AMENDED DECISION DOCUMENT FOR THE REMEDIATION OF

Glacier Vandervell, Inc. (GVI)

Noble County, Ohio

prepared by

THE OHIO ENVIRONMENTAL PROTECTION AGENCY

December 18, 2006

[Signature]
[Date: December 28, 2006]
DECLARATION

SITE NAME AND LOCATION

Glacier Vandervell, Inc (GVI)
Caldwell, Ohio

STATEMENT OF BASIS AND PURPOSE

This Amended Decision Document presents the selected remedial action for the Glacier Vandervell Site in Caldwell, Ohio, chosen in accordance with the policies of the Ohio Environmental Protection Agency, statutes and regulations of the State of Ohio, and the National Contingency Plan, 40 CFR Part 300.

PROCEDURAL SUMMARY

On October 2, 2003, Ohio EPA held a public meeting to discuss the initial Preferred Plan and to solicit public comments. Based on the written comments received by Ohio EPA, some changes were made to the remedy identified in the initial Preferred Plan. On May 5, 2004, Ohio EPA issued the initial Decision Document, which selected the remedy for the Site.

On June 2 and 3, 2004, Glacier Vandervell, Inc. (GVI) and Gould Electronics appealed the initial Decision Document to the Environmental Review Appeals Commission (ERAC). GVI and Gould subsequently met with Ohio EPA and discussed the issues identified in the ERAC appeal. DERR-SEDO staff and Ohio EPA-Legal staff worked with Respondents GVI and Gould and resolved the issues. A draft Amended Decision Document, which included certain changes to the initial Decision Document, was issued on October 3, 2006. On December 7, 2006, Ohio EPA held a public meeting to discuss the draft Amended Decision Document and to solicit public comments. No comments were received, and the Amended Decision Document in final form is presented herein.

ASSESSMENT OF THE SITE

Actual and threatened releases of industrial solvents and heavy metals from historical operations and waste disposal at the Site, if not addressed by implementing the remedial action selected in the Amended Decision Document, constitute a substantial threat to public health or safety and are causing or contributing to ground water pollution and soil contamination.
DESCRIPTION OF THE SELECTED REMEDY

- Excavation and consolidation of wetland sediments, Western Disposal Area soils, and Plant Area soils - construction of an impervious cap over these soils in the Western Disposal Area. The cap will meet the standards provided in Subtitle C of the Resource Conservation and Recovery Act (RCRA).

- Monitoring of Duck Creek sediments to detect potential increases in site-related contaminants arising from construction of the final remedy.

- Use of activity and use limitations, and engineering controls to address SC Line soils, Vapor Degreaser soils, and soils beneath the loading dock area. The selected alternative will utilize the facility structure and loading dock as temporary engineering controls to prevent infiltration of precipitation and leaching of VOCs to groundwater. If the facility structure and/or loading dock are removed at a future time, Ohio EPA may require a Focused Feasibility Study to evaluate capping and other remediation technologies or actions that are expected to achieve RAOs. Absent Ohio EPA approval of another remediation technology, the second phase of the remedy will be implemented to cap the underlying soils, in accordance with RCRA Subtitle C hazardous waste facility standards.

- Reduction of groundwater contamination in primary source areas, through expanded groundwater recovery and treatment.

- Implementation of an expanded groundwater monitoring plan to assess natural attenuation processes, and to provide sufficient monitoring to ensure the protection of potential off-site receptors.

STATUTORY DETERMINATIONS

The selected remedial action is protective of human health and the environment, complies with legally applicable state and federal requirements, is responsive to public participation and input and is cost-effective. The remedy utilizes permanent solutions and treatment technologies to the maximum extent practicable to reduce toxicity, mobility and volume of hazardous substances at the Site. The effectiveness of the remedy will be reviewed regularly.

[Signature]
Joseph P. Kupcik, Director

[Date]
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DECISION SUMMARY
for Glacier Vandervell, Inc. (GVI)
Noble County, Ohio

1.0 SITE BACKGROUND

1.1 Site Description and History

GVI is located at 17226 County Road 57 in Olive Township, Noble County, Ohio, approximately 0.75 mile south of the Village of Caldwell, as shown on Figure 1. The Site lies on a 41-acre parcel of land and is an active industrial property with manufacturing occurring within the plant building. Industrial properties lie to the north and south of the Site. A small residential community lies across Route 821 to the east of the Site. Approximately 10 homes are located in a development about 2,000 feet southeast of the Site. Duck Creek borders the Site on the west and is paralleled by Interstate 77. A limited number of residential dwellings are located approximately 0.2 mile west of the Site across Duck Creek and Interstate 77.

