FOURTH FIVE-YEAR REVIEW REPORT FOR BUCKINGHAM COUNTY LANDFILL SUPERFUND SITE DILLWYN, VIRGINIA

Prepared by

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Date

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LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BTAG	Biological Technical Assistance Group
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	Contaminant of Concern
CSM	Conceptual site model
DCA	Dichloroethane
DCE	Dichloroethene
EPA	United States Environmental Protection Agency
FFS	Focused Feasibility Study
FS	Feasibility Study
FYR	Five-Year Review
GPRA	Government Performance and Results Act
HI	Hazard index
HRS	Hazard Ranking System
HWDA	Hazardous waste disposal area
HDPE	High-density polyetheylene
IC	Institutional Control
ISVE	In-situ vapor extraction
LTGWMP	Long-Term Groundwater Monitoring Program
MCL	Maximum Contaminant Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and maintenance
PA	Preliminary Assessment
PCE	Tetrachloroethene (also tetrachloroethylene or perchloroethylene)
PCOR	Preliminary Closeout Report
PRAP	Proposed Remedial Action Plan
PRP	Potentially Responsible Party
RA	Remedial Action
RAO	Remedial Action Objective
RBC	Risk-based concentration
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Risk-screening level
SI	Site Inspection
SVOC	Semi-volatile organic compound
SWRAU	Site-Wide Ready for Anticipated Use
TBC	To-Be-Considered
TCA	Trichloroethane
TCE	Trichloroethene (also trichloroethylene)
UAO	Unilateral Administrative Order
VDEQ	Virginia Department of Environmental Quality
VSBH	Virginia State Board of Health
VOC	Volatile organic compound
µg/L	Micrograms per liter

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedial response action, or remedy, where hazardous substances or pollutants and contaminants remain at a site above levels that allow for unlimited use and unrestricted exposure in order to determine if the remedy is and will continue to be protective of human health and the environment. FYR reports identify actual or potential issues found during review of the remedy and present recommendations to address the issues. The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy. This is the fourth FYR for the Buckingham County Landfill Site (Site). The triggering action for this statutory review is the signature date of the previous FYR Report.

EPA conducted this FYR from August 2017 to August 2018. The FYR was led by Christian Matta, EPA Region 3 Remedial Project Manager (RPM) and Christopher Sklaney, EPA Region 3 interim RPM. Other participants from EPA included Mindi Snoparsky (Hydrogeologist), Martin Gehlhaus (Toxicologist), Bruce Pluta (Biologist), Matthew Traynor (Biologist), Amanda Miles (Community Involvement Coordinator), and Ben Cohan (Attorney). Staff from EPA contractor CDM Smith Inc. assisted with the preparation of the initial draft report and provided technical input throughout the review process. William Lindsey, Remediation Project Manager with the Virginia Department of Environmental Quality (VDEQ), the support agency for the Site, provided input to EPA during the review process. The potentially responsible party (PRP) currently performing supplemental characterization activities at the Site, Univar USA, Inc. (Univar), was notified of the initiation of the FYR and consulted during the review process to discuss potential issues that could have impacted protectiveness of the remedy. Univar's consultant, EHS Support LLC (EHS Support), coordinates and oversees Site activities on behalf of Univar and participated in the FYR inspection.

Site Location and Description

The Site is located on a 125-acre property northwest of County Road 640 (Andersonville Road) and east of County Road 633 (Oak Hill Road) in Dillwyn, Buckingham County, Virginia, approximately 3.5 miles southeast of the town of Buckingham. The property is owned by Buckingham County. The intersection of U.S. Route 60 and U.S. Route 15 is approximately 1.5 miles northeast of the Site. The primary features on the Site are a 2-acre hazardous waste disposal area (HWDA) and surrounding areas where contaminated groundwater has migrated. The HWDA, which is the principal feature of the Site, is grass-covered and surrounded by a chain-link fence. A 7-acre former municipal solid waste landfill is located directly south of the HWDA. The properties in the vicinity of the Site are primarily rural and wooded. Several residences are located near the Site. An animal shelter is located along the access road to the Site. Figure A1 located in Appendix A shows the location and principal features of the Site.

Surface drainage on the HWDA is directed to Cooper Creek to the north and to the Warner Branch of Cooper Creek to the south. Cooper Creek and Warner Branch of Cooper Creek both flow approximately to the west. A drainage ditch located west of the Site discharges surface water into an unnamed tributary of the Warner Branch. The unnamed tributary flows toward the south-southwest from the HWDA and is intermittent. Drainage features on and in the vicinity of the HWDA have been observed to be damp during visits to the Site, but only during periods of high precipitation. The drainage features do not appear to intersect the water table.

The Site is underlain by high-grade metamorphic rocks (gneiss) and an overburden comprised of saprolite and soil. A single aquifer is located beneath the Site. However, up to five zones of varying interconnection and hydrogeologic characteristics have been identified. EPA currently believes that two regional hydrogeologic features, or fracture traces, may control groundwater flow in and around the HWDA.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Buckingham County Landfill		
EPA ID: VAD089027973		
Region: 3	**State:** VA	**City/County:** Dillwyn/Buckingham County

SITE STATUS	
NPL Status: Final	
Multiple OUs? No	**Has the site achieved construction completion?** Yes

REVIEW STATUS
Lead agency: EPA
Author name (Federal or State Project Manager): Christian Matta/Christopher Sklaney
Author affiliation: EPA Region 3
Review period: August 2017 – August 2018
Date of site inspection: 4/23/2018
Type of review: Statutory
Review number: 3
Triggering action date: 8/26/2013
Due date: 8/26/2018

Site Background

From 1962 to 1982, the property was owned by Joseph Love and operated as Love's Container Service. Mr. Love used the property for disposal of municipal solid waste and hazardous waste. Between 1962 and 1972, Mr. Love collected municipal solid wastes from Buckingham County and surrounding counties that were disposed of at the property. In November 1972, the Virginia State Board of Health (VSBH) issued a sanitary landfill permit to Love's Container Service for approximately 7 acres of the property. The municipal solid waste landfill was covered and closed in or about 1979 by Buckingham County under the supervision of the VSBH.

From 1977 to 1982, Love received and disposed of hazardous wastes at the property. Operations in the HWDA generally involved the receipt of drummed liquid wastes and discharge of wastes into four unlined trenches. According to records, wastes were initially poured into the first trench, where the liquids evaporated or infiltrated into the subsurface (evaporation trench). Residual solids that remained after evaporation were periodically relocated to one of two other trenches (disposal trenches). Emptied drums were crushed and buried in another trench (barrel trench). Wastes received included still bottoms containing, but not limited to, acetone, arsenic, barium, chromium, and toluene. Use of the trenches continued until in or about 1983, when closure of the hazardous waste portion of the Site was completed.

In April 1982, Buckingham County purchased the Site and the disposal permit from Love. The County arranged for closure of the HWDA, which included the installation of a cover over each of the disposal trenches comprised of a clay layer, a synthetic cover, a layer of fine aggregate, and a layer of topsoil. Surface water diversion trenches were constructed around the covered areas, and a fence was constructed around the area of the trenches. Several monitoring wells were also installed at the Site. The municipal solid waste landfill was not addressed in the closure plan.

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Hazardous substances that have been released at the Site are primarily volatile organic compounds (VOCs). The source of contamination is the hazardous waste dumped and buried in the HWDA. Before implementation of the remedy, the cancer risks posed by the contaminated on-site soils, groundwater, and ponded leachate through incidental inhalation, incidental ingestion, and dermal contact were 2.6E-01, which is in excess of a 10^{-6} excess cancer risk for future use. The calculated hazard index (HI) based on a combined exposure due to the groundwater ingestion and volatile inhalation exceeded 1.0 for all age groups (58 for adults, 112 for children), which is higher than EPA's guidance level for evaluating non-cancer hazards.

Response Actions

In 1982 and 1983, EPA conducted a Preliminary Assessment (PA) and Site Inspection (SI), or PA/SI, to assess releases of hazardous substances that occurred at the Site. Based on the findings of the PA/SI, EPA ranked the release pursuant to the Hazard Ranking System (HRS), and on October 4, 1989, added the Site to the National Priorities List (NPL). After promulgation of the Site to the NPL, EPA began steps to characterize the nature and extent of contamination, determine risks to human health and the environment, and evaluate cleanup alternatives in a Remedial Investigation (RI) and Feasibility Study (FS), or RI/FS. In January 1991, EPA entered into an Administrative Order on Consent (AOC) with several PRPs for the performance of the RI/FS under EPA oversight. The PRPs that entered the AOC were Thomasville Furniture Industries, Inc. (Thomasville), Prillaman Chemical Corporation, Westinghouse Electric Corp, Champion International Corporation, and Buckingham County. The Remedial Action Objectives (RAOs) for the Site, developed during the FS, were to protect human health and the environment from potential future risks associated with VOC contamination in the groundwater and leaching of VOCs in trench materials to groundwater.

EPA issued a Record of Decision (ROD) documenting EPA's final remedy on September 30, 1994. EPA structured the ROD to allow for two remedial action options:

Option #1:

- Groundwater monitoring,
- Construction of a Resource Conservation and Recovery Act (RCRA) multi-layer cap over the HWDA,
- Perimeter fencing, and
- Institutional controls (ICs) restricting land use.

Option #2:

- Source control measures (described below),
- Groundwater monitoring,
- Construction of a RCRA multi-layer cap over the HWDA,
- Perimeter fencing, and
- ICs restricting land use.

Contingency source control measures:

- For the eastern disposal trench, performance of an in-situ vapor extraction (ISVE) treatability study followed by full-scale implementation, or if ISVE was deemed unsuccessful, excavation and off-site incineration of the wastes followed by reinstallation of the cap,
- For the barrel trench, preparation of a Focused Feasibility Study (FSS) and selection of an appropriate measure in separate decision document, and
- Groundwater pumping and treatment with air stripping.

Option #1 included a contingency whereby certain conditions would trigger the implementation of the source control measures mandatorily required as part of Option #2. The conditions were the detection of contaminants of concern (COCs) in point-of-compliance groundwater monitoring wells at concentrations above cleanup levels over two consecutive sampling events. COCs are compounds that were released at the Site and found in groundwater at concentrations that potentially present an unacceptable risk to human health or the environment. Point-of-compliance wells are those monitoring wells located within 150 feet of the HWDA cap.

Groundwater cleanup levels were established in the ROD for 13 COCs. The cleanup levels for COCs in groundwater were set at the Maximum Contaminant Level (MCL), as promulgated under the Safe Drinking Water Act, or where an MCL was not promulgated, at the health-based contaminant level. Groundwater cleanup levels are outlined in Table 1.

Table 1. Contaminants of Concern and Cleanup Levels

Contaminant of Concern	Cleanup Level
Acetone	Health-based contaminant level
1,2-Dibromo-3-chloropropane	0.2 µg/L
1,2-Dibromoethane	0.05 µg/L
1,2-Dichloroethane	5 µg/L
1,1-Dichloroethene	7 µg/L
1,2-Dichloropropane	5 µg/L
1,3-Dichloropropene	Health-based contaminant level
Methylene chloride	5 µg/L
1,1,2,2-Tetrachloroethane	Health-based contaminant level
Tetrachloroethene	5 µg/L
1,1,2-Trichloroethane	5 µg/L
Trichloroethene	5 µg/L
Vinyl chloride	2 µg/L

Status of Implementation

In September 1995, EPA issued a Unilateral Administrative Order (UAO), EPA Docket No. III-95-65-DC to Thomasville after negotiations for performance of the Remedial Design (RD) and Remedial Action (RA) were unsuccessful. The UAO required Thomasville to implement the remedy described in the ROD. Based upon the findings of the RD, EPA concurred with Thomasville's preference to implement Option #1 of the ROD, which called for groundwater monitoring and capping of the HWDA landfill. The RA began in April 1998.

The components of the constructed RA included the following:

- Regrading of the landfill to achieve the grades and slopes for the acceptance of the cover system and subgrade preparation which involved grading and placement of compacted general fill;

- Installation of the first geosynthetic element on the prepared landfill;
- Construction of a geocomposite drainage material to serve as a gas vent layer;
- Installation of a gas trench designed to minimize the subsurface lateral flow of landfill gas outside the landfill limits, including a peripheral gas collection trench just beyond the lateral extent of the landfill;
- Installation of a gas vent collection piping system consisting of flexible 4-inch perforated high-density polyethylene (HDPE) pipe along the top of the gas trench and connected to seventeen 4-inch HDPE conveyance pipes and peripheral passive vents along the crest of the cap; an additional fourteen passive gas vents were installed through the surface of the cap with four horizontal perforated flexible HDPE feeder pipes to collect the gas and vent it passively through vent pipes;
- Construction of a geocomposite clay liner, followed by a linear low-density polyethylene liner;
- Construction of a geocomposite drainage layer, followed by an 18-inch-thick protective layer of compacted general fill on the cover system with a 6-inch-thick topsoil layer with grass to serve as the protection layer over the underlying system;
- Installation of surface water diversion ditches;
- Installation of perimeter fencing; and
- Implementation of the Long-Term Groundwater Monitoring Program (LTGWMP).

The Site achieved construction completion status when the Preliminary Close-Out Report (PCOR) was signed on September 21, 1998.

In 2003, EPA prepared the first FYR for the Site. A key finding of the review was the possibility that the monitoring well network at the time did not adequately define the extent of contaminated groundwater. Subsequently, over 20 additional monitoring wells were installed at the Site between 2005 and 2012 in an attempt to improve horizontal and vertical characterization of groundwater and determine the nature and extent of migration of COCs. Numerous direct-push soil samples collected from soil borings and temporary groundwater samples were also collected as part of expanded characterization activities. The majority of the wells were installed along presumed fracture traces trending northeast and north-northwest from the HWDA, and include well clusters installed near and north of Cooper Creek. The wells were installed primarily in lower bedrock and lower saprolite zones.

Prior to installation of additional monitoring wells in 2005, cleanup levels had not been exceeded in groundwater samples collected from the point-of-compliance wells. Since 2005, VOCs have consistently been detected above cleanup levels in point-of-compliance wells and in several of the wells installed down gradient of the point-of-compliance wells, in the area north of the MW-27 cluster. Although 1,4-dioxane was not a Site COC in the 1994 ROD, it has continuously been detected above its screening level in several point-of-compliance wells and down gradient wells. All wells located at the Site can be found on Figures A1 through A6.

