Former Joliet Army Ammunition Plant
Will County, Illinois

Final
2017 Semi-annual Groundwater Monitoring Report

Long-Term Monitoring, Deed Restriction Implementation Plan, and CERCLA Five-Year Review

Prepared For:
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2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT

LONG-TERM MONITORING, DEED RESTRICTION IMPLEMENTATION PLAN, AND CERCLA FIVE-YEAR REVIEW

FORMER JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

January 2018

IEA, Inc./MWH Americas, Inc., now part of Stantec Joint Venture (IEA/MWH JV) certifies that, to the best of its knowledge and belief, the technical data delivered herewith under contract W912QR-15-C-0016 is complete, accurate, and complies with all requirements of the contract.

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ACRONYMS AND ABBREVIATIONS

Army	United States Department of the Army
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
1,1-DCA	1,1-dichloroethane
cis-1,2-DCE	cis-1,2-dichloroethene
2,4-DNT	2,4-dinitrotoluene
2,6-DNT	2,6-dinitrotoluene
2-A-4,6-DNT	2-amino-4,6-dinitrotoluene
4-A-2,6-DNT	4-amino-2,6-dinitrotoluene
DO	dissolved oxygen
1,3-DNB	1,3-dinitrobenzene
FSP	Final Appendix A – 2015 Field Sampling Plan Update (IEA/MWH JV, March 2016)
ft	foot/feet
GMZ	groundwater management zone
GOU	Groundwater Operable Unit
GRU	Groundwater Remedial Unit
HMX	high melting-point explosive
IAC	Illinois Administrative Code
IC	institutional control
IEA/MWH JV	IEA, Inc./MWH Americas Inc. Joint Venture
IEPA	Illinois Environmental Protection Agency
in.	inch
JOAAP	former Joliet Army Ammunition Plant
LAP	Load-Assemble-Package Area
LOQ	limit of quantitation
LTM	long-term monitoring
LTM Plan	Final Long-term Monitoring Plan for Environmental Remediation Services, MWH/TolTest, March 2010
MFG	Manufacturing Area
mg/L	milligrams per liter
ml	milliliters

ml/min	milliliters per minute
MNA	monitored natural attenuation
MNTP	Midewin National Tallgrass Prairie
MS/MSD	matrix spike/matrix spike duplicate
NB	nitrobenzene
NPL	National Priorities List
2-NT	2-nitrotoluene
OD	outside diameter
ORP	oxidation-reduction potential
Other Areas	refers to an area in the northwest part of Manufacturing Area where compliance monitoring wells for the Manufacturing Area GMZ are located
OU	operable unit
PL 104-106	Illinois Land Conservation Act of 1995, Public Law 104-106, Division. B, Title 2901-2932, 10 February 1996
PVC	polyvinyl chloride
2015 QAPP	Final Appendix B - 2015 Quality Assurance Project Plan Update (IEA/MWH JV, March 2016)
2017 QAPP	Final Appendix B - 2017 Quality Assurance Project Plan Update (IEA/MWH JV, July 2017)
RA	remedial action
RDX	Royal Demolition Explosive
Report	2017 Semi-annual Groundwater Monitoring Report
RG	Remediation Goal
RI	Remedial Investigation
1998 ROD	Record of Decision for the Soil and Groundwater Operable Units on the Manufacturing and Load-Assemble-Package Areas, National Priorities List Sites (U.S. Army, October 1998)
Site L1	Group 61
Site L2	Explosive Burning Grounds
Site L3	Demolition Area
Site L14	Group 4
Site M1	Southern Ash Pile
Site M3	Flashing Grounds
Site M4	Lead Azide Area
Site M5	Tetryl Production Area

Site M6	TNT Ditch Complex
Site M7	Red Water Area
Site M8	Acid Manufacturing Area
Site M11	Landfill
Site M13	Gravel Pit
SOP	standard operating procedure
SOU	Soil Operable Unit
SpC	specific conductivity
SVOC	semivolatile organic compound
TAL	target analyte list
1,3,5-TNB	1,3,5-trinitrobenzene
2,4,6-TNT	2,4,6-trinitrotoluene
TOC	top of casing
µg/L	micrograms per liter
USACE	United States Army Corps Of Engineers
USAEC	United States Army Environmental Command
USDA/USFS	United States Department of Agriculture/United States Forest Service
USEPA	United States Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compound

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1.0 INTRODUCTION

This 2017 Semi-annual Groundwater Monitoring Report (Report) has been prepared by IEA, Inc./MWH Americas Inc. Joint Venture (IEA/MWH JV) for environmental services at the former Joliet Army Ammunition Plant (JOAAP) on behalf of the United States Army Environmental Command (USAEC) under contract with the United States Army Corps Of Engineers – Louisville District (USACE). This work was executed under Firm Fixed Price Contract No. W912QR-15-C-0016.

This Report presents April 2017 groundwater and surface water quality data for the long-term monitoring (LTM) program of the Groundwater Operable Unit (GOU) and landfill inspection documentation for the Soil Operable Unit (SOU) at JOAAP is in response to the *Record of Decision for the Soil and Groundwater Operable Units on the Manufacturing and Load-Assemble-Package Areas* (U.S. Army, 1998; 1998 ROD) for JOAAP. The remedy that was selected for the GOU sites at JOAAP was monitored natural attenuation (MNA). As a function of the MNA remedy for the Groundwater Remedial Unit (GRU), LTM is required. This requirement is intended to satisfy three primary objectives:

1. Monitor contaminant concentration reductions and plume migration;
2. Verify containment of contaminant concentrations greater than the Remediation Goal (RG) within the groundwater management zones (GMZs); and
3. Evaluate the effectiveness of SOU remedial action (RA) and MNA for the GOU remedy.

In addition to the GOU, SOU RA included the construction of three landfills at Sites L3 (Demolition Area), M11 (Landfill), and M13 (Gravel Pit). Landfill inspections are required quarterly at Landfill M13 and annually at Landfill M11 (following the initial five years of quarterly inspections, per the LTM Plan) to determine if the remedies continue to function as designed. Removal of Landfill L3 was completed in 2016, and therefore inspections subsequent to the initiation of the removal have not been completed. The Post-closure Landfill Inspection Reports for the first (conducted in March 2017) and second quarters (conducted in April 2017) for Landfill M13 are included in Appendix A.

The objective of this Report is to provide a data submittal of the groundwater and surface water quality sampling results from April 2017, and to provide documentation of landfill inspections. Additionally, water table and potentiometric surface maps for the completed sampling event are included.

1.1 FACILITY DESCRIPTION AND BACKGROUND

Joliet Army Ammunition Plant is a former United States Department of the Army (Army) munitions production facility located on approximately 37 square miles (23,915 acres) of land in Will County, Illinois (Figure 1-1). The former facility is located approximately 60 miles southwest of Chicago and 14 miles south of Joliet, Illinois. As shown on the

Groundwater Study Areas and Landfill Sites Map (Figure 1-2), the JOAAP property is divided into two main functional areas: the Manufacturing Area (MFG), west of Route 53, and the Load-Assemble-Package Area (LAP), east of Route 53. The facility has been described in detail in Section 1.1 of the *Final Long-term Monitoring Plan for Environmental Remediation Services* (MWH/TolTest, March 2010; LTM Plan).

The MFG, covering approximately 15 square miles, is where the chemical constituents of munitions, propellants, and explosives were produced. The production facilities were generally located in the northern half of the MFG. In the southern half of the MFG, there was an extensive explosives storage facility. The LAP, covering approximately 22 square miles, is where munitions were loaded, assembled, and packaged for shipping. The LAP contained munitions filling and assembly lines, storage areas, and a demilitarization area.

Joliet Army Ammunition Plant was constructed during World War II. The production output varied with the demand for munitions. Although the plant was used extensively during World War II, all production of explosives halted in 1945. At that time, the sulfuric acid and ammonium nitrate plants were leased out, and the remaining production facilities were put in layaway status. The installation was reactivated during the Korean War, and again during the Vietnam War. Production gradually decreased until it was stopped completely in 1977.

Hazardous wastes were generated and released into the environment in several ways. Process waters used in the production and handling of 2,4,6-trinitrotoluene (TNT) and other compounds were discharged into drainage systems. Buildings and equipment were periodically washed to remove explosive residues. Most of these wastewaters leached into the ground or flowed into local surface water and creeks. Later, process water incineration or industrial wastewater treatment produced ash or explosives residue that accumulated over time. Ash from the incineration of production by-products was stored in landfills on site. Equipment and demolition materials were flashed (burned) to remove residues. Fire training areas, used to keep fire and safety personnel suitably prepared, introduced contaminants to soil and groundwater. Leaks and spills occasionally occurred in the storage and handling of oils and other liquids. Wastes and unusable explosives and munitions were burned or detonated. In addition, munitions were tested, leaving some residuals in soil at the test sites. Vehicle and equipment maintenance, transformer leaks, and the handling of pesticides introduced further contamination to the soil.

Wastes generated during production activities resulted in environmental contamination at various sites within JOAAP. Because of this contamination, the United States Environmental Protection Agency (USEPA) placed the MFG on the National Priorities List (NPL) on 21 July 1987 and the LAP on the NPL on 31 March 1989.

The contaminated media identified at JOAAP were divided into two operable units (OUs) to aid in the development and evaluation of remedies. The SOU consists of sites where contaminated soils, sediments, and debris were identified. The GOU consists of sites where contaminated groundwater was identified. Surface water was determined to pose no risk to human health and the environment and therefore is not addressed further as a contaminated

media. However, surface water discharge is a major component of the shallow groundwater system, and localized detections of explosives may occur near contaminated groundwater sites. For this reason, surface water is relevant to the GOU.

The Illinois Land Conservation Act of 1995, Public Law 104-106, Division B, Title 2901-2932, 10 February 1996 (PL 104-106), states that the Army will transfer JOAAP land to various Federal, State, and local jurisdictions. Transfer of land is occurring incrementally as it is remediated and is deemed appropriate. Substantial land area at JOAAP is not contaminated. Transfer activities for that land have occurred, and some are still underway. After remaining potential hazards to human health and the environment are addressed under the SOU and these properties are found suitable for transfer under PL 104-106 and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the Army will prepare documentation for transfer.

As of 2017, the distribution of JOAAP land through these incremental transfers is approximately 17,629 acres to the United States Department of Agriculture/United States Forest Service (USDA/USFS) for establishing the Midewin National Tallgrass Prairie (MNTP); 1,009 acres to the Department of Veterans Affairs to establish a Veterans Cemetery; 455 acres to Will County, Illinois to establish the Will County Landfill; and 3,507 acres to the State of Illinois to establish two industrial parks. The Army maintains control over approximately 1,315 acres.

Where groundwater contamination is present within areas to be transferred, the Army has included institutional controls (ICs) in the transfer documents to prevent exposure to contaminants, limit groundwater pumping, and to prevent manipulation of the natural groundwater flow patterns through any means. These controls will help to limit the spread of the remaining contamination in groundwater and will remain in effect with the land until removed by mutual agreement of the Army, USEPA, Illinois Environmental Protection Agency (IEPA), and the current landowner.

1.2 NATURAL ATTENUATION MECHANISMS

The selected remedial action for the GOU is remediation by natural attenuation. A detailed overview of the physical, chemical, and biological criteria, which are most directly linked to natural attenuation mechanisms and the site-specific criteria used to evaluate natural attenuation at JOAAP is provided in the LTM Plan and annual groundwater monitoring reports where natural attenuation is evaluated and reported.

1.3 RECORD OF DECISION REQUIREMENTS

The 1998 ROD specified general groundwater monitoring requirements. These requirements were based on information presented in the Remedial Investigation (RI) Report and did not have the additional information provided by the predesign investigation completed in 1998

or subsequent remedial actions completed at JOAAP. As such, the Army applied subsequent site data as well as historical data to arrive at site-specific LTM locations and analytes, which were included in the LTM Plan.

Based on the objectives presented in Section 1.2 of the LTM Plan and as an extension of the 1998 ROD, several types of monitoring are required. These include:

- Collection of groundwater samples to evaluate contaminant concentrations;
- Collection of surface water samples where groundwater discharges to surface features to evaluate surface water contaminant concentrations;
- Collection of depth to water measurements to evaluate groundwater flow;
- Documentation and evaluation of source removal or surface disturbing activities;
- Documentation of changes in surface water features, impoundments, or conveyances; and
- Evaluation of evidence concerning improper use of groundwater affecting contaminant migration.

1.4 LONG-TERM MONITORING PLAN

Monitoring activities are required pursuant to the decision documents developed for the various contaminated sites found at JOAAP. The LTM Plan was written to present LTM activities for the GOU and required SOU maintenance activities. The LTM Plan includes activities associated with long-term maintenance of the remedies selected for JOAAP. The objective of the LTM Plan was to provide a sufficiently detailed description of the monitoring strategy and process and to establish realistic expectations for execution of the LTM program on the part of all stakeholders. With respect to the latter objective, it is the intent of the LTM Plan to establish both the actions to be taken in the event of various sampling outcomes and the set of conditions required to reduce and eventually discontinue long-term monitoring efforts where practicable. As such, it includes sample collection and analysis of groundwater and surface water, surveillance of the landfill cap condition, and access restrictions at landfills, and surveillance of land use restrictions and other ICs implemented on an installation-wide basis.

Section 3.1 of the LTM Plan summarizes the GMZs and monitoring well designations, and discusses the decision tree for interpretation of groundwater quality results and the logic for optimizing the LTM program. Section 3.2 of the LTM Plan discusses IC monitoring required as part of the MNA remedy.

The LTM program is presented in Section 4.0 of the LTM Plan, which includes a discussion of site-specific LTM programs for the GMZs and landfills, monitoring well installations, abandonments, monitoring schedules, requirements for IC monitoring, and reporting schedules. Tables 1 through 8 of the *Final Appendix A - 2015 Field Sampling Plan Update* (IEA/MWH JV, March 2016; FSP) of the LTM Plan provide specific information about the

current monitoring requirements at each site. However, it is expressly presented that the LTM program included in the original LTM Plan will likely change with changing conditions. Therefore, the LTM Plan sampling tables were consolidated in this Report into a single table (Table 1-1) that is continually updated based on groundwater monitoring results and periodic reviews. Additionally, the changes to the LTM program based on results and the conditions set in the LTM Plan are summarized in Section 4 – Recommendations.

The LTM Plan provides a site-specific evaluation of the natural attenuation remedial option that is being applied to all GOU sites. The purpose of the LTM Plan is to:

- Describe the process by which data will be collected and analyzed;
- Determine if remedies in place at JOAAP are protective of human health and the environment;
- Describe the nature of monitoring results that, if observed, would indicate further action be taken because the remedy does not appear to be sufficiently protective;
- Prescribe the conditions under which certain monitoring activities may be terminated; and
- Provide a detailed description of activities to monitor the GOU natural attenuation RA.

Section 5 of the LTM Plan describes reporting requirements for LTM activities. The LTM Plan reporting schedule requires the following:

- Submittal of a semi-annual report that presents the results of the first and second quarterly landfill inspections for Landfill M13 and the semi-annual sampling event, with minimal analysis; and
- Submittal of an annual report that presents the results of the third and fourth quarterly landfill inspections for Landfill M13, the annual inspection of Landfill M11, and the annual sampling event with detailed evaluation of trends in groundwater data.

The landfill inspection schedule identified in the LTM Plan has been implemented, with Landfill M11 inspections having been reduced to annual only starting in 2015 after completion of five years of quarterly inspections, in accordance with the LTM Plan. The current schedule requires quarterly landfill inspections to generally be conducted in January (first quarter, Landfill M13), April (second quarter, Landfill M13), July (third quarter, Landfill M13), and October (fourth quarter, Landfills M11 and M13) of each year. In 2017, the first quarterly inspection was conducted on 01 March 2017 at Landfill M13 and the second quarterly inspection was conducted on 26 April 2017 at Landfill M13. Additionally, fence-to-fence mowing was conducted in April 2017 on the landfill cap and the perimeter areas at Landfills M11 and M13.

The LTM Plan also provides for a CERCLA five-year review of the GOU natural attenuation remedy and SOU remedy, as required by the 1998 ROD. Five-year reviews are completed to evaluate the effectiveness of the GOU and SOU remedies and, if necessary, provide

recommendations to modify the remedy to make it more effective. The Final First Five-Year Review Reports for the SOU and GOU were each submitted in April 2004. The Final Second Five-Year Review Reports for the SOU and GOU were each submitted in August 2009. The Third Five-Year Review Report was consolidated into one document for both the SOU and GOU and was submitted Final in August 2015 (Revised Final in December 2015). Subsequent Five-Year Review Reports will continue to have the GOU and SOU in one consolidated document. The Fourth Five-Year Review for the SOU and GOU is due September 2019.

2.0 SITE ACTIVITIES

This section provides a summary of the LTM Plan requirements, the groundwater monitoring activities at each of the GOUs, and the SOU RA landfill mowing and inspections.

2.1 LANDFILL INSPECTIONS

Post-closure monitoring requirements for Landfills L11 and M13 are mandated by Illinois Administrative Code (IAC) Title 5, Subtitle G, Chapter 1, Subchapter c, Part 724, Subpart G, for 15 years at Landfill M13 and 30 years at Landfill M11. The LTM Plan states that the Landfill M11 cover will be inspected quarterly for the first five years and annually for 25 years, and the Landfill M13 cover will be inspected quarterly. The inspections at Landfill M13 for the first quarter was conducted on 01 March 2017, and the inspection at Landfill M13 for the second quarter was conducted on 26 April 2017. The landfill inspection reports are included in Appendix A.

From 18 April through 20 April 2017, the caps at Landfills M11 and M13 were mowed, the rip rap aprons were mowed and sprayed, and the area within the perimeter fences were also mowed. Mowing was completed to a height between 4 and 6 inches. Spraying consisted of application of 2,4-D to the vegetation growing in the rip rap, to kill the woody and broadleaf vegetation while leaving the other rooting grasses unaffected. Additionally, a few small trees and brush within the rip rap and perimeter areas of Landfills M11 and M13 appeared to not have been completely killed by previous spot treatments and were therefore sprayed again in April 2017, using a dyed herbicide (Razor™). During mowing activities, small depressions across the landfill cap have been identified. The small depressions were difficult to notice visually due to the thick vegetation growth, but were identified during cap mowing activities. At Landfill M11, approximately 22 cubic yards of topsoil was spread in various locations on the landfill cap where there had been slight depressions. Due to the small areas filled, seeding at this time was deemed unnecessary.

2.2 GROUNDWATER MONITORING

This section provides a summary of the field activities undertaken to conduct the semi-annual groundwater and surface water monitoring at GOU and SOU sites. Site L2 (Explosive Burning Grounds) was not sampled during the semi-annual sampling event, as recommended in the 2009 Annual Report based on Section 4.1.2.5 of the LTM Plan. Site L14 (Group 4) was not sampled during the semi-annual sampling event, as recommended in the 2010 Semi-annual Report based on Section 4.1.4.5 of the LTM Plan. Landfill M11 was not sampled during the semi-annual sampling event, as recommended in the 2011 Annual Report based on Section 4.2.2.5 of the LTM Plan.

The gauging of the monitoring well groundwater elevations was accomplished using an electronic water level indicator. Depth to water was measured from a datum mark on the top

of casing (TOC) of each monitoring well. All gauging measurements were taken to an accuracy of +/- 0.01 foot (ft).

In accordance with the standard operating procedure (SOP) for low-flow sampling, monitoring wells were purged and sampled using low-flow sampling techniques at a flow rate of approximately 250 milliliters per minute (ml/min). Dedicated ¼-inch- (in.-) outside-diameter (OD) polyethylene and silicon tubing is installed in each monitoring well. At locations where there have been previous recent detections of organic compounds, the tubing is Teflon™-lined polyethylene tubing. The tubing was connected with silicon tubing to a variable speed peristaltic pump. During purging, the pump discharge tube was attached to a Horiba™ (or equivalent) multi-probe water quality meter equipped with a flow-through cell. The water quality meter was equipped with probes for measuring groundwater/surface water field parameters, including temperature, pH, specific conductivity (SpC), oxidation-reduction potential (ORP), and dissolved oxygen (DO). The water quality meters were calibrated daily in accordance with the FSP and the manufacturer's instructions.

Measurements of field parameters were taken at two-minute intervals and recorded on Groundwater Sampling Forms. Purging of each monitoring well was considered complete when field parameters stabilized over three successive measurements to within approximately 10 percent (varies by parameter, see FSP in the LTM Plan). The final stabilization readings are summarized in Table 2-1. Upon stabilization of the field parameters, the required samples were collected from the discharge tube of the pump into laboratory-supplied containers after disconnecting the flow-through cell.

Samples were collected in laboratory-supplied containers; for explosive compounds in one-liter unpreserved amber glass bottles, target analyte list (TAL) metals in 250-milliliter (ml) nitric acid-preserved polyethylene bottles, inorganic parameters nitrate and sulfate each in separate 250-ml unpreserved polyethylene bottles, volatile organic compounds (VOCs) in 40-ml hydrochloric acid-preserved glass vials, and semivolatile organic compounds (SVOCs) in one-liter unpreserved amber glass bottles. Samples collected for the inorganic parameters of TAL metals, nitrate, and sulfate were field filtered using high-capacity 0.45-micron in-line cartridge filters. Samples were analyzed by Shealy Environmental Services, Inc., West Columbia, South Carolina in accordance with the *Final Appendix B - 2015 Quality Assurance Project Plan Update* (IEA/MWH JV, March 2016; 2015 QAPP) and the *Final Appendix B - 2017 Quality Assurance Project Plan Update* (IEA/MWH JV, July 2017; 2017 QAPP) of the LTM Plan.

2.2.1 Semi-annual Groundwater Monitoring

The semi-annual groundwater sampling event for 2017 was conducted from 18 April through 25 April 2017 by IEA/MWH JV. Water levels were measured at a total of 117 monitoring wells and 3 surface water locations at JOAAP. A total of 30 monitoring wells and 1 surface water location were sampled at the MFG, and 9 monitoring wells and 2 surface water locations were sampled at the LAP, as summarized in Table 1-1.

The gauging of the monitoring well water levels was accomplished using techniques discussed in Section 2.1. Surface water elevations are determined by referencing to the known elevations of nearby benchmarks using a level and rod, except at Site M1 (Southern Ash Pile) where direct measurement from the bridge with a water level indicator was completed. All gauging and surveying measurements were taken with an accuracy of +/- 0.01 ft. All surface water locations contained water during gauging and sampling activities. Groundwater elevations are summarized in Table 2-2 for the MFG and Table 2-3 for the LAP. Surface water elevations are summarized in Table 2-4. Gauging and surveying activities for individual sites were completed within a 24-hour period. However, water levels at Other Areas monitoring wells MW116, MW117, MW118, and MW119 and Site M6 monitoring wells MW164 and MW316 were not measured in the same 24 hr. period as the rest of the MFG Area monitoring wells, but measured the following day. This should have no effect on the overall configuration of the contoured surface due to the horizontal distances spanned.

Groundwater sampling was conducted in accordance with the FSP, as described above. Surface water samples were collected by directly immersing the sample container into the surface water body to fill the bottle, if filtration for TAL metals was not required. If filtration for TAL metals, sulfate, or nitrate was required, a peristaltic pump with tubing placed directly in the surface water body was used for sample collection.

Blind duplicate samples were collected at a rate of 10 percent (1 per 10) for each analyte sample total. The majority of the duplicate samples were collected from monitoring wells that had previous analyte detections. Duplicate samples were collected from four monitoring wells in the MFG. Details concerning field duplicates are as follows:

Duplicate Sample Number	Monitoring Point Sampled	Site	Sample Date	Analyte
MW996	MW362	M13	4/24/2017	VOCs, SVOCs, Explosives, TAL Metals, Nitrate, and Sulfate
MW997	MW652	M6	4/20/2017	Explosives
MW998	MW654	M6	4/20/2017	Explosives
MW999	MW330	M8	4/19/2017	Sulfate

Matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a rate of 5 percent (1 per 20) for each analyte sample total.

All data was validated with Level III validation, with 10 percent of the samples receiving Level IV validation. Based on the results of the validation, a Data Validation Report is included in Appendix B1 and a Data Usability Report is included in Appendix B2.

2.3 INSTITUTIONAL CONTROLS MONITORING

The remedies selected for all areas of JOAAP do not allow unrestricted use of the property or underlying groundwater. Restrictions on use of groundwater are limited for the GMZs, and annual certification that the restrictions are being followed for each GMZ is required. Land use restrictions over and above those associated with groundwater use apply wherever waste or contamination has been left in place at levels that pose an unacceptable risk without some form of ICs. Some of those areas include the two landfills (M11 and M13) with associated restrictions with annual certification. For all other areas with ICs, there is a need for similar annual certification that the ICs remain in effect and are being followed. Annual certifications are completed separate from this Report.

During landfill inspections conducted in March and April 2017, there were no observations of intrusive soil activities, construction, or improper use of groundwater which would affect the GOU or SOU remedies at Landfills M11 or M13.

3.0 RESULTS AND RECOMMENDATIONS

Groundwater management zones are three-dimensional areas containing groundwater being managed to mitigate impairment according to the IAC. The GMZs comprise both the glacial drift and shallow bedrock (Silurian Dolomite) aquifer and are bounded at depth by a confining shale unit (Maquoketa Shale). The GMZs were established with acceptance of the 1998 ROD. Any future modification of GMZ boundaries will have to be mutually agreed upon by the Army, USEPA, and IEPA. Groundwater monitoring wells and surface water collection points located inside and/or near the borders will be used to monitor contaminant plumes.

In 2017, groundwater and surface water samples were collected during the semi-annual sampling event conducted in April 2017. Samples were analyzed for one of more of the following parameters: explosive compounds, TAL metals, indicator parameters (nitrate and sulfate), VOCs, and SVOCs. Analytical results from 2017 sampling event for explosive compounds, TAL metals, indicator parameters (nitrate and sulfate), VOCs, and SVOCs are summarized in Tables 3-1 through 3-5, respectively. Sites L2, L14, and M11 are not sampled during the semi-annual sampling event as described in Section 2.2 above. This section provides a site-specific presentation of the monitoring well gauging and groundwater and surface water quality sampling results. The discussions are arranged by the GMZs into which each of the sites is grouped. This provides an ability to discuss the contaminant detections in relation to each of the GMZ boundaries.

Each site in Section 3 is organized into the following subsections:

General Site Introduction: General site-specific background information is presented.

Groundwater Hydraulics: Site monitoring wells, surface water sampling locations, and water elevation measurements are presented for the water table and potentiometric surface (generally in the bedrock). For groundwater hydraulic purposes, monitoring wells are designated as overburden monitoring wells, combination overburden/bedrock monitoring wells, or bedrock monitoring wells. This designation indicates in which aquifer(s) the monitoring well is screened. When possible, discussions include the relationship between groundwater flow direction and contaminant migration.

Analytical Results: Figures are presented for contaminant detections observed during the semi-annual sampling event conducted in April 2017. For groundwater quality discussions, monitoring wells and surface water sampling points are designated as in-plume, early warning, or compliance points, and Landfill sites as upgradient or downgradient. These designations are included in the LTM Plan and are based on where the sampling point is located relative to historical groundwater detections, site GMZs, and/or site features.

Analytical data from 2017 sampling are included in the discussion of analytical results. Contaminant concentrations that are greater than site RGs are included in the discussion even if there is not a notable change in the analytical data for that constituent.

Recommendations: Recommendations for each site are presented specific to the conditions of the LTM Plan. A thorough summary of recommendations is presented in Section 4. Since there is little evaluation of trends included in the semi-annual reports, the recommendations included herein are general in nature.

3.1 SITE L1 (Group 61)

Site L1 (Group 61) is one of six GMZs created to manage risk arising from groundwater contamination and to monitor performance of the selected remedy. Site L1 comprises approximately 80 acres on which munitions production facilities were constructed in 1941. It is centrally located in the northern portion of the LAP (Figures 1-2 and 3-1). Historically, Site L1 was used for demilitarization and reclamation of various munitions starting with crystallization of ammonium nitrate, but then was converted for shell renovation and 1,3,5-trinitrobenzene (1,3,5-TNB) recovery up until 1945. By April of 1946, it had been reactivated to reclaim TNT.

In the TNT operation, steam was used to wash the TNT out of shells. The water was discharged to a sump where solid explosives were removed for burning, and the overflow (pink water) was routed to a 4.3-acre ridge and furrow evaporation/percolation pond. By 1952, two additional evaporation ponds had been constructed southeast of the ridge and furrow unit on either side of a drainage ditch flowing from it to Prairie Creek. Prairie Creek, the surface water body draining the area, is incised into the bedrock and appears to transmit groundwater that discharges directly or emerges into the streambed by virtue of the head relief available in the open channel.

Explosive residues in soil were observed in the ridge and furrow impoundment**,** the western-most of the two newer ponds, the area south of the washout building, and the soil around the sump. The underlying groundwater contains TNT; TNB; 2,6-dinitrotoluene (2,6-DNT); and Royal Demolition Explosive (RDX) both in the alluvium and in the shallow weathered bedrock, as well as degradation products from those parent compounds, as a result of the infiltration of pink water and possibly continued leaching of explosives in soil. Soil source control measures at the ridge and furrow pond were completed in March 2006. The contamination is now a legacy groundwater plume continuing to migrate to the southeast toward Prairie Creek, where it is believed to largely discharge into the creek through upwelling. Given these observations, the contaminant footprint is expected to separate from the source area over time and migrate in the alluvium and shallow bedrock until it discharges to Prairie Creek.

The overburden aquifer generally consists of a complex stratification of clay and silt, with some silty gravel observed in the eastern portion of the site near MW174. The overburden is approximately 20 ft thick in the north to less than 5 ft thick in the south, and from approximately 15 ft thick in the east to 5 ft thick in the west.

3.1.1 Groundwater Hydraulics

The groundwater monitoring network at Site L1 consists of 16 monitoring wells: 8 overburden monitoring wells (MW131, MW171, MW173, MW174, MW175, MW176, MW610, and MW611), 1 combined overburden/bedrock monitoring well (MW400), and 7 bedrock wells (MW172, MW177, MW178, MW401, WES1, WES2, and WES3). Water levels are measured at the groundwater/surface water locations that are sampled (listed below), and at monitoring wells MW171, MW172, MW175, MW176, MW177, MW178, MW401, MW610, MW611 and WES2. The water level at monitoring well MW400 was not measured, as the monitoring well is beyond the limits of the figure and is a combination well. Surface water (SW550) elevation is measured at a point along Prairie Creek. Monitoring well information and water levels from April 2017 are summarized in Table 2-3.

Data suggests that Prairie Creek, the surface water body draining the area, transmits groundwater that discharges directly to or upwells into the streambed by virtue of the head relief available in the open channel. The groundwater flow direction in the overburden and bedrock aquifers is typically toward the southeast to the north of Prairie Creek, and toward the north to the south of Prairie Creek, as shown on Figures 3-1 and 3-2, respectively. The overburden and bedrock aquifer flow directions are consistent with flow directions observed historically. Based on groundwater flow data, Prairie Creek is the discharge point for shallow groundwater in the vicinity of Site L1.

During April 2017, vertical gradients observed between the overburden and bedrock were upward at monitoring well nests MW172/MW173 and MW177/MW171, further supporting a gaining-stream scenario; and downward at monitoring well nests MW178/MW176 (at distance from the creek) and MW401/MW610 (on the opposite side of the creek from the site; Table 3-6).

3.1.2 Analytical Results

Groundwater and surface water sampling completed for Site L1 during April 2017 are summarized in Table 1-1. The following monitoring wells and the surface water sampling location at L1 are sampled for explosives:

- In-Plume – MW131, MW173, and WES1;
- Early Warning – MW174 and WES3; and
- Compliance – surface water sampling point SW550.

Early Warning monitoring well MW172 and Compliance monitoring well MW401 were removed from the LTM program beginning in April 2012.

Groundwater and surface water samples collected at Site L1 in April 2017 were analyzed for explosive compounds in accordance with the 2017 QAPP. Explosive compound detections are summarized in Table 3-1 and shown on Figure 3-3. A brief discussion of analytical results by well type follows.

In-Plume Monitoring Wells (MW131, MW173, and WES1): At overburden monitoring well MW131, 2,6-DNT exceeded the RG at a concentration of 10 micrograms per liter (µg/L); 1,3,5-TNB exceeded the RG at a concentration of 2,200 µg/L; TNT exceeded the RG at a concentration of 4,500 µg/L; and 2-amino-4,6-dinitrotoluene (2-A-4,6-DNT) and 4-amino-4,6-dinitrotoluene (4-A-2,6-DNT) were detected in April 2017. There are no RGs for 2-A-4,6-DNT or 4-A-2,6-DNT. Due to required dilution, the limits of quantitation (LOQs) for 1,3-dinitrobezene (1,3-DNB); 2,4-dinitrotoluene (2,4-DNT); and RDX were elevated above their respective RGs in April 2017.

At overburden monitoring well MW173, RDX exceeded the RG at a concentration of 8.1 µg/L; TNT exceeded the RG at a concentration of 13 µg/L; high melting-point explosive (HMX) was detected below the RG at a concentration of 0.94 µg/L; 1,3,5-TMB was detected below the RG at a concentration of 0.68 µg/L; and 2-A-4,6-DNT and 4-A-2,6-DNT were detected in April 2017. There are no RGs for 2-A-2,6-DNT or 4-A-2,6-DNT.

At bedrock monitoring well WES1, 1,3,5-TNB exceeded the RG at a concentration of 100 µg/L; TNT exceeded the RG at a concentration of 74 µg/L; and 2-A-4,6-DNT and 4-A-2,6-DNT were detected in April 2017. There are no RGs for 2-A-2,6-DNT or 4-A-2,6-DNT.

Early Warning Monitoring Wells (MW174 and WES3): At overburden monitoring well MW174, there were no explosive compounds detected in April 2017.

At bedrock monitoring well WES3, RDX was detected below the RG at a concentration of 0.47 µg/L; TNT was detected below the RG at a concentration of 0.99 µg/L; and 4-A-2,6-DNT was detected in April 2017. There is no RG for 4-A-2,6-DNT.

Compliance Points (SW550): At surface water sampling location SW550, there were no explosive compounds detected in April 2017. According to the LTM Plan, SW550 is to be collected at a point along Prairie Creek where the creek leaves the GMZ boundary. However, the GMZ boundary is approximately 1,500 ft downstream from where groundwater emanating from the Site L1 source area would likely be discharging to the surface water. Therefore, the sample has been collected at the location shown on Figure 3-1 to provide an indication if the groundwater discharging to Prairie Creek exceeds the surface water RG. If concentrations are detected in excess of the RG at this current sampling location, the sampling location will be moved downstream to the GMZ boundary to determine if surface water is leaving the GMZ in excess of the RG.

3.1.3 Recommendations

There are no recommended changes to the LTM program at Site L1.

3.2 SITE L3 (Demolition Area)

Site L3 (Demolition Area) is the third of six GMZs created to manage risk arising from groundwater contamination and to monitor performance of the selected remedy. Site L3 comprises approximately 50 acres used as a demolition area, directly southwest of Site L2. Former Landfill L3 occupied approximately 3.32 acres of the Site L3 area (Figures 1-2 and 3-4). Site L3 is bounded on the west by Prairie Creek, the south by an unnamed tributary of Prairie Creek, and the east by Star Grove Cemetery. Predominant use of the area was for open burning of combustibles and munitions crates, including some materials with low-level explosive contamination. An air curtain destructor was constructed at the site to reduce emissions, but was never put into use. There was also a one-acre fire training area at the site, which consisted of a small depression surrounded by an earthen berm.

Specific burning units included “U”- and “L”-shaped burn pads, and a burn cage on a concrete slab. Geophysical surveys noted a number of metallic anomalies buried around the burn pads. The soil was also found to contain lead and RDX contamination at levels requiring remediation. Berms along Prairie Creek were found to contain lead; chlordane; 2,6-DNT; and phosphate exceeding their respective RGs. It has been assumed that the contamination in these berms arises from filling activity in the area when the berms were constructed. Unexploded ordnance (UXO) may also be present in this area. The remedy selected for the area along Prairie Creek was consolidation and capping into what was called Landfill L3, completed in 2008. However, Landfill L3 removal was completed in 2016.

The overburden aquifer primarily consists of silt and clay with some silty clay and sand. The overburden thickness is irregular and generally varies between approximately 5 ft and greater than 30 ft across Site L3, with limited saturated overburden in the southern part of the site.

3.2.1 Groundwater Hydraulics

The groundwater monitoring network at Site L3 consists of 9 monitoring wells: 3 overburden monitoring wells (MW1, MW137, and MW3), 1 combined overburden/bedrock monitoring well (MW136), and 5 bedrock monitoring wells (MW412, MW630, MW631, MW632, and MW633). Water levels are measured at the groundwater/surface water locations that are sampled (listed below), and at monitoring wells MW1, MW3, MW136, MW137, and MW632. Monitoring well information and water levels for April 2017 are summarized in Table 2-3.

Data indicates that Prairie Creek, the surface water body draining the area, transmits groundwater that discharges directly to or upwells into the streambed by virtue of the head relief available in the open channel. The groundwater flow direction in the overburden aquifer is generally toward the west/southwest as shown on Figure 3-4, and the groundwater flow direction in the bedrock aquifer is generally toward the northwest as shown on Figure 3-5. The overburden and bedrock aquifer flow directions are consistent with flow directions observed historically. Based on groundwater flow data, Prairie Creek is the discharge point for shallow groundwater in the vicinity of Site L3.

In April 2017, the groundwater elevation in the bedrock at monitoring well MW632 was greater than the elevation of Prairie Creek, indicating a gaining-stream scenario. An upward vertical gradient was observed in the bedrock at monitoring well nest MW631/MW630 at Site L3 (Table 3-6), further supporting a gaining-stream scenario.

3.2.2 Analytical Results

Groundwater and surface water sampling points for Site L3 during April 2017 are summarized in Table 1-1. The following monitoring wells and surface water sampling point at Site L3 are sampled for explosives:

- In-plume – MW412;
- Early Warning – MW630, MW631, and MW633; and
- Compliance – surface water sampling point SW777 for the overburden aquifer where the creek leaves the GMZ boundary.

Upgradient monitoring well MW03 and compliance monitoring well MW632 were removed from the LTM program beginning in spring 2012. Monitoring well MW410 was abandoned by AECOM in September 2015 as part of Landfill L3 removal activities. Surface water sample locations SW004, SW557, and SW558 and TAL metals were removed from the LTM program in April 2017 following completion of one round of sampling in October 2016 following removal of Landfill L3.

Groundwater and surface water samples collected at Site L3 in April 2017 were analyzed for explosive compounds in accordance with the 2017 QAPP. Explosive compound detections for April 2017 are summarized in Table 3-1 and shown on Figure 3-6. A brief discussion of analytical results by monitoring well type follows:

In-Plume Monitoring Well (MW412):
At bedrock well MW412, HMX was detected below the RG at a concentration of 14 µg/L; RDX exceeded the RG at a concentration of 38 µg/L; and 2-A-4,6-DNT and 4-A-2,6-DNT were detected in April 2017. There are no RGs for 2-A-2,6-DNT or 4-A-2,6-DNT.

Early Warning Monitoring Wells (MW630, MW631 and MW633): At bedrock monitoring well MW630, HMX was detected below the RG at a concentration of 4.3 µg/L, and RDX exceeded the RG at a concentration of 6.4 µg/L in April 2017.

At bedrock monitoring well MW631, there were no explosive compounds detected in April 2017.

At bedrock monitoring well MW633, HMX was detected below the RG at a concentration of 9.1 µg/L; RDX exceeded the RG at a concentration of 23 µg/L; and 4-A-2,6-DNT was detected in April 2017. There is no RG for 4-A-2,6-DNT.

Compliance Point (SW777): At surface water sampling location SW777, there were no explosive compounds detected in April 2017.

3.2.3 Recommendations

There are no recommended changes to the LTM program at Site L3.

3.3 SITE M1 (Southern Ash Pile)

Site M1 (Southern Ash Pile) is part of the MFG (Figures 1-2 and 3-7), but contains unique contaminants not present at actionable levels in any other GMZ. As such, it is singled out as the fifth of the six GMZs. Site M1 comprises approximately 68 acres in the southwestern part of the MFG where, from 1965 to 1974, ash residues from the incineration of "red water" (TNT production waste water) were landfilled and piled on unlined soil. At various times (1985, 1993, and 1996) after closure, polyvinyl chloride (PVC) liner and clay were used to repair erosion damage to the cover.

Groundwater beneath and downgradient of the pile was observed to contain elevated levels of sulfate; 2,6-DNT; and antimony. The latter two exceeded their respective RGs on a single sample event only, but the sulfate has exceeded its RG continuously in groundwater and occasionally in surface water. In February 2003, USACE submitted E*xplanation of Significant Differences Site M1 – Southern Ash Pile* (USACE, 2003), which expanded the northern boundary of the GMZ for Site M1 to encompass concentrations of sulfate in excess of the RG that had migrated beyond the original boundary.

The elevated sulfate is believed to originate in leachate from the Site M1 ash pile that infiltrated through the soil and entered the shallow groundwater. Dissolved sulfate then migrated to the northwest. Sulfate-containing groundwater flows into Prairie Creek, which is located northwest of the former ash pile. Concentrations of sulfate have historically been measured as high as 46,000 milligrams per liter (mg/L), or over 100 times the RG of 400 mg/L. As recently as 2000, surface water samples were collected that exceeded the surface water RG of 500 mg/L. The ash piles were removed in 2006-2007, eliminating the primary source of sulfate. Consequently, dissolved sulfate in groundwater is now a legacy plume migrating to the northwest.

The overburden aquifer primarily consists of silt and clay, with scarce amounts of sand and silty gravel at the bedrock contact. Sand is abundant in the higher, unsaturated parts of the site. Over most of Site M1, the overburden thickness is fairly consistent between 15 and 20 ft thick. At the northern end of the site, near MW642/MW641, the overburden consists entirely of silty gravel, and the depth to bedrock is greater than 40 ft. The presence of Prairie Creek in the western part of M1 suggests that Prairie Creek is the discharge point for shallow groundwater.

3.3.1 Groundwater Hydraulics

The groundwater monitoring network within at Site M1 consists of 18 monitoring wells: 7 overburden monitoring wells (MW104, MW231, MW351, MW641, MW643, MW645, and MW648), 5 combined overburden/bedrock monitoring wells (MW105, MW106, MW107, MW347, and MW649), and 6 bedrock monitoring wells (MW201, MW640, MW642, MW644, MW646, and MW647). Water levels are measured at the groundwater/surface water locations that are sampled (listed below), and at monitoring wells MW104, MW105, MW106, MW201, MW347, MW351, and MW647. Monitoring well information and water levels for April 2017 are summarized in Table 2-2.

Data suggests that Prairie Creek, the surface water body draining the area, transmits groundwater that discharges directly to or upwells into the streambed by virtue of the head relief available in the open channel. The groundwater flow direction in the overburden aquifer and bedrock aquifers is generally to the west-northwest, as shown on Figures 3-7 and 3-8, respectively. The overburden and bedrock aquifer flow directions are consistent with flow directions observed historically. Based on groundwater flow data, Prairie Creek is the discharge point for shallow groundwater in the vicinity of Site M1.

In April 2017, between the overburden and bedrock, vertical gradients observed were upward at monitoring well nests MW644/MW643 (next to and south of Prairie Creek) and MW640/MW351 (located at distance from Prairie Creek). Vertical gradients observed were downward at monitoring well nests MW642/MW641 (near the pond) and MW646/MW645 (next to and north of Prairie Creek; Table 3-6).

3.3.2 Analytical Results

Groundwater sampling points for Site M1 during April 2017 are summarized in Table 1-1. The following monitoring wells and the surface water sampling point at M1 are sampled for sulfate:

- In-Plume – MW107, MW231, MW640, MW641, and MW642;
- Early Warning –MW643 and MW644; and
- Compliance – MW646 for the bedrock aquifer and MW645, MW648, and MW649 and surface water sampling point SW709 where the creek leaves the GMZ boundary for the overburden aquifer.

Groundwater and surface water samples collected at Site M1 in April 2017 were analyzed for sulfate in accordance with the 2015 QAPP. Sulfate detections for April 2017 at Site M1 are summarized in Table 3-3 and shown on Figure 3-9. A brief discussion of analytical results by monitoring well type follows:

In-Plume Monitoring Wells (MW107, MW231, MW640, MW641, and MW642): At combination monitoring well MW107, sulfate exceeded the RG at a concentration of 4,300 mg/L in April 2017.

At overburden monitoring well MW231, sulfate exceeded the RG at a concentration of 30,000 mg/L in April 2017.

At bedrock monitoring well MW640, sulfate exceeded the RG at a concentration of 4,000 mg/L in April 2017.

At overburden monitoring well MW641, sulfate exceeded the RG at a concentration of 520 mg/L in April 2017.

At overburden monitoring well MW642, sulfate was detected below the RG at a concentration of 340 mg/L in April 2017.

Early Warning Monitoring Wells (MW643 and MW644): At overburden monitoring well MW643, sulfate was detected below the RG at a concentration of 42 mg/L in April 2017.

At bedrock monitoring well MW644, sulfate was detected below the RG at a concentration of 140 mg/L in April 2017.

Compliance Points (MW645, MW646, MW648, MW649, and SW709): At overburden monitoring well MW645, sulfate was detected below the RG at a concentration of 40 mg/L in April 2017.

At bedrock monitoring well MW646, sulfate was detected below the RG at a concentration of 97 mg/L in April 2017.

At overburden monitoring well MW648, sulfate was detected below the RG in at a concentration of 26 mg/L in April 2017.

At overburden monitoring well MW649, sulfate was detected below the RG at a concentration of 41 mg/L in April 2017.

At surface water sampling point SW709, sulfate was detected below the surface water RG at a concentration of 40 mg/L in April 2017.

3.3.3 Recommendations

There are no recommended changes to the LTM program at Site M1.

On 08/03/2017 USFS personnel were mowing at Site M1 and impacted compliance monitoring well MW648 with the mower causing heavy damage to the concrete-filled protective bollards, the steel well protective casing, and the PVC monitoring well. Due to

the severity of the damage monitoring well MW648 cannot be repaired and therefore requires abandonment or replacement. However, compliance monitoring well MW648 does not require replacement, as described below.

Monitoring well MW648 is an approximately 17.5 ft. deep 4-in. PVC overburden monitoring well at Site M1 and serves as a compliance sampling point for sulfate to the north of the former ash pile. The sulfate detection at monitoring well MW648 in April 2017 was 26 mg/L (see Figure 3-9, RG is 400 mg/L) and other than an anomalous exceedances in December 2014 there have been no sulfate exceedances at monitoring well MW648 going back to April 2008.

The groundwater flow direction at Site M1 has been relatively constant (typical) over time. Prairie Creek, which borders M1 to the north, flows to the west.. Based on the typical groundwater flow direction being to the northwest in the vicinity of in-plume monitoring well nest MW641/MW642, MW648 has provided a sidegradient compliance sampling point. In-plume bedrock monitoring well MW642 has not had a sulfate exceedance since October 2014 and in-plume overburden monitoring well MW641 has not had a sulfate exceedance since April 2016 (2 rounds with no exceedance).

The monitoring well in the general upgradient direction from monitoring well MW648 and having sulfate exceedances is in-plume bedrock monitoring well MW640 (4,000 mg/L, April 2017) located to the south-southeast and is approximately 23 ft. deep. The water table and bedrock flow direction in the vicinity of monitoring well MW640 is generally to the northwest with little northerly flow component toward monitoring well MW648 (see Figures 3-7 and 3-8). In-plume bedrock monitoring well MW640 is located in the upgradient position from the surface water body (pond) located at Site M1. A slight upward vertical gradient was identified in April 2017 at monitoring well nest MW351/MW640. Based on this information, there is the potential for the sulfate exceedances identified in bedrock at monitoring well MW640 to migrate from the bedrock to the overburden.

Based on the typical groundwater flow, monitoring well nest MW641/MW642 is located in the downgradient position from the pond. A slight downward vertical gradient was identified in April 2017 at monitoring well nest MW641/MW642. Based on this information, there is the potential for sulfate concentrations identified in the overburden at monitoring well MW641 to migrate from the overburden to the bedrock. However, there are no recent sulfate exceedances at in-plume overburden monitoring well MW641 or at in-plume bedrock monitoring well MW642.

Overall, this information indicates the pond is providing recharge to the groundwater system which would likely provide a degree of stagnation of groundwater flowing from upgradient (to the south) in the vicinity of in-plume monitoring well MW640 and dilution of groundwater flowing downgradient (to the northwest) in the vicinity of in-plume monitoring well nest MW641/MW642. This effect would limit the migration of exceedances detected at in-plume monitoring well MW640 as indicated by the reduction in concentration at monitoring well nest MW641/MW642 over time. The recharge from the pond has likely

provided a degree of dilution to the concentrations historically detected in the vicinity of the pond, which is a primary fate and transport mechanism expected at Site M1 and allow low probability for a change in the typical groundwater flow at Site M1.

Additionally, there are ICs in place that prohibit the USDA/USFS from implementing changes to the surface features at Site M1 which would negatively influence or increase migration potentials. Based on these results, well MW648 should be abandoned according to the LTM Plan and not replaced.

3.4 MFG GMZ

The MFG is the sixth GMZ; it lies in the northwestern part of JOAAP and was created by the consolidation of several discrete sites, including M3 (Flashing Grounds), M4 (Lead Azide Area), M5 (Tetryl Production Area), M6 (TNT Ditch Complex), M7 (Red Water Area), M8 (Acid Manufacturing Area), Other Areas (refers to an area in the northwest part of the Manufacturing Area where compliance monitoring wells for the Manufacturing Area GMZ are located), and M13. The MFG Area GMZ is shown on Figures 1-2 and 3-10. In the MFG GMZ, only Sites M6, M8, and M13 continue to have groundwater contamination with contaminants of concern (COCs) in excess of RGs. Each site comprising the MFG GMZ will be independently closed before the MFG GMZ can be eliminated.

Numerous monitoring wells are also measured as water level control points at sites M3, M4, M5, M7, and Other Areas. Results from the monitoring wells at these other MFG sites are discussed in Section 3.4.1 – Site M6 below.

3.4.1 Site M6 (TNT Ditch Complex)

Site M6, (TNT Ditch Complex) covers approximately 271 acres in the central part of the MFG (Figures 1-2 and 3-10) and was largely used for TNT and DNT and DNT production during World War II, and then again in the Korean and Vietnam Wars. In between the wars, the facilities were used for research and development of different explosives like nitroxylenes. Production of TNT was terminated in 1977.

Production of TNT was conducted in 12 parallel lines, each containing a full sequence of production steps from the “mono-house” to the “bi-house” and then the “tri-house” buildings. Waste water (“red water”) from each “tri-house” and the wash houses was discharged from wooden tanks to clay-lined ditches feeding into the TNT Ditch. In 1965, the original drainage system was replaced by wooden flumes completed in the TNT Ditch, and the red water was diverted to Site M7 for treatment. Dintrotoluene production waste water was discharged from wooden tanks into open troughs and ditches that flowed to the storm water sewer system and the TNT Ditch, ultimately flowing untreated into Grant Creek. In addition to normal processing water, the TNT Ditch received drench water used to kill a production run when reactions ran out of control and posed an explosive threat. Between 1972 and

1974, there were more than 30 recorded instances of drenching with the associated discharge of “bi-oil” and concentrated nitric and sulfuric acids.

The full range of nitroaromatic compounds have historically been found in soil at Site M6, with concentrations of TNT; 2,4-DNT; lead; arsenic; and beryllium exceeding their respective RGs. Seven explosive compounds have been historically observed in the underlying groundwater at concentrations that exceed their respective RGs: TNT; 2,4-DNT; 2,6-DNT; 2-nitrotoluene (2-NT); TNB; nitrobenzene (NB); and RDX.

The overburden aquifer primarily consists of silt and clay, with variable amounts of sand and silty gravel. The overburden thickness ranges from 5 to 30 ft across the site. Based on available information, screens for overburden monitoring wells at Site M6 are set in silt and/or clay layers and discontinuous sand and gravel layers, with the exception of monitoring wells MW650 and MW652; which have screens set in a silty gravel layer.

3.4.1.1 Groundwater Hydraulics

The groundwater monitoring network within Site M6 consists of 38 monitoring wells: 12 overburden monitoring wells (MW160, MW164, MW165, MW166R, MW210R, MW212R, MW307, MW309, MW650, MW652, MW662, and MW664), 2 combined overburden/bedrock monitoring wells (MW125R and MW162R), and 24 bedrock monitoring wells (MW122, MW123R, MW208, MW209, MW213R, MW215R, MW308, MW310R, MW311, MW312, MW313, MW314, MW315, MW316, MW317, MW318, MW319, MW320R, MW651, MW653, MW654, MW655, MW663, and MW665).