Paved parking areas are present on the north, northeast and southeast sides of the facility building, and asphalt loading docks and roadways exist on the north and south sides of the building. Other areas lying north and east of the facility are covered with lawn (primarily bluegrass and other turf species). The area west of the plant (i.e., Western Disposal Area) is covered primarily with herbaceous vegetation, with a few shrubs and sparse trees. Three sparsely vegetated zones are located within this area. An emergent wetland is present in the northern/northwestern portion of the Site. Wetland vegetation consists of cattails, scrub/shrub vegetation and trees. A site map illustrating the various areas and facility features is presented on Figure 2.

The original manufacturing facility was constructed in 1952. Several additions have expanded the facility to approximately 210,000 square feet. The plant was originally owned and operated by Cleveland Graphite Bronze Company, which in 1969 became part of Gould, Inc. (Gould). Gould subsequently operated the facility until 1981, when Imperial Clevite Industries purchased the operations and the property. Clevite Industries acquired the facility through a merger with Imperial Clevite Industries in 1986. J.P. Industries, Inc. (JPI) purchased the Site in 1987. JPI was acquired by T&N PLC in August 1990. In the spring of 1998, T&N PLC was acquired by Federal Mogul Corporation. However, the Federal Trade Commission (FTC) required Federal Mogul to divest its interest in the facility, and under the FTC ruling it was sold to Dana Corporation. The Caldwell facility continues to operate under the name Dana Glacier Vandervell Inc.(GVI). All interests in the facility, including the property, structures, and manufacturing operations, are currently owned by Dana Corporation.
The GVI facility has manufactured the same type of products since production began in 1952. Products include a variety of small machined parts, including bimetal bushings and washers. Processes involved in the manufacturing of the parts include casting, milling, rolling, annealing, slitting, blank forming, coining, plating and finishing.

Historically, solvents have been used at the facility to clean and degrease equipment and structures. These solvents include trichloroethene (TCE), 1,1,1-trichloroethane, and trans-1,2-dichloroethene. Areas of the Site that would have been associated with these contaminants include soils beneath the plant (soluble oil line and vapor degreaser areas), the loading dock area, Western Disposal Area, and waste water treatment area.

As a result of manufacturing operations, the facility generated industrial waste water which was treated and discharged into the local publicly owned treatment works (POTW). Prior to final discharge of this water, settled sludge was drawn off and discharged into sludge dewatering beds, also known as sand filter beds, with filtrate recycled to an on-Site treatment plant. The filter beds were used for sludge dewatering since 1952. Waste discharged to these units included electroplating waste as well as oil and grease from degreasing operations. These wastes are designated as F006 listed hazardous waste under the Resource Conservation and Recovery Act (RCRA). Prior to 1980, the waste generated from the filter beds and from other plant operations was disposed of on the Site by Gould and others.

Several environmental investigations have been conducted at the Site to investigate past releases and waste management practices. A chronological review of these investigations is provided below.

• In 1987, a Preliminary Site Investigation (PSI) determined that metal hydroxide sludge, corn cob deburring media waste, and lead-bearing sludge were disposed of at the Site. Additionally, chlorinated solvents may have been spilled or leaked from the loading dock area or from an old railroad siding. Indications were that trichloroethene (TCE) and 1,1,1-trichloroethane may have been stored on the loading dock. Soil borings indicated the presence of lead in the soil, with concentrations as high as 100,000 ppm. Groundwater samples indicated the presence of several chlorinated solvents at concentrations significantly higher than drinking water standards.

• In April 1987, Ohio EPA conducted a RCRA inspection of the Site pursuant to Ohio Revised Code (ORC) Section 3734.04. Subsequently, Clayton Environmental Consultants (Clayton) prepared a RCRA Closure Plan for the sand filter beds and for conducting a groundwater monitoring program. The Closure Plan was approved on February 17, 1988. As part of the closure, 500 tons of soil were removed from the area of the filter beds. Clayton installed one upgradient and four downgradient monitoring wells to evaluate groundwater conditions. Wells were monitored on a quarterly basis in 1988 and on a semiannual basis from July 1989 to February 1991.
In June 1987, Environmental Management Control (EMC) excavated and removed a gasoline underground storage tank (UST) in the area southwest of the facility. In an attempt to remove any remaining product from the subsurface, Groundwater Technology, Inc. (GTI) installed a recovery well and scavenger pump. However, very little product was recovered due to the low yield of the water-bearing zone.