In 2011, tree core sampling was conducted to the north of the HWDA to determine the extent of VOCs in groundwater. Tree cores are sometimes used to determine the extent of VOC-contaminated groundwater, which is taken up through the root system. The results of the sampling indicated the likely presence of VOC-contaminated groundwater between the HWDA and Cooper Creek. Also in 2011, 1,4-dioxane and several chlorinated VOCs were detected in multiple surface water samples within Cooper Creek, at a location approximately 1,200 feet north of the HWDA. Based on data collected to date, EPA believes the detections in Cooper Creek were due to discharge of groundwater containing Site-related contaminants to surface water. In July 2012, two semi-volatile organic compounds (SVOCs), bis(2-ethylhexyl)phthalate and diethyl phthalate, were detected in surface water samples collected from Cooper Creek surface water.

Assessments of the remedy in both the Second FYR (2008) and Third FYR (2013) determined that the remedy as designed and implemented is not performing as intended or required by the ROD. This finding was based on several factors. Several site-related contaminants were observed to have migrated beyond the point-of-compliance wells and were detected in groundwater at concentrations exceeding cleanup levels. Site-related

contaminants were found to have migrated in groundwater and discharged into Cooper Creek at a location approximately 1,200 feet from the HWDA. The expanded site characterization that began in 2005 and is currently ongoing as part of a Supplemental RI and focused feasibility study (FFS) is based on these findings.

In September 2013, Thomasville filed for bankruptcy and ceased performing the remedial action. Thomasville also notified EPA it would be unable to perform the additional characterization identified in the Third FYR. EPA immediately began assessing whether other viable potentially responsible parties (PRPs) existed. In the interim, EPA assumed responsibility for the remedial action and began planning for the performance of the Supplemental RI/FFS. In 2014, EPA contractor CDM Smith performed three rounds of groundwater monitoring.

On September 14, 2015, EPA entered an AOC with Univar for performance of a Supplemental RI/FFS. EPA approved Univar's selection of EHS Support as their primary consultant, and work on the Supplemental RI/FFS began later in 2015. In 2016 and 2017, Univar conducted initial groundwater, surface water, and sediment sampling as part of the Supplemental RI, and since 2015 has performed semi-annual residential groundwater monitoring. At present, Univar continues to conduct the RI/FFS in compliance with the terms of the AOC.

Institutional Controls

ICs are non-engineered administrative and legal controls that help minimize the potential for human exposure to contamination and protect the integrity of remedial response actions. ICs were selected in the ROD to prevent exposure to contaminated subsurface soils and groundwater and prohibit activities that could interfere with or adversely affect the remedy. On March 20, 2000, EPA issued a UAO to Buckingham County, the current owner of the Site, requiring the County to provide EPA with access to the property; develop a plan for land use, public access restriction, and maintenance; and file deed restrictions. The ICs were implemented through a deed restriction executed by Buckingham County on September 1, 2000. The ICs are to remain in effect until remedial performance standards are achieved. Additional detail regarding IC objectives and implementation is presented in Table 2.

Table 2. Summary of Institutional Controls

Media, engineered controls, and areas that do not support unlimited use/unrestricted exposure based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Affected Parcels	IC Objective	IC Implementation
Approximately 8 acres including the HWDA and all land within 150 feet of the HWDA	Yes	Yes	Buckingham County Tax IDs 150-16 and 150-18	Prevent exposure to hazardous substances in soil and groundwater by prohibiting residential use and groundwater use, and prohibit activities that could interfere with or adversely affect in any manner the integrity or protectiveness of the remedy	Deed Restriction, Buckingham County Book 259, Page 663 Executed 09/01/2000

Systems Operations/Operation & Maintenance

O&M for the remedy primarily consists of groundwater monitoring and maintenance of the HWDA. Groundwater monitoring has been performed by Thomasville (1998-2013), EPA (2013-2015), and Univar (2015 to present). From 1998 through 2013, point-of-compliance wells and residential wells were sampled on a quarterly basis by Thomasville as part of an approved O&M plan. In the timeframe between Thomasville's bankruptcy and Univar's acceptance of the AOC for RI/FFS, EPA performed monitoring while Univar currently performs semiannual sampling of monitoring wells and three down gradient potable wells as part of the Supplemental RI. Site-related contaminants have been detected below levels of concern at the residential wells in

the past five years. The LTGWMP calls for semi-annual groundwater monitoring of the closest down-gradient residential wells to continue. Inspection of the condition of the monitoring wells and protective surface casing of each well is performed as part of groundwater monitoring.

Other O&M activities include visual inspection of the cap with regard to vegetative cover, settlement, and stability; periodic mowing; maintenance of the fence surrounding the HWDA; and inspection of the drainage swales for blockage, erosion and instability. Buckingham County performs O&M in accordance with 2000 UAO.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the Third (2013) FYR as well as the current status of steps taken to address the issues outlined in the Third FYR. Tables 3 and 4 present the protectiveness statement from the Third FYR and the status of follow-up actions taken in response to issues and recommendations identified in the Third FYR, respectively.

Table 3. Protectiveness Determination/Statement from the Third (2013) Five-Year Review

OU	Protectiveness Determination	Protectiveness Statement
Site-wide	Short-term Protective	The remedy is protective in the short term. The landfill cap that is in place prevents exposure to the waste material. No human or environmental receptors are currently known to be exposed to Site-related contaminants above screening levels (MCLs or health-based contaminant levels). The remedy is not protective in the long term. The remedy is not functioning as intended nor as called for in the ROD. Contamination continues to migrate away from the capped landfill. Site-related contaminants such as 1,4-dioxane, chlorinated VOCs and metals, have migrated beyond point-of-compliance wells where they have been detected in groundwater and surface water samples at levels exceeding screening levels (MCLs or health-based contaminant levels) identified in the ROD. A groundwater to surface water discharge has been confirmed in Cooper Creek. Site-related contaminants have been detected in Cooper Creek and trees near the creek. In addition, two SVOCs, bis(2-ethylhexyl)phthalate and diethyl phthalate, were detected in the stream. SVOCs have not been previously sampled for in ground water and are therefore not known confirmed COCs. In order for the remedy to be protective in the long term, the extent of groundwater contamination should be fully delineated and the groundwater pump and treatment, contingency remedy should be implemented. Source control measures called for in the ROD contingency remedy, or an appropriate alternative should be implemented to abate further contamination of groundwater.

Table 4. Status of Recommendations from the Third (2013) Five-Year Review

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
01	Groundwater contamination detected in Cooper Creek surface water	Determine appropriate regulations and relevant screening levels (MCLs or health-based contaminant levels) to assess impacts of contaminated groundwater discharge to surface water bodies at the Site. A second surface water body located in close proximity to the southern Site boundary should be sampled to determine if COCs are present. Conduct additional delineation work in Cooper Creek to assess contaminant concentration trends over time and during low-flow stream conditions as well as stream flow and surface water to groundwater interaction. Develop a plan to mitigate discharge of COCs to surface water if contaminant levels exceed appropriate threshold.	Addressed in Next FYR	The unnamed tributary to Warner Branch Creek was sampled for COCs in June 2017. Analysis of the new data is underway as part of the Supplemental RI.	Not yet completed

Table 4. Status of Recommendations from the Third (2013) Five-Year Review (Continued)

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
01	Groundwater contamination detected beyond the line of compliance wells	Delineate nature and extent of contamination and assess risk. Develop and implement a remedial strategy to eliminate or reduce the risk to an acceptable level. Source area needs additional delineation through additional data collection. A remedy needs to be developed which includes source control, addresses groundwater contamination and surface water contamination, as well as achieves hydraulic control of the groundwater plume to stop migration. Use available data to revise the conceptual site model (CSM) and assess the threat to human health and the environment. Use the CSM and assessment to revise RAOs and develop a Site-wide remediation strategy that will address the RAOs. Utilize animal shelter groundwater well to collect samples to develop background level information. Evaluate background metals concentrations to assess Site geochemistry to determine the origin and fate of elevated metals concentrations. RPs should submit a work plan and schedule for design of pump and treat system contingency remedy called for in the ROD.	Addressed in Next FYR	Additional delineation of the nature and extent of contamination at the Site is ongoing as part of the Supplemental RI. The CSM has not been updated and background concentrations have not been studied fully evaluated. A remedial strategy to eliminate or reduce the risk to an acceptable level has not yet been developed, and work plans have not been developed yet for a new remedy.	Not yet completed
01	SVOCs detected in Cooper Creek surface water.	Collect groundwater samples from MW-2, MW-27 and MW-31 clusters and analyze for SVOCs.	Addressed in Next FYR	Groundwater samples were collected and analyzed for SVOCs in June 2017. The report analyzing the results is pending and will be incorporated into the Supplemental RI.	Not yet completed

Table 4. Status of Recommendations from the Third (2013) Five-Year Review (Continued)

OU	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date
01	Possible Site COCs detected in the three routinely sampled residential wells.	Install monitoring wells in area between site and residential wells to determine if plume is migrating in direction of residential wells.	Addressed in Next FYR	New wells have not yet been installed. A comprehensive groundwater sampling program was completed in 2017. The report for the sampling event, including proposed new monitoring wells is pending.	Not yet completed
01	Groundwater contamination above an MCL or an RBC has been detected at several point-of-compliance wells on the west, northwest, and south side of the Site	Assess VOC concentration trends to determine placement of bounding wells that are needed to the west and northwest of these wells to complete plume delineation in this area. Assess metals trends in MW-12, MW-15, MW-23BL to determine placement of additional bounding wells needed outside of these well locations to complete plume delineation in this area. Continue to monitor metals concentrations in MW-7SU to aide in determining location of bounding wells needed south of the Site to complete plume delineation in this area.	Addressed in Next FYR	New wells have not yet been installed. A comprehensive groundwater sampling program was completed in 2017. The report for the sampling event, including proposed new monitoring wells is pending at this time.	Not yet completed

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On March 16, 2018, the public was notified in an advertisement posted in the Farmville, Virginia regional daily newspaper *The Farmville Herald* that EPA was conducting the FYR. The public was advised of the purpose of the FYR, invited to contact EPA with questions or information, and notified of the anticipated release date. The results of the FYR and the report are available at the Site information repository located at the Buckingham Branch of the Central Virginia Regional Library, 1140 Main Street, Dillwyn, Virginia 23936, or can be obtained electronically on the internet (https://www.epa.gov/superfund/search-superfund-five-year-reviews).

During the FYR process, interviews were conducted to document any perceived problems or successes with the Remedy that has been implemented to date**.** By way of electronic mail or personal correspondence, EPA informed the Site owner, EHS Support on behalf of Univar, and VDEQ of the preparation of the Fourth FYR. The County Administrator inquired about the status of the cleanup and in particular, the potential for contaminated groundwater to impact local residents. The Administrator was advised that no unacceptable risks to human health currently exist, and that regular monitoring will continue. EPA also provided an updated on the Supplemental RI/FFS and likelihood of additional remedial actions. EPA will continue to keep the County and community members informed about the progress of the cleanup.

Site Inspection

EPA performed the FYR site inspections on April 23, 2018. The purpose of the inspections was to assess the protectiveness of the remedy. Christopher Sklaney (EPA), William Lindsay (VDEQ), Greg White (EHS Support), and staff from EPA contractor CDM Smith were present during the inspection. Staff from Buckingham County met EPA and others to unlock the gate and provide access to the fenced area, but did not participate in the inspection. The participants inspected the HDWA and adjacent areas.

Maintenance of the grass and soil cover over the HWDA cap and the condition of the security fence has improved since the last FYR. Overall, the inspection revealed that the cover is in good condition and regularly mowed. Surface runoff from the landfill is directed to a perimeter drainage ditch, which then flows to Warner Branch and then offsite. Drainage features in place for runoff management include small riprap check dams, located at the entrance and exit points of the perimeter ditch. The perimeter drainage features are functional and in overall good condition. With the exception of a few minor issues, the monitoring wells appear in good condition. The Site Inspection Map and Checklist are included in Appendix C and D, respectively. Photographs from the Site Inspection are included in Appendix E.

Data Review

The FYR included a review of relevant Site documents and monitoring data, with a focus on data collected in the five-year period from early 2013 through the end of 2017. A review of findings and data trends for COCs and potential COCs in groundwater are included in this section.

Groundwater

Analysis of the groundwater data collected by Univar since 2015 is ongoing. However, an initial comparison of the data collected by Univar in June 2017 versus data from the Third FYR has been completed. Figure A1 shows the location of all the monitoring wells. Figures A2 through A6, located in Appendix A, show COCs present above cleanup levels and potential COCs (e.g., 1,4-dioxane, benzene) present above MCLs or Regional screening levels (RSLs) in each monitoring well.

Figures A2 and A3 show data for the bedrock and saprolite wells, respectively, within the 150-foot compliance zone (which includes the MW-2 well triplet, the only wells installed within the boundaries of the HWDA). In general, COC concentrations have not changed greatly for wells within the compliance zone during the last five years, except for the following notable changes:

- tetrachloroethene (PCE) increased in MW-2SU from 370 micrograms per liter (µg/L) to 1,320 µg/L,
- trichloroethene (TCE) increased in MW-2SU from 100 µg/L to 395 µg/L and increased in MW-6S from 1.1 µg/L to 16.2 µg/L,
- cis-1,2-dichloroethene (DCE) increased in MW-2B from 17 µg/L to 187 µg/L,
- 1,1-DCE increased in MW-2B from 2.6 µg/L to 78.7 µg/L and increased in MW-6S from below its method detection limit to 23.6 µg/L, and
- vinyl chloride increased in MW-2SU from non-detect to 109 µg/L and increased in MW-2B from 0.67 µg/L to 33 µg/L.

In addition, the following notable changes were observed for compounds that may be Site-related but were not considered a COC in the ROD:

- methylene chloride increased in MW-2SU from 1,200 µg/L to 7,490 µg/L (the MCL for methylene chloride is 5 µg/L),
- benzene increased in MW-2SU from non-detect to 15.4 µg/L (the MCL for benzene is 5 µg/L),

- 1,1-dichloroethane (DCA) increased in MW-2SU from 3,600 µg/L to 6,900 and increased in MW-2B from 8.2 µg/L to 471 µg/L (an MCL has not been promulgated for 1,1-DCA; the RSL for 1,1-DCA is 2.8 µg/L), and
- 1,4-dioxane decreased in MW-2SU from 1,100 µg/L to 420 µg/L and increased in MW-2B from 8 µg/L to 106 µg/L (an MCL has not been promulgated for 1,4-dioxane; the RSL for 1,4-dioxane is 0.46 µg/L).

Figures A4 and A5 show data for the bedrock and saprolite wells, respectively, located on the property but outside of the compliance zone. Similarly, COC concentrations have not changed greatly for the wells beyond the compliance zone during the past five years, except for the following notable changes:

- cis-1,2-DCE increased in MW-27SU from 8.7 µg/L to 76.8 µg/L,
- 1,1-DCE increased in MW-27SU from 38 µg/L to 136 µg/L,
- vinyl chloride increased in MW-27B from below its method detection limit to 3.5 µg/L,
- PCE decreased in MW-27B from 440 µg/L to 134 µg/L, and
- 1,1,1-trichloroethane (TCA) decreased in MW-27B from 340 to 116 µg/L.

