ROCKY MOUNTAIN ARSENAL

Annual Covers Report for Resource Conservation and Recovery Act Caps 2014

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LIST OF ACRONYMS

ACB	Articulated Concrete Block
ACRRC	Annual Covers Report for RCRA Caps
ALR	Action Leakage Rate
AMA	Army Maintained Area
CAMU	Corrective Action Management Unit
CFS	Confined Flow System
DCPD	Dicyclopentadiene
DIMP	Diisopropyl Methylphosphonate
ELF	Enhanced Hazardous Waste Landfill
ENDRNA	Endrin Aldehyde
gpad	gallons per acre per day
HWL	Hazardous Waste Landfill
IC	Indicator Compound
LBLDS2	Secondary LB Leak Detection System
LCS	Leachate Collection System
LDS	Leak Detection System
LRCH	Leachate Riser Control House
LS/LF	Leachate Storage and Loadout Facility
MEK	Methyl ethyl ketone
Navarro	Navarro Research and Engineering, Inc.
NRAP	Non-Routine Action Plan
O&M	Operations and Maintenance
OCN	O&M Change Notice
PCGMP	Post-Closure Groundwater Monitoring Plan
PCGMR	Post-Closure Groundwater Monitoring Report
PCP	Post-Closure Plan
PLC	Program Logic Controller
RAVL	Rock-Amended Vegetative Soil Layer
RCRA	Resource Conservation and Recovery Act
RMA	Rocky Mountain Arsenal
SOP	Standard Operating Procedure
UFS	Unconfined Flow System
URS	URS Corporation

EXECUTIVE SUMMARY

This 2014 Annual Covers Report for Resource Conservation and Recovery Act (RCRA) Caps (ACRRC) for the Rocky Mountain Arsenal (RMA) Federal Facility Site was prepared in accordance with the *Hazardous Waste Landfill* (HWL) *Post-Closure Plan* (PCP), Revision 3 (TtEC 2011) and the *Enhanced Hazardous Waste Landfill* (ELF) PCP, Revision 0 (TtEC 2010). The purpose of this ACRRC is to provide a summary of post-closure care activities that occurred between May 1, 2013 and April 30, 2014, and to provide groundwater and Leachate Collection System (LCS)/Leak Detection System (LDS) analytical data for samples collected between January 1, 2013 and December 31, 2013. The activities presented in this report include the following items applicable to both the HWL and ELF:

- Army Maintained Area inspection results
- Surface maintenance activities, both routine and non-routine
- LCS/LDS maintenance
- Action Leakage Rate (ALR) analysis
- LCS/LDS wastewater management quantities
- LCS/LDS wastewater quality assessment
- Groundwater monitoring and assessment

Section 1.0 of the HWL PCP and ELF PCP states that post-closure, as required by RCRA, began following the physical completion of the respective caps and will continue for a minimum of 30 years after those dates. A final inspection meeting and site-walk of the HWL were conducted on May 20, 2009, and a final inspection meeting and site-walk of the ELF were conducted on May 26, 2010. Thus, the HWL post-closure period began May 21, 2009, and the ELF post-closure period began on May 27, 2010. This ACRRC addresses the sixth reporting period of the HWL post-closure period and the fourth reporting period of the ELF post-closure period.

The HWL facility was inspected, repaired, and maintained in accordance with the HWL PCP and the associated appendices. Similarly, the ELF facility was inspected, repaired, and maintained in accordance with the ELF PCP and the associated appendices. Observations noted during the inspections were evaluated by the Covers Manager, who initiated routine maintenance and non-routine actions as appropriate.

In general, the condition of the HWL soil cap and vegetation were good for the reporting period. Vegetation establishment continued to do well and provide adequate cover, and the population of broadleaf weedy species continued to decline. However, monitoring and herbicidal control of weedy annual grass will continue due to the persistent presence of cheatgrass (*Anisantha tectorum*). Erosion in high stormwater flow areas and on channel sideslopes was much less severe and widespread than in previous years.

The condition of the ELF cap was good for the reporting period. Establishment of desirable grass species continues to be a challenge, although vegetation establishment continues to improve. Similar to the HWL, erosion in high stormwater flow areas and on channel sideslopes was much less severe and widespread than in previous years. Occurrence of weedy annual grass

may require fall spraying and the site will again be evaluated for additional seeding activities in the fall of 2014.

The groundwater flow direction in the Unconfined Flow System (UFS) and Confined Flow System (CFS) is to the north-northwest and consistent with previous monitoring events for the HWL. With inclusion of well 25194 in the UFS, a more pronounced groundwater high in the UFS is shown along the west side of the HWL compared to previous reports. Lead and dieldrin were the only indicator compounds (ICs) detected in the downgradient wells. The detections of lead were below the upper prediction limit value, but dieldrin exceeded the calculated prediction limit. Analytical results for samples collected from the HWL Leak Detection System (LDS) sumps exceeded the watch list trigger value for endrin and dieldrin, each on one occasion. PPDDT was also detected in an HWL LDS sample and triggered Regulatory Agency notification. The Regulatory Agencies were notified of the exceedances through the use of Non-Routine Action Plans (NRAPs).

The current flow directions in the UFS and CFS are consistent with the previous preoperational, operational, closure, and post-closure groundwater monitoring events for the ELF. Lead was the only ICs detected in downgradient ELF wells, and the lead concentrations were below the calculated prediction limit of 26.3 μg/L. Analytical results for samples collected from the ELF LDS sumps exceeded the watch list trigger value for chloroform on two occasions. Tetrachloroethylene was also detected in an ELF LDS sample and triggered Regulatory Agency notification. The Regulatory Agencies were notified of the exceedances through the use of NRAPs.

The costs for operating, inspecting, and maintaining the HWL and ELF over the reporting period, including groundwater sampling, LCS/LDS sampling, LCS/LDS O&M, and wastewater disposal, totaled $653,564. Complete budgets for post-closure care of the HWL and ELF for May 2014 through April 2015 have not been approved as of the issuance of this report due to the timing of the annual funding cycle, which typically occurs near the end of the calendar year. However, the combined budgets are estimated to total approximately $909,000.

In summary, and based on the information presented in this report, the HWL and ELF were in compliance with all performance standards and no corrective measures were required. Future plans to maintain the integrity of the caps include continued diligence with weed control, overseeding where necessary, inspection for erosion, and quarterly monitoring the groundwater and LCS/LDS quality.

1.0 INTRODUCTION

This 2014 Annual Covers Report for Resource Conservation and Recovery Act (RCRA) Caps (ACRRC) for the Rocky Mountain Arsenal (RMA) Federal Facility Site was prepared in accordance with the *Hazardous Waste Landfill* (HWL) *Post-Closure Plan* (PCP), Revision 3 (TtEC 2011) and the *Enhanced Hazardous Waste Landfill* (ELF) PCP, Revision 0 (TtEC 2010). The purpose of this ACRRC is to provide a summary of post-closure care activities that occurred during the reporting period of 2014 and to provide recommendations for the post-closure care during the reporting period of 2015. The 2014 activities presented in this report include the following items applicable to both the HWL and ELF:

- Army Maintained Area (AMA) inspection results and maintenance activities, both routine and non-routine
- Leachate Collection System (LCS) and Leak Detection System (LDS) maintenance
- Action Leakage Rate (ALR) analysis
- LCS/LDS wastewater management quantities
- LCS/LDS wastewater quality assessment
- Groundwater monitoring and assessment

Remediation wastes were disposed in the Corrective Action Management Unit (CAMU) HWL and ELF facilities. State regulations (6 Code of Colorado Regulations 1007-3, Section 264.552) require that areas within the CAMU where remediation wastes remain in place after closure be managed and contained to control, minimize, or eliminate future releases to the extent necessary to protect human health and the environment. During the HWL closure period, a cap was constructed over the HWL as required by the *HWL Closure Plan* (TtEC 2006). Likewise, a cap was constructed over the ELF during the ELF closure phase, as required by the *ELF Closure Plan* (TtEC 2008). The HWL and ELF facilities also include stormwater drainage channels, wastewater conveyance systems, and groundwater monitoring wells. The integrity of both landfills and their supporting systems will be maintained by the Army for the duration of their respective post-closure periods. The Army has contracted Navarro Research and Engineering, Inc. (Navarro) to operate, maintain, and monitor the landfills and their associated systems. Navarro is the prime contractor under the RMA Operations and Maintenance Contract (OMC).

As required by Section 3.9 of the HWL PCP and ELF PCP, this ACRRC for 2014 documents maintenance-related activities performed between May 1, 2013 and April 30, 2014, as well as groundwater and LCS/LDS analytical data for samples collected between January 1, 2013 and December 31, 2013.

Section 1.0 of the HWL PCP and ELF PCP states that post-closure, as required by RCRA, will begin following the physical completion of the respective caps and will continue for a minimum of 30 years after those dates. A final inspection meeting and site-walk of the HWL were conducted on May 20, 2009, and a final inspection meeting and site-walk of the ELF were conducted on May 26, 2010. Thus, the HWL post-closure period began May 21, 2009, and the ELF post-closure period began on May 27, 2010. This ACRRC addresses the sixth reporting period of the HWL post-closure period and the fourth reporting period of the ELF post-closure period.

The HWL and ELF facilities are located adjacent to each other within the northwest quadrant of Section 25, within the boundaries of the Rocky Mountain Arsenal National Wildlife Refuge perimeter fence. The Rocky Mountain Arsenal National Wildlife Refuge is managed by the U.S. Fish and Wildlife Service. The two facilities are surrounded by a common fence, which defines the AMA for the HWL and ELF. This AMA includes both landfills and surrounding support facilities, and occupies roughly 130 acres. The ground surface elevation of the facilities generally ranges between 5,200 and 5,300 feet above mean sea level. No 100-year floodplains have been identified in this area.

All components of the HWL and ELF facilities within, and including, the fence are addressed in this ACRRC. Refer to the HWL PCP and ELF PCP for additional detail regarding each component.

2.0 METHODOLOGY

The HWL facility was inspected, repaired, and maintained in accordance with the HWL PCP and the associated appendices. Similarly, the ELF facility was inspected, repaired, and maintained in accordance with the ELF PCP and the associated appendices. Observations noted during the inspections were evaluated by the Covers Manager, who initiated routine maintenance and non-routine actions as appropriate.