Water levels are measured at the groundwater locations that are sampled (listed below), and at numerous monitoring wells at M6 and surrounding sites, including M3, M4, M5, M7, M8, and Other Areas.

The groundwater monitoring network within Site M3 consists of 10 monitoring wells: 1 combined overburden/bedrock monitoring well (MW154) and 9 bedrock monitoring wells (MW111, MW112, MW113, MW203, MW232, MW233, MW348, MW352, and MW353). The *Final Site M3 Groundwater Closure Report* (MWH, May 2015) recommended all monitoring wells at Site M3, with the exception of monitoring well MW113, be abandoned. Monitoring well MW113 will be maintained since it provides a control point for the bedrock groundwater potentiometric surface in the southwestern part of the MFG GMZ.

The groundwater monitoring network within Site M4 consists of 3 monitoring wells: 1 combined overburden/bedrock monitoring well (MW157) and 2 bedrock wells (MW115 and MW158).

The groundwater monitoring network within Site M5 consists of 6 monitoring wells: 2 overburden monitoring wells (MW207R and MW354R), 3 combined overburden/bedrock wells (MW114R, MW127R, and MW355R), and 1 bedrock monitoring well (MW356R). The *Final Site M5 Groundwater Closure Report* (MWH, May 2015) recommended all monitoring well at Site M5, with the exception of monitoring wells MW207R and MW356R,

be abandoned. Monitoring well MW207R will be maintained since it provides a groundwater control point for the overburden water table in the southeastern part of the MFG GMZ, and monitoring well MW356R will be maintained since it provides a groundwater control point for the bedrock potentiometric surface in the south-central part of the MFG GMZ.

The groundwater monitoring network at Site M7 consists of 7 monitoring wells: 4 overburden monitoring wells (MW156, MW216, MW660, and MW661), 1 combined overburden/bedrock monitoring well (MW159), and 2 bedrock monitoring wells (MW124R, and MW217). The *Final Site M7 Groundwater Closure Report* (MWH, May 2015) recommended all monitoring wells at Site M7, with the exception of monitoring well MW159, should be maintained as they provide horizontal groundwater control points and/or vertical flow information.

The groundwater monitoring network within Site M8 consists of 8 monitoring wells: 7 overburden monitoring wells (MW121, MW147R, MW323R, MW324R, MW325R, MW328, and MW330) and 1 combined overburden/bedrock monitoring wells (MW148RR).

The groundwater monitoring network within Other Areas consists of 4 monitoring wells: 2 combined overburden/bedrock monitoring wells (MW117 and MW119) and 2 bedrock monitoring wells (MW116 and MW118).

Monitoring well information and water levels are summarized in Table 2-2. The groundwater flow direction in the overburden and bedrock aquifers is generally toward the west as shown on Figures 3-10 and 3-11. The overburden and bedrock aquifer flow directions are consistent with flow directions observed historically.

For Site M6 monitoring well nests located on the escarpment, vertical gradient observed between the overburden and bedrock at monitoring well nests MW650/MW651, MW652/MW653, MW212R/MW215R, MW210R/MW213R, MW309/MW310R and MW307/MW308 were downward; and at monitoring well nest MW166R/MW320R were upward in April 2017. Vertical gradients in the bedrock at monitoring well nest MW311/MW312 and MW314/MW315 were upward in April 2017.

In April 2017, for monitoring well nests located in the wetland on the west side of Site M6, vertical gradients observed in the bedrock at monitoring well nests MW318/MW319 and MW654/MW313 were upward, and downward at monitoring well nest MW316/MW317.

At combination monitoring well and bedrock monitoring well nest MW162R/MW123R, the vertical gradient was downward in April 2017. Since monitoring well MW162R is a combination monitoring well, the vertical gradient may not indicate the hydraulic relationship between the overburden and bedrock.

At Site M4, located west of the southern part of Site M6, at combination monitoring well and bedrock monitoring well nest MW157/MW158 the vertical gradient was downward in

April 2017. Since monitoring well MW157 is a combination monitoring well the vertical gradient may not indicate the hydraulic relationship between the overburden and bedrock.

During April 2017, at Site M7, located to the southwest of the southern part of site M6, at overburden monitoring well nest MW660/MW661 the vertical gradient was downward, and at overburden to bedrock monitoring well nest MW216/MW217 the vertical gradient was upward (Table 3-6).

3.4.1.2 Analytical Results

Groundwater sampling points for Site M6 and other sites included in the MFG GMZ during April 2017 are summarized in Table 1-1. The following monitoring wells at M6 and other sites included in the MFG GMZ are sampled for explosives (sulfate at Site M8):

- In-Plume – MW212R, MW652, and MW330 (M8, sulfate only);
- Early Warning – MW123R, MW162R, MW313, MW318, MW319, and MW654; and
- Compliance – MW117 and MW118 and MW119 (Other Areas).

In-plume monitoring well MW148RR and compliance monitoring wells MW112, MW113, MW115, and MW116 were removed from the LTM program beginning in spring 2012. Early Warning monitoring well MW124R was removed from the LTM program beginning in August 2015.

Groundwater samples collected at Site M6 and other sites included in the MFG GMZ in April 2017 were analyzed for explosive compounds, and monitoring well MW330 was analyzed for sulfate, in accordance with the 2015 and 2017 QAPP. Explosive compound detections for the April 2017 sampling event conducted at Site M6 are summarized in Table 3-1 and shown on Figure 3-12. Sulfate detections for April 2017 sampling events conducted at Site M8 are summarized in Table 3-3 and shown on Figure 3-12. A brief discussion of analytical results by monitoring well type follows:

In-Plume Monitoring Wells (MW212R, MW652, and MW330): At overburden monitoring well MW212R, 2,4-DNT exceeded the RG at a concentration of 120 µg/L; 2,6-DNT exceeded the RG at a concentration of 47 µg/L; 2-NT was detected below the RG at a concentration of 300 µg/L; and TNT exceeded the RG at a concentration of 9.6 µg/L. In addition, 2-A-4,6-DNT; 3-NT; and 4-NT were detected in April 2017. There are no RGs for 2-A-4,6-DNT; 3-NT; or 4-NT.

At overburden monitoring well MW652, 2,4-DNT exceeded the RG at a concentration of 2,100 µg/L; 2,6-DNT exceeded the RG at a concentration of 800 µg/L; 2-NT exceeded the RG at a concentration of 9,700 µg/L; and TNT exceeded the RG at a concentration of 310 µg/L. In addition, 2-A-4,6-DNT; 3-NT; and 4-NT were detected in April 2017. There are no RGs for 2-A-4,6-DNT; 3-NT; or 4-NT. Due to required dilution, the LOQs for 1,3-DNB; RDX; and 1,3,5-TNB were elevated above their respective RGs.

At overburden monitoring well MW330, sulfate exceeded the RG at a concentration of 510 mg/L in April 2017.

Early Warning Monitoring Wells (MW123R, MW162R, MW313, MW318, MW319, and MW654): At bedrock monitoring well MW123R, there were no explosive compounds detected in April 2017.

At overburden monitoring well MW162R, there were no explosive compounds detected in April 2017.

At bedrock monitoring well MW313, RDX was detected below the RG at a concentration of 0.84 µg/L.

At bedrock monitoring well MW318, 1,3,5-TNB was detected below the RG at a concentration of 1.5 µg/L.

At bedrock monitoring well MW319, 1,3,5-TNB was detected below the RG at a concentration of 3.7 µg/L; and TNT was detected below the RG at a concentration of 1.3 µg/L.

At bedrock monitoring well MW654, 2,6-DNT exceeded the RG at a concentration of 15 µg/L; RDX was detected below the RG at a concentration of 0.32 µg/L; and 2,4,6-TNT exceeded the RG at a concentration of 10 µg/L. In addition, 2-A-4,6-DNT; 4-A-2,6-DNT; and 3-NT were detected in April 2017. There are no RGs for 2-A-4,6-DNT; 4-A-2,6-DNT; or 3-NT.

Compliance Monitoring Wells (MW117 and, MW118 and MW119 (Other Areas): At combination monitoring well MW117, 2-NT was detected below the RG at a concentration of 2.9 µg/L in April 2017.

At bedrock monitoring well MW118, there were no explosive compounds detected in April 2017.

At bedrock monitoring well MW119, there were no explosive compounds detected in April 2017.

3.4.1.3 Recommendations

There are no recommended changes to the LTM program at the Site M6.

3.4.2 Landfill M13 (Gravel Pit)

Site M13 (Gravel Pit) comprises approximately 106 acres of the central part of the MFG, known as the gravel pits. It lies north of the Tetryl Production Area, east of the TNT Ditch Complex, and west of the Acid Area (Figures 1-2 and 3-13).

Landfill M13 is located in the northern part of Site M13 and comprises approximately 10.5 acres. Site features at Landfill M13 and surrounding areas are illustrated on Figure 3-13. Disposal activities were confined to four discrete areas of the site, none of which extended beyond 12 acres in size. Historical records indicate landfilling took place in the Northern Gravel Pit during the period of 1966 to 1984, and involved scrap metals, creosote-treated railroad ties, telephone poles, and construction/demolition debris. Other waste management activities at Site M13 involved explosives. Explosive compounds observed in the groundwater at Site M13 include TNT; TNB; 2,4-DNT; and 2,6-DNT.

Soil in the vicinity of the Northern Gravel Pit had been found to contain beryllium, lead, and benzo(a)pyrene as COCs. On a single occasion in 1991, antimony and cadmium were reported to be present in groundwater samples at concentrations in excess of their respective RGs, but they have not exceeded the RGs since that time.

The current conceptual site model is that metal and benzo(a)pyrene in groundwater may be present as a result of leaching of waste materials in the Northern Gravel Pit. The explosives present in groundwater are far more likely to be present due to infiltration of wastewater in the TNT Ditch. There is no evidence to suggest explosive compounds were ever present in waste materials put into the pit.

The Northern Gravel Pit was consolidated and capped (Landfill M13) from 2007 to 2008. The three other pits received waste materials that do not appear to pose a threat to human health and the environment.

With the implementation of the RA on the TNT Ditch and the capping of the Northern Gravel Pit, it is anticipated that contaminants in site groundwater will detach from the source areas and migrate as legacy plumes to the west. As such, concentrations are expected to decline with time.

Monitoring at Landfill M13 is mandated by IAC Title 35, Subtitle G, Chapter 1, Subchapter c, Part 724, Subpart G, for a period of 15 years.

The overburden aquifer primarily consists of silt and clay, with abundant sand and gravel in the upper, unsaturated portion of the aquifer. The overburden thickness is approximately 25 ft and is fairly consistent across Site M13. Samples from overburden monitoring wells are obtained from silt and/or clay layers.

3.4.2.1 Groundwater Hydraulics

The groundwater monitoring network at Landfill M13 consists of 13 monitoring wells: 6 overburden monitoring wells (AEHA14R, MW126R, MW363, MW806, MW809, and MW811), 2 combined overburden/bedrock monitoring wells (MW350 and MW362), and 5 bedrock monitoring wells (MW321, MW322, MW364, MW807, and MW809). Water levels are measured at the groundwater locations that are sampled (listed below), and at monitoring wells AEHA14R, MW321, MW322, MW350, MW363, and MW364. Monitoring well information and water levels for April 2017 are summarized in Table 2-2.

The groundwater flow direction in the overburden aquifer in the immediate vicinity of Landfill M13 is to the south-southeast as shown on Figure 3-13, which includes the surrounding groundwater flow from Figure 3-10. The groundwater flow direction in the bedrock aquifer in the immediate vicinity of Landfill M13 was generally toward the south-southwest as shown on Figure 3-14, which includes the surrounding groundwater flow from Figure 3-11. The overburden and bedrock aquifer flow directions are consistent with flow directions observed historically.

Vertical gradients observed in the overburden were upward at downgradient monitoring well nest MW126R/MW362. Since monitoring well MW362 is a combination monitoring well, the vertical gradient may not indicate the hydraulic relationship within the overburden. Between the overburden and bedrock, downward vertical gradients were observed at upgradient monitoring well nest MW806/MW807 and downgradient monitoring well nests MW808/MW809 and MW363/MW364. In the bedrock, downward vertical gradients were observed at downgradient monitoring well nest MW321/MW322 (Table 3-6).

3.4.2.2 Analytical Results

Groundwater sampling points for Landfill M13 within the MFG GMZ for the April 2017 sampling event are summarized in Table 1-1. The following monitoring wells at Landfill M13 are sampled for VOCs, SVOCs, TAL metals, explosives, nitrate, and sulfate:

- Upgradient – MW806 and MW807; and
- Downgradient – MW126R, MW362, MW808, MW809, and MW811.

Groundwater samples collected at Landfill M13 during April 2017 were analyzed for explosive compounds, TAL metals, indicator parameters (sulfate and nitrate), VOCs, and SVOCs, in accordance with the 2015 and 2017 QAPP. Detections of explosive compounds, TAL metals, indicator parameters (sulfate and nitrate), VOCs, and SVOCs for the sampling events conducted at Landfill M13 during April 2017 are summarized in Tables 3-1, 3-2, 3-3, 3-4, and 3-5, respectively. Explosive compound and sulfate detections are shown on Figure 3-15. For Landfill M13, the monitoring well locations are classified as upgradient or downgradient locations. A brief discussion of analytical results by monitoring well type follows:

Upgradient Monitoring Wells (MW806 and MW807): At overburden monitoring well MW806 in April 2017, there were no explosive compounds detected; no RG exceedances for TAL metals; nitrate was detected below the RG at a concentration of 0.32 mg/L; sulfate was detected below the RG at a concentration of 67 mg/L; there were no VOCs detected, and there were no SVOCs detected.

At bedrock monitoring well MW807 in April 2017, there were no explosive compounds detected; no RG exceedances for TAL metals; no detection for nitrate; sulfate was detected below the RG at a concentration of 210 mg/L; 1,1-dichloroethane (1,1-DCA) was detected below the RG at a concentration of 1.5 µg/L; cis-1,2-dichloroethene (cis-1,2-DCE) was detected below the RG at a concentration of 1.4 µg/L; and there were no SVOCs detected.

Downgradient Monitoring Wells (MW126R, MW362, MW808, MW809, and MW811): At overburden monitoring well MW126R in April 2017, there were no explosive compounds detected; no RG exceedances for TAL metals; nitrate was detected below the RG at a concentration of 0.052 mg/L; sulfate was detected below the RG at a concentration of 50 mg/L; there were no VOCs detected; and there were no SVOCs detected.

At bedrock monitoring well MW362 in April 2017, 2,4-DNT exceeded the RG at a concentration of 5.3 µg/L; 2-A-4,6-DNT and 4-A-2,6-DNT were detected; there were no RG exceedances for TAL metals; there was no detection for nitrate; sulfate was detected below the RG at a concentration of 250 mg/L; 1,1-DCA was detected below the RG at a concentration of 0.67 µg/L; and in the SVOC sample, 2,4-DNT exceeded the RG at a concentration of 2.3 µg/L. There are no RGs for 2-A-2,6-DNT and 4-A-2,6-DNT.

At overburden monitoring well MW808 in April 2017, there were no explosive compounds detected; no RG exceedances for TAL metals; nitrate was detected below the RG at a concentration of 11 mg/L; sulfate was detected below the RG at a concentration of 74 mg/L; there were no VOCs detected; and no SVOCs were detected.

At bedrock monitoring well MW809 in April 2017, the were no explosive compounds detected; no RG exceedances for TAL metals; nitrate was detected below the RG at a concentration of 0.036 mg/L; sulfate was detected below the RG at a concentration of 5.5 mg/L; there were no VOCs detected; and there were no SVOCs detected.

At overburden monitoring well MW811 in April 2017, the were no explosive compounds detected; no RG exceedances for TAL metals; nitrate was detected below the RG at a concentration of 0.15 mg/L; sulfate was detected below the RG at a concentration of 170 mg/L; there were no VOCs detected; and there were no SVOCs detected.

3.4.2.3 Recommendations

There are no recommended changes to the LTM program at Site M13.

The landfill cap and surrounding area should be mowed in fall 2017.

Remaining woody plants observed on the landfill cap and rip rap will continue to be spot treated using a strong herbicide (Razor™).

4.0 SUMMARY OF RECOMMENDATIONS

The following section present a summary of recommendations made in this Report that are relevant to the LTM program. A summary of the recommendations to the LTM program, the reasoning for the recommendation, and the status of those recommendations are included in Table 4-1.

The following is a summary of recommendations:

- The LTM program, as outlined in Table 3-7, should be implemented for the 2017 annual sampling event.
- The M11 and M13 Landfill caps and surrounding areas should be mowed in fall 2017.
- Monitoring well MW648 should be abandoned.

5.0 REFERENCES

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TABLES

TABLE 1-1

Sample Parameters - April 2017
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Parameter
L1	***In-plume***	
	MW131	E
	MW173	E
	WES1	E
	Early Warning	
	MW174	E
	WES3	E
	Compliance	
	SW550	E
L3	***In-plume***	
	MW412	E
	Early Warning	
	MW630	E
	MW631	E
	MW633	E
	Compliance	
	SW777	E
M1	***In-plume***	
	MW107	S
	MW231	S
	MW640	S
	MW641	S
	MW642	S
	Early Warning	
	MW643	S
	MW644	S
	Compliance	
	MW645	S
	MW646	S
	MW648	S
	MW649	S
	SW709	S

TABLE 1-1

Sample Parameters - April 2017
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Parameter
M6	***In-plume***	
	MW212R	E
	MW330[(1)]	S
	MW652	E
	Early Warning	
	MW123R	E
	MW162R	E
	MW313	E
	MW318	E
	MW319	E
	MW654	E
	Compliance	
	MW117	E
	MW118	E
	MW119	E
Landfill M13	***Upgradient***	
	MW806	E, I, M, SVOC & V
	MW807	E, I, M, SVOC & V
	Downgradient	
	MW126R	E, I, M, SVOC & V
	MW362	E, I, M, SVOC & V
	MW808	E, I, M, SVOC & V
	MW809	E, I, M, SVOC & V
	MW811	E, I, M, SVOC & V

General Notes:
E = Explosives.
M = Target Analyte List metals.
S = Sulfate.
I = Indicator parameters (nitrate-N and sulfate).
SVOC = Semivolatile organic compound.
V = Volatile organic compound.
Sites L2, L14, and M11 sampled only during Annual round.

Footnotes:
(1) MW330 is an in-plume well for Site M8.

TABLE 2-1

Summary of Final Field Parameters
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Sample Date	Temperature (°C)	pH (SU)	Redox (mV)	Specific Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
L1	**In-plume**							
	MW131	4/22/2017	9.1	7.02	130	1180	0.0	3.77
	MW173	4/22/2017	8.9	6.95	115	942	0.0	2.18
	WES1	4/22/2017	10.7	7.22	98	884	0.0	1.62
	Early Warning							
	WES3	4/22/2017	11.6	7.30	164	732	0.0	1.49
	MW174	4/22/2017	9.7	7.37	84	764	0.0	1.03
	Compliance							
	SW550	4/25/2017	16.3	8.27	70	614	**NM**	9.81
L3	**In-plume**							
	MW412	4/22/2017	12.6	7.52	124	658	0.0	4.07
	Early Warning							
	MW630	4/22/2017	9.4	6.96	43	896	0.0	1.44
	MW631	4/22/2017	9.8	6.93	-2	848	0.0	1.15
	MW633	4/22/2017	10.6	7.46	113	636	8.7	4.88
	Compliance							
	SW777	4/22/2017	14.8	8.53	19	601	**NM**	10.22
M1	**In-plume**							
	MW107	4/18/2017	14.1	9.45	64	9740	0.0	0.66
	MW231	4/18/2017	15.0	9.45	-295	4610	0.0	0.38
	MW640	4/18/2017	14.8	7.03	-41	6180	0.0	0.77
	MW641	4/18/2017	20.4	7.44	-104	1110	0.0	0.55
	MW642	4/18/2017	15.9	7.46	43	1130	0.0	0.92
	Early Warning							
	MW643	4/19/2017	13.6	7.35	-80	606	0.0	1.17
	MW644	4/19/2017	11.1	7.87	123	925	0.0	1.74
	Compliance							
	MW645	4/18/2017	10.3	7.23	108	749	0.0	2.74
	MW646	4/18/2017	12.2	7.67	107	761	0.0	3.89
	MW648	4/18/2017	13.4	7.49	62	550	3.3	0.82
	MW649	4/18/2017	14.1	7.55	32	573	0.0	1.52
	SW709	4/19/2017	17.3	8.33	3	589	**NM**	9.71
M6	**In-plume**							
	MW212R	4/20/2017	9.9	7.14	22	1110	0.0	2.85
	MW330[(1)]	4/19/2017	16.2	7.29	163	1450	0.5	0.00
	MW652	4/20/2017	12.5	7.44	110	1730	0.1	0.00
	Early Warning							
	MW123R	4/20/2017	11.7	6.68	47	1380	0.0	1.48
	MW162R	4/20/2017	14.7	7.53	125	537	0.0	3.74
	MW313	4/20/2017	13.8	7.60	86	1490	0.0	0.83
	MW318	4/21/2017	9.0	7.21	-244	1610	0.0	1.82
	MW319	4/21/2017	10.9	7.18	-219	1780	0.0	0.92
	MW654	4/20/2017	12.5	7.15	158	1640	0.0	1.21
	Compliance							
	MW117	4/21/2017	10.5	7.01	-101	2750	0.0	1.43
	MW118	4/21/2017	12.8	7.38	46	575	0.0	0.99
	MW119	4/21/2017	10.8	7.34	20	1780	0.6	0.75

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TABLE 2-1

Summary of Final Field Parameters
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Sample Date	Temperature (°C)	pH (SU)	Redox (mV)	Specific Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)
Landfill M13	**Upgradient**							
	MW806	4/24/2017	13.9	7.76	61	717	0.0	2.30
	MW807	4/24/2017	13.3	7.13	-152	5960	0.0	1.66
	Downgradient							
	MW126R	4/24/2017	13.4	6.16	116	1180	0.0	2.64
	MW362	4/24/2017	15.6	7.33	65	3650	0.0	0.76
	MW808	4/24/2017	11.5	7.13	161	1350	0.0	2.73
	MW809	4/24/2017	11.5	7.49	-68	653	0.0	2.20
	MW811	4/24/2017	14.3	7.40	-97	3630	0.4	0.78

General Notes:
ID = Identification.
R = Replacement well.
°C = Degrees Centigrade.
SU = Standard Unit.
Redox = Reduction/oxidation potential.
mV = Millivolt.
mS/cm = Microsiemens per centimeter.
NTU = Nephelometric Turbidity Unit.
mg/L = Milligrams per liter.
NM = Not measured.

Footnotes:
(1) MW330 is an in-plume well for Site M8.

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TABLE 2-2

Monitoring Well Information Table - Manufacturing Area
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Area/Well ID	Site	Northing (Feet)	Easting (Feet)	TOC Elevation (MSL)	Ground Elevation (MSL)	Depth to Top of Screen (BGS)	Depth to Bottom of Screen (BGS)	Total Borehole Depth (BGS)	Depth to Water April 2017 (TOC)	Water Elevation April 2017 (MSL)	Depth to Bedrock From Log (BGS)	Bedrock Elevation from Log (MSL)	Year Installed	Formation Designation	Screen Length (Feet)	Casing & Screen Diameter (Inches)
MW104	M1	15019989.4	1318790.5	549.10	546.20	7.0	27.0	30.0	4.72	544.38	27.0	519.2	1981	OVB	20.0	4.0
MW105		15020111.7	1320854.1	555.00	552.50	7.0	27.0	29.9	4.78	550.22	24.0	528.5	1981	COMBO	20.0	4.0
MW106		15020948.8	1318761.3	542.00	539.70	10.0	30.0	32.0	2.94	539.06	21.0	518.7	1981	COMBO	20.0	4.0
MW107		15021094.2	1320422.3	552.40	549.10	5.5	25.5	27.4	4.84	547.56	17.0	532.1	1981	COMBO	20.0	4.0
MW201		15020020.6	1318931.6	546.15	544.01	46.5	66.5	70.5	2.19	543.96	24.0	520.0	1988	BRK	20.0	4.0
MW231		15020828.1	1319861.0	550.33	548.47	6.0	16.0	15.7	2.49	547.84	16.0	532.5	1988	OVB	10.0	4.0
MW347		15020481.0	1319595.0	551.73	549.84	14.4	24.4	27.0	4.28	547.45	18.5	531.3	1991	COMBO	10.0	4.0
MW351		15021257.8	1319798.9	548.38	545.68	9.5	19.5	22.7	4.24	544.14	22.5	523.2	1991	OVB	10.0	4.0
MW640		15021244.2	1319804.0	548.12	545.40	29.0	39.0	40.0	3.19	544.93	23.0	522.4	1999	BRK	10.0	4.0
MW641		15021873.5	1319350.2	544.50	541.98	7.0	17.0	17.2	1.69	542.81	29.0	516.1	1999	OVB	10.0	4.0
MW642		15021874.4	1319339.9	544.47	541.95	29.0	39.0	40.0	2.17	542.30	29.0	516.1	1999	BRK	10.0	4.0
MW643		15022117.7	1318719.9	540.03	537.55	4.3	7.2	7.8	6.02	534.01	7.3	530.3	2001	OVB	2.9	4.0
MW644		15022128.9	1318718.6	540.23	537.55	10.8	20.4	21.0	5.96	534.27	7.3	530.3	2001	BRK	9.6	4.0
MW645		15022269.1	1318648.7	541.47	538.90	7.5	11.5	12.0	7.79	533.68	10.5	528.4	2001	OVB	4.0	4.0
MW646		15022257.3	1318650.5	541.48	539.09	12.3	21.9	22.5	7.82	533.66	10.5	528.6	2001	BRK	9.6	4.0
MW647		15022572.9	1318013.0	538.40	535.96	7.3	16.9	17.5	4.19	534.21	6.0	530.0	2001	BRK	9.6	4.0
MW648		15022428.3	1319438.1	546.77	544.17	7.3	16.8	17.4	5.34	541.43	13.5	530.7	2001	OVB	9.6	4.0
MW649		15021299.5	1318723.2	543.10	540.49	7.0	16.6	17.2	5.99	537.11	7.5	533.0	2001	COMBO	9.6	4.0
MW111	M3	15028903.0	1318551.6	531.80	529.40	10.5	54.0	54.0	**NM**	**NM**	10.0	519.4	1981	BRK	43.5	4.0
MW112		15030353.7	1318557.9	534.10	531.70	7.2	27.2	29.0	**NM**	**NM**	8.0	523.7	1981	BRK	20.0	4.0
MW113		15030379.5	1319676.1	536.32	533.70	7.2	27.2	28.0	4.54	531.78	5.0	528.7	1981	BRK	20.0	4.0
MW154		15027749.6	1318572.5	533.06	529.15	5.5	9.1	9.1	**NM**	**NM**	8.0	521.2	1982	COMBO	3.6	4.0
MW203		15029235.4	1318551.2	534.23	532.02	10.5	25.5	25.5	**NM**	**NM**	5.5	526.5	1988	BRK	15.0	4.0
MW232		15030123.9	1318974.4	535.79	533.38	20.0	35.0	37.0	**NM**	**NM**	7.0	526.4	1988	BRK	15.0	4.0
MW233		15029737.9	1319024.9	535.58	532.96	10.0	25.0	25.5	**NM**	**NM**	2.5	530.5	1988	BRK	15.0	4.0
MW348		15029911.3	1318978.0	535.71	532.61	16.5	31.5	35.0	**NM**	**NM**	3.0	529.6	1991	BRK	15.0	4.0
MW352		15029602.8	1318617.3	534.89	532.33	19.0	34.0	34.5	**NM**	**NM**	6.0	526.3	1991	BRK	15.0	4.0
MW353		15030120.6	1318562.3	534.64	531.86	17.0	32.0	34.0	**NM**	**NM**	2.0	529.9	1991	BRK	15.0	4.0
MW115	M4	15032589.5	1318485.3	533.40	530.80	7.2	27.2	28.0	5.48	527.92	2.0	528.8	1981	BRK	20.0	4.0
MW157		15032947.3	1319827.0	535.02	531.37	3.7	10.2	10.5	2.96	532.06	6.5	524.9	1982	COMBO	6.5	2.0
MW158		15032970.9	1319820.0	534.40	531.58	9.0	29.5	31.9	2.75	531.65	5.0	526.6	1982	BRK	20.5	3.0
MW114R	M5	15031315.3	1323651.6	556.80	554.9	6.5	21.5	22.0	**NM**	**NM**	15.0	539.9	2001	COMBO	15.0	4.0
MW127R		15032537.2	1326273.8	596.04	592.9	30.0	45.0	46.0	**NM**	**NM**	40.0	552.9	2001	COMBO	15.0	4.0
MW207R		15032188.9	1323779.7	560.21	557.5	7.0	17.0	18.0	12.00	548.21	15.5(1)	542.0(1)	2001	OVB	10.0	4.0
MW354R		15031780.2	1323424.2	559.61	557.6	7.0	17.0	18.0	**NM**	**NM**	19.0	538.6	2001	OVB	10.0	4.0
MW355R		15030827.1	1323676.8	558.12	555.7	10.0	20.0	22.0	**NM**	**NM**	15.0	540.7	2001	COMBO	10.0	4.0
MW356R		15031372.5	1322054.0	558.08	556.1	24.5	34.5	35.0	16.39	541.69	20.0	536.1	2001	BRK	10.0	4.0
MW122	M6	15038443.3	1321305.0	540.10	537.40	7.0	27.0	27.5	4.20	535.90	6.5	530.9	1981	BRK	20.0	4.0
MW123R		15035314.9	1320626.1	537.22	534.9	15.0	30.0	32.0	5.20	532.02	10.0	524.9	2001	BRK	15.0	4.0
MW125R		15037201.5	1322981.6	567.69	565.1	12.0	32.0	33.0	14.48	553.21	26.0	539.1	2001	COMBO	20.0	4.0
MW160		15034274.9	1321203.9	542.29	538.20	3.3	6.3	10.4	5.83	536.46	6.0	532.2	1982	OVB	3.0	2.0
MW162R		15035325.7	1320625.8	540.19	537.7	4.5	9.5	10.0	5.02	535.17	3.7(1)	534.0(1)	2001	COMBO	5.0	4.0
MW164		15037035.7	1321868.5	545.21	541.69	3.0	6.0	9.7	5.88	539.33	6.0	535.7	1982	OVB	3.0	4.0
MW165		15037644.2	1321700.3	544.01	540.31	2.8	5.3	9.0	5.02	538.99	5.0	535.3	1982	OVB	2.5	4.0
MW166R		15039129.4	1322675.0	558.21	555.6	10.0	20.0	21.0	12.82	545.39	**UNKNOWN**	**UNKNOWN**	2001	OVB	10.0	4.0
MW208		15035028.4	1320126.9	538.38	535.10	12.0	27.0	30.1	5.35	533.03	4.0	531.1	1988	BRK	15.0	4.0
MW209		15037473.3	1320271.3	537.75	534.89	19.5	34.5	34.5	3.88	533.87	11.1	523.8	1988	BRK	15.0	4.0
MW210R		15035465.0	1322154.0	565.83	564.30	10.7	20.0	20.0	10.12	555.71	**NE**	**NE**	1998	OVB	10.0	4.0
MW212R		15035415.0	1321862.0	564.87	565.30	9.5	19.5	21.0	11.36	553.51	**NE**	**NE**	1998	OVB	10.0	4.0
MW213R		15035462.0	1322159.0	566.49	564.30	38.0	53.0	54.0	19.22	547.27	30.5	533.8	1998	BRK	15.0	4.0

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Area/Well ID	Site	Northing (Feet)	Easting (Feet)	TOC Elevation (MSL)	Ground Elevation (MSL)	Depth to Top of Screen (BGS)	Depth to Bottom of Screen (BGS)	Total Borehole Depth (BGS)	Depth to Water April 2017 (TOC)	Water Elevation April 2017 (MSL)	Depth to Bedrock From Log (BGS)	Bedrock Elevation from Log (MSL)	Year Installed	Formation Designation	Screen Length (Feet)	Casing & Screen Diameter (Inches)
MW215R	M6	15035410.0	1321863.0	564.75	565.30	38.5	53.5	54.5	18.12	546.63	30.0	535.3	1998	BRK	15.0	4.0
MW307		15033821.0	1321855.8	563.56	561.45	17.0	27.0	31.7	19.46	544.10	**NE**	**NE**	1991	OVB	10.0	4.0
MW308		15033810.7	1321837.6	563.84	561.38	50.5	65.5	71.8	21.61	542.23	35.0	526.4	1991	BRK	15.0	4.0
MW309		15034826.8	1321825.3	565.87	563.43	12.7	27.7	30.6	11.37	554.50	30.0	533.4	1991	OVB	15.0	4.0
MW310R		15034823.0	1321824.0	565.97	563.00	44.5	59.5	60.0	22.19	543.78	31.0	532.0	1998	BRK	15.0	4.0
MW311		15038100.4	1322342.5	557.08	546.36	14.0	24.0	26.4	8.76	548.32	7.0	539.4	1991	BRK	10.0	4.0
MW312		15038100.6	1322332.5	555.92	545.96	40.0	55.0	58.1	7.49	548.43	7.0	539.0	1991	BRK	15.0	4.0
MW313		15037051.7	1321934.0	551.07	549.20	25.0	40.0	40.9	11.31	539.76	12.0	537.2	1991	BRK	15.0	4.0
MW314		15034383.6	1321451.5	542.32	539.53	9.7	14.7	17.8	5.70	536.62	7.2	532.3	1991	BRK	5.0	4.0
MW315		15034394.6	1321451.7	541.60	538.91	29.7	44.7	47.9	4.91	536.69	6.5	532.4	1991	BRK	15.0	4.0
MW316		15036232.3	1321257.1	542.89	540.49	13.0	18.0	20.9	6.05	536.84	7.5	533.0	1991	BRK	5.0	4.0
MW317		15036222.4	1321257.7	542.96	540.71	34.0	49.0	49.0	6.48	536.48	8.0	532.7	1991	BRK	15.0	4.0
MW318		15037189.7	1321488.6	547.67	545.23	11.8	21.8	24.2	9.63	538.04	11.5	533.7	1991	BRK	10.0	4.0
MW319		15037202.6	1321489.8	548.10	545.49	40.0	55.0	57.0	9.86	538.24	12.0	533.5	1991	BRK	15.0	4.0
MW320R		15039129.7	1322656.0	557.09	554.6	30.5	45.5	46.0	11.42	545.67	8.0(1)	546.6(1)	2001	BRK	15.0	4.0
MW650		15037950.2	1322588.0	566.45	563.83	12.0	22.0	22.5	9.93	556.52	23.0(1)	560.8(1)	1999	OVB	10.0	4.0
MW651		15037939.2	1322583.7	566.88	563.83	36.0	46.0	47.0	17.56	549.32	23.0	560.8	1999	BRK	10.0	4.0
MW652		15037004.9	1322243.1	565.03	561.93	11.0	21.0	22.0	10.81	554.22	25.0(1)	536.9(1)	1999	OVB	10.0	4.0
MW653		15036994.6	1322239.1	564.60	561.93	36.0	46.0	47.0	17.42	547.18	25.0	536.9	1999	BRK	10.0	4.0
MW654		15037070.8	1321976.9	551.15	548.49	13.0	23.0	24.0	11.74	539.41	10.5	539.0	1999	BRK	10.0	4.0
MW655		15034232.3	1320633.2	540.19	537.71	**UNKNOWN**	**UNKNOWN**	**UNKNOWN**	6.12	534.07	5.0	532.7	1999	BRK(2)	**UNKNOWN**	4.0
MW662		15039862.6	1321841.5	547.56	**UNKNOWN**	6.0	16.0	18.0	8.65	538.91	20.0	**UNKNOWN**	2001	OVB	10.0	4.0
MW663		15039854.9	1321841.4	547.86	**UNKNOWN**	30.0	40.0	41.0	7.91	539.95	20.0	**UNKNOWN**	2001	BRK	10.0	4.0
MW664		15040136.6	1322326.4	547.43	**UNKNOWN**	5.0	10.0	10.5	7.56	539.87	10.0	**UNKNOWN**	2001	OVB	5.0	4.0
MW665		15040145.7	1322327.5	546.98	**UNKNOWN**	28.0	38.0	40.0	4.03	542.95	10.0	UNKNOWN	2001	BRK	10.0	4.0
MW124R	M7	15033133.0	1320756.0	537.25	534.70	6.0	16.0	16.0	1.88	535.37	5.0	529.7	1998	BRK	10.0	4.0
MW156		15032408.6	1321713.5	541.35	537.45	1.7	5.2	5.4	4.65	536.70	5.3	532.2	1982	OVB	3.5	4.0
MW159		15033457.9	1320537.1	537.80	533.54	4.4	9.4	12.8	**NM**	**NM**	5.7	527.8	1982	COMBO	5.0	4.0
MW216		15033525.6	1320650.6	538.03	536.51	5.0	10.0	36.7	5.17	532.86	11.0	525.5	1988	OVB	5.0	4.0
MW217		15033449.7	1320652.6	538.97	536.90	19.5	34.5	12.0	5.78	533.19	13.4	523.5	1988	BRK	15.0	4.0
MW660		15032597.2	1320677.4	539.73	537.08	7.0	12.0	12.6	5.14	534.59	**UNKNOWN**	**UNKNOWN**	1999	OVB(3)	5.0	4.0
MW661		15032587.2	1320679.2	539.57	537.09	20.0	30.0	30.0	6.54	533.03	**UNKNOWN**	**UNKNOWN**	1999	OVB(3)	10.0	4.0
MW121	M8	15040140.8	1323725.5	575.75	572.50	10.0	30.0	14.2	18.26	557.49	**NE**	**NE**	1981	OVB	20.0	4.0
MW147R		15037926.9	1323318.0	567.82	564.0	6.5	21.5	22.0	11.08	556.74	**NE**	**NE**	2001	OVB	15.0	4.0
MW148RR		15038954.5	1323542.2	561.59	560.7	8.0	23.0	23.5	15.39	546.20	18.0	542.7	2001	COMBO	15.0	4.0
MW323R		15036514.7	1323739.7	566.00	563.5	8.0	18.0	18.5	10.42	555.58	**NE**	**NE**	2001	OVB	10.0	4.0
MW324R		15038125.4	1323502.9	566.23	562.7	9.5	19.5	20.0	14.35	551.88	**NE**	**NE**	2001	OVB	10.0	4.0
MW325R		15036105.4	1322633.3	569.62	566.9	7.0	17.0	18.0	12.85	556.77	**NE**	**NE**	2001	OVB	10.0	4.0
MW328		15040352.8	1323793.0	582.93	580.72	18.0	28.0	19.7	23.91	559.02	**NE**	**NE**	1991	OVB	10.0	4.0
MW330		15040218.4	1323970.2	580.33	578.20	15.0	25.0	17.0	21.75	558.58	**NE**	**NE**	1991	OVB	10.0	4.0
MW117	Other Areas	15036450.2	1318407.7	529.10	526.90	7.7	27.7	27.7	3.81	525.29	12.0	514.9	1981	COMBO	20.0	4.0
MW116		15034538.6	1318460.3	535.20	532.60	7.0	27.0	27.0	3.84	531.36	5.0	527.6	1981	BRK	20.0	4.0
MW118		15039343.5	1318362.2	534.00	531.20	8.0	23.0	23.0	3.28	530.72	2.5	528.7	1981	BRK	15.0	4.0
MW119		15040962.1	1320127.9	538.90	535.50	3.3	23.3	25.5	6.23	532.67	6.0	529.5	1981	COMBO	20.0	4.0

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Area/Well ID	Site	Northing (Feet)	Easting (Feet)	TOC Elevation (MSL)	Ground Elevation (MSL)	Depth to Top of Screen (BGS)	Depth to Bottom of Screen (BGS)	Total Borehole Depth (BGS)	Depth to Water April 2017 (TOC)	Water Elevation April 2017 (MSL)	Depth to Bedrock From Log (BGS)	Bedrock Elevation from Log (MSL)	Year Installed	Formation Designation	Screen Length (Feet)	Casing & Screen Diameter (Inches)
AEHA14R	M13	15034927.3	1322519.9	569.73	567.03	16.5	26.5	27.0	12.83	556.90	**UNKNOWN**	**UNKNOWN**	2001	OVB	10.0	4.0
MW126R		15034092.6	1323332.3	562.41	563.00	11.0	21.0	22.0	15.25	547.16	NE	NE	2004	OVB	10.0	4.0
MW321		15033167.5	1321626.5	545.55	542.93	13.5	23.5	26.6	6.92	538.63	9.5	533.4	1991	BRK	10.0	4.0
MW322		15033161.0	1321640.2	544.54	542.26	34.5	49.5	51.5	9.58	534.96	9.0	533.3	1991	BRK	15.0	4.0
MW350		15032810.1	1321811.0	554.34	552.34	12.5	22.5	24.8	14.94	539.40	19.0	533.3	1991	COMBO	10.0	4.0
MW362		15034100.6	1323339.4	562.46	562.78	28.0	33.0	34.0	13.14	549.32	29.5	533.3	2004	COMBO	5.0	4.0
MW363		15032768.3	1322536.0	570.03	567.66	21.0	31.0	32.0	27.58	542.45	31.5	536.2	2004	OVB	10.0	4.0
MW364		15032775.4	1322527.2	569.82	567.69	37.0	42.0	42.5	27.40	542.42	31.5	536.2	2004	BRK	5.0	4.0
MW806		15034807.2	1323337.9	565.53	**UNKNOWN**	15.0	25.0	25.0	13.85	551.68	29.0	**UNKNOWN**	2008	OVB	10.0	4.0
MW807		15034817.4	1323338.1	565.79	**UNKNOWN**	35.0	45.0	45.0	15.50	550.29	29.0	**UNKNOWN**	2008	BRK	10.0	4.0
MW808		15034539.9	1322493.1	569.23	**UNKNOWN**	15.0	25.0	25.0	15.68	553.55	30.0	**UNKNOWN**	2008	OVB	10.0	4.0
MW809		15034530.2	1322492.9	569.18	**UNKNOWN**	35.0	45.0	45.0	19.77	549.41	30.0	**UNKNOWN**	2008	BRK	10.0	4.0
MW811		15034212.0	1323111.7	568.24	565.60	20.0	30.0	30.2	20.73	547.51	30.2	535.4	2014	OVB	10.0	2.0
MW108	M11(4)	15025248.1	1320261.2	543.60	540.80	7.0	27.0	27.0	**NM**	**NM**	9.0	531.8	1981	COMBO	20.0	4.0
MW333		15026529.4	1319776.9	536.41	533.63	17.9	32.9	34.5	**NM**	**NM**	5.0	528.6	1991	BRK	15.0	4.0
MW334		15025998.4	1319521.8	536.22	533.40	19.0	34.0	35.0	**NM**	**NM**	5.0	528.4	1991	BRK	15.0	4.0
MW335		15025671.9	1319364.8	538.36	535.66	9.4	19.4	19.5	**NM**	**NM**	6.0	529.7	1991	BRK	10.0	4.0
MW336		15025322.1	1319223.4	537.28	534.79	12.0	22.0	23.5	**NM**	**NM**	7.5	527.3	1991	BRK	10.0	4.0
MW337		15024992.0	1319103.4	536.96	534.32	21.1	36.1	35.0	**NM**	**NM**	6.5	527.8	1991	BRK	15.0	4.0
MW338		15024414.1	1318777.5	537.73	534.70	13.5	28.5	30.5	**NM**	**NM**	3.0	531.7	1991	BRK	15.0	4.0
MW339		15023897.9	1318660.6	541.27	538.41	9.7	19.7	20.0	**NM**	**NM**	9.0	529.4	1991	BRK	10.0	4.0
MW340		15023157.7	1318683.2	542.47	539.83	7.0	17.0	22.0	**NM**	**NM**	10.0	529.8	1991	COMBO	10.0	4.0
MW802		15025690.0	1320235.7	543.42	541.62	5.0	15.0	15.0	**NM**	**NM**	9.5	532.1	2008	COMBO	10.0	4.0
MW803		15025697.7	1320237.5	543.66	541.56	26.5	36.5	36.5	**NM**	**NM**	9.5	532.1	2008	BRK	10.0	4.0
MW804		15025916.1	1319219.3	536.48	533.78	5.0	15.0	15.0	**NM**	**NM**	3.5	530.3	2008	BRK	10.0	4.0
MW805		15025913.6	1319229.6	536.27	533.62	25.0	35.0	35.0	**NM**	**NM**	3.5	530.1	2008	BRK	10.0	4.0

General Notes:

Coordinates are Universal Transverse Mercator (UTM), Zone 16 North, North American Datum 1983 (NAD83).
UNKNOWN = Indicate data not presented on borelogs or provided in Remedial Investigation/Feasibility Study documentation.
NM = Water level not measured.
NE = Not encountered.
BRK = Bedrock.
OVB = Overburden.
COMBO = Combination overburden/bedrock well.
MSL = Feet relative to mean sea level.
BGS = Feet below ground surface.
ID = Identification.
TOC = Top of casing.

Footnotes:

(1) Bedrock elevation from depth to bedrock from boring log for original monitoring well or the depth to bedrock from nested monitoring well.
(2) Designation assumed based on shallow depth to bedrock, screen length unknown.
(3) Designation assumed, depth to bedrock unknown.
(4) Site M11 measured only during Annual round.

TABLE 2-3

Monitoring Well Information Table - Load-Assemble-Package Area
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Area/Well ID	Site	Northing (Feet)	Easting (Feet)	TOC Elevation (MSL)	Ground Elevation (MSL)	Depth to Top of Screen (BGS)	Depth to Bottom of Screen (BGS)	Total Borehole Depth (BGS)	Depth to Water April 2017 (TOC)	Water Elevation April 2017 (MSL)	Depth to Bedrock From Log (BGS)	Bedrock Elevation from Log (MSL)	Year Installed	Well Designation	Screen Length (Feet)	Casing & Screen Diameter (Inches)
MW131	L1	15029483.20	1344039.100	625.01	622.29	2.5	22.5	24.0	11.53	613.48	**NE**	**NE**	1981	OVB	20.0	4.0
MW171		15028774.67	1343406.032	618.24	615.03	2.9	7.9	11.1	10.69	607.55	8.0	607.0	1982	OVB	5.0	4.0
MW172		15028836.84	1344094.147	615.87	613.19	14.5	34.5	37.5	7.57	608.30	11.0	602.2	1982	BRK	20.0	4.0
MW173		15028827.26	1344123.204	615.56	612.56	2.8	11.8	15.2	7.39	608.17	12.0	600.6	1982	OVB	9.0	3.6
MW174		15028974.94	1344649.467	615.32	612.40	3.5	14.5	18.1	7.26	608.06	15.0	597.4	1982	OVB	11.0	3.6
MW175		15029420.69	1343046.596	634.45	630.96	3.7	19.7	23.2	9.04	625.41	20.0	611.0	1982	OVB	16.0	3.6
MW176		15030320.57	1343491.565	646.77	643.49	4.8	20.8	23.6	19.34	627.43	20.8	622.7	1982	OVB	16.0	3.6
MW177		15028773.31	1343380.183	616.29	613.84	11.8	31.0	33.4	6.92	609.37	6.5	607.3	1983	BRK	19.2	3.0
MW178		15030330.01	1343512.024	643.83	640.39	27.3	46.5	50.1	21.19	622.64	20.0	620.4	1983	BRK	19.2	3.0
MW400		15030872.22	1344840.211	655.17	652.56	16.2	26.2	28.6	**NM**	**NM**	21.0	631.6	1991	COMBO	10.0	4.0
MW401		15028228.22	1344007.476	611.96	610.20	28.5	43.5	46.1	6.38	605.58	16.0	594.2	1991	BRK	15.0	4.0
WES1		15029404.21	1343978.508	623.13	621.43	20.0	40.0	40.0	10.52	612.61	20.0	601.4	1997	BRK	20.0	4.0
WES2		15029874.92	1343699.213	637.69	635.98	22.0	42.0	42.0	19.05	618.64	22.0	614.0	1997	BRK	20.0	4.0
WES3		15028686.71	1344093.581	611.69	610.33	20.0	40.0	40.0	3.93	607.76	20.0	590.3	1997	BRK	20.0	4.0
MW610		15028213.06	1344005.102	612.63	609.62	4.0	14.0	14.0	7.04	605.59	16.0[1]	594.2[1]	1999	OVB	10.0	4.0
MW611		15027976.15	1344327.569	620.45	617.83	10.0	20.0	21.0	6.08	614.37	**NE**	**NE**	1999	OVB	10.0	4.0
MW132	L2[2]	15026868.16	1339653.570	612.30	609.84	7.5	27.5	29.4	**NM**	**NM**	18.0	591.8	1981	COMBO	20.0	4.0
MW133		15026726.48	1338362.506	605.88	603.51	7.2	27.2	28.7	**NM**	**NM**	19.5	584.0	1981	COMBO	20.0	4.0
MW134		15025646.63	1338233.841	613.30	609.70	6.7	26.7	27.1	**NM**	**NM**	**NE**	**NE**	1981	OVB	20.0	4.0
MW135		15025761.10	1339631.781	637.35	634.18	6.0	26.0	27.0	**NM**	**NM**	**NE**	**NE**	1981	OVB	20.0	4.0
MW404		15026798.76	1338548.502	605.88	604.09	7.7	17.7	20.5	**NM**	**NM**	12.0	592.1	1991	COMBO	10.0	4.0
MW405		15027072.91	1338771.791	607.21	605.16	10.8	20.8	23.5	**NM**	**NM**	16.0	589.2	1991	COMBO	10.0	4.0
MW406		15026560.78	1339282.341	623.13	620.72	23.8	33.8	35.7	**NM**	**NM**	29.0	591.7	1991	COMBO	10.0	4.0
MW407		15026676.15	1339269.053	620.05	618.30	20.5	30.5	33.9	**NM**	**NM**	25.5	592.8	1991	COMBO	10.0	4.0
MW501		15025985.85	1338411.03	617.05	614.72	12.7	22.7	**NA**	**NM**	**NM**	25.0	589.7	1991	OVB	10.0	4.0
MW620		15027048.61	1338602.438	605.07	602.41	7.0	17.0	18.0	**NM**	**NM**	**UNKNOWN**	**UNKNOWN**	1999	OVB	10.0	4.0
MW621		15027058.70	1338599.038	604.96	602.41	22.0	32.0	32.8	**NM**	**NM**	20.0	582.4	1999	BRK	10.0	4.0
MW810		15027142.71	1338476.770	604.58	601.91	7.0	17.3	18.0	**NM**	**NM**	**NE**	**NE**	2009	OVB	10.0	4.0
MW1	L3	15025237.01	1338193.456	630.63	628.68	16.5	26.5	27.8	13.52	617.11	**NE**	**NE**	1986	OVB	10.0	2.0
MW136		15024523.06	1337305.702	602.70	600.8	7.2	27.2	**NA**	7.38	595.32	11.0	589.8	1981	COMBO	20.0	4.0
MW137		15024661.00	1338608.636	632.90	631.40	7.0	27.0	28.7	3.66	629.24	**NE**	**NE**	1981	OVB	20.0	4.0
MW3		15025504.29	1337801.715	610.34	608.50	9.0	19.0	20.9	3.38	606.96	19.0	589.5	1986	OVB	10.0	2.0
MW412		15024596.02	1337101.399	599.14	597.41	7.4	17.4	19.2	5.75	593.39	3.0	594.4	1991	BRK	10.0	4.0

TABLE 2-3

Monitoring Well Information Table - Load-Assemble-Package Area
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Area/Well ID	Site	Northing (Feet)	Easting (Feet)	TOC Elevation (MSL)	Ground Elevation (MSL)	Depth to Top of Screen (BGS)	Depth to Bottom of Screen (BGS)	Total Borehole Depth (BGS)	Depth to Water April 2017 (TOC)	Water Elevation April 2017 (MSL)	Depth to Bedrock From Log (BGS)	Bedrock Elevation from Log (MSL)	Year Installed	Well Designation	Screen Length (Feet)	Casing & Screen Diameter (Inches)
MW630	L3	15024770.15	1337013.674	595.06	592.23	7.0	12.0	12.7	6.60	588.46	4.0	588.2	1999	BRK	5.0	4.0
MW631		15024764.63	1337010.736	595.09	592.23	16.0	26.0	27.0	4.24	590.85	4.0	588.2	1999	BRK	10.0	4.0
MW632		15024828.58	1336912.350	606.25	603.75	12.0	27.2	27.5	14.70	591.55	9.5	594.3	2009	BRK	15.0	4.0
MW633		15024474.50	1336978.448	600.37	597.90	7.0	17.0	18.0	8.08	592.29	5.0	592.9	1999	BRK	10.0	4.0
H-7	L14(2)	15019448.58	1332662.795	584.62	581.45	4.0	14.0	15.5	**NM**	**NM**	12.0	569.5	1982	OVB	10.0	2.0
H-8		15019409.64	1333457.292	591.40	588.14	7.0	22.0	22.9	**NM**	**NM**	20.0	568.1	1982	OVB	15.0	2.0
MW140		15018819.68	1332901.750	584.59	581.68	7.0	27.0	30.3	**NM**	**NM**	22.0	559.7	1981	COMBO	20.0	4.0
MW508		15019632.37	1333106.169	587.44	585.34	10.0	20.0	22.9	**NM**	**NM**	**NE**	**NE**	1993	OVB	10.0	4.0
MW511		15019645.92	1333029.631	587.45	584.98	4.0	14.0	17.0	**NM**	**NM**	16.0	569.0	1997	OVB	10.0	4.0
MW512		15019541.13	1333111.131	588.04	585.98	5.0	15.0	18.2	**NM**	**NM**	16.0	570.0	1997	OVB	10.0	4.0
MW600		15019920.13	1332928.643	587.22	584.75	6.0	11.0	11.0	**NM**	**NM**	11.0	573.8	1998	OVB	5.0	2.0
MW601		15019196.31	1333121.302	586.72	584.29	9.0	19.0	20.0	**NM**	**NM**	19.6	564.7	1998	OVB	10.0	2.0
MW602		15019432.73	1332663.469	583.83	581.22	21.0	31.0	31.0	**NM**	**NM**	12.0	569.2	1999	BRK	10.0	4.0
MW603		15019323.75	1332379.579	580.77	578.27	6.0	16.0	16.0	**NM**	**NM**	13.0	565.3	1999	COMBO	10.0	4.0
MW604		15019335.87	1332379.437	581.12	578.27	20.0	30.0	31.0	**NM**	**NM**	13.0	565.3	1999	BRK	10.0	4.0

General Notes:

Coordinates are Universal Transverse Mercator (UTM), Zone 16 North, North American Datum 1983 (NAD83).