Figure A6 shows the monitoring wells which are beyond the compliance zone. Concentrations for most COCs in these wells have not changed greatly during the last five years. One notable observation is that 1,4-dioxane data were not collected in the MW-34 and MW-35 clusters prior to 2013, and 1,4-dioxane was detected above screening levels in MW-34SU, MW-34B and MW-35SU in 2017. In summary, based on an initial review of the new data, it does not appear that the groundwater plume has moved greatly in the past five years. Indications of an increase in concentrations was observed in some of the source area wells (e.g., MW-2SU and MW-2B), and possible indications of natural attenuation were observed occurring in other locations. Additionally, COC and 1,4-dioxane concentrations continue to be detected above screening levels in several of the wells installed beyond the point-of-compliance wells, north of the MW-27 cluster. Furthermore, 1,4-dioxane has been detected on the northern side of Cooper Creek.

Surface Water and Sediment

Surface water and sediment sampling has been conducted periodically in Cooper Creek during the review period. The periodic sampling was performed to determine whether surface water was being impacted by migration and discharge of groundwater contaminated by COCs or other potential COCs, such as 1,4-dioxane and bis(2-ethylhexyl)phthalate. No cleanup levels were established in the ROD for surface water or sediment. Analytical results of samples were compared to EPA Region 3 Biological Technical Assistance Group (BTAG) freshwater and sediment ecological screening levels.

In June 2013, CDM Smith performed an assessment of Cooper Creek that included the collection of surface water samples from six locations. Two additional samples were collected in August 2013 to confirm results at upstream locations. The samples were analyzed for VOCs, SVOCs, and inorganic elements, including mercury. Eleven VOCs were detected in the samples, but all at concentrations below their respective screening levels (for those VOCs for which screening levels have been established). Five of the 11 VOCs are groundwater COCs: acetone, 1,2-dibromo-3-chloropropene, PCE, 1,1-DCE, and TCE. None of these compounds were present in the samples at concentrations above their groundwater cleanup levels. Bis(2-ethylhexyl)phthalate was detected in two samples, with one result (50 µg/L) being above its screening level of 16 µg/L. 1,4-Dioxane was detected in one sample at a concentration of 2.6 µg/L; no Regional ecological freshwater screening level has been established for 1,4-dioxane. Three inorganic elements were detected in the samples above screening levels: iron, lead, and aluminum. Iron was detected in all samples above its screening level (300 µg/L), at concentrations ranging from 345 µg/L to 936 µg/L. The mean concentration was 585 µg/L. Lead was detected in five samples above its screening level (2.5 µg/L), with a maximum concentration of 5.4 µg/L. Aluminum was detected in three samples above its screening level of 87 µg/L, with a maximum concentration of 203 µg/L. EPA believes that the presence of these three metals above screening levels is most likely due to naturally occurring factors and is not Site-related. Sampling locations and detected compounds and elements are presented on Figure A7.

EHS Support, on behalf of Univar, has performed the most recent characterization of Cooper Creek, conducting two phases of data collection as part of the Supplemental RI. Phase 1 activities included completion of an ecological and hydrogeologic characterization of Cooper Creek and the unnamed tributary of Warner Branch. Phase 2 activities included analysis of surface water and groundwater interaction in Cooper Creek, and delineation of surface water and sediment in Cooper Creek and the unnamed tributary to Warner Branch. Ten surface water and five sediment samples were collected and analyzed for VOCs, SVOCs, and inorganic elements; surface water samples were additionally analyzed for dissolved metals. Field work was performed in June 2017. Surface water and sediment sampling locations are presented on Figure A8.

Figures A8 through A11, located in Appendix A, include Cooper Creek surface water and sediment sampling results from the June 2017 investigation. Figure A7 shows an overview of all surface water and sediment locations. Figures A8 and A9 show surface water sampling results and figure A10 shows sediment sampling results.

Five VOCs (1,1-DCA, 1,1-DCE, 1,1,1-TCA, cis-1,2-DCE, and PCE) and three SVOCs (di-*n*-butyl phthalate, 1,4-dioxane, and bis(2-ethylhexyl)phthalate) were detected in the surface water samples. The VOCs were detected primarily in three samples located in the stretch of Cooper Creek located about 500 feet northwest of the MW-34 well cluster (samples SW011, SW012, and SW015). All five VOCs were detected in SW012. 1,1-DCA was also detected in SW011 and SW015. 1,1-DCE was also detected in SW015. No VOCs were detected upstream of SW011 or downstream of SW015. Locations SW011 and SW012 are located approximately within the projected fracture trace extending northeast from the HWDA. None of the compounds were detected above freshwater screening levels. Di-*n*-butyl phthalate was detected in the farthest downstream sample (SW029) at a concentration of 1.8 µg/L, below its screening level of 6.47 µg/L. Di-*n*-butyl phthalate was not detected in any other locations. 1,4-Dioxane was detected in three locations located north of the MW-33 well cluster (SW015, SW020, and SW023.5) at concentrations ranging from 0.88 µg/L to 1.1 µg/L.

Three inorganic elements were detected in the samples above screening levels in all samples collected from Cooper Creek: iron, aluminum, and barium. Iron was detected above its screening level (300 µg/L) in unfiltered samples at concentrations ranging from 313 µg/L to 734 µg/L. The mean concentration was 447 µg/L. Iron was not detected in samples filtered for dissolved metals analyses. Aluminum was detected above its screening level of 87 µg/L, with a maximum concentration of 435 µg/L. As with iron, aluminum was not detected in samples filtered for dissolved metals analyses. Barium was detected above its screening level of 4 µg/L, at concentrations ranging from 14.6 to 19.2 µg/L. The concentrations in filtered samples were nearly identical to unfiltered samples. EPA believes that the presence of these three metals above screening levels is most likely due to naturally occurring factors and is not Site-related. Analytical results for detected compounds and elements are presented on Figures A9 and A10.

Surface water in the unnamed tributary to Warner Branch was also sampled in June 2017. Bis(2-ethylhexyl) phthalate was detected below its RSL at a concentration of 2.8 µg/L. No other potential COCs were detected in the unnamed tributary.

In addition to surface water sampling, sediment sampling was conducted in Cooper Creek in June 2017. Eight VOCs were detected in one sample (SD011.5), but at concentrations below screening levels. Location SD011.5 is located approximately within the projected fracture trace extending northeast from the HWDA. Analytical results for detected compounds are presented on Figure A11.

Residential Wells

Quarterly monitoring of the residential wells was conducted through the end of 2013. Due to the change in PRP lead, monitoring of the residential wells occurred three times in 2014 (by CDM Smith for EPA) once in 2015 and twice in 2017 (by EHS Support for Univar). Univar currently performs monitoring of the residential wells on a semi-annual basis. Three VOCs (2-butanone (MEK), dichlorodifluoromethane, and acetone) and three SVOCs

(1,4-dioxane, 2-methylnaphthalene, and bis(2-ethylhexyl)phthalate) were detected in the residential wells during the past five years. Each contaminant was detected in any one residential well only one time, with the exception of acetone which was detected in the same well multiple times. Of these compounds, only acetone is considered a COC in the 1994 ROD. All detections in the past five years have been below the respective screening levels for those compounds for which MCLs have not been promulgated (1,4-dioxane or 2-methylnaphthalene). Each contaminant was detected in one residential well only one time, with the exception of acetone which was detected in the same well multiple times. This is the first time that each of the contaminants was detected in the residential wells, with the exception of acetone. 1,4-Dioxane and 2-methylnaphthalene were detected in December 2017.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

No. A review of documents, applicable or relevant and appropriate requirements (ARARs), and the results of the Site inspection and recent Supplemental RI/FFS data indicate that the remedy is not functioning as intended by the ROD. The capping of the HWDA achieved the remedial objective of containing contaminated landfill soil and waste material and preventing dermal contact and incidental ingestion. However, groundwater concentration trends in point-of-compliance wells and wells farther down gradient suggest that Site-related contaminants are not be fully contained or stable. The implementation of the deed restrictions in 2000 has maintained the protectiveness of the remedy and prevented exposures to hazardous substances in the HWDA and compliance zone.

The residential well sampling has indicated low levels of COCs or potential COCs are present at times. No cleanup levels or health-based screening levels have been exceeded in the residential well samples. Nevertheless, data collected from these wells indicate an increase in the number of contaminants detected during any given semi-annual sampling event. In total, 26 combined VOCs and SVOCs have been detected in the residential wells since the beginning of monitoring. Various combinations of the 26 contaminants are found during various sampling events. During the last five years, five additional contaminants (of the 26 noted above) were detected, including 1,4-dioxane in one residential well (December 2017).

Results of surface water and sediment samples collected from Cooper Creek, tree cores collected north of the HWDA, and groundwater samples in this review period, in addition to other information compiled to date, suggest that groundwater contamination has migrated beyond the point-of-compliance wells. Although no complete exposure pathways currently exist at the Site, the uncontrolled migration of contaminated groundwater is considered a potential long-term threat to the residential wells and direct human and ecological contact. Moreover, the presence of COCs in point-of-compliance wells over more than two consecutive sampling events provides the basis for triggering the contingency source control measures identified in the ROD.

In addition, Univar is in the process of completing the Supplemental RI/FFS, which includes additional investigations of groundwater beyond the compliance zone. The data generated as part of the Supplemental RI/FFS will be used to update the CSM, update the human health risk assessement, and revise, as warranted, the list of Site-related COCs. The Supplemental RI/FFS is scheduled to be completed in or about early 2020. Once complete, EPA will determine if additional response actions are necessary outside of the compliance zone, and as appropriate, select such actions in a new decision document.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy selection still valid?

Question B Summary:
There have been no major changes in the physical conditions of the Site or land use that would affect the protectiveness of the remedy. For some contaminants, toxicity data and exposure assumptions have changed since the Baseline Risk Assessment for this Site was performed; however, those changes do not impact the current protectiveness of the remedy or the performance standards identified in the ROD. RAOs have not changed and are still valid.

As part of this FYR, EPA reviewed the ARARs for the Site to determine if any significant changes in regulations, promulgated standards, or those "to be considered" (TBC) such as criteria and guidance had occurred, and if so, whether the changes impact the selected cleanup levels or protectiveness of the remedy. A comprehensive list of those ARARs identified for the Site is included in the decision documents. During the review, EPA did not identify any changes in regulations, standards, or TBCs that would call into question the protectiveness of the remedy.

The groundwater cleanup levels were derived in accordance with the requirement that remedial actions "at least" attain ARARs, including MCLs, and be protective of human health and the environment. There have been no new additions to the list of COCs since the ROD was signed. The ROD established cleanup levels only for COCs for which MCLs were established. Cleanup levels were not established for COCs without MCLs. The ROD references "health-based contaminant levels" for contaminants without MCLs but does not provide how these levels are to be established. Further consideration of the cleanup goals does not alter the short-term protectiveness of the remedy because no complete exposure pathways currently exist at the Site. However, the long-term protectiveness could be affected if there are COCs that do not have established cleanup levels or if cumulative risk is not assessed.

Site-related groundwater contaminants that were detected in Cooper Creek in the past have indicated that the stream is a groundwater discharge area and that surface water exposure pathways should be assessed. This assessment is currently ongoing.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

Question C Summary:
No other information is known or suspected that would impact the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations					
OU: 01	**Issue Category:** Remedy Performance				
	Issue: COCs detected in point-of-compliance wells over two consecutive monitoring events at concentrations exceeding cleanup standards.				
	Recommendation: Implement the pump and treat component of the contingency source control measures as selected in the ROD and evaluate the appropriateness of the contingency source control measures for the eastern disposal trench and barrel trench.				
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**	
No	Yes	PRP	EPA	9/30/2020	

Issues and Recommendations Identified in the Five-Year Review (Continued):				
OU: 01	**Issue Category:** Remedy Performance			
	Issue: Groundwater contamination detected in wells beyond point of compliance wells, residential wells and Cooper Creek surface water.			
	Recommendation: Complete the Supplemental RI/FFS, and if necessary, select a remedy in an appropriate decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

OU: 01	**Issue Category:** Remedy Performance			
	Issue: Possible Site-related contaminants detected in point-of-compliance wells and in two routinely sampled residential wells			
	Recommendation: Install monitoring wells in the area between site and residential wells to determine if plume is migrating in direction of residential wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	8/26/2019

OU: 01	**Issue Category:** Remedy Performance			
	Issue: The ROD established cleanup levels only for Site-related contaminants for which MCLs were promulgated. Cleanup levels were not established for Site-related contaminants without MCLs.			
	Recommendation: Based on an updated risk assessment, establish numeric cleanup levels for Site-related contaminants for which unacceptable risks exist in an appropriate decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA	9/30/2020

Other Findings

In addition, the following are minor issues that were identified during the FYR Inspection, but do not affect current or future protectiveness:

- A loose fence pole at the northwestern edge of the landfill and a damaged portion of fence in the southeast corner of the landfill require repair;
- MW-3B within the landfill fence line is missing a monitoring well cap and lock;
- The protective concrete ring around MW-2SU is damaged;
- MW-7S was not locked;
- The well pad for MW-25SL is cracked.

Buckingham County is responsible for maintenance of the fence. EPA will notify Buckingham County of the portions of the fence requiring repair. During LTGWMP sampling in June 2018, EHS Support replaced the well cap and lock for both MW-3B and MW-7S. EHS Support indicated to EPA that repair of the concrete pads around MW-2SU and MW-25SL was scheduled to occur during upcoming monitoring well installation activities at the Site.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy is protective in the short term. There are no complete exposure pathways currently causing unacceptable risk to human health or the environment. The HWDA cap and perimeter fencing is regularly maintained and in good condition. Institutional controls are in place preventing the use of groundwater and contact with hazardous substances in the HWDA. However, due to the regular presence of Site-related contaminants in groundwater beyond point-of-compliance wells, the remedy is not functioning as designed and is not protective in the long term. To achieve long-term protectiveness, implement the pump and treat component of the contingency remedy in the 1994 ROD and evaluate the appropriateness of the contingency source control measures for the eastern disposal trench and barrel trench. Complete the Supplemental RI/FFS, and if necessary, select a remedy in an appropriate decision document, install monitoring wells in the area between site and residential wells to determine if plume is migrating in direction of residential wells and based on an updated risk assessment, establish numeric cleanup levels for Site-related contaminants for which unacceptable risks exist in an appropriate decision document.	