2.1 Monthly and Semiannual Inspections

2.1.1 HWL Inspections

The procedures for inspecting the HWL soil cap and infrastructure features are detailed in Standard Operating Procedure (SOP) HWL-001, presented in Appendix A of the HWL PCP. The SOP provides procedures for monthly and semiannual inspections, as well as a procedure for measuring the loss of cap soil thickness. Monthly inspections were performed regularly from May 2013 through November 2013 in accordance with the SOP. A Semiannual inspection was held on September 4, 2013. OCN-HWL-2013-002 was approved by all of the parties on November 20, 2013 which changed the inspection frequency from monthly to quarterly inspections. A Type I (i.e. quarterly) inspection was conducted on December 11, 2013 and a Type II (i.e. semiannual) inspection was conducted on April 2, 2014. Results of the monthly, semiannual, Type I, and Type II HWL inspections are discussed in Section 4.1.

2.1.2 ELF Inspections

The procedures for inspecting the ELF soil cap and infrastructure features are detailed in SOP ELF-001, presented in Appendix A of the ELF PCP. The SOP includes procedures for monthly and semiannual inspections, as well as a procedure for measuring the loss of cap soil thickness. Monthly inspections were performed regularly from May 2013 through December 2013 in accordance with the SOP. A Semiannual inspection was held on September 4, 2013. OCN-ELF-2013-002 was approved by all of the parties on January 3, 2014, via e-mail, which changed the inspection frequency from monthly to quarterly inspections. A Type II (i.e. semiannual) inspection was conducted on April 2, 2014. Results of the monthly, semiannual, and Type II ELF inspections are discussed in Section 5.1.

2.2 Maintenance and Repair Activities

Examples of routine maintenance and repair activities for the HWL are listed in Table 3.0-1 of the HWL PCP, while conditions requiring Non-Routine Actions are listed in Table 3.0-2 of the HWL PCP. Likewise, examples of routine maintenance and repair activities for the ELF are listed in Table 3.0-1 of the ELF PCP, while conditions requiring Non-Routine Actions are listed in Table 3.0-2 of the ELF PCP. Routine and non-routine maintenance and repair activities are discussed in Sections 4.2 and 5.2.

2.3 LCS/LDS Sump Inspection, Sampling and Analysis

2.3.1 HWL LCS/LDS Sump

Quarterly inspection of the HWL LCS, LDS and Wastewater Conveyance System were performed in accordance with the *HWL Post-Closure Wastewater Management Plan*, presented in Appendix C of the HWL PCP. Sampling and analysis of the HWL LCS and LDS liquids were performed quarterly in accordance with the *HWL Post-Closure Groundwater Monitoring Plan* (PCGMP), presented in Appendix B of the HWL PCP. Samples collected from the HWL LCS and LDS sumps were analyzed using methods that captured all analytes on the Indicator Analyte List. In April of 2013, wastewater from the LCS and LDS sumps were analyzed for the complete analyte list as shown in Table 3.2-2 of the HWL PCGMP. Analytical results and data evaluation for HWL post-closure LCS and LDS wastewater sampling performed from January through December of 2013 are presented in the *2013 HWL Post-Closure Groundwater Monitoring Report* (PCGMR), provided in Appendix F-1 of this ACRRC.

2.3.2 ELF LCS/LDS Sump

Quarterly inspection of the ELF LCS, LDS and Wastewater Conveyance System were performed in accordance with the *ELF Post-Closure Wastewater Management Plan*, presented in Appendix C of the ELF PCP. Sampling and analysis of the ELF LCS and LDS liquids were performed quarterly in accordance with the ELF PCGMP, presented in Appendix B of the ELF PCP. Samples collected from the ELF LCS and LDS sumps were analyzed using methods that captured all analytes on the Indicator Analyte List. In April of 2013, wastewater from the LCS and LDS sumps were analyzed for the complete analyte list as shown in Table 3.2-3 of the ELF PCGMP. Analytical results and data evaluation for ELF post-closure LCS and LDS wastewater sampling performed from January through December of 2013 are presented in the 2013 ELF PCGMR, provided in Appendix F-2 of this ACRRC.

2.4 ALR Evaluation

The ALR is the liquid flow rate that, when withdrawn from the LDS sumps, warrants follow-up actions. The ALR represents the capacity of the LDS to transmit flow and is independent of the sources of the liquids flowing into the system.

The monthly flow rate data was converted to an average daily flow rate for each of the HWL and ELF LDS sumps. The average daily flow rates for the HWL LDS sumps were compared with the ALRs identified in the *HWL Post-Closure Action Leakage Rate/Response Action Plan* presented in Appendix D of the HWL PCP, and the Non-Routine Action Trigger Levels presented in Table 3.0-2 of the HWL PCP. Likewise, the average daily flow rates for the ELF LDS sumps were compared with the ALRs identified in the *ELF Post-Closure Action Leakage Rate/Response Action Plan* presented in Appendix D of the ELF PCP, and the Non-Routine

Action Trigger Levels presented in Table 3.0-2 of the ELF PCP. Results of the HWL ALR comparison and ELF ALR comparison are presented in Section 6.1.2 and 6.3.2, respectively.

2.5 Groundwater Sampling

2.5.1 HWL Groundwater Sampling

The HWL PCGMP, presented in Appendix B of the HWL PCP, was implemented quarterly with inspection and sampling of groundwater monitoring wells in the HWL groundwater monitoring well network. The network of groundwater monitoring wells, both upgradient and downgradient of the HWL is intended to monitor for existing hazardous constituents in the groundwater, and to monitor for potential releases of hazardous constituents from the HWL. Analytical results and data evaluation for post-closure groundwater sampling performed from January through December of 2013 are presented in Appendix F-1 of this ACRRC.

2.5.2 ELF Groundwater Sampling

The ELF PCGMP, presented in Appendix B of the ELF PCP, was implemented quarterly with inspection and sampling of groundwater monitoring wells in the ELF groundwater monitoring well network. The network of groundwater monitoring wells, both upgradient and downgradient of the ELF is intended to monitor for existing hazardous constituents in the groundwater, and to monitor for potential releases of hazardous constituents from the ELF. Analytical results and data evaluation for post-closure groundwater sampling performed from January through December of 2013 are presented in Appendix F-2 of this ACRRC.

3.0 PRECIPITATION DATA

Precipitation data presented in Appendix A were collected from a rain gauge located on the Shell Disposal Trenches RCRA-Equivalent Cover in Section 36, which is located approximately 1.5 miles south of the HWL and ELF. Total precipitation measured at the RCRA-Equivalent Cover between May 1, 2013 and April 30, 2014 was 15.38 inches. One significant storm event occurred on August 21, 2013 where the RMA received 1.14 inches of rain, and three significant storm events occurred on September 10, 12, and 15, 2014 where the RMA received 1.21, 2.45, and 1.57 inches of rain, respectively.

4.0 HWL CAP ASSESSMENT, MAINTENANCE AND REPAIR ACTIONS

In general, the condition of the HWL soil cap and vegetation were good for the reporting period. Vegetation establishment continued to do well and provide adequate cover, and the population of broadleaf weedy species continued to decline. However, monitoring and herbicidal control of weedy annual grass will continue due to the persistent presence of cheatgrass (*Anisantha tectorum*). Erosion in high stormwater flow areas and on channel sideslopes was much less severe and widespread than in previous years.

4.1 HWL Cap Inspections

The HWL cap was inspected monthly and semiannually. A post-storm inspection was conducted in August 2013 after the RMA received more than one inch of rain within a 24 hour period. Also, beginning on September 9, 2013 and ending on September 15, 2013, the RMA received 8.2 inches of rain. OMC personnel performed this post-storm inspection in October 2013. A semiannual inspection was held on September 4, 2013.

OCN-2013-002 was approved by all of the parties on November 20, 2013 which changed the inspection frequency from monthly to quarterly inspections. A Type I (i.e. quarterly) inspection was conducted on December 11, 2013 and a Type II (i.e. semiannual) inspection was conducted on April 2, 2014.

During inspections, inspectors evaluated the condition of the soil cap surface for evidence of erosion, cracking, subsidence, ponding of rainwater, and the presence of burrowing animals. Other features, such as the vegetative cover, engineering and access controls, surface water controls, and erosion/settlement monuments were also inspected. Specific inspection items are listed on forms SOP HWL 001-1 and SOP HWL 001-2, contained in Appendix A of the HWL PCP. Copies of the completed inspection forms are provided in Appendix B-1.

4.2 HWL Inspection Observations and Associated Repairs

The inspection observations listed below were identified during the monthly inspections, post-storm inspections, semiannual inspections, and Type I and Type II inspections. The resulting maintenance and repair activities are discussed following each observation. Documentation of HWL maintenance activities are provided in Appendix C-1 and are illustrated on Figure 4.2-1 and Figure 4.2-2.

- Cottonwood saplings were observed growing in the lowest level north articulated concrete block (ACB) lined terrace channel and in the northwest, northeast, and east center downchutes. These saplings were removed in June 2013.
- Erosion rills were documented in the east perimeter channel. These rills were not repaired during this reporting period and will therefore be discussed in the 2015 ACRRC.
- Noxious and undesirable weeds were identified on the HWL. Weed control efforts were ongoing using ground herbicide application. In September 2013, an aerial application of Plateau was applied to the entire HWL AMA in an effort to control cheatgrass (*Anisantha tectorum*).
- Several areas of erosion were noted on the perimeter road after the September rain storms. These areas were repaired using stockpiled road base and recycled asphalt. These repairs to the road were completed in March 2014.
- An area was observed in the northeast perimeter channel that could benefit from overseeding. This area was scarified and then hand seeded and raked in April 2014.
- A general observation made by the Vegetation Expert was to enhance the native grass species on the HWL Cap. In December 2013, areas of the HWL that had a low population of established grass species were broadcast seeded using sand dropseed (*Sprobolus cryptandrus*).
- Tumbleweeds were removed from the perimeter fence and from the ACB lined channels in March and April 2014.