During the fall of 1987, Dames and Moore conducted a soil gas investigation to determine the general extent of soil contamination. The investigation determined that the area to the west of the southwest loading dock and an additional area approximately 300 feet west of the north wall of the plant had elevated soil gas levels of volatile organic compounds (VOCs). Clayton conducted a second investigation of the former UST area in October 1988. Groundwater contamination was identified in the area of the former UST and surficial staining was observed in the nearby drainage culvert.

In December 1990, Kemron Environmental Services (Kemron) installed five groundwater monitoring wells and four soil borings in an area north of the facility. VOC contamination was identified in the four borings and some of the monitoring wells.


Ohio EPA issued a Consent Order on December 11, 1991. On April 27, 1992, Site Respondents Gould and Glacier Vandervell, Inc. submitted a proposed Remedial Investigation Work Plan. The Site Respondents implemented field work for the Remedial Investigation (RI) in July 1992. This work included sampling and analysis of soil, groundwater, and Duck Creek surface water and sediments. Subsequently, the Site Respondents conducted additional field work for the RI at the request of Ohio EPA. The additional sampling focused on the evaluation of contamination underlying the facility, in Duck Creek, and areas northwest and south of the facility.

The Site Respondents installed an interim groundwater recovery and treatment system in January 1997, which is currently operating at the Site. The system consists of three pumping wells (MW-7, MW-10, and MW-18) located in the area of highest VOC concentration and an activated carbon system to treat VOC-contaminated groundwater.


In accordance with the Consent Order, monthly progress reports are submitted by the Site Respondents to Ohio EPA to document activities related to the Site.
1.2 Summary of the Remedial Investigation

The Remedial Investigation, performed by the Site Respondents with Ohio EPA oversight, included a number of tasks to identify the nature and extent of Site-related chemical contaminants. The tasks included sampling of surface and subsurface soil, sediments, surface water, and groundwater.

The RI field work was completed in three phases. From July 1992 through May 1993, field work for the “initial RI” was conducted. At the request of Ohio EPA, two supplemental RIs were conducted to further evaluate the presence and extent of contamination underlying the plant, in Duck Creek, and in areas located to the northwest and south of the plant. From September 1994 through December 1994, field work for the first supplemental RI was conducted. In June 1995, field work for the second supplemental RI was conducted. At the time of the RI, a Resource Conservation and Recovery Act (RCRA) investigation had been ongoing at the Site since 1987. Although most of the RCRA-related work was completed by June 1992, additional work was required to fulfill the RCRA requirements. Therefore, this remaining work was conducted concurrently with the RI work, and a final RCRA report was postponed until the RI work was completed. The RCRA report was then included as a stand-alone document as Appendix 1A of the RI report.

Investigative activities performed during the RI, supplemental RIs, and the RCRA investigation included the installation of 38 monitoring wells and the drilling of 91 soil borings. The data obtained from the investigation were used to conduct a Baseline Risk Assessment (BRA) and to determine the need to evaluate remedial alternatives. This Amended Decision Document contains only a brief summary of the findings of the Remedial Investigation and Feasibility Study. Please refer to the Remedial Investigation and Feasibility Study reports for additional information.

The nature and extent of contamination in each environmental medium and the contaminants of concern attributable to the Site are described below. Figures 3 and 4 show the extent of metals impact in the WDA and Plant Area Soils, respectively. Figure 5 illustrates the extent of VOC impact to soils Site-wide.

1.2.1 Soil Contamination

1.2.1.1 Western Disposal Area Soils

The Western Disposal Area (WDA) was historically used to dispose of wastes generated in the production processes at the Site. These wastes included plating and grinding sludge, corn cob deburring media, waste oil, solvents, and waste water treatment sludge from the sand filter beds.