VIII. GOVERNMENT PERFORMANCE AND RESULTS ACT MEASURES

As part of this five-year review, the Government Performance and Results Act (GPRA) Measures have also been reviewed. The GPRA Measures and their status are provided as follows:

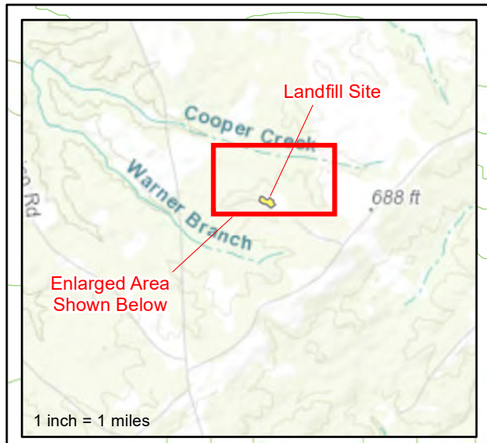
Environmental Indicators
Human Health: Human Exposure Under Control
Groundwater Migration: Groundwater Migration Not Under Control

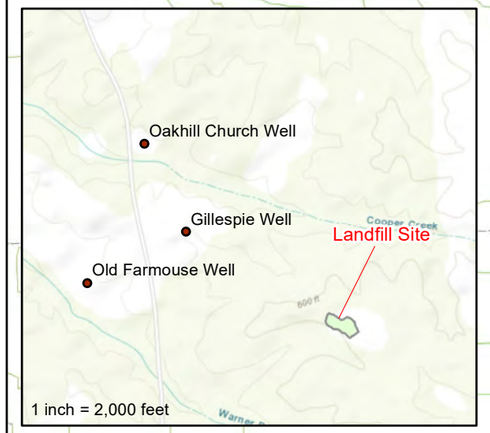
Sitewide Ready for Anticipated Use (SWRAU)
Conditions for SWRAU status have not been achieved.

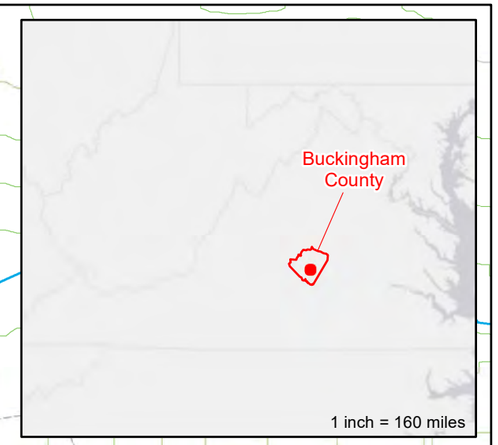
IX. NEXT REVIEW

The next FYR report for the Site is required five years from the completion date of this review.

APPENDIX A – FIGURES







Legend

- Figure A2 (POC & Source Area Wells - Bedrock)
- Figure A3 (POC & Source Area Wells - Saprolite)
- Figure A4 (Peripheral Bedrock Wells)
- Figure A5 (Peripheral Saprolite Wells)
- Figure A6 (Offsite Wells)
- Land Surface Elevation (ft msl)
- Property Line
- Drainage Swale
- Site Fence
- Road
- Rock Dam
- Stream
- Pond
- Disposal Trench
- Evaporation Trench
- Barrel Trench
- Landfill Cap
- Treeline

Notes:
POC = Point of Compliance
World Topography Service Layer Credits: Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.
Light Gray Canvas Service Layer Credits: Sources: Esri, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

Buckingham County Landfill Site
Buckingham County, Virginia

0 105 210 420 Feet

Figure A1
Site Overview
June 15, 2018

CDM Smith

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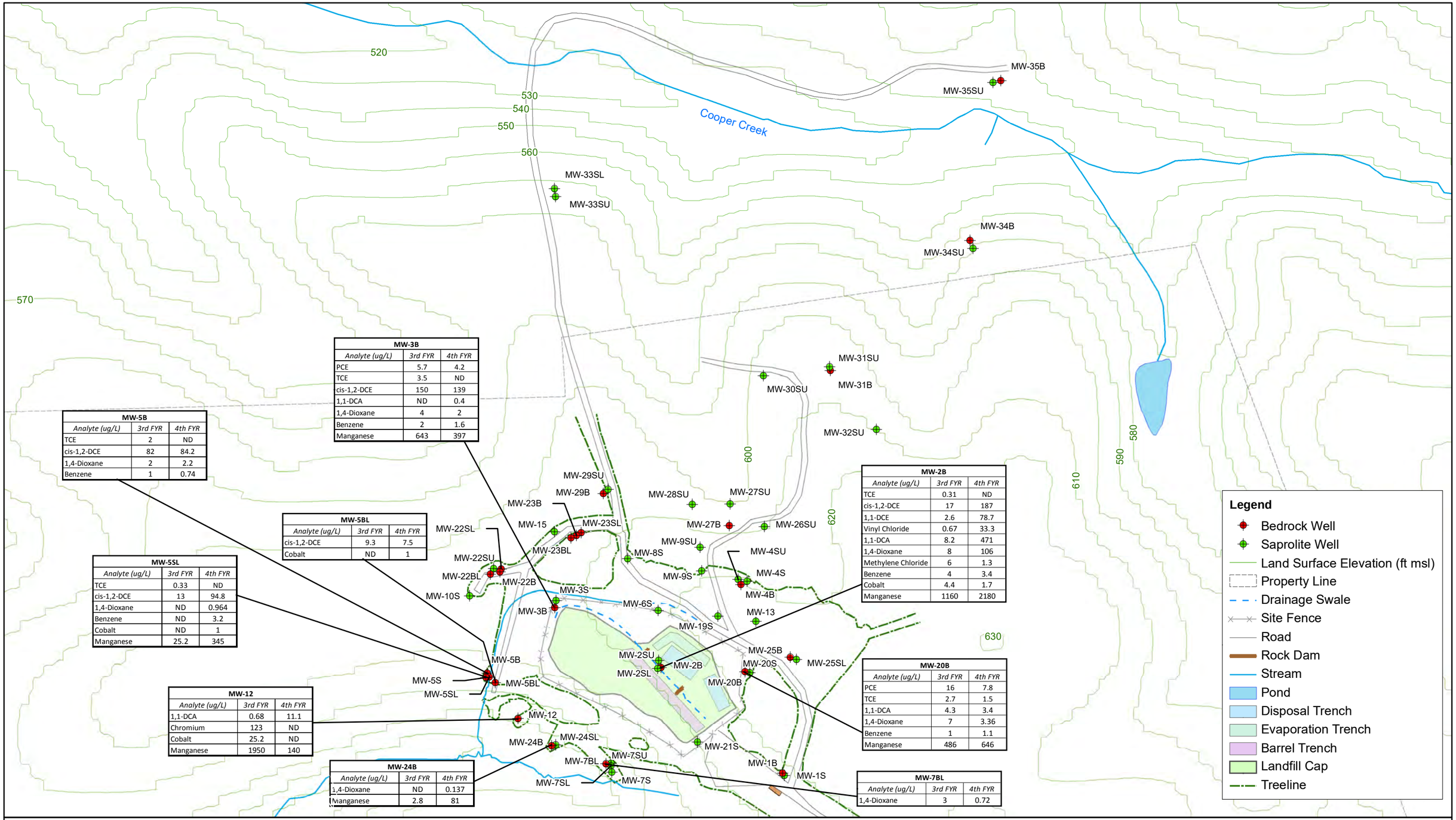

MW-5B

Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	2	ND
cis-1,2-DCE	82	84.2
1,4-Dioxane	2	2.2
Benzene	1	0.74

MW-3B

Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	5.7	4.2
TCE	3.5	ND
cis-1,2-DCE	150	139
1,1-DCA	ND	0.4
1,4-Dioxane	4	2
Benzene	2	1.6
Manganese	643	397

MW-5BL

Analyte (ug/L)	*3rd FYR*	*4th FYR*
cis-1,2-DCE	9.3	7.5
Cobalt	ND	1

MW-5SL

Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	0.33	ND
cis-1,2-DCE	13	94.8
1,4-Dioxane	ND	0.964
Benzene	ND	3.2
Cobalt	ND	1
Manganese	25.2	345

MW-12

Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,1-DCA	0.68	11.1
Chromium	123	ND
Cobalt	25.2	ND
Manganese	1950	140

MW-24B

Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	ND	0.137
Manganese	2.8	81

MW-2B

Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	0.31	ND
cis-1,2-DCE	17	187
1,1-DCE	2.6	78.7
Vinyl Chloride	0.67	33.3
1,1-DCA	8.2	471
1,4-Dioxane	8	106
Methylene Chloride	6	1.3
Benzene	4	3.4
Cobalt	4.4	1.7
Manganese	1160	2180

MW-20B

Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	16	7.8
TCE	2.7	1.5
1,1-DCA	4.3	3.4
1,4-Dioxane	7	3.36
Benzene	1	1.1
Manganese	486	646

MW-7BL

Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	3	0.72

Notes:
FYR = Five Year Review
3rd FYR data from the 2013 "Revised Draft Hydrogeological Analysis of the Effectiveness of Long-Term Groundwater Monitoring" by CDM Smith
4th FYR data from PRP Consultants (EHS Support) June 2017 event
COCs = Contaminants of Concern
ND = Non-detect result
POC = Point of Compliance

0 105 210 420 Feet

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A2
POC and Source Area Bedrock Wells with COCs above Screening Levels
June 15, 2018

CDM Smith

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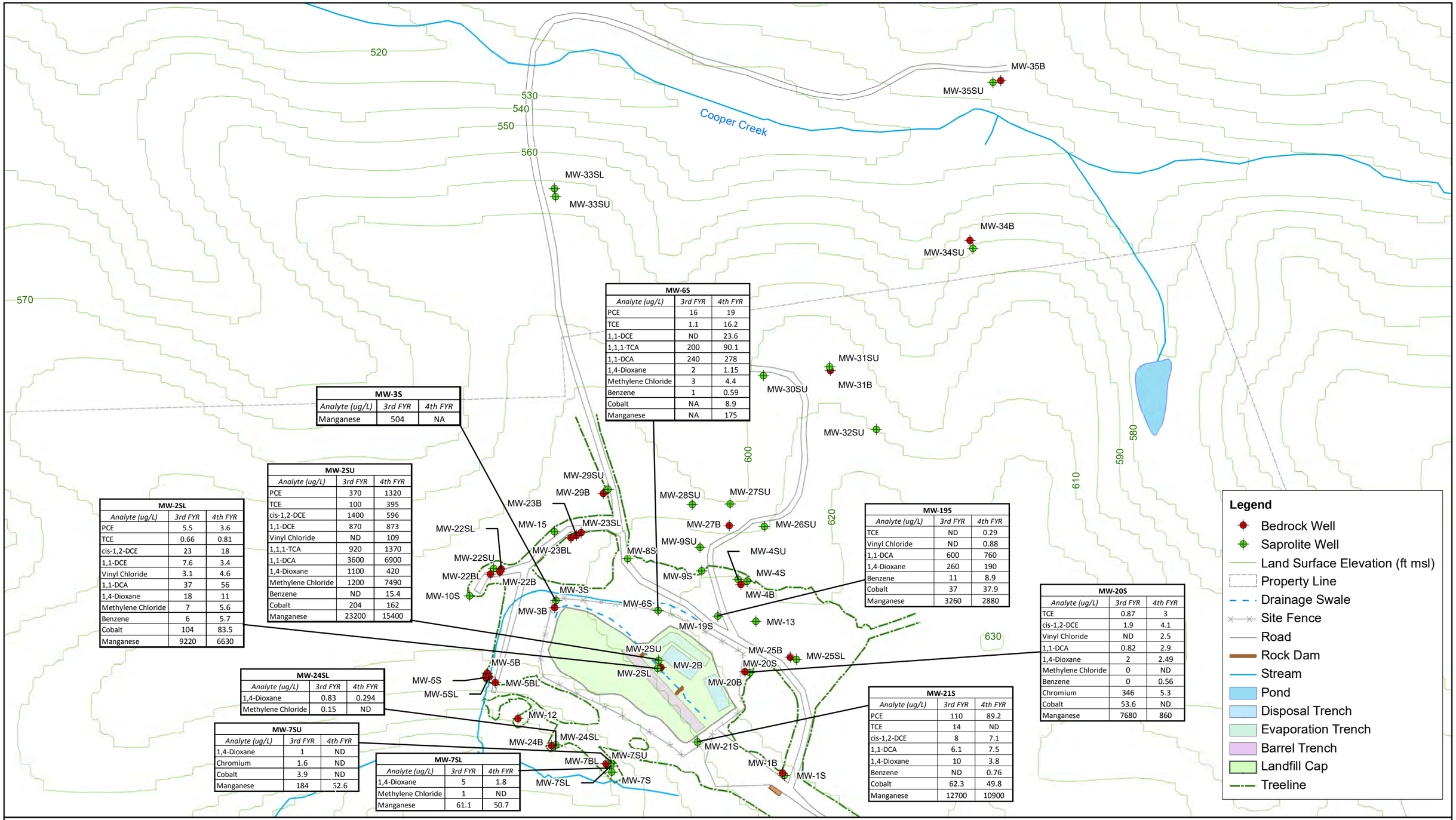

MW-3S		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
Manganese	504	NA

MW-6S		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	16	19
TCE	1.1	16.2
1,1-DCE	ND	23.6
1,1,1-TCA	200	90.1
1,1-DCA	240	278
1,4-Dioxane	2	1.15
Methylene Chloride	3	4.4
Benzene	1	0.59
Cobalt	NA	8.9
Manganese	NA	175

MW-2SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	370	1320
TCE	100	395
cis-1,2-DCE	1400	596
1,1-DCE	870	873
Vinyl Chloride	ND	109
1,1,1-TCA	920	1370
1,1-DCA	3600	6900
1,4-Dioxane	1100	420
Methylene Chloride	1200	7490
Benzene	ND	15.4
Cobalt	204	162
Manganese	23200	15400

MW-2SL		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	5.5	3.6
TCE	0.66	0.81
cis-1,2-DCE	23	18
1,1-DCE	7.6	3.4
Vinyl Chloride	3.1	4.6
1,1-DCA	37	56
1,4-Dioxane	18	11
Methylene Chloride	7	5.6
Benzene	6	5.7
Cobalt	104	83.5
Manganese	9220	6630

MW-19S		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	ND	0.29
Vinyl Chloride	ND	0.88
1,1-DCA	600	760
1,4-Dioxane	260	190
Benzene	11	8.9
Cobalt	37	37.9
Manganese	3260	2880

MW-20S		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	0.87	3
cis-1,2-DCE	1.9	4.1
Vinyl Chloride	ND	2.5
1,1-DCA	0.82	2.9
1,4-Dioxane	2	2.49
Methylene Chloride	0	ND
Benzene	0	0.56
Chromium	346	5.3
Cobalt	53.6	ND
Manganese	7680	860

MW-24SL		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	0.83	0.294
Methylene Chloride	0.15	ND