The maintenance items listed below were identified as improvements that were necessary to facilitate effective operation and maintenance of the HWL and were not the result of inspection observations.

- Weedy vegetation was removed from the HWL sump manways in August 2013. Primarily kochia weed was pulled and chopped to aid in the health and safety of personnel accessing the HWL sumps.
- Weedy kochia areas were mowed in the support areas of the HWL to limit shading for the seeded species.
- More gravel was added around the HWL manholes near the front facing flanges in August 2013. These areas need to be accessible to personnel and the addition of this gravel will deter vegetation from blocking the access.
- In December 2013, OMC personnel checked all gates on the HWL perimeter fence to ensure they would open and close properly. Three of the HWL gates were in need of repair. During this reporting period, one of the gates was repaired. The repair of the other two gates will be discussed in the 2015 ACRRC.
- The berm around the HWL lift station was removed and this area was levelled out in March 2014. This area was then scarified and hand seeded in April 2014.

4.3 HWL Erosion/Settlement Monuments

During the semiannual inspection in September 2013 and the Type II inspection in April 2014, the erosion/settlement monuments were measured for soil thickness loss. The measured soil thickness loss for all nine monuments ranged from 0.0 to 1.5 inches, which is well below the trigger level of 4.8 inches. The position of each monument was also surveyed as part of the semiannual inspections. Survey data are attached in Appendix D, together with data collected during prior surveys for reference.

4.4 HWL Vegetation

Established areas of seeded vegetation on the HWL cap continue to do well and provide substantial cover. Cool season grass species, especially Western Wheatgrass (*Pascopyrum smithii*) continue to dominate in the grass community. Broadleaf weedy species were sparse, but some areas of cheatgrass (*Anisantha tectorum*) were noted during the semiannual inspection, even though the entire area had been treated by aerial spraying the previous fall. Monitoring of the cheatgrass will continue.

Species seeded during 2012 in disturbed areas resulting from the interior road construction, as well as other areas with sparse vegetation continue to develop slowly. Additional broadcast seeding with sand dropseed (*Sprobolus cryptandrus*) was conducted during the winter of 2013 and spring of 2014 in an effort to further enhance the perennial plant communities in these areas.

The HWL will continue to be monitored for development of perennial grass species, especially in the reseeded areas, and methods for additional control of the cheatgrass will be investigated.

5.0 ELF CAP ASSESSMENT, MAINTENANCE AND REPAIR ACTIONS

The condition of the ELF cap was good for the reporting period. Establishment of desirable grass species is improving, but still remains somewhat sparse. Monitoring of weedy annual grass will continue due to the persistent presence of cheatgrass. Erosion in high stormwater flow areas and on channel sideslopes was much less severe and widespread than in previous years.

5.1 ELF Cap Inspections

The ELF cap was inspected monthly and semiannually. A post-storm inspection was conducted in August 2013 after the RMA received more than one inch of rain within a 24 hour period. Also, beginning on September 9, 2013 and ending on September 15, 2013, the RMA received 8.2 inches of rain. OMC personnel performed this post-storm inspection in October 2013. A fall semiannual inspection was held on September 4, 2013.

OCN-2013-002 was approved by all of the parties on January 3, 2014, via e-mail, which changed the inspection frequency from monthly to quarterly inspections. A Type II (i.e. semiannual) inspection was conducted on April 2, 2014.

During inspections, inspectors evaluated the condition of the soil cap surface for evidence of erosion, cracking, subsidence, ponding of rainwater and the presence of burrowing animals. Other features, such as the vegetative cover, trench drain outlets, engineering and access controls, surface water controls, erosion/settlement monuments, and the Leachate Storage and Loadout Facility (LS/LF) Building, were also inspected. Specific inspection items are listed on forms SOP ELF 001-1 and SOP ELF 001-2, contained in Appendix A of the ELF PCP. Copies of the completed inspection forms are provided in Appendix B-2.

5.2 ELF Inspection Observations and Associated Repairs

The inspection observations listed below were identified during the monthly inspections, post-storm inspections, and semiannual inspections. The resulting maintenance and repair activities are discussed following each observation. Documentation of ELF maintenance activities are provided in Appendix C-2 and are illustrated on Figure 5.2-1 and Figure 5.2-2.

- A general observation made by the Vegetation Expert was to enhance the native grass species on the ELF Cap. In December 2013, areas of the ELF with a low population of established grass species were broadcast seeded using sand dropseed (*Sprobolus cryptandrus*).
- Tumbleweeds were removed from the perimeter fence and from the ACB lined channels in March and April 2014.
- Noxious and undesirable weeds were identified on the ELF. Weed control efforts were ongoing using ground herbicide application. Cheatgrass was also observed on most of the cap and surrounding areas. In September 2013, an aerial application of Plateau was applied to the entire ELF AMA in an effort to control cheatgrass.
- After the September rains, one of the temporary rock check dams located in the west perimeter channel was breached and rocks were scattered downstream in the grass lined portion of the channel. In March 2014, the rocks and dam were removed from the channel and this area was hand raked.
- Several areas of erosion were noted on the perimeter road after the September rain storms. These areas were repaired using stockpiled road base and recycled asphalt. These repairs to the road were completed in March 2014; however two culverts will be installed to help prevent this erosion in the future. The installation of the culverts will be discussed in the 2015 ACRRC.

- The animal trails that were first documented in the 2013 ACRRC (Navarro 2013) on the south slope continued to diminish. All of the gates on the southern ELF perimeter fence were closed and locked during the February 2013 monthly inspection.
- Three areas of erosion were identified during the spring 2013 semiannual inspection. The areas of erosion are in the south and west perimeter channels. No maintenance related activity was performed during this reporting period and will therefore be presented in the 2015 ACRRC.
- Stormwater drains from the Section 25 stockpile area, located directly south of the ELF, into the southwest perimeter channel. This drainage washed away the soil from the rip rap soil matrix on the sideslope of the perimeter channel and thus exposed the rip rap. A revised grading plan for the Section 25 stockpile area was prepared during this reporting period to prevent additional run-on from entering the channel. All grading and stormwater diversion work will be performed outside of the AMA. The work is planned for the spring of 2014 and will be discussed in the 2015 ACRRC.

The maintenance items listed below were identified as improvements that were necessary to facilitate effective operation and maintenance of the ELF and were not the result of inspection observations.

- OMC maintenance personnel inspected the roofs of both Leachate Riser Control House (LRCH) buildings. No leaks were identified and displaced interior insulation was placed back on the ceiling in January 2014.
- Two erosion control logs had washed loose in the west perimeter channel after the September rain storms. These erosion control logs were replaced in the channel in January 2014.
- OMC maintenance personnel rotated the middle light fixture 90 degrees in the LB LRCH building in February 2014.
- The heater in the WP LRCH building was repaired in February 2014.
- OMC maintenance personnel added a footpath around the ELF electrical panel, just south of the Leachate Storage and Loadout Facility (LS/LF) building, using recycled asphalt in February 2014.

The maintenance items listed below were identified for repair during the previous reporting period, but were repaired during the 2014 reporting period.

- The southeast gate on the ELF perimeter fence needed two nuts on the bolts to hold the gate hinge. This repair was made in June 2013.
- A localized depression was observed around Erosion Control Monument EM-ELF06. This depression was filled using rock amended vegetative layer and hand raked to match the surrounding grade. This repair was made in February 2014.

5.3 ELF Erosion/Settlement Monuments

During the semiannual inspection in September 2013 and the Type II Inspection in April 2014, the erosion/settlement monuments were measured for soil thickness loss. The measured soil thickness loss for all eight monuments ranged from 0.0 to 1.75 inches, which is well below the

trigger level of 4.8 inches. The position of each monument was also surveyed as part of the semiannual inspections. Survey data are attached in Appendix D, together with data collected during prior surveys for reference.

5.4 ELF Anchor Trench Drains

The ELF anchor trench drain outfalls were inspected in accordance with the SOP for evidence of flow, erosion, seepage, moisture or bare/sparse vegetation. The inspections were documented on monthly, semiannual, and Type II inspection forms provided in Appendix B-2. All of the outfalls were free of flow and indications of moisture on all of the inspections for this reporting period.

5.5 ELF Vegetation

Seeded vegetation, although remaining somewhat sparse on the ELF cap continues to improve and provide greater cover. Established seeded species plants are developing and reproducing. Sand dropseed (*Sprobolus cryptandrus*) remains the most conspicuous grass species, but blue gramma (*Chondrosum gracile*) and buffalo grass (*Buchloe dactyloides*) are becoming more obvious. Cool season grass species remain sparse and isolated on the ELF cap. Seed was produced by established plants during the 2012/13 growing seasons. During the early spring 2014 Type II inspection, there was not wide spread evidence of establishment by new seedlings. Recent spring precipitation may improve seedling establishment. More widespread patches of cheatgrass were identified during the spring 2014 Type II inspection and will be monitored for potential additional treatment.

The area near the gas vent layer's perimeter continues to have sparse vegetation cover by both annual and perennial vegetation. No change in this status is expected because the soil thickness in this zone above the gas vent layer's filter fabric is too thin to support plant growth, especially in hot, dry weather.

The ELF will continue to be monitored for development of perennial grass species. Maintenance activities, such as weed control by mowing, will be conducted at regular and necessary intervals, and the site will again be evaluated for additional seeding activities in the fall of 2014.

6.0 LCS/LDS AND GROUNDWATER MONITORING

6.1 HWL LCS/LDS Operations

The Wastewater Operator used flowmeter data to prepare Landfill Wastewater Flow Summary reports on a weekly basis. Flow meters record the actual volume removed from the sumps and these data are downloaded daily into the RMA Environmental Database. The weekly flow summaries are provided in Appendix E. The Wastewater Operator also inspected the sump level in the manholes weekly and inspected the manholes for damage. These weekly sump level inspections and weekly flow rate calculations exceed the monthly requirement.

6.1.1 HWL LCS/LDS Inspections and Maintenance

The Wastewater Operators inspected and maintained the HWL LCS/LDS in accordance with Sections 3.1.3 and 3.1.4 of the *HWL Post-Closure Wastewater Management Plan*, contained in Appendix C of the HWL PCP. The following routine maintenance and repair activities were performed on the HWL LCS/LDS.

