every test kit. This is the key element in obtaining accurate results. In addition, store your unused test kits at room temperature and do not use them past their expiration date (see label on each test kit).

INTERNAL TEST QC

One control is provided with each Kit to provide internal test system quality control. Test runs resulting in a number that falls outside of the specified range should be repeated to ensure valid conclusions.

QA/QC

The validity of field test results can be substantially enhanced by employing a modest, but effective QA/QC plan. SDI recommends that you structure your QA/QC plan with the elements detailed below. These have been developed based on the data quality principles established by the U.S. Environmental Protection Agency.

A. **Sample Documentation**
    1. Location, depth
    2. Time and date of collection and field analysis

B. **Field analysis documentation** - provide raw data, calibration, any calculations, and final results of field analysis for all samples screened (including QC samples)

C. **Method calibration** - this is an integral part of SDI tests; a TNT control analysis should be performed daily (see the instructions in the User's Guide)

D. **Method blank** - field analyze fresh acetone

E. **Site-specific matrix background field analysis** - collect and field analyze uncontaminated sample from site matrix to document matrix effect

F. **Duplicate sample field analysis** - field analyze duplicate sample to document method repeatability; at least one of every 20 samples should be analyzed in duplicate

G. **Confirmation of field analysis** - provide confirmation of the quantitation of the analyte via an EPA-approved method different from the field method on at least 10% of the samples; provide chain of custody and documentation such as gas chromatograms, mass spectra, etc.

H. **Performance evaluation sample field analysis (optional, but strongly recommended)** - field analyze performance evaluation sample daily to document method/operator performance

I. **Matrix spike field analysis (optional)** - field analyze matrix spike to document matrix effect on analyte measurement

FURTHER QUESTIONS?

SDI's Technical Support personnel are always prepared to discuss your quality needs to help you meet your data quality objectives. Call 1-(800) 544-8881.

TNT SOIL TEST - ABBREVIATED PROCEDURE

STEP	PROCEDURE
1	• Clean cuvettes • Zero the spectrophotometer at 540 nm
2	• Add 10 g soil and 50 ml acetone to extraction jar • Shake 3 minutes, let settle • Draw up 25 mL extract, filter into cuvette
3	• Read $Abs_{initial}$, record • Add 1 drop developer solution, shake • Read Abs_{sample}, record
4	• Multiply $Abs_{initial}$ by 4 • Subtract from Abs_{sample} • Divide by 0.0323 • $TNT_{(ppm)} = \frac{Abs_{sample} - (Abs_{initial} \times 4)}{0.0323}$

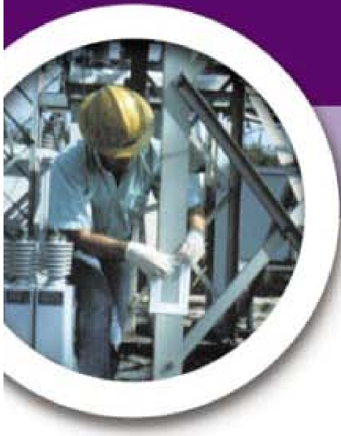
TNT SOIL TEST KIT WORKSHEET

$Abs_{background}$ ____________________ $Abs_{control}$ ____________________

1	2	3	4	5	6
SAMPLE #	$Abs_{initial}$	Abs_{sample}	$Abs_{initial}$ x4	Abs_{final} (Column 3 - Column 4)	TNT CONC ppm (Column 5/0.0323)

Remediation, Assessment & Industrial Testing

EnSys



EnSys RDX Soil Test System

Features

- detects RDX, HMX and related explosives compounds in soil samples
- provides quantitative results
- convenient and rapid testing in the field or lab, with results in about 30 minutes
- sample extractions may be performed simultaneously, with analysis in singlicate
- based on method developed by Dr. Thomas Jenkins at USACE - CRREL (non-immunoassay method)
- can test soil sample extracts from SDI's EnSys TNT test
- training recommended
- EPA SW-846 Method # 8510 (proposed status, Final with 4th Update)

SDI

Test Result Type

- Quantitative.

Samples per Kit

- 20 soil samples.

Assay Range

- 1 ppm to 30 ppm Total RDX in soil.
- Higher sample concentrations can be quantified by sample extract dilution.

Sample Preparation

- Soil samples require extraction using the included extraction components and user supplied acetone.
- Soil samples should be dried prior to analysis.
- Soil sample extracts from SDI's TNT Soil Test Kit may be used.

Sampling Time

- "Dirt-to-Data" in approximately 30 minutes.
- Typically, about 6 samples can be run in about one hour.
- Soil extraction time is typically 2-10 minutes per sample plus test run time of approximately 20 minutes.

Remediation, Assessment & Industrial Testing

EnSys

SDI

Strategic Diagnostics Inc.

111 Pencader Drive
Newark, DE USA 19702

302.456.6789 *tele*
800.544.8881 *tele*
302.456.6782 *fax*

www.sdix.com

Basic Test Procedures

- Clean cuvettes and set spectrophotometer.
- Extract soil sample:
  - weigh 10 grams of soil sample in weigh boat
  - measure 50 mL acetone into 50 mL tube
  - pour acetone into extraction jar
  - add acetone and shake for 3 minutes
  - allow to settle for 5 minutes
- Draw into a syringe 5.5 mL of liquid from above the sediment layer in extraction jar.
- Attach filter tip to syringe and transfer 5 mL of sample extract into a 13 mL tube.
- (Note: If nitrate/nitrite interferents are present, attach an Alumina-A cartridge to the syringe, and dispense through this.)
- Cut open an Acetic Acid bulb and add contents to the 13 mL tube. Cap and shake.
- Cut open a NitriVer pillow and add it to a 50 mL reaction vial containing water.
- Remove plunger from 5cc zinc syringe, pour 13 mL tube contents into it, replace & invert.
- Rapidly filter the solution into the 50 mL reaction vial, cap and shake for 30 seconds.
- Incubate for 15 minutes for color development, and transfer contents to 30 mL syringe barrel. Attach syringe filter and dispense into spectrophotometer cuvette.
- Place cuvette in spectophotometer and record absorbance.
- Calculate results.

Specificity

The EnSys RDX test is specific for RDX, HMX and related explosives compounds and exhibits the following sensitivities. The RDX test does not measure TNT, TNB, or DNB.

Compound	MDL Soil (ppm)
RDX	0.8
HMX	2.4
PETN	1.0
nitroglycerine	8.9
nitroguanadine	10.1
nitrocellulose	42.2

Test Kit Components

- 20 weigh boats & wooden spatulas.
- 20 extraction jars.
- 1 - 50 mL graduated tube.
- 20 - 50 mL reaction vials w/ H_2O.
- 20 - 5cc zinc syringes.
- 20 - 10cc, 20cc, & 30cc syringes.
- 20 - 13 mL tubes.
- 20 NitriVer pillows.
- 20 Acetic Acid bulb pipets.
- 40 syringe filters.
- 1 bulb pipet.
- 1 RDX control vial & ampule cracker.
- 2 cuvette stopper plugs.
- Test Kit instructions.

Storage & Precautions

- Shelf life is typically one year from date of manufacture, with lot specific kit expiration date information provided on product packaging.
- Storage at ambient temperature 64° to 81°F (18° to 27°C) is acceptable.
- Operate kit at greater than 4°C/40°F and less than 39°C/100°F.

Other Required Materials	SDI Part #
Ensys TNT Accessory Kit (Rental) (includes HACH DR/2000 or 2010)	69997
Acetone: hardware or laboratory grade (minimum of 50 mL per sample)	
Alumina A cartridges (if nitrate/nitrite interferents present)	60212
Scissors	
Tap or laboratory grade water for cuvette rinsing	
Marking pen, Calculator	
Absorbent paper	
Liquid waste container	
PPE: Disposable gloves, Eyewear	

Ordering Information	SDI Part #
EnSys RDX Explosives Soil Test Kit (with extraction jars)	70850
EnSys RDX Explosives Soil Test Kit (without extraction jars)	70851
EnSys TNT Explosives Soil Test Kit	70020
TNT Ensys Accessory Kit (Rental) (with HACH DR/2000 or 2010)	69997

N01511 6/24/98

Part II

Quality Assurance Project Plan
for the Sampling and Analysis Plan
for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers
Addendum No. 1

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:
SAIC Engineering of Ohio, Inc.
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

July 31, 2009

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ACRONYMS AND ABBREVIATIONS

ADR	Automated Data Review
A-E	Architect-Engineer
AOC	Area of Concern
ASTM	American Society of Testing and Materials
COC	Chain of Custody
CX	Center of Expertise
DoD	United States Department of Defense
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EDMS	Environmental Data Management System
FSP	Field Sampling Plan
HTRW	Hazardous, Toxic, and Radioactive Waste
ICP	Inductively-Coupled Plasma
LCS	Laboratory Control Samples
MI	Multi-Increment
MS/MSD	Matrix Spike/Matrix Spike Duplicate
MRL	Method Reporting Level
Ohio EPA	Ohio Environnemental Protection Agency
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PID	Photoionization Detector
QA	Quality Assurance
QAAP	Quality Assurance Administrative Procedure
QAPP	Quality Assurance Project Plan
QC	Quality Control
QSM	Quality Systems Manual
RI	Remedial Investigation
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TBD	To Be Determined
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) for the Sampling and Analysis Plan (SAP) for the Remedial Investigation (RI) of RVAAP-67 Facility-Wide Sewers Addendum (herein referred to as this SAP Addendum) addresses supplemental project-specific information for the Facility-Wide QAPP for the Ravenna Army Ammunition Plant (RVAAP) (USACE 2001). Each section in this report documents adherence to the Facility-Wide QAPP or stipulating project-specific addendum requirements.

Primary analytical direction for these projects will be obtained from the identified United States Environmental Protection Agency (USEPA) SW-846 Methods, the United States Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories (DoD 2006), and the Louisville QSM Supplement.

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2.0 PROJECT DESCRIPTION

This QAPP addresses supplemental project-specific information and tiers under the Facility-Wide QAPP for RVAAP (USACE 2001). Each QAPP section documents adherence to the Facility-Wide QAPP or stipulates project-specific requirements.

Primary analytical direction for these projects will be obtained from the identified EPA SW-846 Methods, the DoD QSM for Environmental Laboratories (DoD 2006), and the Louisville QSM Supplement.

2.1 SITE HISTORY/BACKGROUND INFORMATION

Site history and background information is contained in Sections 1.0 and 2.0 of the Field Sampling Plan (FSP) for this SAP Addendum. Sewer-specific background and history information is included in Appendices B through Q of the FSP.

2.2 PAST DATA COLLECTION ACTIVITY/CURRENT STATUS

Past data collection activities and current status information is provided in Appendices B through Q of the FSP (Part I).

2.3 PROJECT OBJECTIVES AND SCOPE

Project objectives are listed in Section 3.0 of the FSP.

2.4 SAMPLE NETWORK DESIGN AND RATIONALE

General information regarding the sample network design and rationale is provided in Section 3.2.9 of the FSP. The FSP contains information specific to each sewer area presented in Appendices B through Q.

2.5 PARAMETERS TO BE TESTED AND FREQUENCY

Sample matrix types, analytical parameters, and analytical methods are discussed in Section 4.5 and in Appendices B through Q (for specific sewer areas) of the FSP. These sampling and analysis requirements are summarized in Table 2-1, in conjunction with anticipated sample frequencies, quality assurance (QA) sample frequencies, and field quality control (QC) sample frequencies. The total number of samples to be collected for fixed-base laboratory analyses will be based on the sampling decision flowchart (Figure 3-2 of the FSP).

2.6 PROJECT SCHEDULE

The project schedule is discussed in Section 2.2 of the FSP.

Table 2-1. Sampling and Analytical Requirements

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
Soil – Chemical Analysis											
Metals (TAL)	SW-846, 6010C/6020A/ 7471B	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Semivolatile Organics	SW-846, 8270D/3540C	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Explosives	SW-846, 8330A	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Volatile Organics	SW-846, 8260B/5035B	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Pesticides	SW-846, 8081B/3540C	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
PCBs	SW-846, 8082A/3540C	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Nitroguanidine	SW-846, 8330A Mod.	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Nitrocellulose	SW-846, 9056A Mod.	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Polyaromatic Hydrocarbons	SW-846, 8310	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Cyanide	SW-846, 9010C/9012B	TBD	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
Surface Water											
Metals (TAL)	SW-846, 6010/7470A	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Semivolatile Organics	SW-846, 8270D/3520C	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Explosives	SW-846, 8330A/3520	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Nitrate	SW-846, 300.0	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Volatile Organics	SW-846, 8260B/5030B	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Pesticides	SW846, 8081B/3520C.	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
PCBs	SW846, 8082/3520C	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Nitroguanidine	SW846, 8330A Mod.	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Nitrocellulose	SW-846, 9056A Mod.	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Polyaromatic Hydrocarbons	SW-846, 8310	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Cyanide	SW-846, 9010C/9012B	-	-	TBD	TBD	2	TBD	TBD	TBD	TBD	TBD
Wet Sediment											
Metals (TAL)	SW-846, 6010C/6020A/ 7471B	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Semivolatile Organics	SW-846, 8270D/3540C	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD

Table 2-1. Sampling and Analytical Requirements (continued)

Parameter	Methods	Field Samples[a]			Field Duplicate Samples[b]	Site Source Water[c]	Sampler Rinsates[d]	Trip Blanks[e]	Total A-E Samples	USACE QA Split Samples[f]	USACE Trip Blanks[e]
		Discrete	MI	Total							
Explosives	SW-846, 8330A	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Volatile Organics	SW-846, 8260B	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Pesticides	SW-846, 8081B/3540C	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
PCBs	SW-846, 8082A/3540C	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Nitroguanidine	SW-846, 8330A Mod.	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Nitrocellulose	SW-846, 9056A Mod.	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Polyaromatic Hydrocarbons	SW-846, 8310	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD
Cyanide	SW-846, 9010C/9012B	-	-	TBD	TBD	-	TBD	TBD	TBD	TBD	TBD

[a]All samples collected for fixed-base laboratory analyses will be analyzed for TAL metals and explosives. Full suite samples will be collected at a frequency of 10% according to the FSP. Matrix spike/matrix spike duplicate samples will be collected at a rate of 5% (1 per 20) of total samples per media.
[b]Duplicate samples are collected at a frequency of 10 % of the total number of samples.
[c]Source waters will be collected from the potable water source and from the ASTM (de-ionized) water supply lot for the project. The source water sample quantities are included under the surface water subheading.
[d]Rinsate samples will be collected at a frequency of 10% for water samples (surface water) for which undedicated, decontaminated equipment is used. For soil samples, two rinsate samples will be collected per field cycle.
[e]One trip blank will be collected for each shipping container (e.g., cooler) that contains water samples for VOC analysis.
[f]USACE QA Split Samples will be collected at a frequency to be determined by USACE.