UNKNOWN = Indicate data not presented on borelogs or provided in Remedial Investigation/Feasibility Study documentation.

NM = Water level not measured.

NE = Not encountered.

BRK = Bedrock.

OVB = Overburden.

COMBO = Combination overburden/bedrock well.

MSL = Feet relative to mean sea level.

BGS = Feet below ground surface.

ID = Identification.

TOC = Top of casing.

Footnote:

(1) Based on the depth to bedrock from nested monitoring well.
(2) Sites L2 and L14 measured only during Annual round.

TABLE 2-4

Surface Water Elevations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Surface Water Location	Surface Water Elevation	
		Date	Feet (MSL)
L1	SW550	4/25/2017	603.89
L2[1]	SW555	**NM**	**NM**
L3	SW777	4/22/2017	588.40
M1	SW709	4/19/2017	532.89

General Notes:
MSL = Mean sea level.
NM = Not measured.

Footnotes:
(1) Site L2 measured only during Annual round.

TABLE 3-1

Summary of Analytical Results - Explosives
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Compound	**1,3-DNB**		**2,4-DNT**		**2,6-DNT**		**2-A-4,6-DNT**		**4-A-2,6-DNT**		**HMX**		**NB**		**2-NT**		**3-NT**		**4-NT**		**RDX**		**Tetryl**		**1,3,5-TNB**		**2,4,6-TNT**	
		Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Project Action Limit[1]	10		0.42		0.42		NS		NS		5100		51		5100		NS		NS		2.6		200		5.1		9.5	
		Surface Water RG[2]	4		330		150		NS		NS		260		8000		62		NS		NS		500		NS		15		75	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**
L1	***In-Plume***																													
	MW131	4/22/2017	<22	/ UJ	<6.6	/ UJ	**10**	/ J	39	/ J	43	/ J	<22	/ UJ	<22	/ UJ	<22	/ UJ	<22	/ UJ	<22	/ UJ	<22	/ UJ	<22	/ UJ	**2200**	/ J	**4500**	/ J
	MW173	4/22/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	3.6	/ J	4.4	/ J	0.94	J / J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	**8.1**	/ J	<1.0	/ UJ	0.68	J / J	**13**	/ J
	WES1	4/22/2017	<1.0	/ UJ	<0.31	/ UJ	<0.31	/ UJ	8.5	/ J	12	/ J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	**100**	/ J	**74**	/ J
	Early Warning																													
	MW174	4/22/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	WES3	4/25/2017	<1.0		<0.30		<0.30		<1.0		0.61	J /	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		0.47	J /	<1.0		<1.0		0.99	J /
	Compliance																													
	SW550	4/25/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
L3	***In-Plume***																													
	MW412	4/22/2017	<1.0	/ UJ	<0.31	/ UJ	<0.31	/ UJ	0.37	J / J	0.62	J / J	14	/ J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	**38**	/ J	<1.0	/ UJ	<1.0	H / UJ	<1.0	/ UJ
	Early Warning																													
	MW630	4/22/2017	<1.1	/ UJ	<0.32	/ UJ	<0.32	/ UJ	<1.1	/ UJ	<1.1	/ UJ	4.3	/ J	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	**6.4**	/ J	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ
	MW631	4/22/2017	<1.1	/ UJ	<0.33	/ UJ	<0.33	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ
	MW633	4/22/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	0.3	J / J	9.1	/ J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	**23**	/ J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	Compliance																													
	SW777	4/22/2017	<1.0	/ UJ	<0.31	/ UJ	<0.31	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
M6	***In-Plume***																													
	MW212R	4/20/2017	<1.0		**120**		**47**		5.7		<1.0		<1.0		<1.0		300		57		120		<1.0		<1.0		<1.0		**9.6**	
	MW652	4/20/2017	<20		**2100**		**800**		100		<20		<20		<20		**9700**		1100		6700		<20		<20		<20		**310**	
		4/20/2017 (DUP)	<20		**1900**		**720**		88		<20		<20		<20		**8700**		950		6000		<20		<20		<20		**280**	
	Early Warning																													
	MW123R	4/20/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW162R	4/20/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW313	4/20/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		0.84	J /	<1.0		<1.0		<1.0	
	MW318	4/21/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		1.5	/ J	<1.0	
	MW319	4/21/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		3.7	/ J	1.3	/ J
	MW654	4/20/2017	<1.0	/ UJ	<0.30	/ UJ	**15**	/ J	28	/ J	32		<1.0		<1.0	/ UJ	<1.0	/ UJ	1.3	/ J		/ R	0.32	J /	<1.0		<1.0		**10**	
		4/20/2017 (DUP)	<1.0		0.21	J / J	**14**		27		31		<1.0		<1.0		<1.0		1.2		<1.0		0.41	J /	<1.0		<1.0		**10**	
	Compliance																													
(Other Areas)	MW117	4/21/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	2.9	/ J	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	MW118	4/21/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	MW119	4/21/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ

TABLE 3-1

Summary of Analytical Results - Explosives
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Compound	**1,3-DNB**		**2,4-DNT**		**2,6-DNT**		**2-A-4,6-DNT**		**4-A-2,6-DNT**		**HMX**		**NB**		**2-NT**		**3-NT**		**4-NT**		**RDX**		**Tetryl**		**1,3,5-TNB**		**2,4,6-TNT**	
		Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
		Project Action Limit(1)	10		0.42		0.42		NS		NS		5100		51		5100		NS		NS		2.6		200		5.1		9.5	
		Surface Water RG(2)	4		330		150		NS		NS		260		8000		62		NS		NS		500		NS		15		75	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**
M13	***Upgradient***																													
	MW806	4/24/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	MW807	4/24/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	Downgradient																													
	MW126R	4/24/2017	<1.1	/ UJ	<0.33	/ UJ	<0.33	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ	<1.1	/ UJ
	MW362	4/24/2017	<1.0		**5.3**		<0.30		1.1		0.68	J /	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
		4/24/2017 (DUP)	<1.0		**5.9**		<0.30		1.2		0.66	J /	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW808	4/24/2017	<1.0	/ UJ	<0.30	/ UJ	<0.30	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ
	MW809	4/24/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW811	4/24/2017	<1.0		<0.30		<0.30		<1.0		<1.0		<1.0	/ UJ	<1.0	/ UJ	<1.0	/ UJ	<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	

General Notes:
µg/L = Micrograms per liter.
NS = No standard.
RG = Remedial Goal.
LF/VF = Lab flag/validation flag.
< = Result shows laboratory Method Reporting Limit for non-detected results.
J = Estimated concentration.
UJ = Not detected, estimated detection limit.
R = Rejected.
DUP = Duplicate.
Bolded result indicates Project Action Limit (RG) exceedance.
Sites L2, L14, and M11 sampled only during Annual round.

1,3,5-TNB = 1,3,5-Trinitrobenzene.
1,3-DNB = 1,3-Dinitrobenzene.
TNT = 2,4,6-Trinitrotoluene.
2,4-DNT = 2,4-Dinitrotoluene.
2,6-DNT = 2,6-Dinitrotoluene.
2-A-4,6-DNT = 2-amino-4,6-Dinitrotoluene.
2-NT = 2-Nitrotoluene.
3-NT = 3-Nitrotoluene.
4-A-2,6-DNT = 4-amino-2,6-Dinitrotoluene.
4-NT = 4-Nitrotoluene.

HMX = High melting-point explosive.
NB = Nitrobenzene.
RDX = Royal Demolition Explosive.

Footnotes:
(1) Project Action Limits are the Remedial Goals as specified in Table 6-2 of the 1998 Record of Decision. Where no RG is presented in the 1998 Record of Decision, the Project Action Limit is obtained from Illinois Environmental Protection Agency Class II groundwater standards.
(2) The surface water Project Action Limits are obtained from Table 10-1 in the 1998 Record of Decision.

TABLE 3-2

Summary of Analytical Results - Target Analyte List Metals
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Analyte	**Aluminum**		**Antimony**		**Arsenic**		**Barium**		**Beryllium**		**Cadmium**		**Chromium**		**Cobalt**		**Copper**		**Iron**		**Lead**		**Manganese**		**Mercury**		**Nickel**		**Selenium**		**Silver**		**Thallium**		**Vanadium**		**Zinc**	
		Units	mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L		mg/L	
	Project Action Limit[1]		100		0.024		0.2		NS		NS		0.05		1.0		NS		NS		5.0		0.1		10		NS		NS		NS		0.511		NS		NS		10	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**
M13	***Upgradient***																																							
	MW806	4/24/2017	<0.40		<0.020		0.0034	BJ / UB	0.093		0.00038	J /	<0.0050		0.0053	J /	<0.025		<0.010		<0.10		0.008	J / UB	0.001	J /	<0.00020		<0.040		<0.020		<0.010		<0.050		<0.050		<0.020	
	MW807	4/24/2017	<0.40		<0.020		0.0048	BJ / UB	0.11		0.00089	J /	0.0007	J /	0.0013	J /	<0.025		<0.010		0.96		<0.010		0.095		<0.00020		<0.040		<0.020		<0.010		<0.050		<0.050		<0.020	
	Downgradient																																							
	MW126R	4/24/2017	<0.40		<0.020		0.0043	BJ / UB	0.062		0.00045	J /	<0.0050		<0.010		<0.025		<0.010		<0.10		0.0078	J / UB	0.0045	J /	<0.00020		<0.040		<0.020		<0.010		0.0056	J / UB	<0.050		<0.020	
	MW362	4/24/2017	<0.40		<0.020		0.0027	BJ / UB	0.056		0.00091	J /	0.0008	J /	0.0012	J /	0.0024	J /	<0.010		<0.10		0.0055	J / UB	0.2		<0.00020		<0.040		<0.020		<0.010		0.0052	J / UB	<0.050		<0.020	
		4/24/2017 (DUP)	<0.40		<0.020		0.0037	BJ / UB	0.056		0.00084	J /	0.0006	J /	0.001	J /	0.0018	J /	<0.010		<0.10		<0.010		0.2		<0.00020		<0.040		<0.020		<0.010		<0.050		<0.050		<0.020	
	MW808	4/24/2017	<0.40		<0.020		0.0023	BJ / UB	0.079		0.00051	J /	<0.0050		0.0011	J /	<0.025		<0.010		<0.10		0.0052	J / UB	0.064		<0.00020		<0.040		<0.020		<0.010		<0.050		<0.050		<0.020	
	MW809	4/24/2017	<0.40		<0.020		<0.015		0.03		0.00029	J /	<0.0050		<0.010		<0.025		<0.010		<0.10		0.0076	J / UB	0.0041	J /	<0.00020		<0.040		<0.020		<0.010		<0.050		<0.050		<0.020	
	MW811	4/24/2017	<0.40		<0.020		0.0062	BJ / UB	0.083		0.00075	J /	<0.0050		0.0012	J /	0.0013	J /	<0.010		1.4		<0.010		0.046		0.000031	BJ / UB	0.0028	J /	<0.020		<0.010		<0.050		<0.050		0.0057	J /

General Notes:
An abbreviated list of analytes is used for reporting based on historically detected and reported compounds.
mg/L = Milligrams per liter.
NS = No standard.
LF/VF = Lab flag/validation flag.
< = Result shows laboratory Method Reporting Limit for non-detected results.
J = Estimated concentration.
UB = Not detected, blank contamination.
DUP = Duplicate.
Bolded result indicates Project Action Limit (RG) exceedance.
Site M11 is sampled only during Annual round.

Footnotes:
(1) Project Action Limits are the Remedial Goals (RGs) as specified in Table 6-2 of the 1998 Record of Decision. Where no RG is presented in the 1998 Record of Decision, the Project Action Limit is obtained from Illinois Environmental Protection Agency Class II groundwater standards.

TABLE 3-3

Summary of Analytical Results - Indicator Parameters
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Compound	Nitrate		Sulfate	
		Units	mg/L		mg/L	
		Project Action Limit(1)	100		400	
		Surface Water RG(2)	NS		500	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**
M1	***In-Plume***					
	MW107	4/18/2017	NA		**4300**	
	MW231	4/18/2017	NA		**30000**	
	MW640	4/18/2017	NA		**4000**	
	MW641	4/18/2017	NA		340	
	MW642	4/18/2017	NA		330	
	Early Warning					
	MW643	4/19/2017	NA		42	
	MW644	4/19/2017	NA		140	
	Compliance					
	MW645	4/18/2017	NA		40	
	MW646	4/18/2017	NA		97	
	MW648	4/18/2017	NA		26	
	MW649	4/18/2017	NA		41	
	SW709	4/19/2017	NA		40	/ J
M8	***In-Plume***					
	MW330	4/19/2017	NA		**510**	
		4/19/2017 (DUP)	NA		**510**	
M13	***Upgradient***					
	MW806	4/24/2017	0.32		67	
	MW807	4/24/2017	<0.20		210	
	Downgradient					
	MW126R	4/24/2017	0.052	B /	50	
	MW362	4/24/2017	<0.20		250	
		4/24/2017 (DUP)	<0.20		250	
	MW808	4/24/2017	11		74	
	MW809	4/24/2017	0.036	/ J	5.5	
	MW811	4/24/2017	0.15	B /	170	

General Notes:
mg/L = Milligrams per liter.
RG = Remedial Goal.
NS = No standard.
LF/VF = Lab flag/validation flag.
NA = Not analyzed.
J = Estimated concentration.
< = Result shows laboratory Method Reporting Limit for non-detected results.
DUP = Duplicate.
B = Blank contamination.
Bolded result indicates Project Action Limit (RG) exceedance.
Site M11 is sampled only during Annual round.

Footnotes:
(1) Project Action Limits are the Remedial Goals as specified in Table 6-2 of the 1998 Record of Decision. Where no RG is presented in the 1998 Record of Decision, the Project Action Limit is obtained from Illinois Environmental Protection Agency Class II groundwater standards.
(2) The surface water Project Action Limits are obtained from Table 10-1 in the 1998 Record of Decision.

EDD/IEL/RJR/DMK
J:\2028A USACE JOAAP\03.00 Deliverables\03.04 Reports 2017\03.04.04 Semi-Annual Report\03.04.04.03 Final Semi-Annual Report\Parts\Tables\Table 3-3_2017 Semi-annual Indicator Parameter Results

TABLE 3-4

Summary of Analytical Results - Volatile Organic Compounds
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Compound	**Acetone**		**Benzene**		**Carbon disulfide**		**Chlorobenzene**		**Chloromethane**		**1,1-DCA**		**1,2-DCA**		**cis-1,2-DCE**		**Ethyl benzene**		**MethCl**		**MEK**		**Naphthalene**		**PCE**		**Toluene**		**1,1,1-TCA**		**TCE**		**VC**		**Xylenes (total)**	
		Units	µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L		µg/L	
	Project Action Limit[(1)]		NS		25		NS		500		NS		3500		25		200		1,000		NS		NS		NS		25		2,500		1,000		25		25		10,000	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**
M13	***Upgradient***																																					
	MW806	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW807	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		1.5		<1.0		1.4		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	Downgradient																																					
	MW126R	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW362	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		0.67	J /	<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
		4/24/2017 DUP	<10		<1.0		<1.0		<1.0		<1.0		0.75	J /	<1.0		<1.0		<1.0		<1.0		<10		<1.0		0.41	J /	<1.0		<1.0		<1.0		<1.0		<1.0	
	MW808	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW809	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	
	MW811	4/24/2017	<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<10		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0		<1.0	

General Notes:

An abbreviated list of compounds analyzed is used for reporting based on historically detected and reported compounds.
µg/L = Micrograms per liter.
NS = No standard.
LF/VF = Lab flag/validation flag.
< = Result shows laboratory method reporting limit for non-detected results.
J = Estimated concentration.
DUP = Duplicate.
Bolded result indicates Project Action Limit (RG) exceedance.
Site M11 is sampled only during Annual round.

1,1,1-TCA = 1,1,1-Trichloroethane.
1,1-DCA = 1,1-Dichloroethane.
1,2-DCA = 1,2-Dichloroethane.
cis-1,2-DCE = cis-1,2-Dichloroethene.
MEK = Methyl ethyl ketone (2-butanone).
MethCl = Methylene chloride.
PCE = Tetrachloroethene.
TCE = Trichloroethene.
VC = Vinyl chloride.

Footnotes:

(1) Project Action Limits are the Remedial Goals (RGs) as specified in Table 6-2 of the 1998 Record of Decision. Where no RG is presented in the 1998 Record of Decision, the Project Action Limit is obtained from Illinois Environmental Protection Agency Class II groundwater standards.

TABLE 3-5

Summary of Analytical Results - Semivolatile Organic Compounds
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

		Compound	**2,4-DNT**		**2,6-DNT**		**Naphthalene**		**NB**		**Phenol**	
		Units	µg/L		µg/L		µg/L		µg/L		µg/L	
		Project Action Limit[(1)]	0.42		0.42		NS		51		NS	
Site	**Well**	**Date**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**	**Result**	**LF/VF**
M13	***Upgradient***											
	MW806	4/24/2017	<1.6		<1.6		<0.80		<0.80		<0.80	/ UJ
	MW807	4/24/2017	<1.6		<1.6		<0.80		<0.80		<0.80	/ UJ
	Downgradient											
	MW126R	4/24/2017	<1.6	/ UJ	<1.6	/ UJ	<0.80		<0.80	/ UJ	<0.80	/ UJ
	MW362	4/24/2017	**2.3**		<1.6		<0.80		<0.80		<0.80	/ UJ
		4/24/2017 DUP	**2.1**		<1.6		<0.80		<0.80		<0.80	/ UJ
	Downgradient											
	MW808	4/24/2017	<1.6		<1.6		<0.80		<0.80		<0.80	/ UJ
	MW809	4/24/2017	<1.6	/ UJ	<1.6	/ UJ	<0.80	/ UJ	<0.80	/ UJ	<0.80	/ UJ
	MW811	4/24/2017	<1.6		<1.6		<0.80		<0.80		<0.80	/ UJ

General Notes:

An abbreviated list of compounds analyzed is used for reporting based on historically detected and reported compounds.
2,4-DNT = 2,4-Dinitrotoluene.
2,6-DNT = 2,6-Dinitrotoluene.
NB = Nitrobenzene.
µg/L = Micrograms per liter.
NS = No standard.
LF/VF = Lab flag/validation flag.
< = Result shows laboratory method reporting limit for non-detected results.
DUP = Duplicate.
UJ = Estimated detection limit.
Bolded result indicates Project Action Limit (RG) exceedance.
Site M11 sampled only during Annual round.
See Table 3-1 for 2,4-DNT and 2,6-DNT results where the semivolatile organic compound reporting limit exceeded the RG.

Footnote:

(1) Project Action Limits are the Remedial Goals (RGs) as specified in Table 6-2 of the 1998 Record of Decision. Where no RG is presented in the 1998 Record of Decision, the Project Action Limit is obtained from Illinois Environmental Protection Agency Class II groundwater standards.

TABLE 3-6

Vertical Gradient Calculations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site ID	Well ID	Ground Elevation (ft MSL)	Depth (ft) to top of screen (from ground)	Depth (ft) to Bottom of Screen (from ground)	Top of Screen Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Screen Length (feet)	Elevation of Screen Midpoint (ft MSL)	Groundwater Elevation 4/17 (ft MSL)	Vertical Gradient 4/17 (ft/ft)
L1	**Overburden to Bedrock**									
	MW178	640.39	27.3	46.5	613.09	593.89	19.2	603.49	622.64	-0.2001
	MW176	643.49	4.8	20.8	638.69	622.69	16.0	630.69	627.43	
	MW172	613.19	14.5	34.5	598.69	578.69	20.0	588.69	608.30	0.0067
	MW173	612.56	2.8	11.8	609.76	600.76	9.0	605.26	608.17	
	MW177	613.84	11.8	31.0	602.04	582.84	19.2	592.44	609.37	0.1205
	MW171	615.03	2.9	7.9	612.13	607.13	5.0	609.63	607.55	
	MW401	610.2	28.5	43.5	581.70	566.70	15.0	574.20	605.58	-0.0003
	MW610	609.62	4.0	14.0	605.62	595.62	10.0	600.62	605.59	
L3/ Landfill L3	**Bedrock to Bedrock**									
	MW631	592.23	16.0	26.0	576.23	566.23	10.0	571.23	590.85	0.2078
	MW630	592.23	7.0	12.0	585.23	580.23	5.0	582.73	588.46	
M1	**Overburden to Bedrock**									
	MW640	545.4	29.0	39.0	516.40	506.40	10.0	511.40	544.93	0.0399
	MW351	545.68	9.5	19.5	536.18	526.18	10.0	531.18	544.14	
	MW642	545.08	29.0	39.0	516.08	506.08	10.0	511.08	542.30	-0.0232
	MW641	545.08	7.0	17.0	538.08	528.08	10.0	533.08	542.81	
	MW644	540.23	10.8	20.4	529.43	519.83	9.6	524.63	534.27	0.0277
	MW643	540.03	4.3	7.2	535.73	532.83	2.9	534.28	534.01	
	MW646	541.48	12.3	21.9	529.18	519.58	9.6	524.38	533.66	-0.0022
	MW645	541.47	7.5	11.5	533.97	529.97	4.0	531.97	533.68	
M4	**Combination to Bedrock**									
	MW158	531.58	9.0	29.5	522.58	502.08	20.5	512.33	531.65	-0.0339
	MW157	531.37	3.7	10.2	527.67	521.17	6.5	524.42	532.06	
M6	**Overburden to Bedrock**									
	MW320R	554.6	30.5	45.5	524.10	509.10	15.0	516.60	545.67	0.0097
	MW166R	555.6	10.0	20.0	545.60	535.60	10.0	540.60	545.39	
	MW651	563.83	36.0	46.0	527.83	517.83	10.0	522.83	549.32	-0.3000
	MW650	563.83	12.0	22.0	551.83	541.83	10.0	546.83	556.52	
	MW653	561.93	36.0	46.0	525.93	515.93	10.0	520.93	547.18	-0.2816
	MW652	561.93	11.0	21.0	550.93	540.93	10.0	545.93	554.22	
	MW215R	565.30	38.5	53.5	526.80	511.80	15.0	519.30	546.63	-0.2011
	MW212R	565.30	9.5	19.5	555.80	545.80	10.0	550.80	553.51	
	MW213R	564.30	38.0	53.0	526.30	511.30	15.0	518.80	547.27	-0.2799
	MW210R	564.30	10.7	20.0	553.60	544.30	9.3	548.95	555.71	
	MW310R	563.00	44.5	59.5	518.50	503.50	15.0	511.00	543.78	-0.3326
	MW309	563.43	12.7	27.7	550.73	535.73	15.0	543.23	554.50	
	MW308	561.38	50.5	65.5	510.88	495.88	15.0	503.38	542.23	-0.0459
	MW307	561.45	17.0	27.0	544.45	534.45	10.0	539.45	544.10	
	Combination to Bedrock									
	MW123R	534.90	15.0	30.0	519.90	504.90	15.0	512.40	532.02	-0.1721
	MW162R	537.70	4.5	9.5	533.20	528.20	5.0	530.70	535.17	

RJR/rjr/DMK
J:\Joliet 2017\Semi-annual Report\Final\Tables\Table 3-6_2017 Semi-annual Vert Grads.xlsx

TABLE 3-6

Vertical Gradient Calculations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site ID	Well ID	Ground Elevation (ft MSL)	Depth (ft) to top of screen (from ground)	Depth (ft) to Bottom of Screen (from ground)	Top of Screen Elevation (ft MSL)	Top of Screen Elevation (ft MSL)	Screen Length (feet)	Elevation of Screen Midpoint (ft MSL)	Groundwater Elevation 4/17 (ft MSL)	Vertical Gradient 4/17 (ft/ft)
M6	**Bedrock to Bedrock**									
	MW312	545.96	40.0	55.0	505.96	490.96	15.0	498.46	548.43	0.0038
	MW311	546.36	14.0	24.0	532.36	522.36	10.0	527.36	548.32	
	MW319	545.49	40.0	55.0	505.49	490.49	15.0	497.99	538.24	0.0066
	MW318	545.23	11.8	21.8	533.43	523.43	10.0	528.43	538.04	
	MW313	549.20	25.0	40.0	524.20	509.20	15.0	516.70	539.76	0.0254
	MW654	548.49	13.0	23.0	535.49	525.49	10.0	530.49	539.41	
	MW317	540.71	34.0	49.0	506.71	491.71	15.0	499.21	536.48	-0.0140
	MW316	540.49	13.0	18.0	527.49	522.49	5.0	524.99	536.84	
	MW315	538.91	29.7	44.7	509.21	494.21	15.0	501.71	536.69	0.0027
	MW314	539.53	9.7	14.7	529.83	524.83	5.0	527.33	536.62	
M7	**Overburden to Overburden**									
	MW661	537.09	20.0	30.0	517.09	507.09	10.0	512.09	533.03	-0.1007
	MW660	537.08	7.0	12.0	530.08	525.08	5.0	527.58	534.59	
	Overburden to Bedrock									
	MW217	536.90	19.5	34.5	517.40	502.40	15.0	509.90	533.19	0.0173
	MW216	536.51	5.0	10.0	531.51	526.51	5.0	529.01	532.86	
Landfill M13	**Overburden to Bedrock**									
	MW807	563.79	35.0	45.0	528.79	518.79	10.0	523.79	550.29	-0.0697
	MW806	563.73	15.0	25.0	548.73	538.73	10.0	543.73	551.68	
	MW809	567.28	35.0	45.0	532.28	522.28	10.0	527.28	549.41	-0.2065
	MW808	567.33	15.0	25.0	552.33	542.33	10.0	547.33	553.55	
	MW364	567.69	37.0	42.0	530.69	525.69	5.0	528.19	542.42	-0.0021
	MW363	567.66	21.0	31.0	546.66	536.66	10.0	541.66	542.45	
	Overburden to Combination									
	MW362	562.78	28.0	33.0	534.78	529.78	5.0	532.28	549.32	0.1452
	MW126R	563.00	11.0	21.0	552.00	542.00	10.0	547.00	547.16	
	Bedrock to Bedrock									
	MW322	542.26	34.5	49.5	507.76	492.76	15.0	500.26	534.96	-0.1518
	MW321	542.93	13.5	23.5	529.43	519.43	10.0	524.43	538.63	

General Notes:

$$\text{Vertical Gradient} = \frac{\text{Water Level in Deep Well - Water Level in Shallow Well}}{\text{ABS (Water Table Elevation - Screen Midpoint in Deep Well)}}$$

For well nests with water elevation in shallow well above top of screen:

$$\text{Vertical Gradient} = \frac{\text{Water Level in Deep Well - Water Level in Shallow Well}}{\text{ABS (Screen Midpoint in Shallow Well - Screen Midpoint in Deep Well)}}$$

Negative vertical gradients indicate downward flow; positive indicates upward flow.
ID = Identification.
ft = Feet.
MSL = Mean sea level.
ft/ft = Feet per foot.
Sites L2, L14, and M11 only sampled during Annual round.

RJR/rjr/DMK
J:\Joliet 2017\Semi-annual Report\Final\Tables\Table 3-6_2017 Semi-annual Vert Grads.xlsx

TABLE 3-7

Proposed Sampling Plan - October 2017
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Parameter
L1	***In-plume***	
	MW131	E
	MW173	E
	WES1	E
	Early Warning	
	MW174	E
	WES3	E
	Compliance	
	SW550	E
L2[(1)]	***In-plume***	
	MW404	E
	Early Warning	
	MW620	E
	Compliance	
	MW621	E
	SW555	E
L3	***In-plume***	
	MW412	E
	Early Warning	
	MW630	E
	MW631	E
	MW633	E
	Compliance	
	SW777	E
L14[(1)]	***In-plume***	
	MW511	E
	MW512	E
	Early Warning	
	H7	E
M1	***In-plume***	
	MW107	S
	MW231	S
	MW640	S
	MW641	S
	MW642	S
	Early Warning	
	MW643	S
	MW644	S
	Compliance	
	MW645	S
	MW646	S
	MW648	S
	MW649	S
	SW709	S

RJR/rjr/DMK
J:\2028A USACE JOAAP\03.00 Deliverables\03.04 Reports 2017\03.04.04 Semi-Annual Report\03.04.04.03 Final Semi-Annual Report\Parts\Tables\Table 3-7_2017 Semi-annual Proposed Sample Plan_October 2017

TABLE 3-7

Proposed Sampling Plan - October 2017
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Site	Well ID	Parameter
M6	***In-plume***	
	MW212R	E
	MW330[2]	S
	MW652	E
	Early Warning	
	MW123R	E
	MW162R	E
	MW313	E
	MW318	E
	MW319	E
	MW654	E
	Compliance	
	MW117	E
	MW118	E
	MW119	E
Landfill M13	***Upgradient***	
	MW806	E, I, M, SVOC & V
	MW807	E, I, M, SVOC & V
	Downgradient	
	MW126R	E, I, M, SVOC & V
	MW362	E, I, M, SVOC & V
	MW808	E, I, M, SVOC & V
	MW809	E, I, M, SVOC & V
	MW811	E, I, M, SVOC & V
Landfill M11[1]	***Upgradient***	
	MW802	E, I, M, SVOC & V
	MW803	E, I, M, SVOC & V
	Downgradient	
	MW333	E, I, M, SVOC & V
	MW334	E, I, M, SVOC & V
	MW335	E, I, M, SVOC & V
	MW336	E, I, M, SVOC & V
	MW804	E, I, M, SVOC & V
	MW805	E, I, M, SVOC & V

General Notes:
ID = Identification.
E = Explosives.
M = Target Analyte List metals.
S = Sulfate.
I = Indicator parameters (nitrate-N and sulfate).
SVOC = Semivolatile organic compound.
V = Volatile organic compound.

Footnote:
(1) Sites L2, L14, and M11 sampled only during Annual round.
(2) MW330 is an in-plume well for Site M8.

RJR/rjr/DMK
J:\2028A USACE JOAAP\03.00 Deliverables\03.04 Reports 2017\03.04.04 Semi-Annual Report\03.04.04.03 Final Semi-Annual Report\Parts\Tables\Table 3-7_2017 Semi-annual Proposed Sample Plan_October 2017

TABLE 4-1

Summary of Recommendations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Report	Recommendation	Reasoning	Status Pending/Initiated/Completed
2009 Semi-annual			
	No recommendations regarding the monitoring program		
2009 Annual			
	Fall Sampling only at L2	Section 4.1.2.5 of LTM Plan, round with highest concentration	Initiated, Site L2 will not be sampled spring 2012
	Remove TAL metals analysis from Site L3 well MW410	No metals exceedances since sampling re-initiated in spring 2008	Initiated, metals at well MW410 were not sampled beginning fall 2011
	Remove Site M5 well MW207R from monitoring program	Section 4.1.7.4 of LTM Plan, no RG exceedances for 4 rounds	Initiated, well MW207R was not sampled beginning fall 2011
	Remove Site M3 wells MW233 and MW352 from monitoring program	Section 4.1.6.5 of LTM Plan, no RG exceedances for 4 rounds	Initiated, wells MW233 and MW352 were not sampled beginning fall 2011
	Prepare closure report for Site M3	Section 4.1.6.6 of LTM Plan, no RG exceedances for 4 rounds	Completed Final Closure Report in May 2015
2010 Semi-annual			
	Remove Site L2 well MW501 from monitoring program	Section 4.1.2.5 of LTM Plan, no RG exceedances for 4 rounds	Initiated, well MW501 was not sampled fall beginning 2011
	Fall Sampling only at L14	Section 4.1.4.5 of LTM Plan, round with highest concentration	Initiated, Site L14 will not be sampled spring 2012
	Prepare closure report for Site M5	Section 4.1.7.4 of LTM Plan, no RG exceedances for 4 rounds	Completed Final Closure Report in May 2015
	Remove cadmium analysis from Site M6 well MW123R	Section 4.1.7.4 of LTM Plan, no cadmium detections	Initiated, cadmium at well MW123R was not analyzed beginning fall 2010
2010 Annual			
	Remove Site L1 compliance well MW401 from monitoring program	No explosives detections. Site has upgradient early warning wells with no detections	Initiated, well MW401 will not be sampled beginning spring 2012
	Remove Site L1 early warning well MW172 from monitoring program	Well MW172 redundant with well MW173, upward vertical gradients	Initiated, well MW172 will not be sampled beginning spring 2012
	Change designation of Site L1 well MW173 to in-plume	Migration of contaminants	Initiated in 2011 Annual Report
	Remove Site L2 compliance well MW810 from monitoring program	No explosives detections. Site had upgradient early warning wells with no detections	Initiated, L2 is no longer sampled in spring and well MW810 will not be sampled in fall 2012
	Remove Site L3 compliance well MW632 from monitoring program	No explosives detections. Hydraulics suggest well not within migration flow path	Initiated, well MW632 will not be sampled beginning spring 2012
	Change designation of Site M1 wells MW640, MW641, and MW642 to in-plume	Migration of contaminants	Initiated in 2011 Annual Report
	Remove Site M8 in-plume well MW148RR from monitoring program	In-plume well with no sulfate exceedances since spring 2009	Initiated, well MW148RR will not be sampled beginning spring 2012
	Remove Site M13 wells AEHA14R and AEHA15 from monitoring program and abandon	Problematic wells	Initiated, wells AEHA14R and AEHA15 will not be sampled beginning spring 2012
2011 Semi-annual			
	No new recommendations		
2011 Annual			
	At Site L3/Landfill L3 sample SW004 in spring only	Upstream sample SW555 provides data for fall rounds	Initiated, SW004 will no longer sampled in fall when Site L2 is sampled
	Remove Site Landfill L3/Landfill L3 upgradient well MW03 from monitoring program	No RG exceedances at Site L3 in-plume well MW410	Initiated, well MW03 will not be sampled beginning spring 2012
	Remove Site L14 in-plume well MW508 from monitoring program	No RG exceedances	Initiated, well MW508 will not be sampled beginning spring 2012
	Remove Site L14 compliance wells MW603 and MW604 from monitoring program	Redundant, no RG exceedances in early warning well H7	Initiated, wells MW603 and MW604 will not be sampled beginning spring 2012
	Remove MFG compliance wells MW115 and MW116 from monitoring program	Redundant, no RG exceedances in upgradient Site M6 early warning wells MW123R and MW162R or Site M7 early warning well MW124R	Initiated, wells MW115 and MW116 will not be sampled beginning spring 2012
	Remove MFG compliance wells MW112 and MW113 from monitoring program	Removal of upgradient Site M5 in-plume well MW207R from monitoring program and Site M5 closure	Initiated, wells MW112 and MW113 will not be sampled beginning spring 2012
	Prepare closure report for Site M8	Removal of in-plume well MW148RR from monitoring program	Rescinded, Monitoring well MW330 remains in LTM program
	Fall Sampling only at M11	Section 4.2.2.5 of LTM Plan, stable and predictable results	Initiated spring 2013. Monitoring wells MW802, MW803, MW333, MW334, MW335, MW336, MW804, and MW805 were not sampled in spring 2012.

TABLE 4-1

Summary of Recommendations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Report	Recommendation	Reasoning	Status Pending/Initiated/Completed
2012 Semi-annual			
	Install monitoring well downgradient of Site M13 to replace monitoring wells AEHA14R and AEHA15	Intended to replace monitoring wells AEHA14R and AEHA15 which were removed from the monitoring program	Completed
2012 Annual			
	No new recommendations		
2013 Semi-annual			
	Abandon two unidentified monitoring wells identified at Site M4 and Site M6.	Wells unidentified and not included in monitoring program	Pending
2013 Annual			
	Continue quarterly landfill cap inspections at Landfill M11 through 2014	October 2013 landfill inspection report missing.	Completed
	Do not abandon monitoring well AEHA14R as previously recommended by IEPA	Provides water level control point for Site M13.	Completed
	Redesignate Site L1 monitoring well MW171 from bedrock to overburden	Bottom of the well screen at 7.9 ft bgs and top of bedrock at 8.0 ft bgs.	Completed
	Redesignate Site L14 monitoring well MW603 from overburden to combination	Bottom of the well screen at 16.0 ft bgs and top of bedrock at 13.0 ft bgs.	Completed
	Redesignate Site M1 monitoring well MW642 from overburden to bedrock	Top of the well screen at 29.0 ft bgs and top of bedrock at 29.0 ft bgs.	Completed
	Redesignate Site M1 monitoring well MW647 from overburden to bedrock	Top of the well screen at 7.3 ft bgs and top of bedrock at 6.0 ft bgs.	Completed
	Redesignate Site M1 monitoring well MW649 from overburden to combination	Top of the well screen at 7.0 ft bgs and top of bedrock at 7.5 ft bgs.	Completed
	Redesignate Site M3 monitoring well MW154 from bedrock to combination	Bottom of the well screen at 9.1 ft bgs and top of bedrock at 8.0 ft bgs.	Completed
	Redesignate Site M5 monitoring well MW354R from combination to overburden	Bottom of the well screen at 17.0 ft bgs and top of bedrock at 19.0 ft bgs.	Completed
	Redesignate Site M6 monitoring well MW162R from overburden to bedrock	Top of the well screen at 3.7 ft bgs and top of bedrock at 4.5 ft bgs.	Completed
	Redesignate Site M6 monitoring well MW320R from overburden to bedrock	Top of the well screen at 30.5 ft bgs and top of bedrock at 8.0 ft bgs.	Completed
	Redesignate Other Areas monitoring well MW119 from bedrock to combination	Top of the well screen at 3.3 ft bgs and top of bedrock at 6.0 ft bgs.	Completed
	Redesignate Site M11 monitoring well MW108 from bedrock to combination	Top of the well screen at 7.0 ft bgs and top of bedrock at 9.0 ft bgs.	Completed
	Redesignate Site M11 monitoring well MW804 from combination to bedrock	Top of the well screen at 5.0 ft bgs and top of bedrock at 3.5 ft bgs.	Completed
	Site M11 groundwater flow maps have been revised from a water table and potentiometric to a shallow and deep potentiometric map.	Insufficient overburden wells to create a water table map.	Completed
	Redesignate Site M13 monitoring well MW362 from bedrock to combination	Top of the well screen at 28.0 ft bgs and top of bedrock at 29.5 ft bgs.	Completed
2014 Semi-annual			
	Spot treat woody vegetation on Landfill L3 cap in spring 2015	Kill woody vegetation	Completed
	Continue quarterly inspections at Landfill M11 through 2014	October 2013 and January 2014 inspections not completed	Completed
	Remove small trees from Landfill M11 rip rap apron	Kill woody vegetation	Completed
	Spot treat woody vegetation on Landfill M11 cap in spring 2015	Kill woody vegetation	Completed
	Clear debris from drainage ditch on south side of Landfill M13	Allow proper drainage	NA - did not exist
	Spot treat woody vegetation on Landfill M13 cap in spring 2015	Kill woody vegetation	Completed
	Remove small trees from Landfill M13 rip rap apron	Kill woody vegetation	Completed
	Complete additional mowing around Landfill M13 perimeter	Reduce encroachment	Completed

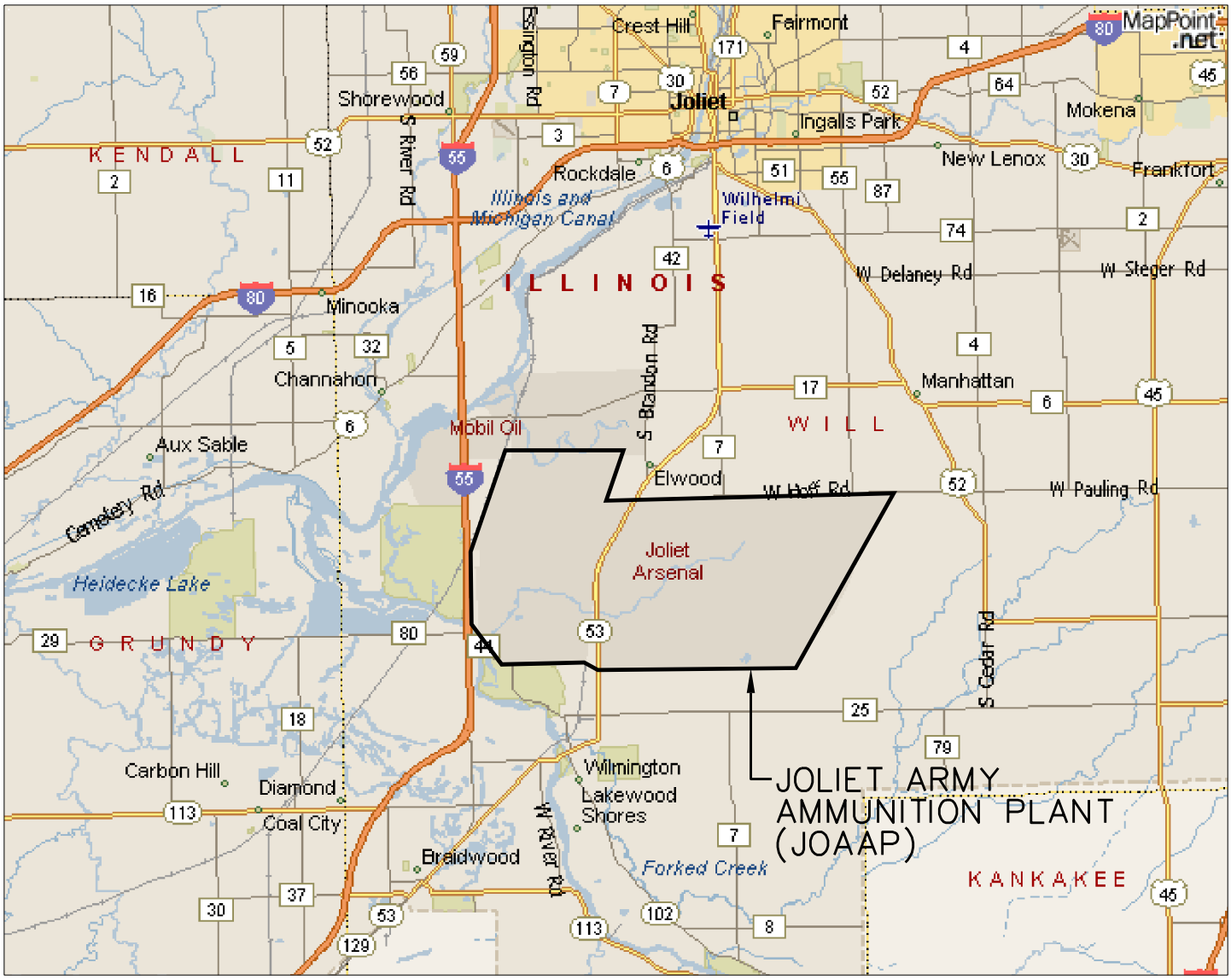
TABLE 4-1

Summary of Recommendations
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Report	Recommendation	Reasoning	Status Pending/Initiated/Completed
2014 Annual			
	Reduce inspections at Landfill M11 from quarterly to annual.	Sections 4.2.2.2 and 4.2.2.3.3 of LTM Plan	Initiated
	Reduce groundwater sampling at Landfill M13 from quarterly to semi-annually	Section 4.2.3.5 of LTM Plan	Initiated
	Remove early warning monitoring well MW124R from LTM	Per Site M7 Groundwater Closure Report, no RG exceedances since 2009 with no upgradient source areas	Initiated
2015 Semi-annual			
	Repair well nest MW309/MW310R and MW311/MW312	Destroyed during CenterPoint construction activities	Completed August 2016
	Do not replace Site L3 monitoring well MW410	No previous detections, overburden well, source being removed, remaining overburden unknown	Approved
	If Site L3 monitoring well MW411 is replaced, is should be replaced as a shallow bedrock well	Provide potentiometric surface control point	Rescinded, well will not be replaced
2015 Annual			
	Modify well nest MW212R/MW215R stickup to current surface grade	Surface grade lowered during CenterPoint construction activities	Completed August 2016
	Complete monitoring well rehabilitation, excluding redevelopment	General monitoring well maintenance	Completed April 2017
	Remove SW557 and SW558 from the monitoring program after one sampling event following Landfill L3 removal activities completed	Sampling locations based on landfill physical features which will no longer exist	Initiated April 2017
	Cease quarterly inspections and mowing at Landfill L3 due to landfill removal. Quarterly inspections and mowing will not be completed in 2016.	Landfill removal	Initiated October 2015
	Remove TAL metals analysis from Site L3 following one round after landfill removal completed.	There have been no prior exceedances and the source (Landfill L3) will have been removed	Initiated April 2017
	Sample Site M1 monitoring well MW104 one-time in October 2016 for sulfate	Confirm there is not migration occurring from the vicinity of MW231 toward MW104	Completed October 2016
2016 Semi-annual			
	Do not replace Site L3 monitoring well MW411	Not included in LTM program, combination well, no remaining overburden, would not provide relevant flow data	Approved
2016 Annual			
	Remove Site L3 surface water sampling locations SW004, SW557, and SW558	Sampling locations based on Landfill L3, which has been removed and one round of sampling completed following removal	Initiated April 2017
	Remove TAL metals analysis from Site L3 following one round completed after landfill removal completed	There have been no prior exceedances and the source (Landfill L3) has been removed	Initiated April 2017
	Change monitoring well designations: MW412 – revised from In-plume/Downgradient to In-plume MW630, MW631, and MW633 – revised from Early Warning/Downgradient to Early Warning SW777 – revised from Compliance/Downgradient to Compliance	Landfill L3 removal completed and one round of sampling completed following removal	Approved
	Do not continue Site M1 monitoring well MW104 sampling for sulfate	Sampling in October 2016 indicated only a low level detection of sulfate at 6.6 mg/L.	Approved
2017 Semi-annual			
	Abandon destroyed Site M1 monitoring well MW648.	Monitoring well severely damaged by USDA mower. Based on groundwater flow direction and recent detections, monitoring well does not require replacement.	Approved

Notes:
Does not include minor maintenance activities such as replacing well locks.
Does not include recommendations repeated in subsequent reports.

FIGURES



NOTE

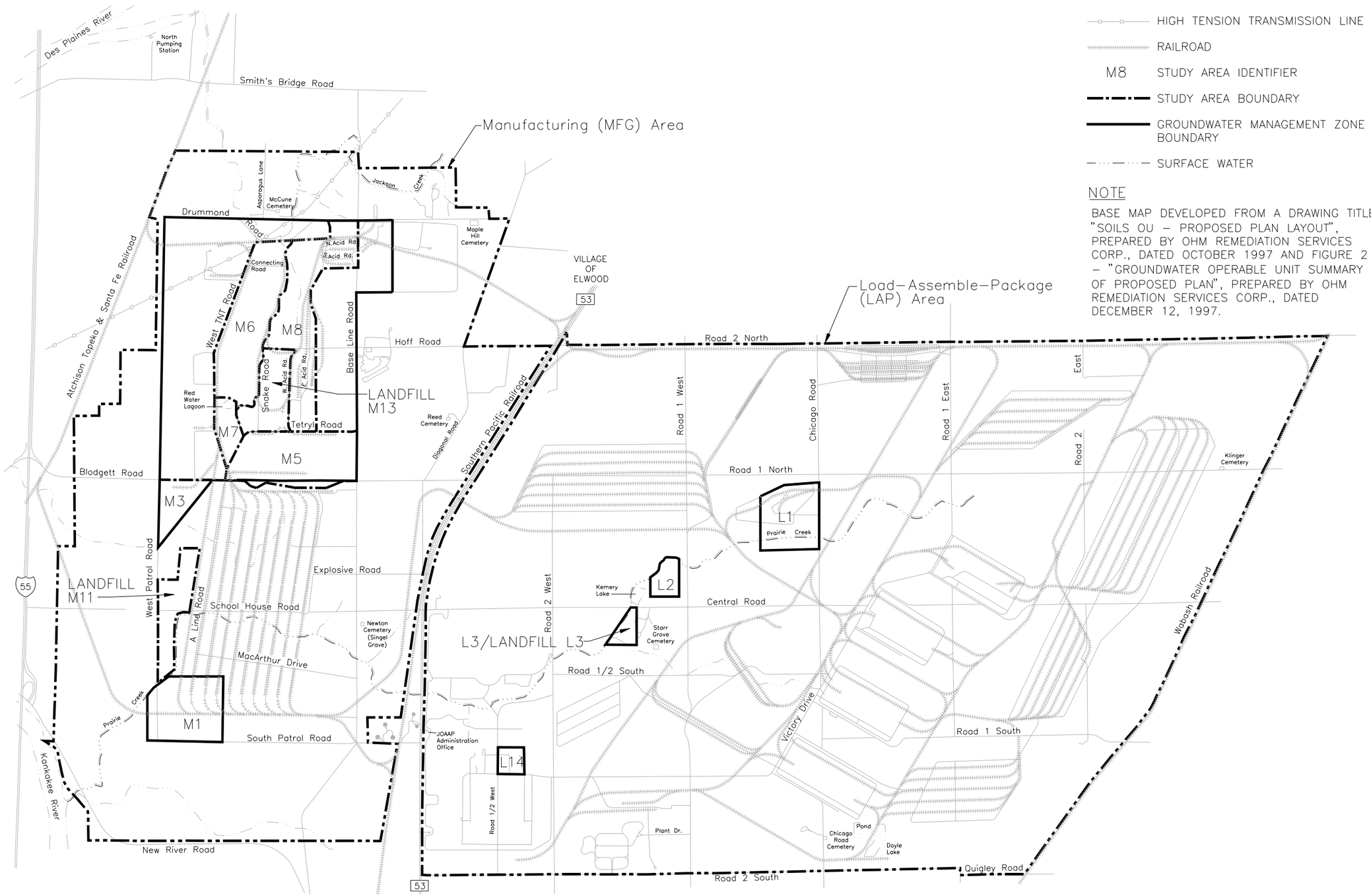
BASE MAP DEVELOPED FROM 2002 MICROSOFT CORPORATION, EXPEDIA.COM.

north

RJR DEVELOPED BY / TMM DRAWN BY	CONTRACT NO. W912QR-15-C-0016	SITE LOCATION MAP	FIGURE 1-1
APPROVED BY / 7/27/2017 DATE	VERIFY SCALE 0 1/2 1 BAR REPRESENTS ONE INCH	SCALE 1"=4 Miles (Approx.)	2017 SEMIANNUAL GROUNDWATER MONITORING REPORT JOLIET ARMY AMMUNITION PLANT WILL COUNTY, ILLINOIS	IEA MWH JOINT VENTURE
REVISIONS / DATE			

File: \\IEA-FLSRVR\J-Jobs\2028A USACE JOAAP\06.00 Design\06.04 Sheets_17spr_LocationMap_Fig1-1.dgn

Drawn By & Date: TMM 2/17/16 | Approved By & Date: RJR 2/17/16 | Revised By & Date: | Approved By & Date:



LEGEND

- APPROXIMATE JOAAP BOUNDARY
- HIGH TENSION TRANSMISSION LINE
- RAILROAD
- M8 STUDY AREA IDENTIFIER
- STUDY AREA BOUNDARY
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- SURFACE WATER

NOTE

BASE MAP DEVELOPED FROM A DRAWING TITLED "SOILS OU – PROPOSED PLAN LAYOUT", PREPARED BY OHM REMEDIATION SERVICES CORP., DATED OCTOBER 1997 AND FIGURE 2 – "GROUNDWATER OPERABLE UNIT SUMMARY OF PROPOSED PLAN", PREPARED BY OHM REMEDIATION SERVICES CORP., DATED DECEMBER 12, 1997.