MW-21S		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	110	89.2
TCE	14	ND
cis-1,2-DCE	8	7.1
1,1-DCA	6.1	7.5
1,4-Dioxane	10	3.8
Benzene	ND	0.76
Cobalt	62.3	49.8
Manganese	12700	10900

MW-7SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	1	ND
Chromium	1.6	ND
Cobalt	3.9	ND
Manganese	184	52.6

MW-7SL		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	5	1.8
Methylene Chloride	1	ND
Manganese	61.1	50.7

Legend

- Bedrock Well
- Saprolite Well
- Land Surface Elevation (ft msl)
- Property Line
- Drainage Swale
- Site Fence
- Road
- Rock Dam
- Stream
- Pond
- Disposal Trench
- Evaporation Trench
- Barrel Trench
- Landfill Cap
- Treeline

Notes:
FYR = Five Year Review
3rd FYR data from the 2013 "Revised Draft Hydrogeological Analysis of the Effectiveness of Long-Term Groundwater Monitoring" by CDM Smith
4th FYR data from PRP Consultants (EHS Support) June 2017 event
COCs = Contaminants of Concern
ND = Non-detect result
NA = Not analyzed
POC = Point of Compliance

0 105 210 420 Feet

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A3
POC and Source Area Saprolite Wells with COCs above Screening Levels
June 15, 2018

CDM Smith

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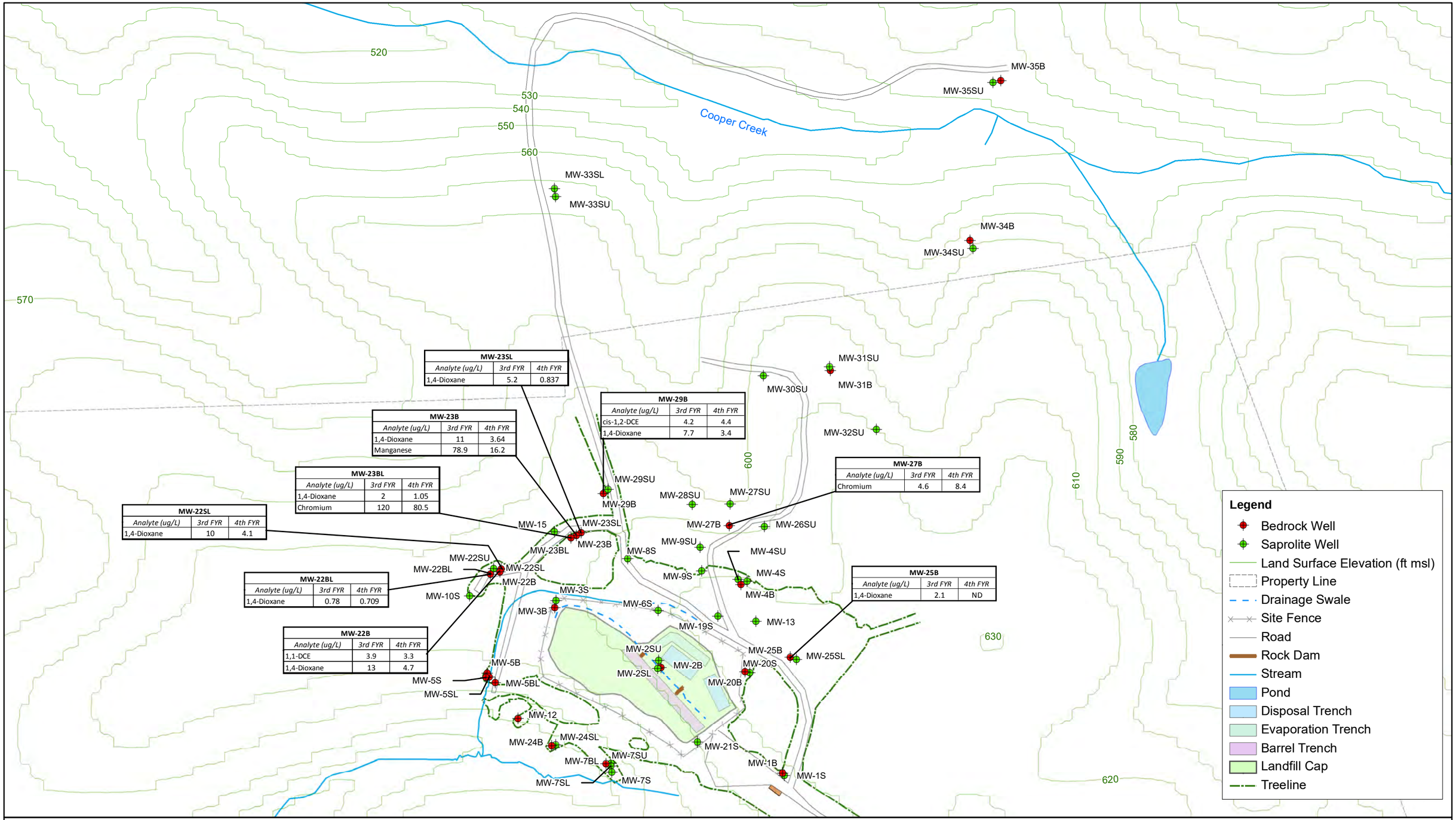

Notes:
FYR = Five Year Review
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4th FYR data from PRP Consultants (EHS Support) June 2017 event
COCs = Contaminants of Concern
ND = Non-detect result

0 105 210 420 Feet

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A4
Peripheral Bedrock Wells with COCs above Screening Levels
June 15, 2018

CDM Smith

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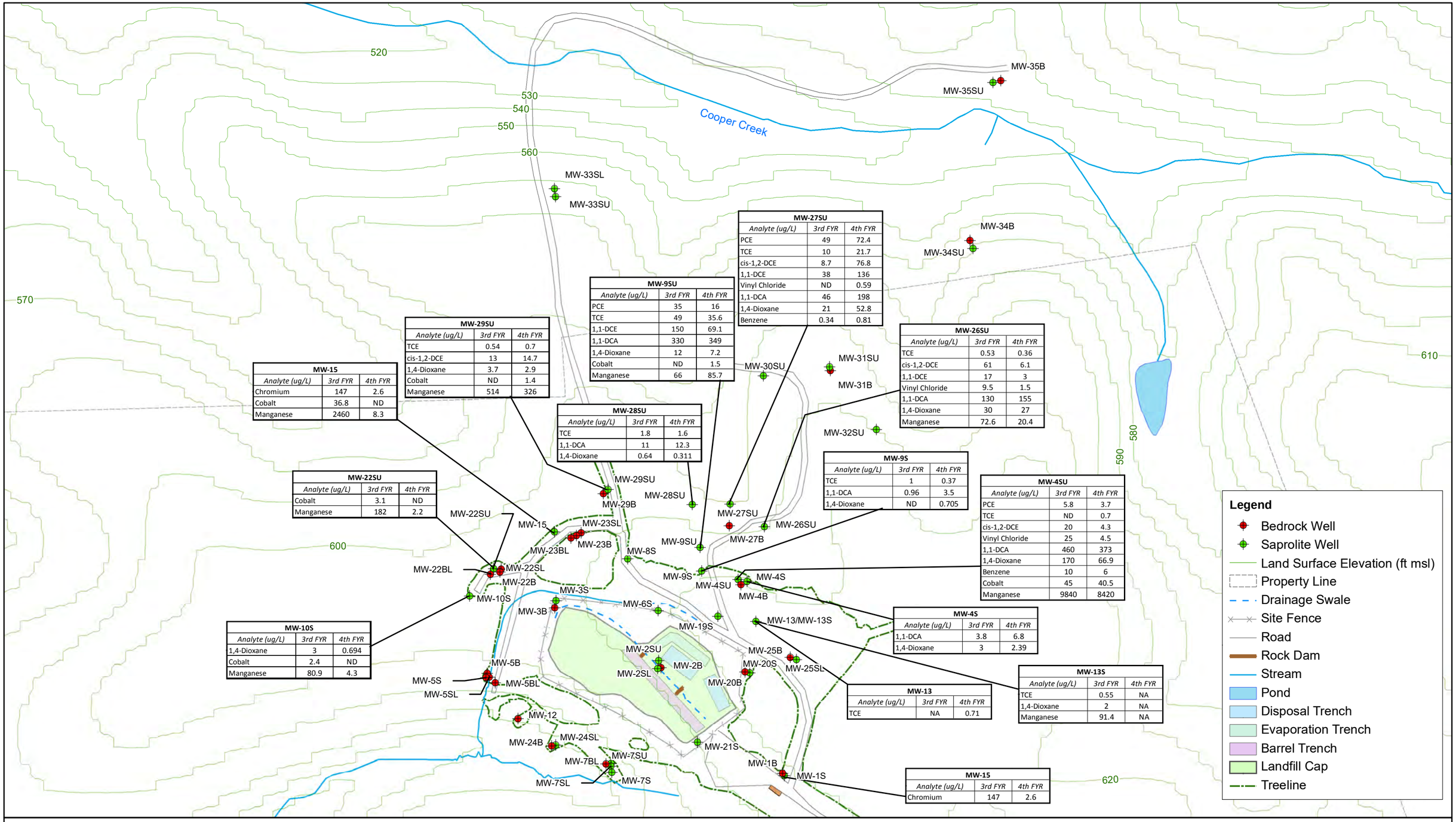


MW-27SU

Analyte (ug/L)	3rd FYR	4th FYR
PCE	49	72.4
TCE	10	21.7
cis-1,2-DCE	8.7	76.8
1,1-DCE	38	136
Vinyl Chloride	ND	0.59
1,1-DCA	46	198
1,4-Dioxane	21	52.8
Benzene	0.34	0.81

MW-9SU

Analyte (ug/L)	3rd FYR	4th FYR
PCE	35	16
TCE	49	35.6
1,1-DCE	150	69.1
1,1-DCA	330	349
1,4-Dioxane	12	7.2
Cobalt	ND	1.5
Manganese	66	85.7

MW-29SU

Analyte (ug/L)	3rd FYR	4th FYR
TCE	0.54	0.7
cis-1,2-DCE	13	14.7
1,4-Dioxane	3.7	2.9
Cobalt	ND	1.4
Manganese	514	326

MW-15

Analyte (ug/L)	3rd FYR	4th FYR
Chromium	147	2.6
Cobalt	36.8	ND
Manganese	2460	8.3

MW-28SU

Analyte (ug/L)	3rd FYR	4th FYR
TCE	1.8	1.6
1,1-DCA	11	12.3
1,4-Dioxane	0.64	0.311

MW-26SU

Analyte (ug/L)	3rd FYR	4th FYR
TCE	0.53	0.36
cis-1,2-DCE	61	6.1
1,1-DCE	17	3
Vinyl Chloride	9.5	1.5
1,1-DCA	130	155
1,4-Dioxane	30	27
Manganese	72.6	20.4

MW-9S

Analyte (ug/L)	3rd FYR	4th FYR
TCE	1	0.37
1,1-DCA	0.96	3.5
1,4-Dioxane	ND	0.705

MW-4SU

Analyte (ug/L)	3rd FYR	4th FYR
PCE	5.8	3.7
TCE	ND	0.7
cis-1,2-DCE	20	4.3
Vinyl Chloride	25	4.5
1,1-DCA	460	373
1,4-Dioxane	170	66.9
Benzene	10	6
Cobalt	45	40.5
Manganese	9840	8420

MW-22SU

Analyte (ug/L)	3rd FYR	4th FYR
Cobalt	3.1	ND
Manganese	182	2.2

MW-4S

Analyte (ug/L)	3rd FYR	4th FYR
1,1-DCA	3.8	6.8
1,4-Dioxane	3	2.39

MW-10S

Analyte (ug/L)	3rd FYR	4th FYR
1,4-Dioxane	3	0.694
Cobalt	2.4	ND
Manganese	80.9	4.3

MW-13S

Analyte (ug/L)	3rd FYR	4th FYR
TCE	0.55	NA
1,4-Dioxane	2	NA
Manganese	91.4	NA

MW-13

Analyte (ug/L)	3rd FYR	4th FYR
TCE	NA	0.71

MW-15

Analyte (ug/L)	3rd FYR	4th FYR
Chromium	147	2.6

Notes:
FYR = Five Year Review
3rd FYR data from the 2013 "Revised Draft Hydrogeological Analysis of the Effectiveness of Long-Term Groundwater Monitoring" by CDM Smith
4th FYR data from PRP Consultants (EHS Support) June 2017 event
COCs = Contaminants of Concern
ND = Non-detect result
NA = Not analyzed

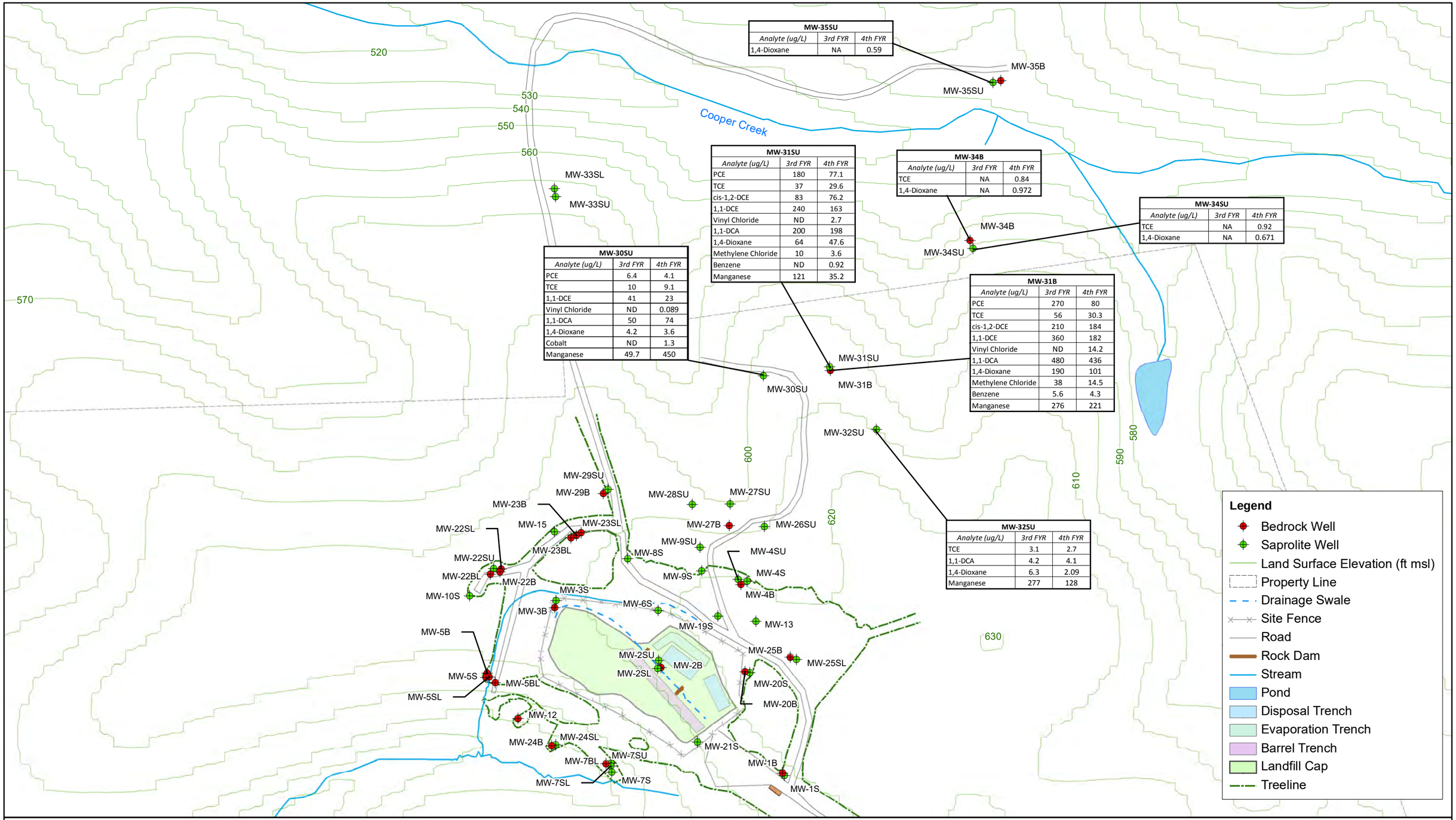
0 105 210 420 Feet

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A5
Peripheral Saprolite Wells with COCs above Screening Levels
June 15, 2018