The RI found that elevated concentrations of heavy metals were present in the WDA soils. The metals consisted primarily of copper and lead and were most prevalent at the 0-2 feet below-ground-surface (bgs) sampling interval. The maximum concentration of copper was
140,000 milligrams per kilogram (mg/kg), compared to a Site background concentration of 34.5 mg/kg. The maximum concentration of lead was 52,000 mg/kg, compared to a background concentration of 22.5 mg/kg. Antimony was detected twice in the WDA at concentrations of 73 and 240 mg/kg, with a background concentration of less than 30 mg/kg. Arsenic was detected once at a concentration of 24 mg/kg, exceeding the background concentration of 18 mg/kg.

In the WDA, twenty-nine soil samples were submitted for VOC analysis during the RI. Ten VOCs were detected in samples from two borings, at depths ranging from ground surface to 22 feet bgs. TCE was the primary compound detected, at a maximum concentration of 2.9 mg/kg.

1.2.1.2 Plant Area Soils

Plant Area Soils are those shallow (0-2 feet below ground surface) soils found in the general outdoor portions of the facility, including the former RCRA closure unit, the former UST area, the southwest loading dock area, and upland areas near the wetland. Lead represents the primary chemical of concern in the Plant Area Soils. The distribution of lead was identified during Pre-RI investigations, which indicated elevated concentrations in surface soils to the north and south of the western side of the building. The origin of the lead is presumed to be primarily from airborne distribution from the casting operations at the facility. The maximum isoconcentration line for lead based on contouring of soil data was 2,500 mg/kg and was located to the north of the plant building. Elevated concentrations of copper were detected in one RI boring outside the southwest loading dock. VOCs were detected only occasionally in Plant Area Soils, and were primarily limited to detections of toluene, xylenes, and TCE in the vicinity of the former gasoline UST and the southwest loading dock area.

1.2.1.3 Soluble Oil Line/Vapor Degreaser Soils

The Soluble Oil (SO) Line, located beneath the facility building, was historically used to transport spent solvents to a concrete holding tank for further treatment. The line is no longer in use. The VOCs TCE and/or PCE were detected in twelve (12) RI borings drilled to investigate potential contamination from the SO Line. TCE and PCE were detected at maximum concentrations of 210 mg/kg and 92 mg/kg, respectively, in soil from 8 to 12 feet below ground surface. One RI boring drilled near Vapor Degreaser #1 contained TCE at 1.5 mg/kg and PCE at 2.5 mg/kg in soil at 5 feet below ground surface. Based upon the RI data, the SO Line area appears to be the largest and most significant area of VOC-contaminated soil at the Site. It is also likely that this area is a significant past and/or current contributor to VOC contamination in groundwater.

1.2.2 Ground Water Contamination

Groundwater at the Site is found in both unconfined alluvial deposits and in bedrock, and is typically encountered between 10 and 15 feet bgs. The alluvium is composed primarily
of clay, silt, and fine sand, and has a low hydraulic conductivity. The bedrock is composed of shale, with the upper portions characterized as soft, weathered, and clayey, and also demonstrates low hydraulic conductivity. It is likely that groundwater flow within the bedrock is controlled by joint and fracture density and orientation.

During the RI and other Site investigations, nested monitoring wells were installed to screen the alluvium, the alluvium/bedrock interface, and the bedrock. Potentiometric data suggest that these units are in hydraulic communication. The letters “a”, “b”, and “a/b” are used as qualifiers in the identification of monitoring wells to denote wells screened within alluvium, bedrock, or at the interface, respectively.

1.2.2.1 Alluvium

Groundwater sampling of alluvium wells and alluvium/bedrock interface wells was performed on various occasions during the RI, and again in May 2000 prior to preparation of the FS report. Based upon the recent FS sampling, the following VOCs were detected in alluvium groundwater at concentrations exceeding USEPA Maximum Contaminant Levels (MCLs) or Action Levels:

- TCE (MCL = 5 ug/l)
- Cis-1,2 dichloroethene (MCL = 70 ug/l)
- PCE (MCL = 5 ug/l)
- Vinyl Chloride (MCL = 2 ug/l)
- Benzene (MCL = 5 ug/l)

Concentrations of TCE ranged to as high as 190 ug/l, while cis-1,2-DCE ranged to as high as 240 ug/l. The other contaminants were present in lesser concentration and/or extent, but nonetheless exceeded the respective MCLs. Similar to the RI findings, VOC concentrations were highest in wells near or downgradient of the former sand filter beds and SO Line areas. Comparing the RI data from 1993 and 1994 to the 2000 FS data, total VOC concentrations in the alluvium decreased, on average, approximately 89%. Of the VOC contaminants in groundwater, TCE and cis-1,2-DCE appear to be the most dominant (i.e. highest concentration) overall. Comparing the RI data to the FS data for these individual compounds reveals an average decrease in concentration of approximately 86% for TCE and 74% for cis-1,2-DCE. Figures 6 and 7 illustrate the 2000 FS sampling data showing the extent and concentration of TCE and cis-1,2-DCE, respectively, in groundwater within the alluvium at the Site.