A-E = Architect-Engineer
ASTM = American Society of Testing and Materials
EM = Engineering Manual (USACE)
MI = Multi-Increment (sample)
N/A = not applicable
PCB = polychlorinated biphenyl
QA = Quality Assurance
RI = Remedial Investigation
TAL = Target Analyte List
TBD = To Be Determined
USACE = U.S. Army Corps of Engineers
VOC = Volatile Organic Compound
- = not applicable/not required

3.0 PROJECT ORGANIZATION

The project organization and responsibilities are described in Section 2.0 of the Facility-Wide SAP.

Analytical support for this work has been assigned to the following contract laboratory:

White Water Associates, Inc.
429 River Lane, Amasa, Michigan 49903
Phone: (906) 822-7889
Fax Number: (906) 822-7977
Contact: Bette J. Premo, Laboratory Director
Email: bette.premo@white-water-associates.com

The contract laboratory's QAPP will be forwarded at the request of the USACE.

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4.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

4.1 DATA QUALITY OBJECTIVES

Data quality objective (DQO) summaries for this investigation will follow Tables 3-1 and 3-2 in the Facility-Wide QAPP. All QC parameters stated in the specific USEPA SW-846 methods will be adhered to for each chemical listed. The SW-846 method references found in the Facility-Wide QAPP have been revised to the Update IV methods. However, either the Update III or IV methods may be used by the analytical laboratory. Laboratories are required to comply with all methods as written; recommendations are considered requirements. Concurrence with the DoD QSM for Environmental Laboratories (DoD 2006) and the Louisville QSM Supplement is also required.

The contract laboratory will deliver an electronic data deliverable (EDD) that is automated data review (ADR) compatible. The contract laboratory must identify variances to the established library prior to any analysis being performed. No variances to the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement are anticipated.

4.2 LEVEL OF QUALITY CONTROL EFFORT

QC efforts will follow Section 3.2 of the Facility-Wide QAPP. Field QC measurements will include field source water blanks, trip blanks, field duplicates, and equipment rinsate blanks. Laboratory QC measurements will include method blanks, laboratory control samples (LCS), laboratory duplicates, and matrix spike/matrix spike duplicate (MS/MSD) samples. LCS measurements will include the standard mid-level analyte concentration, plus a QC/method reporting level (MRL) low-level concentration. The QC/MRL will be successfully analyzed at the beginning of the analytical sequence as required by the QSM. Additionally, the lab will analyze the QC/MRL sample at the close of the analytical sequence.

4.3 ACCURACY, PRECISION, AND SENSITIVITY OF ANALYSIS

Accuracy, precision, and sensitivity goals identified in Section 3.3 and Tables 3-3 through 3-9 of the Facility-Wide QAPP will be imposed for this investigation. As stated above, some of the analytical methods numbers have been updated (refer to Table 2-1). Quality objectives related to individual method QC protocol will also follow requirements given in the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement.

Laboratories will make all reasonable attempts to meet the program and project reporting levels in Tables 3-1 through 3-9 of the Facility-Wide QAPP for each individual sample analysis. When samples require dilution, both the minimum dilution and quantified dilution must be reported. All samples will be screened to determine optimum dilution ranges. Dilution runs will be performed to quantitate high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, a five times less diluted run will then be performed to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analyte, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact Science Applications International Corporation (SAIC) and USACE Louisville District, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

4.4 COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

Completeness, representativeness, and comparability goals identified in Section 3.4 and Tables 3-1 and 3-2 of the Facility-Wide QAPP will be imposed for this investigation.

5.0 SAMPLING PROCEDURES

Sampling procedures are described in Section 4.0 of the Facility-Wide SAP and referenced in Section 4.0 of the FSP.

Tables 5-1 and 5-2 summarize sample container, preservation, and holding time requirements for the soil, wet sediment, and water matrices for this investigation. The number of containers required will be estimated in this table after the laboratory has been selected.

As noted in the Facility-Wide QAPP, additional sample volumes will be provided, when necessary, for the express purpose of performing associated laboratory QC (MS/MSD). These laboratory QC samples will be designated by the field and identified for the laboratory on respective chain-of-custody (COC) documentation.

Table 5-1. Container Requirements for Soil and Wet Sediment Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	EnCore Samplers[a] or Glass w/ Teflon Lid[b]	3 EnCore Samplers[a] or 2-2 oz jars[b]	Cool, 4°C	14 d
Semivolatile Organic Compounds	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Pesticide Compounds	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
PCBs	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
PAH Compounds	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Explosive Compounds	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitroguanidine	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrocellulose	Glass w/ Teflon Lid	100 grams	Cool, 4°C	14 d (extraction) 40 d (analysis)
Metals (TAL)	Glass w/ Teflon Lid	10 grams	Cool, 4°C	180 d; Hg @ 28 d
Cyanide	Glass w/ Teflon Lid	10 grams	Cool, 4°C	14 d

[a] Sample container for soil samples.
[b] Sample container for wet sediment samples.
PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbon
TAL = target analyte list
TBD = To be Determined

Table 5-2. Container Requirements for Surface Water Samples

Analyte Group	Container	Minimum Sample Size	Preservative	Holding Time
Volatile Organic Compounds	Glass Vials w/ Teflon Lined Septum Cap	3- 40 oz	HCl to pH <2 Cool, 4°C	14 d
Semivolatile Organic Compounds	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Pesticide Compounds	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
PCBs	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
PAH Compounds	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Explosive Compounds	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	7 d (extraction) 40 d (analysis)
Nitroguanidine	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrocellulose	Amber Glass w/ Teflon Lid	1000 mL	Cool, 4°C	14 d (extraction) 40 d (analysis)
Nitrate	Plastic	100 mL	Cool, 4°C	48 hrs
Metals (TAL)	High Density Polyethylene	200 mL	HNO3 to pH <2 Cool, 4°C	180 d; Hg @ 28 d
Cyanide	Plastic	500 mL	NaOH to pH >12 Cool, 4°C	14 d

PCB = Polychlorinated Biphenyl
PAH = Polycyclic Aromatic Hydrocarbon
TAL = target analyte list
TBD = To be Determined

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6.0 SAMPLE CUSTODY

Sample custody procedures will follow the procedures identified in Section 5.0 of the Facility-Wide QAPP.

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7.0 CALIBRATION PROCEDURES AND FREQUENCY

7.1 FIELD INSTRUMENTS/EQUIPMENT

Field instruments and equipment calibrations will follow procedures described in Section 6.1 of the Facility-Wide QAPP and Section 4.0 of the FSP.

7.2 LABORATORY INSTRUMENTS

Calibration of laboratory equipment will follow procedures identified in Section 6.2 of the Facility-Wide QAPP, the contract laboratory QAPP, laboratory-specific standard operating procedures (SOP), and corporate and facility-specific operating procedures.

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8.0 ANALYTICAL PROCEDURES

8.1 LABORATORY ANALYSIS

Analytical methods, parameters, and quantitation or detection limits are listed in Tables 3-3 through 3-9 of the Facility-Wide QAPP. The SW-846 method references found in the Facility-Wide QAPP have been revised to the Update III methods (i.e., 8260A is now 8260B and 8270B is now 8270D). Laboratory analysis procedures are provided in Section 7.1 of the Facility-Wide QAPP. Either the Update III or IV methods may be used by the analytical laboratory.

The contract laboratory facilities will at all times maintain a safe and contaminant free environment for the analysis of samples. The laboratories will demonstrate, through instrument blanks, holding blanks, and analytical method blanks, that the laboratory environment and procedures will not and do not impact analytical results.

The contract laboratory facilities will also implement all reasonable procedures to maintain project reporting levels for all sample analyses. Where contaminant and sample matrix analytical interferences impact the laboratory's ability to obtain project reporting levels, the laboratory will institute sample clean-up processes, minimize dilutions, adjust instrument operational parameters, or propose alternative analytical methods or procedures. Elevated reporting levels will be kept to a minimum throughout the execution of this work. When samples require dilution, both the minimum dilution and quantified dilution must be reported. The contract laboratory will screen all samples to determine optimum dilution ranges. Dilution runs will be performed to quantitate high target analyte concentrations within the upper half of the calibration range, thus reducing the degree of dilution as much as possible. In addition, a five times less diluted run will then be performed to report other target analyte reporting levels as low as possible without destroying analytical detectors and instrumentation. If there are matrix interferences, non-target analyte, or high target analyte concentrations that preclude analysis of an undiluted sample, the laboratory project manager will contact SAIC and USACE Louisville District, forward analytical and chromatographic information from diluted runs, and obtain direction on how to proceed.

8.2 FIELD SCREENING ANALYTICAL PROTOCOLS

Procedures for instrument calibration, calibration frequency, and field analysis are identified in Section 6.0 of the Facility-Wide FSP, and in Section 4.0 of the FSP. Field screening for explosives will be conducted to allow real-time decision making for collection of fixed-base laboratory analyses. Organic vapors will be screened using a photoionization detector (PID). Headspace analysis will not be conducted.

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9.0 INTERNAL QUALITY CONTROL CHECK

9.1 FIELD SAMPLE COLLECTION

Field QC sample types and frequencies are identified in Sections 4.0 of the FSP. In general, field duplicates will be collected at a frequency of 10%. Field equipment rinsates will be collected at a frequency of 10% for water samples and one soil equipment rinsate sample will be collected per field cycle. Equipment rinsate samples pertain only to samples collected using reusable, decontaminated equipment. This will constitute a process check for the effectiveness of the decontamination procedure. Two site source water samples (one potable water source and one deionized water source) will be collected for the combined field effort.

9.2 FIELD MEASUREMENT

Refer to Section 4.0 of the FSP for details regarding field measurements.

9.3 LABORATORY ANALYSIS

Analytical QC procedures will follow those identified in the referenced USEPA methodologies. These will include method blanks, LCS, MS, MSD, laboratory duplicate analysis, calibration standards, internal standards, surrogate standards, and calibration check standards.

The contract laboratory facilities will conform to their QAPP and implement their established SOPs to perform the various analytical methods required by the project. QC frequencies will follow those identified in Section 8.3 of the Facility-Wide QAPP.

Analyses will also be consistent with direction provided by the DoD QSM for Environmental Laboratories and the Louisville QSM Supplement. The following are clarifications to this guidance relative to this project:

- The QC/MDL check will be performed quarterly, until criteria can be established. After performance criteria are determined, the frequency of this QC check may be reduced to biannually or annually per instrument.

- Analytical method blanks will be considered clean as long as analyte concentrations are below one-half the reporting levels for all analytes except common laboratory contaminants which are expected to be below the reporting level. Corrective actions will be performed for any analyte detected above the established method reporting level. Any analytes detected between the method detection limit and the MRL will be flagged appropriately.

- LCSs will contain all project target compounds. The number of marginal exceedances should not exceed the number allowed by the QSM.

- For methods that have multi-responders (i.e., aroclors) within the same analytical process, the laboratory will not include all analytes within the matrix spiking mixture. A representative analyte will be employed for the MS evaluation.

- Inductively coupled plasma initial calibration curves will be confirmed through the analysis of a blank and three standards, and this documentation will be reported as part of the analytical data package.

- Inductively coupled plasma (ICP) serial dilution will be performed on a per batch basis. If the serial dilution falls outside acceptance criteria, a post-digestion spike analyses will be performed.

- Sediment samples having moisture levels that preclude soxlet extraction processes will be extracted by sonication methods.

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

Data reduction will follow the established protocols defined in Section 9.1 in the Facility-Wide QAPP. Sample collection and field measurements will follow the established protocols defined in the Facility-Wide QAPP, Facility-Wide SAP, and this SAP Addendum. Laboratory data reduction will follow the contract laboratory QAPP guidance and will conform to general direction provided by the Facility-Wide QAPP, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement.

10.2 DATA VERIFICATION/VALIDATION

Project data verification and validation will follow direction provided in the Facility-Wide QAPP Section 9.2 and diagramed in Figure 9-1. Protocol for analytical data verification and validation has been updated to the following references:

- DoD QSM for Environmental Laboratories, January 2006 (DOD 2006).
- Louisville QSM Supplement.
- USEPA National Functional Guidelines for Organic Data Review, EPA-540/R-99/008, October 1999 (USEPA 1999).
- USEPA National Functional Guidelines for Inorganic Data Review, EPA-540-R-04-004, October 2004 (USEPA 2004).

All data will be reviewed and verified by SAIC according to the Facility-Wide QAPP.

Validation of 10% of the data will follow the direction provided in the Facility-Wide QAPP, the DoD QSM for Environmental Laboratories, and the Louisville QSM Supplement. An independent data validation subcontractor qualified by USACE Louisville District will perform this data validation. The validator shall document the findings of the review using the checklists in Attachment B of the Louisville Chemistry Guideline (LCG), Rev. 5, June 2002. These checklists may be modified to implement QSM criteria.

10.3 DATA REPORTING

Data reports will follow the established protocols defined in Section 9.3 in the Facility-Wide QAPP. The contract laboratory will deliver an EDD that is ADR compatible. All data will be processed by ADR/environmental data management system (EDMS) software using the Ravenna library. All errors in the ADR/EDD found by CHECKER must be corrected by the laboratory prior to transmittal. EDDs with errors will not be accepted.

10.4 DATA QUALITY ASSESSMENT

Data quality will be assessed using the procedures provided in Section 9.4 of the Facility-Wide QAPP.