- Performed monthly inspections on the HWL emergency generator and fire extinguishers.
- Performed monthly inspections on the lift station liner leak detection and conveyance pipelines leak detection.
- Performed quarterly inspections on the HWL LCS/LDS and Wastewater Conveyance System.
- Performed quarterly inspections for grounding and tool safety inspections and first aid kits.
- Performed weekly HWL leak detection panel readings.
- Replaced the fiber/Ethernet switch at the HWL Lift Station with two media converters and a new Ethernet switch.
- Replaced the air conditioner in the Lift Station control panel.
- Exercised the Lift Station generator to ensure it stays in working order.
- The HWL LCS-2 digital readout was repaired.
- A new controller was installed in HWL LDS-1, LCS-2, and LDS-3.
- A wire was replaced from the leak detection panel that is in the electrical cabinet at the HWL Lift Station to the first electrical box located approximately 200 ft. south of the lift station.
- Installed new slip resistant mats on the lids of the HWL sumps and made adjustments to LCS/LDS-1 and LCS/LDS-2 to crown the lids to shed water.
- Replaced the Program Logic Controller (PLC) battery at the Lift Station.
- Transferred wastewater from the HWL LCS/LDS manholes to the lift station, and then to the storage tanks in the LS/LF Building as needed.
- Clean Harbors collected wastewater for off-site shipment and disposal.

The Wastewater Operators documented system inspections on inspection forms included in the *HWL Post-Closure Wastewater Management Plan*. Copies of the completed quarterly inspection forms are provided in Appendix B-1. Also, a system maintenance database was used to document inspections and maintenance activities. The Wastewater Operations and Maintenance (O&M) Reports, provided in Appendix C-1, were generated by the database and include log entries for inspections and maintenance activities.

6.1.2 HWL ALR Comparison

Each month OMC personnel calculated the wastewater collection rate in each LDS sump and compared that rate to the ALR for the respective sump as described in the *HWL Post-Closure Action Leakage Rate/Response Action Plan*, provided in Appendix D of the HWL PCP. The average daily flow rate was calculated as the volume of liquid pumped from the sump during the month, divided by the number of days in the month; divided by the acreage of surface area served by the sump. This average value is defined as the average daily flow rate and is expressed as gallons per acre per day (gpad). This average daily flow rate was then compared to the ALR and 85 percent of the ALR for the HWL to determine whether any response action is

necessary. Table 6.1.2-1 presents the comparisons and conclusions for HWL Sumps 1 through 4. In all cases, the average daily flow rates were much lower than the ALR and the non-routine action trigger level of 85 percent of the ALR. Hence, the performance standards and non-routine action trigger levels for leak detection liquids were not exceeded. Appendix E provides the weekly flow summaries used to calculate the average daily flow rates for each of the sumps.

6.1.3 HWL Wastewater Management Quantities

When wastewater in the HWL LCS and LDS sumps reached the high level switch settings of 30 inches and 20 inches of head, respectively, the wastewater was transferred to the lift station, and then to the two storage tanks located in the LS/LF building. The wastewater was stored in these tanks until a tanker truck arrived to transport the material off site for disposal. Approximately 39,950 gallons of HWL wastewater were transported off-site for disposal between May 2013 and April 2014. That equates to a 17 percent reduction in wastewater compared to the previous period of May 2012 to April 2013 when 48,100 gallons of wastewater were collected.

6.1.4 HWL LCS/LDS Wastewater Quality

Analytical data from the HWL LCS/LDS wastewater sampling is provided in this ACRRC in accordance with Section 3.9 of the HWL PCP. The HWL PCP requires the reporting of wastewater analytical data for the 12-month period from January 1 to December 31 that precedes the submittal of this report. Wastewater from the LCS/LDS is sampled quarterly for indicator compounds (ICs) and annually in the second quarter of the calendar year (typically in April) for the full analyte suite. The purpose of the samples collected from the LCS/LDS is to meet the requirements of the HWL PCP and to evaluate the chemistry of the liquids in order to determine potential leakage from the HWL.

This section presents a summary of analytical results from post-closure LCS/LDS wastewater monitoring at the HWL. Refer to the 2013 HWL PCGMR, provided in Appendix F-1 of this report, for additional details regarding the methods, results and conclusions of post-closure LCS/LDS wastewater sampling performed between January and December of 2013.

6.1.4.1 *HWL LCS Analytical Results*

Analytical results from the LCS leachate samples were consistent with wastes placed in the landfill and were within the chemical groups used in determining potential groundwater impacts. The ICs detected in the LCS sumps in 2013 include DIMP, dichlorodifluoromethane, dicyclopentadiene, dieldrin, mercury, and lead. Analytical results from the LCS sump samples are included in Appendix F-1.

6.1.4.2 *HWL LDS Analytical Results*

Analytes detected in the LDS sumps are presented in Appendix F-1 of this report. DIMP, dichlorodifluoromethane, dieldrin, lead, and mercury were the ICs detected in the LDS sumps during 2013. The following analytes were detected during the 2013 LDS sump sampling program and required action:

- Dieldrin was detected in LDS2 at a concentration of 0.133 μg/L in a sampled collected on January 16, 2013. The dieldrin concentration exceeded the watch list trigger level of 0.073 μg/L as provided in Table 3.2.5-2 of the HWL PCGMP. OMC personnel prepared NRAP-2014-005 to document the subsequent evaluation, recommendation, and

notification to the Regulatory Agencies. No further action was recommended in the NRAP.

- PPDDT was detected in LDS3 at a concentration of 0.0371 µg/L, and in LDS4 at concentrations of 0.027 µg/L, 0.0318 µg/L, and 0.0345µg/L, respectively in the April, July, and October 2013 sampling events. PPDDT is listed in Table 3.2.5-3 of the HWL PCGMP and is subject to the requirements of Section 3.2.5.3 *Analytes Requiring Reporting if Detected.* PPDDT has been detected two times since 2006. OMC personnel prepared NRAP-2014-003 to document the subsequent evaluation, recommendation, and notification to the Regulatory Agencies. Based on the increased frequency at which PPDDT has been detected in the LDS sumps, the Army recommended moving the compound from Table 3.2.5-3 to Table 3.2.5-2 and calculating a watch list trigger level for PPDDT. OCN-HWL-2014-010 was prepared to document the change and provide appropriate justification. Approval of the OCN by the Regulatory Agencies is pending.
- Endrin was detected in LDS4 at a concentration of 0.0966 µg/L in a sampled collected on July 22, 2013. The endrin concentration exceeded the watch list trigger level of 0.088 µg/L as provided in Table 3.2.5-2 of the HWL PCGMP. OMC personnel prepared NRAP-2014-002 to document the subsequent evaluation, recommendation, and notification to the Regulatory Agencies. No further action was recommended in the NRAP.

6.2 HWL Groundwater Monitoring and Assessment

Similar to the reporting requirements for HWL LCS/LDS wastewater sampling, Section 3.9 of the HWL PCP requires analytical data from the post-closure groundwater sampling to be reported in this ACRRC for the 12-month period from January 1 to December 31 that precedes the submittal of this report. The purpose of the post-closure groundwater sampling is to meet the requirements of the HWL PCP, to monitor groundwater flow directions and groundwater quality beneath and around the HWL, and to monitor for potential releases of hazardous constituents from the HWL.

Sampling of the HWL groundwater was performed quarterly in conjunction with the HWL LCS/LDS wastewater sampling described above. The 2013 HWL PCGMR provided in Appendix F-1 presents the methods, results, and conclusions of post-closure groundwater monitoring performed over four quarterly sampling events in the calendar year of 2013.

6.2.1 CAMU Groundwater Flow Direction

Groundwater level measurements were collected quarterly at 64 wells to evaluate the groundwater flow directions in the Unconfined Flow System (UFS) and Confined Flow System (CFS) in the area of the CAMU. This information was used to evaluate groundwater flow for significant changes in flow direction over time. The water level data are presented in tabular and graphical form in Appendix F-1 of this report. Across the entire CAMU, groundwater flow is generally to the north-northwest. No significant variations in groundwater flow directions were identified during the four quarters of post-closure monitoring. Overall groundwater flow direction is consistent with previous post-closure monitoring in the CAMU area.

6.2.2 HWL Impacts on Groundwater Quality

The results from the water quality sampling completed during the 2013 post-closure groundwater monitoring period were compared to the prediction limits calculated from the 2012 sampling results. Lead and dieldrin were the ICs detected in HWL downgradient wells. None of the downgradient HWL wells had reported values of lead above the calculated prediction limits. Dieldrin was below the prediction limit in all but one well (25194). At the time well 25194 was excluded from the prediction limit evaluation because it was not considered indicative of the UFS, and therefore not a true downgradient well.

Based on statistical evaluation, a conclusion can be made that the groundwater quality around the HWL has not been affected by operations, closure and post-closure O&M of the landfill. Refer to the HWL PCGMR included in Appendix F-1 for additional information regarding groundwater analytical results.

6.2.3 Dieldrin in Well 25194

The groundwater sample collected from well 25194 on February 12, 2013 contained dieldrin at a concentration of 0.0515 μg/L, which was higher than the upper prediction limit of 0.03 μg/L. An assessment of the water level data from well 25194 and surrounding wells suggested that the saturated interval may be a perched zone that was not in hydraulic communication with the UFS. No baseline data had been accumulated for this perched zone, and without baseline data, prediction limits could not be calculated. Therefore, well 25194 data has historically been used as an indicator of potential perched water contamination and not included in the prediction limit evaluation. This assessment was documented in previous annual HWL Post-Closure Groundwater Monitoring Reports (Navarro 2013).

In response to comments provided by the Colorado Department of Public Health and Environment (CDPHE 2013), OMC personnel re-evaluated the available data related to well 25194. As part of this re-evaluation, water level data, water quality data, and site history were reviewed to identify potential sources of the dieldrin and other analytes that have been detected in well 25194. The HWL LCS, LDS, and surrounding groundwater monitoring well water quality data suggest that the HWL LCS and LDS liners are intact and the groundwater quality downgradient of the HWL has not been impacted. However, a review of the operational history at Basins C and F appear to provide an explanation for the presence of dieldrin prior to HWL operations.