Drawn By & Date: TMM 7/27/2017	Approved By & Date: RJR 7/27/2017	Revised By & Date:	Approved By & Date:

TMM DEVELOPED BY
TMM DRAWN BY
7/27/2017 DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 4000'

REV	DATE	BY	DESCRIPTION

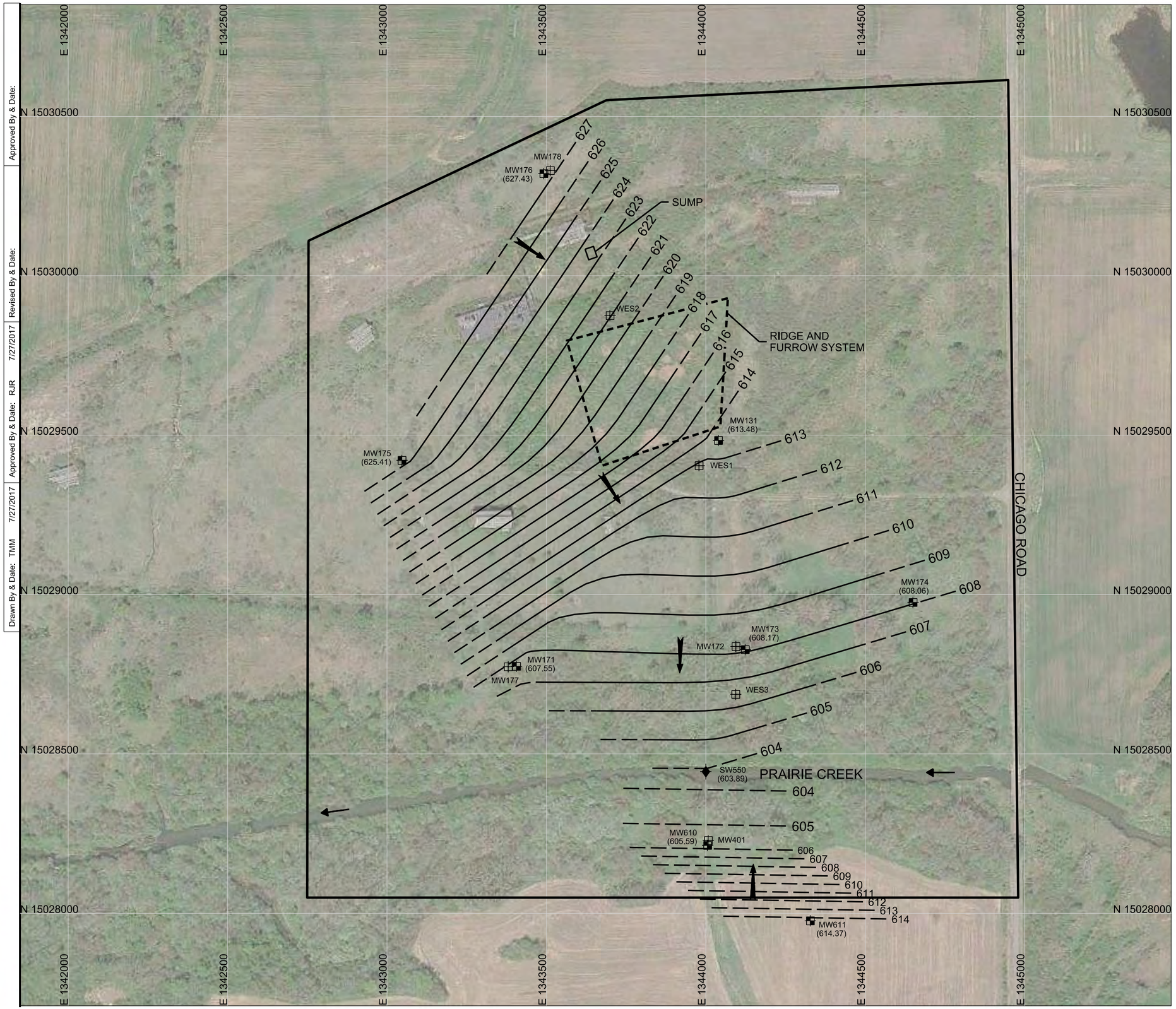
GROUNDWATER STUDY AREAS AND LANDFILL SITES

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 1-2
DRAWING NUMBER

IEA MWH
JOINT VENTURE



LEGEND:

- MW171 (607.55) — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW177 — BEDROCK MONITORING WELL LOCATION AND NUMBER.
- SW550 (603.89) — SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION.
- 606 — WATER TABLE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 25 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE WATER TABLE MAP ARE SHOWN WITH ELEVATIONS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Revised By & Date: 7/27/2017 | Approved By & Date:

TMM DEVELOPED BY | TMM DRAWN BY | 7/27/2017 DATE | APPROVED BY

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE 0 1/2 1 — BAR REPRESENTS ONE INCH ON ORIGINAL — SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

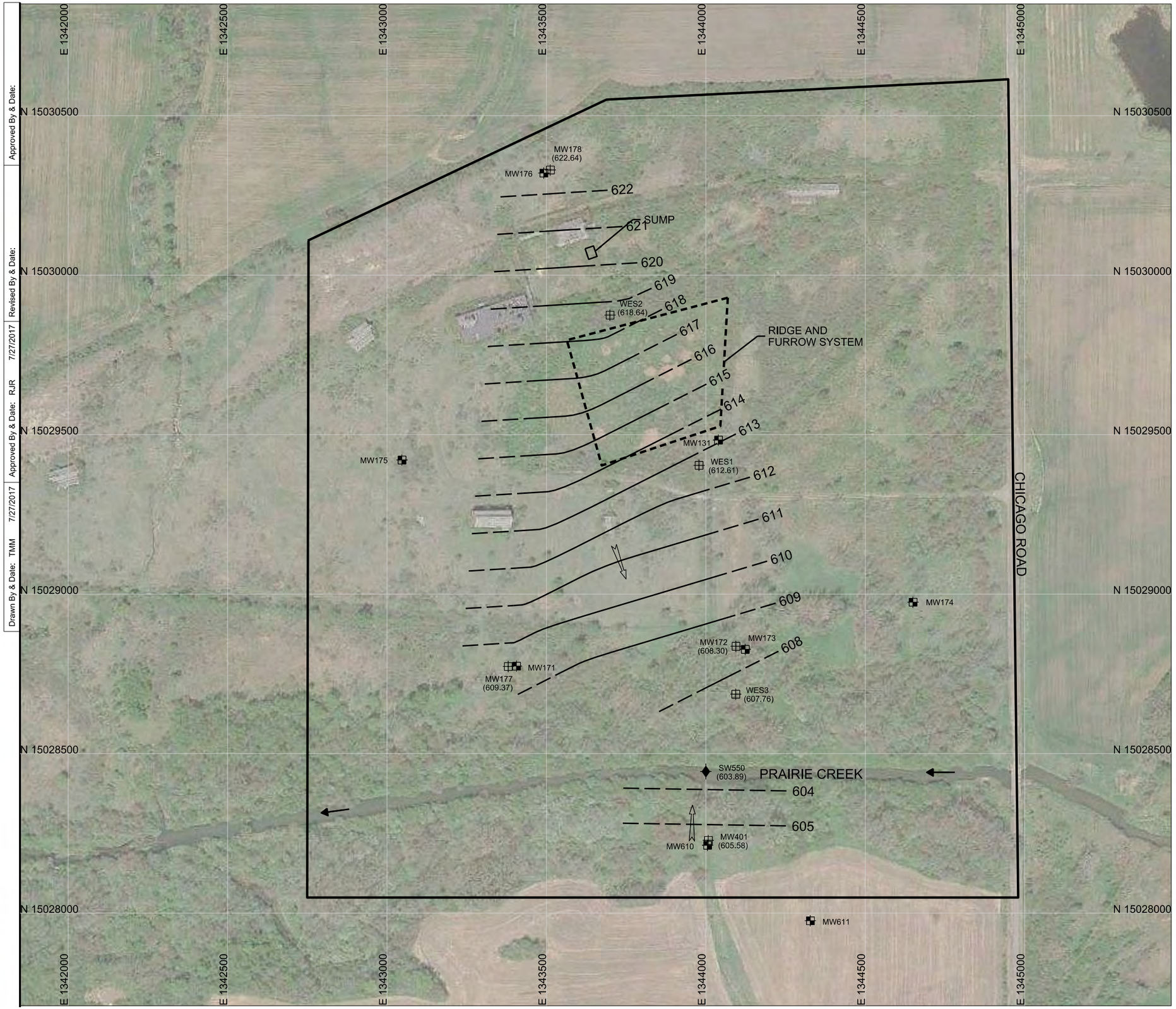
SITE FEATURES/WATER TABLE MAP - LAP AREA
SITE L1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-1
DRAWING NUMBER

IEA MWH
JOINT VENTURE



LEGEND:

- MW171 — OVERBURDEN MONITORING WELL LOCATION, NUMBER.
- MW177 (609.37) — BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- SW550 (603.89) — SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION (NOT USED IN POTENTIOMETRIC SURFACE CONTOURING.
- 610 — POTENTIOMETRIC SURFACE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 25 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE POTENTIOMETRIC SURFACE MAP ARE SHOWN WITH ELEVATIONS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Approved By & Date: | Revised By & Date: | Approved By & Date:

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: RJR
DATE: 7/27/2017

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

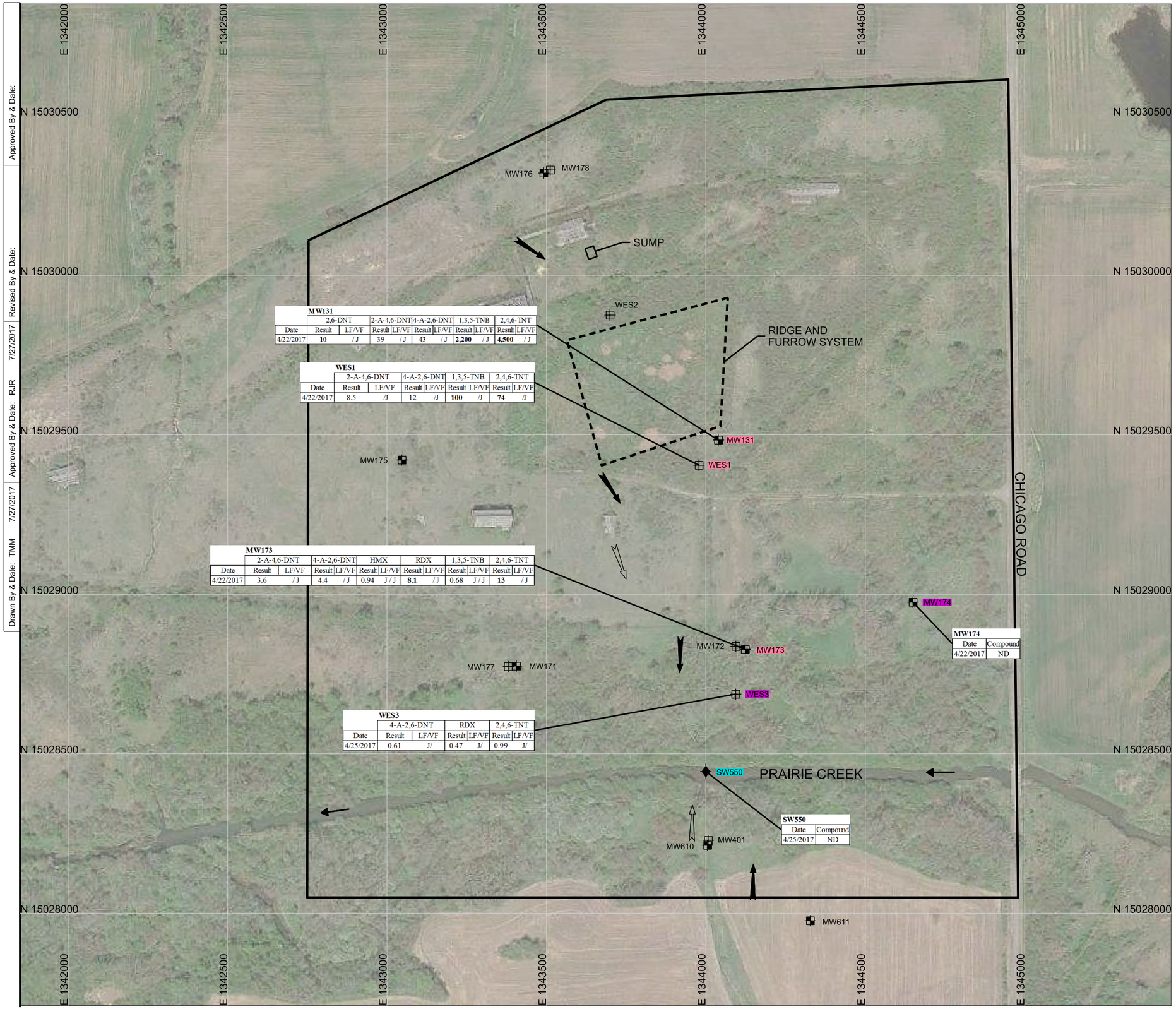
POTENTIOMETRIC SURFACE MAP - LAP AREA
SITE L1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-2
DRAWING NUMBER

IEA MWH
JOINT VENTURE



MW131

	2,6-DNT		2-A-4,6-DNT		4-A-2,6-DNT		1,3,5-TNB		2,4,6- TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/22/2017	**10**	/ J	39	/ J	43	/ J	**2,200**	/ J	**4,500**	/ J

WES1

	2-A-4,6-DNT		4-A-2,6-DNT		1,3,5-TNB		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/22/2017	8.5	/J	12	/J	**100**	/J	**74**	/J

MW173

	2-A-4,6-DNT		4-A-2,6-DNT		HMX		RDX		1,3,5-TNB		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/22/2017	3.6	/ J	4.4	/ J	0.94	J / J	**8.1**	/ J	0.68	J / J	**13**	/ J

MW174

Date	Compound
4/22/2017	ND

WES3

	4-A-2,6-DNT		RDX		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/25/2017	0.61	J/	0.47	J/	0.99	J/

SW550

Date	Compound
4/25/2017	ND

LEGEND:

- MW173 — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES DETECTIONS.
- WES1 — BEDROCK MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES DETECTIONS.
- SW550 — SURFACE WATER MONITORING LOCATION, NUMBER, AND EXPLOSIVES DETECTIONS.
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- IN-PLUME MONITORING POINT
- EARLY WARNING MONITORING POINT
- COMPLIANCE MONITORING POINT

2,6-DNT	2,6-DINITROTOLUENE
1,3,5-TNB	1,3,5 TRINITROBENZENE
2,4,6-TNT	2,4,6-TRINITROTOLUENE
2-A-4,6-DNT	2-AMINO-4,6-DINITROTOLUENE
4-A-2,6-DNT	4-AMINO-2,6-DINITROTOLUENE
HMX	HIGH MELTING-POINT EXPLOSIVE
RDX	ROYAL DEMOLITION EXPLOSIVE
J	ESTIMATED CONCENTRATION
LF/VF	LAB FLAG/VALIDATION FLAG
µg/L	MICROGRAMS PER LITER
ND	NOT DETECTED
NS	NO STANDARD
RG	REMEDIATION GOAL

COMPOUND (µg/L)	PROJECT ACTION LIMIT	SURFACE WATER RG
2,6-DNT	0.42	150
1,3,5-TNB	5.1	15
2,4,6-TNT	9.5	75
2-A-4,6-DNT	NS	NS
4-A-2,6-DNT	NS	NS
HMX	5,100	260
RDX	2.6	500

NOTES:

1. PROJECT ACTION LIMITS ARE THE REMEDIAL GOALS AS SPECIFIED IN TABLE 6-2 OF THE 1998 RECORD OF DECISION. WHERE NO RG IS PRESENTED IN THE 1998 RECORD OF DECISION, THE PROJECT ACTION LIMIT IS OBTAINED FROM IEPA CLASS II GROUNDWATER STANDARDS.
2. THE SURFACE WATER PROJECT ACTION LIMITS ARE OBTAINED FROM TABLE 10-1 OF THE 1998 RECORD OF DECISION.
3. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
4. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
5. SAMPLES COLLECTED BY IEA/MWH JV PERSONNEL ON 22 AND 25 APRIL, 2017.
6. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L).
7. BOLDED VALUE INDICATES RG EXCEEDANCE

north

Approved By & Date:
Revised By & Date:
Approved By & Date: RJR 7/27/2017
Drawn By & Date: TMM 7/27/2017

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: 7/27/2017
DATE

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

EXPLOSIVES DETECTIONS - LAP AREA
SITE L1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-3
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW1 (617.11) — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW136 (595.32) — COMBINED MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW630 — SHALLOW BEDROCK MONITORING WELL LOCATION AND NUMBER.
- MW632 — DEEPER BEDROCK MONITORING WELL LOCATION AND NUMBER.
- SW777 (588.40) — SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION.
- 632 — WATER TABLE CONTOUR (CONTOUR INTERVAL: 2 FT) (DASHED WHERE INFERRED)
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- APPROXIMATE LIMITS OF FORMER LANDFILL

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 22 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE WATER TABLE MAP ARE SHOWN WITH ELEVATIONS.
5. APPROXIMATE LIMITS OF FORMER LANDFILL OBTAINED FROM SITE L3 CLOSURE REPORT, PREPARED BY MWH, DATED JUNE 25, 2010.
6. MW136 IS A COMBINATION OVERBURDEN/BEDROCK WELL USED AS A HORIZONTAL CONTROL POINT.
7. LANDFILL REMOVAL ACTIVITIES COMPLETED AUGUST 2016.

north

Drawn By & Date: TMM 7/27/2017	Approved By & Date: RJR 7/27/2017	Revised By & Date: 7/27/2017	Approved By & Date:

TMM — DEVELOPED BY
TMM — DRAWN BY
7/27/2017 — DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 200'

REV	DATE	BY	DESCRIPTION

SITE FEATURES/WATER TABLE MAP - LAP AREA
SITE L3
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-4
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW1 — OVERBURDEN MONITORING WELL LOCATION AND NUMBER.
- MW136 (595.32) — COMBINED MONITORING WELL LOCATION, NUMBER, AND POTENTIOMETRIC SURFACE ELEVATION.
- MW630 (588.46) — SHALLOW BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- MW632 (591.55) — DEEPER BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- SW777 (588.40) — SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION (NOT USED IN POTENTIOMETRIC SURFACE CONTOURING.
- 591 — POTENTIOMETRIC SURFACE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- APPROXIMATE LIMITS OF FORMER LANDFILL

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 22 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE POTENTIOMETRIC SURFACE MAP ARE SHOWN WITH ELEVATIONS.
5. APPROXIMATE LIMITS OF FORMER LANDFILL OBTAINED FROM SITE L3 CLOSURE REPORT, PREPARED BY MWH, DATED JUNE 25, 2010.
6. MW136 IS A COMBINATION OVERBURDEN/BEDROCK WELL USED AS A HORIZONTAL CONTROL POINT.
7. LANDFILL REMOVAL ACTIVITIES COMPLETED AUGUST 2016.

north

Drawn By & Date: TMM 7/27/2017	Approved By & Date: RJR 7/27/2017	Revised By & Date: 7/27/2017	Approved By & Date:

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: RJR
DATE: 7/27/2017
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 200'

REV	DATE	BY	DESCRIPTION

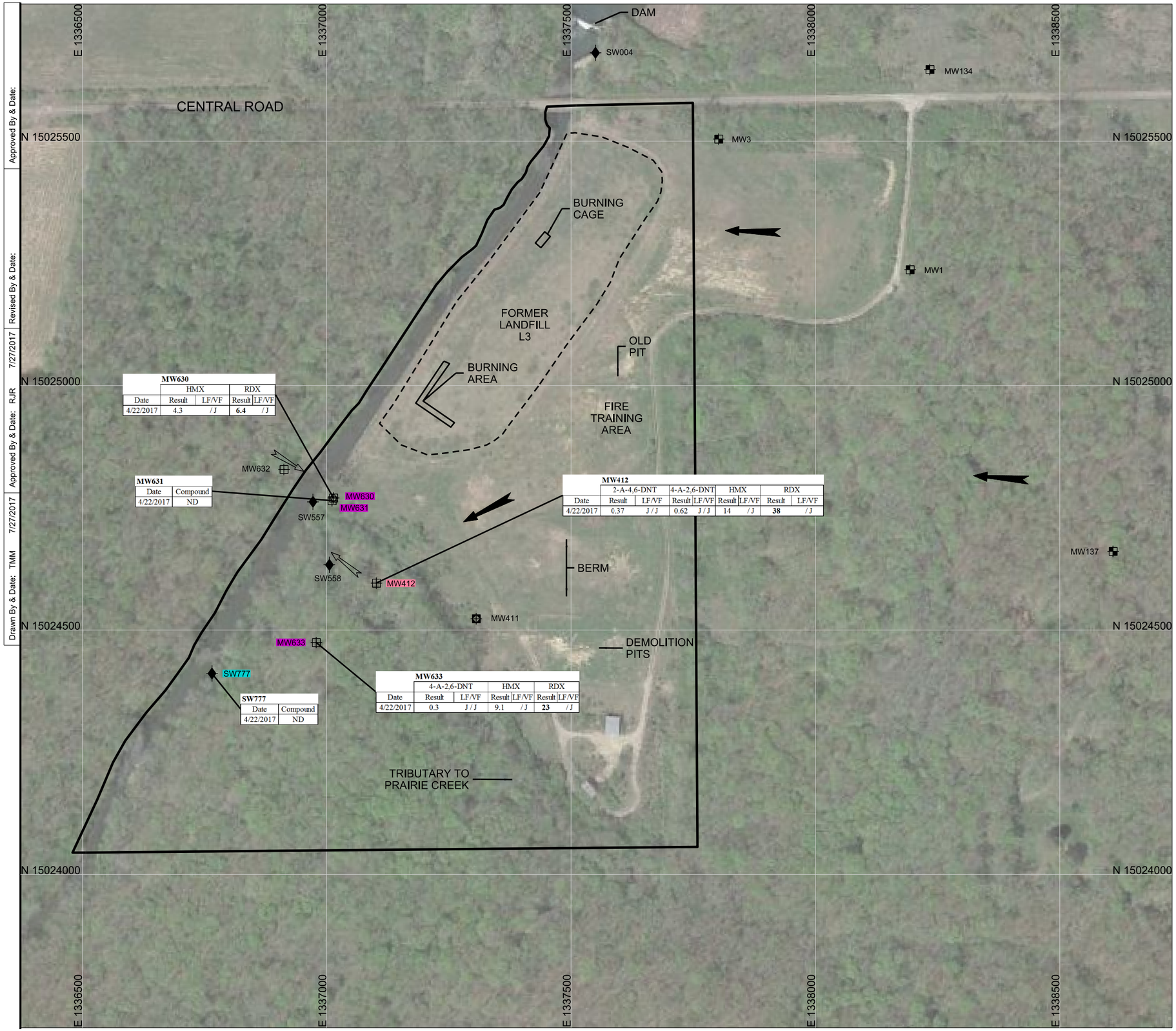
POTENTIOMETRIC SURFACE MAP - LAP AREA
SITE L3
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-5
DRAWING NUMBER

IEA MWH
JOINT VENTURE



MW630

	HMX		RDX	
Date	Result	LF/VF	Result	LF/VF
4/22/2017	4.3	/ J	**6.4**	/ J

MW631

Date	Compound
4/22/2017	ND

MW412

	2-A-4,6-DNT		4-A-2,6-DNT		HMX		RDX	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/22/2017	0.37	J / J	0.62	J / J	14	/ J	**38**	/ J

MW633

	4-A-2,6-DNT		HMX		RDX	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/22/2017	0.3	J / J	9.1	/ J	**23**	/ J

SW777

Date	Compound
4/22/2017	ND

LEGEND:

- MW1 — OVERBURDEN MONITORING WELL LOCATION AND NUMBER.
- MW136 — COMBINED MONITORING WELL LOCATION AND NUMBER.
- MW630 — SHALLOW BEDROCK MONITORING WELL LOCATION, NUMBER AND EXPLOSIVES DETECTIONS.
- MW631 — DEEPER BEDROCK MONITORING WELL LOCATION, NUMBER AND EXPLOSIVES DETECTIONS.
- SW777 — SURFACE WATER MONITORING LOCATION, NUMBER, AND EXPLOSIVES DETECTIONS.
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- APPROXIMATE LIMITS OF LANDFILL
- IN-PLUME/DOWNGRADIENT MONITORING POINT
- EARLY WARNING/DOWNGRADIENT MONITORING POINT
- COMPLIANCE/DOWNGRADIENT AND UPGRADIENT MONITORING POINT

2-A-4,6-DNT	2-AMINO-4,6-DINITROTOLUENE
4-A-2,6-DNT	4-AMINO-2,6-DINITROTOLUENE
HMX	HIGH MELTING-POINT EXPLOSIVE
RDX	ROYAL DEMOLITION EXPLOSIVE
J	ESTIMATED CONCENTRATION
LF/VF	LAB FLAG/VALIDATION FLAG
µg/L	MICROGRAMS PER LITER
ND	NOT DETECTED
NS	NO STANDARD
RG	REMEDIATION GOAL

COMPOUND (µg/L)	PROJECT ACTION LIMIT	SURFACE WATER RG
2-A-4,6-DNT	NS	NS
4-A-2,6-DNT	NS	NS
HMX	5,100	260
RDX	2.6	500

NOTES:

1. PROJECT ACTION LIMITS ARE THE REMEDIAL GOALS AS SPECIFIED IN TABLE 6-2 OF THE 1998 RECORD OF DECISION. WHERE NO RG IS PRESENTED IN THE 1998 RECORD OF DECISION, THE PROJECT ACTION LIMIT IS OBTAINED FROM IEPA CLASS II GROUNDWATER STANDARDS.
2. THE SURFACE WATER PROJECT ACTION LIMITS ARE OBTAINED FROM TABLE 10-1 OF THE 1998 RECORD OF DECISION.
3. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
4. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
5. SAMPLES COLLECTED BY IEA/MWH JV PERSONNEL ON 22 APRIL, 2017.
6. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L).
7. BOLDED VALUE INDICATES RG EXCEEDANCE.
8. APPROXIMATE LIMITS OF FORMER LANDFILL OBTAINED FROM SITE L3 CLOSURE REPORT, PREPARED BY MWH, DATED JUNE 25, 2010.
9. LANDFILL REMOVAL ACTIVITIES COMPLETED AUGUST 2016.

north

Approved By & Date:
Revised By & Date:
Approved By & Date: RJR 7/27/2017
Drawn By & Date: TMM 7/27/2017

TMM DEVELOPED BY
TMM DRAWN BY
7/27/2017 DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 200'

REV	DATE	BY	DESCRIPTION

EXPLOSIVES DETECTIONS - LAP AREA
SITE L3
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-6
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW104 (544.38) OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW649 (537.11) COMBINED MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW642 BEDROCK MONITORING WELL LOCATION AND NUMBER.
- SW709 (532.89) SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION.
- 540 WATER TABLE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 18, 19 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE WATER TABLE MAP ARE SHOWN WITH ELEVATIONS.
5. MW105, MW106, MW107 AND MW649 ARE COMBINATION OVERBURDEN/BEDROCK WELLS USED AS HORIZONTAL CONTROL POINTS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Approved By & Date: | Revised By & Date: | Approved By & Date:

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: RJR
DATE: 7/27/2017

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

SITE FEATURES/WATER TABLE MAP - MFG AREA
SITE M1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-7
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW104 — OVERBURDEN MONITORING WELL LOCATION AND NUMBER.
- MW649 — COMBINED MONITORING WELL LOCATION AND NUMBER.
- MW642 (542.30) — BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- SW709 (532.89) — SURFACE WATER MONITORING LOCATION, NUMBER, AND SURFACE WATER ELEVATION.
- 540 — POTENTIOMETRIC SURFACE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 18, 19 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE POTENTIOMETRIC SURFACE MAP ARE SHOWN WITH ELEVATIONS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Revised By & Date: | Approved By & Date:

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: RJR
DATE: 7/27/2017

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

POTENTIOMETRIC SURFACE MAP - MFG AREA
SITE M1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-8
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW107 — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND SULFATE DETECTION.
- MW649 — COMBINED MONITORING WELL LOCATION, NUMBER, AND SULFATE DETECTION.
- MW642 — BEDROCK MONITORING WELL LOCATION, NUMBER AND SULFATE DETECTION.
- SW709 — SURFACE WATER MONITORING LOCATION, NUMBER, AND SULFATE DETECTION.
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF BEDROCK FLOW
- DIRECTION OF FLOW IN CREEK
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- LF/VF — LAB FLAG/VALIDATION FLAG
- mg/L — MILLIGRAMS PER LITER
- RG — REMEDIATION GOAL
- IN-PLUME MONITORING POINT
- EARLY WARNING MONITORING POINT
- COMPLIANCE MONITORING POINT

COMPOUND (mg/L)	PROJECT ACTION LIMIT	SURFACE WATER RG
SULFATE	400	500

NOTES:

1. PROJECT ACTION LIMITS ARE THE REMEDIAL GOALS AS SPECIFIED IN TABLE 6-2 OF THE 1998 RECORD OF DECISION. WHERE NO RG IS PRESENTED IN THE 1998 RECORD OF DECISION, THE PROJECT ACTION LIMIT IS OBTAINED FROM IEPA CLASS II GROUNDWATER STANDARDS.
2. THE SURFACE WATER PROJECT ACTION LIMITS ARE OBTAINED FROM TABLE 10-1 OF THE 1998 RECORD OF DECISION.
3. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
4. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
5. SAMPLES COLLECTED BY IEA/MWH JV PERSONNEL ON 18 AND 19 APRIL, 2017.
6. CONCENTRATIONS REPORTED IN MILLIGRAMS PER LITER (mg/L).
7. BOLDED VALUE INDICATES RG EXCEEDANCE.

north

Approved By & Date:
Revised By & Date:
Approved By & Date: RJR 7/27/2017
Drawn By & Date: TMM 7/27/2017

TMM DEVELOPED BY
TMM DRAWN BY
7/27/2017 DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 300'

REV	DATE	BY	DESCRIPTION

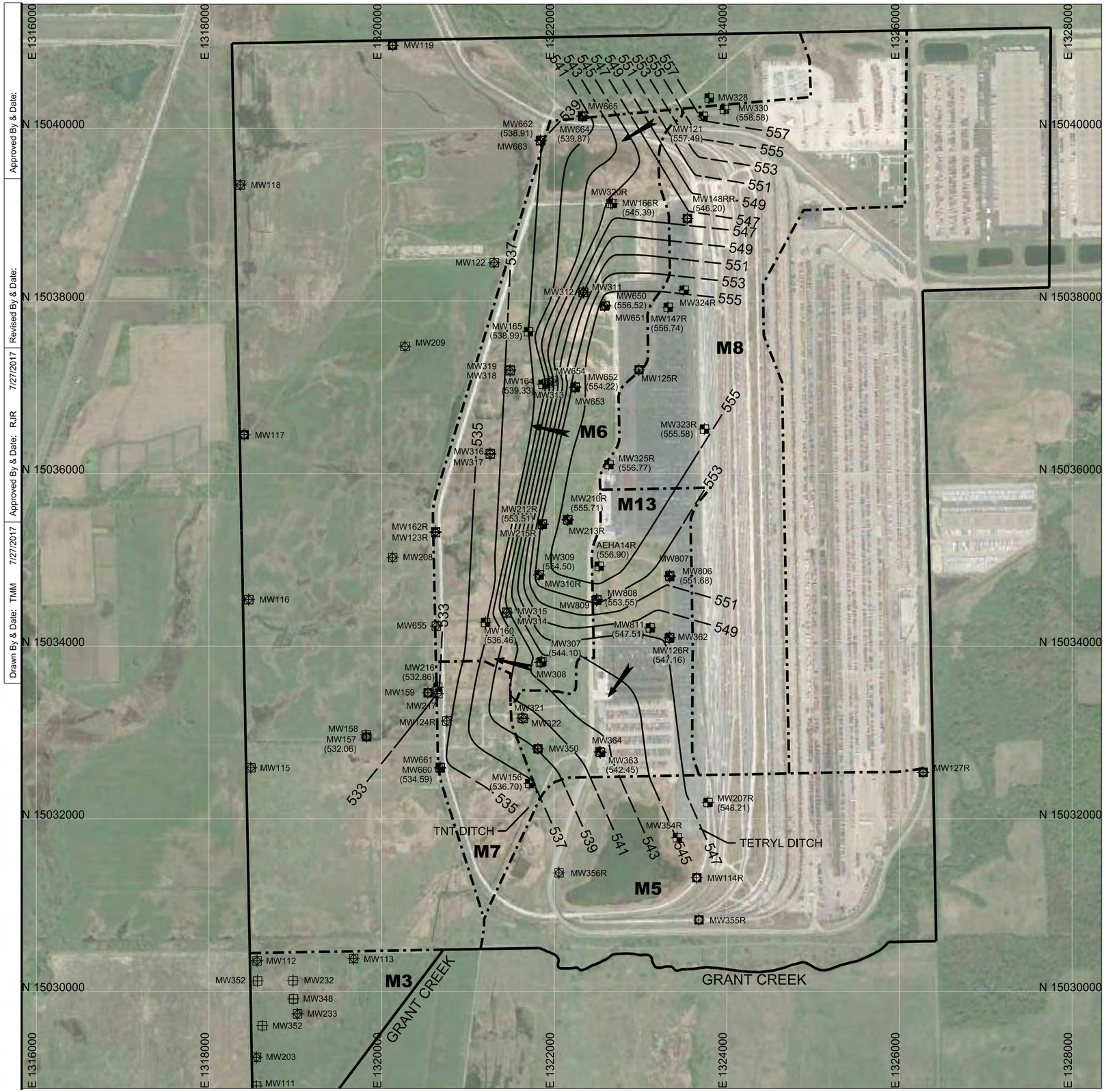
SULFATE DETECTIONS - MFG AREA
SITE M1
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED
7/27/2017

FIGURE 3-9
DRAWING NUMBER

IEA MWH
JOINT VENTURE



LEGEND:

- MW330 (558.58) — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW157 (532.06) — COMBINED MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW118 — SHALLOW BEDROCK MONITORING WELL LOCATION AND NUMBER.
- MW665 — DEEPER BEDROCK MONITORING WELL LOCATION AND NUMBER.
- 550 — WATER TABLE CONTOUR (CONTOUR INTERVAL: 2 FT) (DASHED WHERE INFERRED)
- DIRECTION OF WATER TABLE FLOW
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- STUDY AREA BOUNDARIES

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 19, 20 AND 21 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE WATER TABLE MAP ARE SHOWN WITH ELEVATIONS.
5. SELECT COMBINATION OVERBURDEN/BEDROCK WELLS ARE USED AS HORIZONTAL CONTROL POINTS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Revised By & Date: | Approved By & Date:

DEVELOPED BY: TMM
DRAWN BY: TMM
APPROVED BY: RJR
DATE: 7/27/2017

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 1200'

REV	DATE	BY	DESCRIPTION

SITE FEATURES/WATER TABLE MAP - MFG AREA
SITES M3, M4, M5, M6, M7, M8, M13 AND OTHER AREAS (APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-10
DRAWING NUMBER

IEA MWH
JOINT VENTURE

LEGEND:

- MW330 — OVERBURDEN MONITORING WELL LOCATION AND NUMBER.
- MW119 (532.67) — COMBINED MONITORING WELL LOCATION AND NUMBER.
- MW118 (530.72) — SHALLOW BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- MW665 (542.95) — DEEPER BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- 548 — POTENTIOMETRIC SURFACE CONTOUR (CONTOUR INTERVAL: 2 FT) (DASHED WHERE INFERRED)
- DIRECTION OF BEDROCK FLOW
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- STUDY AREA BOUNDARIES

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 19, 20 AND 21 APRIL, 2017.
4. MONITORING WELLS USED TO CREATE THE POTENTIOMETRIC SURFACE MAP ARE SHOWN WITH ELEVATIONS.
5. SELECT COMBINATION OVERBURDEN/BEDROCK WELLS ARE USED AS HORIZONTAL CONTROL POINTS.

north

Drawn By & Date: TMM 7/27/2017 | Approved By & Date: RJR 7/27/2017 | Revised By & Date: | Approved By & Date:

TMM DEVELOPED BY | TMM DRAWN BY | 7/27/2017 DATE | APPROVED BY

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE 0 1/2 1

BAR REPRESENTS ONE INCH ON ORIGINAL

SCALE 1" = 1200'

REV	DATE	BY	DESCRIPTION

POTENTIOMETRIC SURFACE MAP - MFG AREA SITES M3, M4, M5, M6, M7, M8, M13 AND OTHER AREAS (APRIL 2017)

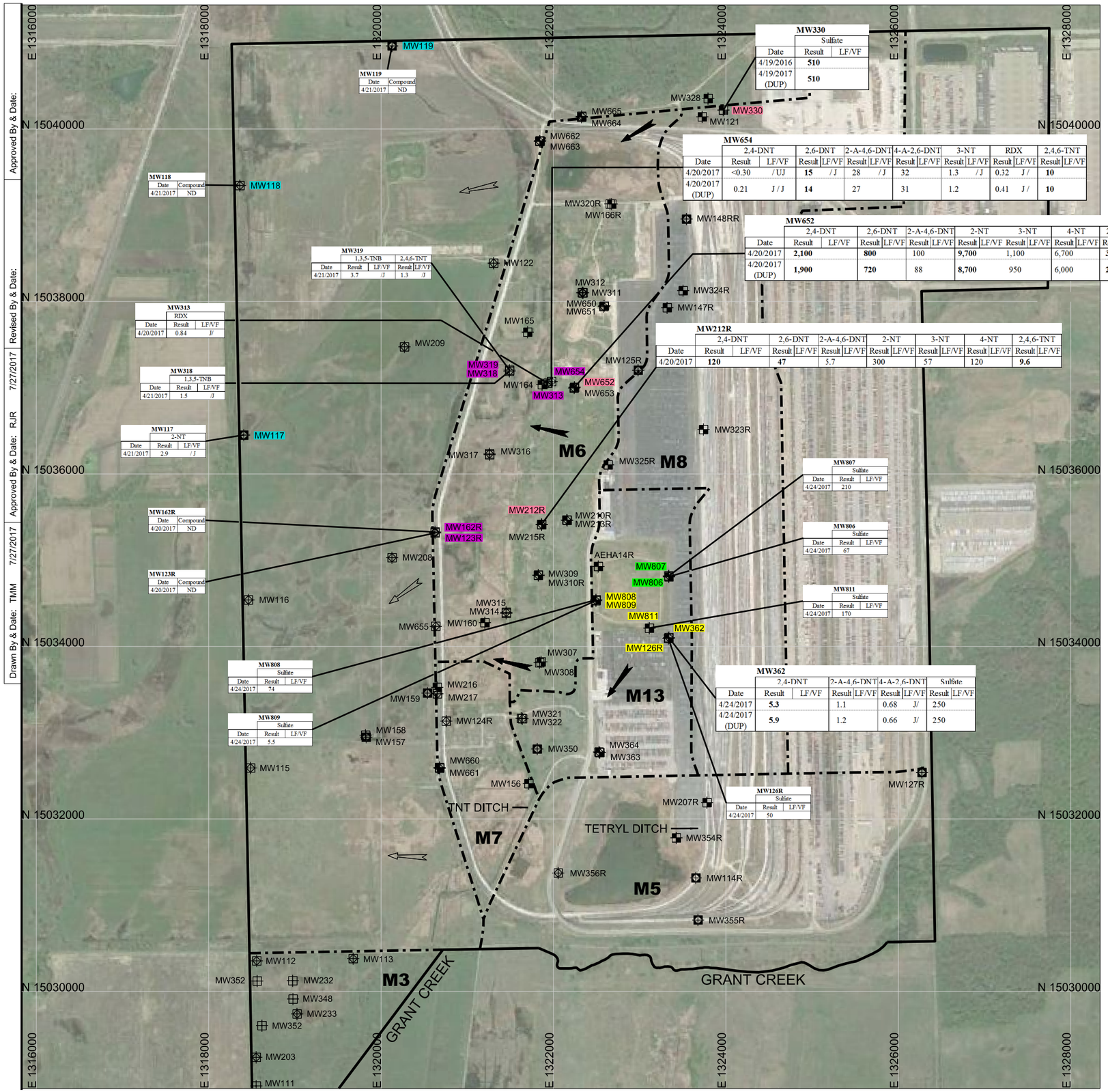
2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-11

DRAWING NUMBER

IEA MWH JOINT VENTURE



MW119

Date	Compound
4/21/2017	ND

MW118

Date	Compound
4/21/2017	ND

MW319

	1,3,5-TNB		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF
4/21/2017	3.7	/J	1.3	/J

MW313

	RDX	
Date	Result	LF/VF
4/20/2017	0.84	J/

MW318

	1,3,5-TNB	
Date	Result	LF/VF
4/21/2017	1.5	/J

MW117

	2-NT	
Date	Result	LF/VF
4/21/2017	2.9	/J

MW162R

Date	Compound
4/20/2017	ND

MW123R

Date	Compound
4/20/2017	ND

MW330

	Sulfate	
Date	Result	LF/VF
4/19/2016	**510**	
4/19/2017 (DUP)	**510**	

MW654

	2,4-DNT		2,6-DNT		2-A-4,6-DNT		4-A-2,6-DNT		3-NT		RDX		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/20/2017	<0.30	/UJ	**15**	/J	28	/J	32		1.3	/J	0.32	J/	**10**	
4/20/2017 (DUP)	0.21	J/J	**14**		27		31		1.2		0.41	J/	**10**	

MW652

	2,4-DNT		2,6-DNT		2-A-4,6-DNT		2-NT		3-NT		4-NT		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/20/2017	**2,100**		**800**		100		**9,700**		1,100		6,700		**310**	
4/20/2017 (DUP)	**1,900**		**720**		88		**8,700**		950		6,000		**280**	

MW212R

	2,4-DNT		2,6-DNT		2-A-4,6-DNT		2-NT		3-NT		4-NT		2,4,6-TNT	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/20/2017	**120**		**47**		5.7		300		57		120		**9.6**	

MW807

	Sulfate	
Date	Result	LF/VF
4/24/2017	210	

MW806

	Sulfate	
Date	Result	LF/VF
4/24/2017	67	

MW811

	Sulfate	
Date	Result	LF/VF
4/24/2017	170	

MW808

	Sulfate	
Date	Result	LF/VF
4/24/2017	74	

MW809

	Sulfate	
Date	Result	LF/VF
4/24/2017	5.5	

MW362

	2,4-DNT		2-A-4,6-DNT		4-A-2,6-DNT		Sulfate	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/24/2017	**5.3**		1.1		0.68	J/	250	
4/24/2017 (DUP)	**5.9**		1.2		0.66	J/	250	

MW126R

	Sulfate	
Date	Result	LF/VF
4/24/2017	50	

LEGEND:

- MW330 — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES OR SULFATE DETECTIONS.
- MW119 — COMBINED MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES OR SULFATE DETECTIONS.
- MW118 — SHALLOW BEDROCK MONITORING WELL LOCATION, NUMBER AND EXPLOSIVES OR SULFATE DETECTIONS.
- MW319 — DEEPER BEDROCK MONITORING WELL LOCATION, NUMBER AND EXPLOSIVES OR SULFATE DETECTIONS.
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF BEDROCK FLOW
- GROUNDWATER MANAGEMENT ZONE BOUNDARY
- STUDY AREA BOUNDARIES
- IN-PLUME MONITORING POINT
- EARLY WARNING MONITORING POINT
- COMPLIANCE MONITORING POINT
- DOWNGRADIENT MONITORING POINT
- UPGRADIENT MONITORING POINT

COMPOUND (µg/L)	PROJECT ACTION LIMIT
1,3,5-TNB	5.1
1,3-DNB	10
2,4,6-TNT	9.5
2,4-DNT	0.42
2,6-DNT	0.42
2-A-4,6-DNT	NS
4-A-2,6-DNT	NS
2-NT	5,100
3-NT	NS
4-NT	NS
HMX	5,100
RDX	2.6
NB	51
TETRYL	200
SULFATE (mg/L)	400

1,3,5-TNB	1,3,5-TRINITROBENZENE
1,3-DNB	1,3-DINITROBENZENE
2,4,6-TNT	2,4,6-TRINITROTOLUENE
2,4-DNT	2,4-DINITROTOLUENE
2,6-DNT	2,6-DINITROTOLUENE
2-A-4,6-DNT	2-AMINO-4,6-DINITROTOLUENE
4-A-2,6-DNT	4-AMINO-2,6-DINITROTOLUENE
2-NT	2-NITROTOLUENE
3-NT	3-NITROTOLUENE
4-NT	4-NITROTOLUENE
HMX	HIGH MELTING-POINT EXPLOSIVE
RDX	ROYAL DEMOLITION EXPLOSIVE
NB	NITROBENZENE
TETRYL	2,4,6-TRINITROPHENYLMETHYLNITRAMINE
DUP	DUPLICATE
LF/VF	LAB FLAG/VALIDATION FLAG
J	ESTIMATED CONCENTRATION
UJ	NOT DETECTED, ESTIMATED DETECTION LIMIT
µg/L	MICROGRAMS PER LITER
mg/L	MILLIGRAMS PER LITER
ND	NOT DETECTED
NS	NO STANDARD
RG	REMEDIATION GOAL

NOTES:

1. PROJECT ACTION LIMITS ARE THE REMEDIAL GOALS AS SPECIFIED IN TABLE 6-2 OF THE 1998 RECORD OF DECISION. WHERE NO RG IS PRESENTED IN THE 1998 RECORD OF DECISION, THE PROJECT ACTION LIMIT IS OBTAINED FROM IEPA CLASS II GROUNDWATER STANDARDS.
2. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
3. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NOTRH AMERICAN DATUM 1983 (NAD83).
4. SAMPLES COLLECTED BY IEA/MWH JV PERSONNEL ON 19, 20, 21, AND 24 APRIL, 2017.
5. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L) WITH THE EXCEPTION OF SULFATE, REPORTED IN MILLIGRAMS PER LITER (mg/L).
6. BOLDED VALUE INDICATES RG EXCEEDANCE.

north

Approved By & Date:
Revised By & Date:
Approved By & Date: RJR 7/27/2017
Drawn By & Date: TMM 7/27/2017

TMM DEVELOPED BY | TMM DRAWN BY | 7/27/2017 DATE | APPROVED BY | CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE — BAR REPRESENTS ONE INCH ON ORIGINAL — SCALE 1" = 1200'

REV	DATE	BY	DESCRIPTION

EXPLOSIVES AND SULFATE DETECTIONS - MFG AREA SITES M6, M8, M13 AND OTHER AREAS (APRIL 2017)

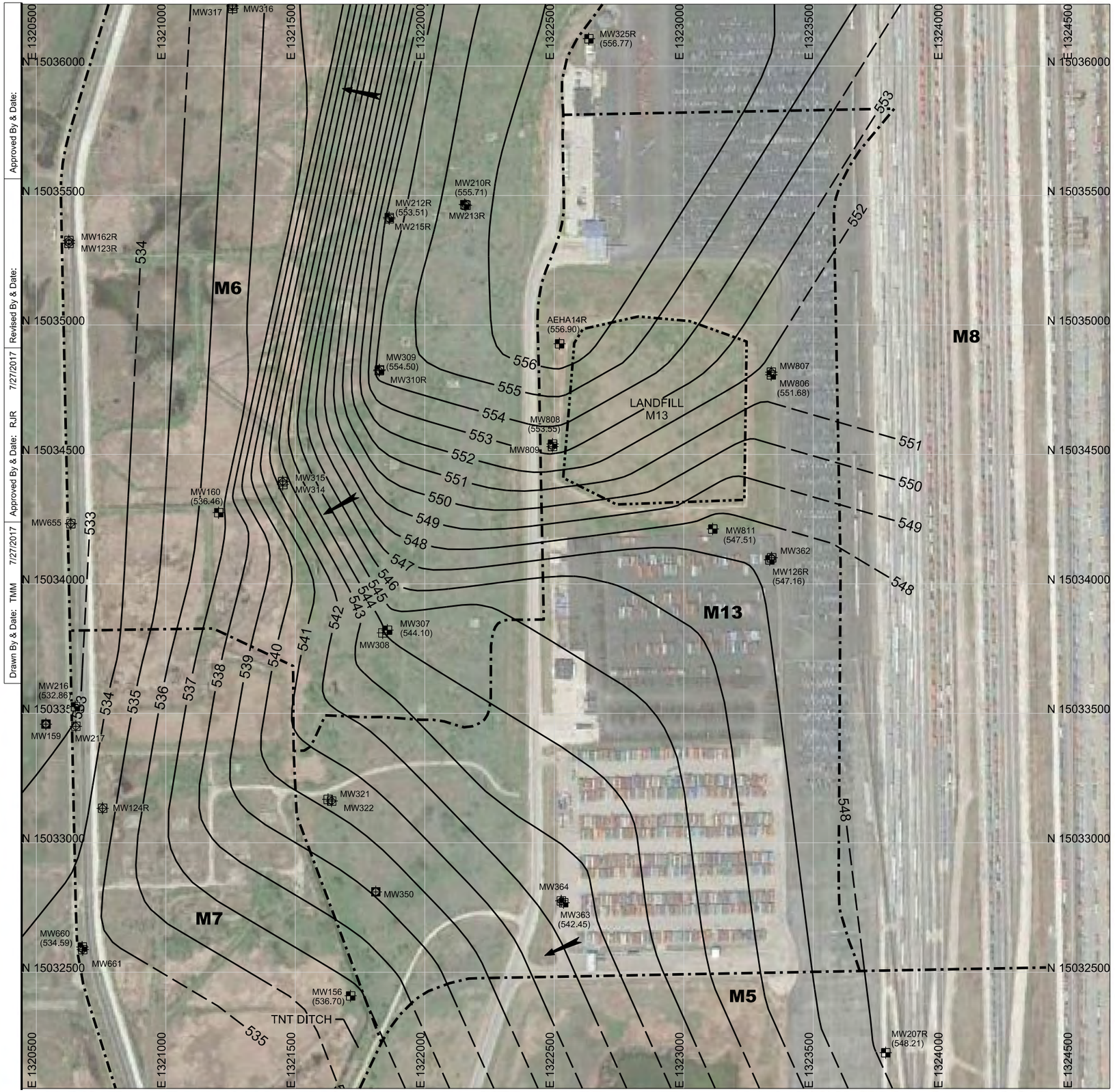
2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-12

DRAWING NUMBER

IEA MWH JOINT VENTURE



LEGEND:

- MW126R (547.16) — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND WATER TABLE ELEVATION.
- MW362 — COMBINED MONITORING WELL LOCATION AND NUMBER.
- MW321 — SHALLOW BEDROCK MONITORING WELL LOCATION AND NUMBER.
- MW807 — DEEPER BEDROCK MONITORING WELL LOCATION AND NUMBER.
- 555 — WATER TABLE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF WATER TABLE FLOW
- STUDY AREA BOUNDARIES
- APPROXIMATE LIMITS OF LANDFILL

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. SEE FIGURE 3-16 FOR WATER TABLE ELEVATIONS AND CONFIGURATION OF AREA SURROUNDING LANDFILL M13.
4. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 19, 20, AND 21 APRIL, 2017.
5. MONITORING WELLS USED TO CREATE THE WATER TABLE MAP ARE SHOWN WITH ELEVATIONS.
6. SELECT COMBINATION OVERBURDEN/BEDROCK WELLS ARE USED AS HOIZONTAL CONTROL POINTS.
7. APPROXIMATE LIMITS OF LANDFILL OBTAINED FROM A DRAWING, "M13 NEW WELL LOCATIONS", FIGURE 1, PROJECT NO. 7-61M-11686, PREPARED BY AMEC EARTH & ENVIRONMENTAL, DATED MAY 2008.