11.0 PERFORMANCE AND SYSTEM AUDITS

11.1 FIELD AUDITS

One field surveillance for the investigation will be performed by the SAIC QA/QC Officer, the SAIC Field Operations Manager, or another properly trained SAIC auditor. This surveillance will encompass the performance of sampling of any environmental medium. The surveillance will follow SAIC Quality Assurance Administrative Procedure (QAAP) 18.3.

USACE, USEPA Region 5, or Ohio Environmental Protection Agency (Ohio EPA) audits may be conducted at the discretion of the respective agency.

11.2 LABORATORY AUDITS

Routine USACE Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX) on-site laboratory audits may be conducted by USACE, while audits by EPA Region 5 or Ohio EPA may be conducted at the discretion of the respective agency.

Internal performance and systems audits will be conducted by the contract laboratory’s QA staff, as defined in their QAPP.

More information regarding laboratory audits can be found in Section 10.2 of the Facility-Wide QAPP.

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12.0 PREVENTIVE MAINTENANCE PROCEDURES

Maintenance of all field and laboratory sampling and analytical equipment will follow direction provided in Section 11.0 of the Facility-Wide QAPP. Routine and preventive maintenance for all laboratory instruments and equipment will follow the direction of the contract laboratory QAPP.

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13.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Field and laboratory data will be assessed as outlined in Sections 12.1 and 12.2 of the Facility-Wide QAPP.

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14.0 CORRECTIVE ACTIONS

Field and laboratory activity corrective action protocol will follow directions provided in Sections 13.1 and 13.2 of the Facility-Wide QAPP. Laboratory corrective actions will also follow the procedures in the contract laboratory QAPP.

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15.0 QA REPORTS

Procedures and reports will follow the protocol identified in Section 14.0 of the Facility-Wide QAPP and those directed by the contract laboratory QAPP.

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16.0 REFERENCES

DoD (United States Department of Defense) 2006. *Quality Systems Manual for Environmental Laboratories,* Environmental Data Quality Workgroup, Final Version 3. Final. January 2006.

USACE (U.S. Army Corps of Engineers) 2002. *Louisville Chemistry Guideline*. Environmental Chemistry Branch, Rev. 5. June 2002.

USACE 2001. *Facility-Wide Sampling and Analysis Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, *DACA62-00-D-0001, Delivery Order CY02.* Final. March 2001.

USEPA (U.S. Environmental Protection Agency) 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA-540/R-99/008. Final. October 1999.

USEPA 2004. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA-540-R-04-004. Final. October 2004.

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Part III

Site Safety and Health Plan
for the Remedial Investigation of RVAAP-67 Facility-Wide Sewers
Addendum No.1

Ravenna Army Ammunition Plant
Ravenna, Ohio

Contract No. W912QR-04-D-0028
Delivery Order No. 0001

Prepared for:
U.S. Army Corps of Engineers
600 Martin Luther King, Jr. Place
Louisville, Kentucky 40202

Prepared by:
SAIC Engineering of Ohio, Inc.
8866 Commons Boulevard, Suite 201
Twinsburg, Ohio 44087

July 31, 2009

APPROVALS

Final
Site Safety and Health Plan
Addendum No. 1 for the
Remedial Investigation of RVAAP-67 Facility-Wide Sewers

July 2009

07-21-09

Kevin Jago Phone 865-481-4614 — Date
SAIC Project Manager

July 22, 2009

Stephen Davis, CIH (#4213), CSP (#10044), Phone 865-481-4755 — Date
SAIC Health and Safety Officer

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AOC	Area of Concern
BGS	Below Ground Surface
Camp Ravenna	Camp Ravenna Joint Military Training Center
CIH	Certified Industrial Hygienist
COC	Chemical of Concern
CPR	Cardiopulmonary Resuscitation
CSP	Certified Safety Professional
DPT	Direct-Push Technology
E2I	Energy, Environment & Infrastructure
EH&S	Environmental Health and Safety
FM	Field Manager
FOM	Field Operations Manager
FP	Flash Point
FWSHP	Facility Wide Safety and Health Plan
GFCI	Ground-Fault Circuit Interrupter
HAZWOPER	Hazardous Waste Operations
H&S	Health and Safety
HTRW	Hazardous, Toxic, and Radioactive Waste
IDW	Investigation-Derived Waste
IDLH	Immediately Dangerous to Life and Health
IP	Ionization Potential
IRP	Installation Restoration Program
MEC	Munitions and Explosives of Concern
MMRP	Military Munitions Response Program
MSDS	Material Safety Data Sheet
NGB	National Guard Bureau
NIOSH	National Institute for Occupational Safety and Health
NRR	Noise Reduction Rating
OEW	Ordnance and Explosive Waste
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
OJT	On-the-Job Training
O&M	Operations and Maintenance
PAH	Polycyclic Aromatic Hydrocarbon
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
ppm	Parts Per Pillion
PVC	Polyvinyl Chloride

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
STEL	Short-Term Exposure Limit
TBD	To Be Determined
TLV	Threshold Limit Value
TWA	Time-Weighted Average
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
VP	Vapor Pressure

1.0 INTRODUCTION

Science Applications International Corporation's (SAIC's) formal policy, stated in the Environmental Compliance and Health and Safety Program manual, is to take every reasonable precaution to protect the health and safety of our employees, the public, and the environment. To this end, the Ravenna Army Ammunition Plant (RVAAP) *Facility-Wide Safety and Health Plan* (FWSHP) (USACE 2001) and this Site Safety and Health Plan (SSHP) collectively set forth the specific procedures required to protect SAIC and SAIC subcontractor personnel involved in the field activities. These plans are driven by requirements contained in the most current revisions of the Unites States Army Corps of Engineers (USACE) *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW)* and *Ordnance and Explosive Waste (OEW) Activities, ER-385-1-92,* and the USACE *Safety and Health Manual, EM-385-1-1*, which are available online via the USACE web site. SAIC activities are also subject to the requirements of the SAIC Corporate Environmental Compliance and Health and Safety Program and associated procedures. All field personnel are required to comply with the requirements of these programs and plans.

The FWSHP addresses program issues and hazards and hazard controls common to the entire installation. This SSHP Addendum to the FWSHP serves as the lower tier document addressing the hazards and controls specific to the *Sampling and Analysis (SAP) Plan Addendum No. 1 RVAAP- 67 Facility-Wide Sewers Area of Concern (AOC).* Copies of the FWSHP and this SSHP Addendum will be present at the work site during all fieldwork.

SAIC will perform an investigation at RVAAP of the sanitary and storm water sewers area of concern, designated RVAAP-67 Facility-Wide Sewers. The objective of this investigation is to:

- Conduct visual survey of accessible sanitary and storm sewer structures (e.g., manholes, drop inlets) to document physical conditions and identify potential sampling locations;

- Collect sewer sediment samples by using a remote sampling device (Eckman sampler or sediment core sampler) for analysis of explosives via (1) screening-level field analysis using explosives test kits and (2) fixed-base laboratory analysis;

- Collect sewer water samples by using a dipper or pond sampler for analysis of explosives and metals via fixed-base laboratory analysis;

- Conduct video surveys of sewer lines; and

- Advance soil borings via hand-augering and/or direct-push technology (DPT) methods and collect samples for fixed-base laboratory analysis of explosives and metals.

A photoionization detector (PID) will be used to continuously monitor the breathing zone during all sampling activities. All work will be conducted from ground surface. Entry into a manhole or catch basin may be required for the video survey. If a video survey is necessary, it will be performed by an

SAIC subcontractor, and all work performed shall be supervised by SAIC personnel. If confined space entry is required, the subcontractor will perform the confined space entry in accordance with 29 CFR 1910.146 and EM 385-1-1 Section O6I, and an additional addendum to the FWSHP will be submitted. No SAIC personnel shall enter or participate in confined spaces entry during any phase of this project.

Sampling crews will use protective gloves to handle potentially contaminated materials, and if necessary, the Site Safety and Health Officer (SSHO) will upgrade the required personal protective equipment (PPE). The SSHO will observe all site tasks during daily safety inspections and will use professional judgment and appropriate monitoring results to determine if upgrading PPE is required. A detailed analysis of these hazards and specific appropriate controls is presented in Table 3-2 (Section 3.0). Details regarding PPE are contained in Section 7.0.

2.0 FACILITY DESCRIPTION AND CONTAMINANT CHARACTERIZATION

2.1 FACILITY DESCRIPTION

The current RVAAP consists of 1,280 acres scattered throughout the Ohio Army National Guard (OHARNG) Camp Ravenna Joint Military Training Center (Camp Ravenna). Camp Ravenna is in northeastern Ohio within Portage and Trumbull Counties, approximately 4.8 km (3 miles) east-northeast of the City of Ravenna and approximately 1.6 km (1 mile) northwest of the City of Newton Falls. The RVAAP portions of the property are solely located within Portage County. Camp Ravenna/RVAAP is a parcel of property approximately 17.7 km (11 miles) long and 5.6 km (3.5 miles) wide bounded by State Route 5, the Michael J. Kirwan Reservoir, and the CSX System Railroad on the south; Garret, McCormick, and Berry roads on the west; the Norfolk Southern Railroad on the north; and State Route 534 on the east (Figures A-1 and A-2). Camp Ravenna is surrounded by several communities: Windham on the north; Garrettsville 9.6 km (6 miles) to the northwest; Newton Falls 1.6 km (1 mile) to the southeast; Charlestown to the southwest; and Wayland 4.8 km (3 miles) to the south.

Facility-Wide Sewers (RVAAP-67) is an AOC created in 2008 and comprised of Installation Restoration Program (IRP) eligible storm and sanitary sewers located throughout RVAAP, including Load Lines 1-12 and the Administrative Areas. The sewer system in the plant is divided into two sewage basins: a western basin and an eastern basin. The western basin includes the combined sanitary and storm sewers draining the Administrative Areas and sanitary sewers at Load Lines 5-11 that terminate at the George Road Sewage Treatment Plant. Also, several short runs of separated storm sewer exist throughout Load Lines 5-11 in the western basin, terminating in ditches and other drainage features. The eastern basin includes the sanitary sewers draining Load Lines 1-4, Load Line 12, and Atlas Scrap Yard, and terminates at the Sand Creek Sewage Treatment Plant. Load Lines 1-4 and Load Line 12 also have separate storm sewer systems terminating in drainage features such as ditches and retention ponds.

The sewers sometimes received inadvertent discharges of contaminated wastewaters from the manufacturing of munitions. In the course of normal facility operations at RVAAP, explosive compounds were routinely washed off of the floors and walls for operational safety. Wash water potentially containing explosives were washed onto the surrounding ground and may have found their way into sewers. Based on operational history and the layout of the sewer network, potential contamination would be expected to occur: (1) in the sewers underlying the source buildings to the first manhole outside the building; (2) in sewers from a group of source buildings which join at common manholes; and (3) in main sewer lines that connect to the centralized treatment plant (Lakeshore Engineering 2007).

Two investigations specific to sewers at RVAAP have been conducted to identify and evaluate any potential threats to human health due to the disposal or release of explosive compounds or their derivatives by way of the sanitary and storm sewers (Lakeshore Engineering 2007; USACE CERL

2007). These investigations utilized visual inspections of manholes, video surveys of lines, DropEx field screenings, and an evaluation of historical data to identify locations of residual contamination from ammunition production activities. In the large load lines (1-4), trace explosives were found at a few locations peripheral to the melt-pour buildings. Although these occurrences were observed predominantly in the storm water lines, screening data indicate detections in adjacent sanitary lines. Trace explosives were observed in only a few of the smaller load lines (5-11). During the investigation, some sewer manholes were observed to be inaccessible due to being paved over with asphalt/concrete, having caved in, or containing debris such as dirt and concrete. In the load line areas where the buildings had been demolished, difficulty was encountered in locating the sewer structures without the buildings to provide context, necessitating the use of a GPS system. Overall, both the sanitary and storm sewers were observed to be largely free of explosive contamination, and no accumulations of explosives sediment that may pose an explosion hazard were observed.

2.2 CONTAMINANTS

Table 2-1 lists contaminants known to occur in sewer and outfall sediment and sewer water. Inclusion in this table indicates the potential to encounter a contaminant during sampling activities, but it does not necessarily indicate that the contaminant is present in sufficient quantity to pose a health risk to workers.