The low-level dieldrin concentrations in well 25194 appear to be residual Basins C/F plume contamination that pre-exist the HWL. Contamination from Basins C and F was mobilized to the area of well 25194 as a result of Basin C being repeatedly filled with fresh water from the South Lakes between 1957 and 1975. The fresh water recharge caused groundwater levels near Basins C and F to be significantly higher and created a contaminant migration pathway that coincides with the location of well 25194. Dieldrin and other contaminants remained in the soil west of the HWL after water levels in this area subsided. However, after the landfill's grass-lined perimeter channel was constructed west of the HWL in 2008, the hydrogeology in this area was modified and the residual contamination from the Basins C/F plume was mobilized. Prior to July 2003, well 25094 was dry, and the groundwater elevations have risen about two feet since 2003. The mobilized contamination in the saturated zone has now been detected in well 25194.

The new evaluation of conditions surrounding well 25194 has been documented in NRAP-2014-006. After the parties come to consensus on how to proceed, an OCN will be developed to document any changes that may be necessary to the HWL PCGMP.

6.3 ELF LCS/LDS Operations

The Wastewater Operator used flowmeter data to prepare Landfill Wastewater Flow Summary reports on a weekly basis. Flow meters record the actual volume removed from the sumps and these data are downloaded daily into the RMA Environmental Database. The weekly flow summaries are provided in Appendix E. The Wastewater Operator also inspected the sump level in the LRCH buildings weekly and inspected the piping for damage. These weekly LRCH building inspections and weekly flow rate calculations exceed the monthly requirement.

6.3.1 ELF LCS/LDS Inspections and Maintenance

The Wastewater Operators inspected and maintained the ELF LCS/LDS and associated buildings in accordance with Sections 3.1.3 and 3.1.4 of the *ELF Post-Closure Wastewater Management Plan*, contained in Appendix C of the ELF PCP. The following routine maintenance and repair activities were performed on the ELF LCS/LDS.

- Performed weekly inspections on the LB LRCH building, the WP LRCH building, and the LS/LF building.
- Performed quarterly inspections on the ELF LCS/LDS and Wastewater Conveyance System.
- Recorded weekly sump and tank levels for the ELF LCS/LDS and LS/LF building.
- Performed monthly inspections on emergency/exit lights in the LS/LF building, and both LRCH buildings.
- Inspected grounding and tools quarterly and also inspected the first aid kits quarterly.
- Installed rubber flashing on the LS/LF overhead door to help prevent water from entering the building during a hard rain.
- Repaired the unit heater in the WP LRCH building.
- Rotated the light fixture in the LB LRCH building.
- The exhaust fans in the LS/LF building were shut off for the winter.
- Insulation repairs were made in the LB LRCH building.
- Replaced the PLC batteries at the LRCH and LS/LF buildings.
- Installed a web relay at the LS/LF building for call out on low temperature at the WP LRCH building and leak detection at the LS/LF building.
- Cleaned the T-401 level probe so that it would function correctly.
- Replaced the PLC in the WP LRCH building.
- Transferred wastewater from the ELF LCS/LDS sumps to the tanks in the LS/LF building as needed.
- Clean Harbors collected wastewater for off-site shipment and disposal.

The Wastewater Operators documented system inspections on inspection forms included in the *ELF Post-Closure Wastewater Management Plan*. Copies of the completed quarterly inspection forms are provided in Appendix B-2. Also, a system maintenance database was used to document inspections and maintenance activities. The Wastewater O&M Reports, provided in Appendix C-2, were generated by the database and include log entries for inspections and maintenance activities.

6.3.2 ELF ALR Comparison

Each month OMC personnel calculated the wastewater collection rate in each LDS sump and compared that rate to the ALR for the respective sump as described in the *ELF Post-Closure Action Leakage Rate/Response Action Plan*, provided in Appendix D of the ELF PCP. The average daily flow rate was calculated as the volume of liquid pumped from the sump during the month, divided by the number of days in the month; divided by the acreage of surface area served by the sump. This average value is defined as the average daily flow rate and is expressed as gpad. This average daily flow rate was compared to the ALR, and 85 percent and 50 percent of the ALR to determine whether any response action is necessary. Table 6.3.2-1 presents the comparisons and conclusions for the four sumps. In all cases the average daily flow rates were much lower than the ALR and the non-routine action trigger levels of 50 and 85 percent of the ALR. Hence, the performance standards and non-routine action trigger levels for leak detection liquids were not exceeded. Appendix E provides the weekly flow summaries used to calculate the average daily flow rates for each of the sumps.

6.3.3 ELF Wastewater Management Quantities

When wastewater in ELF LCS and LDS sumps reached the high level switch settings of 24 inches of head, the wastewater was transferred to two storage tanks located in the LS/LF building. The wastewater was stored in these tanks until a tanker truck arrived to transport the material off site for disposal. Approximately 3,900 gallons of ELF wastewater were transported off-site for disposal between May 2013 and April 2014. That equates to a 45 percent reduction in wastewater generation compared to the previous period of May 2012 to April 2013 when 7,100 gallons of wastewater were collected.

6.3.4 ELF LCS/LDS Wastewater Quality

Analytical data from the ELF LCS/LDS wastewater sampling is provided in this ACRRC in accordance with Section 3.9 of the ELF PCP. The ELF PCP requires the reporting of wastewater analytical data for the 12-month period from January 1 to December 31 that precedes the submittal of this report. Wastewater from the LCS/LDS is sampled quarterly for ICs and annually (April) for the full analyte suite. The purpose of the samples collected from the LCS/LDS is to meet the post-closure requirements specified in the ELF PCGMP and to evaluate the chemistry of the liquids in order to determine potential leakage from the ELF.

This section presents a summary of analytical results from post-closure LCS/LDS wastewater monitoring at the ELF. Refer to the 2013 ELF PCGMR, provided in Appendix F-2 of this report, for additional details regarding the methods, results and conclusions of post-closure LCS/LDS wastewater sampling.

6.3.4.1 *ELF LCS Analyte Detections*

Analytical results from the LCS leachate samples were consistent with wastes placed in the landfill and were within the chemical groups used in determining potential groundwater impacts. The ICs detected in the LCS sumps in 2013 include chloroform and dieldrin. Analytical results from the LBLCS and WPLCS are included in Appendix F-2.

6.3.4.2 *ELF LDS Analyte Detections*

Analytes detected in the LDS sumps are presented in Appendix F-2 of this report. Benzene, chloroform, dieldrin, and lead were the ICs detected in the LDS sumps during 2013. The following analytes were detected during the 2013 LDS sump sampling program and required action:

- Chloroform levels detected in the secondary LB LDS (LBLDS2) sample collected in January 2013 exceeded the calculated watch list trigger level presented in Table 3.2.5-2 of the ELF PCGMP. The detection was subject to the requirements of PCGMP Section 3.2.5.2 *Watch List Analytes*, which initiated a non-routine action that followed the sump data evaluation process identified in Figure 3.2-2 of the PCGMP. OMC personnel prepared NRAP-2014-004 to document the subsequent evaluation, recommendation, and notification to the Regulatory Agencies. No further action regarding the chloroform detection was recommended in the NRAP.
- Chloroform levels detected in the secondary WP LDS (WPLDS2) sample collected in April 2013 exceeded the calculated watch list trigger level presented in Table 3.2.5-2 of the ELF PCGMP. The detection was subject to the requirements of PCGMP Section 3.2.5.2 *Watch List Analytes*, which initiated a non-routine action that followed the sump data evaluation process identified in Figure 3.2-2 of the PCGMP. OMC personnel prepared NRAP-2013-006 to document the subsequent evaluation, recommendation, and notification to the Regulatory Agencies. No further action was recommended in the NRAP.
- Tetrachloroethylene (TCLEE) was detected in WPLDS2 during the April 2013 sampling event. The analyte is listed on Table 3.2.5-3 of the ELF PCGMP and is subject to the requirements of Section 3.2.5.3 *Analytes Requiring Reporting if Detected.* The TCLEE detected in April 2013 was the third detection of the analyte in an ELF LDS sump, so notification of the Regulatory Agencies and preparation of an NRAP was required per the ELF PCGMP. NRAP-2014-004 described above also documented the subsequent evaluation, recommendation, and notification to the Regulatory Agencies. Based on the increased frequency at which TCLEE has been detected in the LDS sumps, the Army recommended moving the compound from Table 3.2.5-3 to Table 3.2.5-2 and calculating a watch list trigger level for TCLEE. The parties have yet to agree on the proposed approach. If the Regulatory Agencies agree with the NRAP's recommendation, an OCN will be prepared to document the change and provide appropriate justification.

6.4 ELF Groundwater Monitoring and Assessment

Similar to the reporting requirements for ELF LCS/LDS wastewater sampling, Section 3.9 of the ELF PCP requires analytical data from the post-closure groundwater sampling to be reported in this ACRRC for the 12-month period from January 1 to December 31 that precedes the submittal of this report. The purpose of the post-closure groundwater sampling is to meet the requirements

of the ELF PCP, to monitor groundwater flow directions and groundwater quality beneath and around the ELF, and to monitor for potential releases of hazardous constituents from the ELF.

Sampling of the ELF groundwater was performed quarterly in conjunction with the ELF LCS/LDS wastewater sampling described above. The 2013 ELF PCGMR, provided in Appendix F-2, presents the methods, results, and conclusions of post-closure groundwater monitoring performed over four quarterly sampling events in the calendar year of 2013.

6.4.1 CAMU Groundwater Flow Direction

Groundwater level measurements were collected quarterly at 64 wells to evaluate the groundwater flow directions in the UFS and CFS in the area of the CAMU. This information was used to evaluate groundwater flow for significant changes in flow direction over time. The water level data are presented in tabular and graphical form in Appendix F-2 of this report. Across the entire CAMU, groundwater flow is generally to the north-northwest. No significant variations in groundwater flow directions were identified during the four quarters of post-closure monitoring. Overall groundwater flow direction is consistent with previous post-closure monitoring in the CAMU area.