north

Drawn By & Date: TMM 7/27/2017
Approved By & Date: RJR 7/27/2017
Revised By & Date:
Approved By & Date:

TMM — DEVELOPED BY
TMM — DRAWN BY
7/27/2017 — DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 400'

REV	DATE	BY	DESCRIPTION

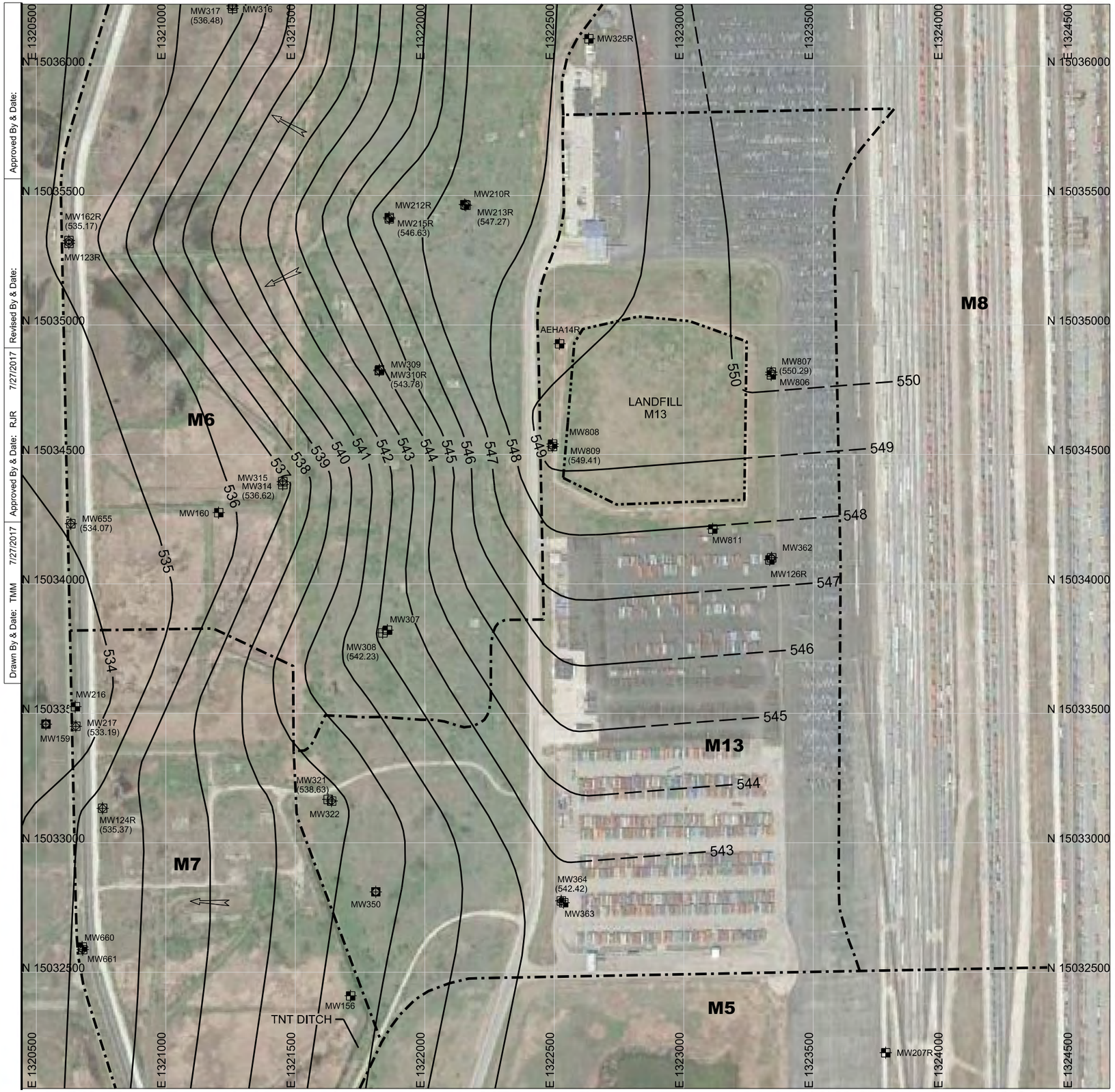
SITE FEATURES/WATER TABLE MAP - MFG AREA
SITE M13 LANDFILL
(APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-13
DRAWING NUMBER

IEA MWH
JOINT VENTURE



LEGEND:

- MW126R — OVERBURDEN MONITORING WELL LOCATION AND NUMBER.
- MW362 — COMBINED MONITORING WELL LOCATION AND NUMBER.
- MW321 — SHALLOW BEDROCK MONITORING WELL LOCATION, NUMBER AND POTENTIOMETRIC SURFACE ELEVATION.
- MW807 (550.29) — DEEPER BEDROCK MONITORING WELL LOCATION AND NUMBER.
- 540 — POTENTIOMETRIC SURFACE CONTOUR (CONTOUR INTERVAL: 1 FT) (DASHED WHERE INFERRED)
- DIRECTION OF BEDROCK FLOW
- STUDY AREA BOUNDARIES
- APPROXIMATE LIMITS OF LANDFILL

NOTES:

1. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
2. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
3. SEE FIGURE 3-17 FOR POTENTIOMETRIC SURFACE ELEVATIONS AND CONFIGURATION OF AREA SURROUNDING LANDFILL M13.
4. WATER LEVELS MEASURED BY IEA/MWH JV PERSONNEL ON 19, 20 AND 21 APRIL, 2017.
5. MONITORING WELLS USED TO CREATE THE POTENTIOMETRIC SURFACE MAP ARE SHOWN WITH ELEVATIONS.
6. SELECT COMBINATION OVERBURDEN/BEDROCK WELLS ARE USED AS HORIZONTAL CONTROL POINTS.
7. APPROXIMATE LIMITS OF LANDFILL OBTAINED FROM A DRAWING, "M13 NEW WELL LOCATIONS", FIGURE 1, PROJECT NO. 7-61M-11686, PREPARED BY AMEC EARTH & ENVIRONMENTAL, DATED MAY2008.

north

Drawn By & Date: TMM 7/27/2017 Approved By & Date: RJR 7/27/2017 Revised By & Date: Approved By & Date:

TMM DRAWN BY | TMM DEVELOPED BY | 7/27/2017 DATE | APPROVED BY

CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE 0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 400'

REV	DATE	BY	DESCRIPTION

POTENTIOMETRIC SURFACE MAP - MFG AREA
SITE M13 LANDFILL
(APRIL 2017)

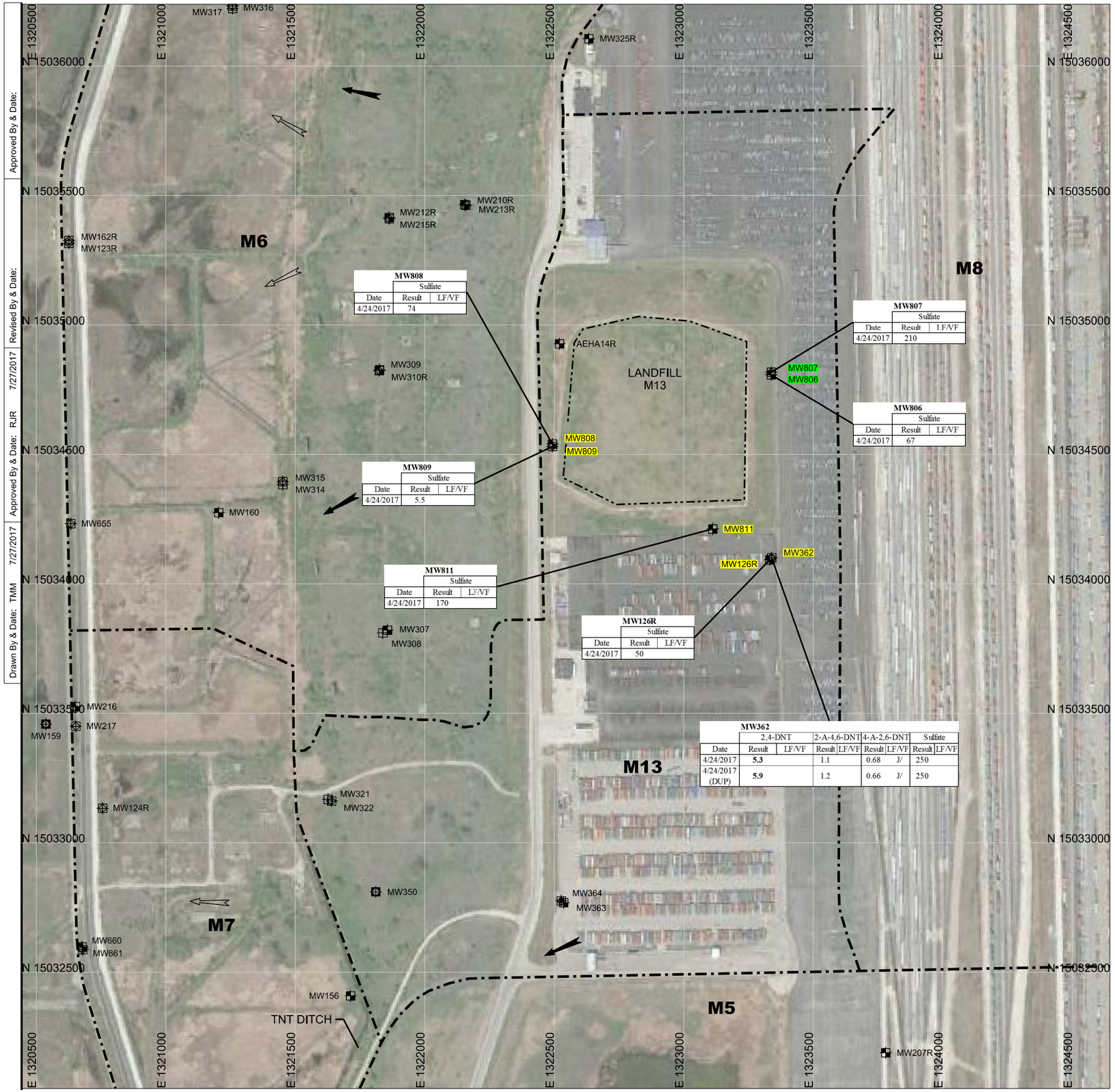
2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-14

DRAWING NUMBER

IEA MWH
JOINT VENTURE



MW808		
	Sulfate	
Date	Result	LF/VF
4/24/2017	74	

MW807		
	Sulfate	
Date	Result	LF/VF
4/24/2017	210	

MW806		
	Sulfate	
Date	Result	LF/VF
4/24/2017	67	

MW809		
	Sulfate	
Date	Result	LF/VF
4/24/2017	5.5	

MW811		
	Sulfate	
Date	Result	LF/VF
4/24/2017	170	

MW126R		
	Sulfate	
Date	Result	LF/VF
4/24/2017	50	

MW362								
	2,4-DNT		2-A-4,6-DNT		4-A-2,6-DNT		Sulfate	
Date	Result	LF/VF	Result	LF/VF	Result	LF/VF	Result	LF/VF
4/24/2017	**5.3**		1.1		0.68	J/	250	
4/24/2017 (DUP)	**5.9**		1.2		0.66	J/	250	

LEGEND:

- MW126R — OVERBURDEN MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES AND SULFATE DETECTIONS.
- MW362 — COMBINED MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES AND SULFATE DETECTIONS.
- MW321 — SHALLOW BEDROCK MONITORING WELL LOCATION AND NUMBER.
- MW807 — DEEPER BEDROCK MONITORING WELL LOCATION, NUMBER, AND EXPLOSIVES AND SULFATE DETECTIONS.
- DIRECTION OF WATER TABLE FLOW
- DIRECTION OF BEDROCK FLOW
- STUDY AREA BOUNDARIES
- APPROXIMATE LIMITS OF LANDFILL
- DOWNGRADIENT MONITORING POINT
- UPGRADIENT MONITORING POINT
- 2,4-DNT — 2,4-DINITROTOLUENE
- 1,3,5-TNB — 1,3,5-TRINITROBENZENE
- 2-A-4,6-DNT — 2-AMINO-4,6-DINITROTOLUENE
- 4-A-2,6-DNT — 4-AMINO-2,6-DINITROTOLUENE
- DUP — DUPLICATE
- J — ESTIMATED CONCENTRATION
- LF/VF — LAB FLAG/VALIDATION FLAG
- µg/L — MICROGRAMS PER LITER
- mg/L — MILLIGRAMS PER LITER
- NS — NO STANDARD
- RG — REMEDIATION GOAL

COMPOUND (µg/L)	PROJECT ACTION LIMIT
2,4-DNT	0.42
1,3,5-TNB	5.1
2-A-4,6-DNT	NS
4-A-2,6-DNT	NS
SULFATE (mg/L)	400

NOTES:

1. PROJECT ACTION LIMITS ARE THE REMEDIAL GOALS AS SPECIFIED IN TABLE 6-2 OF THE 1998 RECORD OF DECISION. WHERE NO RG IS PRESENTED IN THE 1998 RECORD OF DECISION, THE PROJECT ACTION LIMIT IS OBTAINED FROM IEPA CLASS II GROUNDWATER STANDARDS.
2. BASE MAP DEVELOPED FROM AN AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH, DATED MAY 5, 2015.
3. COORDINATES ARE UNIVERSAL TRANSVERSE MERCATOR (UTM), ZONE 16 NORTH, NORTH AMERICAN DATUM 1983 (NAD83).
4. SAMPLES COLLECTED BY IEA/MWH JV PERSONNEL ON 20 APRIL, 2017.
5. CONCENTRATIONS REPORTED IN MICROGRAMS PER LITER (µg/L) WITH THE EXCEPTION OF SULFATE, REPORTED IN MILLIGRAMS PER LITER (mg/L).
6. BOLDED VALUE INDICATES RG EXCEEDANCE.
7. APPROXIMATE LIMITS OF LANDFILL OBTAINED FROM A DRAWING, "M13 NEW WELL LOCATIONS", FIGURE 1, PROJECT NO. 7-61M-11686, PREPARED BY AMEC EARTH & ENVIRONMENTAL, DATED MAY 2008.

north

Approved By & Date:
Revised By & Date:
Approved By & Date: RJR 7/27/2017
Drawn By & Date: TMM 7/27/2017

TMM — DEVELOPED BY
TMM — DRAWN BY
7/27/2017 — DATE
APPROVED BY
CONTRACT NO. W912QR-15-C-0016

VERIFY SCALE
0 1/2 1
BAR REPRESENTS ONE INCH ON ORIGINAL
SCALE 1" = 400'

REV	DATE	BY	DESCRIPTION

EXPLOSIVES AND SULFATE DETECTIONS - MFG AREA SITE M13 LANDFILL (APRIL 2017)

2017 SEMI-ANNUAL GROUNDWATER MONITORING REPORT
JOLIET ARMY AMMUNITION PLANT
WILL COUNTY, ILLINOIS

PRINTED 7/27/2017

FIGURE 3-15

DRAWING NUMBER

IEA MWH
JOINT VENTURE

APPENDIX A

POST-CLOSURE LANDFILL INSPECTION REPORTS

A1 – Post-closure Landfill Inspection Report – March 2017
A2 – Post-closure Landfill Inspection Report – April 2017

A1 – POST-CLOSURE LANDFILL INSPECTION REPORT – MARCH 2017

Former Joliet Army Ammunition Plant
Will County, Illinois

Appendix A1
Post-closure Landfill Inspection Report
March 2017

Long-Term Monitoring, Deed Restriction Implementation Plan, and CERCLA Five-Year Review

Prepared For:
U.S. Army Environmental Command under Contract with the U.S. Army Corps Of Engineers

Firm Fixed Price Contract
W912QR-15-C-0016

March 2017

TABLE OF CONTENTS

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ACRONYMS AND ABBREVIATIONS ii

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2.0 LANDFILL M13 DESCRIPTION 3

3.0 INSPECTION RESULTS 4

4.0 RECOMMENDATIONS 5

LIST OF ATTACHMENTS

Attachment

1 Post-closure Inspection Checklist

2 Inspection Photographs – Landfill M13

ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
GMZ	Groundwater Management Zone
IAC	Illinois Administrative Code
IEA/MWH JV	IEA, Inc./MWH Americas, Inc.
JOAAP	former Joliet Army Ammunition Plant
LTM Plan	Final Long-term Monitoring Plan for Environmental Remediation Services (MWH/TolTest, March 2010)
MFG	Manufacturing Area
RA	Remedial Action
Report	Post-closure Landfill Inspection Report, March 2017
USACE	United States Army Corps of Engineers – Louisville District
USAEC	United States Army Environmental Command

1.0 INTRODUCTION

IEA, Inc./MWH Americas, Inc. Joint Venture (IEA/MWH JV) has been retained by the United States Army Corps Of Engineers – Louisville District (USACE) on behalf of the United States Army Environmental Command (USAEC) to conduct environmental services at the former Joliet Army Ammunition Plant (JOAAP), Will County, Illinois. Work will be executed under Firm Fixed Price Contract No. W912QR-15-C-0016, which includes quarterly inspection of the condition of Landfill M13 and annual inspection of Landfill M11, located at JOAAP. This Post-closure Landfill Inspection Report, March 2017 (Report) documents the conditions identified during the inspection of Landfill M13, conducted in March 2017.

Post-closure monitoring requirements for Landfills M11 and M13 are mandated by Illinois Administrative Code (IAC) Title 5, Subtitle G, Chapter 1, Subchapter c, Part 724, Subpart G, for 15 years at Landfill M13 and 30 years at Landfill M11.

According to the *Final Long-term Monitoring Plan for Environmental Remediation Services* (LTM Plan [MWH/TolTest, March 2010]):

- Section 4.2.2.3.2, *"According to IAC, the Landfill M11 cover will be inspected quarterly for the first five years and then annually for 25 years."*
- Section 4.2.3.2, *"Long-term monitoring of the landfill cap (M13) will include quarterly inspections of the cap, …"*

Landfill inspections have been generally conducted on a quarterly basis at Landfills M13 and M11 from October 2008 through December 2014 in accordance with the LTM Plan. Quarterly inspections at Landfill M11 ended in 2014 and will subsequently be conducted annually, generally during the fall annual groundwater sampling event.

Inspection objectives include:

- Confirm that the landfill cap has controlled leaching so that water quality will not be threatened in the future.
- Ensure that the cap is maintained in a manner that will not increase infiltration in the future or otherwise allow waste to be exposed.
- Keep survey points protected and visible to facilitate identification in the future.
- At M13, ensure the fence and signage installed to restrict site access remain in place and serviceable.
- At M13, certify that institutional controls remain in place.

According to IAC and the LTM Plan, Landfills M13 and M11 covers will be inspected for:

- Depressions indicating subsidence or other deformations that could breach the cover.
- Erosion features.

- Growth of deep-rooted vegetation or invasive species that would adversely affect evapotranspiration and/or erosion armoring.
- Debris or blockage of drainage structure.

Any damages or changes noted will be repaired to comply with the final design specifications for the cover.

In addition, land use restrictions have been imposed across the area within the fence. Annual certification is required to document that none of the following are occurring within the fence:

- Development
- Intrusive work
- Excavation that could mobilize contaminants of concern (COC)
- Alteration of surface water flow
- Vehicle use other than that associated with maintenance of the cover/cap.

2.0 LANDFILL M13 DESCRIPTION

Site M13 comprises approximately 106 acres of the central part of the Manufacturing Area (MFG) formerly known as the gravel pits. It lies north of the Tetryl Production Area, east of the TNT Ditch Complex, and west of the Acid Area. Disposal activities were confined to four discrete areas of the site, none of which extended beyond 12 acres in size. Historical records indicate landfilling took place in the Northern Gravel Pit during the period 1966 to 1984, and involved scrap metals, creosote-treated railroad ties, telephone poles, and construction/demolition debris. The three other pits received waste materials that do not appear to pose a threat to human health and the environment. The Remedial Action (RA) selected for the Site M13 was consolidation and capping into what is now called Landfill M13. Implementation of the remedy began in 2007 and was completed in 2008.

Landfill M13 comprises approximately 10.2 acres and is located in the northern part of Site M13 and within the MFG Groundwater Management Zone (GMZ). The current conceptual site model is that metals and benzo(a)pyrene in groundwater may be present as a result of leaching of waste materials in the Northern Gravel Pit. The explosives present in groundwater are far more likely to be present due to infiltration of wastewater in the TNT Ditch. There is no evidence to suggest explosive compounds were ever present in waste materials put into the pit. With the implementation of the RA at Site M13, it is anticipated that the landfill cap will prevent percolation of precipitation through waste consolidated in the landfill, and it is anticipated that contaminants in site groundwater will detach from the source areas and migrate as legacy plumes to the west. As such, concentrations are expected to decline with time.

Monitoring Locations

Groundwater sample points which are monitored at Landfill M13 during the semi-annual and annual sampling events include:

- Upgradient Locations
  - MW806
  - MW807
- Downgradient Locations
  - MW126R
  - MW362
  - MW808
  - MW809
  - MW811

3.0 INSPECTION RESULTS

The inspection at Landfill M13 was conducted on 01 March 2017. This Report includes copies of the inspection checklist, photographs, and recommendations. The Post-closure Inspection Checklist is included in Attachment 1, and Inspection Photographs – Landfill M13 are included in Attachment 2.

The cap for Landfill M13 was last mowed October 2016. The vegetative cover is well established. Additionally, fence-to-fence mowing was completed. The vegetation was cut to between approximately 4 to 6 inches in height. The rip rap along the perimeter of the landfill was mowed to the extent possible. Woody vegetation outside of the landfill cap which continue to show signs of life in October was spot-treated using a stronger dyed herbicide.

No evidence of damage due to burrowing animals was observed.

The perimeter fence and site postings were in good condition. The fence post on the north side of the entrance gate is loose and requires additional support.

During the inspection there was no indication of the following:

- Depressions indicating subsidence or other deformations that could breach the cover.
- Erosion features.

During the inspection there was no indication of the following activities:

- Development
- Intrusive work
- Excavation that could mobilize COCs
- Alteration of surface water flow
- Vehicle use other than that associated with maintenance of the cover/cap.

4.0 RECOMMENDATIONS

The deficiencies noted within this Report which need to be addressed include the following:

Landfill M13:

- Fence-to-fence mowing will be completed during April 2017.
- The fence post on the north side of the entry gate will be supported during the April 2017 sampling event.

Attachment 1

Post-closure Inspection Checklist

JOAAP LANDFILL INSPECTION CHECKLIST			
Landfill Designation: M13		Date of Inspection: March 1, 2017	
Inspected By: Jeff Ramsby, Stantec		Weather Conditions: Cloudy, Very Windy, 41 deg.	
Names of those present at inspection: Matt Riley and Craig Coombs – USACE COR and PM			
Checklist	Yes	No	Explanation
Site Security			
a. Was fencing, gates and signs in good condition?		√	Post for north gate needs supporting in April.
b. Were gates locked?	√		
c. Evidence of trespassing		√	
Landfill Cover			
d. Evidence of Settling and/or Ponding?		√	
e. Any desiccation or cracking detected?		√	
f. Erosion around cap?		√	
g. Animal burrowing detected?		√	
Vegetation Condition			
h. Is vegetation well established?	√		
i. Evidence of vegetation detrimental to cap?		√	
Landfill structures			
j. Evidence of damage to monitoring wells?		√	
k. Evidence of damage to gas vents?		√	
Field Conclusions			
l. Is there an imminent hazard to the integrity of the unit?		√	
m. Are repairs necessary?	√		Gate post as described above
Certification			
Inspector Signature:		Printed Name: Jeff Ramsby	
Title: Lead Supervising Hydrogeologist		Date: March 1, 2017	

Attachment 2

Inspection Photographs – Landfill M13

Landfill M13 – Northwest Perimeter Area, Looking North from Near Northwest Corner of Landfill

Landfill M13 – North Side of Landfill, Looking East from Northwest Corner of Landfill

Landfill M13 – Top of Landfill, Looking Southeast from Northwest Corner of Landfill

Landfill M13 – West Side of Landfill, Looking South from Northwest Corner of Landfill

Landfill M13 – Southwest Corner of Landfill, Looking Northeast from Southwest Perimeter Area

Landfill M13 – West End of South Side of Landfill, Looking East from Southwest Perimeter Area

Landfill M13 – Top of Landfill, Looking Northeast from near Southwest Corner of Landfill

Landfill M13 – East End of South Side of Landfill, Looking East from Center of South Side of Landfill

Landfill M13 – East End of South Side of Landfill, Looking West from Southeast Corner of Landfill

Landfill M13 – East Side of Landfill, Looking North from Southeast Corner of Landfill

Landfill M13 – Top of Landfill, Looking West from near Center of East Side of Landfill

Landfill M13 – East Side of Landfill, Looking South from Northeast Corner of Landfill

Landfill M13 – Southeast Corner of Landfill, Looking Southwest from Northeast Perimeter Area

Landfill M13 – North Side of Landfill, Looking West from Northeast Corner of Landfill

A2 – POST-CLOSURE LANDFILL INSPECTION REPORT – APRIL 2017

Former Joliet Army Ammunition Plant
Will County, Illinois

Appendix A2
Post-closure Landfill Inspection Report
April 2017

Long-Term Monitoring, Deed Restriction Implementation Plan, and CERCLA Five-Year Review

Prepared For:
U.S. Army Environmental Command under Contract with the U.S. Army Corps Of Engineers

Firm Fixed Price Contract
W912QR-15-C-0016

April 2017

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4.0 RECOMMENDATIONS 5

LIST OF ATTACHMENTS

Attachment

1 Post-closure Inspection Checklist

2 Inspection Photographs – Landfill M13

ACRONYMS AND ABBREVIATIONS

COC	contaminant of concern
GMZ	Groundwater Management Zone
IAC	Illinois Administrative Code
IEA/MWH JV	IEA, Inc./MWH Americas, Inc.
JOAAP	former Joliet Army Ammunition Plant
LTM Plan	Final Long-term Monitoring Plan for Environmental Remediation Services (MWH/TolTest, March 2010)
MFG	Manufacturing Area
RA	Remedial Action
Report	Post-closure Landfill Inspection Report, April 2017
USACE	United States Army Corps Of Engineers – Louisville District
USAEC	United States Army Environmental Command

1.0 INTRODUCTION

IEA, Inc./MWH Americas, Inc. (IEA/MWH JV) has been retained by the United States Army Corps Of Engineers – Louisville District (USACE) on behalf of the United States Army Environmental Command (USAEC) to conduct environmental services at the former Joliet Army Ammunition Plant (JOAAP), Will County, Illinois. Work will be executed under Firm Fixed Price Contract No. W912QR-15-C-0016, which includes quarterly inspection of the condition of Landfill M13 and annual inspection of Landfill M11, located at JOAAP. This Post-closure Landfill Inspection Report, April 2017 (Report) documents the conditions identified during the inspection of Landfill M13, conducted in April 2017.

Post-closure monitoring requirements for Landfills M13 and M11 are mandated by Illinois Administrative Code (IAC) Title 5, Subtitle G, Chapter 1, Subchapter c, Part 724, Subpart G, for 15 years at Landfill M13 and 30 years at Landfill M11.

According to the *Final Long-term Monitoring Plan for Environmental Remediation Services* (LTM Plan [MWH/TolTest, March 2010]):

- Section 4.2.2.3.2, *"According to IAC, the Landfill M11 cover will be inspected quarterly for the first five years and then annually for 25 years."*
- Section 4.2.3.2, *"Long-term monitoring of the landfill cap (M13) will include quarterly inspections of the cap, …"*

Landfill inspections have been generally conducted on a quarterly basis at Landfills M13 and M11 from October 2008 through December 2014 in accordance with the LTM Plan. Quarterly inspections at Landfill M11 ended in 2014, and will subsequently be conducted annually, generally during the fall annual groundwater sampling event.

Inspection objectives include:

- Confirm that the landfill cap has controlled leaching so that water quality will not be threatened in the future.
- Ensure that the cap is maintained in a manner that will not increase infiltration in the future or otherwise allow waste to be exposed.
- Keep survey points protected and visible to facilitate identification in the future.
- At M13, ensure the fence and signage installed to restrict site access remain in place and serviceable.
- At M13, certify that institutional controls remain in place.

According to IAC and the LTM Plan, Landfills M13 and M11 covers will be inspected for:

- Depressions indicating subsidence or other deformations that could breach the cover.
- Erosion features.

- Growth of deep-rooted vegetation or invasive species that would adversely affect evapotranspiration and/or erosion armoring.
- Debris or blockage of drainage structure.

Any damages or changes noted will be repaired to comply with the final design specifications for the cover.

In addition, land use restrictions have been imposed across the area within the fence. Annual certification is required to document that none of the following are occurring within the fence:

- Development
- Intrusive work
- Excavation that could mobilize contaminants of concern (COC)
- Alteration of surface water flow
- Vehicle use other than that associated with maintenance of the cover/cap.

2.0 LANDFILL M13 DESCRIPTION

Site M13 comprises approximately 106 acres of the central part of the Manufacturing Area (MFG) formerly known as the gravel pits. It lies north of the Tetryl Production Area, east of the TNT Ditch Complex, and west of the Acid Area. Disposal activities were confined to four discrete areas of the site, none of which extended beyond 12 acres in size. Historical records indicate landfilling took place in the Northern Gravel Pit during the period 1966 to 1984 and involved scrap metals, creosote-treated railroad ties, telephone poles, and construction/demolition debris. The three other pits received waste materials that do not appear to pose a threat to human health and the environment. The Remedial Action (RA) selected for the Site M13 was consolidation and capping into what is now called Landfill M13. Implementation of the remedy began in 2007 and was completed in 2008.

Landfill M13 comprises approximately 10.2 acres and is located in the northern part of Site M13 and within the MFG Groundwater Management Zone (GMZ). The current conceptual site model is that metals and benzo(a)pyrene in groundwater may be present as a result of leaching of waste materials in the Northern Gravel Pit. The explosives present in groundwater are far more likely to be present due to infiltration of wastewater in the TNT Ditch. There is no evidence to suggest explosive compounds were ever present in waste materials put into the pit. With the implementation of the RA at Site M13, it is anticipated that the landfill cap will prevent percolation of precipitation through waste consolidated in the landfill, and it is anticipated that contaminants in site groundwater will detach from the source areas and migrate as legacy plumes to the west. As such, concentrations are expected to decline with time.

Monitoring Locations

Groundwater sample points which are monitored at Landfill M13 during the semi-annual and annual sampling events include:

- Upgradient Locations
  - MW806
  - MW807
- Downgradient Locations
  - MW126R
  - MW362
  - MW808
  - MW809
  - MW811

3.0 INSPECTION RESULTS

The inspection at Landfill M13 was conducted on 26 April 2017. This Report includes copies of the inspection checklist, photographs, and recommendations. The Post-closure Inspection Checklist is included in Attachment 1, and Inspection Photographs – Landfill M13 are included in Attachment 2.

The cap for Landfill M13 was mowed in April 2017. The vegetative cover is well established. Additionally, fence-to-fence mowing was completed. The vegetation was cut to between approximately 4 to 6 inches in height. The rip rap along the perimeter of the landfill was mowed to the extent possible and sprayed with 2,4-D. Woody vegetation outside of the landfill cap that continued to show signs of life was spot-treated using a stronger dyed herbicide.

No evidence of damage due to burrowing animals was observed.

The perimeter fence and site postings were in good condition. The north fence post for the gate was further supported with T-bar fence posts in April.

During the inspection there was no indication of the following:

- Depressions indicating subsidence or other deformations that could breach the cover.
- Erosion features.

During the inspection there was no indication of the following activities:

- Development
- Intrusive work
- Excavation that could mobilize COCs
- Alteration of surface water flow (see above)
- Vehicle use other than that associated with maintenance of the cover/cap.

4.0 RECOMMENDATIONS

The deficiencies noted within this Report which need to be addressed include the following:

Landfill M13:

- Fence-to-fence mowing will be completed during October 2017.

Attachment 1
Post-closure Inspection Checklist

JOAAP LANDFILL INSPECTION CHECKLIST			
Landfill Designation: M13		Date of Inspection: April 26, 2017	
Inspected By: Jeff Ramsby, Stantec		Weather Conditions: Pt. Cloudy, 77 deg.	
Names of those present at inspection: Todd Milburn - IEA			
Checklist	Yes	No	Explanation
Site Security			
a. Was fencing, gates and signs in good condition?		√	Post for north gate braced using T-bar fence posts attached to existing post.
b. Were gates locked?	√		
c. Evidence of trespassing		√	
Landfill Cover			
d. Evidence of Settling and/or Ponding?		√	
e. Any desiccation or cracking detected?		√	
f. Erosion around cap?		√	
g. Animal burrowing detected?		√	
Vegetation Condition			
h. Is vegetation well established?	√		
i. Evidence of vegetation detrimental to cap?		√	
Landfill structures			
j. Evidence of damage to monitoring wells?		√	
k. Evidence of damage to gas vents?		√	
Field Conclusions			
l. Is there an imminent hazard to the integrity of the unit?		√	
m. Are repairs necessary?		√	
Certification			
Inspector Signature:		Printed Name: Jeff Ramsby	
Title: Hydrogeologist		Date: April 26, 2017	

Attachment 2
Inspection Photographs – Landfill M13

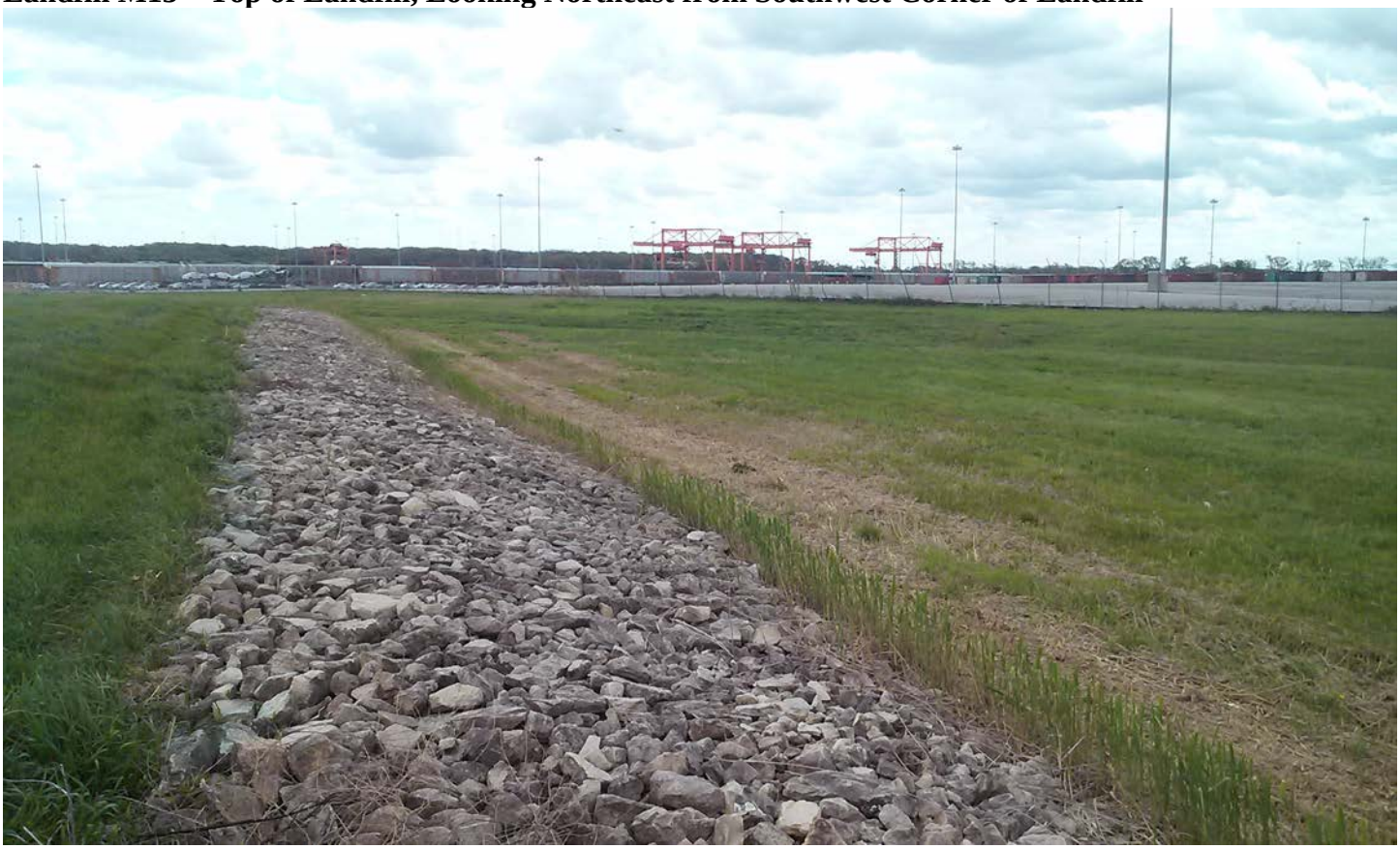
Landfill M13 – North Side of Landfill, Looking East from Northwest Corner of Landfill

Landfill M13 – Top of Landfill, Looking Southeast from Northwest Corner of Landfill

Landfill M13 – West Side of Landfill, Looking South from Northwest Corner of Landfill

Landfill M13 – West Side of Landfill, Looking North from Southwest Corner of Landfill

Landfill M13 – Top of Landfill, Looking Northeast from Southwest Corner of Landfill



Landfill M13 – South Side of Landfill, Looking East from Southwest Corner of Landfill

Landfill M13 – Top of Landfill, Looking North from Middle of South Side of Landfill

Landfill M13 – South Side of Landfill, Looking West from Southeast Corner of Landfill

Landfill M13 – Top of Landfill, Looking Northwest from Southeast Corner of Landfill

Landfill M13 – East Side of Landfill, Looking North from Southeast Corner of Landfill

Landfill M13 – East Side of Landfill, Looking South from Northeast Corner of Landfill

APPENDIX B

DATA REPORTS

B1 – Data Validation Report
B2 – Data Usability Report

B1 – DATA VALIDATION REPORT

LABORATORY DATA CONSULTANTS, INC.
2701 Loker Ave. West, Suite 220, Carlsbad, CA 92010 Bus: 760-827-1100 Fax: 760-827-1099

Stantec
35055 W. 12 Mile Rd., Suite 140
Farmington Hills, MI 48331
ATTN: Ms. Linda Goad

June 28, 2017

SUBJECT: Joliet Army Ammunition Plant (JOAAP), Data Validation

Dear Ms. Goad,

Enclosed are the final validation reports for the fractions listed below. These SDGs were received on June 2, 2017. Attachment 1 is a summary of the samples that were reviewed for each analysis.

LDC Project #38831:

SDG #	**Fraction**
SD25024,SD25025,SD27018	Volatiles, Semivolatiles, Explosives, Metals, Wet Chemistry

The data validation was performed under Level III & IV guidelines. The analyses were validated using the following documents, as applicable to each method:

- Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois, March 2016
- U.S. Department of Defense Quality Systems Manual for Environmental Laboratories, Version 5.0, July 2013
- USEPA, National Functional Guidelines for Superfund Organic Methods Data Review, August 2014
- USEPA, National Functional Guidelines for Inorganic Superfund Data Review, August 2014
- EPA SW 846, Third Edition, Test Methods for Evaluating Solid Waste, update 1, July 1992; update IIA, August 1993; update II, September 1994; update IIB, January 1995; update III, December 1996; update IIIA, April 1998; IIIB, November 2004; update IV, February 2007; update V, July 2014

Please feel free to contact us if you have any questions.

Sincerely,

Christina Rink

Christina Rink
Project Manager/Chemist

EDD 90/10

LDC #38831 (MWH Americas, Inc.-Detroit, MI / Joliet Army Ammunition Plant (JOAAP))

Project # 10507707

LDC	SDG#	DATE REC'D	(3) DATE DUE	VOA (8260B)		SVOA (8270D)		Metals (6010C/ 7470A)		Expl. (8330A)		NO_3-N (9056A)		SO_4 (9056A)																							
Matrix:	Water/Soil			W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S	W	S
A	SD25024	06/02/17	06/23/17	-	-	-	-	-	-	17	0	-	-	12	0																						
A	SD25024	06/02/17	06/23/17	-	-	-	-	-	-	3	0	-	-	2	0																						
B	SD25025	06/02/17	06/23/17	8	0	7	0	7	0	7	0	7	0	7	0																						
B	SD25025	06/02/17	06/23/17	1	0	1	0	1	0	1	0	1	0	1	0																						
C	SD27018	06/02/17	06/23/17	-	-	-	-	-	-	4	0	-	-	-	-																						
Total	T/CR			9	0	8	0	8	0	32	0	8	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	87

Shaded cells indicate Level IV validation (all other cells are Level III validation). These sample counts do not include MS/MSD, and DUPs

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 26, 2017

Parameters: Sulfate

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25024

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M1-GWMW107**	SD25024-001**	Water	04/18/17
JP-M1-GWMW231**	SD25024-002**	Water	04/18/17
JP-M1-GWMW640	SD25024-003	Water	04/18/17
JP-M1-GWMW641	SD25024-004	Water	04/18/17
JP-M1-GWMW642	SD25024-005	Water	04/18/17
JP-M1-GWMW645	SD25024-006	Water	04/18/17
JP-M1-GWMW646	SD25024-007	Water	04/18/17
JP-M1-GWMW648	SD25024-008	Water	04/18/17
JP-M1-GWMW649	SD25024-009	Water	04/18/17
JP-M1-GWMW644	SD25024-010	Water	04/19/17
JP-M1-GWMW643	SD25024-011	Water	04/19/17
JP-M1-SW709	SD25024-012	Water	04/19/17
JP-M8-GWMW330	SD25024-013	Water	04/19/17
JP-M8-GWMW999	SD25024-014	Water	04/19/17
JP-M1-SW709MS	SD25024-012MS	Water	04/19/17
JP-M1-SW709MSD	SD25024-012MSD	Water	04/19/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Sulfate by Environmental Protection Agency (EPA) SW 846 Method 9056A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Initial Calibration

All criteria for the initial calibration were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
JP-M1-SW709MS/MSD (JP-M1-SW709)	Sulfate	-8.0 (87-112)	65 (87-112)	J (all detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Analyte	RPD (Limits)	Flag	A or P
JP-M1-SW709MS/MSD (JP-M1-SW709)	Sulfate	47 (≤15)	J (all detects)	A

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples JP-M8-GWMW330 and JP-M8-GWMW999 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M8-GWMW330	JP-M8-GWMW999				
Sulfate	510	510	0 (≤25)	-	-	-

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to MS/MSD %R and RPD, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Sulfate - Data Qualification Summary - SDG SD25024

Sample	Analyte	Flag	A or P	Reason
JP-M1-SW709	Sulfate	J (all detects)	A	Matrix spike/Matrix spike duplicate (%R)(RPD)

Joliet Army Ammunition Plant
Sulfate - Laboratory Blank Data Qualification Summary - SDG SD25024

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Sulfate - Field Blank Data Qualification Summary - SDG SD25024

No Sample Data Qualified in this SDG

LDC #: 38831A6

SDG #: SD25024

Laboratory: Shealy Environmental Services, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 06/20/17

Page: 1 of 1

Reviewer: AIL

2nd Reviewer: a

METHOD: (Analyte) Sulfate (EPA SW846 Method 9056A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	A	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	SW	
VII.	Duplicate sample analysis	N	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	13,14
X.	Sample result verification	A	Not reviewed for Level III validation.
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	JP-M1-GWMW107**	SD25024-001**	Water	04/18/17
2	JP-M1-GWMW231**	SD25024-002**	Water	04/18/17
3	JP-M1-GWMW640	SD25024-003	Water	04/18/17
4	JP-M1-GWMW641	SD25024-004	Water	04/18/17
5	JP-M1-GWMW642	SD25024-005	Water	04/18/17
6	JP-M1-GWMW645	SD25024-006	Water	04/18/17
7	JP-M1-GWMW646	SD25024-007	Water	04/18/17
8	JP-M1-GWMW648	SD25024-008	Water	04/18/17
9	JP-M1-GWMW649	SD25024-009	Water	04/18/17
10	JP-M1-GWMW644	SD25024-010	Water	04/19/17
11	JP-M1-GWMW643	SD25024-011	Water	04/19/17
12	JP-M1-SW709	SD25024-012	Water	04/19/17
13	JP-M8-GWMW330	SD25024-013	Water	04/19/17
14	JP-M8-GWMW999	SD25024-014	Water	04/19/17
15	JP-M1-SW709MS	SD25024-012MS	Water	04/19/17
16	JP-M1-SW709MSD	SD25024-012MSD	Water	04/19/17
17				

DC #: 38831AG

VALIDATION FINDINGS CHECKLIST

Reviewer: AM
2nd Reviewer: [illegible]

Method: Inorganics (EPA Method See cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
II. Calibration				
Were all instruments calibrated daily, each set-up time?		✓		
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.		✓		
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.		✓		
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?		✓		

.DC #: 38831A6

VALIDATION FINDINGS CHECKLIST

Reviewer: ATL
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 38831A6

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: ATL
2nd Reviewer: [illegible]

METHOD: Inorganics, EPA Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a matrix spike analyzed for each matrix in this SDG? 87-112

Y N N/A Were matrix spike percent recoveries (%R) within the control limits of 75-125? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water samples and ≤35% for soil samples?

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	MS/MSD ID	Matrix	Analyte	MS %Recovery	MSD %Recovery	RPD (Limits)	Associated Samples	Qualifications
	15/16	W	SO4	-8.0 (87-112)	65 (87-112)		12	J/R/A (detect)
	15/16	W	SO4			47 (0-15)	12	Jdet/A (detect)

Comments:

LDC# 38831A6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: ATL
2nd Reviewer:

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤25)	
	13	14		
Sulfate	510	510	0	

\\LDCFILESERVER\Validation\FIELD DUPLICATES\FD_inorganic\2017\38831A6.wpd

LDC #: 38831A6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Reviewer: ATV
2nd Reviewer: [illegible]

Method: Inorganics, Method see cover

The correlation coefficient (r) for the calibration of SO_4^- was recalculated. Calibration date: 04/04/17

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

$$\%R = \frac{\text{Found} \times 100}{\text{True}}$$

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (mg/l)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	SO_4^-	s1	0	0.4125	*0.999778*	0.999940	Y
		s2	0.5	0.7562			
		s3	1	0.8978			
		s4	2	1.4061			
		s5	5	2.3113			
		s6	10	4.1665			
		s7	25	9.9507			
		s8	50	18.6925			
ICV (04/04 @ 21:08) Calibration verification	SO_4^-	FOUND 21.24	TRUE 20		106	106	Y
CCV (04/27 @ 03:48) Calibration verification	SO_4^-	23.49	25		94	94	Y
CCV (04/27 @ 01:24) Calibration verification	SO_4^-	24.67	25		99	99	Y

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831A6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: ATL
2nd Reviewer: [illegible]

METHOD: Inorganics, Method see cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS (04/26 @ 19:34)	Laboratory control sample (batch 40712)	SO_4^-	21	20	107	107	Y
15	Matrix spike sample MS	SO_4^-	(SSR-SR) -7	20	-~~8~~ 35	-8	Y
15/16	Duplicate sample MS/MSD	SO_4^-	53	33	47	47	Y

Comments:

TOTCLC.6

LDC #: 38831A6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: ATL
2nd reviewer: [illegible]

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for SO_4^- reported with a positive detect were recalculated and verified using the following equation:

Concentration = $A(2.73733887) - 1.517970$

Recalculation: #1 $[16.378(2.73733887) - 1.517970] \times 100 = 4331$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	1	SO4	4300	4300	Y
	2	SO4	30000	30000	Y

Note:

LDC #: 38831

EDD POPULATION COMPLETENESS WORKSHEET

Date: 6/27
Page: 1 of 1
2nd Reviewer:

The LDC job number listed above was entered by BA.

	EDD Process		Comments/Action
I.	EDD Completeness	-	
Ia.	- All methods present?	Y	
Ib.	- All samples present/match report?	Y	
Ic.	- All reported analytes present?	Y	
Id.	- 10% or 100% verification of EDD?	Y	
II.	EDD Preparation/Entry	-	
IIa.	- Carryover U/J?	N	
IIb.	- Reason Codes used? If so, note which codes.	N	
IIc.	- Additional Information (QC Level, Validator, Validated Y/N, etc.)	N	
III.	Reasonableness Checks	-	
IIIa.	- Do all qualified ND results have ND qualifier (e.g. UJ)?	Y	
IIIb.	- Do all qualified detect results have detect qualifier (e.g. J)?	Y	
IIIc.	- If reason codes are used, do all qualified results have reason code field populated, and vice versa?	N/A	
IIId.	-Does the detect flag require changing for blank qualifier? If so, are all U results marked ND?	↓	
IIIe.	- Do blank concentrations in report match EDD where data was qualified due to blank contamination?	Y	
IIIf.	- Were multiple results reported due to dilutions/reanalysis? If so, were results qualified appropriately?	N/A	
IIIg.	-Are there any discrepancies between the data packet and the EDD?	N	

Notes: *see discrepancy sheet

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 22, 2017

Parameters: Explosives

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25024

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M6-GWMW654**	SD25024-015**	Water	04/20/17
JP-M6-GWMW652**	SD25024-016**	Water	04/20/17
JP-M6-GWMW313	SD25024-017	Water	04/20/17
JP-M6-GWMW998**	SD25024-018**	Water	04/20/17
JP-M6-GWMW997	SD25024-019	Water	04/20/17
JP-M6-GWMW212R	SD25024-020	Water	04/20/17
JP-M6-GWMW162R	SD25024-021	Water	04/20/17
JP-M6-GWMW123R	SD25024-022	Water	04/20/17
JP-M6-GWMW318	SD25024-023	Water	04/21/17
JP-M6-GWMW319	SD25024-024	Water	04/21/17
JP-OA-GWMW117	SD25024-025	Water	04/21/17
JP-OA-GWMW118	SD25024-026	Water	04/21/17
JP-OA-GWMW119	SD25024-027	Water	04/21/17
JP-L3-GWMW630	SD25024-028	Water	04/22/17
JP-L3-GWMW631	SD25024-029	Water	04/22/17
JP-L3-GWMW633	SD25024-030	Water	04/22/17
JP-L3-GWMW412	SD25024-031	Water	04/22/17
JP-L3-SW777	SD25024-032	Water	04/22/17
JP-L1-GWWESI	SD25024-033	Water	04/22/17
JP-L1-GWMW131	SD25024-034	Water	04/22/17
JP-M6-GWMW654MS	SD25024-015MS	Water	04/20/17
JP-M6-GWMW654MSD	SD25024-015MSD	Water	04/20/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Explosives by Environmental Protection Agency (EPA) SW 846 Method 8330A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detect at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
JP-L3-GWMW630 JP-L3-GWMW631 JP-L3-GWMW633 JP-L3-GWMW412 JP-L3-SW777 JP-L1-GWWESI JP-L1-GWMW131	All compounds	12	7	J (all detects) UJ (all non-detects)	P

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 15.0% for all compounds.

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Detector	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
JP-M6-GWMW318	DB35MS DBXLB	1,2-Dinitrobenzene	182 (83-119) 142 (83-119)	All compounds	J (all detects)	P
JP-M6-GWMW319	DB35MS	1,2-Dinitrobenzene	197 (83-119)	All compounds	J (all detects)	P
JP-OA-GWMW117	DBXLB	1,2-Dinitrobenzene	81 (83-119)	All compounds	J (all detects) UJ (all non-detects)	P
JP-OA-GWMW118	DBXLB	1,2-Dinitrobenzene	82 (83-119)	All compounds	UJ (all non-detects)	P
JP-OA-GWMW119	DBXLB	1,2-Dinitrobenzene	78 (83-119)	All compounds	UJ (all non-detects)	P
JP-L3-GWMW633	DBXLB	1,2-Dinitrobenzene	81 (83-119)	All compounds	J (all detects) UJ (all non-detects)	P
JP-L1-GWWESI	DBXLB	1,2-Dinitrobenzene	474 (83-119)	All compounds	J (all detects)	P
JP-L1-GWMW131	DBXLB DB35MS	1,2-Dinitrobenzene	64 (83-119) 126 (83-119)	All compounds	J (all detects) UJ (all non-detects)	P

Surrogate recoveries (%R) were not within QC limits for sample JP-M6-GWMW652**. No data were qualified for samples analyzed at greater than or equal to 5X dilution.