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Sewer Sediment and Water

Chemical	Units	Maximum Detect[a]
Sewer Sediment		
Metals		
Aluminum	mg/kg	21,600
Antimony	mg/kg	7,150
Arsenic	mg/kg	157
Barium	mg/kg	2,030
Cadmium	mg/kg	11.2
Chromium	mg/kg	2,380
Cobalt	mg/kg	79
Copper	mg/kg	2,540
Lead	mg/kg	14,600
Manganese	mg/kg	34,000
Mercury	mg/kg	110
Silver	mg/kg	393
Thallium	mg/kg	3.6
Vanadium	mg/kg	56
Zinc	mg/kg	2,480
Organics - Explosives		
2,4,6-Trinitrotoluene	mg/kg	68
2-Amino-4,6-Dinitrotoluene	mg/kg	8.9
4-Amino-2,6-Dinitrotoluene	mg/kg	22
RDX	mg/kg	13
Organics - Pesticides/Polychlorinated Biphenyls (PCBs)		
PCB-1254	mg/kg	31
Organics - Semivolatile Organic Compounds (SVOCs)		
Benz(a)anthracene	mg/kg	10
Benzo(a)pyrene	mg/kg	3.5
Benzo(b)fluoranthene	mg/kg	5.5
Dibenz(a,h)anthracene	mg/kg	0.61
Indeno(1,2,3-cd)pyrene	mg/kg	1.8
Sewer Water		
Anions		
Nitrate	mg/L	2,600
Metals		
Antimony	mg/L	0.0053
Lead	mg/L	2.2
Manganese	mg/L	3.17
Thallium	mg/L	0.0019
Organics - Explosives		
2,4,6-Trinitrotoluene	mg/L	0.37
2,4-Dinitrotoluene	mg/L	0.0028
2-Amino-4,6-Dinitrotoluene	mg/L	0.19
4-Amino-2,6-Dinitrotoluene	mg/L	0.26
RDX	mg/L	0.69

Table 2-1. Maximum Concentrations of Constituents of Potential Concern in Sewer Sediment and Water (continued)

Chemical	Units	Maximum Detect[a]
Organics - Pesticides/Polychlorinated Biphenyls (PCBs)		
Heptachlor epoxide	mg/L	0.00075
Organics - Semivolatile Organic Compounds (SVOCs)		
Benz(a)anthracene	mg/L	0.0014
Benzo(a)pyrene	mg/L	0.0018
Benzo(b)fluoranthene	mg/L	0.002
Benzo(k)fluoranthene	mg/L	0.00012
Bis(2-ethylhexyl)phthalate	mg/L	0.01
Chrysene	mg/L	0.0016
Dibenz(a,h)anthracene	mg/L	0.00042
Indeno(1,2,3-cd)pyrene	mg/L	0.001
Organics - Volatile Organic Compounds (VOCs)		
Trichloroethene	mg/L	0.0021
Outfall Sediment		
Metals		
Antimony	mg/kg	8,120
Arsenic	mg/kg	36.5
Barium	mg/kg	1,060
Chromium	mg/kg	4,000
Chromium, hexavalent	mg/kg	11
Cobalt	mg/kg	115
Copper	mg/kg	1,070
Lead	mg/kg	24,800
Manganese	mg/kg	2,750
Mercury	mg/kg	2.8
Thallium	mg/kg	0.93
Organics - Explosives		
2-Amino-4,6-dinitrotoluene	mg/kg	5
4-Amino-2,6-Dinitrotoluene	mg/kg	6.5
Organics - Pesticides/Polychlorinated Biphenyls (PCBs)		
PCB-1254	mg/kg	36
Organics - Semivolatile Organic Compounds (SVOCs)		
Benzo(a)pyrene	mg/kg	0.18

[a]Chemicals listed are historical data which exceed the screening levels. [a]Screening levels are based on the Draft Facility-Wide Cleanup Goal for Hazard Quotient (HQ)=0.1 and Carcinogenic Risk=1E-6. Where background values were higher than the cleanup goal (HQ=0.1/R=1E-6), the background value is utilized as the screening level.

3.0 HAZARD/RISK ANALYSIS

The purpose of the task hazard/risk analysis is to identify and assess potential hazards that may be encountered by personnel, and to prescribe required controls. Table 3-1, a general checklist of hazards that may be posed by this project, indicates whether a particular major type of hazard is present. If additional tasks or significant hazards are identified during the work, this document will be modified by addendum or field change order to include the additional information. Confined space entry is not anticipated for this project. However if it is required, an additional addendum to the FWSHP will be submitted in conformance with the requirements of 29 *CFR* 1910.146 and EM 385-1-1 Section O6I.

Table 3-1. Hazards Inventory

Yes	No	Hazard
	X	Confined space entry
X		Heavy equipment (drill rigs, backhoe)
X		Fire and explosion (fuels)
X		Electrical shock (utilities and tools)
X		Exposure to chemicals (contaminants and chemical tools)
X		Temperature extremes
X		Biological hazards (poison ivy, Lyme disease, West Nile disease)
X		Noise (drill rig)
X		MEC (potential to encounter unexploded ordnance)

MEC = munitions and explosives of concern

Specific tasks are as follows:

- Visual inspection of sewer structures;
- Sewer water and sediment sampling collection;
- Video survey of inactive storm and sanitary sewer lines, and
- Soil boring installation and sampling.

3.1 TASK-SPECIFIC HAZARD ANALYSIS

Table 3-2 presents task-specific hazards, relevant hazard controls, and required monitoring, if appropriate, for all of the planned tasks.

3.2 POTENTIAL EXPOSURES

Table 3-3 contains information on the reagents and chemicals that will be used for this project. Sewer water, sewer sediment, soil and groundwater contaminants are possible, but unlikely. Exposure to chemical tools, such as corrosive sample preservatives, field laboratory reagents, or flammable fuels, is a possibility and will be controlled through standard safe handling practices.

Table 3-2. Hazards Analysis

Safety and Health Hazards	Controls	Monitoring Requirements
Mobilize to Work Site		
Traffic accident	Compliance with SAIC E2I EH&S Procedure 110, Vehicle Operation (valid driver's license, seat belt use, routine vehicle inspections, no cell phone use while driving).	None
Visual Inspection, Sampling of Sanitary and Storm Sewer Structures and Video Survey		
Vehicle accidents	Compliance with SAIC E2I EH&S Procedure 110 "Vehicle Operation" to include verification of current drivers licenses, use of seat belts when vehicle is in motion, daily (undocumented) vehicle safety inspection, compliance with applicable laws and regulations, and defensive driving.	Verification of valid drivers licenses by FM
Lifting (musculoskeletal injuries) hazards	Level D PPE: long pants, shirts with sleeves, safety glasses, and safety boots. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs, or has to be moved by maneuvering through awkward positioning. Manhole hooks will be used to slide all lids open. Compliance with SAIC E2I EH&S Procedures 150 and 230.	Daily site safety inspections
Unauthorized personnel in work area	Level D PPE: long pants, shirts with sleeves, safety glasses, and safety boots. Establish an exclusion zone boundary that unauthorized personnel can not cross.	Daily site safety inspections
Falls into Uncovered Manholes	The buddy system will be used while locating manholes. Watch footing and stop walking while looking around or at field maps. Mark all uncovered manholes with caution tape and record locations on field notes and maps.	Daily site safety inspections
Slips/Trips	Clear area of all unnecessary equipment and slip/trip hazards. Proper housekeeping.	Daily site safety inspections
Noise	None, unless SSHO determines that equipment potentially exceeds 85 dBA.	Daily site safety inspection
Fire (fuels)	Fuel stored in safety cans with flame arresters, no ignition sources within 50 ft of open manholes, and fire extinguishers kept in immediate work area. Compliance with SAIC E2I EH&S Procedure 260.	Daily site safety inspections

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Exposure to chemicals	Level D PPE, including nitrile or PVC gloves, to handle potentially contaminated material. Minimal contact, wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance required by site workers. Fifteen-minute eyewash within 100 ft when pouring corrosive sample preservatives; eyewash bottle within 10 ft when adding water to pre-preserved sample containers. Site training must include hazards and controls of exposure to contaminants and chemicals used on-site. MSDSs for chemical tools kept on-site. All chemical containers will have contents and hazards labeled.	Daily site safety inspections PID monitoring if prior monitoring during soil boring indicated a potential for exposure
Contact with MEC	Pre-entry screening survey by MEC Avoidance Subcontractor. On-site training in ordnance recognition for all field personnel. Continuous escort by MEC Avoidance Subcontractor in areas with a potential to encounter MEC. Withdrawal of all SAIC and subcontractor personnel from immediate area and field marking of suspect area if MEC is discovered. Compliance with SAIC E2I EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Electrical shock	GFCI for all electrical hand tools. Compliance with SAIC E2I EH&S Procedure 190.	Daily safety inspection
Temperature stress	If temperature is above 70°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling). Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F.	Temperature measurements at least twice daily Pulse rates at the start of each break if wearing impermeable clothing
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (arroyo, ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain Check forecast prior to starting work daily.
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots and work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP).	Visual survey

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Fall protection	Sites with grated lids that do not need to be opened will not require fall protection. Sites with lids that need to be removed that are ≥ 6 ft will require compliance with SAIC E2I EH&S 170, Fall Protection. Lids will either be opened no more than necessary to perform sampling but not far enough to enter, or the lids will be opened and immediately covered with a grate that will prevent falls but allow personnel to perform sampling. Safety lines will be tied to equipment that is lowered into manholes for easy retrieval if dropped.	Daily site safety inspections and depth measurements
Soil Boring and Soil Sampling using hand auger or DPT		
Lifting (musculoskeletal injuries) hazards	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling plus hard hat (see Section 5.0 of FWSHP). If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning. Compliance with SAIC E2I EH&S Procedures 150 and 230.	Daily site safety inspections
Slips/Trips	Clear area of all unnecessary equipment and slip/trip hazards. Proper housekeeping.	Daily site safety inspections
Unauthorized personnel in work area	Exclusion zone at least equal to mast height if there is any potential for unauthorized entry.	Daily site safety inspections
Rotating and/or moving equipment.	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling plus hard hat (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. No employees under lifted loads. At least two functional kill switches. Functional backup alarm. Drill rig manual on-site. Only experienced operators. Rigs will be operated per subcontractor's standard procedures or per manufacturer's directions; all hoses and cables will be inspected daily. At no time should anyone work in close proximity to the rotating augers. Exclusion zone at least equal to mast height if there is any potential for unauthorized entry. Compliance with SAIC E2I EH&S Procedures 150 and 230.	Daily site safety inspections Weekly drill rig inspections

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Cuts/contusions	Use dedicated tube cutter or hooked safety blades when opening polymer sample tubes. Wear heavy cut resistant gloves when opening polymer sample tubes. Keep fingers from between split spoon halves. Compliance with SAIC E2I EH&S Procedure 230.	Daily site safety inspections
Noise	Hearing protection ≥NRR 25 within 7.6 m (25 ft) of rig unless rig-specific monitoring indicates noise exposure of less than 85 dBA	Daily site safety inspections
Fire (vehicle fuels or subsurface contaminants)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Fire extinguishers in all fuel use areas. Compliance with SAIC E2I EH&S Procedure 260.	Daily site safety inspections
Contact with MEC	Pre-entry screening survey by MEC Avoidance Subcontractor. On-site training in ordnance recognition for all field personnel. Continuous escort by MEC Avoidance Subcontractor in areas with a potential to encounter MEC. Clearance of sites by UXO technicians for intrusive work. Downhole monitoring every 2 to 3 ft until cleared for continuous drilling by MEC Avoidance Subcontractor. Withdrawal of all SAIC and subcontractor personnel from immediate area and field marking of suspect area if MEC is discovered. Compliance with SAIC E2I EH&S Procedure 120.	Visual and instrument surveys by MEC Avoidance Subcontractor
Subsurface utilities (electric shock, fire, damage to utilities)	FM will ensure that each boring location has been cleared to preclude contact with buried utilities through compliance with SAIC E2I EH&S Procedure 130.	Daily site safety inspections and completion of digging permit
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Stay upwind of any dust-generating activities. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for site contaminants and all chemicals used on-site. MSDSs for chemical tools on-site. Chemical containers labeled to indicate contents and hazard.	PID or other sampling, as appropriate

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F	Temperature measurements at least twice per day Pulse rates at the start of each break if wearing impermeable clothing
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots and work clothes). Insect repellant on boots, pants, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize potential for tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Electric shock	Identification and clearance of overhead and underground utilities. GFCI required for electric hand tools. Note – one live overhead electrical line is present at Load Line 2. Compliance with SAIC E2I EH&S Procedure 190.	Visual of all work areas
Investigation-Derived Waste Handling		
Lifting (musculoskeletal injuries) hazards	Level D PPE: long pants, shirts with sleeves, safety glasses, safety boots, work gloves for material handling (see Section 5.0 of FWSHP). If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning. Compliance with SAIC E2I EH&S Procedures 150 and 230.	Daily site safety inspections
Slips/Trips	Clear area of all unnecessary equipment and slip/trip hazards. Proper housekeeping.	Daily site safety inspections
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material. Wash face and hands prior to taking anything by mouth. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site	Daily safety inspections

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Vehicle accidents	Compliance with SAIC E2I EH&S Procedure 110 "Vehicle Operation" to include verification of current drivers licenses, use of seat belts when vehicle is in motion, daily (undocumented) vehicle safety inspection, compliance with applicable laws and regulations, and defensive driving.	Verification of valid drivers licenses by FM
Drum monitoring and sampling	Level D PPE: long pants, shirts with sleeves, safety glasses, safety shoes or boots, heavy-duty gloves for materials handling (see Section 5.0 of FWSHP). Buddy system. Site-specific training. Proper housekeeping. Unnecessary personnel will stay well clear of operating equipment. Functional back-up alarm on fork trucks, Bobcats, trucks, etc. Ravenna O&M contractor personnel will provide any required fork truck services in the IDW staging area (Building 1036). IDW movement from field sites to Building 1036 will be conducted by the drilling subcontractor using a backhoe equipped with forks and drum dollies. No personnel allowed under lifted loads. Hazardous waste safety training. Compliance with EM 385-1-1 Sections 14 and 16.	Daily safety inspections of operations Daily inspection of equipment to verify brakes and operating systems are in proper working condition
Fire (vehicle fuels and flammable contaminants)	Fuels stored in safety cans with flame arrestors. Bonding (metal to metal) and grounding during fuel transfers. Fuel storage areas marked with no smoking or open flames signs. Gasoline-powered equipment will be shut down and allowed to cool for 5 min before fueling. Fire extinguishers in all fuel use areas. Compliance with SAIC E2I EH&S Procedure 260.	Daily safety inspection
Noise	Hearing protection within 7.6 m (25 ft) of any noisy drum moving equipment unless equipment-specific monitoring indicates exposures less than 85 dBA	Daily safety inspections
Biological hazards (bees, ticks, Lyme disease, histoplasmosis, wasps, snakes, West Nile Virus)	PPE (boots, work clothes). Insect repellant on pants, boots, and elsewhere, as necessary, to repel ticks and mosquitoes. Pant legs tucked into boots or otherwise closed to minimize tick entry. Snake chaps if working in overgrown areas. Inspect for ticks during the day and at the end of each workday (see Section 9.0 of FWSHP). Avoidance of accumulations of bird or bat droppings (see Section 9.0 of FWSHP)	Visual survey
Electric shock	Identification and clearance of overhead utilities. GFCI for all electrical hand tools. Compliance with SAIC E2I EH&S Procedure 190.	Visual survey of all work areas