During RI sampling in 1994, benzene was detected in three alluvium wells, and concentrations exceeded the MCL of 5 ug/l at MW-9 and MW-15. During FS sampling, benzene was detected in two of the alluvium wells; however, only the concentration in MW-9 (720 ug/l) was above the MCL. Semi-volatile organic compounds (SVOCs) were detected in two alluvium wells - MW-5 and MW-9; however, the compounds detected do not have established MCLs.
Groundwater flow within the alluvium is generally to the west-northwest toward the wetland area, and southwest toward Duck Creek. A comparison of the 2000 FS data to the 1994 RI data indicate that the areal extent of the VOC plume within the alluvium has not changed appreciably over time. Based upon this comparison, as well as the above-noted decrease in plume concentrations, the alluvium VOC plume would not be expected to migrate beyond the current areas of impact.

1.2.2.2 Bedrock

Based upon the 2000 FS sampling, the following VOCs were detected in bedrock groundwater at concentrations exceeding USEPA MCLs or Action Levels:

- TCE (MCL = 5 ug/l)
- Cis-1,2 dichloroethene (MCL = 70 ug/l)
- PCE (MCL = 5 ug/l)
- Vinyl Chloride (MCL = 2 ug/l)
- Benzene (MCL = 5 ug/l)
- 1,1 Dichloroethene (MCL = 7 ug/l)

VOC concentrations in bedrock groundwater were highest in wells located near or downgradient of the southwest loading dock, former sand filter beds, and SO Line areas. Compared to alluvium, contaminants were present in significantly greater concentrations in the bedrock, with concentrations of TCE, cis-1,2-DCE, and vinyl chloride ranging to as high as 4,300 ug/l, 4,400 ug/l, and 410 ug/l, respectively.

Comparing the 1994 RI data to the 2000 FS data, total VOC concentrations in bedrock decreased, on average, approximately 57%. Of the VOC contaminants in the groundwater, TCE and cis-1,2-DCE appear to be the most dominant overall. A comparison of the RI data to the FS data for wells in the most contaminated zone reveals an average decrease in concentration of approximately 53% for TCE and 34% for cis-1, 2-DCE. Figures 8 and 9 illustrate the FS sampling data, showing the extent and concentration of TCE and cis-1,2-DCE, respectively, within bedrock at the Site.

During FS sampling, benzene was detected in seven of the bedrock wells; however, only concentrations in two of the wells - MW-7 (9.7 ug/l) and MW-10 (160 ug/l) - were above the MCL. Both wells are downgradient from the former gasoline UST area. One SVOC, bis(2-ethylhexyl) phthalate, was detected in three bedrock wells - MW-6, MW-7, and MW-11; however, this compound does not have an established MCL.

Like the alluvium, groundwater flow within the bedrock is generally to the west and southwest, toward the wetland area and Duck Creek. Findings of the RI estimated a horizontal hydraulic conductivity of 1.23 ft/day for bedrock, with a horizontal flow velocity estimated at 0.58 ft/day (211 ft/year). A comparison of the 2000 FS data to the 1994 RI data indicate that the areal extent of the VOC plume within bedrock has not changed appreciably in that time, with the exception of a slight plume extension down gradient of
the former filter beds in the vicinity of well MW-22. Based upon this comparison, as well as the above-noted decrease in average plume concentrations, the bedrock VOC plume would not be expected to migrate or expand appreciably beyond the current areas of impact.

1.2.3 Surface Water/Sediment Contamination

The Site is located within the Ohio River Drainage Basin. The primary surface water feature is Duck Creek (West Fork), which borders the Site on the west and regionally flows from north to south. Surface water from the Site drains to Duck Creek, which has an average width of approximately 35 feet, and also drains to the wetland area.