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\5_yr_2018_update\BCL_5YR_2018_Well_3rd4thFYR_Peripheral_Sap_Wells_Analyte_Hits_A5_20180615.mxd



MW-35SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
1,4-Dioxane	NA	0.59

MW-31SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	180	77.1
TCE	37	29.6
cis-1,2-DCE	83	76.2
1,1-DCE	240	163
Vinyl Chloride	ND	2.7
1,1-DCA	200	198
1,4-Dioxane	64	47.6
Methylene Chloride	10	3.6
Benzene	ND	0.92
Manganese	121	35.2

MW-34B		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	NA	0.84
1,4-Dioxane	NA	0.972

MW-34SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	NA	0.92
1,4-Dioxane	NA	0.671

MW-30SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	6.4	4.1
TCE	10	9.1
1,1-DCE	41	23
Vinyl Chloride	ND	0.089
1,1-DCA	50	74
1,4-Dioxane	4.2	3.6
Cobalt	ND	1.3
Manganese	49.7	450

MW-31B		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
PCE	270	80
TCE	56	30.3
cis-1,2-DCE	210	184
1,1-DCE	360	182
Vinyl Chloride	ND	14.2
1,1-DCA	480	436
1,4-Dioxane	190	101
Methylene Chloride	38	14.5
Benzene	5.6	4.3
Manganese	276	221

MW-32SU		
Analyte (ug/L)	*3rd FYR*	*4th FYR*
TCE	3.1	2.7
1,1-DCA	4.2	4.1
1,4-Dioxane	6.3	2.09
Manganese	277	128

Legend

- Bedrock Well
- Saprolite Well
- Land Surface Elevation (ft msl)
- Property Line
- Drainage Swale
- Site Fence
- Road
- Rock Dam
- Stream
- Pond
- Disposal Trench
- Evaporation Trench
- Barrel Trench
- Landfill Cap
- Treeline

Notes:
FYR = Five Year Review
3rd FYR data from the 2013 "Revised Draft Hydrogeological Analysis of the Effectiveness of Long-Term Groundwater Monitoring" by CDM Smith
4th FYR data from PRP Consultants (EHS Support) June 2017 event
COCs = Contaminants of Concern
ND = Non-detect result
NA = Not analyzed

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A6
Offsite Wells with COCs above Screening Levels
June 15, 2018

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\5_yr_2018_update\BCL_5YR_2018_Well_3rd4thFYR_OffsiteWells_Analyte_Hits_A6_20180615.mxd

Path: \\CHYFEDSVR1\Ecaffx\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\stream investigation 2013\stream sampling locs_June & Aug 2013.mxd

Date: 11/4/2013 Screening levels modified by C. Sklaney, EPA RPM (August 2018)

	Screening Level	BCL-SW-06-1306
Total Metals (µg/L)		
Calcium	116,000	3,360 J
Iron	300	**547**
Lead	2.5	**2.7 J**
Magnesium	82,000	2,390 J
Manganese	460	24.5
Nickel	52	1.1 J
Sodium	680,000	3,320 J

	Screening Level	BCL-SW-05-1306
Volatile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	0.21 J
Acetone	1,500	1.7 J
Tetrachloroethene	111	0.11 J
Semivolatile Organic Compounds (µg/L)		
Bis(2-ethylhexyl)phthalate	16	**50**
Total Metals (µg/L)		
Calcium	116,000	3,210 J
Iron	300	**518**
Lead	2.5	2.4 J
Magnesium	82,000	2,240 J
Manganese	460	20.1
Nickel	52	1 J
Sodium	680,000	2,770 J

	Screening Level	BCL-SW-02-1306
Volatile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	0.3 J
cis-1,2-Dichloroethene	590	0.19 J
Tetrachloroethene	111	0.12 J
Total Metals (µg/L)		
Aluminum	87	**203**
Calcium	116,000	3,850 J
Iron	300	**936**
Lead	2.5	**2.9 J**
Magnesium	82,000	2,680 J
Manganese	460	81.7
Nickel	52	1.2 J
Sodium	680,000	2,610 J

	Screening Level	BCL-SW-01-1308
Volatile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	0.77
cis-1,2-Dichloroethene	590	0.46 J
Tetrachloroethene	111	0.2 J
Total Metals (µg/L)		
Aluminum	87	**162 J**
Calcium	116,000	3,690 J
Cobalt	23	0.85 J
Iron	300	**487**
Lead	2.5	**5.4 J**
Magnesium	82,000	1,810 J
Manganese	460	67.3
Nickel	52	1.9 J

	Screening Level	BCL-SW-01-1306
Volatile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	2.6
cis-1,2-Dichloroethene	590	1.4
Tetrachloroethene	111	0.74
Trichloroethene	21	0.31 J
Trichlorofluoromethane	NE	0.18 J
Semivolatile Organic Compounds (µg/L)		
1,4-Dioxane	NE	2.6
Total Metals (µg/L)		
Calcium	116,000	4,220 J
Chromium	85	7.5 J
Iron	300	**345**
Lead	2.5	**3.6 J**
Magnesium	82,000	2,120 J
Manganese	460	39.9
Nickel	52	1.7 J
Sodium	680,000	2,900 J

	Screening Level	BCL-SW-04-1306
Volatile Organic Compounds (µg/L)		
1,1,1-Trichloroethane	11	0.57
1,1-Dichloroethane	47	1.2
1,1-Dichloroethene	25	1.3
1,2,3-Trichlorobenzene	8	0.45 J
1,2,4-Trichlorobenzene	24	0.16 J
1,2-Dibromo-3-chloropropane	NE	0.31 J
cis-1,2-Dichloroethene	590	0.26 J
Tetrachloroethene	111	0.55
Trichloroethene	21	0.24 J
Trichlorofluoromethane	NE	0.14 J
Semivolatile Organic Compounds (µg/L)		
Bis(2-ethylhexyl)phthalate	16	4.1 J
Total Metals (µg/L)		
Calcium	116,000	3,600 J
Iron	300	**576**
Lead	2.5	2.4 J
Magnesium	82,000	2,410 J
Manganese	460	25.7
Nickel	52	1.2 J
Sodium	680,000	2,670 J

	Screening Level	BCL-SW-02-1308
Volatile Organic Compounds (µg/L)		
Trichlorofluoromethane	NE	0.28 J
1,1-Dichloroethene	25	2.6
1,1-Dichloroethane	47	2.1
cis-1,2-Dichloroethene	590	0.5
1,1,1-Trichloroethane	11	1
Trichloroethene	21	0.33 J
Tetrachloroethene	11	0.85
Total Metals (µg/L)		
Aluminum	87	**140 J**
Calcium	116,000	4,440 J
Iron	300	**596**
Magnesium	82,000	2,820 J
Manganese	460	37.3
Nickel	52	0.72 J

	Screening Level	BCL-SW-03-1306
Volatile Organic Compounds (µg/L)		
1,1,1-Trichloroethane	11	0.58
1,1-Dichloroethane	47	1.6
1,1-Dichloroethene	25	1.6
cis-1,2-Dichloroethene	590	0.62
Tetrachloroethene	111	0.83
Trichloroethene	21	0.24 J
Trichlorofluoromethane	NE	0.28 J
Total Metals (µg/L)		
Calcium	116,000	4,010 J
Iron	300	**674**
Magnesium	82,000	2,770 J
Manganese	460	26.7
Nickel	52	1.1 J
Sodium	680,000	2,920 J

BCL-SW-06-1306
BCL-SW-05-1306
BCL-SW-04-1306
BCL-SW-03-1306
BCL-SW-02-1306
BCL-SW-01-1306
BCL-SW-02-1308
BCL-SW-01-1308
Cooper Creek
Flow Direction
MW-35SU
MW-35B
MW-33SL
MW-33SU
MW-34B
MW-34SU
MW-30SU
MW-31SU
MW-31B
MW-32SU
520
530
540
550
560
570
580
590
600
610
620

Legend

- Aug 2013 Stream Sampling Location
- June 2013 Stream Sampling Location
- Saprolite Monitoring Well
- Bedrock Monitoring Well
- Land Surface Elevation (ft msl)
- Projected Land Surface Fracture Trace
- Intermittent Stream
- Perennial Stream
- Pond

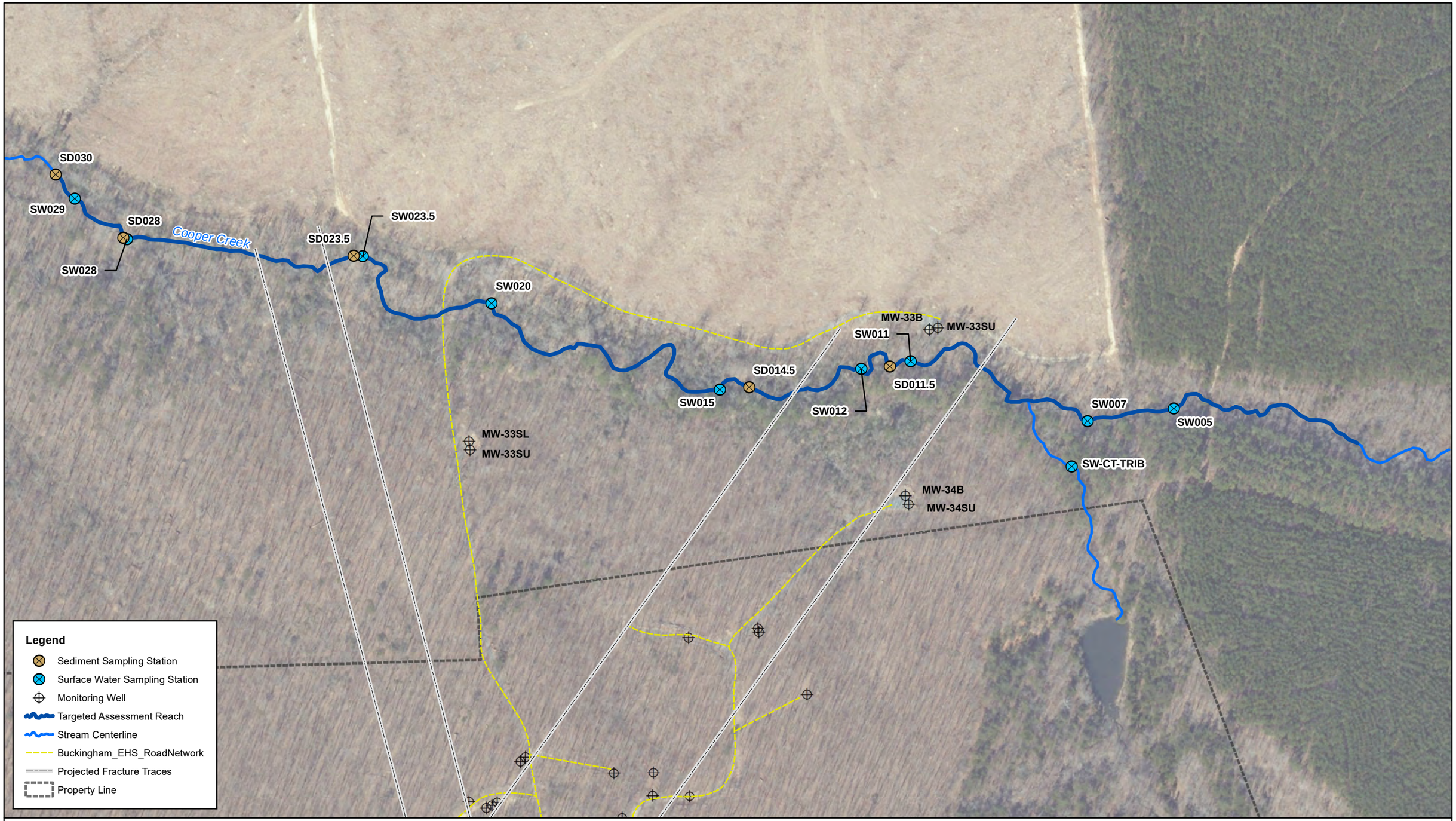
Notes:
Land surface elevation in feet above mean sea level.
NE - Not Established
J = Analyte present. Reported value may not be accurate or precise.
Screening levelis the EPA Region 3 Biological Technical Assessment Team Freshwater Screening Benchmark (2006).