6.4.2 ELF Impacts on Groundwater Quality

The results from the water quality sampling completed during 2013 post-closure groundwater monitoring period were compared to the prediction limits calculated from the 2012 sampling results. Lead was the only IC detected in downgradient wells in 2013. Detections of lead were below the calculated prediction limit of 26.3 μg/L. Historically, lead has been detected in downgradient wells prior to waste being placed in the ELF. No ICs exceeded the calculated prediction limits, and based on the statistical evaluation, it can be concluded that the groundwater quality around the ELF has not been impacted by operations, closure, and post-closure O&M of the landfill. Refer to the ELF PCGMR included in Appendix F-2 for additional information regarding groundwater analytical results.

7.0 ROUTINE AND NON-ROUTINE ACTIONS

7.1 Routine Actions

Routine maintenance and repairs were performed on the HWL and ELF caps and were intended to ensure that the cap systems continue to function as designed. Routine maintenance and repair actions were identified during inspections and are discussed in Sections 4.2 and 5.2 of this report. Figures 4.2-1 and 4.2-2 illustrate the locations of routine maintenance and repair activities performed on the HWL, while Figures 5.2-1 and 5.2-2 show the locations of routine maintenance and repair activities performed on the ELF.

7.2 Non-Routine Actions

The implementation of non-routine actions is described in the HWL PCP and ELF PCP. Both PCPs provide criteria for non-routine actions and a mechanism for consultation between the parties and documentation of the consultative outcome. Each time a non-routine action was identified a NRAP was prepared to document the substandard condition, the actions that will be carried out to remedy the condition, consultation between the parties, and approval of the proposed action. This process is described in Section 3.5 of both PCPs. All NRAPs applicable to the HWL and ELF for this reporting period are analyte detection notices. One previously

prepared NRAP, NRAP-2012-007, which describes the installation of wingwalls adjacent to the two LRCH buildings, was signed by the Regulatory Agencies in April 2014. The NRAP Log is provided in Appendix G.

7.3 O&M Change Notices

Some non-routine actions required changes to portions of the PCPs, such as groundwater monitoring plans or record drawings. In these cases, the Army instituted the *RVO SOP ENGR.004.RA O&M Change Notice Procedure*, Revision 0 (RVO 2012). OCNs were provided to the Regulatory Agencies for approval as attachments to NRAPs. The following OCNs were approved during the reporting period.

7.3.1 HWL OCNs

OCN-HWL-2013-002: This OCN changed the HWL post-closure inspection frequency to Type I inspections, which are conducted quarterly and after significant storm events, and Type II inspections which are conducted semiannually.

OCN-HWL-2013-003: This OCN proposed a change to the definition of a significant storm event. The EPA and CDPHE both denied this proposed change and therefore the definition of a storm event remains rainfall of one inch or greater during a 24-hour period.

OCN-HWL-2013-004: This OCN removed the emergency generator, located near the HWL Lift Station, from the Record Drawings.

OCN-HWL-2014-001: This OCN revised the Roles and Responsibilities section of the HWL PCP to clarify that the Army will provide qualified and competent personnel to perform O&M activities, but is not required to continually fill every role listed in the HWL PCP.

OCN-HWL-2014-002: This OCN proposed eliminating the minimum number of years of experience for the roles of Covers Manager, Field Inspectors, the Vegetation Expert, the Operations Manager, the Operations Engineer, the Facilities Maintenance and Wastewater Operators, the Health and Safety Supervisor, and Groundwater Sampler and Site Quality Representative. The EPA and CDPHE both denied this proposed change and therefore the minimum number of years of experience were not changed.

OCN-HWL-2014-003: Reserved

OCN-HWL-2014-004: Reserved

OCN-HWL-2014-005: This OCN revised Attachment A in the HWL PCGMP to include Figure A.1 – Flow Chart Prediction Limit Statistical Evaluation of Analytical Results Upgradient Groundwater – Double-Lined Landfill.

OCN-HWL-2014-006: This OCN revised Form SOP HWL 001-2: HWL CAP TYPE II INSPECTION FORM for Inspection Item 3.5 to read: "Cap perimeter survey monuments appear to be disturbed (Inspect every five years, in conjunction with the CERCLA Five Year Review, for legibility and to confirm record locations.)".

OCN-HWL-2014-007: This OCN stated that the Facilities Maintenance and Wastewater Operators shall have the appropriate Industrial Wastewater Treatment Operators Certification, or perform duties under the supervision of someone possessing the appropriate certification, depending upon the type of wastewater treatment being conducted at the HWL, if any.

7.3.2 ELF OCNs

OCN-ELF-2012-004: This OCN provided design details to construct wingwalls adjacent to each of the two LRCH buildings and improve drainage around the LRCH buildings. The change is intended to prevent sediment from entering the buildings.

OCN-ELF-2013-001: The ELF PCGMP was changed to incorporate revised Tables 3.2.5-2 *Watch List Analytes* and 3.2.5-3 *Analytes Requiring Reporting if Detected.* The analyte DCPD was moved from Table 3.2.5-3 to Table 3.2.5-2.

OCN-ELF-2013-002: This OCN changed the ELF post-closure inspection frequency to Type I inspections, which are conducted quarterly and after significant storm events, and Type II inspections which are conducted semiannually.

OCN-ELF-2014-001: This OCN revised the Roles and Responsibilities section of the ELF PCP to clarify that the Army will provide qualified and competent personnel to perform O&M activities, but is not required to continually fill every role listed in the ELF PCP.

OCN-ELF-2014-002: This OCN proposed eliminating the minimum number of years of experience for the roles of Covers Manager, Field Inspectors, the Vegetation Expert, the Operations Manager, the Operations Engineer, the Facilities Maintenance and Wastewater Operators, the Health and Safety Supervisor, and Groundwater Sampler and Site Quality Representative. The EPA and CDPHE both denied this proposed change and therefore the minimum number of years of experience were not changed.

OCN-ELF-2014-003: Reserved

OCN-ELF-2014-004: Reserved

OCN-ELF-2014-005: This OCN revised Attachment A in the ELF PCGMP to include Figure A.1 – Flow Chart Prediction Limit Statistical Evaluation of Analytical Results Upgradient Groundwater – Double-Lined Landfill.

OCN-ELF-2014-006: This OCN revised Form SOP ELF 001-2: ELF CAP TYPE II INSPECTION FORM for Inspection Item 3.5 to read: "Cap perimeter survey monuments appear to be disturbed (Inspect every five years, in conjunction with the CERCLA Five Year Review, for legibility and to confirm record locations.)".

OCN-ELF-2014-007: This OCN stated that the Facilities Maintenance and Wastewater Operators shall have the appropriate Industrial Wastewater Treatment Operators Certification, or perform duties under the supervision of someone possessing the appropriate certification, depending upon the type of wastewater treatment being conducted at the ELF, if any.

8.0 RECOMMENDATIONS AND CORRECTIVE MEASURES

There were no recommendations offered for the 2014 reporting period other than the inspection and maintenance activities already required by the PCPs. Grass establishment and weed control continue to be challenging within the HWL and ELF AMA, and the Army intends to be especially diligent with activities that may promote the establishment of desirable species. Monitoring and maintenance of the stormwater conveyance structures will also be a high priority.

The HWL and ELF met all compliance standards; therefore, no corrective measures were necessary or are currently planned for the reporting period of 2015.

9.0 COSTS AND BUDGETS

Table 9.0-1 shows the costs incurred between May 2013 and April 2014, as well as the current budgets established for monitoring and maintenance of the HWL and ELF.

The costs for operating, inspecting, and maintaining the HWL and ELF over the reporting period, including groundwater sampling, LCS/LDS sampling, LCS/LDS O&M, and wastewater disposal, totaled $653,564. Complete budgets for post-closure care of the HWL and ELF for May 2014 through April 2015 have not been approved as of the issuance of this report due to the timing of the annual funding cycle, which typically occurs near the end of the calendar year. However, the combined budgets are estimated to total approximately $909,000.

10.0 CONCLUSIONS

In summary, and based on the information presented in this report, the HWL and ELF were in compliance with all performance standards and no corrective measures were required. Future plans to maintain the integrity of the caps include continued diligence with weed control, overseeding where necessary, inspection for erosion, and monitoring the groundwater and LCS/LDS quality quarterly.

11.0 REFERENCES

CDPHE (Colorado Department of Public Health and Environment)

2013 (Aug 2) *Letter to Roberta Ober Regarding Annual Covers Report for RCRA Caps 2013, Rocky Mountain Arsenal, dated June 27th, 2013*

Navarro (Navarro Research and Engineering, Inc.)

2013 (Jun 26) *Annual Covers Report for Resource Conservation and Recovery Act Caps 2013.* Revision 0.

RVO (Remediation Venture Office)

2012 (Jan) *RVO SOP ENGR.004.RA O&M Change Notice Procedure.* Revision 0.

TtEC (TetraTech EC, Inc.)

2006 (Aug) *Hazardous Waste Landfill Closure Plan.*

2008 (July) *Enhanced Hazardous Waste Landfill Closure Plan.* Revision 0.

2010 (May 20) *Enhanced Hazardous Waste Landfill Post-Closure Plan.* Revision 0.

2011 (Mar 16) *Hazardous Waste Landfill Post-Closure Plan*. Revision 3.