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F.	Temperature measurements at least twice daily Pulse rates at the start of each break if wearing impermeable clothing
Severe weather	Locate nearest severe weather shelter/strong structure before beginning fieldwork. Suspend fieldwork if lighting within 10 miles of site or tornado warning issued. Do not work in areas subject to flash flooding (arroyo, ditch, etc.) if rain is forecast in immediate area or upstream of site.	Visual observation for lightning, strong winds, or heavy rain Check forecast prior to starting work daily.
Equipment Decontamination (Soap and Water Washing, HCl, and Methanol Rinse)		
General equipment decontamination hazards (hot water, slips, falls, equipment handling)	Level D PPE plus nitrile or PVC gloves (see Section 5.0 of FWSHP). Face shield and Saranax or rain suit when operating steam washer. Site-specific training. Proper housekeeping	Daily safety inspections
Fire (decontamination solvents and gasoline)	Flammable material stored in original containers or in safety cans with flame arrestors. Fire extinguisher kept near decontamination area. Compliance with SAIC E2I EH&S Procedure 260.	Daily safety inspection
Exposure to chemicals	Level D PPE plus nitrile or equivalent gloves for contact with contaminated material and Decontamination fluids (HCL and Methanol). Wash face and hands prior to taking anything by mouth. Minimal contact. Hazardous waste site operations training and medical clearance. Site training must include hazards and controls for exposure to site contaminants and chemicals used on-site. MSDSs on-site. All chemical containers labeled to indicate contents and hazard. 15-minute eyewash must be within 20 feet if pouring corrosives.	None

Table 3-2. Hazards Analysis (continued)

Safety and Health Hazards	Controls	Monitoring Requirements
Temperature extremes	Administrative controls (see Section 8.0 of FWSHP). Cooled (shaded) or warmed break area depending on the season. Routine breaks in established break area (see Section 8.0 of FWSHP). Chilled drinks if temperature exceeds 70°F.	Temperature measurements at least twice a day Pulse rates at the start of each break if wearing impermeable clothing

EH&S = Environmental, Health and Safety
FM = Field Manager
FWSHP = Facility Wide Safety and Health Plan
GFCI = ground-fault circuit interrupter
IDW = investigation-derived waste
MEC = munitions and explosives of concern
PVC = polyvinyl chloride
MSDS = Material Safety Data Sheet
NRR= Noise Reduction Rating
O&M = operations and maintenance
PID = photoionization detector
PPE = personal protective equipment
RVAAP = Ravenna Army Ammunition Plant
SAIC = Science Applications International Corporation
UXO = unexploded ordnance

Table 3-3. Potential Exposures

Chemical	TLV/PEL/STEL/IDLH[a]	Health Effects/ Potential Hazards[b]	Chemical and Physical Properties[b]	Exposure Route(s)
Hydrochloric acid (potentially used to preserve water samples or for equipment decontamination)	TLV: 2 ppm ceiling IDLH: 50 ppm	Irritation of eyes, skin, respiratory system	Liquid; VP: fuming; IP: 12.74 eV; FP: none	Inhalation Ingestion Contact
Isopropyl alcohol (potentially used for equipment decontamination)	TLV/TWA: 200 ppm STEL: 500 ppm IDLH: 2,000 ppm	Irritation of eyes, skin, respiratory system; drowsiness; headache	Colorless liquid with alcohol odor; VP: 33 mm; IP: 10.10 eV; FP: 53°F	Inhalation Ingestion Contact
Methanol (potentially used for equipment decontamination)	TLV/TWA: 200 ppm Skin notation IDLH: 6,000 ppm	Irritation of eyes, skin, respiratory system; headache; optic nerve damage	Liquid; VP: 96 mm; IP: 10.84 eV; FP: 52°F	Inhalation Absorption Ingestion Contact
Gasoline (used for fuel)	TLV/TWA: 300 ppm, A2 IDLH: Ca	Potential carcinogen per NIOSH, dizziness, eye irritation, dermatitis	Liquid with aromatic odor; FP: -45°F; VP: 38-300 mm	Inhalation Ingestion Absorption Contact
Liquinox (used for decontamination)	TLV/TWA: None	Inhalation may cause local irritation to mucus membranes	Yellow odorless liquid (biodegradable cleaner); FP: NA	Inhalation Ingestion

[a]From 2008 Threshold Limit Values, American Conference of Governmental Industrial Hygienists.
[b]From NIOSH Guide to Chemical Hazards web site.

A2 = suspected human carcinogen
FP = flash point
IDLH = immediately dangerous to life and health
IP = ionization potential
NIOSH = National Institute for Occupational Safety and Health
ppm = parts per million
STEL = short-term exposure limit
TLV = threshold limit value
TWA = time-weighted average
VP = vapor pressure

4.0 MUNITIONS AND EXPLOSIVES OF CONCERN AVOIDANCE

A qualified unexploded ordnance (UXO) subcontractor, approved by the USACE Louisville District, will provide munitions and explosives of concern (MEC) avoidance support for this project. The subcontractor's UXO technician will employ a Schonstedt Model GA 52 and/or GA-72 (or equivalent) magnetic locator for surface anomaly surveys, and a Schonstedt Model MG-220 (or equivalent) magnetic gradiometer for any downhole surveys. All field activities will be conducted in accordance with SAIC E2I EH&S 120 and the MEC Avoidance Work Plan.

Previous investigations of the sewers focused on explosives hazards and indicate that there has been no evidence of accumulations that could pose an explosives hazard. UXO support will only be required during activities at areas where sewers occur within boundaries of Military Munitions Response Program (MMRP) Munitions Response Sites:

- Load Line 1 (MRS RVAAP-008-R-01);
- Load Line 6/Firestone Test Facility (MRS RVAAP-033-R-01); and
- Atlas Scrap Yard (MRS RVAAP-050-R-01).

The UXO Team Leader will train all field personnel to recognize and stay away from propellants and MEC. Safety briefings for MEC avoidance will also be provided to all site personnel and site visitors. At all off-road access routes to the sampling locations, ground surface surveys will be conducted prior to entry using visual inspection and hand-held magnetometers. Surveys of ingress and egress routes will be at least twice as wide as the widest vehicle that will use the route (normally a minimum of 20 ft). A work area having a radius of approximately 100 ft will be surveyed around each sewer location. The UXO technician will clearly mark the boundaries of the cleared work area and access routes. If MEC is encountered at the ground surface, the approach path will be diverted away from the MEC, the area clearly marked with red flagging, and the area will be avoided. Any identified magnetic anomaly will also be clearly marked, and the anomaly will be avoided. The cleared approach paths will be the only ingress/egress routes to a particular sampling location.

At each staked sewer location, the UXO technician will use a magnetic gradiometer to clear the locations prior to commencing activities. The UXO technician will remain on-site and provide support to the project team until all access surveys are completed and the work areas are cleared as described above.

Should any MEC be discovered, it will be avoided. The UXO subcontractor will not be tasked with disposal of MEC under this specific task. The UXO technician will notify the SAIC Field Operations Manager (FOM), who will, in turn, contact the SAIC Project Manager (PM), USACE and RVAAP Environmental Coordinator, who will initiate the appropriate response actions.

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5.0 STAFF ORGANIZATION, QUALIFICATIONS, AND RESPONSIBILITIES

This Section presents the personnel (and their associated telephone numbers) responsible for site safety and health and emergency response. Table 5-1 identifies the SAIC and subcontractor staff who will fill key roles. See the FWSHP for information on the roles and responsibilities of key positions.

Table 5-1. Staff Organization

Position	Name	Phone
SAIC Health and Safety Manager	Steve Davis CIH, CSP	865-481-4755
SAIC Project Manager	Kevin Jago	865-481-4614
SAIC Task Lead	MaryAnn Bogucki	865-481-4719
SAIC Field Operations Manager	TBD	
SAIC Site Safety and Health Officer	TBD	

Subcontractor Site Safety and Health Officer will be SSHO for all remedial activities.
CIH= Certified Industrial Hygienist
CSP = Certified Safety Professional
MEC = munitions and explosives of concern
SAIC = Science Applications International Corporation
TBD = To be determined

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6.0 TRAINING

Training requirements, from Section 4.0 of the FWSHP, are summarized in Table 6-1 and in Table 3-2.

Table 6-1. Training Requirements

Training	Worker	Supervisor	Site Visitor (exclusion zone)
HAZWOPER (40-hr, 3-day OJT)	√	√	√
HAZWOPER Annual Refresher (8 hr)	√	√	√
HAZWOPER Supervisors Training (8 hr)		√	
General Hazard Communication Training	√	√	√
Respiratory Protection Training (required only if respirators are worn)	√	√	√
Hearing Conservation Training (for workers in hearing conservation program)	√	√	√
Pre-entry Briefing	√	√	√
Site-Specific Hazard Communication (contained in pre-entry briefing)	√	√	√
Safety Briefing (daily and whenever conditions or tasks change)	√	√	√
CPR and First Aid Training	√	√	

√ = required.
HAZWOPER = Hazardous Waste Site Operations
OJT = on-the-job training
CPR = Cardio Pulmonary Resuscitation

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7.0 PERSONAL PROTECTIVE EQUIPMENT

General guidelines for selection and use of PPE are presented in the FWSHP. Specific PPE requirements for this work are presented in the hazard/risk analysis section (Section 3.0).

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8.0 MEDICAL SURVEILLANCE

Medical surveillance requirements, as presented in Section 6.0 of the FWSHP, are summarized in Table 8-1.

Table 8-1. Medical Surveillance Requirements

Baseline	Routine	Overexposure	Termination
Prior to work assessment	Every 12 months, unless greater frequency is deemed appropriate by attending physician. Not to exceed 2-year interval	Upon developing symptoms or where exposure limits have been exceeded or suspected to have been exceeded	Upon termination or re-assignment

All medical exams shall include (see Section 6.2 of the Facility Wide Safety and Health Plan):

- Medical/work history;
- Physical exam by physician;
- Audiometry;
- Blood screening and blood count;
- Chest x-ray, as specified by physician;
- Electrocardiogram, as specified by physician;
- Spirometry; and
- Urinalysis.

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9.0 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Assessment of airborne chemical concentrations will be performed, as appropriate, to ensure that exposures do not exceed acceptable levels. Action levels, with appropriate responses, have been established for this monitoring. In addition to the specified monitoring, the SSHO may perform or require additional monitoring, such as organic vapor monitoring in the equipment decontamination area or personnel exposure monitoring for specific chemicals. The deployment of monitoring equipment will depend on the activities being conducted and the potential exposures. All personal exposure monitoring records will be maintained in accordance with 29 *Code of Federal Regulations* 1910.1020. The minimum monitoring requirements and action levels are presented in Table 9-1.

During sampling, it is anticipated a PID or equivalent will be used to perform air monitoring of the breathing zone when the COCs being evaluated pose a potential hazard, or where COCs have not been previously identified in an AOC. However, the SSHO will examine site conditions and will contact the Health and Safety Manager and initiate additional monitoring if there is any indication of a potential airborne exposure.

Table 9-1. Monitoring Requirements and Action Limits

Hazard or Measured Parameter	Area	Interval	Limit	Action	Tasks
Airborne organics with PID or equivalent	Breathing zone [14 in.] in front of employee's shoulder	From 1 to 3 ft BGS and if site conditions, such as discolored soil or chemical smells, indicate that monitoring is necessary	<5 ppm >5 ppm	Level D Withdraw and evaluate • evaluate need for PPE upgrade • identify contaminants • notify project manager and H&S manager	Drilling, hand auguring, and other intrusive work
Visible contamination	All	Continuously	Visible contamination of skin or personal clothing	Upgrade PPE to preclude contact; may include disposable coveralls boot covers, etc.	All
Noise	All areas perceived as noisy	Any area where there is some doubt about noise levels	85 dBA And any area perceived as noisy	Require the use of hearing protection	Hearing protection will be worn within the exclusion zone, around power augers, or other motorized equipment

H&S = health and safety
PAH = polycyclic aromatic hydrocarbon
PID = photoionization detector
PPE = personal protective equipment
ppm = parts per million)

10.0 HEAT/COLD STRESS MONITORING

General requirements for heat/cold stress monitoring are contained in the FWSHP.

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11.0 STANDARD OPERATING SAFETY PROCEDURES

Standard operating safety procedures are described in the FWSHP.

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12.0 SITE CONTROL MEASURES

Site control measures are described in the FWSHP. No formal site control is expected to be necessary for this work, as the work areas are somewhat remote and bystanders are not anticipated. The RVAAP installation is not open to the public, and only authorized personnel are allowed in the AOCs. If the SSHO determines that a potential exists for unauthorized personnel to approach within 25 ft of a work zone or otherwise be at risk due to proximity, then exclusion zones will be established as described in the FWSHP.

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13.0 PERSONNEL HYGIENE AND DECONTAMINATION

Personal hygiene and decontamination requirements are described in the FWSHP and in Section 2.0 of this addendum.

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14.0 EMERGENCY PROCEDURES AND EQUIPMENT

Emergency contacts, telephone numbers, directions to the nearest medical facility, and general procedures can be found in the FWSHP. All emergencies on-site will be coordinated first through **Guard Post 1 [(330) 358-2017]** who will coordinate the response. The SAIC Field Operations Manager will remain in charge of all SAIC and subcontractor personnel during emergency activities. The SAIC field office will serve as the assembly point if it becomes necessary to evacuate one or more remedial locations. During mobilization, the SSHO will verify that the emergency information in the FWSHP is correct.

Each field team shall have a cellular phone and/or a 2-way radio capable of contacting Guard Post 1 for communications purposes.

During field operations all on-site personnel shall have CPR/first aid training.

Table 14-1. Emergency Phone Numbers

Position	Phone
RVAAP Guard Post 1 (Police, Fire, Emergency Medical)	(330) 358-2017
Hospital (Robinson Memorial, Ravenna)	(330) 297-2449/0811
RVAAP Facility Manager Mark Patterson	 (330) 358-7311
RVAAP Operation and Maintenance Contractor Jim McGee, PIKA International, Inc.	 (330) 358-3005
USACE Mark W. Nichter	 (502) 315-6375
Camp Ravenna Garrison Commander LTC Ed Meade	 (614) 336-6560
Ohio EPA, Eileen Mohr	Office: (330) 963-1221 Cell: (216) 401-8382
SAIC Project Manager, Kevin Jago Jed Thomas	 (865) 481-4614 Office: (330) 405-5802 Cell: (216) 214-2599
SAIC Health and Safety Personnel, Steve Davis CIH, CSP Heather Miller	 (865) 481-4755 Office: (330) 405-5814 Cell: (330) 573-8571

RVAAP = Ravenna Army Ammunition Plant
USACE = U.S. Army Corps of Engineers
Ohio EPA = Ohio Environmental Protection Agency
SAIC = Science Applications International Corporation, Inc.
CIH= Certified Industrial Hygienist
CSP = Certified Safety Professional

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15.0 LOGS, REPORTS, AND RECORD KEEPING

Logs, reports, and record keeping requirements are described in the FWSHP.