CDM Smith

0 100 200 Feet

Buckingham County Landfill Site
Buckingham County, Virginia

Figure A7
Compounds and Elements Detected in Cooper Creek Surface Water
June and August 2013



Notes:
Figure based on information from PRP Consultants (EHS Support), 2017.
Service Layer Credits: Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Buckingham County Landfill Site
Buckingham County, Virginia

0 100 200 400 Feet

Figure A8
Sediment and Surface Water Sampling Locations
June 2017

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\June_2017_Sampling\BCL_SE_SW_SamplingLocs_June2017_A7_20180615.mxd

	Screening Level	EHS SW-CT-15
Volitile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	1.2
1,1-Dichloroethene	25	0.56 J
Semivolitile Organic Compounds (µg/L)		
1,4-Dioxane	NE	1.1
Total Metals (µg/L)		
Aluminum	87	**187**
Barium	4	**17.9**
Calcium	116,000	4,010
Iron	300	**433**
Magnesium	82,000	2,450
Manganese	460	27.2
Potasium	53,000	1,010
Sodium	680,000	3,340
Vanadium	NE	2

	Screening Level	EHS SW-CT-12
Volitile Organic Compounds (µg/L)		
1,1,1-Trichloroethane	11	0.49 J
1,1-Dichloroethane	47	2.3
1,1-Dichloroethene	25	1.8
Cis-1,2-Dichloroethylene	590	0.8 J
Tetrachloroethylene (PCE)	111	0.81 J
Semivolitile Organic Compounds (µg/L)		
1,4-Dioxane	NE	0.91 J
Dissolved Metals (µg/L)		
Barium	4	**17.4**
Calcium	116,000	3,960
Iron	300	149
Magnesium	82,000	2,660
Manganese	460	12.8
Potasium	53,000	1,000
Sodium	680,000	3,270
Total Metals (µg/L)		
Aluminum	87	**160**
Barium	4	**17.9**
Calcium	116,000	3,900
Iron	300	**444**
Magnesium	82,000	2,610
Manganese	460	21.7
Potasium	53,000	991
Sodium	680,000	3,190

	Screening Level	EHS SW-CT-05
Dissolved Metals (µg/L)		
Barium	4	**17.8**
Calcium	116,000	4,210
Iron	300	94.2
Magnesium	82,000	3,170
Manganese	460	6.2
Potasium	53,000	956
Sodium	680,000	3,230
Total Metals (µg/L)		
Aluminum	87	**105**
Barium	4	**19.1**
Calcium	116,000	4,360
Iron	300	**313**
Magnesium	82,000	3,220
Manganese	460	13.3
Potasium	53,000	982
Sodium	680,000	3,290
Vanadium	8.6	2.1

	Screening Level	EHS SW-CT-11
Volitile Organic Compounds (µg/L)		
1,1-Dichloroethane	47	0.7 J
Dissolved Metals (µg/L)		
Barium	4	**16.8**
Calcium	116,000	3,780
Iron	300	216
Magnesium	82,000	2,600
Manganese	460	17.3
Potasium	53,000	993
Sodium	680,000	3,150
Total Metals (µg/L)		
Aluminum	87	**120**
Barium	4	**18.4**
Calcium	116,000	4,040
Iron	300	**417**
Magnesium	82,000	2,730
Manganese	460	21.2
Potasium	53,000	1,050
Sodium	680,000	3,320

	Screening Level	EHS SW-CT-07
Dissolved Metals (µg/L)		
Barium	4	**18.1**
Calcium	116,000	4,330
Iron	300	157
Magnesium	82,000	3,140
Manganese	460	9.2
Potasium	53,000	995
Sodium	680,000	3,350
Total Metals (µg/L)		
Aluminum	87	**132**
Barium	4	**19.2**
Calcium	116,000	4,280
Iron	300	**426**
Magnesium	82,000	3,090
Manganese	460	24.7
Potasium	53,000	985
Sodium	680,000	3,330
Vanadium	NE	2.2

MW-35SU
MW-35B
SW011
SW012
SW015
SW005
SW007
SW-CT-TRIB
MW-34B
MW-34SU

Legend

- Surface Water Sampling Station
- Monitoring Well
- Targeted Assessment Reach
- Stream Centerline
- Buckingham_EHS_RoadNetwork
- Projected Fracture Traces
- Property Line

Notes:
ug/l = micrograms per liter
NE - Not established
J = Estimated value. Reported value may not be accurate or precise.
UJ = The analyte was not detected above the sample reporting limit; and the reporting limit is approximate U = Not detected above the listed reporting limit
Figure based on information from PRP Consultants (EHS Support), 2017.
Service Layer Credits: Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Screening level is the EPA Region 3 Biological Technical Assessment Team Ecological Freshwater Screening Benchmark.

Buckingham County Landfill Site
Buckingham County, Virginia

0 50 100 200 Feet

Figure A9
Surface Water Sampling Locations and Analytical Results - East
Upstream Portion of Cooper Creek Basin
June 2017

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\June_2017_Sampling\BCL_SW_East_SamplingLocs_June2017_A8_20180615.mxd

	Screening Level	EHS SW-CT-28
Dissolved Metals (µg/L)		
Barium	4	**14.6**
Calcium	116,000	3,920
Iron	300	145
Magnesium	82,000	2,490
Manganese	460	11.4
Potasium	53,000	888
Sodium	680,000	4,020
Total Metals (µg/L)		
Aluminum	87	**176**
Barium	4	**16.7**
Calcium	116,000	3,970
Iron	300	**516**
Magnesium	82,000	2,530
Manganese	460	34.8
Potasium	53,000	913
Sodium	680,000	4,060
Vanadium	8.6	2

	Screening Level	EHS SW-CT-20	EHS SW-CT-20-DUP
Semivolitile Organic Compounds (µg/L)			
1,4-Dioxane	NE	1	1.1
Dissolved Metals (µg/L)			
Barium	4	**15.9**	**15.5**
Calcium	116,000	3,850	3,770
Iron	300	189	150
Magnesium	82,000	2,550	2,450
Manganese	460	16.1	14.8
Potasium	53,000	972	933
Sodium	680,000	3,700	3,530
Total Metals (µg/L)			
Aluminum	87	76.5	**104**
Barium	4	**16.4**	**16**
Calcium	116,000	3,720	3,790
Iron	300	**344**	**376**
Magnesium	82,000	2,470	2,460
Manganese	460	20.2	19.9
Potasium	53,000	928	941
Sodium	680,000	3,570	3,550

	Screening Level	EHS SW-CT-29
Semivolitile Organic Compounds (µg/L)		
Di-n-butyl phthalate	6.47	1.8 J
Dissolved Metals (µg/L)		
Barium	4	**14**
Calcium	116,000	4,040
Iron	300	121
Magnesium	82,000	2,500
Manganese	460	15.4
Potasium	53,000	823
Sodium	680,000	4,050
Total Metals (µg/L)		
Aluminum	87	**113**
Barium	4	**15.8**
Calcium	116,000	4,150
Iron	300	**378**
Magnesium	82,000	2,570
Manganese	460	22.1
Potasium	53,000	862
Sodium	680,000	4,120

	Screening Level	EHS SW-CT-23.5
Semivolitile Organic Compounds (µg/L)		
1,4-Dioxane	NE	0.88 J
Dissolved Metals (µg/L)		
Barium	4	**14.8**
Calcium	116,000	3,700
Iron	300	141
Magnesium	82,000	2,510
Manganese	460	10.9
Potasium	53,000	896
Sodium	680,000	3,790
Total Metals (µg/L)		
Aluminum	87	**435**
Barium	4	**18.2**
Calcium	116,000	3,690
Chromium	85	3.1
Iron	300	**734**
Magnesium	82,000	2,540
Manganese	460	48.7
Potasium	53,000	919
Sodium	680,000	3,730
Vanadium	8.6	2.3

SW029
SW028
Cooper Creek
SW023.5
SW020
MW-33SL
MW-33SU

Legend
- Surface Water Sampling Station
- Monitoring Well
- Targeted Assessment Reach
- Stream Centerline
- Buckingham_EHS_RoadNetwork
- Projected Fracture Traces
- Property Line

Notes:
ug/l = micrograms per liter
NE - Not established
J = Estimated value. Reported value may not be accurate or precise.
UJ = The analyte was not detected above the sample reporting limit; and the reporting limit is approximate U = Not detected above the listed reporting limit
Figure based on information from PRP Consultants (EHS Support), 2017.
Service Layer Credits: Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Screening level is the EPA Region 3 Biological Technical Assessment Team Ecological Freshwater Screening Benchmark.

Buckingham County Landfill Site
Buckingham County, Virginia

0 50 100 200 Feet

Figure A10
Surface Water Sampling Locations and Analytical Results - West
Downstream Portion of Cooper Creek Basin
June 2017

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\June_2017_Sampling\BCL_SW_West_SamplingLocs_June2017_A9_20180615.mxd

	Screening Level	EHS SED-CT-28
Volitile Organic Compounds (mg/kg)		
Acetone	NE	0.0265

	Screening Level	EHS SED-CT-14.5	EHS SED-CT-14.5-DUP
Volitile Organic Compounds (mg/kg)			
Acetone	NE	0.0495	0.0218

	Screening Level	EHS SED-CT-11.5
Volitile Organic Compounds (mg/kg)		
1,1-Dichloroethane	NE	0.0022 J
1,1-Dichloroethene	0.031	0.0039
Acetone	NE	0.0992
Cis-1,2-Dichloroethene	NE	0.0085
2-Butanone (MEK)	NE	0.0492
Tetrachloroethene (PCE)	0.468	0.0025 J
Toluene	NE	0.0018 J
Trichloroethene (TCE)	0.0969	0.00081 J

	Screening Level	EHS SED-CT-30
Volitile Organic Compounds (mg/kg)		
Acetone	NE	0.0188
m,p-Xylene*	0.0252	0.00027 J

	Screening Level	EHS SED-CT-23.5
Volitile Organic Compounds (mg/kg)		
Acetone	NE	0.0088 J

SD030
SD028
Cooper Creek
SD023.5
SD014.5
SD011.5
MW-35SU
MW-35B
MW-33SL
MW-33SU
MW-34B
MW-34SU

Legend

- Sediment Sampling Station
- Monitoring Well
- Targeted Assessment Reach
- Stream Centerline
- Buckingham_EHS_RoadNetwork
- Projected Fracture Traces
- Property Line

Notes:
ug/kg = micrograms per kilogram
NE - Not established
J = Estimated value. Reported value may not be accurate or precise.
UJ = The analyte was not detected above the sample reporting limit; and the reporting limit is approximate U = Not detected above the listed reporting limit
Figure based on information from PRP Consultants (EHS Support), 2017.
Service Layer Credits: Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

Screening level is the EPA Region 3 Biological Technical Assessment Team Ecological Freshwater Sediment Screening Benchmark.
* Value only established for m-xylene. No value established for o-xylene.

Buckingham County Landfill Site
Buckingham County, Virginia

N

0 100 200 400 Feet

Figure A11
Sediment Sampling Locations and Analytical Results
June 2017

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\June_2017_Sampling\BCL_SE_SamplingLocs_June2017_A10_20180615.mxd

APPENDIX B – REFERENCE LIST

Appendix B – Reference List

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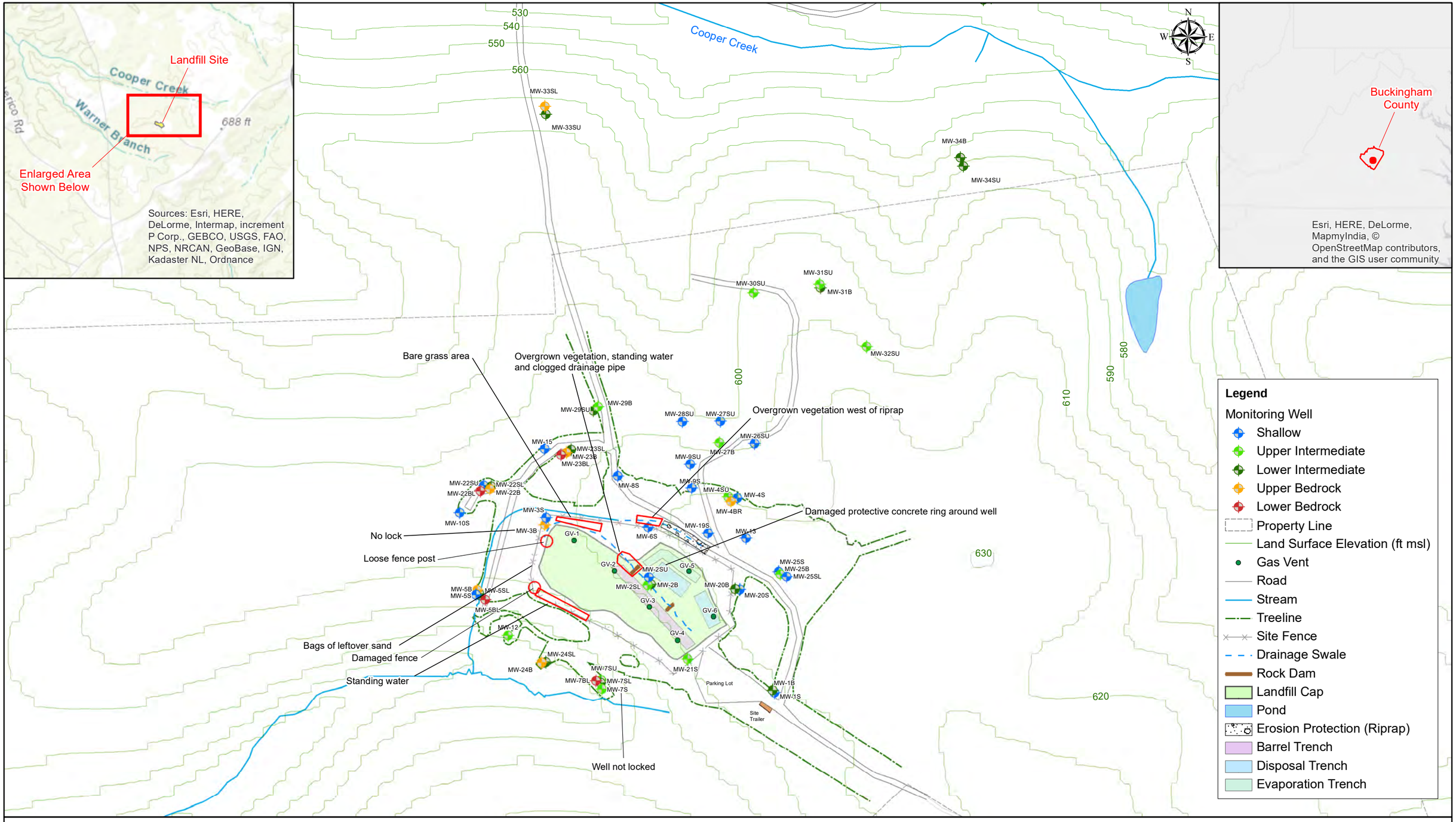
APPENDIX C – SITE INSPECTION MAP



Notes: Wells symbolized by hydrologic zone.
MW-33, 34, and 35 clusters installed in 2012.