TABLES

Table 6.1.2-1: HWL Average Daily LDS Flow Rate and ALR Comparison

Sump No.	Month	Average Daily Flow Rate (gpad)	Comparison to 85% ALR (>, <, or =)	85% ALR (gpad)	Comparison to ALR (>, <, or =)	ALR (gpad)	Conclusion
HWL LDS Sump 1	May 2013	0.00	<	112	<	132	No exceedance
	June 2013	0.00	<	112	<	132	No exceedance
	July 2013	5.18	<	112	<	132	No exceedance
	August 2013	0.00	<	112	<	132	No exceedance
	Sept. 2013	0.00	<	112	<	132	No exceedance
	Oct. 2013	0.00	<	112	<	132	No exceedance
	Nov. 2013	0.00	<	112	<	132	No exceedance
	Dec. 2013	0.00	<	112	<	132	No exceedance
	Jan. 2014	0.83	<	112	<	132	No exceedance
	Feb. 2014	0.00	<	112	<	132	No exceedance
	March 2014	7.27	<	112	<	132	No exceedance
	April 2014	1.62	<	112	<	132	No exceedance
HWL LDS Sump 2	May 2013	0.00	<	111	<	131	No exceedance
	June 2013	0.00	<	111	<	131	No exceedance
	July 2013	0.00	<	111	<	131	No exceedance
	August 2013	0.00	<	111	<	131	No exceedance
	Sept. 2013	0.00	<	111	<	131	No exceedance
	Oct. 2013	0.00	<	111	<	131	No exceedance
	Nov. 2013	0.00	<	111	<	131	No exceedance
	Dec. 2013	0.00	<	111	<	131	No exceedance
	Jan. 2014	0.68	<	111	<	131	No exceedance
	Feb. 2014	0.00	<	111	<	131	No exceedance
	March 2014	0.05	<	111	<	131	No exceedance
	April 2014	0.27	<	111	<	131	No exceedance

Table 6.1.2-1: HWL Average Daily LDS Flow Rate and ALR Comparison

Sump No.	Month	Average Daily Flow Rate (gpad)	Comparison to 85% ALR (>, <, or =)	85% ALR (gpad)	Comparison to ALR (>, <, or =)	ALR (gpad)	Conclusion
HWL LDS Sump 3	May 2013	1.61	<	111	<	131	No exceedance
	June 2013	0.00	<	111	<	131	No exceedance
	July 2013	0.00	<	111	<	131	No exceedance
	August 2013	0.00	<	111	<	131	No exceedance
	Sept. 2013	0.00	<	111	<	131	No exceedance
	Oct. 2013	0.00	<	111	<	131	No exceedance
	Nov. 2013	0.00	<	111	<	131	No exceedance
	Dec. 2013	0.00	<	111	<	131	No exceedance
	Jan. 2014	0.32	<	111	<	131	No exceedance
	Feb. 2014	0.00	<	111	<	131	No exceedance
	March 2014	0.03	<	111	<	131	No exceedance
	April 2014	2.42	<	111	<	131	No exceedance
HWL LDS Sump 4	May 2013	0.00	<	111	<	131	No exceedance
	June 2013	0.00	<	111	<	131	No exceedance
	July 2013	0.00	<	111	<	131	No exceedance
	August 2013	0.15	<	111	<	131	No exceedance
	Sept. 2013	0.00	<	111	<	131	No exceedance
	Oct. 2013	0.00	<	111	<	131	No exceedance
	Nov. 2013	0.00	<	111	<	131	No exceedance
	Dec. 2013	0.00	<	111	<	131	No exceedance
	Jan. 2014	2.21	<	111	<	131	No exceedance
	Feb. 2014	0.00	<	111	<	131	No exceedance
	March 2014	0.02	<	111	<	131	No exceedance
	April 2014	0.82	<	111	<	131	No exceedance

Table 6.3.2-1: ELF Average Daily LDS Flow Rate and ALR Comparison

Sump No.	Month	Average Daily Flow Rate (gpad)	Comparison to 50% ALR (>, <, or =)	50% ALR (gpad)	Comparison to 85% ALR (>, <, or =)	85% ALR (gpad)	Comparison to ALR (>, <, or =)	ALR (gpad)	Conclusion
ELF WP LDS 1	May 2013	0.00	<	65	<	110.5	<	130	No exceedance
	June 2013	0.00	<	65	<	110.5	<	130	No exceedance
	July 2013	0.01	<	65	<	110.5	<	130	No exceedance
	August 2013	0.00	<	65	<	110.5	<	130	No exceedance
	Sept. 2013	0.00	<	65	<	110.5	<	130	No exceedance
	Oct. 2013	0.00	<	65	<	110.5	<	130	No exceedance
	Nov. 2013	0.00	<	65	<	110.5	<	130	No exceedance
	Dec. 2013	0.00	<	65	<	110.5	<	130	No exceedance
	Jan. 2014	0.36	<	65	<	110.5	<	130	No exceedance
	Feb. 2014	0.00	<	65	<	110.5	<	130	No exceedance
	March 2014	0.00	<	65	<	110.5	<	130	No exceedance
	April 2014	0.67	<	65	<	110.5	<	130	No exceedance
ELF WP LDS 2	May 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	June 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	July 2013	0.01	<	79.5	<	135.2	<	159	No exceedance
	August 2013	0.11	<	79.5	<	135.2	<	159	No exceedance
	Sept. 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	Oct. 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	Nov. 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	Dec. 2013	0.00	<	79.5	<	135.2	<	159	No exceedance
	Jan. 2014	0.31	<	79.5	<	135.2	<	159	No exceedance
	Feb. 2014	0.00	<	79.5	<	135.2	<	159	No exceedance
	March 2014	0.00	<	79.5	<	135.2	<	159	No exceedance
	April 2014	1.15	<	79.5	<	135.2	<	159	No exceedance

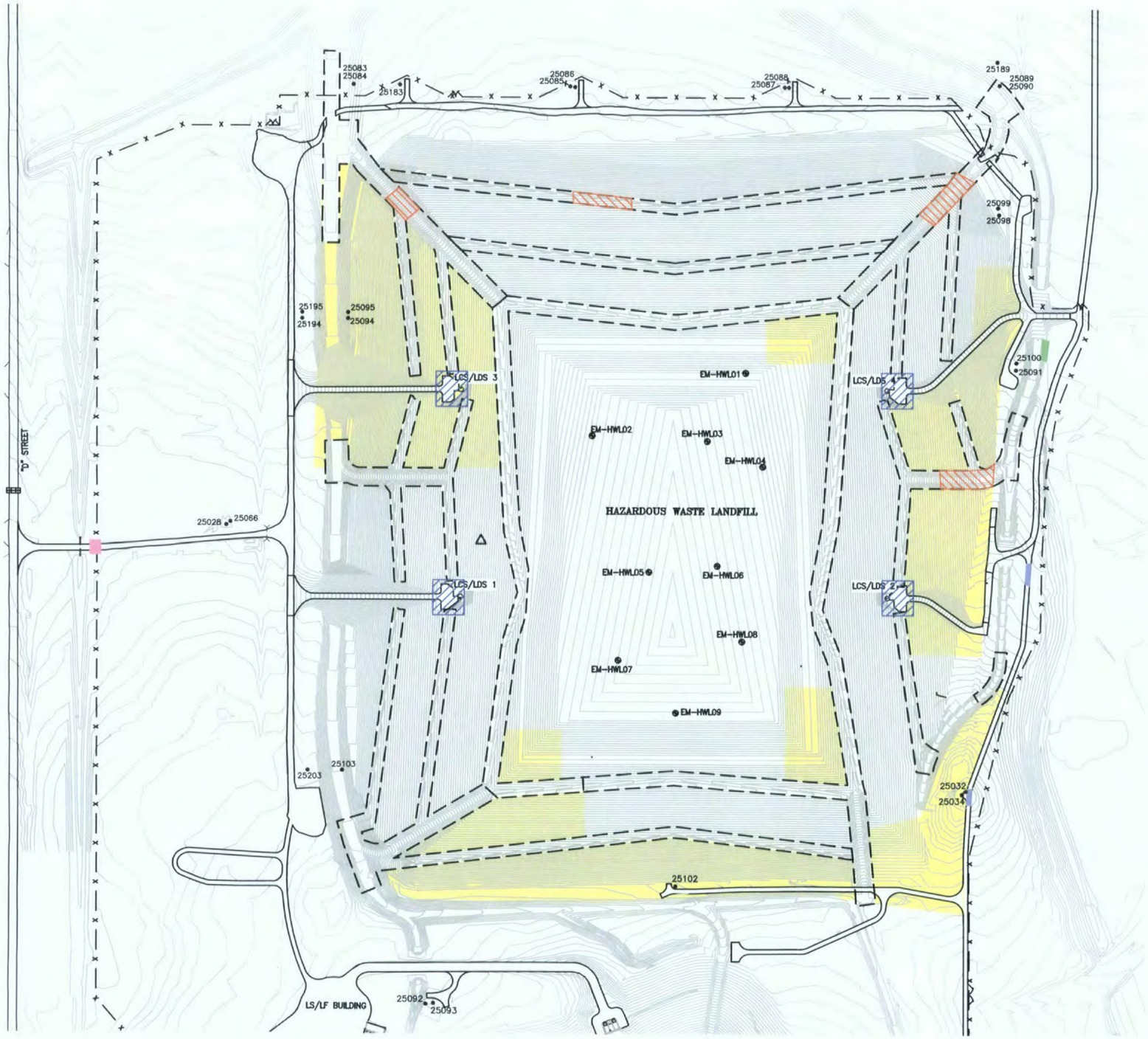
Table 6.3.2-1: ELF Average Daily LDS Flow Rate and ALR Comparison

Sump No.	Month	Average Daily Flow Rate (gpad)	Comparison to 50% ALR (>, <, or =)	50% ALR (gpad)	Comparison to 85% ALR (>, <, or =)	85% ALR (gpad)	Comparison to ALR (>, <, or =)	ALR (gpad)	Conclusion
ELF LB LDS 1	May 2013	0.00	<	130	<	221	<	260	No exceedance
	June 2013	0.00	<	130	<	221	<	260	No exceedance
	July 2013	0.01	<	130	<	221	<	260	No exceedance
	August 2013	0.00	<	130	<	221	<	260	No exceedance
	Sept. 2013	0.00	<	130	<	221	<	260	No exceedance
	Oct. 2013	0.00	<	130	<	221	<	260	No exceedance
	Nov. 2013	0.00	<	130	<	221	<	260	No exceedance
	Dec. 2013	0.00	<	130	<	221	<	260	No exceedance
	Jan. 2014	0.56	<	130	<	221	<	260	No exceedance
	Feb. 2014	0.00	<	130	<	221	<	260	No exceedance
	March 2014	0.00	<	130	<	221	<	260	No exceedance
	April 2014	1.31	<	130	<	221	<	260	No exceedance
ELF LB LDS 2	May 2013	0.00	<	159	<	270.3	<	318	No exceedance
	June 2013	0.00	<	159	<	270.3	<	318	No exceedance
	July 2013	0.01	<	159	<	270.3	<	318	No exceedance
	August 2013	0.00	<	159	<	270.3	<	318	No exceedance
	Sept. 2013	0.00	<	159	<	270.3	<	318	No exceedance
	Oct. 2013	0.00	<	159	<	270.3	<	318	No exceedance
	Nov. 2013	0.00	<	159	<	270.3	<	318	No exceedance
	Dec. 2013	0.00	<	159	<	270.3	<	318	No exceedance
	Jan. 2014	0.60	<	159	<	270.3	<	318	No exceedance
	Feb. 2014	0.00	<	159	<	270.3	<	318	No exceedance
	March 2014	0.00	<	159	<	270.3	<	318	No exceedance
	April 2014	1.16	<	159	<	270.3	<	318	No exceedance