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16.0 REFERENCES

ACGIH (American Conference of Governmental Hygienists) 2008. *Threshold Limit Values*. 2008.

Lakeshore Engineering Services, Inc., 2007. *Final Project Completion Report for Explosive Evaluation of Sewers at Ravenna Army Ammunition Plant.* November 2007.

NIOSH (National Institute for Occupational Safety and Health) 2005. *NIOSH Pocket Guide to Chemical Hazards*. September 2005.

USACE (U.S. Army Corps of Engineers). *Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OEW) Activitie.,* ER-385-1-92.

USACE *Safety and Health Manua.,* EM-385-1-1-13.

USACE 2001. *Facility Wide Safety and Health Plan for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio, DACA62-00-D-0001, D.O. CY02*. March 2001.

USACE 2004. *Facility-Wide Groundwater Monitoring Program for the Ravenna Army Ammunition Plant, Ravenna, Ohio,* GS-*10F-0350M, D.O. DACA27-03-F-0047*. September 2004.

USACE-CERL (U.S. Army Corps of Engineers – Construction Engineering Research Laboratory) 2007. *Summary of Findings, Ravenna Army Ammunition Plant Sewer System*, ERDC-CERL. June 2007.

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17.0 FACILITY AND HOSPITAL MAPS

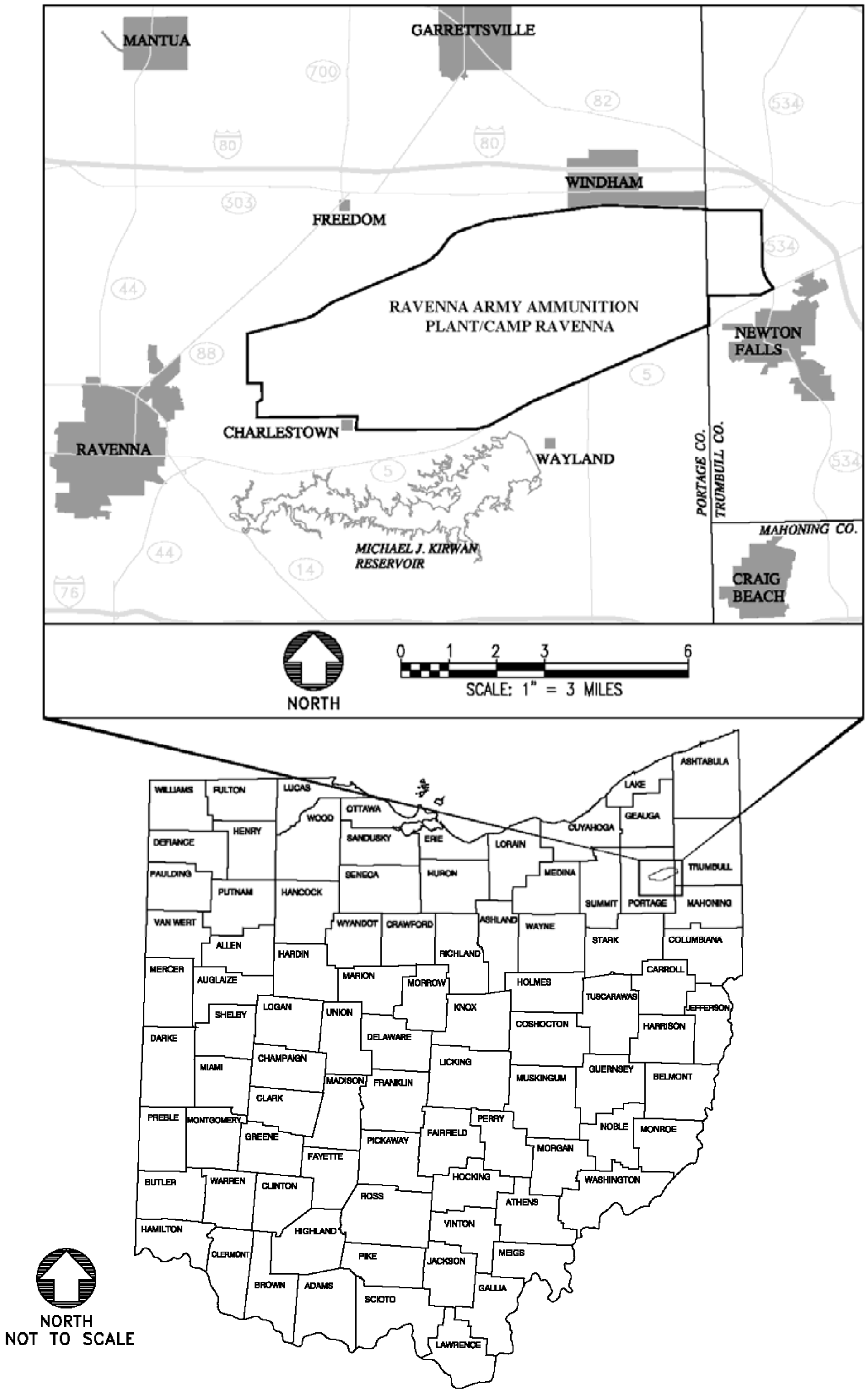

Figure 17-1. General Location and Orientation of the RVAAP/Camp Ravenna

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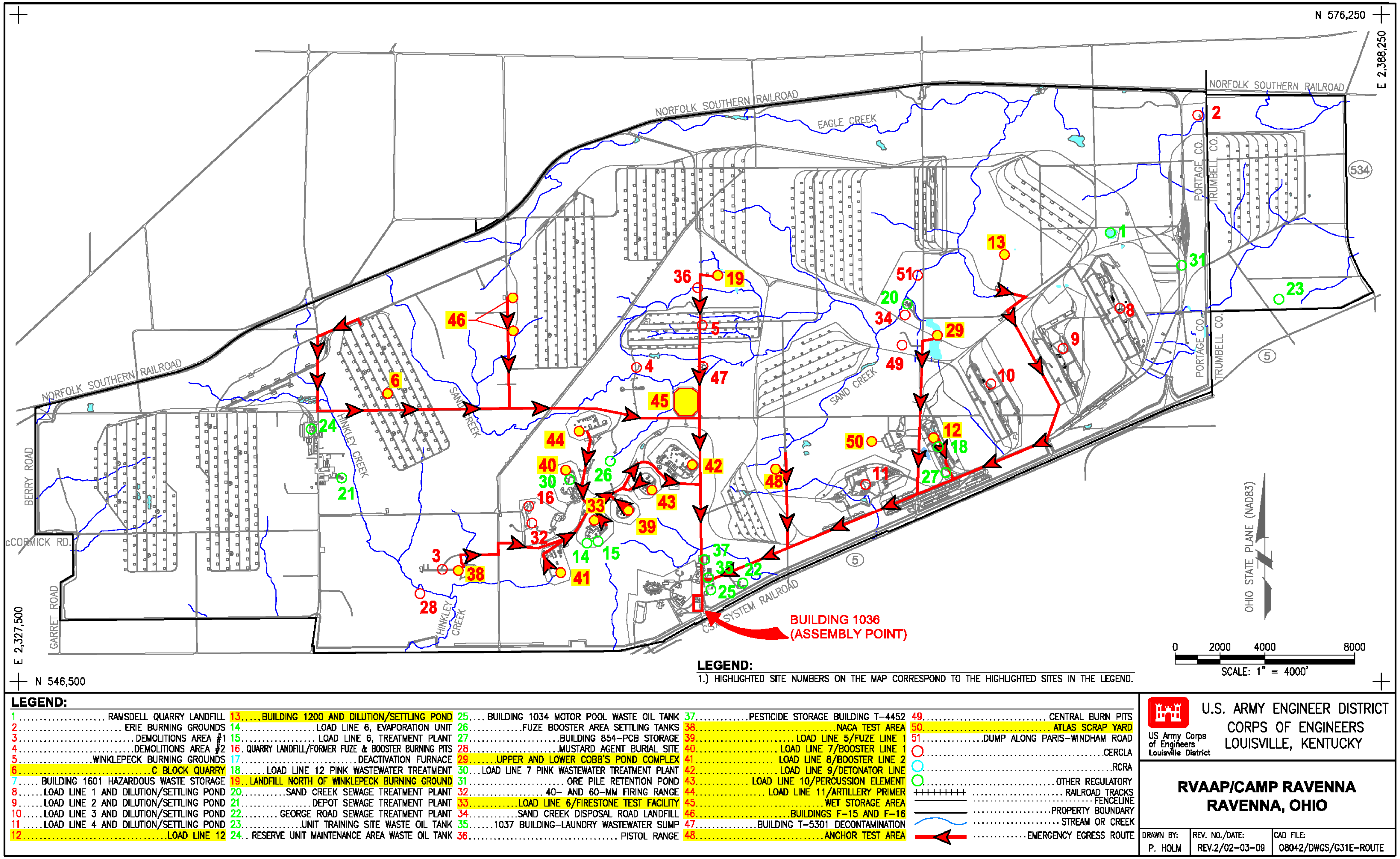

Figure 17-2. RVAAP/Camp Ravenna Site Map and Egress Route

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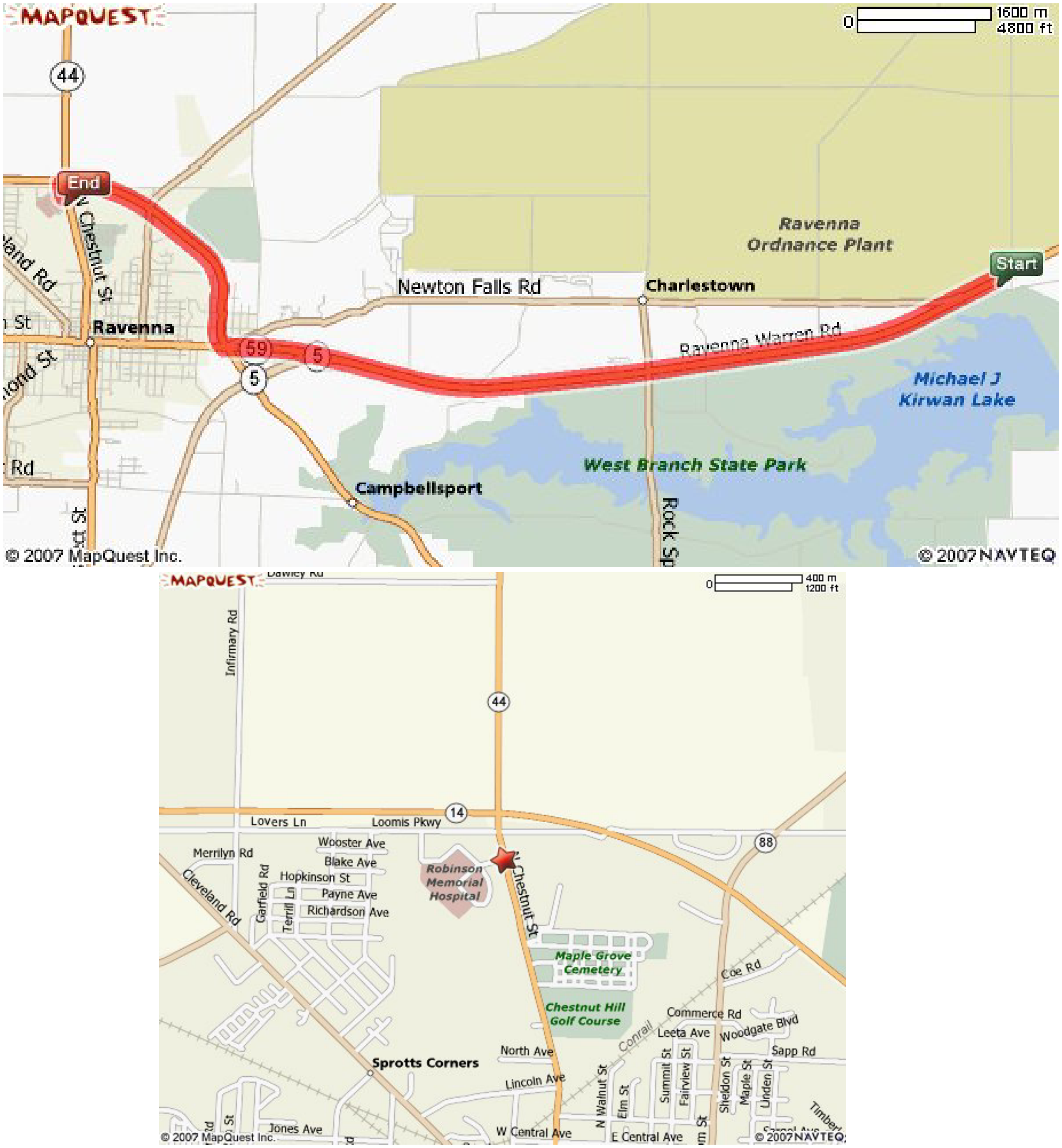

Figure 17-3. Route Map to Pre-Notified Medical Facility

Robinson Memorial Hospital

6847 N. Chestnut Street
Ravenna, Ohio
(330) 297-0811

Directions: West on State Route 5. Stay straight onto OH-59 West. Turn Right onto OH-14/OH-44. Turn Left onto North Chestnut St.