Buckingham County Landfill Site
Buckingham County, Virginia

0 105 210 420 Feet

Figure 1
Site Inspection Map
April 23, 2018

CDM Smith

Path: E:_projects\Buckingham County Landfill\WA 029 WA002 LTRA OS\GIS\MXD\5_yr_2018_update\Site Map w markups.mxd

APPENDIX D – SITE INSPECTION CHECKSHEET

Appendix D
Five-Year Review Site Inspection Checklist

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Five-Year Review Site Inspection Checklist

Purpose of the Checklist

The site inspection checklist provides a useful method for collecting important information during the site inspection portion of the five-year review. The checklist serves as a reminder of what information should to be gathered and provides the means of checking off information obtained and reviewed, or information not available or applicable. The checklist is divided into sections as follows:

I. Site Information
II. Interviews
III. On-site Documents & Records Verified
IV. O&M Costs
V. Access and Institutional Controls
VI. General Site Conditions
VII. Landfill Covers
VIII. Vertical Barrier Walls
IX. Groundwater/Surface Water Remedies
X. Other Remedies
XI. Overall Observations

Some data and information identified in the checklist may or may not be available at the site depending on how the site is managed. Sampling results, costs, and maintenance reports may be kept on site or may be kept in the offices of the contractor or at State offices. In cases where the information is not kept at the site, the item should not be checked as "not applicable," but rather it should be obtained from the office or agency where it is maintained. If this is known in advance, it may be possible to obtain the information before the site inspection.

This checklist was developed by EPA and the U.S. Army Corps of Engineers (USACE). It focuses on the two most common types of remedies that are subject to five-year reviews: landfill covers, and groundwater pump and treat remedies. Sections of the checklist are also provided for some other remedies. The sections on general site conditions would be applicable to a wider variety of remedies. The checklist should be modified to suit your needs when inspecting other types of remedies, as appropriate.

The checklist may be completed and attached to the Five-Year Review report to document site status. Please note that the checklist is not meant to be completely definitive or restrictive; additional information may be supplemented if the reviewer deems necessary. Also note that actual site conditions should be documented with photographs whenever possible.

Using the Checklist for Types of Remedies

The checklist has sections designed to capture information concerning the main types of remedies which are found at sites requiring five-year reviews. These remedies are landfill covers (Section VII of the checklist) and groundwater and surface water remedies (Section IX of the checklist). The primary elements and appurtenances for these remedies are listed in sections which can be checked off as the facility is inspected. The opportunity is also provided to note site conditions, write comments on the facilities, and attach any additional pertinent information. If a site includes remedies beyond these, such as soil vapor extraction or soil landfarming, the information should be gathered in a similar manner and attached to the checklist.

Considering Operation and Maintenance Costs

Unexpectedly widely varying or unexpectedly high O&M costs may be early indicators of remedy problems. For this reason, it is important to obtain a record of the original O&M cost estimate and of annual O&M costs during the years for which costs incurred are available. Section IV of the checklist provides a place for documenting annual costs and for commenting on unanticipated or unusually high O&M costs. A more detailed categorization of costs may be attached to the checklist if available. Examples of categories of O&M costs are listed below.

Operating Labor - This includes all wages, salaries, training, overhead, and fringe benefits associated with the labor needed for operation of the facilities and equipment associated with the remedial actions.

Maintenance Equipment and Materials - This includes the costs for equipment, parts, and other materials required to perform routine maintenance of facilities and equipment associated with a remedial action.

Maintenance Labor - This includes the costs for labor required to perform routine maintenance of facilities and for equipment associated with a remedial action.

Auxiliary Materials and Energy - This includes items such as chemicals and utilities which can include electricity, telephone, natural gas, water, and fuel. Auxiliary materials include other expendable materials such as chemicals used during plant operations.

Purchased Services - This includes items such as sampling costs, laboratory fees, and other professional services for which the need can be predicted.

Administrative Costs - This includes all costs associated with administration of O&M not included under other categories, such as labor overhead.

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items which do not fit into any of the above categories.

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Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist (Template)

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: Buckingham County Landfill	**Date of inspection: 04/23/2018**
Location and Region: Buckingham County VA. Region 3	**EPA ID: VADO89027973**
Agency, office, or company leading the five-year review: CDM Smith/US EPA	**Weather/temperature: Sunny, 60º F**
Remedy Includes: (Check all that apply) X Landfill cover/containment ☐ Access controls ☐ Institutional controls ☐ Groundwater pump and treatment ☐ Surface water collection and treatment ☐ Other_ Long-term groundwater monitoring_____ _____ ☐ Monitored natural attenuation ☐ Groundwater containment ☐ Vertical barrier walls	
Attachments: ☐ Inspection team roster attached X Site map attached	
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** _____ _____ _____ Name Title Date Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____ Problems, suggestions; ☐ Report attached _____ _____	

2. **O&M staff** _____ _____ _____
Name Title Date
Interviewed □ at site □ at office □ by phone Phone no. _____
Problems, suggestions; □ Report attached _____
_____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; □ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; □ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; □ Report attached _____
_____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.
Problems; suggestions; □ Report attached _____
_____

4. **Other interviews** (optional) □ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ As-built drawings ☐ Readily available ☐ Up to date X N/A
   - ☐ Maintenance logs ☐ Readily available ☐ Up to date X N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date X N/A
   - ☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date X N/A

   Remarks_____

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date X N/A

   Remarks_____

4. **Permits and Service Agreements**
   - ☐ Air discharge permit ☐ Readily available ☐ Up to date X N/A
   - ☐ Effluent discharge ☐ Readily available ☐ Up to date X N/A
   - ☐ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A
   - ☐ Other permits_____ ☐ Readily available ☐ Up to date X N/A

   Remarks_____

5. **Gas Generation Records** ☐ Readily available ☐ Up to date X N/A

   Remarks_____

6. **Settlement Monument Records** ☐ Readily available ☐ Up to date X N/A

   Remarks_____

7. **Groundwater Monitoring Records** X Readily available ☐ Up to date ☐ N/A

   Remarks_ Monitoring data from 2013-2017 is available; however not all data reporting from the PRPs is up to date at this time. CDM Smith records are up to date. _____

8. **Leachate Extraction Records** ☐ Readily available ☐ Up to date X N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air ☐ Readily available ☐ Up to date X N/A
   - ☐ Water (effluent) ☐ Readily available ☐ Up to date X N/A

   Remarks_____

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date X N/A

    Remarks_____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
X PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____
_____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____N/A_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _N/A _____
_____
_____
_____
_____
_____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** X Location shown on site map X Gates secured ☐ N/A

Remarks_ Minor fence damage in two locations (loose poles). _____
_____

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map X N/A

Remarks: Site entrance gate on route 640 remains in good condition and locked 24/7. _____
_____

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No X N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No X N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No X N/A
Reports are verified by the lead agency ☐ Yes ☐ No X N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No X N/A
Violations have been reported ☐ Yes ☐ No X N/A
Other problems or suggestions: ☐ Report attached
County – owned property. Site access restricted by gate at road. _____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate X N/A
Remarks_____
_____
_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map X No vandalism evident
Remarks__None _____
_____

2. **Land use changes on site** ☐ N/A
Remarks__None _____
_____

3. **Land use changes off site** ☐ N/A
Remarks___None _____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ☐ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map X Roads adequate ☐ N/A
Remarks_____
_____

B. Other Site Conditions

Remarks _Evidence of standing water in various locations, bare grass spots in various locations. __

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map X Settlement not evident
   Areal extent_____ Depth_____
   Remarks _Good condition _____

2. **Cracks** ☐ Location shown on site map X Cracking not evident
   Lengths_____ Widths_____ Depths_____
   Remarks_____

3. **Erosion** X Location shown on site map ☐ Erosion not evident
   Areal extent_____ Depth_____
   Remarks_ One bare spot on landfill. See photo log. _____

4. **Holes** ☐ Location shown on site map X Holes not evident
   Areal extent_____ Depth_____
   Remarks_____

5. **Vegetative Cover** X Grass ☐ Cover properly established ☐ No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks_ One bare spot on landfill. See photolog _____

6. **Alternative Cover (armored rock, concrete, etc.)** X N/A
   Remarks_____

7. **Bulges** ☐ Location shown on site map X Bulges not evident
   Areal extent_____ Height_____
   Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
X Wet areas X Location shown on site map Areal extent_____
X Ponding X Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks__Wet areas/ponding persistent during winter and spring. _____
_____

9. **Slope Instability** ☐ Slides ☐ Location shown on site map X No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable X N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map X N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map X N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map X N/A or okay
Remarks_____
_____

C. Letdown Channels X Applicable ☐ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map X No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map X No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐ Location shown on site map X No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** ☐ Location shown on site map X No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ X No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_Brush and Shrubs_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
X Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations X Applicable ☐ N/A

1. **Gas Vents** ☐ Active X Passive
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled X Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance X N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration X Needs Maintenance ☐ N/A
Remarks_MW-2SU has cracked concrete ring around well. MW-3B and MW-7S are not locked.
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance X N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed X N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable X N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition☐ Needs Maintenance X N/A
   Remarks_____
   _____

F. Cover Drainage Layer X Applicable ☐ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_ Most outlet pipes functioning; appear to be in good condition. Clogged drainage pipe at _
   __ northern part of landfill. See photo log _____

2. **Outlet Rock Inspected** ☐ Functioning X N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A

1. **Siltation** Areal extent_____ Depth_____ X N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning X N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning X N/A
   Remarks_____
   _____

H. Retaining Walls □ Applicable X N/A

1. **Deformations** □ Location shown on site map □ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** □ Location shown on site map □ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge X Applicable □ N/A

1. **Siltation** □ Location shown on site map X Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** X Location shown on site map □ N/A
   □ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_ Slight overgrown vegetation in various locations. See photo log. _____
   _____

3. **Erosion** □ Location shown on site map X Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** □ Functioning X N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS □ Applicable X N/A

1. **Settlement** □ Location shown on site map □ Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   □ Performance not monitored
   Frequency_____□ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable X N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable X N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks_____
_____
_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable X N/A

1. **Collection Structures, Pumps, and Electrical**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition☐ Needs Maintenance
Remarks_____
_____

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition☐ Requires upgrade ☐ Needs to be provided
Remarks_____
_____

C. Treatment System ☐ Applicable X N/A

1. **Treatment Train** (Check components that apply)
   ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   ☐ Air stripping ☐ Carbon adsorbers
   ☐ Filters_____
   ☐ Additive (*e.g.*, chelation agent, flocculent) _____
   ☐ Others_____
   ☐ Good condition ☐ Needs Maintenance
   ☐ Sampling ports properly marked and functional
   ☐ Sampling/maintenance log displayed and up to date
   ☐ Equipment properly identified
   ☐ Quantity of groundwater treated annually_____
   ☐ Quantity of surface water treated annually_____
   Remarks_____
   _____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   X N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

3. **Tanks, Vaults, Storage Vessels**
   X N/A ☐ Good condition☐ Proper secondary containment ☐ Needs Maintenance
   Remarks_____
   _____

4. **Discharge Structure and Appurtenances**
   X N/A ☐ Good condition☐ Needs Maintenance
   Remarks_____
   _____

5. **Treatment Building(s)**
   X N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   ☐ Chemicals and equipment properly stored
   Remarks_____
   _____

6. **Monitoring Wells** (pump and treatment remedy)
   ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
   ☐ All required wells located ☐ Needs Maintenance X N/A
   Remarks_____
   _____

D. Monitoring Data

1. Monitoring Data – Issue with reporting of summer 2017 monitoring. Not received till April 2018.
   X Is routinely submitted on time X Is of acceptable quality

2. Monitoring data suggests:
   ☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance X N/A
Remarks_____
_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Landfill RCRA Cap designed to minimize infiltration. Lower groundwater levels under this cap at
_MW-2SU indicate that the cap is limiting recharge from precipitation. Groundwater monitoring data
_prior to the third five-year review, showed that limiting infiltration has not been successful in limiting
_migration of groundwater contamination. Since the third five-year review, no further groundwater__
_contamination migration has been observed. Contamination has traveled beyond the point of _____
compliance wells and property lines; and is still present in the nearby surface, copper creek, located
_northeast to northwest of the site. _____
_____
_____
_____

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

_Maintenance of the landfill, including areas of erosion, overgrown vegetation and algae have _____
_improved since the third five-year review. Drainage features have been well maintained and _____
_continuing erosion issues are minimal. Damaged portions of the fence and unlocked monitoring ___
_wells need to be addressed. _____
_____
_____
_____
_____
_____

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. N/A

D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. _Groundwater monitoring of residential wells is being reduced to a semiannual schedule. _____ _Selected groundwater monitoring wells will be monitored semiannually as well. _____

APPENDIX E – PHOTO LOG

Photo: 001 **Date:** 04/23/18 **Description:** Facing northwest at Landfill. Landfill grass cover.
Photographer: [redacted]

Photo: 002 **Date:** 04/23/18 **Description:** Facing southeast at Landfill. Landfill grass cover.
Photographer: [redacted]

Photo: 003 **Date:** 04/23/18 **Description:** Facing northwest at Landfill. Standing water in drainage swale. **Photographer:** [redacted]

Photo: 004 **Date:** 04/23/18 **Description:** Clogged drainage pipe located at the northern portion of Landfill. **Photographer:** [redacted]

Photo: 005 **Date:** 04/23/18 **Description:** Facing west at outside of northern edge of landfill. Overgrown drainage path. **Photographer:** [redacted]

Photo: 006 **Date:** 04/23/18 **Description:** Facing west at inside of norther edge of landfill. Bare grass spot. **Photographer:** [redacted]

Photo: 007 **Date:** 04/23/18 **Description:** Loose fence pole at northwestern edge of landfill. **Photographer:** [redacted]

Photo: 008 **Date:** 04/23/18 **Description:** Facing northwest within Landfill at locked gate.
Photographer: [redacted]

Photo: 009 **Date:** 04/23/18 **Description:** On Landfill. Gas vent, GV-4, in good condition.
Photographer: [redacted]

Photo: 010 **Date:** 04/23/18 **Description:** Near MW-2SU. Overgrown vegetation within rock dam. **Photographer:** [redacted]

Photo: 011 **Date:** 04/23/18 **Description:** Near MW-2SU. Overgrown vegetation in southeast corner of landfill. **Photographer:** [redacted]

Photo: 012 **Date:** 04/23/18 **Description:** Near MW-2SU. Damaged fence in southeast corner of Landfill. **Photographer:** [redacted]

Photo: 013 **Date:** 04/23/18 **Description:** Damaged fence in southeast corner of Landfill (closeup).
Photographer: [redacted]

Photo: 014 **Date:** 04/23/18 **Description:** Facing southwest at northeast corner of landfill. Standing water and overgrown vegetation. **Photographer:** [redacted]

Photo: 015 **Date:** 04/23/18 **Description:** At monitoring well, MW-3B. Well protective casing missing lock. **Photographer:** [redacted]

Photo: 016 **Date:** 04/23/18 **Description:** At monitoring well, MW-2SU. Concrete ring cracked.
Photographer: [redacted]

Photo: 017 **Date:** 04/23/18 **Description:** At monitoring well, MW-7S. Well cap not locked.
Photographer: [redacted]

Photo: 018 **Date:** 04/23/18 **Description:** At monitoring well, MW-25SL. Well pad cracked.
Photographer: [redacted]