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
JP-M6-GWMW654MS/MSD (JP-M6-GWMW654**)	2-Amino-4,6-Dinitrotoluene 1,3-Dinitrobenzene 2,4-Dinitrotoluene 2,6-Dinitrotoluene Nitrobenzene 2-Nitrotoluene 3-Nitrotoluene	- - - - - - -	71 (79-120) 73 (78-120) 62 (78-120) 18 (77-127) 16 (65-134) 17 (70-127) 12 (73-125)	J (all detects) UJ (all non-detects)	A

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
JP-M6-GWMW654MS/MSD (JP-M6-GWMW654**)	4-Nitrotoluene	-	0 (71-127)	R (all non-detects)	A

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
JP-M6-GWMW654MS/MSD (JP-M6-GWMW654**)	2,6-Dinitrotoluene 3-Nitrotoluene	57 (≤30) 130 (≤30)	J (all detects) J (all detects)	A

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples JP-M6-GWMW654** and JP-M6-GWMW998** and samples JP-M6-GWMW652** and JP-M6-GWMW997 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M6-GWMW654**	JP-M6-GWMW998**				
4-Amino-2,6-Dinitrotoluene	32	31	3 (≤25)	-	-	-
2-Amino-4,6-Dinitrotoluene	28	27	4 (≤25)	-	-	-
2,4-Dinitrotoluene	0.20U	0.21	-	0.01 (≤0.60)	-	-
2,6-Dinitrotoluene	15	14	7 (≤25)	-	-	-
3-Nitrotoluene	1.3	1.2	-	0.1 (≤2.0)	-	-
RDX	0.32	0.41	-	0.09 (≤2.0)	-	-
2,4,6-Trinitrotoluene	10	10	0 (≤25)	-	-	-

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M6-GWMW652**	JP-M6-GWMW997				
2-Amino-4,6-Dinitrotoluene	100	88	13 (≤25)	-	-	-
2,4-Dinitrotoluene	2100	1900	10 (≤25)	-	-	-
2,6-Dinitrotoluene	800	720	11 (≤25)	-	-	-
2-Nitrotoluene	9700	8700	11 (≤25)	-	-	-
3-Nitrotoluene	1100	950	15 (≤25)	-	-	-
4-Nitrotoluene	6700	6000	11 (≤25)	-	-	-
2,4,6-Trinitrotoluene	310	280	10 (≤25)	-	-	-

X. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
JP-M6-GWMW998**	2,4-Dinitrotoluene	75.3	J (all detects)	A
JP-M6-GWMW318	1,3,5-Trinitrobenzene	102.8	J (all detects)	A
JP-M6-GWMW319	1,3,5-Trinitrobenzene 2,4,6-Trinitrotoluene	108.0 131.4	J (all detects) J (all detects)	A
JP-OA-GWMW117	2-Nitrotoluene	106.5	J (all detects)	A
JP-L1-GWWESI	4-Amino-2,6-Dinitrotoluene	59.7	J (all detects)	A
JP-L1-GWMW131	2,6-Dinitrotoluene	180.6	J (all detects)	A

XI. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method.

Due to MS/MSD %R, data were rejected in one sample.

Due to technical holding time, surrogate %R, MS/MSD %R and RPD, and RPDs between two columns, data were qualified as estimated in twenty samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be rejected (R) are unusable for all purposes. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Explosives - Data Qualification Summary - SDG SD25024

Sample	Compound	Flag	A or P	Reason
JP-L3-GWMW630 JP-L3-GWMW631 JP-L3-GWMW633 JP-L3-GWMW412 JP-L3-SW777 JP-L1-GWWESI JP-L1-GWMW131	All compounds	J (all detects) UJ (all non-detects)	P	Technical holding times
JP-M6-GWMW318 JP-M6-GWMW319 JP-L1-GWWESI	All compounds	J (all detects)	P	Surrogates (%R)
JP-OA-GWMW117 JP-OA-GWMW118 JP-OA-GWMW119 JP-L3-GWMW633 JP-L1-GWMW131	All compounds	J (all detects) UJ (all non-detects)	P	Surrogates (%R)
JP-M6-GWMW654**	2-Amino-4,6-Dinitrotoluene 1,3-Dinitrobenzene 2,4-Dinitrotoluene 2,6-Dinitrotoluene Nitrobenzene 2-Nitrotoluene 3-Nitrotoluene	J (all detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
JP-M6-GWMW654**	4-Nitrotoluene	R (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
JP-M6-GWMW654**	2,6-Dinitrotoluene 3-Nitrotoluene	J (all detects) J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
JP-M6-GWMW998**	2,4-Dinitrotoluene	J (all detects)	A	Compound quantitation (RPD between two columns)
JP-M6-GWMW318	1,3,5-Trinitrobenzene	J (all detects)	A	Compound quantitation (RPD between two columns)
JP-M6-GWMW319	1,3,5-Trinitrobenzene 2,4,6-Trinitrotoluene	J (all detects) J (all detects)	A	Compound quantitation (RPD between two columns)
JP-OA-GWMW117	2-Nitrotoluene	J (all detects)	A	Compound quantitation (RPD between two columns)
JP-L1-GWWESI	4-Amino-2,6-Dinitrotoluene	J (all detects)	A	Compound quantitation (RPD between two columns)
JP-L1-GWMW131	2,6-Dinitrotoluene	J (all detects)	A	Compound quantitation (RPD between two columns)

Joliet Army Ammunition Plant
Explosives - Laboratory Blank Data Qualification Summary - SDG SD25024

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Explosives - Field Blank Data Qualification Summary - SDG SD25024

No Sample Data Qualified in this SDG

LDC #: 38831A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 5/4/17

SDG #: SD25024 Level III/IV Page: 1 of 1

Laboratory: Shealy Environmental Services, Inc. Reviewer: 2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% r ICV ≤ 25%
III.	Continuing calibration	A	CCV ≤ 15%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D=1+4. 2+5.
X.	Compound quantitation RL/LOQ/LODs	SW	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
+ 1	JP-M6-GWMW654** D1	SD25024-015**	Water	04/20/17
+ 2	JP-M6-GWMW652** D2	SD25024-016**	Water	04/20/17
+ 3	JP-M6-GWMW313	SD25024-017	Water	04/20/17
+ 4	JP-M6-GWMW998** D1	SD25024-018**	Water	04/20/17
+ 5	JP-M6-GWMW997 D2	SD25024-019	Water	04/20/17
+ 6	JP-M6-GWMW212R	SD25024-020	Water	04/20/17
− 7	JP-M6-GWMW162R	SD25024-021	Water	04/20/17
− 8	JP-M6-GWMW123R	SD25024-022	Water	04/20/17
+ 9	JP-M6-GWMW318	SD25024-023	Water	04/21/17
+ 10	JP-M6-GWMW319	SD25024-024	Water	04/21/17
+ 11	JP-OA-GWMW117	SD25024-025	Water	04/21/17
− 12	JP-OA-GWMW118	SD25024-026	Water	04/21/17
− 13	JP-OA-GWMW119	SD25024-027	Water	04/21/17
+ 2 14	JP-L3-GWMW630	SD25024-028	Water	04/22/17
+ 2 15	JP-L3-GWMW631	SD25024-029	Water	04/22/17
+ 2 16	JP-L3-GWMW633	SD25024-030	Water	04/22/17
+ 17	JP-L3-GWMW412	SD25024-031	Water	04/22/17

LDC #: 38831A40 **VALIDATION COMPLETENESS WORKSHEET** Date: 6/14/17

SDG #: SD25024 Level III/IV Page: 2 of 2

Laboratory: Shealy Environmental Services, Inc. Reviewer: JVG

2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330A)

	Client ID	Lab ID	Matrix	Date
18 + 2	JP-L3-SW777	SD25024-032	Water	04/22/17
19 + 2	JP-L1-GWWESI	SD25024-033	Water	04/22/17
20 + 2	JP-L1-GWMW131	SD25024-034	Water	04/22/17
21	JP-M6-GWMW654MS	SD25024-015MS	Water	04/20/17
22	JP-M6-GWMW654MSD	SD25024-015MSD	Water	04/20/17
23				
24				
25				
26				
27				

Notes:

-1	40528 MB						
-2	41169 ↓						

LDC #: 38831A10

VALIDATION FINDINGS CHECKLIST

Page: 1 of 3
Reviewer: Q
2nd Reviewer: Q

Method: ____ GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
Were all the retention times within the acceptance windows?		✓		
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?		✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?		✓		
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		

LDC #: 38834A40

VALIDATION FINDINGS CHECKLIST

Reviewer: Q
2nd Reviewer: Q

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: ____GC ___HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	X. EPN	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	Y. Azinphos-methyl	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	Z. Coumaphos	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	AA. Parathion	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	BB. Trichloronate	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	CC. Trichlorinate	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	DD. Trifluralin	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	EE. Def	**8315A**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	FF. Prowl	A. Formaldehyde
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon	GG. Ethion	B. Acetaldehyde
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton	HH. Famphur	C. Benzaldehyde
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	II. Phosmet	D. Butyraldehyde
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	JJ. Tetrachlorvinphos	
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	KK. Demeton (total)	
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos		
P. Pyrene	P. Picric acid	P.	P. Fenthion		
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl		
R.	R. 3,5-Dinitroaniline		R. Trichlornate		
S.	S. 2-Nitrophenol		S. Merphos		
	T. 4-Nitrophenol		T. Stirofos		
	U. Picramic acid		U. Tokuthion		
	V. PETN		V. Fensulfothion		
			W. Bolstar		

Notes:_____

LST_r1.WPD

LDC #: 38831 A40

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: JVG
2nd Reviewer:

All circled dates have exceeded the technical holding times.
Y N N/A Were all cooler temperatures within validation criteria?

METHOD : ___ GC / HPLC

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
14-20	W	N	04/22/17	05/04/17	05/05/17	12	J/UJ/P
(MD +Det)							

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:	Water unpreserved:	Aromatic within 7 days, non-aromatic within 14 days of sample collection.
	Water preserved:	Both within 14 days of sample collection.
	Soils:	Both within 14 days of sample collection.
EXTRACTABLES:		
	Water:	Extracted within 7 days, analyzed within 40 days.
	Soil:	Extracted within 14 days, analyzed within 40 days.

LDC #: 38831 A40

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Reviewer: JVG
2nd Reviewer: a

METHOD: __ GC ✓ __ HPLC

Are surrogates required by the method? Yes ✓ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	2 (20x)	DB35MS/XLB	FF	0/83 (83-119)	No qual (dil)
	5			0/0 ( )	
				( )	
	9 (MD + Dct)	DB 35MS		187 ( )	J dets/P
		DB XLB		147 ( )	
				( )	
	10	DB 35MS		197 ( )	
				( )	
	11	DB XLB		81 ( )	J/UJ/P
				( )	
	12 (MD)			82 ( )	
				( )	
	13			78 ( )	
				( )	
	16 (MD + Dct)			81 ( )	
				( )	
	19			474 ( )	J dets/P
				( )	
	20			64 ( )	J/UJ/P
		DB 35MS		126 ( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 38831 A4o

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Reviewer: JVG
2nd Reviewer: a

METHOD: ___ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG?

Y N N/A Was an MS/MSD analyzed every 20 samples for each matrix or whenever a sample extraction was performed?

Y N N/A Were the MS/MSD percent recoveries (%R) and relative percent differences (RPD) within QC limits?

#	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
	21/22	I	( )	71 (79-120)	( )	1 (Det)	J/UJ/A
		D	( )	73 (78-120)	( )	(ND)	
		J	( )	62 ( )	( )		
		K	( )	18 (77-127)	( )	(Det)	
		F	( )	16 (65-134)	( )	(ND)	
		L	( )	17 (70-127)	( )		
		M	( )	12 (73-125)	( )	(Det)	
		N	( )	0 (71-127)	( )	(ND)	J/R/A
		K	( )	( )	57 (30)	(Det)	J dets/A
		M	( )	( )	130 ( )		
			( )	( )	( )		
		J, N, F, L, M	%RPD outside limits, non-detects in the sample				NA
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		
			( )	( )	( )		

LDC#: 38831A40

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: HPLC Explosives (EPA SW 846 Method 8330A)
Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤25%)	Difference (ug/L)	Difference (≤2xLOQ)	Qualifications (Parent Only)
	1	4				
H	32	31	3			
I	28	27	4			
J	0.20U	0.21		0.01	≤0.60	
K	15	14	7			
M	1.3	1.2		0.1	≤2.0	
B	0.32	0.41		0.09	≤2.0	
G	10	10	0			

Compound	Concentration (ug/L)		RPD (≤25%)	Difference (ug/L)	Difference (≤2xLOQ)	Qualifications (Parent Only)
	2	5				
I	100	88	13			
J	2100	1900	10			
K	800	720	11			
L	9700	8700	11			
M	1100	950	15			
N	6700	6000	11			
G	310	280	10			

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LDC #: 38831 A40

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ___ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications	
	A	1	181.3	J dets / A	(ND)
	A	3	121.9		(ND)
	J	4	75.3		
	C	9	102.8		
	C	10	108.0		
	G	↓	131.4		
	L	11	106.5		
	H	19	59.7		
	K	20	180.6	✓	

Comments: See sample calculation verification worksheet for recalculations

COMQUA%RPD2col_r1.wpd

LDC #: 38831A40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC _____ HPLC ✓

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound		Reported CF (60 std)	Recalculated CF (60 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	04/28/17	HMX	DB-35MS/LC02	208.0	208.4	215.8	215.8	11.0	11.0
			2,4-DNT	DB-35MS/LC02	612.0	611.7	613.5	613.5	4.5	4.5
			HMX	DB-XLB/LC01	631.0	630.7	652.6	652.6	15.3	15.3
			2,4-DNT	DB-XLB/LC01	2170.0	2170.1	2404.0	2404.0	12.3	12.3

LDC # 38831A40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC_____ HPLC ✓

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound		CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	008-0901	4/28/2017	HMX	DB-35MS/LC02	200.00	173.62	173.64	13.2	13.2
	ICV		2,4-DNT	DB-35MS/LC02	200.00	205.15	205.26	2.6	2.6
	008-1001	4/28/2017	HMX	DB-XLB/LC01	100.00	93.12	93.08	6.9	6.9
	ICV		2,4-DNT	DB-XLB/LC01	100.00	97.77	97.76	2.2	2.2

LDC #: 38831 A6

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: [illegible]

METHOD: __ GC / HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 1

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
FT	DB-XLB	10	8.852	89	89	2
	-35MS		10.495	105	105	

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

SURRCALCNew.wpd

LDC #: 28831A40

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC / HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 21 / 22

Compound		Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
		MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)											
Diesel	(8015)											
Benzene	(8021B)											
Methane	(RSK-175)											
2,4-D	(8151)											
Dinoseb	(8151)											
Naphthalene	(8310)											
Anthracene	(8310)											
HMX	(8330)	21.28	21.28	0	18.116	~~20.367~~ 19.082	85	85	90	90	5.2	5.2
2,4,6-Trinitrotoluene	(8330)	↓	↓	10	29.157	25.264	87	87	71	72	13	13
Phorate	(8141A)											
Malathion	(8141A)											
Formaldehyde	(8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 35831 A46

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: __ GC ✓ __ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: E LCS 28

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)	10	NA	7.5	NA	75	75				
2,4,6-Trinitrotoluene (8330)	↓	↓	8.5	↓	85	85				
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 A40

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd Reviewer: a

METHOD: __ GC ✓ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 2 Compound Name 2,4-DNT LC01

Concentration = (513552)(10 ml)(20) / (2404)(1L)(20 ml) = 21362 ≈ 2100 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			2100		

Comments:

SAMPCALCnew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 22, 2017

Parameters: Volatiles

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25025

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M13-GWMW126R	SD25025-001	Water	04/24/17
JP-M13-GWMW806	SD25025-002	Water	04/24/17
JP-M13-GWMW807	SD25025-003	Water	04/24/17
JP-M13-GWMW808	SD25025-004	Water	04/24/17
JP-M13-GWMW811	SD25025-005	Water	04/24/17
JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
JP-M13-GWMW362	SD25025-007	Water	04/24/17
JP-M13-GWMW809	SD25025-008	Water	04/24/17
TRIP BLANK	SD25025-009	Water	04/24/17
JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Volatile Organic Compounds (VOCs) by Environmental Protection Agency (EPA) SW 846 Method 8260B

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A bromofluorobenzene (BFB) tune was performed at 12 hour intervals. All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, the percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds.

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds.

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

Sample TRIP BLANK was identified as a trip blank. No contaminants were found.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

X. Field Duplicates

Samples JP-M13-GWMW996** and JP-M13-GWMW362 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M13-GWMW996**	JP-M13-GWMW362				
1,1-Dichloroethane	0.75	0.67	-	0.08 (≤2.0)	-	-
Tetrachloroethene	0.41	0.80U	-	0.39 (≤2.0)	-	-

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

The quality control criteria reviewed were met and are considered acceptable. Based upon the data validation all results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Volatiles - Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Volatiles - Laboratory Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Volatiles - Field Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

LDC #: 38831B1

SDG #: SD25025

Laboratory: Shealy Environmental Services, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 06/19/17

Page: 1 of 1

Reviewer: JVL

2nd Reviewer:

METHOD: GC/MS Volatiles (EPA SW846 Method 8260B)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A/A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A/A	ICAL ≤ 15% r² ICV ≤ 20%
IV.	Continuing calibration	A	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	ND	TB = 9
VII.	Surrogate spikes	A	
VIII.	Matrix spike/Matrix spike duplicates	A	
IX.	Laboratory control samples	A	LCS
X.	Field duplicates	SW	D = 6/7
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	JP-M13-GWMW126R	SD25025-001	Water	04/24/17
2	JP-M13-GWMW806	SD25025-002	Water	04/24/17
3	JP-M13-GWMW807	SD25025-003	Water	04/24/17
4	JP-M13-GWMW808	SD25025-004	Water	04/24/17
5	JP-M13-GWMW811	SD25025-005	Water	04/24/17
6	JP-M13-GWMW996** D	SD25025-006**	Water	04/24/17
7	JP-M13-GWMW362 D	SD25025-007	Water	04/24/17
8	JP-M13-GWMW809	SD25025-008	Water	04/24/17
9	TRIP BLANK	SD25025-009	Water	04/24/17
10	JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
11	JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17
12				
13	VBLK VU			

LDC #: 38831 B1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Volatiles (EPA SW 846 Method 8260B)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the BFB performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
Were all percent relative standard deviations (%RSD) ≤ 30%/15% and relative response factors (RRF) ≥ 0.05?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ 20% or percent recoveries (%R) 80-120%?	✓			
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) and relative response factors (RRF) within method criteria for all CCCs and SPCCs?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) ≥ 0.05?	✓			
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?	✓			
Were target compounds detected in the field blanks?		✓		
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?	✓			
If the percent recovery (%R) for one or more surrogates was out of QC limits, was a reanalysis performed to confirm samples with %R outside of criteria?			✓	

LDC #: 38831 B1

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

TARGET COMPOUND WORKSHEET

METHOD: VOA

A. Chloromethane	AA. Tetrachloroethene	AAA. 1,3,5-Trimethylbenzene	AAAA. Ethyl tert-butyl ether	A1. 1,3-Butadiene	A2.
B. Bromomethane	BB. 1,1,2,2-Tetrachloroethane	BBB. 4-Chlorotoluene	BBBB. tert-Amyl methyl ether	B1. Hexane	B2.
C. Vinyl choride	CC. Toluene	CCC. tert-Butylbenzene	CCCC. 1-Chlorohexane	C1. Heptane	C2.
D. Chloroethane	DD. Chlorobenzene	DDD. 1,2,4-Trimethylbenzene	DDDD. Isopropyl alcohol	D1. Propylene	D2.
E. Methylene chloride	EE. Ethylbenzene	EEE. sec-Butylbenzene	EEEE. Acetonitrile	E1. Freon 11	E2.
F. Acetone	FF. Styrene	FFF. 1,3-Dichlorobenzene	FFFF. Acrolein	F1. Freon 12	F2.
G. Carbon disulfide	GG. Xylenes, total	GGG. p-Isopropyltoluene	GGGG. Acrylonitrile	G1. Freon 113	G2.
H. 1,1-Dichloroethene	HH. Vinyl acetate	HHH. 1,4-Dichlorobenzene	HHHH. 1,4-Dioxane	H1. Freon 114	H2.
I. 1,1-Dichloroethane	II. 2-Chloroethylvinyl ether	III. n-Butylbenzene	IIII. Isobutyl alcohol	I1. 2-Nitropropane	I2.
J. 1,2-Dichloroethene, total	JJ. Dichlorodifluoromethane	JJJ. 1,2-Dichlorobenzene	JJJJ. Methacrylonitrile	J1. Dimethyl disulfide	J2.
K. Chloroform	KK. Trichlorofluoromethane	KKK. 1,2,4-Trichlorobenzene	KKKK. Propionitrile	K1. 2,3-Dimethyl pentane	K2.
L. 1,2-Dichloroethane	LL. Methyl-tert-butyl ether	LLL. Hexachlorobutadiene	LLLL. Ethyl ether	L1. 2,4-Dimethyl pentane	L2.
M. 2-Butanone	MM. 1,2-Dibromo-3-chloropropane	MMM. Naphthalene	MMMM. Benzyl chloride	M1. 3,3-Dimethyl pentane	M2.
N. 1,1,1-Trichloroethane	NN. Methyl ethyl ketone	NNN. 1,2,3-Trichlorobenzene	NNNN. Iodomethane	N1. 2-Methylpentane	N2.
O. Carbon tetrachloride	OO. 2,2-Dichloropropane	OOO. 1,3,5-Trichlorobenzene	OOOO.1,1-Difluoroethane	O1. 3-Methylpentane	O2.
P. Bromodichloromethane	PP. Bromochloromethane	PPP. trans-1,2-Dichloroethene	PPPP. Tetrahydrofuran	P1. 3-Ethylpentane	P2.
Q. 1,2-Dichloropropane	QQ. 1,1-Dichloropropene	QQQ. cis-1,2-Dichloroethene	QQQQ. Methyl acetate	Q1. 2,2-Dimethylpentane	Q2.
R. cis-1,3-Dichloropropene	RR. Dibromomethane	RRR. m,p-Xylenes	RRRR. Ethyl acetate	R1. 2,2,3- Trimethylbutane	R2.
S. Trichloroethene	SS. 1,3-Dichloropropane	SSS. o-Xylene	SSSS. Cyclohexane	S1. 2,2,4-Trimethylpentane	S2.
T. Dibromochloromethane	TT. 1,2-Dibromoethane	TTT. 1,1,2-Trichloro-1,2,2-trifluoroethane	TTTT. Methylcyclohexane	T1. 2-Methylhexane	T2.
U. 1,1,2-Trichloroethane	UU. 1,1,1,2-Tetrachloroethane	UUU. 1,2-Dichlorotetrafluoroethane	UUUU. Allyl chloride	U1. Nonanal	U2.
V. Benzene	VV. Isopropylbenzene	VVV. 4-Ethyltoluene	VVVV. Methyl methacrylate	V1. 2-Methylnaphthalene	V2.
W. trans-1,3-Dichloropropene	WW. Bromobenzene	WWW. Ethanol	WWWW. Ethyl methacrylate	W1. Methanol	W2.
X. Bromoform	XX. 1,2,3-Trichloropropane	XXX. Di-isopropyl ether	XXXX. cis-1,4-Dichloro-2-butene	X1. 1,2,3-Trimethylbenzene	X2.
Y. 4-Methyl-2-pentanone	YY. n-Propylbenzene	YYY. tert-Butanol	YYYY. trans-1,4-Dichloro-2-butene	Y1.	Y2.
Z. 2-Hexanone	ZZ. 2-Chlorotoluene	ZZZ. tert-Butyl alcohol	ZZZZ. Pentachloroethane	Z1.	Z2.

LDC#: 38831 B1

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC MS Volatiles (EPA SW 846 Method 8260B)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤25 %)	Difference (ug/L)	Limits	Qualifications (Parent Only)
	6	7				
~~H~~ I	0.75	0.67		0.08	(≤2.0)	
AA	0.41	0.80U		0.39	(≤2.0)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (ug/L)		RPD (≤25%)	Difference (ug/L)	Limits (≤LOQ)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

FD %Diff%RPD w.wpd

LDC #: 38831 B1

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer:

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 6

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane	50.0	51.534	103	103	0
1,2-Dichloroethane-d4		47.854	96	96	
Toluene-d8		49.936	100	100	
Bromofluorobenzene		46.947	94	94	

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Dibromofluoromethane					
1,2-Dichloroethane-d4					
Toluene-d8					
Bromofluorobenzene					

LDC #: 38831B1

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (50 std)	Recalculated RRF (50 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL MSD7	4/20/2017	cis-1,2-DCE (IS1)	0.6026	0.6026	0.5561	0.5561	6.2	6.2
			Trichloroethene (IS2)	0.3739	0.3739	0.3298	0.3298	10.5	10.5
			Tetrachloroethene (IS3)	0.3399	0.3399	0.2946	0.2946	12.2	12.2
			1,2,4-TCB (IS4)	1.2801	1.2801	1.1472	1.1472	8.2	8.2

LDC # 38831B1

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: G

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

Where:
ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,
Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF (Initial)	Reported RRF (CCV)	Recalculated RRF (CCV)	Reported % D	Recalculated %D
1	70427A02 MSD7	4/27/2017	cis-1,2-DCE (IS1)	0.5561	0.5579	0.5579	0.3	0.3
			Trichloroethene (IS2)	0.3298	0.3221	0.3221	2.4	2.4
			Tetrachloroethene (IS3)	0.2946	0.2851	0.2851	3.2	3.2
			1,2,4-TCB (IS4)	1.1472	1.0510	1.0510	8.4	8.4

LDC #: 38831 B1

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentration

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD sample: 10 A1

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
1,1-Dichloroethene	50.0	50.0	0	57.054	58.629	114	114	117	117	2.7	2.7
Trichloroethene				56.717	57.830	113	113	116	116	1.9	1.9
Benzene				54.053	55.312	108	108	111	111	2.3	2.3
Toluene				54.867	56.573	110	110	113	113	3.0	3.0
Chlorobenzene				54.548	55.483	109	109	111	111	1.9	1.9

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 B1

VALIDATION FINDINGS WORKSHEET
Laboratory Control Sample Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratoy control sample and laboratory control sample duplicate (if applicable) were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * SSC/SA Where: SSC = Spiked sample concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC) LCSC = Laboraotry control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS ID: LCS 40641

Compound	Spike Added (ug/L)		Spiked Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalculated
1,1-Dichloroethene	50.0	NA	54.302	NA	109	109				
Trichloroethene			51.351		103	103				
Benzene			50.392		101	101				
Toluene			50.331		101	101				
Chlorobenzene			49.789		100	100				

Comments: Refer to Laboratory Control Sample findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 B1

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [signature]

METHOD: GC/MS VOA (EPA SW 846 Method 8260B)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(DF)}{(A_{is})(RRF)(V_o)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
RRF	=	Relative response factor of the calibration standard.
V_o	=	Volume or weight of sample pruged in milliliters (ml) or grams (g).
Df	=	Dilution factor.
%S	=	Percent solids, applicable to soils and solid matrices only.

Example:

Sample I.D. 6, AA:

Conc. = (1302)(50)( )
(543900 (0.294615))( )( )

= 0.406

≈ 0.41 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			0.41		

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 22, 2017

Parameters: Semivolatiles

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25025

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M13-GWMW126R	SD25025-001	Water	04/24/17
JP-M13-GWMW806	SD25025-002	Water	04/24/17
JP-M13-GWMW807	SD25025-003	Water	04/24/17
JP-M13-GWMW808	SD25025-004	Water	04/24/17
JP-M13-GWMW811	SD25025-005	Water	04/24/17
JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
JP-M13-GWMW362	SD25025-007	Water	04/24/17
JP-M13-GWMW809	SD25025-008	Water	04/24/17
JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Semivolatile Organic Compounds (SVOCs) by Environmental Protection Agency (EPA) SW 846 Method 8270D

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met.

II. GC/MS Instrument Performance Check

A decafluorotriphenylphosphine (DFTPP) tune was performed at 12 hour intervals. All ion abundance requirements were met.

III. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average relative response factors (RRFs) were utilized, percent relative standard deviations (%RSD) were less than or equal to 15.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

Average relative response factors (RRF) for all compounds were within validation criteria.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
04/14/17	Pyridine	26.4	All samples in SDG SD25025	J (all detects) UJ (all non-detects)	A
	2,4,6-Trichlorophenol	20.3		J (all detects) UJ (all non-detects)	

IV. Continuing Calibration

Continuing calibration was performed at the required frequencies.

The percent differences (%D) were less than or equal to 20.0% for all compounds with the following exceptions:

Date	Compound	%D	Associated Samples	Flag	A or P
05/03/17	Pyridine	20.3	All samples in SDG SD25025	J (all detects) UJ (all non-detects)	A

All of the continuing calibration relative response factors (RRF) were within validation criteria.

V. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

VI. Field Blanks

No field blanks were identified in this SDG.

VII. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
JP-M13-GWMW809	2-Fluorobiphenyl	36 (44-119)	1,3-Dichlorobenzene	UJ (all non-detects)	A
	Nitrobenzene-d5	43 (44-120)	1,4-Dichlorobenzene	UJ (all non-detects)	
			1,2-Dichlorobenzene	UJ (all non-detects)	
			Bis(2-chloroisopropyl)ether	UJ (all non-detects)	
			N-Nitroso-di-n-propylamine	UJ (all non-detects)	
			Hexachloroethane	UJ (all non-detects)	
			Nitrobenzene	UJ (all non-detects)	
			Isophorone	UJ (all non-detects)	
			Bis(2-chloroethoxy)methane	UJ (all non-detects)	
			1,2,4-Trichlorobenzene	UJ (all non-detects)	
			Naphthalene	UJ (all non-detects)	
			4-Chloroaniline	UJ (all non-detects)	
			Hexachlorobutadiene	UJ (all non-detects)	
			2-Methylnaphthalene	UJ (all non-detects)	
			2-Chloronaphthalene	UJ (all non-detects)	
			2-Nitroaniline	UJ (all non-detects)	
			Dimethylphthalate	UJ (all non-detects)	
			Acenaphthylene	UJ (all non-detects)	
			2,6-Dinitrotoluene	UJ (all non-detects)	
			3-Nitroaniline	UJ (all non-detects)	
			Acenaphthene	UJ (all non-detects)	
			Dibenzofuran	UJ (all non-detects)	
			2,4-Dinitrotoluene	UJ (all non-detects)	
			Diethylphthalate	UJ (all non-detects)	
			4-Chlorophenyl-phenyl ether	UJ (all non-detects)	
			Fluorene	UJ (all non-detects)	
			4-Nitroaniline	UJ (all non-detects)	
			N-Nitrosodiphenylamine	UJ (all non-detects)	
			4-Bromophenyl-phenylether	UJ (all non-detects)	
			Hexachlorobenzene	UJ (all non-detects)	
			Phenanthrene	UJ (all non-detects)	
			Anthracene	UJ (all non-detects)	
			Di-n-butylphthalate	UJ (all non-detects)	
			Fluoranthene	UJ (all non-detects)	
			Pyrene	UJ (all non-detects)	
			Butylbenzylphthalate	UJ (all non-detects)	
			3,3'-Dichlorobenzidine	UJ (all non-detects)	
			Benzo(a)anthracene	UJ (all non-detects)	
			Chrysene	UJ (all non-detects)	
			Bis(2-ethylhexyl)phthalate	UJ (all non-detects)	
			Di-n-octylphthalate	UJ (all non-detects)	
			Benzo(b)fluoranthene	UJ (all non-detects)	

Sample	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
JP-M13-GWMW809 (continued)	2-Fluorobiphenyl	36 (44-119)	Benzo(k)fluoranthene	UJ (all non-detects)	A
			Benzo(a)pyrene	UJ (all non-detects)	
			Indeno(1,2,3-cd)pyrene	UJ (all non-detects)	
			Dibenzo(a,h)anthracene	UJ (all non-detects)	
			Benzo(g,h,i)perylene	UJ (all non-detects)	
			Benzyl alcohol	UJ (all non-detects)	
			Aniline	UJ (all non-detects)	
			Benzidine	UJ (all non-detects)	
			Hexachlorocyclopentadiene	UJ (all non-detects)	
			N-Nitrosodimethylamine	UJ (all non-detects)	
			1,2-Diphenylhydrazine	UJ (all non-detects)	
			bis(2-chloro-1-methylethyl)ether	UJ (all non-detects)	
			Carbazole	UJ (all non-detects)	
			Dibenzofuran	UJ (all non-detects)	
			Pyridine	UJ (all non-detects)	

Surrogate recoveries (%R) were not within QC limits for samples JP-M13-GWMW996** and JP-M13-GWMW362. Using professional judgment, no data were qualified when one base or one acid surrogate %R was outside the QC limits and the %R was greater than or equal to 10%.

VIII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	MS (%R) (Limits)	MSD (%R) (Limits)	Flag	A or P
JP-M13-GWMW126RMS/MSD (JP-M13-GWMW126R)	Acenaphthene	-	39 (47-122)	UJ (all non-detects)	A
	Anthracene	-	44 (57-123)	UJ (all non-detects)	
	Benzo(a)anthracene	-	54 (58-125)	UJ (all non-detects)	
	Benzo(a)pyrene	-	49 (54-128)	UJ (all non-detects)	
	Benzo(b)fluoranthene	-	49 (53-131)	UJ (all non-detects)	
	Benzo(k)fluoranthene	-	55 (57-129)	UJ (all non-detects)	
	4-Bromophenyl-phenyl ether	53 (55-124)	39 (55-124)	UJ (all non-detects)	
	Carbazole	-	53 (60-122)	UJ (all non-detects)	
	4-Chloro-3-methylphenol	-	40 (52-119)	UJ (all non-detects)	
	Bis(2-chloroethoxy)methane	-	42 (48-120)	UJ (all non-detects)	
	4-Chlorophenyl-phenyl ether	50 (53-121)	38 (53-121)	UJ (all non-detects)	
	Chrysene	-	57 (59-123)	UJ (all non-detects)	
	Dibenzo(a,h)anthracene	-	44 (51-134)	UJ (all non-detects)	
	Dibenzofuran	-	44 (53-118)	UJ (all non-detects)	
	2,4-Dichlorophenol	-	39 (47-121)	UJ (all non-detects)	
	Diethylphthalate	-	46 (56-125)	UJ (all non-detects)	
	Dimethylphthalate	-	44 (45-127)	UJ (all non-detects)	
	Di-n-butylphthalate	-	53 (59-127)	UJ (all non-detects)	
	4,6-Dinitro-2-methylphenol	-	43 (44-137)	UJ (all non-detects)	
	2,4-Dinitrotoluene	-	43 (57-128)	UJ (all non-detects)	
	2,6-Dinitrotoluene	56 (57-124)	42 (57-124)	UJ (all non-detects)	
	Di-n-octylphthalate	-	48 (51-140)	UJ (all non-detects)	
	1,2-Diphenylhydrazine	-	38 (49-122)	UJ (all non-detects)	
	Bis(2-ethylhexyl)phthalate	-	54 (55-135)	UJ (all non-detects)	
	Fluoranthene	-	53 (57-128)	UJ (all non-detects)	
	Fluorene	-	42 (52-124)	UJ (all non-detects)	
	Hexachlorobenzene	-	40 (53-125)	UJ (all non-detects)	
	2-Nitroaniline	54 (55-127)	42 (55-127)	UJ (all non-detects)	
	3-Nitroaniline	-	44 (41-128)	UJ (all non-detects)	
	4-Nitroaniline	-	54 (60-135)	UJ (all non-detects)	
	Nitrobenzene	-	44 (45-121)	UJ (all non-detects)	
	2-Nitrophenol	-	42 (47-123)	UJ (all non-detects)	
	4-Nitrophenol	-	41 (53-130)	UJ (all non-detects)	
	N-Nitroso-di-n-propylamine	-	48 (49-119)	UJ (all non-detects)	
	N-Nitrosodiphenylamine	-	42 (51-123)	UJ (all non-detects)	
	Phenanthrene	-	44 (59-120)	UJ (all non-detects)	
	Phenol	43 (49-117)	37 (49-117)	UJ (all non-detects)	
	Pyrene	-	53 (57-126)	UJ (all non-detects)	
	2,4,5-Trichlorophenol	51 (53-123)	39 (53-123)	UJ (all non-detects)	
	2,4,6-Trichlorophenol	-	40 (50-125)	UJ (all non-detects)	

Relative percent differences (RPD) were within QC limits with the following exceptions:

Spike ID (Associated Samples)	Compound	RPD (Limits)	Flag	A or P
JP-M13-GWMW126RMS/MSD (JP-M13-GWMW126R)	Pyridine	22 (≤20)	J (all detects)	A

IX. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits with the following exceptions:

LCS ID	Compound	%R (Limits)	Associated Samples	Flag	A or P
SLCS26	2,4,5-Trichlorophenol Phenol	50 (53-123) 47 (49-117)	All samples in SDG SD25025	UJ (all non-detects) UJ (all non-detects)	P

X. Field Duplicates

Samples JP-M13-GWMW996** and JP-M13-GWMW362 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M13-GWMW996**	JP-M13-GWMW362				
Benzoic acid	1.4	0.80U	-	0.6 ug/L (≤80)	-	-
2,4-Dinitrotoluene	2.1	2.3	-	0.2 ug/L (≤3.2)	-	-

XI. Internal Standards

All internal standard areas and retention times were within QC limits.

XII. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIII. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XIV. System Performance

The system performance was acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XV. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to ICV and continuing calibration %D, surrogate %R, MS/MSD %R and RPD, and LCS %R, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Semivolatiles - Data Qualification Summary - SDG SD25025

Sample	Compound	Flag	A or P	Reason
JP-M13-GWMW126R JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW808 JP-M13-GWMW811 JP-M13-GWMW996** JP-M13-GWMW362 JP-M13-GWMW809	Pyridine 2,4,6-Trichlorophenol	J (all detects) UJ (all non-detects) J (all detects) UJ (all non-detects)	A	Initial calibration verification (%D)
JP-M13-GWMW126R JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW808 JP-M13-GWMW811 JP-M13-GWMW996** JP-M13-GWMW362 JP-M13-GWMW809	Pyridine	J (all detects) UJ (all non-detects)	A	Continuing calibration (%D)

Sample	Compound	Flag	A or P	Reason
JP-M13-GWMW809	1,3-Dichlorobenzene	UJ (all non-detects)	A	Surrogates (%R)
	1,4-Dichlorobenzene	UJ (all non-detects)		
	1,2-Dichlorobenzene	UJ (all non-detects)		
	N-Nitroso-di-n-propylamine	UJ (all non-detects)		
	Hexachloroethane	UJ (all non-detects)		
	Nitrobenzene	UJ (all non-detects)		
	Isophorone	UJ (all non-detects)		
	Bis(2-chloroethoxy)methane	UJ (all non-detects)		
	1,2,4-Trichlorobenzene	UJ (all non-detects)		
	Naphthalene	UJ (all non-detects)		
	4-Chloroaniline	UJ (all non-detects)		
	Hexachlorobutadiene	UJ (all non-detects)		
	2-Nitroaniline	UJ (all non-detects)		
	Dimethylphthalate	UJ (all non-detects)		
	Acenaphthylene	UJ (all non-detects)		
	2,6-Dinitrotoluene	UJ (all non-detects)		
	3-Nitroaniline	UJ (all non-detects)		
	Acenaphthene	UJ (all non-detects)		
	Dibenzofuran	UJ (all non-detects)		
	2,4-Dinitrotoluene	UJ (all non-detects)		
	Diethylphthalate	UJ (all non-detects)		
	4-Chlorophenyl-phenyl ether	UJ (all non-detects)		
	Fluorene	UJ (all non-detects)		
	4-Nitroaniline	UJ (all non-detects)		
	N-Nitrosodiphenylamine	UJ (all non-detects)		
	4-Bromophenyl-phenylether	UJ (all non-detects)		
	Hexachlorobenzene	UJ (all non-detects)		
	Phenanthrene	UJ (all non-detects)		
	Anthracene	UJ (all non-detects)		
	Di-n-butylphthalate	UJ (all non-detects)		
	Fluoranthene	UJ (all non-detects)		
	Pyrene	UJ (all non-detects)		
	Butylbenzylphthalate	UJ (all non-detects)		
	3,3'-Dichlorobenzidine	UJ (all non-detects)		
	Benzo(a)anthracene	UJ (all non-detects)		
	Chrysene	UJ (all non-detects)		
	Bis(2-ethylhexyl)phthalate	UJ (all non-detects)		
	Di-n-octylphthalate	UJ (all non-detects)		
	Benzo(b)fluoranthene	UJ (all non-detects)		
	Benzo(k)fluoranthene	UJ (all non-detects)		
	Benzo(a)pyrene	UJ (all non-detects)		
	Indeno(1,2,3-cd)pyrene	UJ (all non-detects)		
	Dibenzo(a,h)anthracene	UJ (all non-detects)		
	Benzo(g,h,i)perylene	UJ (all non-detects)		
	Benzyl alcohol	UJ (all non-detects)		
	Aniline	UJ (all non-detects)		
	Benzidine	UJ (all non-detects)		
	Hexachlorocyclopentadiene	UJ (all non-detects)		
	N-Nitrosodimethylamine	UJ (all non-detects)		
	1,2-Diphenylhydrazine	UJ (all non-detects)		
	bis(2-chloro-1-methylethyl)ether	UJ (all non-detects)		
	Carbazole	UJ (all non-detects)		
	Pyridine	UJ (all non-detects)		

Sample	Compound	Flag	A or P	Reason
JP-M13-GWMW126R	Acenaphthene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene 4-Bromophenyl-phenyl ether Carbazole 4-Chloro-3-methylphenol Bis(2-chloroethoxy)methane 4-Chlorophenyl-phenyl ether Chrysene Dibenzo(a,h)anthracene Dibenzofuran 2,4-Dichlorophenol Diethylphthalate Dimethylphthalate Di-n-butylphthalate 4,6-Dinitro-2-methylphenol 2,4-Dinitrotoluene 2,6-Dinitrotoluene Di-n-octylphthalate 1,2-Diphenylhydrazine Bis(2-ethylhexyl)phthalate Fluoranthene Fluorene Hexachlorobenzene 2-Nitroaniline 3-Nitroaniline 4-Nitroaniline Nitrobenzene 2-Nitrophenol 4-Nitrophenol N-Nitroso-di-n-propylamine N-Nitrosodiphenylamine Phenanthrene Phenol Pyrene 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol	UJ (all non-detects) UJ (all non-detects)	A	Matrix spike/Matrix spike duplicate (%R)
JP-M13-GWMW126R	Pyridine	J (all detects)	A	Matrix spike/Matrix spike duplicate (RPD)
JP-M13-GWMW126R JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW808 JP-M13-GWMW811 JP-M13-GWMW996** JP-M13-GWMW362 JP-M13-GWMW809	2,4,5-Trichlorophenol Phenol	UJ (all non-detects) UJ (all non-detects)	P	Laboratory control samples (%R)

Joliet Army Ammunition Plant
Semivolatiles - Laboratory Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Semivolatiles - Field Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

LDC #: 38831B2a

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 06/19/17

SDG #: SD25025

Page: 1 of 1

Laboratory: Shealy Environmental Services, Inc.

Reviewer: NG

2nd Reviewer: C

METHOD: GC/MS Semivolatiles (EPA SW846 Method 8270D)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	GC/MS Instrument performance check	A	
III.	Initial calibration/ICV	A / SW	ICAL ≤ 15% rr ICV ≤ 20%
IV.	Continuing calibration	SW	CCV ≤ 20%
V.	Laboratory Blanks	A	
VI.	Field blanks	N	
VII.	Surrogate spikes	SW	
VIII.	Matrix spike/Matrix spike duplicates	SW	
IX.	Laboratory control samples	SW	LCS
X.	Field duplicates	SW	D = 6/7
XI.	Internal standards	A	
XII.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level III validation.
XIII.	Target compound identification	A	Not reviewed for Level III validation.
XIV.	System performance	A	Not reviewed for Level III validation.
XV.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
+ 1	JP-M13-GWMW126R	SD25025-001	Water	04/24/17
− 2	JP-M13-GWMW806	SD25025-002	Water	04/24/17
+ 3	JP-M13-GWMW807	SD25025-003	Water	04/24/17
+ 4	JP-M13-GWMW808	SD25025-004	Water	04/24/17
− 5	JP-M13-GWMW811	SD25025-005	Water	04/24/17
+ 6	JP-M13-GWMW996** D	SD25025-006**	Water	04/24/17
7	JP-M13-GWMW362 D	SD25025-007	Water	04/24/17
8	JP-M13-GWMW809	SD25025-008	Water	04/24/17
9	JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
10	JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17
11				
12				
13	SBLK26			

LDC #: 38831 B2a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: Semivolatiles (EPA SW 846 Method 8270D)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
II. GC/MS Instrument performance check				
Were the DFTPP performance results reviewed and found to be within the specified criteria?	✓			
Were all samples analyzed within the 12 hour clock criteria?	✓			
IIIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ ~~20%~~ 15% and relative response factors (RRF) within method criteria?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥ 0.990?	✓			
IIIb. Initial Calibration Verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~30%~~ 20% or percent recoveries (%R) ~~70-130%~~?		✓		
IV. Continuing calibration				
Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?	✓			
Were all percent differences (%D) ≤ 20% and relative response factors (RRF) within method criteria?		✓		
V. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed at least once every 12 hours for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
VI. Field blanks				
Were field blanks were identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VII. Surrogate spikes				
Were all surrogate percent recovery (%R) within QC limits?		✓		
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis?	✓			
If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?			✓	

LDC #: 38831 B2a

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?		✓		
IX. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per analytical batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?		✓		
X. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
XI. Internal standards				
Were internal standard area counts within -50% to +100% of the associated calibration standard?	✓			
Were retention times within ± 30 seconds of the associated calibration standard?	✓			
XII. Compound quantitation				
Were the correct internal standard (IS), quantitation ion and relative response factor (RRF) used to quantitate the compound?	✓			
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XIII. Target compound identification				
Were relative retention times (RRT's) within ± 0.06 RRT units of the standard?	✓			
Did compound spectra meet specified EPA "Functional Guidelines" criteria?	✓			
Were chromatogram peaks verified and accounted for?	✓			
XIV. System performance				
System performance was found to be acceptable.	✓			
XV. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: GC/MS SVOA

A. Phenol	AA. 2-Chloronaphthalene	AAA. Butylbenzylphthalate	AAAA. Dibenzothiophene	A1. N-Nitrosodiethylamine
B. Bis (2-chloroethyl) ether	BB. 2-Nitroaniline	BBB. 3,3'-Dichlorobenzidine	BBBB. Benzo(a)fluoranthene	B1. N-Nitrosodi-n-butylamine
C. 2-Chlorophenol	CC. Dimethylphthalate	CCC. Benzo(a)anthracene	CCCC. Benzo(b)fluorene	C1. N-Nitrosomethylethylamine
D. 1,3-Dichlorobenzene	DD. Acenaphthylene	DDD. Chrysene	DDDD. cis/trans-Decalin	D1. N-Nitrosomorpholine
E. 1,4-Dichlorobenzene	EE. 2,6-Dinitrotoluene	EEE. Bis(2-ethylhexyl)phthalate	EEEE. Biphenyl	E1. N-Nitrosopyrrolidine
F. 1,2-Dichlorobenzene	FF. 3-Nitroaniline	FFF. Di-n-octylphthalate	FFFF. Retene	F1. Phenacetin
G. 2-Methylphenol	GG. Acenaphthene	GGG. Benzo(b)fluoranthene	GGGG. C30-Hopane	G1. 2-Acetylaminofluorene
H. 2,2'-Oxybis(1-chloropropane)	HH. 2,4-Dinitrophenol	HHH. Benzo(k)fluoranthene	HHHH. 1-Methylphenanthrene	H1. Pronamide
I. 4-Methylphenol	II. 4-Nitrophenol	III. Benzo(a)pyrene	IIII. 1,4-Dioxane	I1. Methyl methanesulfonate
J. N-Nitroso-di-n-propylamine	JJ. Dibenzofuran	JJJ. Indeno(1,2,3-cd)pyrene	JJJJ. Acetophenone	J1. Ethyl methanesulfonate
K. Hexachloroethane	KK. 2,4-Dinitrotoluene	KKK. Dibenz(a,h)anthracene	KKKK. Atrazine	K1. o,o',o''-Triethylphosphorothioate
L. Nitrobenzene	LL. Diethylphthalate	LLL. Benzo(g,h,i)perylene	LLLL. Benzaldehyde	L1. n-Phenylene diamine
M. Isophorone	MM. 4-Chlorophenyl-phenyl ether	MMM. Bis(2-Chloroisopropyl)ether	MMMM. Caprolactam	M1. 1,4-Naphthoquinone
N. 2-Nitrophenol	NN. Fluorene	NNN. Aniline	NNNN. 2,6-Dichlorophenol	N1. N-Nitro-o-toluidine
O. 2,4-Dimethylphenol	OO. 4-Nitroaniline	OOO. N-Nitrosodimethylamine	OOOO. 1,2-Diphenylhydrazine	O1. 1,3,5-Trinitrobenzene
P. Bis(2-chloroethoxy)methane	PP. 4,6-Dinitro-2-methylphenol	PPP. Benzoic Acid	PPPP. 3-Methylphenol	P1. Pentachlorobenzene
Q. 2,4-Dichlorophenol	QQ. N-Nitrosodiphenylamine	QQQ. Benzyl alcohol	QQQQ. 3&4-Methylphenol	Q1. 4-Aminobiphenyl
R. 1,2,4-Trichlorobenzene	RR. 4-Bromophenyl-phenylether	RRR. Pyridine	RRRR. 4-Dimethyldibenzothiophene (4MDT)	R1. 2-Naphthylamine
S. Naphthalene	SS. Hexachlorobenzene	SSS. Benzidine	SSSS. 2/3-Dimethyldibenzothiophene (4MDT)	S1. Triphenylene
T. 4-Chloroaniline	TT. Pentachlorophenol	TTT. 1-Methylnaphthalene	TTTT. 1-Methyldibenzothiophene (1MDT)	T1. Octachlorostyrene
U. Hexachlorobutadiene	UU. Phenanthrene	UUU.Benzo(b)thiophene	UUUU.. 2,3,4,6-Tetrachlorophenol	U1.
V. 4-Chloro-3-methylphenol	VV. Anthracene	VVV.Benzonaphthothiophene	VVVV. 1,2,4,5-Tetrachlorobenzene	V1.
W. 2-Methylnaphthalene	WW. Carbazole	WWW.Benzo(e)pyrene	WWWW.. 2-Picoline	W1.
X. Hexachlorocyclopentadiene	XX. Di-n-butylphthalate	XXX. 2,6-Dimethylnaphthalene	XXXX. 3-Methylcholanthrene	X1.
Y. 2,4,6-Trichlorophenol	YY. Fluoranthene	YYY. 2,3,5-Trimethylnaphthalene	YYYY. a,a-Dimethylphenethylamine	Y1.
Z. 2,4,5-Trichlorophenol	ZZ. Pyrene	ZZZ. Perylene	ZZZZ. Hexachloropropene	Z1.

LDC #: 38831 B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was an initial calibration verification standard analyzed after each ICAL for each instrument?
Y N N/A Were all %D within the validation criteria of ≤30% %D ?

#	Date	Standard ID	Compound	Finding %D (Limit: ~~≤30%~~) 20%	Associated Samples	Qualifications
	04/14/17	110414B22	RRR	26.4	All (ND + Det)	J/UJ/A
				20.3		

ICVsvoa.wpd

LDC #: 38831B2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Reviewer: JVG
2nd Reviewer: Q

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a continuing calibration standard analyzed at least once every 12 hours for each instrument?

Y N N/A Were percent differences (%D) ≤20 % and relative response factors (RRF) within the method criteria?

#	Date	Standard ID	Compound	Finding %D (Limit: <20.0%)	Finding RRF (Limit)	Associated Samples	Qualifications
	05/03/17	110503B02	RRR	20.3		All (ND + Det)	J/UJ/A

Note: * Ave RRF failed method criteria but within validation criteria

LDC #: 38831 B2a

VALIDATION FINDINGS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
Please see qualification below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were percent recoveries (%R) for surrogates within QC limits?
Y N N/A If 2 or more base neutral or acid surrogates were outside QC limits, was a reanalysis performed to confirm %R?
Y N N/A If any %R was less than 10 percent, was a reanalysis performed to confirm %R?