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DRAFT SAMPLING AND ANALYSIS PLAN FOR THE REMEDIAL INVESTIGATION OF RVAAP-67 FACILITY-WIDE SEWERS, ADDENDUM NO. 1
RAVENNA ARMY AMMUNITION PLANT, RAVENNA OHIO
COMMENT RESPONSE TABLE
JULY 10, 2009
Rev. 1 - Comment Response Meeting Resolution Minutes

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
Ohio EPA, NEDO, DERR (Andrew Kocher and Bruce Miller)					
O-1.	Page 2-1, Lines 12-18	Page 2-1	The key to Table 2-1 has duplicate items (QA/QC, OE, CSP, and TBD).	Please remove the duplicate items.	Agree. The duplicate entries which occur on lines 16 through 19 will be deleted as requested.
O-2.	Page 3-4, Figure 3-1	Page 3-4	In the figure, below Secondary Sources, the Outfall sediment has an asterisk next to it.	Please include a key with the figure explain the asterisk.	Clarification. The asterisk is a relic that was inadvertently left in from earlier version of the figure. The asterisk will be deleted from the "Outfall sediment" box of Figure 3-1.
O-3.	Page 3-5, Lines 21-22	Page 3-5	This sentence incorrectly states that the 14AOCs included Load Lines 5 through 11. The 14 AOCs only included the following Load Lines: LL5, LL7, LL8, and LL10.	Please revise this sentence.	Agree. The fourth bullet will be revised as follows: "● *Characterization of 14 AOCs at RVAAP* (MKM 2007a) – sanitary sewers at Load Lines 5, 7, 8, 10 ~~through 11~~ and Atlas Scrap Yard;~~ and~~" The period at the end of the current fifth bullet will be replaced with a semicolon, and the following two bullets will be added as the sixth and seventh: "● Load Line 9 Phase I RI (MKM 2007c) – sanitary sewers present only; ● Load Line 11 Phase I RI (MKM 2005) – sanitary sewers present only."
O-4.	Page 3-9, Line 35	Page 3-10	There appears to be a typographical error in this line – "during the" is listed twice	Please revise this sentence.	Agree. One of the duplicated instances of "during the" in the referenced sentence will be deleted.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-5.	Page 3-13, Line 15	Page 3-14, and Sections 3 and 4 Pages F-4, F-6, F-7 Table F-2 Page G-5, Table G-2	This sentence states "Chromium speciation samples will be collected in accordance with Section 4.1.3 of this SAP…" This section in the SAP seems to be missing or located somewhere else.	Please locate Section 4.1.3 or add a section describing chromium speciation.	Clarification. The footnote at the bottom of Table 3-1 was inadvertently left in this version of the table, and refers to sections in a different and unrelated document, as collection of hexavalent chromium sewer samples was not originally planned. However, in consideration of the historical data, a FSP revision to include sample collection for hexavalent chromium is proposed at this time. In Tier 1 of the investigation, sediment sampling for hexavalent chromium will be conducted at sewer locations where the historical total chromium data exceeds the CUG for the resident farmer of 187 mg/kg. An assessment of the historical data indicates that this will result in the collection of hexavalent chromium samples at five locations, all of which are currently designated as primary sample locations: Inlet C4 (LL2, storm), Inlet DB20 (LL2, storm), Inlet DB21 (LL2, storm), storm outfall south of Inlets DA20/DA21 (LL2), and Inlet EH21 (storm, LL3). Under Tier 2 of the investigation, hexavalent chromium samples would be collected based upon the results of the Tier 1 sampling. If sediment samples collected for TAL metals under Tier 1 of the investigation indicated concentration of chromium above the resident farmer CUG of 187 mg/kg, sediment samples would be collected from these locations and

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					analyzed for hexavalent chromium. Soil boring samples will be submitted for hexavalent chromium analysis at locations where the historical results indicated hexavalent chromium enrichment in the sediment of the adjacent sewer line or where the results of the Tier 1 sediment sampling indicated concentrations above 187 mg/kg. Additionally, hexavalent chromium soil boring samples will be collected at a representative set of locations where total chromium was detected at low, medium and high ranges of concentrations within each functional area (e.g.: AOCs or other administrative area) in order to provide speciation data. The locations for the subsurface borings and the follow-up sewer sediment hexavalent chromium sampling will be submitted for approval in a Technical Memorandum prior to the inception of Tier 2 field activities. Text additions will be incorporated where appropriate to the sampling approach discussions in Sections 3 and 4 of the FSP to address the proposed hexavalent chromium sampling. The correct section references will be added to the referenced footnote of Table 3-1, and corresponding revisions will be implemented in the sampling approach discussions in Sections 3 and 4 of the FSP. Additionally, the Tier 1 hexavalent chromium sediment sampling locations will be noted in the Appendices for Load Lines 2 and 3.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					29 June 2009 Comment Response Resolution Teleconference: As per request, the proposed revisions to the FSP as a result of the addition of the chromium speciation sampling are provided as an attachment to this comment response table for review.
O-6.	Page 3-15, Lines 36-38	Page 3-16, 3-19	This sentence states that only 10% of the sewer lines will be filmed "…where possible". Ohio EPA would like to discuss this issue at the comment resolution meeting. Some rules need to be developed for this and 10% "where possible" will not adequately portray the condition of the sewer lines. It is highly possible, if only 10% were filmed, that many large breaks in the lines were overlooked and subsequently many large groundwater plumes not detected.	Although Ohio EPA would like to discuss at the comment resolution meeting, please prepare a response to this question: Why only conduct video camera surveys on 10% or less of the lines?	Original Response Dated June 23, 2009: The video survey will not occur until the end of Tier 1 after the visual inspection and sample collection/field screening have been completed. Locations will be selected based upon assessment of the historical data (both analytical and previous video survey) and the Tier 1 field screening data. The FSP states that the objective is to "survey a minimum of 10% of the total length of a sewer line segment of interest where possible" to provide representative data on the condition of that segment. The FSP also states that "where contaminated sewer line segments are identified… the goal is to survey as much of these lines as feasible." The "where possible" language in the referenced text is intended to convey that access issues may prohibit the video survey activities at some locations. For instance, many of the lines are flooded, and the video cameras cannot be operated in fully

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					submerged conditions. Also, as past video surveys have indicated, debris in the lines has prevented access for the camera. If screening or historical data indicates contamination in a sewer line reach, even in the absence of video survey data, confirmatory borings will still be collected along the pipeline at these locations. With respect to the potential existence of large groundwater plumes, all available data will be utilized in the evaluation of the facility-wide sewers. However, to date, facility-wide groundwater data has not indicated evidence of large groundwater plumes. 29 June 2009 Comment Response Resolution Teleconference: As per discussion, the text will be revised to provide clarification that the intent of the video survey is obtain as much information as possible about the condition of potentially contaminated sewer segments of interest, as defined by historical and field screening data. Additionally, video survey will be added to the Tier 2 of the investigation, if the analytical results from Tier 1 indicate additional contaminated segments that do not have sufficient video data (i.e.: either historical or Tier 1). The appropriate text revisions will be incorporated into Chapters 3 and 4 of the FSP. Proposed revisions to the FSP are

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					attached to this comment response table for review.
O-7.	Page 3-16, Lines 1-7	Page 3-17	This paragraph describes how access to the sewers may be limited. Buried or blocked sewers still have to be evaluated. This may involve intrusive techniques, such as digging, to access these sewer lines.	Please explain how these inaccessible sewer lines will be evaluated to show the presence of COCs or lack thereof.	Original Response Dated June 23, 2009: During the December 2008 preliminary reconnaissance survey, it was noted that the sanitary sewer lines overall were generally intact and in good condition. The accessibility concerns are limited almost exclusively to the storm structures at the melt-pour lines (Load Lines 1 through 4) where demolition activities have resulted in extensive damage to the storm sewer drop inlets and manholes that immediately abutted the buildings and walkways. In some extreme cases at some of the former melt-pour line building locations, segments of storm pipeline appeared to be missing in their entirety, and broken fragments of vitrified clay pipe were noted on the ground surface in the vicinity. Even storm structures that were likely still intact could not be accessed in some cases, as they had been covered over with ballast when the railbeds had been removed. In one particular case during the survey, a 10-ft tall pile ballast and broken chunks of concrete and rebar was observed to be sitting directly over a storm drop inlet (i.e.: the exact location was known because its partner drop inlet was noted to be directly across the road from this pile). In other cases, even when the drop inlet was found to be

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					intact and the opening accessible, the inlet itself was observed to be completely filled with 6+ ft of ballast, concrete rubble and rebar, railroad ties and other large debris items. Additionally, the demolition and removal of the remaining walkways at Load Lines 1, 2, 3 and 4 is planned for Summer 2009. As the majority of storm structures underlie the edge of these raised walkways, it is likely that additional damage and even complete destruction of the storm sewer structures at some locations will occur as a result of these activities. 29 June 2009 Comment Response Resolution Teleconference: As per discussion, in order to address pipe segments with no access for sampling via manhole or drop inlet, the use of intrusive methods would be evaluated. Equipment such as a backhoe/excavator would be utilized to expose three points along the segment ("upstream" end, midpoint and "downstream" end) in order to collect a sample of the material within the sewer pipe. The appropriate text revisions will be incorporated into Chapters 3 and 4 of the FSP. Proposed revisions to the FSP are attached to this comment response table for review.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-8.	Page 3-16, Lines 9-43	Figure 4-1, Page 4-3	This section describes the sewer line sediment and water sampling, but does not include a paragraph describing petroleum or free product. In the Characterization of the 14 AOCs Report, 2007, three sewer surface water locations at Atlas Scrap Yard contained a tarry, organic odor and visual contamination (likely petroleum or free product). The consultant added TPH to the analytical suite.	Please add a paragraph describing the additional analytical if petroleum substances or free product are found. If significant amounts are found it may constitute the collection of two separate phases. In addition, a description should been added on how the source of contamination will be located.	Clarification. The *Characterization of 14 AOCs Report* (MKM 2007) indicated that samplers had observed "visual contamination" that was inferred to be coal tar at three manholes (MH-1, MH-2 and MH-3). Historical operations data indicate that these manholes were located adjacent to a former boilerhouse. During the December 2008 preliminary reconnaissance survey, these three manholes were visually inspected and no evidence of coal tar was noted. MH-2 and MH-3 are currently designated as primary sample locations. Appendix C will be revised to indicate that sediment samples will be collected at all three manholes and analyzed for SVOCs due to the coal tar observations in 2004. No free product has been observed at any of the sewer locations during investigations conducted to date. However, any evidence of free product or petroleum contamination will be noted and documented during the comprehensive visual inspection. The following entry will be added to the Visual Inspection Form (Figure 4-1, page 4-3): "**Evidence of free product, coal tar, or petroleum?** Yes No". Therefore, if suspected petroleum-related contamination is encountered in the Visual Inspection, its distribution within the sewer lines will be documented in the Tier 1 investigation and an SVOC sample will be collected. Analysis for TPH will not be conducted, as there is no

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					toxicity data and therefore no CUG for TPH. Soil boring locations under Tier 2 to assess if the sewers were a source of contamination to the adjacent subsurface media would be presented in the Technical Memorandum. However, if the investigation indicates that petroleum contamination is entering the sewers system from a source outside and unrelated to the sewer lines, that source of contamination would be investigated and addressed under that area of concern (e.g.: the Atlas Scrap Yard RVAAP-50, rather than Facility-Wide Sewers RVAAP-67). 29 June 2009 Comment Response Resolution Teleconference: As per discussion, if the visual survey indicates that there is evidence of free product, coal tar or petroleum, contingency sampling will be collected. No additional text changes are proposed, as contingency sampling in the event of visual contamination is already included in the FSP. The current text on lines 5-7 of page 3-17 and lines 12-15 of page 3-18 states that: "In addition, a full suite of fixed-based laboratory analyses will be conducted where visual surveys indicate the likely occurrence of contamination (e.g.: visible reddish or white crystalline explosive deposits or evidence of sheens …)"

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-9.	Page 3-16, Lines 31-36	Page 3-17, 3-18	These two bulleted items describe that 30% of the samples with be analyzed for SVOCs and 10% with be analyzed for full suite. In general, Ohio EPA believes that these percentages are too low to represent the contents of the sewers; however, if additional screening techniques were used to better bias the sampling, Ohio EPA would be more amenable to keeping the 30% and 10%. Some suggestions may include: PID or FID headspace, portable GC, Chlor-n-Soil tests, etc.	Please justify the current analytical percentage. Also, include field techniques/tests that may give more biased sampling for SVOCs and full suite analyses. Describe how the screening techniques are proposed for use and how the results will be confirmed.	Original Response Dated June 23, 2009: Field screening techniques for SVOCs would likely be functionally ineffectual for the purposes of this investigation. PID or FID headspace techniques would be of limited utility because these methods are better suited for VOCs, rather than the range of PAH compounds typically observed in the sewer system. Field test kits for PAHs would not be effective for screening purposes because the positive detection limits are excessively high relative to the screening levels that would be utilized as comparative criteria (Table 3-1 of the FSP). For example, the screening level for the commonly detected benzo(a)pyrene is 0.022 mg/kg, as compared to a positive detection limit of 8.2 mg/kg for the Ensys™ PAH Soil Test Kit (EPA Method 4035). It is proposed that wherever the explosives field screening indicates a positive detection, all of these samples would be sent to the fixed-base laboratory for analysis of explosives and SVOCs (instead of the original 30%), plus 10% for full suite. No change is proposed to the percentages for explosives non-detects at this time (explosives in all samples, 30% SVOCs, 10% full suite). 29 June 2009 Comment Response Resolution Teleconference: As per discussion, the proposed addition of SVOCs to the analytical suite for locations

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					where explosives field screening indicates a positive detection will be implemented. The appropriate text revisions will be incorporated into Chapters 3 and 4 of the FSP. Proposed revisions to the FSP are attached to this comment response table for review.
O-10.	Page 3-20, Lines 1-10	Page 3-21, Section 3.2.5.3	These bullets indicate that subsurface soil or bedding will be sampled from 4-7 ft BGS and 7-13 ft BGS, respectively. This means that a possible 3-foot interval and a 6-foot interval may be collected. Ohio EPA does not agree with this approach, because the sample (near the sewer) may be diluted by collecting soil greater than a 2-ft interval. Ohio EPA recommends that this approach be changed similar to Lines 13-14 on this page.	Please change this sampling approach for consistency. Regardless of the depth of the sewer a 2 ft interval of soil will be collected immediately below the pipeline. The remaining soil (below the first sample) will be collected and composited to a depth of 13 ft BGS.	Original Response Dated June 23, 2009: This approach was previously discussed with Ohio EPA at the DQO meeting for facility-wide sewers on October 28, 2008. The sample intervals for the subsurface soil borings presented in the FSP correspond to the vertical exposure units for established land uses: 0-4 ft for National Guard Trainee (mounted), 0-7 ft for National Guard Trainee (dismounted), and 0-13 ft for Resident Farmer. There is no technical basis for arbitrary utilization of a 2-ft interval, neither does use of the proposed intervals result in "dilution," but rather provides characterization of the interval of interest. 29 June 2009 Comment Response Resolution Teleconference: As per discussion, characterization targeting the bedding layer immediately underlying the pipeline was suggested, as this is the interval most likely to exhibit contamination. In an email dated 1 July 2009, Ohio EPA