Table 9.0-1: Costs and Budgets

Task	Costs		Current Budgets	
	Incurred	Period	Value	Period
HWL (Inspection, Maintenance, LCS/LDS and Groundwater Sampling, and Off-Site Wastewater Disposal)	$408,817	May 13 – Apr 14	$553,000 (Estimated)	May 14 – Apr 15
ELF (Inspection, Maintenance, LCS/LDS and Groundwater Sampling, and Off-Site Wastewater Disposal)	$244,747	May 13 – Apr 14	$356,000 (Estimated)	May 14 – Apr 15
TOTAL	$653,564		$909,000	

FIGURES



LEGEND:

- PERIMETER FENCE/ARMY MAINTAINED AREA BOUNDARY
- CHANNELS AND DOWNCHUTES
- EM-HWL08 EROSION/SETTLEMENT MONUMENT
- 25098 GROUNDWATER MONITORING WELL
- ROAD
- CONTOURS
- REMOVED COTTONWOOD SAPLINGS
- OVERSEEDED AREA
- IMPROVED ACCESS AROUND MANHOLES
- PERIMETER ROAD EROSION
- REPAIRED GATE
- BROADCAST SEEDED SAND DROPSEED

NAD 1983 COORDINATES

0 120 240

Scale In Feet

Program Manager
Rocky Mountain Arsenal

ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

PROJECT NAME

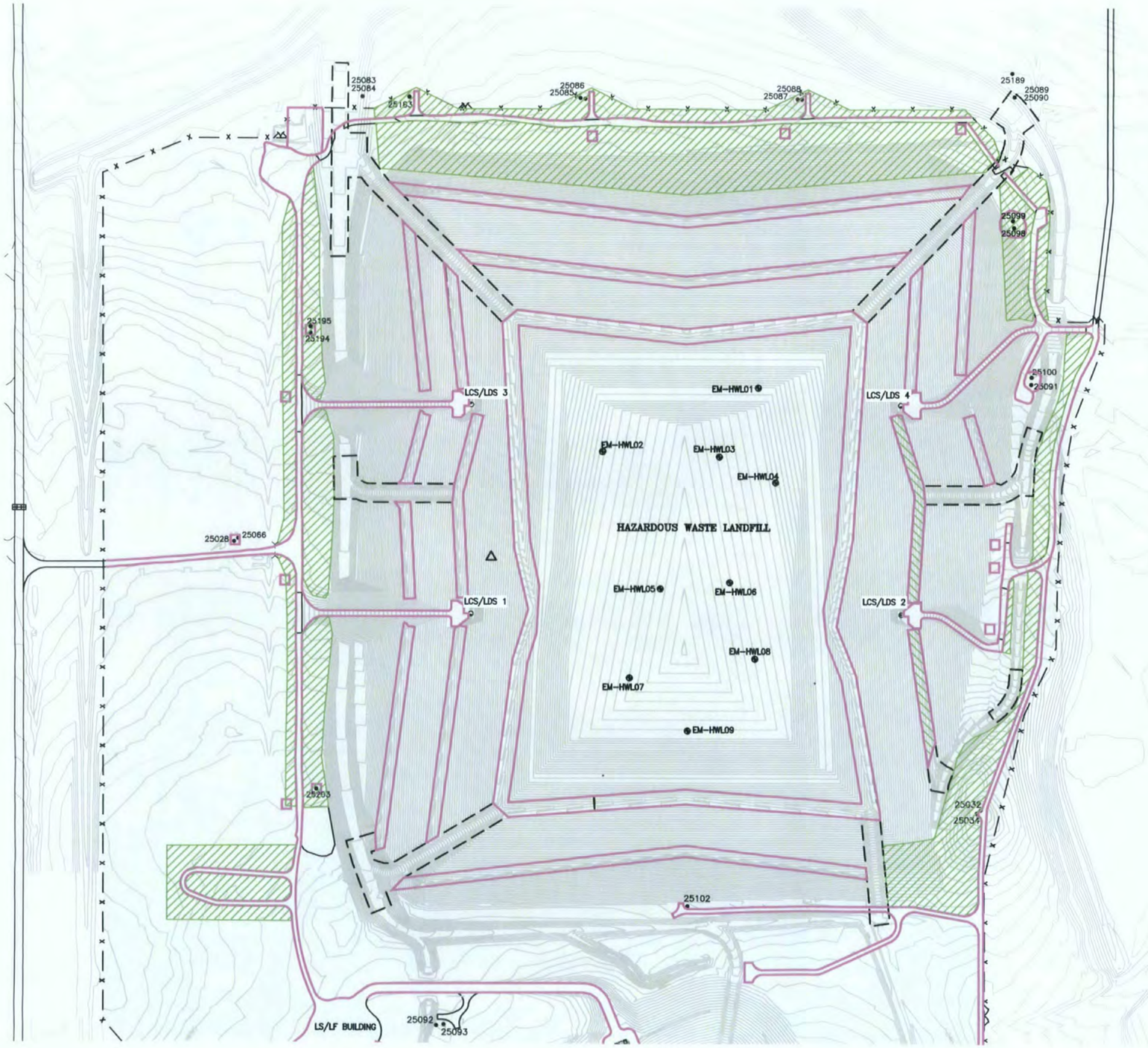
2014 ANNUAL COVERS REPORT FOR RCRA CAPS

TITLE

HWL ROUTINE MAINTENANCE MAP

CAD FILE:	DATE	FIGURE NUMBER
Figure 4.2-1.DWG	06.18.14	4.2-1

S:\G PROJECTS\ANNUAL COVERS REPORT 2014\FIGURE 4.2-1.dwg



LEGEND:

- PERIMETER FENCE/ARMY MAINTAINED AREA BOUNDARY
- CHANNELS AND DOWNCHUTES
- EM-HWL08 EROSION/SETTLEMENT MONUMENT
- 25098 GROUNDWATER MONITORING WELL
- ROAD
- CONTOURS
- GROUND HERBICIDE
- AERIAL HERBICIDE
- MOWED

COLORADO STATE PLANE

0 120 240

Scale In Feet

ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

PROJECT NAME

2014 ANNUAL COVERS REPORT FOR RCRA CAPS

TITLE

HWL ROUTINE MAINTENANCE WEED CONTROL MAP

CAD FILE:	DATE	FIGURE NUMBER
Figure 4.2-2.DWG	06.18.14	4.2-2

S:\G PROJECTS\ANNUAL COVERS REPORT 2014\FIGURE 4.2-2.dwg

HAZARDOUS WASTE LANDFILL

"D" STREET

26099

25120

LEACHATE STORAGE AND LOADOUT FACILITY

25092

25093

WP LRCH

LB LRCH

25102

PERIMETER CHANNEL

25121

25101

EM-ELF01

EM-ELF02

EM-ELF03

EM-ELF04

EM-ELF05

EM-ELF06

EM-ELF07

EM-ELF08

ENHANCED HAZARDOUS WASTE LANDFILL

25123

25122

PERIMETER CHANNEL

LEGEND:

- EM-ELF01 — EROSION/SETTLEMENT MONUMENT
- TRENCH DRAIN OUTFALL
- 25121 — GROUNDWATER MONITORING WELL
- PERIMETER FENCE/ARMY-MAINTAINED AREA BOUNDARY
- TERRACE CHANNELS AND DOWNCHUTES
- CONTOURS
- ROAD
- REPLACED EROSION CONTROL LOGS
- FOOTPATH CONSTRUCTED
- ANIMAL TRAILS
- PERIMETER ROAD EROSION
- EROSION IN PERIMETER CHANNEL
- ROCK CHECK DAM REMOVAL
- REPAIRED GATE
- BROADCAST SEEDED SAND DROPSEED

COLORADO STATE PLANE

0 100 200

Scale In Feet

Program Manager
Rocky Mountain Arsenal

ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

PROJECT NAME

2014 ANNUAL COVERS REPORT FOR RCRA CAPS

TITLE

ELF ROUTINE MAINTENANCE MAP

CAD FILE:	DATE	FIGURE NUMBER
FIGURE 5.2-1.DWG	06.18.14	5.2-1

S:\G PROJECTS\ANNUAL COVERS REPORT 2014\FIGURE 5.2-1.dwg

ROCKY MOUNTAIN ARSENAL
COMMERCE CITY, COLORADO

PROJECT NAME

2014 ANNUAL COVERS REPORT FOR RCRA CAPS

TITLE

ELF ROUTINE MAINTENANCE WEED CONTROL MAP

CAD FILE:	DATE	FIGURE NUMBER:
FIGURE 5.2-2.DWG	06.18.14	5.2-2

S:\G PROJECTS\ANNUAL COVERS REPORT 2014\FIGURE 5.2-2.dwg

APPENDICES
(All on CD)

A	Precipitation Data (May 01, 2013 through April 30, 2014)
B-1	HWL Inspection Documentation
B-2	ELF Inspection Documentation
C-1	HWL Maintenance Documentation
C-2	ELF Maintenance Documentation
D	HWL and ELF Erosion/Settlement Monument Survey Data
E	Weekly Flow Summaries
F-1	HWL Post-Closure Groundwater Monitoring Report, 2013
F-2	ELF Post-Closure Groundwater Monitoring Report, 2013
G	NRAP Log