#	Date	Sample ID	Surrogate	%R (Limits)	Qualifications
		6	FBP	41 (44-119)	No qual (only one acid/base out)
			TBP	40 (43-140)	
				( )	
		7	FBP	43 (44-119)	
			TBP	40 (43-140)	
				( )	
		8 (NO)	FBP	36 (44-119)	J/UJ/A (qual base only)
			NBZ	43 (44-120)	
			TBP	35 (43-140)	No qual (acid)
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

(NBZ) = Nitrobenzene-d5
(FBP) = 2-Fluorobiphenyl
(TPH) = Terphenyl-d14
(PHL) = Phenol-d5
(2FP)= 2-Fluorophenol
(TBP) = 2,4,6-Tribromophenol
(2CP) = 2-Chlorophenol-d4
(DCB) = 1,2-Dichlorobenzene-d4

SUR.wpd

SEMI-VOLATILES SURROGATES

Acid	Base
Phenol-d5 (PHL)	Nitrobenzene-d5 (NBZ)
2-Fluorophenol (2-FP)	2-Fluorobiphenyl(FBP)
2,4,6 Tribromophenol (TBP)	Terphenyl-d14 (TPH)
2-Chlorophenol-d4	1,2-Dichlorobenzene-d4

Semi-Volatile Acid/Base Fraction

Acid Fraction	Base Neutral
Phenol	1,3-Dichlorobenzene
2-Chlorophenol	1,4-Dichlorobenzene
2-Methylphenol	1,2-Dichlorobenzene
3+4-Methylphenol	~~Bis(2-chloroisopropyl)ether~~
2-Nitrophenol	N-Nitroso-di-n-propylamine
2,4-Dimethylphenol	Hexachloroethane
2,4-Dichlorophenol	Nitrobenzene
4-Chloro-3-methylphenol	Isophorone
2,4,6-Trichlorophenol	Bis(2-chloroethoxy)methane
2,4,5-Trichlorophenol	1,2,4-Trichlorobenzene
2,4-Dinitrophenol	Naphthalene
4-Nitrophenol	4-Chloroaniline
4,6-Dinitro-2-methylphenol	Hexachlorobutadiene
Pentachlorophenol	~~2-Methylnaphthalene~~
Benzoic acid	~~2-Chloronaphthalene~~
	2-Nitroaniline
	Dimethylphthalate
	Acenaphthylene
	2,6-Dinitrotoluene
	3-Nitroaniline
	Acenaphthene
	Dibenzofuran
	2,4-Dinitrotoluene
	Diethylphthalate
	4-Chlorophenyl-phenyl ether
	Fluorene
	4-Nitroaniline
	N-Nitrosodiphenylamine
	4-Bromophenyl-phenylether
	Hexachlorobenzene
	Phenanthrene
	Anthracene
	Di-n-butylphthalate
	Fluoranthene
	Pyrene
	Butylbenzylphthalate
	3,3'-Dichlorobenzidine
	Benzo(a)anthracene
	Chrysene
	Bis(2-ethylhexyl)phthalate
	Di-n-octylphthalate
	Benzo(b)fluoranthene
	Benzo(k)fluoranthene
	Benzo(a)pyrene
	Indeno(1,2,3-cd)pyrene
	Dibenzo(a,h)anthracene
	Benzo(g,h,i)perylene
	Benzyl alcohol
	Aniline
	Benzidine
	Hexachlorocyclopentadiene
	N-Nitrosodimethylamine
	1,2-Diphenylhydrazine
	bis(2-chloro-1-methylethyl)ether
	Carbazole
	~~Dibenzofuran~~
	Pyridine

LDC #: 38831 & 2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: a

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)
Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.

Y N N/A Was a MS/MSD analyzed every 20 samples of each matrix?

Y N N/A Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	MS/MSD ID	Compound	MS %R (Limits)	MSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		9/10	RR	53 (54-124)	See attached for MSD failures		1 (ND)	J/UJ/A
			MM	50 (53-121)	( )	( )		
			EE	56 (57-124)	( )	( )		
			BB	54 (55-127)	( )	( )		
			A	43 (49-117)	( )	( )		
			Z	51 (53-123)	( )	( )		
			RRR	( )	( )	22 (20)	(Det)	J dets/A
				( )	( )	( )		
				( )	( )	( )		
			Several compounds	outside limits for	% RPD			~~NQ~~ NA
				results non-detects, *	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

FORM 3
MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Shealy Environmental Services, Inc. Lot No.: SD25025

Project No.: _____

Analytical Method: SVOA Matrix: Water

Client Sample ID (Matrix Spike/Matrix Spike Duplicate): JP-M13-GWMW126R

Instrument ID: Agilent_MSD11

Concentration Units (ug/L, mg/L, ug/kg): ug/L

ANALYTE		SPIKE ADDED	MSD CONCENTRATION	MSD %R	#	RPD	#	QC LIMITS RPD	QC LIMITS %R
Acenaphthene	GG	8.0	3.1	39	*	23	*	0-20	47-122
Acenaphthylene		8.0	3.4	42		21	*	0-20	41-130
Aniline		8.0	5.7	72		10		0-40	30-130
Anthracene	VV	8.0	3.5	44	*	28	*	0-20	57-123
Benzidine		40	7.9	20		10		0-20	10-54
Benzo(a)anthracene	CCC	8.0	4.3	54	*	29	*	0-20	58-125
Benzo(a)pyrene	III	8.0	3.9	49	*	29	*	0-20	54-128
Benzo(b)fluoranthene	GGG	8.0	3.9	49	*	33	*	0-20	53-131
Benzo(g,h,i)perylene		8.0	5.1	64		23	*	0-20	50-134
Benzo(k)fluoranthene	HHH	8.0	4.4	55	*	29	*	0-20	57-129
Benzyl alcohol		8.0	2.7	33		19		0-20	31-112
4-Bromophenyl phenyl ether	RR	8.0	3.1	39	*	30	*	0-20	55-124
Butyl benzyl phthalate		8.0	4.4	55		28	*	0-20	53-134
Carbazole	WW	8.0	4.3	53	*	32	*	0-20	60-122
bis (2-Chloro-1-		8.0	3.3	41		15		0-20	37-130
4-Chloro-3-methyl phenol	V	8.0	3.2	40	*	27	*	0-20	52-119
4-Chloroaniline		8.0	3.4	42		7.8		0-20	33-117
bis(2-Chloroethoxy)methane	P	8.0	3.3	42	*	18		0-20	48-120
2-Chlorophenol		8.0	3.2	40		12		0-20	38-117
4-Chlorophenyl phenyl ether	MM	8.0	3.1	38	*	27	*	0-20	53-121
Chrysene	DDD	8.0	4.5	57	*	31	*	0-20	59-123
Dibenzo(a,h)anthracene	KKK	8.0	3.6	44	*	22	*	0-20	51-134
Dibenzofuran	JJ	8.0	3.5	44	*	22	*	0-20	53-118
1,2-Dichlorobenzene		8.0	2.6	33		5.5		0-20	32-111
1,3-Dichlorobenzene		8.0	2.6	33		6.6		0-20	28-110
1,4-Dichlorobenzene		8.0	2.6	33		6.0		0-20	29-112
3,3'-Dichlorobenzidine		8.0	3.8	47		19		0-20	27-129
2,4-Dichlorophenol	Q	8.0	3.1	39	*	18		0-20	47-121
Diethylphthalate	LL	8.0	3.7	46	*	36	*	0-20	56-125
Dimethyl phthalate	CC	8.0	3.6	44	*	29	*	0-20	45-127
2,4-Dimethylphenol		8.0	2.7	33		20		0-20	31-124
Di-n-butyl phthalate	XX	8.0	4.3	53	*	39	*	0-20	59-127
4,6-Dinitro-2-methylphenol	PP	8.0	3.4	43	*	33	*	0-20	44-137
2,4-Dinitrophenol		16	6.2	38		26	*	0-20	23-143

* Values outside of QC Limits

FORM 3
MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Shealy Environmental Services, Inc. Lot No.: SD25025

Project No.: _____

Analytical Method: SVOA Matrix: Water

Client Sample ID (Matrix Spike/Matrix Spike Duplicate): JP-M13-GWMW126R

Instrument ID: Agilent_MSD11

Concentration Units (ug/L, mg/L, ug/kg): ug/L

ANALYTE	SPIKE ADDED	MSD CONCENTRATION	MSD %R	#	RPD	#	QC LIMITS RPD	QC LIMITS %R
2,4-Dinitrotoluene KK	8.0	3.5	43	*	34	*	0-20	57-128
2,6-Dinitrotoluene EE	8.0	3.3	42	*	29	*	0-20	57-124
Di-n-octylphthalate FFF	8.0	3.8	48	*	32	*	0-20	51-140
1,2-Diphenylhydrazine ~~Las~~ OOOO	8.0	3.0	38	*	29	*	0-20	49-122
bis(2-Ethylhexyl)phthalate EEE	8.0	4.3	54	*	34	*	0-20	55-135
Fluoranthene YY	8.0	4.2	53	*	35	*	0-20	57-128
Fluorene NN	8.0	3.3	42	*	26	*	0-20	52-124
Hexachlorobenzene SS	8.0	3.2	40	*	34	*	0-20	53-125
Hexachlorobutadiene	8.0	2.6	32		15		0-20	22-124
Hexachlorocyclopentadiene	40	7.9	20		12		0-20	16-96
Hexachloroethane	8.0	2.6	32		6.9		0-20	21-115
Indeno(1,2,3-c,d)pyrene	8.0	4.5	56		22	*	0-20	52-134
Isophorone	8.0	3.4	43		20		0-20	42-124
2-Methylphenol	8.0	4.0	50		11		0-20	30-117
3+4-Methylphenol	8.0	3.5	44		12		0-20	29-110
Naphthalene	8.0	3.3	41		13		0-20	40-121
2-Nitroaniline BB	8.0	3.4	42	*	24	*	0-20	55-127
3-Nitroaniline FF	8.0	3.5	44		32	*	0-20	41-128
4-Nitroaniline OO	8.0	4.3	54	*	36	*	0-20	60-135
Nitrobenzene L	8.0	3.5	44	*	17		0-20	45-121
2-Nitrophenol N	8.0	3.4	42	*	18		0-20	47-123
4-Nitrophenol II	16	6.5	41	*	44	*	0-20	53-130
N-Nitrosodimethylamine	8.0	3.5	43		21	*	0-20	41-123
N-Nitrosodi-n-propylamine J	8.0	3.8	48	*	14		0-20	49-119
N-Nitrosodiphenylamine QQ	8.0	3.4	42	*	31	*	0-20	51-123
Pentachlorophenol	16	6.3	39		35	*	0-20	35-138
Phenanthrene UU	8.0	3.5	44	*	31	*	0-20	59-120
Phenol A	8.0	3.0	37	*	15		0-20	49-117
Pyrene ZZ	8.0	4.2	53	*	23	*	0-20	57-126
Pyridine	8.0	4.2	49		22	*	0-20	19-112
1,2,4-Trichlorobenzene	8.0	2.7	33		11		0-20	29-116
2,4,5-Trichlorophenol Z	8.0	3.1	39	*	26	*	0-20	53-123
2,4,6-Trichlorophenol Y	8.0	3.2	40	*	24	*	0-20	50-125

* Values outside of QC Limits

LDC #: 38831 B2a

VALIDATION FINDINGS WORKSHEET
Laboratory Control Samples (LCS)

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a LCS required?

Y N N/A Were the LCS/LCSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?

#	Date	LCS/LCSD ID	Compound	LCS %R (Limits)	LCSD %R (Limits)	RPD (Limits)	Associated Samples	Qualifications
		SLCS 26	Z	50 (53-123)	( )	( )	All (ND)	J/UJ/P
			A	47 (49-117)	( )	( )	↓ ↓	↓
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		
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				( )	( )	( )		
				( )	( )	( )		
				( )	( )	( )		

LDC#: 38831B2a

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: GC MS SVOA (EPA SW 846 Method 8270D)

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L)		RPD (≤ 25 %)	Difference (ug/L)	Limits (≤ 2xLOQ)	Qualifications (Parent Only)
	6	7				
ppp	1.4	0.80U		0.6	(≤ 80)	
kk	2.1	2.3		0.2	(≤ 3.2)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (____)		RPD (≤____%)	Difference (____)	Limits (≤____)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (____)		RPD (≤____%)	Difference (____)	Limits (≤____)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration (____)		RPD (≤____%)	Difference (____)	Limits (≤____)	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

LDC #: 38831B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: a

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The Relative Response Factor (RRF), average RRF, and percent relative standard deviation (%RSD) were recalculated for the compounds identified below using the following calculations:

$RRF = (A_x)(C_{is})/(A_{is})(C_x)$
average RRF = sum of the RRFs/number of standards
%RSD = 100 * (S/X)

A_x = Area of Compound
C_x = Concentration of compound,
S= Standard deviation of the RRFs,

A_{is} = Area of associated internal standard
C_{is} = Concentration of internal standard
X = Mean of the RRFs

#	Standard ID	Calibration Date	Compound (IS)	Reported RRF (RRF 20 std)	Recalculated RRF (RRF 20 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	4/14/2017	Phenol (DCB)	2.015315	2.015315	2.178511	2.178511	4.7	4.7
			Nitrobenzene (NPT)	0.488851	0.488851	0.455185	0.455185	6.7	6.7
	MSD11		2,4-DNT (ANT)	see r2					
			Phenanthrene (PHN)	1.103602	1.103602	1.080764	1.080764	6.9	6.9
			Bis(2-eh)phthalate (CRY)	0.892307	0.892307	0.830957	0.830957	12.3	12.3
			Benzo(a)pyrene (PRY)	1.089114	1.089114	1.023273	1.023273	13.5	13.5

LDC # 38831B2a

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GCMS Semivolatiles (EPA SW 846 Method 8270D)

Parameter: 2,4-DNT

Order of regression: Linear

Date	Instrument	Compound	Points	x area ratio	y conc ratio
4/14/2017	MSD 11	2,4-DNT	Cal2	1.27045E-02	0.050
			Cal3	0.029257455	0.100
			Cal4	0.084354991	0.250
			Cal5	0.178262472	0.500
			Cal6	0.284928008	0.750
			Cal7	0.38351308	1.000
			Cal8	0.519878297	1.250
			Cal9	0.632086144	1.500

Regression Output: Regression Output:			Reported WLR	
Constant	b =	0.05307	b =	0.02641
Std Err of Y Est		0.04		
R Squared	r^2 =	0.99649	r^2 =	0.99700
No. of Observations		6.00		
Degrees of Freedom		4.00		
X Coefficient(s)	m1 =	0.42560	m1 =	0.40944
Std Err of Coef.	0.01			

LDC #: 38831B2a

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS SVOA (EPA SW 846 Method 8270D)

The percent difference (%D) of the initial calibration average Relative Response Factors (RRFs) and the continuing calibration RRFs were recalculated for the compounds identified below using the following calculation:

% Difference = 100 * (ave. RRF - RRF)/ave. RRF
RRF = (Ax)(Cis)/(Ais)(Cx)

ave. RRF = initial calibration average RRF
RRF = continuing calibration RRF
Ax = Area of compound,

Cx = Concentration of compound,
Ais = Area of associated internal standard
Cis = Concentration of internal standard

#	Standard ID	Calibration Date	Compound (IS)	Average RRF/Conc (Initial)	Reported RRF (CC)	Recalculated RRF (CC)	Reported % D	Recalculated % D
1	110503b02	05/03/17	Phenol (DCB)	2.179	2.073	2.073	4.8	4.8
			Nitrobenzene (NPT)	0.455	0.429	0.429	5.8	5.8
	MSD11		2,4-DNT (ANT)	15.000	14.127	14.126	5.8	5.8
			Phenanthrene (PHN)	1.081	1.094	1.094	1.2	1.2
			Bis(2-eh)phthalate (CRY)	0.831	0.856	0.856	3.0	3.0
			Benzo(a)pyrene (PRY)	1.023	1.060	1.060	3.6	3.6

LDC #: 38831 #29

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS Semivolatiles (EPA SW 846 Method 8270D)

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: # 6

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5	8.00	3.8399	48	48	0
2-Fluorobiphenyl	↓	3.3103	41	41	↓
Terphenyl-d14	10.0	5.7454	57	57	↓
Phenol-d5	8.0	3.1035	39	39	↓
2-Fluorophenol	↓	2.3728	30	30	↓
2,4,6-Tribromophenol	↓	3.1728	40	40	↓
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

Sample ID:

	Surrogate Spiked	Surrogate Found	Percent Recovery Reported	Percent Recovery Recalculated	Percent Difference
Nitrobenzene-d5					
2-Fluorobiphenyl					
Terphenyl-d14					
Phenol-d5					
2-Fluorophenol					
2,4,6-Tribromophenol					
2-Chlorophenol-d4					
1,2-Dichlorobenzene-d4					

LDC #: 38831 B2a

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SSC - SC)/SA Where: SSC = Spiked sample concentration; SA = Spike added; SC = Sample concentation

RPD = I MSC - MSC I * 2/(MSC + MSDC) MSC = Matrix spike concentration MSDC = Matrix spike duplicate concentration

MS/MSD samples: 9/10

Compound	Spike Added (ug/L)		Sample Concentration (ug/L)	Spiked Sample Concentration (ug/L)		Matrix Spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
	MS	MSD	------	MS	MSD	Reported	Recalc	Reported	Recalc	Reported	Recalc
Phenol	8.0	8.0	0	3.433	2.955	43	43	37	37	15	15
N-Nitroso-di-n-propylamine				4.430	3.835	55	55	48	48	14	14
4-Chloro-3-methylphenol				4.251	3.723	53	53	40	40	27	27
Acenaphthene				3.898	3.082	49	49	39	39	23	23
Pentachlorophenol	16.0	16.0		8.946	6.275	56	56	39	39	35	35
Pyrene	8.0	8.0		5.352	3.234	67	67	40	40	27	27

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 B2a

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG

2nd Reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

The percent recoveries (%R) and Relative Percent Difference (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

% Recovery = 100 * (SC/SA

Where: SSC = Spike concentration
SA = Spike added

RPD = I LCSC - LCSDC I * 2/(LCSC + LCSDC)

LCSC = Laboratory control sample concentration LCSDC = Laboratory control sample duplicate concentration

LCS/LCSD samples: SLCS 26

Compound	Spike Added (ug/L)		Spike Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc	Reported	Recalc	Reported	Recalculated
Phenol	8.0	NA	3.8	NA	47	47				
N-Nitroso-di-n-propylamine			5.0		63	63				
4-Chloro-3-methylphenol			4.4		54	54				
Acenaphthene			4.1		51	51				
Pentachlorophenol	16.0		8.2		51	51				
Pyrene	8.0		5.3		67	67				

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831B 2a

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: JVG
2nd reviewer: [illegible]

METHOD: GC/MS BNA (EPA SW 846 Method 8270D)

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds agree within 10.0% of the reported results?

Concentration = $\frac{(A_x)(I_s)(V_t)(DF)(2.0)}{(A_{is})(RRF)(V_o)(V_i)(\%S)}$

A_x	=	Area of the characteristic ion (EICP) for the compound to be measured
A_{is}	=	Area of the characteristic ion (EICP) for the specific internal standard
I_s	=	Amount of internal standard added in nanograms (ng)
V_o	=	Volume or weight of sample extract in milliliters (ml) or grams (g).
V_i	=	Volume of extract injected in microliters (ul)
V_t	=	Volume of the concentrated extract in microliters (ul)
Df	=	Dilution Factor.
%S	=	Percent solids, applicable to soil and solid matrices only.
2.0	=	Factor of 2 to account for GPC cleanup

Example:

Sample I.D. 6, 2,4-DNT

Conc. = $\frac{\left[\frac{(48368)(\quad)}{(112167)(\quad)}\right] - (0.026414)(\quad)(\quad)(\quad)}{(0.469436)}$

= 2.6346

final conc. = $\frac{(2.6346)(1\,ml)(1000)}{(250\,ml)(5\,uL)}$

= 2.108 ug/L

#	Sample ID	Compound	Reported Concentration (ug/L)	Calculated Concentration ( )	Qualification
			2.1		
	on col = 2.6347				

V_o = 250 ml
V_t = 1 ml
V_{inj} = 5 uL

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 26, 2017

Parameters: Metals

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25025

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M13-GWMW126R	SD25025-001	Water	04/24/17
JP-M13-GWMW806	SD25025-002	Water	04/24/17
JP-M13-GWMW807	SD25025-003	Water	04/24/17
JP-M13-GWMW808	SD25025-004	Water	04/24/17
JP-M13-GWMW811	SD25025-005	Water	04/24/17
JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
JP-M13-GWMW362	SD25025-007	Water	04/24/17
JP-M13-GWMW809	SD25025-008	Water	04/24/17
JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17
JP-M13-GWMW806MS	SD25025-002MS	Water	04/24/17
JP-M13-GWMW806MSD	SD25025-002MSD	Water	04/24/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following methods:

Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, and Zinc by Environmental Protection Agency (EPA) SW846 Method 6010C
Mercury by EPA SW 846 Method 7470A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met.

II. Instrument Calibration

Initial and continuing calibrations were performed as required by the methods.

The initial calibration verification (ICV) and continuing calibration verification (CCV) standards were within QC limits.

III. ICP Interference Check Sample Analysis

The frequency of interference check sample (ICS) analysis was met. All criteria were within QC limits.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Aluminum Arsenic Calcium Copper Mercury	0.15 mg/L 0.0037 mg/L 0.19 mg/L 0.0024 mg/L 0.000039 mg/L	All samples in SDG SD25025
ICB/CCB	Thallium Lead	0.0049 mg/L 0.0048 mg/L	All samples in SDG SD25025

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks with the following exceptions:

Sample	Analyte	Reported Concentration	Modified Final Concentration
JP-M13-GWMW126R	Arsenic Thallium Lead	0.0043 mg/L 0.0056 mg/L 0.0078 mg/L	0.0043U mg/L 0.0056U mg/L 0.0078U mg/L
JP-M13-GWMW806	Arsenic Lead	0.0034 mg/L 0.0080 mg/L	0.0034U mg/L 0.0080U mg/L

Sample	Analyte	Reported Concentration	Modified Final Concentration
JP-M13-GWMW807	Arsenic	0.0048 mg/L	0.0048U mg/L
JP-M13-GWMW808	Arsenic Lead	0.0023 mg/L 0.0052 mg/L	0.0023U mg/L 0.0052U mg/L
JP-M13-GWMW811	Arsenic Mercury	0.0062 mg/L 0.000031 mg/L	0.0062U mg/L 0.000031U mg/L
JP-M13-GWMW996**	Arsenic	0.0037 mg/L	0.0037U mg/L
JP-M13-GWMW362	Arsenic Thallium Lead	0.0027 mg/L 0.0052 mg/L 0.0055 mg/L	0.0027U mg/L 0.0052U mg/L 0.0055U mg/L
JP-M13-GWMW809	Lead	0.0076 mg/L	0.0076U mg/L

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

The laboratory has indicated that there were no duplicate (DUP) analyses specified for the samples in this SDG, and therefore duplicate analyses were not performed for this SDG.

VIII. Serial Dilution

Serial dilution analysis was performed on an associated project sample. The analysis criteria were met.

IX. Laboratory Control Samples

Laboratory control samples (LCS) and laboratory control samples duplicates (LCSD) were analyzed as required by the method. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

X. Field Duplicates

Samples JP-M13-GWMW996** and JP-M13-GWMW362 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M13-GWMW996**	JP-M13-GWMW362				
Arsenic	0.0037	0.0027	-	0.001 (≤0.03)	-	-
Barium	0.056	0.056	-	0 (≤0.05)	-	-
Beryllium	0.00084	0.00091	-	0.00007 (≤0.01)	-	-
Cadmium	0.00060	0.00080	-	0.0002 (≤0.01)	-	-
Calcium	190	200	5 (≤25)	-	-	-
Chromium	0.0010	0.0012	-	0.0002 (≤0.02)	-	-
Cobalt	0.0018	0.0024	-	0.0006 (≤0.05)	-	-
Lead	0.0090 U	0.0055	-	0.0035 (≤0.02)	-	-
Magnesium	110	120	9 (≤25)	-	-	-
Manganese	0.20	0.20	0 (≤25)	-	-	-
Potassium	7.6	7.8	-	0.2 (≤10)	-	-
Sodium	450	460	2 (≤25)	-	-	-
Thallium	0.025 U	0.0052	-	0.0198 (≤0.10)	-	-

XI. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the methods. No results were rejected in this SDG.

Due to laboratory blank contamination, data were qualified as not detected in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Metals - Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Metals - Laboratory Blank Data Qualification Summary - SDG SD25025

Sample	Analyte	Modified Final Concentration	A or P
JP-M13-GWMW126R	Arsenic Thallium Lead	0.0043U mg/L 0.0056U mg/L 0.0078U mg/L	A
JP-M13-GWMW806	Arsenic Lead	0.0034U mg/L 0.0080U mg/L	A
JP-M13-GWMW807	Arsenic	0.0048U mg/L	A
JP-M13-GWMW808	Arsenic Lead	0.0023U mg/L 0.0052U mg/L	A
JP-M13-GWMW811	Arsenic Mercury	0.0062U mg/L 0.000031U mg/L	A
JP-M13-GWMW996**	Arsenic	0.0037U mg/L	A
JP-M13-GWMW362	Arsenic Thallium Lead	0.0027U mg/L 0.0052U mg/L 0.0055U mg/L	A
JP-M13-GWMW809	Lead	0.0076U mg/L	A

Joliet Army Ammunition Plant
Metals - Field Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

LDC #: 38831B4b

SDG #: SD25025

Laboratory: Shealy Environmental Services, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 06/22/17

Page: 1 of 1

Reviewer: ATL

2nd Reviewer: [illegible]

METHOD: Metals (EPA SW 846 Method 6010C/7470A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / A	
II.	Instrument Calibration	A	
III.	ICP Interference Check Sample (ICS) Analysis	A	
IV.	Laboratory Blanks	SW	
V.	Field Blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	N	
VIII.	Serial Dilution	A	
IX.	Laboratory control samples	A	LCS/LCSD
X.	Field Duplicates	SW	6,7
XI.	Sample Result Verification	A	Not reviewed for Level III validation.
XII.	Overall Assessment of Data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	JP-M13-GWMW126R	SD25025-001	Water	04/24/17
2	JP-M13-GWMW806	SD25025-002	Water	04/24/17
3	JP-M13-GWMW807	SD25025-003	Water	04/24/17
4	JP-M13-GWMW808	SD25025-004	Water	04/24/17
5	JP-M13-GWMW811	SD25025-005	Water	04/24/17
6	JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
7	JP-M13-GWMW362	SD25025-007	Water	04/24/17
8	JP-M13-GWMW809	SD25025-008	Water	04/24/17
9	JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
10	JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17
11	JP-M13-GWMW806MS	SD25025-002MS	Water	04/24/17
12	JP-M13-GWMW806MSD	SD25025-002MSD	Water	04/24/17
13				
14				

Notes:

LDC #: 38831B4b

VALIDATION FINDINGS WORKSHEET
Sample Specific Element Reference

Reviewer: ATL
2nd reviewer: a

All circled elements are applicable to each sample.

Sample ID	Matrix	Target Analyte List (TAL)
1->8	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
QC		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
11, 12	W	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
9	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
10	↓	Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
Analysis Method		
ICP		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
ICP-MS		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___
GFAA		Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Tl, V, Zn, Mo, B, Sn, Ti, ___

Comments: Mercury by CVAA if performed

LDC #: 38831B4b

VALIDATION FINDINGS CHECKLIST

Reviewer: ATL
2nd Reviewer: [illegible]

Method: Metals (EPA SW 846 Method 6010/6020/7000)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.	✓			
Cooler temperature criteria was met.	✓			
II. ICP/MS Tune				
Were all isotopes in the tuning solution mass resolution within 0.1 amu?			✓	
Were %RSD of isotopes in the tuning solution ≤5%?			✓	
III. Calibration				
Were all instruments calibrated daily, each set-up time?	✓			
Were the proper number of standards used?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% (80-120% for mercury) QC limits?	✓			
Were the low standard checks within 70-130%			✓	
Were all initial calibration correlation coefficients within limits as specified by the method?	✓			
IV. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
V. ICP Interference Check Sample				
Were ICP interference check samples performed daily?	✓			
Were the AB solution percent recoveries (%R) with the 80-120% QC limits?	✓			
VI. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of +/- RL(+/-2X RL for soil) was used for samples that were ≤ 5X the RL, including when only one of the duplicate sample values were ≤ 5X the RL.	✓			
VII. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% QC limits for water samples and laboratory established QC limits for soils?	✓			

LDC #: 38831B4b

VALIDATION FINDINGS CHECKLIST

Reviewer: ATL
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VIII. Internal Standards (EPA SW 846 Method 6020/EPA 200.8)				
Were all the percent recoveries (%R) within the 30-120% (6020)/60-125% (200.8) of the intensity of the internal standard in the associated initial calibration?			✓	
If the %Rs were outside the criteria, was a reanalysis performed?			✓	
IX. ICP Serial Dilution				
Was an ICP serial dilution analyzed if analyte concentrations were > 50X the MDL (ICP)/>100X the MDL(ICP/MS)?	✓			
Were all percent differences (%Ds) < 10%?	✓			
Was there evidence of negative interference? If yes, professional judgement will be used to qualify the data.			✓	
X. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
XII. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
XIII. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 38831B4b

VALIDATION FINDINGS WORKSHEET
PB/ICB/CCB QUALIFIED SAMPLES

Reviewer: ATL
2nd Reviewer: a

METHOD: Trace metals (EPA SW 864 Method 6010B/6020/7000)
Sample Concentration units, unless otherwise noted: mg/L

Soil preparation factor applied: NA
Associated Samples: All

Analyte	Maximum PB[a] (mg/Kg)	Maximum PB[a] (mg/L)	Maximum ICB/CCB[a] (mg/L)	Action Level	1	2	3	4	5	6	7	8	
Al		0.15		0.75									
As		0.0037		0.0185	0.0043	0.0034	0.0048	0.0023	0.0062	0.0037	0.0027		
Ca		0.19		0.95									
Cu		0.0024		0.012									
Hg		0.000039		0.000195					0.000031				
Tl			0.0049	0.0245	0.0056						0.0052		
Pb			0.0048	0.024	0.0078	0.0080		0.0052			0.0055	0.0076	

Samples with analyte concentrations within five times the associated ICB, CCB or PB concentration are listed above with the identifications from the Validation Completeness Worksheet. These sample results were qualified as not detected, "U".
Note : a - The listed analyte concentration is the highest ICB, CCB, or PB detected in the analysis of each element.

LDC#: 38831B4b **VALIDATION FINDINGS WORKSHEET**
Field Duplicates

Reviewer: ATL
2nd Reviewer: G

METHOD: Metals (EPA Method 6010C/7470A)

Analyte	Concentration (mg/L)		RPD (≤25)	Difference	Limits	Qualifiers
	6	7				
Arsenic	0.0037	0.0027		0.001	0.03	
Barium	0.056	0.056		0	0.05	
Beryllium	0.00084	0.00091		0.00007	0.01	
Cadmium	0.00060	0.00080		0.0002	0.01	
Calcium	190	200	5			
Chromium	0.0010	0.0012		0.0002	0.02	
Cobalt	0.0018	0.0024		0.0006	0.05	
Lead	0.0090 U	0.0055		0.0035	0.02	
Magnesium	110	120	9			
Manganese	0.20	0.20	0			
Potassium	7.6	7.8		0.2	10	
Sodium	450	460	2			
Thallium	0.025 U	0.0052		0.0198	0.10	

LDC #: 38831B4b

VALIDATION FINDINGS WORKSHEET
Initial and Continuing Calibration Calculation Verification

Reviewer: AI
2nd Reviewer: [illegible]

METHOD: Trace Metals (See cover)

An initial and continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found / True x 100 Where, Found = concentration (in ug/L) of each analyte measured in the analysis of the ICV or CCV solution
True = concentration (in ug/L) of each analyte in the ICV or CCV source

Standard ID	Type of Analysis	Element	Found (~~ug~~ mg/L)	True (~~ug~~ mg/L)	Recalculated %R	Reported %R	Acceptable (Y/N)
ICV	ICP (Initial calibration) (05/02 @ 10:39)	As	0.5158	0.5000	103	103	Y
CCV3	ICP (Continuing calibration) (05/02 @ 13:51)	Co	2.5428	2.5000	102	102	Y
	ICP-MS (Initial calibration)						
	ICP-MS (Continuing calibration)						
ICV	CVAA (Initial calibration) (04/26 @ 15:24)	Hg	0.002054	0.002000	103	103	Y
CCV3	CVAA (Contining calibration) (04/26 @ 18:09)	Hg	0.001955	0.002000	98	98	Y

Comments: _____

CALCLC

LDC #: 38831B4b

VALIDATION FINDINGS WORKSHEET

Level IV Recalculation Worksheet

Reviewer: ATL

2nd Reviewer: C

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Percent recoveries (%R) for an ICP interference check sample, a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$$\%R = \frac{Found}{True} \times 100$$

Where, Found = Concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).

True = Concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where, S = Original sample concentration

D = Duplicate sample concentration

An ICP serial dilution percent difference (%D) was recalculated using the following formula:

$$\%D = \frac{|I-SDR|}{I} \times 100$$

Where, I = Initial Sample Result (mg/L)

SDR = Serial Dilution Result (mg/L) (Instrument Reading x 5)

Sample ID	Type of Analysis	Element	Found / S / I (units)	True / D / SDR (units)	Recalculated %R / RPD / %D	Reported %R / RPD / %D	Acceptable (Y/N)
ICSA	ICP interference check (5/2 @ 10:51)	Fe	476.42	500	95	95	Y
LCS	Laboratory control sample (5/4 @ 20:13)	Zn	2.0	2.0	100	100	Y
9	Matrix spike	Hg	(SSR-SR) 0.00212	0.0020	106	106	Y
9110	Duplicate	Hg	0.0021248	0.0021199	0.23	0.23	Y
2	ICP serial dilution (5/2 @ 13:40)	Mg	46.04	44.99	2.3	2.3	Y

Comments:

TOTCLC

LDC #: 38831B46

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: ATL
2nd reviewer: [illegible]

METHOD: Trace Metals (EPA SW 846 Method 6010/6020/7000)

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments and within the linear range of the ICP?
Y N N/A Are all detection limits below the CRDL?

Detected analyte results for Hg were recalculated and verified using the following equation:

Concentration = (RD)(FV)(Dil) / (In. Vol.)

Recalculation: #6

0.0247 ppb = 0.0000247 ppm

RD = Raw data concentration
FV = Final volume (ml)
In. Vol. = Initial volume (ml) or weight (G)
Dil = Dilution factor

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	6	Hg	ND	ND	Y
	6	Cd	0.00060	0.00060	Y

Note:

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 26, 2017

Parameters: Wet Chemistry

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25025

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M13-GWMW126R	SD25025-001	Water	04/24/17
JP-M13-GWMW806	SD25025-002	Water	04/24/17
JP-M13-GWMW807	SD25025-003	Water	04/24/17
JP-M13-GWMW808	SD25025-004	Water	04/24/17
JP-M13-GWMW811	SD25025-005	Water	04/24/17
JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
JP-M13-GWMW362	SD25025-007	Water	04/24/17
JP-M13-GWMW809	SD25025-008	Water	04/24/17
JP-M13-GWMW806MS	SD25025-002MS	Water	04/24/17
JP-M13-GWMW806DUP	SD25025-002DUP	Water	04/24/17
JP-M13-GWMW809MS	SD25025-008MS	Water	04/24/17
JP-M13-GWMW809DUP	SD25025-008DUP	Water	04/24/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Inorganic Superfund Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Sulfate and Nitrate as Nitrogen by Environmental Protection Agency (EPA) SW 846 Method 9056A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition.

All technical holding time requirements were met with the following exceptions:

Sample	Analyte	Total Time From Sample Collection Until Analysis	Required Holding Time From Sample Collection Until Analysis	Flag	A or P
JP-M13-GWMW809	Nitrate as N	11 days	48 hours	J (all detects)	P

II. Initial Calibration

All criteria for the initial calibration were met.

III. Continuing Calibration

Continuing calibration frequency and analysis criteria were met.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the methods. No contaminants were found in the laboratory blanks with the following exceptions:

Blank ID	Analyte	Maximum Concentration	Associated Samples
PB (prep blank)	Nitrate as N	0.0065 mg/L	JP-M13-GWMW126R JP-M13-GWMW807 JP-M13-GWMW811

Data qualification by the laboratory blanks was based on the maximum contaminant concentration in the laboratory blanks in the analysis of each analyte. The sample concentrations were either not detected or were significantly greater (>5X blank contaminants) than the concentrations found in the associated laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VII. Duplicate Sample Analysis

Duplicate (DUP) sample analysis was performed on an associated project sample. Results were within QC limits with the following exceptions:

DUP ID (Associated Samples)	Analyte	RPD (Limits)	Difference (Limits)	Flag	A or P
JP-M13-GWMW809DUP (JP-M13-GWMW809)	Nitrate as N	-	0.244 mg/L (≤0.020)	J (all detects)	A

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples JP-M13-GWMW996** and JP-M13-GWMW362 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Analyte	Concentration (mg/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M13-GWMW996**	JP-M13-GWMW362				
Sulfate	250	250	0 (≤25)	-	-	-

X. Sample Result Verification

All sample result verifications were acceptable for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to technical holding time and DUP difference, data were qualified as estimated in one sample.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Wet Chemistry - Data Qualification Summary - SDG SD25025

Sample	Analyte	Flag	A or P	Reason
JP-M13-GWMW809	Nitrate as N	J (all detects)	P	Technical holding times
JP-M13-GWMW809	Nitrate as N	J (all detects)	A	Duplicate sample analysis (difference)

Joliet Army Ammunition Plant
Wet Chemistry - Laboratory Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Wet Chemistry - Field Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

LDC #: 38831B6

SDG #: SD25025

Laboratory: Shealy Environmental Services, Inc.

VALIDATION COMPLETENESS WORKSHEET

Level III/IV

Date: 06/22/17

Page: 1 of 1

Reviewer: AIL

2nd Reviewer: [illegible]

METHOD: (Analyte) Sulfate, Nitrate-N (EPA SW846 Method 9056A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II	Initial calibration	A	
III.	Calibration verification	A	
IV	Laboratory Blanks	SW	
V	Field blanks	N	
VI.	Matrix Spike/Matrix Spike Duplicates	A	
VII.	Duplicate sample analysis	SW	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	6,7
X.	Sample result verification	A	Not reviewed for Level III validation.
XI	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID	Lab ID	Matrix	Date
1	JP-M13-GWMW126R	SD25025-001	Water	04/24/17
2	JP-M13-GWMW806	SD25025-002	Water	04/24/17
3	JP-M13-GWMW807	SD25025-003	Water	04/24/17
4	JP-M13-GWMW808	SD25025-004	Water	04/24/17
5	JP-M13-GWMW811	SD25025-005	Water	04/24/17
6	JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
7	JP-M13-GWMW362	SD25025-007	Water	04/24/17
8	JP-M13-GWMW809	SD25025-008	Water	04/24/17
9	JP-M13-GWMW806MS	SD25025-002MS	Water	04/24/17
10	JP-M13-GWMW806DUP	SD25025-002DUP	Water	04/24/17
11	JP-M13-GWMW809MS	SD25025-008MS	Water	04/24/17
12	JP-M13-GWMW809DUP	SD25025-008DUP	Water	04/24/17
13				
14				
15				
16				

Notes:

DC #: 38831B6

VALIDATION FINDINGS CHECKLIST

Reviewer: ATL
2nd Reviewer: [illegible]

Method: Inorganics (EPA Method see cover)

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
All technical holding times were met.		✓		
II. Calibration				
Were all instruments calibrated daily, each set-up time?		✓		
Were the proper number of standards used?	✓			
Were all initial calibration correlation coefficients ≥ 0.995?	✓			
Were all initial and continuing calibration verification %Rs within the 90-110% QC limits?	✓			
Were titrant checks performed as required? (Level IV only)			✓	
Were balance checks performed as required? (Level IV only)			✓	
III. Blanks				
Was a method blank associated with every sample in this SDG?	✓			
Was there contamination in the method blanks? If yes, please see the Blanks validation completeness worksheet.	✓			
IV. Matrix spike/Matrix spike duplicates and Duplicates				
Were a matrix spike (MS) and duplicate (DUP) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD or MS/DUP. Soil / Water.	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the 75-125 QC limits? If the sample concentration exceeded the spike concentration by a factor of 4 or more, no action was taken.	✓			
Were the MS/MSD or duplicate relative percent differences (RPD) ≤ 20% for waters and ≤ 35% for soil samples? A control limit of ≤ CRDL(≤ 2X CRDL for soil) was used for samples that were ≤ 5X the CRDL, including when only one of the duplicate sample values were ≤ 5X the CRDL.	✓			
V. Laboratory control samples				
Was an LCS anaylzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the 80-120% (85-115% for Method 300.0) QC limits?	✓			
VI. Regional Quality Assurance and Quality Control				
Were performance evaluation (PE) samples performed?		✓		
Were the performance evaluation (PE) samples within the acceptance limits?		✓		

LDC #: 38831B6

VALIDATION FINDINGS CHECKLIST

Reviewer: ATL
2nd Reviewer: [illegible]

Validation Area	Yes	No	NA	Findings/Comments
VII. Sample Result Verification				
Were RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
Were detection limits < RL?	✓			
VIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			
IX. Field duplicates				
Field duplicate pairs were identified in this SDG.	✓			
Target analytes were detected in the field duplicates.	✓			
X. Field blanks				
Field blanks were identified in this SDG.		✓		
Target analytes were detected in the field blanks.			✓	

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Sample Specific Analysis Reference

Reviewer: ATL
2nd reviewer: [illegible]

All circled methods are applicable to each sample.

Sample ID	Parameter
1→8	pH TDS Cl F (N) NO_3 NO_2 (SO) SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
QC	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
9,10	pH TDS Cl F (N) NO_3 NO_2 (SO) SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
11,12	pH TDS Cl F (N) NO_3 NO_2 (SO) SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4
	pH TDS Cl F NO_3 NO_2 SO_4 O-PO_4 Alk CN NH_3 TKN TOC Cr6+ ClO_4

Comments:

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Reviewer: ATL
2nd reviewer: [illegible]

All circled dates have exceeded the technical holding time.
Y N N/A Were all samples preserved as applicable to each method ?
Y N N/A Were all cooler temperatures within validation criteria?

Method:	NO3-N (Method 9056A)	
Parameters:	water	
Technical holding time:	48 hrs	

Sample ID	Sampling date	Analysis date	Total Time	Qualifier	Analysis date	Total Time	Qualifier
8	04/24/17	05/05/17	11 days	J/R/P (detect)			

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Blanks

Reviewer: ATL
2nd Reviewer: [illegible]

METHOD: Inorganics, Method See Cover

Conc. units: mg/L **Associated Samples:** 1,3,5

Analyte	Blank ID	Blank ID	Blank Action Limit										
	PB (mg/L)	ICB/CCB (mg/L)		No Qualifiers									
NO3-N	0.0065		0.0325										

CIRCLED RESULTS WERE NOT QUALIFIED. ALL RESULTS NOT CIRCLED WERE QUALIFIED BY THE FOLLOWING STATEMENT:
All contaminants within five times the method blank concentration were qualified as not detected, "U".

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Duplicate Analysis

Reviewer: ATL
2nd Reviewer: [illegible]

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Was a duplicate sample analyzed for each matrix in this SDG?

Y N N/A Were all duplicate sample relative percent differences (RPD) ≤ 20% for water and ≤ 35% for soil samples (≤ 10% for Method 300.0)? If no, see qualification below. A control limit of ±CRDL (±2X CRDL for soil) was used for samples that were ≤5X the CRDL, including when only one of the duplicate sample values were ≤5X the CRDL. If field blanks were used for laboratory duplicates, see overall assessment.

LEVEL IV ONLY:

Y N N/A Were recalculated results acceptable? See Level IV Recalculation Worksheet for recalculations.

#	Date	Duplicate ID	Matrix	Analyte	RPD (Limits)	Difference (Limits)	Associated Samples	Qualifications
	04/26/17	12	W	NO3-N		0.244 (≤ 0.020) mg/L	8	Jdet/A (detect)

Comments:

LDC# 38831B6

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Reviewer: ATL
2nd Reviewer: [illegible]

Inorganics: Method See Cover

Analyte	Concentration (mg/L)		RPD (≤25)	
	6	7		
Sulfate	250	250	0	

\\LDCFILESERVER\Validation\FIELD DUPLICATES\FD_inorganic\2017\38831B6-1.wpd

LDC #: 38831 B6

Validation Findings Worksheet
Initial and Continuing Calibration Calculation Verification

Page: 1 of 1
Reviewer: ATL
2nd Reviewer: G

Method: Inorganics, Method See cover

The correlation coefficient (r) for the calibration of NO_3-N was recalculated.Calibration date: 04/04/17

An initial or continuing calibration verification percent recovery (%R) was recalculated for each type of analysis using the following formula:

%R = Found X 100 / True

Where, Found = concentration of each analyte measured in the analysis of the ICV or CCV solution
True = concentration of each analyte in the ICV or CCV source

Type of analysis	Analyte	Standard	Conc. (mg/l)	Area	Recalculated r or r^2	Reported r or r^2	Acceptable (Y/N)
Initial calibration	NO_3-N	s1	0.01	0.008	*0.999961*	0.999940	Y
		s2	0.02	0.017			
		s3	0.04	0.036			
		s4	0.1	0.096			
		s5	0.2	0.207			
		s6	0.4	0.444			
		s7	1	1.147			
		s8	2	2.294			
ICV (04/04 @ 21:08) Calibration verification	NO_3-N	FOUND 0.87	TRUE 0.8		109	109	Y
CCV (04/25 @ 21:50) Calibration verification	SO_4^-	25.35	25		101	101	Y
CCV (04/25 @ 19:26) Calibration verification	NO_3-N	1.07	1.0		107	107	Y

Comments: Refer to Calibration Verification findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Level IV Recalculation Worksheet

Reviewer: ATL
2nd Reviewer: a

METHOD: Inorganics, Method See cover

Percent recoveries (%R) for a laboratory control sample and a matrix spike sample were recalculated using the following formula:

$\%R = \frac{Found}{True} \times 100$ Where, Found = concentration of each analyte measured in the analysis of the sample. For the matrix spike calculation, Found = SSR (spiked sample result) - SR (sample result).
True = concentration of each analyte in the source.

A sample and duplicate relative percent difference (RPD) was recalculated using the following formula:

$RPD = \frac{|S-D|}{(S+D)/2} \times 100$ Where, S = Original sample concentration
D = Duplicate sample concentration

Sample ID	Type of Analysis	Element	Found / S (units)	True / D (units)	Recalculated %R / RPD	Reported %R / RPD	Acceptable (Y/N)
LCS	Laboratory control sample (04/25 @17:35)	SO_4^-	21.01	20	105	105	Y
9	Matrix spike sample (04/25 @ 20:26)	NO_3-N	(SSR-SR) 0.747	0.8	93	93	Y
2/10	Duplicate sample (04/25 @ 20:14)	SO_4^-	65	67	2.5	2.6	Y

Comments:

LDC #: 38831B6

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Reviewer: ATL
2nd reviewer: C

METHOD: Inorganics, Method See cover

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Y N N/A Have results been reported and calculated correctly?
Y N N/A Are results within the calibrated range of the instruments?
Y N N/A Are all detection limits below the CRQL?

Compound (analyte) results for SO_4^- reported with a positive detect were recalculated and verified using the following equation:

Concentration =

$$\frac{A - 0.511}{0.367} \times DF$$

Recalculation: #6

$$\frac{9.601 - 0.511}{0.367} \times 10 = 247.68$$

#	Sample ID	Analyte	Reported Concentration (mg/L)	Calculated Concentration (mg/L)	Acceptable (Y/N)
	6	SO_4^-	250	250	Y
	6	NO_3-N	ND	ND	Y

Note:

LDC Report# 38831B40

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 22, 2017

Parameters: Explosives

Validation Level: Level III & IV

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD25025

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-M13-GWMW126R	SD25025-001	Water	04/24/17
JP-M13-GWMW806	SD25025-002	Water	04/24/17
JP-M13-GWMW807	SD25025-003	Water	04/24/17
JP-M13-GWMW808	SD25025-004	Water	04/24/17
JP-M13-GWMW811	SD25025-005	Water	04/24/17
JP-M13-GWMW996**	SD25025-006**	Water	04/24/17
JP-M13-GWMW362	SD25025-007	Water	04/24/17
JP-M13-GWMW809	SD25025-008	Water	04/24/17
JP-M13-GWMW126RMS	SD25025-001MS	Water	04/24/17
JP-M13-GWMW126RMSD	SD25025-001MSD	Water	04/24/17

**Indicates sample underwent Level IV validation

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Explosives by Environmental Protection Agency (EPA) SW 846 Method 8330A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results. Samples appended with a double asterisk on the cover page were subjected to Level IV data validation, which is comprised of the QC summary forms as well as the raw data, to confirm sample quantitation and identification.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detect at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
JP-M13-GWMW126R JP-M13-GWMW808	All compounds	10	7	UJ (all non-detects)	P

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0% for all compounds.