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					recommended that the soil borings under Tier 2 of the investigation be collected as a single sample from 1-2 feet from the bottom of the sewer pipe to determine if the sewer pack has become contaminated and may represent a potential source. If no contamination is found in the sample immediately below the pipe, then no additional subsurface samples will be collected from this location. However, if the media directly underlying the pipe is contaminated from a sewer leak, then Tier 3 sampling will be conducted, consisting of additional subsurface borings (at depth intervals [i.e.: exposure units] in current Tier 2) to determine the nature and extent of subsurface soil contamination. The sampling locations for Tier 3 will be proposed in a technical memorandum for Ohio EPA review and approval prior to the inception of fieldwork. The current Tier 2 discussion presented in Chapter 3 of the FSP will be revised to incorporate the revisions to the subsurface soil sampling approach. A new Section 3.2.5.3 has been added to describe the Tier 3 investigation. Additionally, since bedding material sampling has been added to the FSP, Chapter 4 text on subsurface sampling will be revised to indicate that "a portable power auger may be employed to assist in reaching target depths." The proposed FSP revisions are appended to this comment response table for review.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-11.	Page 3-24, Lines 12-43	Page 3-25, Section 3.4	This paragraph describes the lack of a need to evaluate ecological risk screening for the sewers.	What are the maximum, minimum and average diameter dimensions? Has the ecological assessment taken into account the ability of fauna to habitat large diameter sewers?	Clarification. Sewer lines are of large enough diameter to accommodate some small mammals, and this has been considered in the approach to the ecological risk assessment, or lack of it in this case; however, the sewer pipe dimensions do not justify or constitute viable habitat. The following information will be added to the text for clarification purposes (page 3-24 and line 22 after the phrase, "... horizontal drains and pipes.") as follows: "The majority of the sewer lines in both the storm and sanitary system are 6" or 8" in diameter; and many of these lines typically occur at depths greater than 4 ft below ground surface (approximately 63%). Larger diameter pipes on the order of 10" or 12" occur predominantly as sanitary connector/trunk lines and at major storm outfalls, and these lines typically occur at depths at or greater than 10 ft below ground surface. Thus, the pipe diameters could accommodate several species of smaller mammals (e.g., mice, ground squirrels, opossums, rabbits, and snakes) but almost all the system is below-ground and has very limited access. The facility-wide sewers are a man-engineered system designed to serve a far different function from providing pseudo-habitat to organisms; neither the underground sewer system, nor the few entrances to it constitute conventional ecological habitat. Both by design and circumstance, there is lack of ecological sources (e.g.: lack

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					of light, food sources, and low chance of finding a mate). Therefore, the lack of suitability of the sewers as an ecological habitat is not as much a function of the dimensions of the pipes as the inhospitable internal conditions."
O-12.	Page 4-7, Lines13-14	Page 4-7, Section 4.4	This sentence describes the items the camera survey subcontractor will submit, at a minimum. It does not include the video recordings.	Please have the subcontractor include the video recordings.	Agree. The referenced text will be revised as follows: "The camera survey subcontractor shall prepare and submit a final report that will include, at a minimum, all field logbooks, copies of the video recordings on a suitable archival medium (e.g., files on CD-ROM), and a listing and sketch map of all identified or potential problem areas or anomalies."
O-13.	Page 4-7, Line 41	Page 4-8, Section 4.7	Please clarify "…per field cycle".	Please clarify.	Clarification. Typically, fieldwork is conducted in cycles of ten workdays followed by four days off. However, the sampling portion of both phases for facility-wide sewers will run approximately two to three weeks apiece. In consideration that the structure of the sewers sampling work will not follow a standard field cycle pattern, equipment rinsate samples will be instead collected at a frequency of once per week. The referenced text will be revised as follows: "~~Two~~ One rinsate blank~~s~~ will be collected for soil/sediment equipment per week ~~field cycle~~."

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
O-14.	Page 5-2, Figure 5-1	Page 5-2, Figure 5-1	In the table, it states “mmm = Sample Location Type”. There are too many m’s.	Please revise.	Agree. The referenced text will be revised as requested: “mm~~m~~ = Sample Location Type”
O-15.	Page A-1, Lines 33-34	NA	This sentence states that “…sample collection may be unavailable and because site conditions may preclude access…”	Please clarify. Give examples as to why the sewer may be unavailable and what site conditions may preclude access.	Clarification. Please refer to the response to comment O-7 for some examples of conditions that may preclude access to the sewer structures. No text change proposed.
O-16.	Site Maps / Appendices A-Q	Appendices A-Q	The site maps have missing information.	Please include the following on the maps: road names, names of bodies of water, all former and current site buildings, contour line labels, and associated areas in conjunction with the sewers (e.g., parking lots, storage areas). In addition, please add (in each appendix) a brief summary of the operation and/or use of the building/s. This information will be useful while reviewing the next draft’s sampling locations.	Agree. Information such as road names, bodies of water, former/current buildings, and contour line labels will be added where such data is available. Sewer specific details, such as ejector stations and force mains, are already labeled where they occur, as well as the former treatment plants. Additionally, a brief description will be added to the Area Description section of each appendix to provide a high level summary of the functional groups of activities that occurred within that area.
O-17.	General Note	NA	On June 9, Ohio EPA attempted to verify the accuracy of the sewer line map at the Depot Administration Area. We noted many more manholes than located on the map, sewer lines in the wrong location, outfall in the wrong location, and manholes in the wrong location.	This is just a note to reiterate the fact that the sewer maps will need to be updated along with their associated GPS location.	Agree. Although an exhaustive search of all available historical documents and maps was performed, no detailed information was available for the Depot Administration Area. During the preliminary reconnaissance survey conducted in December 2008, locations where the maps were incorrect were noted, such as at the Depot Administration Area, were noted. Correspondingly, the Appendices of the SAP

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					for these locations indicates that additional survey work and investigation using dye or smoke tracing will be necessary to develop accurate maps of these areas. No text changes proposed. 29 June 2009 Comment Response Resolution Teleconference: SAIC requested concurrence from the RVAAP Team to be able to proceed with the Visual Survey and mapping (as needed) or sewer lines in advance of an approved SAP. No intrusive work or sampling would be conducted. The Team provided concurrence; the expected start would be early August.
O-18.	General	NA	During the site visit, Ohio EPA noted a missing manhole cover at the Depot Administration Area.	During this investigation, please note and flag the locations where manhole covers are damaged or missing.	Agree. During the preliminary sewer reconnaissance survey in December 2008, missing manholes and other potentially hazardous conditions were documented in the field, and flagged with orange tape at that time. A list of these locations identified to have structural issues was subsequently provided to the Army on January 9, 2009. The condition of the sewer structures and any conditions that may pose a safety concern will be documented during the Visual Survey phase of the investigation, and will be flagged in the field as well to indicate the presence of potential hazards. No text change proposed.

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
OHARNG RTLS-ENV (Katie Elgin)					
R-1.	General	NA	We will need to discuss the investigation boundary and if and how this affects the OHARNG activities.	Discussion Required. No text change required	Original Response Dated June 23, 2009: While many portions of the facility-wide sewers occur within AOCs that already have defined land uses (e.g.: RVAAP-50 Atlas Scrap Yard, Mounted Training – No Digging), many parts of the system are located outside of the boundaries of existing AOCs. This situation is predominantly confined to sanitary sewer trunk/connector lines and areas such as the Depot Administration Area. Discussion is required to determine the appropriate land use and applicable risk assessment/management process for these areas. 29 June 2009 Comment Response Resolution Teleconference: As the FWS AOC crosses areas which are considered "multipurpose" or do not yet have specific training use designations, it is acknowledged that further discussion is required to resolve the land use issues, as ultimately this will affect future remedial alternative and risk management decisions. OHARNG noted that use restrictions relative to deep sewer lines would need to be discussed and resolved. Also, pending final remedy (four years in the future), the need for any interim or near-term restrictions would have to be considered. The additional discussion to resolve land use issues with respect to the AOC will be conducted

Comment Number	Page or Sheet	New Page or Sheet	Comment	Recommendation	Response
					subsequently and in context of the RI/FS report, rather than this SAP. No text changes recommended.
R-2.	Pg 3-23, Lines 22-28	Pg 3-24, Section 3.3	Outfall Sediments – "Receptors to these source materials will include: Security Guard Maintenance Worker, Adult and Child Resident Farmer, National Guard Trainee, Fisher/Recreator, Adult and Juvenile Trespasser." Does the engineering school instructor need to be included here?	Include engineering school receptor if applicable.	Agree. Engineering School Instructor will be added to the bulleted list under Outfall Sediments, as requested.
R-3.	Pg 3-23, Lines 33-37	Pg 3-24, Section 3.3	"Only receptors who may excavate to depth are evaluated for this source type: National Guard Trainee (if the site is in a designated training area)." What does 'if the site is in a designated training area' mean? The whole facility is a designated training area. Please explain.		Original Response Dated June 23, 2009: The wording of the referenced text was intended to convey that portions of the system do not occur in areas with known designated land uses. Please refer to the response to comment R-1. The parenthetical text in the referenced bullet for the National Guard Trainee will be removed. 29 June 2009 Comment Response Resolution Teleconference: Additional discussion to resolve land use issues with respect to the AOC will be conducted subsequently and in context of the RI/FS report, rather than the SAP. The recommended text change indicated

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					above will be implemented as written.
R-4.	General-Figures and Mapping	General-Figures and Mapping	Figures and Mapping indicate the following: Sanitary Line <4 feet BGS Sanitary Line 4> feet BGS Both of these mean that the sanitary sewers are less than 4 feet bgs. Should be written as: Sanitary Line <4 feet BGS and Sanitary Line >4 feet BGS. Needs revised on all Figures.	Revise greater than and less than symbols throughout the report.	Agree. All instances of “4> FEET BGS” in the figure legends will be revised as follows: “>4~~>~~ FEET BGS”
R-5.	Figure D-1	Figure D-1	Change ‘Railroad Tracks’ to ‘Former Railroad Tracks’. All buildings on this figure are indicated as being demolished. Not all of the buildings in the Depot Area have been demolished. Please check which ones have been demolished and which remain and mark appropriately on the Figures.		Agree. The legend on all Appendix D figures will be revised to indicate that the railroad tracks in the Depot Administration Area have since been demolished. A review of the aerial photograph data will be conducted and the status of the buildings in the Depot Administration Area will be revised on the Appendix D figures as appropriate.
R-6.	Figure F-4	Figure F-4	Indicates buildings along South Service Road (outside of Load Line 2) are demolished. This is incorrect as the buildings remain. Please revise accordingly.		Agree. The figures in Appendix F will be revised to indicate that the buildings in this area have not been demolished.

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R-7.	Figure I-1	Figure I-1	Identify Vegetation symbol in the Legend.		Agree. The vegetation symbol will be added to the legend of I-1, and any other affected figures as well.
R-8.	Figure I-3	Figure I-3	- Building 813 is identified as being demolished. This building still remains. Please revise accordingly. - Identify the road names on the maps/figures where applicable. - What is the orange dashed line on the map?		Agree. The figures in Appendix I will be revised to indicate that Building 813 has not been demolished. Also, road names will be added where appropriate. The dashed orange line is for storm sewer infrastructure of unknown depth. This symbol will be added to the legend of the Appendix I figures. The storm structures in the Fuze and Booster Hill area occur as under-road structures, as indicated by the small segments shown on the map.
R-9.	Figure J-1	Figure J-1	-All buildings are marked as being demolished. This is incorrect. Buildings remaining on this figure are Building 813, Power House, Gas Chamber, and the building on the corner near the intersection. -What does tower location mean? -What is the red/brown dashed line on the figure?		Agree. The figures in Appendix J will be revised to correctly show the buildings that have not been demolished, as requested. The "tower" location shown is presumably a former guard tower or similar structure that was digitized into the structures layer based on historical drawings. The dashed orange line is for storm sewer infrastructure of unknown depth. This symbol will be added to the legend of the Appendix I figures. The storm structures in the Fuze and Booster Hill area occur as under-road structures, as indicated by the small segments shown on the map.

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R-10.	Figure K-2	Figure K-2	Change 'railroad tracks' to 'former railroad tracks' in the Legend.		Agree. The legend on all Appendix K figures will be revised to indicate that the railroad tracks in this area have since been demolished.
R-11.	Pg M-1, Line 8	Pg M-1	"The buildings at LL9 were thermally decontaminated and demolished to 2 feet below ground surface in 2003 and the foundations and footers were removed." Sounds like the structures below 2 feet bgs remain? I think all foundations and footers have been removed. Please indicate in the text.		Agree. The referenced text will be revised as follows, as based on the description from the FY08 Installation Action Plan: "The buildings at LL9 were thermally decontaminated and demolished to 2 feet below ground surface in 2003, and the ~~foundations and footers were removed~~ removal of all remaining slabs and foundations was completed in 2007."
R-12.	Figure O-1	Figure O-1	Label the creek on the figure. Also identify the vegetation line in the Legend.		Agree. The creek name will be added as requested, and the vegetation line added to the figure legend.
R-13.	Figure Q-1	Figure Q-1	Mark and distinguish between which buildings have been demolished and which ones remain. Also, include road names.		Agree. The aerial photography data will be reviewed and the buildings' statuses in the Appendix Q figures will be revised as appropriate. Road names will also be added as requested.
R-14.	Pg 14-1	SSHP Pg 14-1	Emergency Phone Numbers – Please also include LTC Ed Meade, Garrison Commander, (614)336-6560.		Agree. An entry for the Garrison Commander will be added to Table 14-1 of the SSHP, as requested.