Retention time windows were established as required by the method for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 15.0% for all compounds with the following exceptions:

Date	Column	Compound	%D	Associated Samples	Flag	A or P
05/02/17	LC01	HMX Nitrobenzene 2-Nitrotoluene	27.4 17.1 21	JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW811 JP-M13-GWMW996** JP-M13-GWMW362 JP-M13-GWMW809	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A

Retention times of all compounds in the calibration standards were within the established retention time windows for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Detector	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
JP-M13-GWMW806	DB-X43	1,2-Dinitrobenzene	78 (83-119)	All compounds	UJ (all non-detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

Samples JP-M13-GWMW996** and JP-M13-GWMW362 were identified as field duplicates. No results were detected in any of the samples with the following exceptions:

Compound	Concentration (ug/L)		RPD (Limits)	Difference (Limits)	Flag	A or P
	JP-M13-GWMW996**	JP-M13-GWMW362				
4-Amino-2,6-Dinitrotoluene	0.66	0.68	-	0.02 (≤2.0)	-	-
2-Amino-4,6-Dinitrotoluene	1.2	1.1	-	0.1 (≤2.0)	-	-
2,4-Dinitrotoluene	5.9	5.3	11 (≤25)	-	-	-

X. Compound Quantitation

All compound quantitations met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XI. Target Compound Identifications

All target compound identifications met validation criteria for samples which underwent Level IV validation. Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to technical holding time, continuing calibration %D, and surrogate %R, data were qualified as estimated in eight samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Explosives - Data Qualification Summary - SDG SD25025

Sample	Compound	Flag	A or P	Reason
JP-M13-GWMW126R JP-M13-GWMW808	All compounds	UJ (all non-detects)	P	Technical holding times
JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW811 JP-M13-GWMW996** JP-M13-GWMW362 JP-M13-GWMW809	HMX Nitrobenzene 2-Nitrotoluene	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A	Continuing calibration (%D)
JP-M13-GWMW806	All compounds	UJ (all non-detects)	P	Surrogates (%R)

Joliet Army Ammunition Plant
Explosives - Laboratory Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Explosives - Field Blank Data Qualification Summary - SDG SD25025

No Sample Data Qualified in this SDG

LDC #: 38831B40 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/19/17
SDG #: SD25025 Level III/IV Page: 1 of 1
Laboratory: Shealy Environmental Services, Inc. Reviewer: SVG
2nd Reviewer:

METHOD: HPLC Explosives (EPA SW 846 Method 8330A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% ✓ ICV ≤ 15%
III.	Continuing calibration	SW	CCV ≤ 15%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	SW	D = 6/7
X.	Compound quantitation RL/LOQ/LODs	A	Not reviewed for Level III validation.
XI.	Target compound identification	A	Not reviewed for Level III validation.
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

** Indicates sample was underwent Level IV review

	Client ID		Lab ID	Matrix	Date
1	JP-M13-GWMW126R		SD25025-001	Water	04/24/17
2	JP-M13-GWMW806		SD25025-002	Water	04/24/17
3	JP-M13-GWMW807		SD25025-003	Water	04/24/17
4	JP-M13-GWMW808		SD25025-004	Water	04/24/17
5	JP-M13-GWMW811		SD25025-005	Water	04/24/17
6	JP-M13-GWMW996**	D	SD25025-006**	Water	04/24/17
7	JP-M13-GWMW362	D	SD25025-007	Water	04/24/17
8	JP-M13-GWMW809		SD25025-008	Water	04/24/17
9	JP-M13-GWMW126RMS		SD25025-001MS	Water	04/24/17
10	JP-M13-GWMW126RMSD		SD25025-001MSD	Water	04/24/17
11					
12					
13					

Notes:

1	40853 MB						
2	41169 ↓						

LDC #: 38831 B40

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer: [illegible]

Method: ____ GC ✓ HPLC

Validation Area	Yes	No	NA	Findings/Comments
I. Technical holding times				
Were all technical holding times met?	✓			
Was cooler temperature criteria met?	✓			
IIa. Initial calibration				
Did the laboratory perform a 5 point calibration prior to sample analysis?	✓			
Were all percent relative standard deviations (%RSD) ≤ 20%?	✓			
Was a curve fit used for evaluation? If yes, did the initial calibration meet the curve fit acceptance criteria of ≥0.990?	✓			
Were the RT windows properly established?	✓			
IIb. Initial calibration verification				
Was an initial calibration verification standard analyzed after each initial calibration for each instrument?	✓			
Were all percent differences (%D) ≤ ~~20%~~ 15 or percent recoveries (%R) ~~80-120%?~~	✓			
III. Continuing calibration				
Was a continuing calibration analyzed daily?	✓			
Were all percent differences (%D) ≤ ~~20%~~ 15 or percent recoveries (%R) ~~80-120%?~~		✓		
Were all the retention times within the acceptance windows?	✓			
IV. Laboratory Blanks				
Was a laboratory blank associated with every sample in this SDG?	✓			
Was a laboratory blank analyzed for each matrix and concentration?	✓			
Was there contamination in the laboratory blanks? If yes, please see the Blanks validation completeness worksheet.		✓		
V. Field Blanks				
Were field blanks identified in this SDG?		✓		
Were target compounds detected in the field blanks?			✓	
VI. Surrogate spikes				
Were all surrogate percent recovery (%R) within the QC limits?		✓		
If the percent recovery (%R) of one or more surrogates was outside QC limits, was a reanalysis performed to confirm %R?			✓	
If any %R was less than 10 percent, was a reanalysis performed to confirm %R?			✓	
VII. Matrix spike/Matrix spike duplicates				
Were a matrix spike (MS) and matrix spike duplicate (MSD) analyzed for each matrix in this SDG? If no, indicate which matrix does not have an associated MS/MSD. Soil / Water.	✓			
Was a MS/MSD analyzed every 20 samples of each matrix?	✓			
Were the MS/MSD percent recoveries (%R) and the relative percent differences (RPD) within the QC limits?	✓			

LDC #: 38831 b40

VALIDATION FINDINGS CHECKLIST

Reviewer: JVG
2nd Reviewer:

Validation Area	Yes	No	NA	Findings/Comments
VIII. Laboratory control samples				
Was an LCS analyzed for this SDG?	✓			
Was an LCS analyzed per extraction batch?	✓			
Were the LCS percent recoveries (%R) and relative percent difference (RPD) within the QC limits?	✓			
IX. Field duplicates				
Were field duplicate pairs identified in this SDG?	✓			
Were target compounds detected in the field duplicates?	✓			
X. Compound quantitation				
Were compound quantitation and RLs adjusted to reflect all sample dilutions and dry weight factors applicable to level IV validation?	✓			
XI. Target compound identification				
Were the retention times of reported detects within the RT windows?	✓			
XIII. Overall assessment of data				
Overall assessment of data was found to be acceptable.	✓			

VALIDATION FINDINGS WORKSHEET

METHOD: ____GC ✓ HPLC

8310	8330	8151	8141	8141 (Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	X. EPN	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	Y. Azinphos-methyl	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	Z. Coumaphos	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	AA. Parathion	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	BB. Trichloronate	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	CC. Trichlorinate	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	DD. Trifluralin	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	EE. Def	**8315A**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	FF. Prowl	A. Formaldehyde
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon	GG. Ethion	B. Acetaldehyde
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton	HH. Famphur	C. Benzaldehyde
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	II. Phosmet	D. Butyraldehyde
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	JJ. Tetrachlorvinphos	
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	KK. Demeton (total)	
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos		
P. Pyrene	P. Picric acid	P.	P. Fenthion		
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl		
R.	R. 3,5-Dinitroaniline		R. Trichlornate		
S.	S. 2-Nitrophenol		S. Merphos		
	T. 4-Nitrophenol		T. Stirofos		
	U. Picramic acid		U. Tokuthion		
	V. PETN		V. Fensulfothion		
			W. Bolstar		

Notes:_____

LDC #: 38831 B4b

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [signature]

All circled dates have exceeded the technical holding times.
Y N N/A Were all cooler temperatures within validation criteria?

METHOD : ___ GC ✓ HPLC

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
1 4	W	N	04/24/17	05/04/17	05/05/17	10	J/UJ/P
(ND)							

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:	Water unpreserved:	Aromatic within 7 days, non-aromatic within 14 days of sample collection.
	Water preserved:	Both within 14 days of sample collection.
	Soils:	Both within 14 days of sample collection.
EXTRACTABLES:		
	Water:	Extracted within 7 days, analyzed within 40 days.
	Soil:	Extracted within 14 days, analyzed within 40 days.

LDC #: 38831 B40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of continuing calibration calculation was performed? / %D or __ %R
Y N N/A Were continuing calibration standards analyzed at the required frequencies?
Y N N/A Did the continuing calibration standards meet the %D / %R validation criteria of ≤20.0% / 80-120%?
Level IV Only
Y N N/A Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector Column	Compound	%D (Limit ≤ 20.0)	RT (limit)	Associated Samples	Qualifications
05/02/17		002_0601	LC01	A	27.4	( )	2, 3, 5-8, 40853 MB (MD)	J / UJ A
				F	17.1	( )		
				L	21	( )		
						( )		
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LDC #: 38831B40

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: C

METHOD: __ GC ✓ HPLC

Are surrogates required by the method? Yes ✓ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	2 (MD)	DB-XLB	FF	78 (83-119)	J/UJ/P
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	
				( )	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC#: 38831 B40

VALIDATION FINDINGS WORKSHEET
Field Duplicates

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

METHOD: ✓ GC ____ HPLC

Y N NA Were field duplicate pairs identified in this SDG?
Y N NA Were target analytes detected in the field duplicate pairs?

Compound	Concentration (ug/L) 6	7	RPD (≤ 25 %)	Difference	Limits	Qualifications (Parent Only)
H	0.66	0.68		0.02	(≤ 2.0)	
I	1.2	1.1		0.1	(≤ ↓)	
J	5.9	5.3	11		(≤)	
					(≤)	
					(≤)	

Compound	Concentration ( )		RPD (≤ %)	Difference	Limits	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

Compound	Concentration ( )		RPD (≤ %)	Difference	Limits	Qualifications (Parent Only)
					(≤)	
					(≤)	
					(≤)	
					(≤)	
					(≤)	

LDC #: 38831B40

VALIDATION FINDINGS WORKSHEET
Initial Calibration Calculation Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC _____ HPLC ✓

The calibration factors (CF), average CF, and relative standard deviation (%RSD) were recalculated for compounds identified below using the following calculations:

CF = A/C
average CF = sum of the CF/number of standards
%RSD = 100 * (S/X)

Where:
A = Area of compound
C = Concentration of compound
S = Standard deviation of calibration factors
X = Mean of calibration factors

#	Standard ID	Calibration Date	Compound		Reported CF (60 std)	Recalculated CF (60 std)	Reported Average RRF (Initial)	Recalculated Average RRF (Initial)	Reported %RSD	Recalculated %RSD
1	ICAL	04/28/17	HMX	DB-35MS/LC02	208.0	208.4	215.8	215.8	11.0	11.0
			2,4-DNT	DB-35MS/LC02	612.0	611.7	613.5	613.5	4.5	4.5
			HMX	DB-XLB/LC01	631.0	630.7	652.6	652.6	15.3	15.3
			2,4-DNT	DB-XLB/LC01	2170.0	2170.1	2404.0	2404.0	12.3	12.3

LDC # 38831B40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: GC____HPLC✓

The percent difference (%D) of the initial calibration average Calibration Factors (CF) and the continuing calibration percent difference (%D) values were recalculated for the compounds identified below using the following calculation:

Percent difference (%D) = 100 * (N - C)/N

Where:
N = Initial Calibration Factor or Nominal Amount
C = Calibration Factor from Continuing Calibration Standard or Calculated Amount

#	Standard ID	Calibration Date	Compound		CCV Conc	Reported Conc	Recalculated Conc	Reported % D	Recalculated %D
1	002_0201	5/1/2017	HMX	DB-35MS/LC02	216	185	185	14.4	14.4
			2,4-DNT	DB-35MS/LC02	614	632	632	3.1	3.1
2	002_0601	5/2/2017	HMX	DB-XLB/LC01	653	832	832	27.4	27.5
			2,4-DNT	DB-XLB/LC01	2404	2261	2261	6.0	6.0

LDC #: 58831 BFO

VALIDATION FINDINGS WORKSHEET
Surrogate Results Verification

Page: 1 of 1
Reviewer: JVG
2nd reviewer: [illegible]

METHOD: __ GC / HPLC

The percent recoveries (%R) of surrogates were recalculated for the compounds identified below using the following calculation:

% Recovery: SF/SS * 100

Where: SF = Surrogate Found
SS = Surrogate Spiked

Sample ID: 6

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	
FF	DB-XLB/LC01	10.0	11.587	116	116	0
↓	DB-35MS/LC02	↓	9.6757	97	97	↓

Sample ID: _____

Surrogate	Column/Detector	Surrogate Spiked	Surrogate Found	Percent Recovery	Percent Recovery	Percent Difference
				Reported	Recalculated	

	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 38831 B40

VALIDATION FINDINGS WORKSHEET
Matrix Spike/Matrix Spike Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: a

METHOD: __ GC ✓ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the matrix spike and matrix spike duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC - SC)/SA

RPD =(({SSCMS - SSCMSD} * 2) / (SSCMS + SSCMSD))*100

Where SSC = Spiked sample concentration; SC = Sample concentration; SA = Spike added; MS = Matrix spike; MSD = Matrix spike duplicate

MS/MSD samples: 9/10

Compound		Spike Added (ug/L)		Sample Conc. (ug/L)	Spike Sample Concentration (ug/L)		Matrix spike Percent Recovery		Matrix Spike Duplicate Percent Recovery		MS/MSD RPD	
		MS	MSD	---	MS	MSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline	(8015)											
Diesel	(8015)											
Benzene	(8021B)											
Methane	(RSK-175)											
2,4-D	(8151)											
Dinoseb	(8151)											
Naphthalene	(8310)											
Anthracene	(8310)											
HMX	(8330)	11	11	0	9.266	9.279	84	84	84	84	0.14	0.14
2,4,6-Trinitrotoluene	(8330)	1	1	1	10.194	9.888	93	93	99	99	3.0	3.0
Phorate	(8141A)											
Malathion	(8141A)											
Formaldehyde	(8315A)											

Comments: Refer to Matrix Spike/Matrix Spike Duplicates findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 D40

VALIDATION FINDINGS WORKSHEET

Laboratory Control Sample/Laboratory Control Sample Duplicates Results Verification

Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: __ GC _/_ HPLC

The percent recoveries (%R) and relative percent differences (RPD) of the laboratory control sample and laboratory control sample duplicate were recalculated for the compounds identified below using the following calculation:

%Recovery = 100 * (SSC/SA)
RPD =(({SSCLCS - SSCLCSD} * 2) / (SSCLCS + SSCLCSD))*100

Where SSC = Spiked sample concentration; LCS = Laboratory Control Sample; SA = Spike added; LCSD = Laboratory Control Sample duplicate

LCS/LCSD samples: E LCS 53

Compound	Spike Added (ug/L)		Spike Sample Concentration (ug/L)		LCS Percent Recovery		LCSD Percent Recovery		LCS/LCSD RPD	
	LCS	LCSD	LCS	LCSD	Reported	Recalc.	Reported	Recalc.	Reported	Recalc.
Gasoline (8015)										
Diesel (8015)										
Benzene (8021B)										
Methane (RSK-175)										
2,4-D (8151)										
Dinoseb (8151)										
Naphthalene (8310)										
Anthracene (8310)										
HMX (8330)	10	NA	11.3	NA	113	113				
2,4,6-Trinitrotoluene (8330)	↓	↓	9.7	↓	97	97				
Phorate (8141A)										
Malathion (8141A)										
Formaldehyde (8315A)										

Comments: Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate findings worksheet for list of qualifications and associated samples when reported results do not agree within 10.0% of the recalculated results.

LDC #: 38831 B40

VALIDATION FINDINGS WORKSHEET
Sample Calculation Verification

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: G

METHOD: __ GC ✓ __ HPLC

Y N N/A Were all reported results recalculated and verified for all level IV samples?
Y N N/A Were all recalculated results for detected target compounds within 10% of the reported results?

Concentration= (A)(Fv)(Df) / (RF)(Vs or Ws)(%S/100)

A= Area or height of the compound to be measured
Fv= Final Volume of extract
Df= Dilution Factor
RF= Average response factor of the compound In the initial calibration
Vs= Initial volume of the sample
Ws= Initial weight of the sample
%S= Percent Solid

Example:

Sample ID. 6 Compound Name 2,4-DNT (1001)

Concentration = (28332)(10 ml)(1000) / (2404)(1000 ml)(20 ml) = 5.89 ug/L

#	Sample ID	Compound	Reported Concentrations (ug/L)	Recalculated Results Concentrations ( )	Qualifications
			5.9		

Comments:

SAMPCALCnew.wpd

Laboratory Data Consultants, Inc.
Data Validation Report

Project/Site Name: Joliet Army Ammunition Plant

LDC Report Date: June 22, 2017

Parameters: Explosives

Validation Level: Level III

Laboratory: Shealy Environmental Services, Inc.

Sample Delivery Group (SDG): SD27018

Sample Identification	Laboratory Sample Identification	Matrix	Collection Date
JP-L1-GWMW173	SD27018-001	Water	04/22/17
JP-L1-GWMW174	SD27018-002	Water	04/22/17
JP-L1-GWWE53	SD27018-003	Water	04/25/17
JP-L1-SW550	SD27018-004	Water	04/25/17
JP-L1-SW550MS	SD27018-004MS	Water	04/25/17
JP-L1-SW550MSD	SD27018-004MSD	Water	04/25/17

Introduction

This Data Validation Report (DVR) presents data validation findings and results for the associated samples listed on the cover page. Data validation was performed in accordance with the Final Appendix B Quality Assurance Project Plan Update, Long-Term Monitoring Plan, Former Joliet Army Ammunition Plant, Will County, Illinois (March 2016), the U.S. Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (July 2013), and a modified outline of the USEPA National Functional Guidelines (NFG) for Superfund Organic Methods Data Review (August 2014). Where specific guidance was not available, the data has been evaluated in a conservative manner consistent with industry standards using professional experience.

The analyses were performed by the following method:

Explosives by Environmental Protection Agency (EPA) SW 846 Method 8330A

All sample results were subjected to Level III data validation, which comprises an evaluation of quality control (QC) summary results.

The following are definitions of the data qualifiers utilized during data validation:

J (Estimated): The compound or analyte was analyzed for and positively identified by the laboratory; however the reported concentration is estimated due to non-conformances discovered during data validation.

U (Non-detected): The compound or analyte was analyzed for and positively identified by the laboratory; however the compound or analyte should be considered non-detect at the reported concentration due to the presence of contaminants detected in the associated blank(s).

UJ (Non-detected estimated): The compound or analyte was reported as not detected by the laboratory; however the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.

R (Rejected): The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected is not usable.

NA (Not Applicable): The non-conformance discovered during data validation demonstrates a high bias, while the affected compound or analyte in the associated sample(s) was reported as not detected by the laboratory and did not warrant the qualification of the data.

A qualification summary table is provided at the end of this report if data has been qualified. Flags are classified as P (protocol) or A (advisory) to indicate whether the flag is due to a laboratory deviation from a specified protocol or is of technical advisory nature.

I. Sample Receipt and Technical Holding Times

All samples were received in good condition and cooler temperatures upon receipt met validation criteria.

All technical holding time requirements were met with the following exceptions:

Sample	Compound	Total Days From Sample Collection Until Extraction	Required Holding Time (in Days) From Sample Collection Until Extraction	Flag	A or P
JP-L1-GWMW173 JP-L1-GWMW174	All compounds	12	7	J (all detects) UJ (all non-detects)	P

II. Initial Calibration and Initial Calibration Verification

An initial calibration was performed as required by the method.

For compounds where average calibration factors were utilized, the percent relative standard deviations (%RSD) were less than or equal to 20.0%.

In the case where the laboratory used a calibration curve to evaluate the compounds, all coefficients of determination (r^2) were greater than or equal to 0.990.

The percent differences (%D) of the initial calibration verification (ICV) standard were less than or equal to 15.0% for all compounds.

III. Continuing Calibration

Continuing calibration was performed at required frequencies.

The percent differences (%D) were less than or equal to 15.0% for all compounds with the following exceptions:

Date	Column	Compound	%D	Associated Samples	Flag	A or P
05/02/17	LC01	HMX Nitrobenzene 2-Nitrotoluene	27.4 17.1 21	JP-L1-GWWE53 JP-L1-SW550	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A

IV. Laboratory Blanks

Laboratory blanks were analyzed as required by the method. No contaminants were found in the laboratory blanks.

V. Field Blanks

No field blanks were identified in this SDG.

VI. Surrogates

Surrogates were added to all samples as required by the method. All surrogate recoveries (%R) were within QC limits with the following exceptions:

Sample	Detector	Surrogate	%R (Limits)	Affected Compound	Flag	A or P
JP-L1-SW550	DB-XLB	1,2-Dinitrobenzene	71 (83-119)	All compounds	UJ (all non-detects)	P

VII. Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicate (MSD) sample analysis was performed on an associated project sample. Percent recoveries (%R) were within QC limits. Relative percent differences (RPD) were within QC limits.

VIII. Laboratory Control Samples

Laboratory control samples (LCS) were analyzed as required by the method. Percent recoveries (%R) were within QC limits.

IX. Field Duplicates

No field duplicates were identified in this SDG.

X. Compound Quantitation

The sample results for detected compounds from the two columns were within 40% relative percent difference (RPD) with the following exceptions:

Sample	Compound	RPD	Flag	A or P
JP-L1-GWMW173	HMX	64.3	J (all detects)	A

Raw data were not reviewed for Level III validation.

XI. Target Compound Identifications

Raw data were not reviewed for Level III validation.

XII. Overall Assessment of Data

The analysis was conducted within all specifications of the method. No results were rejected in this SDG.

Due to technical holding time, continuing calibration %D, surrogate %R, and RPD between two columns, data were qualified as estimated in four samples.

The quality control criteria reviewed, other than those discussed above, were met and are considered acceptable. Sample results that were found to be estimated (J) are usable for limited purposes only. Based upon the data validation all other results are considered valid and usable for all purposes.

Joliet Army Ammunition Plant
Explosives - Data Qualification Summary - SDG SD27018

Sample	Compound	Flag	A or P	Reason
JP-L1-GWMW173 JP-L1-GWMW174	All compounds	J (all detects) UJ (all non-detects)	P	Technical holding times
JP-L1-GWWE53 JP-L1-SW550	HMX Nitrobenzene 2-Nitrotoluene	UJ (all non-detects) UJ (all non-detects) UJ (all non-detects)	A	Continuing calibration (%D)
JP-L1-SW550	All compounds	UJ (all non-detects)	P	Surrogate spikes (%R)
JP-L1-GWMW173	HMX	J (all detects)	A	Compound quantitation (RPD between two columns)

Joliet Army Ammunition Plant
Explosives - Laboratory Blank Data Qualification Summary - SDG SD27018

No Sample Data Qualified in this SDG

Joliet Army Ammunition Plant
Explosives - Field Blank Data Qualification Summary - SDG SD27018

No Sample Data Qualified in this SDG

LDC #: 38831C40 **VALIDATION COMPLETENESS WORKSHEET** Date: 06/19/17

SDG #: SD27018 Level III Page: 1 of 1

Laboratory: Shealy Environmental Services, Inc. Reviewer: [illegible]

2nd Reviewer: [illegible]

METHOD: HPLC Explosives (EPA SW 846 Method 8330A)

The samples listed below were reviewed for each of the following validation areas. Validation findings are noted in attached validation findings worksheets.

	Validation Area		Comments
I.	Sample receipt/Technical holding times	A / SW	
II.	Initial calibration/ICV	A / A	ICAL ≤ 20% rr ICV ≤ 15%
III.	Continuing calibration	SW	CCV ≤ 15%
IV.	Laboratory Blanks	A	
V.	Field blanks	N	
VI.	Surrogate spikes	SW	
VII.	Matrix spike/Matrix spike duplicates	A	
VIII.	Laboratory control samples	A	LCS
IX.	Field duplicates	N	
X.	Compound quantitation RL/LOQ/LODs	SW	
XI.	Target compound identification	N	
XII.	Overall assessment of data	A	

Note: A = Acceptable; N = Not provided/applicable; SW = See worksheet; ND = No compounds detected; R = Rinsate; FB = Field blank; D = Duplicate; TB = Trip blank; EB = Equipment blank; SB=Source blank; OTHER:

	Client ID	Lab ID	Matrix	Date
+ 1	JP-L1-GWMW173	SD27018-001	Water	04/22/17
− 2	JP-L1-GWMW174	SD27018-002	Water	04/22/17
+ 3	JP-L1-GWWE53	SD27018-003	Water	04/25/17
− 4	JP-L1-SW550	SD27018-004	Water	04/25/17
5	JP-L1-SW550MS	SD27018-004MS	Water	04/25/17
6	JP-L1-SW550MSD	SD27018-004MSD	Water	04/25/17
7				
8				
9				
10				
11				
12				

Notes:

1	40853 MB						
✓	41169 I						

VALIDATION FINDINGS WORKSHEET

METHOD: ____GC ___/__HPLC

8310	8330	8151	8141	8141(Con't)	8021B
A. Acenaphthene	A. HMX	A. 2,4-D	A. Dichlorvos	X. EPN	V. Benzene
B. Acenaphthylene	B. RDX	B. 2,4-DB	B. Mevinphos	Y. Azinphos-methyl	CC. Toluene
C. Anthracene	C. 1,3,5-Trinitrobenzene	C. 2,4,5-T	C. Demeton-O	Z. Coumaphos	EE. Ethyl Benzene
D. Benzo(a)anthracene	D. 1,3-Dinitrobenzene	D. 2,4,5-TP	D. Demeton-S	AA. Parathion	SSS. O-Xylene
E. Benzo(a)pyrene	E. Tetryl	E. Dinoseb	E. Ethoprop	BB. Trichloronate	RRR. MP-Xylene
F. Benzo(b)fluoranthene	F. Nitrobenzene	F. Dichlorprop	F. Naled	CC. Trichlorinate	GG. Total Xylene
G. Benzo(g,h,i)perylene	G. 2.4.6-Trinitrotoluene	G. Dicamba	G. Sulfotep	DD. Trifluralin	
H. Benzo(k)fluoranthene	H. 4-Amino-2,6-dinitrotoluene	H. Dalapon	H. Phorate	EE. Def	**8315A**
I. Chrysene	I. 2-Amino-4,6-dinitrotoluene	I. MCPP	I. Dimethoate	FF. Prowl	A. Formaldehyde
J. Dibenz(a,h)anthracene	J. 2,4-Dinitrotoluene	J. MCPA	J. Diazinon	GG. Ethion	B. Acetaldehyde
K. Fluoranthene	K. 2,6-Dinitrotoluene	K. Pentachlorophenol	K. Disulfoton	HH. Famphur	C. Benzaldehyde
L. Fluorene	L. 2-Nitrotoluene	L. 2,4,5-TP (silvex)	L. Parathion-methyl	II. Phosmet	D. Butyraldehyde
M. Indeno(1,2,3-cd)pyrene	M. 3-Nitrotoluene	M. Silvex	M. Ronnel	JJ. Tetrachlorvinphos	
N. Naphthalene	N. 4-Nitrotoluene	N.	N. Malathion	KK. Demeton (total)	
O. Phenanthrene	O. Nitroglycerin	O.	O. Chlorpyrifos		
P. Pyrene	P. Picric acid	P.	P. Fenthion		
Q.	Q. 2,4-Dinitrophenol	Q.	Q. Parathion-ethyl		
R.	R. 3,5-Dinitroaniline		R. Trichlornate		
S.	S. 2-Nitrophenol		S. Merphos		
	T. 4-Nitrophenol		T. Stirofos		
	U. Picramic acid		U. Tokuthion		
	V. PETN		V. Fensulfothion		
			W. Bolstar		

Notes:_____

LDC #: 38831 C40

VALIDATION FINDINGS WORKSHEET
Technical Holding Times

Page: 1 of 1
Reviewer: JVG
2nd Reviewer:

All circled dates have exceeded the technical holding times.
Y N N/A Were all cooler temperatures within validation criteria?

METHOD : GC / HPLC

Sample ID	Matrix	Preserved	Sampling Date	Extraction date	Analysis date	Total # of Days	Qualifier
1, 2	W	N	04/27/17	05/04/17	05/05/17	12	J/UJ/P
(ND +bet)							

TECHNICAL HOLDING TIME CRITERIA

VOLATILES:	Water unpreserved:	Aromatic within 7 days, non-aromatic within 14 days of sample collection.
	Water preserved:	Both within 14 days of sample collection.
	Soils:	Both within 14 days of sample collection.
EXTRACTABLES:		
	Water:	Extracted within 7 days, analyzed within 40 days.
	Soil:	Extracted within 14 days, analyzed within 40 days.

LDC #: 38831C40

VALIDATION FINDINGS WORKSHEET
Continuing Calibration

Page: 1 of 1
Reviewer: JVG
2nd Reviewer: [illegible]

METHOD: ___ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".
What type of continuing calibration calculation was performed? ___%D or ___%R
Y N N/A Were continuing calibration standards analyzed at the required frequencies? 15 %
Y N N/A Did the continuing calibration standards meet the %D / %R validation criteria of ~~≤20.0% / 80-120~~%?
Level IV Only
Y N N/A Were the retention times for all calibrated compounds within their respective acceptance windows?

#	Date	Standard ID	Detector/ Column	Compound	%D 15 % (Limit ≤ ~~20.0~~)	RT (limit)	Associated Samples	Qualifications
	05/02/17	002_0601	LC01	A	27.4	( )	3-6, 40853 MB (MB)	J/UJ/A
				F	17.1	( )	↓ ↓	↓
				L	21	( )		
						( )		
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LDC #: 38831C40

VALIDATION FINDINDS WORKSHEET
Surrogate Recovery

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: __ GC ✓ HPLC

Are surrogates required by the method? Yes ✓ or No____.

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

(Y) N N/A Were surrogates spiked into all samples and blanks?

Y (N) N/A Did all surrogate recoveries (%R) meet the QC limits?

#	Sample ID	Detector/ Column	Surrogate Compound	%R (Limits)	Qualifications
	4 (ND)	DB-XLB	FF	71 (83-119)	J/UJ/P
				( )	
				( )	
				( )	
				( )	
				( )	
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	Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound		Surrogate Compound
A	Chlorobenzene (CBZ)	H	Ortho-Terphenyl	O	Decachlorobiphenyl (DCB)	V	Tri-n-propyltin	CC	2,5-Dibromotoluene
B	4-Bromofluorobenzene (BFB)	I	Fluorobenzene (FBZ)	P	1-methylnaphthalene	W	Tributyl Phosphate	DD	n-Nonatriacontane
C	a,a,a-Trifluorotoluene	J	n-Triacontane	Q	Dichlorophenyl Acetic Acid (DCAA)	X	Triphenyl Phosphate	EE	1,2-Dibromopropane
D	Bromochlorobenene	K	Hexacosane	R	4-Nitrophenol	Y	Tetrachloro-m- xylene	FF	1,2-Dinitrobenzene
E	1,4-Dichlorobutane	L	Bromobenzene	S	1-Chloro-3-Nitrobenzene	Z	2-Bromonaphthalene	GG	2-Nitro-m-xylene
F	1,4-Difluorobenzene (DFB)	M	Benzo(e)Pyrene	T	3,4-Dinitrotoluene	AA	1-Chlorooctadecane	HH	p-Terphenyl
G	Octacosane	N	Terphenyl-D14	U	Tripentyltin	BB	2,4-Dichlorophenylacetic acid	II	

LDC #: 38831C40

VALIDATION FINDINGS WORKSHEET
Compound Quantitation and Reported CRQLs

Reviewer: JVG
2nd Reviewer: [signature]

METHOD: __ GC / HPLC

Please see qualifications below for all questions answered "N". Not applicable questions are identified as "N/A".

Level IV/D Only

Y N N/A Were CRQLs adjusted for sample dilutions, dry weight factors, etc.?
Y N N/A Did the reported results for detected target compounds agree within 10.0% of the recalculated results?
Y N N/A Did the percent difference of detected compounds between two columns./detectors ≤40%?
If no, please see findings bellow.

#	Compound Name	Sample ID	%RPD/%D Between Two Columns/Detectors Limit (≤ 40%)	Qualifications
	A	1	64.3	J dets /A

Comments: See sample calculation verification worksheet for recalculations

B2 – DATA USABILITY REPORT

Former Joliet Army Ammunition Plant
Will County, Illinois

Appendix B2
Data Usability Report
Groundwater and Surface Water Sampling – April 2017

Long-Term Monitoring, Deed Restriction Implementation Plan, and CERCLA Five-Year Review

Prepared For:
U.S. Army Environmental Command under Contract with the U.S. Army Corps Of Engineers

Firm Fixed Price Contract
W912QR-15-C-0016

April 2017

APPENDIX B2

DATA USABILITY REPORT

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BTZ/btz/RJR/DMK
P:\Joliet 2017\Semi-annual Report\Final\Appendix B - Data Reports\B2- Data Usability Report\TOC_2017 Semi.docx

ACRONYMS AND ABBREVIATIONS

%D	percent difference
%R	percent recovery
CCB	continuing calibration blank
CCV	continuing calibration verification
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
FSP	Final Appendix A – 2015 Field Sampling Plan Update (IEA/MWH JV, March 2016)
GC/MS	gas chromatography/mass spectroscopy
ICAL	initial calibration
ICB	initial calibration blank
ICS	interference check sample
ICV	initial calibration verification
IEA/MWH JV	IEA Inc./MWH Americas, Inc. Joint Venture
J	estimated value
JOAAP	former Joliet Army Ammunition Plant
LCS/LCSD	laboratory control sample/laboratory control sample duplicate
LDC	Laboratory Data Consultants, Inc.
LOD	limit of detection
LOQ	limit of quantitation
MS/MSD	matrix spike/matrix spike duplicate
ORP	oxidation/reduction potential
QA	quality assurance
2015 QAPP	Final Appendix B – 2015 Quality Assurance Project Plan Update (IEA/MWH JV, March 2016)
2017 QAPP	Final Appendix B – 2017 Quality Assurance Project Plan Update (IEA/MWH JV, July 2017)
QC	quality control
QSM	Quality Systems Manual
R	rejected
RPD	relative percent difference
SDG	sample delivery group
Shealy	Shealy Environmental Services, Inc.
SVOC	semivolatile organic compound
TAL	target analyte list
U	not detected
UJ	not detected, estimated quantitation limit
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

APPENDIX B2

DATA USABILITY REPORT

1.0 INTRODUCTION

The following Data Usability Report discusses quality assurance/quality control (QA/QC) outliers for each analyte group and summarizes the Data Validation Reports presented in Appendix B1. Data qualifiers were added to results and imported into the former Joliet Army Ammunition Plant (JOAAP) database. Data qualifiers used in the validation process may include the following:

- U – Not detected. The compound or analyte was analyzed for and positively identified by the laboratory; however, the compound or analyte should be considered not detected at the reported concentration due to the presence of contaminants detected in the associated blank(s).
- J – Estimated value. The compound or analyte was analyzed for and positively identified by the laboratory; however, the reported concentration is estimated due to non-conformances discovered during data validation.
- UJ – Not detected, estimated quantitation limit. The compound or analyte was reported as not detected by the laboratory; however, the reported quantitation/detection limit is estimated due to non-conformances discovered during data validation.
- R – Rejected. The sample results were rejected due to gross non-conformances discovered during data validation. Data qualified as rejected are not usable.

Shealy Environmental Services, Inc. (Shealy), located at 106 Vantage Point Drive, West Columbia, South Carolina, performed the analyses of groundwater and surface water samples collected in April 2017 at JOAAP in Will County, Illinois. Groundwater and surface water samples were analyzed for one or more of the following parameters:

- Volatile organic compounds (VOCs) were analyzed by SW-846 Method 8260B.
- Semi-volatile organic compounds (SVOCs) were analyzed by SW-846 Method 8270D.
- Explosives were analyzed by SW-846 Method 8330A.
- Target analyte list (TAL) metals were analyzed by SW-846 Methods 6010C and 7470A.
- Sulfate was analyzed by SW-846 Method 9056A.
- Nitrate was analyzed by SW-846 Method 9056A.

Groundwater was collected from seven sites (L1, L3, M1, M6, M8, M13 Landfill, and Other Areas) and analyzed for the following parameters:

- VOCs were analyzed from Site M13 Landfill.

- SVOCs were analyzed from Site M13 Landfill.
- Explosives were analyzed from Sites L1, L3, M6, M13 Landfill, and Other Areas.
- TAL metals were analyzed from Site M13 Landfill.
- Sulfate was analyzed from Sites M1, M8, and M13 Landfill.
- Nitrate was analyzed from Site M13 Landfill.

Surface water was collected from three sites at JOAAP and analyzed for the following parameters:

- Explosives were analyzed from Sites L1 and L3.
- Sulfate was analyzed from Site M1.

Field parameters are not discussed in this Data Usability Report, but were recorded by field personnel with a water quality meter at the time of sample collection and included:

- pH, temperature, specific conductivity, dissolved oxygen (DO), turbidity, and oxidation/reduction potential (ORP).

The following summarizes the sample delivery group (SDG) and corresponding data validation report

Sample Delivery Group	Data Validation Report	Associated Samples
SD25024	JOAAP Data Validation Report - June 28, 2017	JP-M1-GWMW107 JP-M1-GWMW231 JP-M1-GWMW641 JP-M1-GWMW640 JP-M1-GWMW648 JP-M1-GWMW642 JP-M1-GWMW649 JP-M1-GWMW643 JP-M1-GWMW644 JP-M1-GWMW645 JP-M1-GWMW646 JP-M1-SW709 JP-M8-GWMW330 JP-M8-GWMW999 JP-M6-GWMW654 JP-M6-GWMW313 JP-M6-GWMW652 JP-M6-GWMW998 JP-M6-GWMW212R JP-M6-GWMW997 JP-M6-GWMW162R JP-M6-GWMW123R

Sample Delivery Group	Data Validation Report	Associated Samples
		JP-M6-GWMW318 JP-M6-GWMW319 JP-M6-GWMW117 JP-OA-GWMW118 JP-OA-GWMW119 JP-L3-GWMW630 JP-L3-GWMW631 JP-L3-GWMW633 JP-L3-GWMW412 JP-L3-SW777 JP-L1-GWWES1 JP-L1-GWMW131
SD25025	JOAAP Data Validation Report - June 28, 2017	JP-M13-GWMW809 JP-M13-GWMW808 JP-M13-GWMW362 JP-M13-GWMW996 JP-M13-GWMW126R JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW811
SD27018	JOAAP Data Validation Report - June 28, 2017	JP-L1-GWMW173 JP-L1-GWMW174 JP-L1-GWWES3 JP-L1-SW550

2.0 LABORATORY QA/QC ELEMENTS

Laboratory Data Consultants, Inc. (LDC) performed the equivalent of United States Environmental Protection Agency (USEPA) Level III validation on 90% of the data, and Level IV on the remaining 10% of the data (which includes an evaluation of all Level III items) in accordance with the *Final Appendix B – 2015 Quality Assurance Project Plan Update, Long-Term Monitoring Plan* (2015 QAPP; IEA, Inc./MWH Americas, Inc. Joint Venture [IEA/MWH JV], March 2016) and the *Final Appendix B – 2017 Quality Assurance Project Plan Update, Long-Term Monitoring Plan* (2017 QAPP; IEA/MWH JV, July 2017); the USEPA National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2014); the USEPA National Functional Guidelines for Inorganic Superfund Data Review (USEPA, 2014); USEPA SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition (USEPA, 1986) and updates; and the Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0 (DoD, 2013) validation guidelines, as appropriate. QAPP Worksheets #34, #35, and #36 describe the verification process, and QAPP Worksheet #37 describes the data usability assessment.

Data were evaluated for precision, accuracy, representativeness, comparability, and completeness based on results of the following QA/QC samples and parameters, where applicable:

- Sample preservation
- Sample holding times
- Surrogate spikes (organics)
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD)
- Matrix spike/matrix spike duplicate (MS/MSD)
- Matrix duplicate for metals
- Laboratory duplicate samples
- Gas chromatography/mass spectroscopy (GC/MS) tunes (organics)
- Internal standards (organics)
- Initial calibration (ICAL) standards
- Initial calibration verification (ICV) standards
- Continuing calibration verification (CCV) standards
- Interference check samples (ICSs; metals)
- Trip blanks (VOCs)
- Serial dilution (metals)
- Method blanks
- Initial calibration blanks (ICBs)
- Continuing calibration blanks (CCBs)

- Post digestion spikes (metals).

The following field QA/QC samples were collected and analyzed:

- One field duplicate per 10 field samples collected, or fewer.
- One MS/MSD (extra sample volume) per 20 field samples collected, or fewer.
- Trip blanks included with each cooler containing VOC samples.

Samples were stored in coolers on wet ice, then shipped to Shealy in West Columbia, South Carolina under proper chain-of-custody documentation.

3.0 EVALUATION OF MEASUREMENT QUALITY OBJECTIVES

For each analytical method, laboratory QA/QC results were compared to the established acceptance limits. Refer to the associated Data Validation Reports presented in Appendix B1 for analysis of the below criteria for each individual SDG and associated samples. The parameters reviewed by method within the Data Validation Report for each SDG are outlined as follows.

Precision was quantitatively evaluated by reviewing the relative percent differences (RPDs) for the following QA/QC samples:

- MS/MSDs
- Matrix duplicate (metals)
- LCS/LCSDs
- Laboratory duplicate samples
- Serial dilution (metals)
- Field duplicate samples
- Primary and secondary column confirmation (explosives).

Accuracy was quantitatively evaluated by comparing the percent recovery (%R) or percent difference (%D) for the following QA/QC samples or parameters:

- Surrogate spikes (VOCs, SVOCs, and explosives)
- Internal standards (VOCs and SVOCs)
- ICVs
- CCVs
- MS/MSDs
- LCSs
- ICSs (metals)
- Post digestion spike (metals).

Refer to QAPP Worksheet #12 (Method Performance Criteria Table) and QAPP Worksheet #28 (QC Samples Table) for QC samples analyzed and criteria limits.

Representativeness was evaluated through a review of the following QA/QC elements:

- Sample preservation
- Sample holding times
- Compliance with sample collection, handling, and analysis methods specified in the *Final Appendix A – 2015 Field Sampling Plan Update, Long-Term Monitoring Plan* (FSP; IEA/MWH JV, March 2016).

Refer to QAPP Worksheets #21 through #27 for evaluation criteria related to representativeness.

Comparability was qualitatively evaluated through a review of the following QA/QC elements:

- Sample collection and handling procedures
- Sample preparation, analysis, and quantitation procedures
- Units of measure.

Refer to QAPP Worksheets #21 through #27 for evaluation criteria related to comparability. Comparability was acceptable for the April 2017 sampling event.

3.1 COMPLETENESS

Completeness was calculated by dividing the number of acceptable sample results by the total number of scheduled sample results. All scheduled and planned samples were collected and analyzed. The completeness goal for holding times is 100%. Holding times were met for all analytes in the April 2017 sampling round, with the exception of seven explosive samples in SDG SD25024, two explosive samples in SDG SD25025, 1 nitrate sample in SDG SD25025, and two explosive samples in SDG SD27018. The samples outside of holding times were re-analyzed. The initial runs were within hold times, therefore data was not rejected due to holding time issues, the completeness goal of 100% for holding times was met.

The analytical method utilized by the laboratory was SW-846 Method 8330A. This is a variation from the 2015 QAPP which indicated that SW-846 Method 8330B would be utilized. This however does not impact the usability of the data.

The laboratory completeness goal for the number of acceptable sample results compared to the total sample results is 100%. Only results qualified “R” as unusable were considered unacceptable sample results for calculating laboratory completeness. Sample results qualified “J” as estimated, “U” as not detected, or “UJ” as not detected estimated quantitation limit were considered quantitative and acceptable. One compound, in one sample, was rejected due to MS/MSD %R, and therefore the completeness goal for acceptability was 99.9%.

Refer to QAPP Worksheet #37 for the data usability criteria.

3.2 SENSITIVITY

Sensitivity was evaluated by comparing limit of quantitation (LOQ), limit of detection (LOD), and detection limit (DL) with the appropriate QAPP criteria. In samples not

requiring dilutions, adequate sensitivity was demonstrated with LOQs equal to or less than the associated criteria. Refer to QAPP Worksheet #15 the Reference Limits and Evaluation Table for compound-specific LOQs, LODs, DLs, and project action limits.

3.3 TRACEABILITY

Traceability was evaluated by reviewing field documentation, chain-of-custody documentation, and analytical reports. Each sample was found to be traceable from collection through analysis.

3.4 DATA QUALIFIERS

Refer to Tables 3-1 through 3-5 of this 2017 Semi-annual Groundwater Monitoring Report for summaries of groundwater and surface water data. Refer to Appendix B1 for the Data Validation Reports associated with each SDG. Table 1 of Appendix B2 provides a summary of all reported data that has been qualified.

3.5 CONCLUSIONS

As discussed in Section 3.1, completeness goals were not met for acceptability completeness for the April 2017 analytical data; however, this had minimal impact on the usability of the data. The holding time completeness was 100% and the acceptability completeness was 99.9% for this data set. The data complies with contract requirements. The data that did not meet QA criteria and were qualified as estimated data with a “J” or “UJ” are considered usable and do not negatively impact the project objectives. There were no biases or trends observed in this dataset.

4.0 REFERENCES

DoD, 2013. *Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.0*. July 2013.

IEA/MWH JV, 2016. *Final Appendix A - 2015 Field Sampling Plan Update, Long-Term Monitoring Plan* (IEA/MWH JV, March 2016).

IEA/MWH JV, 2016. *Final Appendix B - 2015 Quality Assurance Project Plan Update, Long-Term Monitoring Plan* (IEA/MWH JV, March 2016).

IEA/MWH JV, 2017. *Final Appendix B - 2017 Quality Assurance Project Plan Update, Long-Term Monitoring Plan* (IEA/MWH JV, July 2017).

USEPA, 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition*. November 1986.

USEPA, 2014. *USEPA National Functional Guidelines for Superfund Organic Methods Data Review*. August 2014.

USEPA, 2014. *USEPA National Functional Guidelines for Inorganic Superfund Data Review*. August 2014.

APPENDIX B2
TABLE 1

Summary of Qualified Results
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Analysis	Failed Criteria	Compound	Result	Associated Samples	SDG	Flag
Sampling Conducted April 2017						
Sulfate	MS/MSD %R and RPD	Sulfate	%R = -8.0/65 RPD = 47	JP-M1-SW709	SD25024	J (all detects)
Explosives	Holding time	All compounds	5 days past holding time from sample collection to extraction	JP-L3-GWMW630 JP-L3-GWMW631 JP-L3-GWMW633 JP-L3-GWMW412 JP-L3-SW777 JP-L1-GWWES1 JP-L1-GWMW131	SD25024	J (detects) UJ (non-detects)
Explosives	Surrogates (both columns) 1,2-dinitrobenzene	All compounds	%R = 182/142	JP-M6-GWMW318	SD25024	J (all detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 197	JP-M6-GWMW319	SD25024	J (all detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 81	JP-OA-GWMW117	SD25024	J (detects) UJ (non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 82	JP-OA-GWMW118	SD25024	UJ (all non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 78	JP-OA-GWMW119	SD25024	UJ (all non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 81	JP-L3-GWMW663	SD25024	J (detects) UJ (non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 474	JP-L1-GWWES1	SD25024	J (all detects)
Explosives	Surrogates (both columns) 1,2-dinitrobenzene	All compounds	%R = 64/126	JP-L1-GWMW131	SD25024	J (detects) UJ (non-detects)
Explosives	MS/MSD	2-amino-4,6-dinitrotoluene 1,3-dinitrobenzene 2,4-dinitrotoluene 2,6-dinitrotoluene nitrobenzene 2-nitrotoluene 3-nitrotoluene	%R = -- /71 %R = --/73 %R = -- /62 %R = -- /18; RPD = 57 %R = -- /16 %R = -- / 17 %R = -- /12; RPD = 130	JP-M6-GWMW654	SD25024	J (detects) UJ (non-detects)
Explosives	MS/MSD	4-nitrotoluene	%R = -- /0	JP-M6-GWMW654	SD25024	R (all non-detects)
Explosives	Compound Quantitation (RPD between two columns)	2,4-dinitrotoluene	%R = 75.3	JP-M6-GWMW998	SD25024	J (all detects)
Explosives	Compound Quantitation (RPD between two columns)	1,3,5-trinitrobenzene	%R = 102.8	JP-M6-GWMW318	SD25024	J (all detects)
Explosives	Compound Quantitation (RPD between two columns)	1,3,5-trinitrobenzene 2,4,6-trinitrotoluene	%R = 108 %R = 131.4	JP-M6-GWMW319	SD25024	J (all detects)
Explosives	Compound Quantitation (RPD between two columns)	2-nitrotoluene	%R = 106.5	JP-OA-GWMW117	SD25024	J (all detects)
Explosives	Compound Quantitation (RPD between two columns)	4-amino-2,6-dinitrotoluene	%R = 59.7	JP-L1-GWWES1	SD25024	J (all detects)
Explosives	Compound Quantitation (RPD between two columns)	2,6-dinitrotoluene	%R = 180.6	JP-L1-GWMW131	SD25024	J (all detects)
SVOCs	ICV	Pyridine 2,4,6-trichlorophenol	%D = 26.4 %D = 20.3	All samples in SDG	SD25025	J (detects) UJ (non-detects)
SVOCs	CCV	Pyridine	%D = 20.3	All samples in SDG	SD25025	J (detects) UJ (non-detects)
SVOCs	Surrogates 2-Fluorobiphenyl Nitrobenzene-d5	1,2-dichlorobenzene 1,2,4-trichlorobenzene 1,3-dichlorobenzene 1,4-dichlorobenzene 2-nitroaniline 2,4-dinitrotoluene 2,6-dinitrotoluene 3-nitroaniline 3,3'-dichlorobenzidine 4-bromophenyl-phenylether 4-chloroaniline 4-chlorophenyl-phenylether 4-nitroaniline acenaphthene acenaphthylene anthracene benzo(a)anthracene benzo(a)pyrene benzo(b)fluoranthene benzo(g,h,i)perylene benzo(k)fluoranthene benzyl alcohol bis(2-chloroethoxy)methane bis(2-ethylhexyl)phthalate butylbenzylphthalate	%R = 36 %'R = 43	JP--M13-GWMW809	SD25025	UJ (all non-detects)
		carbazole chrysene di-n-butylphthalate di-n-octylphthalate Dibenzo(a,h)anthracene dibenzofuran diethylphthalate dimethylphthalate fluoranthene Fluorene Hexachlorobenzene hexachlorobutadiene hexachloroethane indeno(1,2,3-cd)pyrene isophorone n-nitroso-di-n-propylamine n-nitrosodiphenylamine naphthalene nitrobezene phenanthrene pyrene aniline benzidine				
		bis(2-chloro1-mehyletheyl)ether 1,2-diphenylhydrazine 'hexachlorocyclopentadiene n-nitrosodimethylamine pyridine				

APPENDIX B2
TABLE 1

Summary of Qualified Results
2017 Semi-annual Groundwater Monitoring Report
Joliet Army Ammunition Plant
Will County, Illinois

Analysis	Failed Criteria	Compound	Result	Associated Samples	SDG	Flag
SVOCs	MS/MSD	Acenaphthene Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene 4-Bromophenyl-phenyl ether Carbazole 4-Chloro-3-methylphenol Bis(2-chloroethoxy)methane 4-Chlorophenyl-phenyl ether Chrysene Dibenzo(a,h)anthracene Dibenzofuran 2,4-Dichlorophenol Diethylphthalate Dimethylphthalate Di-n-butylphthalate 4,6-Dinitro-2-methylphenol 2,4-Dinitrotoluene 2,6-Dinitrotoluene Di-n-octylphthalate 1,2-Diphenylhydrazine Bis(2-ethylhexyl)phthalate Fluoranthene	%R = -/39 %R = -/44 %R = -/ 54 %R = -/ 49 %R = -/ 49 %R = -/55 %R = 53/39 %R = -/ 53 %R = -/ 40 %R = -/42 %R = 50/38 %R = -/ 57 %R = -/ 44 %R = -/44 %R = -/ 39 %R = -/ 46 %R = -/ 44 %R = -/53 %R = -/ 43 %R = -/ 43 %R = 56/42 %R = -/48 %R = -/ 38 %R = -/ 54 %R = -/ 53	JP-M13-GWMW126R	SD25025	UJ (all non-detects)
		Fluorene Hexachlorobenzene 2- Nitroaniline 3- Nitroaniline 4- Nitroaniline Nitrobenzene 2-Nitrophenol 4-Nitrophenol N-Nitroso-di-n-propylamine N-Nitrosodiphenylamine Phenanthrene Phenol Pyrene 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol	%R = -/42 %R = -/ 40 %R = 54/42 %R = -/ 44 %R = -/54 %R = -/ 44 %R = -/ 42 %R = -/ 41 %R = -/48 %R = -/ 42 %R = -/44 %R = 43/37 %R = -/53 %R = 51/39 %R = -/ 40			
SVOCs	MS/MSD	Pyridine	RPD = 22	JP-M13-GWMW126R	SD25025	J (all detects)
SVOCs	LCS	24,5-trichlorophenol Phenol	%R = 50 %R = 47	All samples in SDG	SD25025	UJ (all non-detects)
Metals	Laboratory Blank	Arsenic Thallium Lead	NA	JP-M13-GWMW126R	SD25025	UB
Metals	Laboratory Blank	Arsenic Lead	NA	JP-M13-GWMW806	SD25025	UB
Metals	Laboratory Blank	Arsenic	NA	JP-M13-GWMW807	SD25025	UB
Metals	Laboratory Blank	Arsenic Lead	NA	JP-M13-GWMW808	SD25025	UB
Metals	Laboratory Blank	Arsenic Mercury	NA	JP-M13-GWMW811	SD25025	UB
Metals	Laboratory Blank	Arsenic	NA	JP-M13-GWMW996	SD25025	UB
Metals	Laboratory Blank	Arsenic Thallium Lead	NA	JP-M13-GWMW362	SD25025	UB
Metals	Laboratory Blank	Lead	NA	JP-M13-GWMW809	SD25025	UB
Nitrate as N	Holding time	Nitrate as N	9 days past holding time of 48 hours	JP-M13-GWMW809	SD25025	J (all detects)
Nitrate as N	Duplicate sample analysis	Nitrate as N	NA	JP-M13-GWMW809DUP	SD25025	J (all detects)
Explosives	Holding time	All compounds	3 days past holding time from collection to extraction	JP-M13-GWMW126R JP-M13-GWMW808	SD25025	UJ (all non-detects)
Explosives	CCV	HMX Nitrobenzene 2-Nitrotoluene	%D = 27.4 %D = 17.1 %D = 21	JP-M13-GWMW806 JP-M13-GWMW807 JP-M13-GWMW811 JP-M13-GWMW996 JP-M13-GWMW362 JP-M13-GWMW809	SD25025	UJ (all non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 78	JP-M13-GWMW806	SD25025	UJ (all non-detects)
Explosives	Holding time	All compounds	5 days past holding time from sample collection to extraction	JP-L1-GWMW173 JP-L1-GWMW174	SD27018	J (detects) UJ (non-detects)
Explosives	CCV	HMX Nitrobenzene 2-Nitrotoluene	%D = 27.4 %D = 17.1 %D = 21	JP-L1-GWWES53 JP-L1-SW550	SD27018	UJ (all non-detects)
Explosives	Surrogate 1,2-dinitrobenzene	All compounds	%R = 71	JP-L1-SW550	SD27018	UJ (all non-detects)
Explosives	Compound Quantitation (RPD between two columns)	HMX	RPD = 64.3	JP-L1-GWMW173	SD27018	J (all detects)

Notes:
SDG = Sample delivery group.
HMX = High melting-point explosive.
RDX = Royal Demolition Explosive.
%R = Percent recovery.
UJ = Not detected, estimated detection limit.
MS/MSD = Matrix spike/matrix spike duplicate.
J = Estimated concentration.
UB = Non-detect due to blank contamination.
RPD = Relative percent difference.
SVOC = Semi-volatile organic compound.
ICV = Initial calibration verification.
%D = Percent difference.
CCV = Continuing calibration verification.