During the RI, seven sediment and surface water samples were collected from Duck Creek at 200-foot intervals along the Site boundary. All sediment samples were analyzed for VOCs, copper, lead, and tin to detect any impact from the Site. The surface water samples were analyzed for VOCs, metals, and hardness. One sediment sample and one surface water sample were analyzed for the priority pollutant metals.

No VOCs were detected in either the sediment or surface water samples collected from Duck Creek.

Arsenic, beryllium, cadmium, chromium, copper, lead, nickel and zinc were each detected in at least one sediment sample. Concentrations of arsenic, cadmium and nickel exceeded the USEPA Ecotox Thresholds for sediment, while all other metals were below the Ecotox Thresholds (Ecotox thresholds are critical concentrations of contaminants above which wildlife may be harmed). As part of the FS, additional Duck Creek sediment sampling was performed for analysis of arsenic, cadmium, and nickel to better characterize the extent of metals impacts and to establish a background concentration. The sampling results indicated only minor exceedances (less than 2x) of the background concentrations for arsenic and nickel. Cadmium did not exceed background levels.

Chromium, copper, mercury and zinc were detected in Duck Creek surface water samples collected during the RI. All concentrations were below the USEPA Region 9 Preliminary Risk Goals (PRGs; see Section 2.1 below) for drinking water, which were used for screening in the Baseline Human Health Risk Assessment (BHHRA). The concentrations were also compared to the Ohio EPA surface water quality criteria for the Ohio River Drainage Basin. None of the concentrations exceeded the applicable water quality criteria. Therefore, surface water did not warrant further evaluation in the FS.

1.2.4 Wetland Sediment Contamination

A six-acre emergent wetland is located in the northern/northwestern portion of the Site, as shown on Figure 2. Approximately three acres of the wetland are covered by cattail vegetation. Surface water from the northwestern portion of the property, including the WDA, flows toward and into the wetland.
A field delineation and wetland functionality assessment was conducted at the Site in July 1999 by representatives of Advanced Geoservices Corp. (AGC) as part of the FS Work Plan preparation. The assessment utilized the Hydrogeomorphic (HGM) scheme to classify the wetland. Based upon this assessment, the area was classified as a slope wetland, implying unidirectional movement of water downslope, albeit at a very slow rate. The assessment also found that the wetland area, as a whole, appears to primarily retain surface water. Therefore, primary ecological receptors of concern are wetland-associated communities. PRGs based on these receptors are therefore more appropriate than benchmarks based on stream benthic fauna. As determined during FS preparation, the muskrat is considered to be a representative species for the cattail and open-water wetland areas, while the meadow vole is the representative species for the non-cattail wetland areas.

During the RI and supplemental RI investigations, a total of 14 surface soil samples were collected in and around the wetland area and were analyzed to determine metals concentrations. The primary metals detected above background concentrations were copper, lead, and tin. Copper concentrations ranged to a maximum of 3,500 mg/kg, lead ranged to a maximum of 3,800 mg/kg, and tin ranged to a maximum of 3,300 mg/kg. Thirteen of the wetland area samples contained concentrations of copper, lead, and/or tin which exceeded the respective Ecological Risk-Based Concentrations (ERBC) of these contaminants for the muskrat. Two of the samples exceeded the respective ERBCs for the meadow vole. Figure 10 illustrates the locations of the wetland sediment samples and the approximate area of wetland sediment requiring removal to meet the ERBCs for these receptors.

1.2.5 Impacts to Biological Resources

To date there has been no observed, documented impact to Site biological resources. However, as indicated in Section 2.2, the Ecological Risk Assessment identified various risks to biological receptors on-Site, including the muskrat, meadow vole, American robin, red-tailed hawk, American woodcock, and great blue heron. It is also important to note that any impacts to biological resources are expected to be long-term and chronic in nature and, therefore, more difficult to observe.

1.3 Interim or Removal Actions Taken to Date

An interim remedial measure (IRM) was installed in January 1997 and is currently operating at the Site. The IRM consists of pumping groundwater from three monitoring wells installed into shallow bedrock and located in the areas of highest VOC contamination. The wells being utilized for the IRM are the shallow bedrock wells MW-7, MW-10, and MW-18. Groundwater is pumped from the wells using submersible pneumatic pumps and is routed through a carbon treatment system to remove VOCs. The treated water is then combined with the plant waste water stream, which is subsequently discharged to the POTW.
From the 1997 startup of the groundwater removal system through the end of 2001, a total of approximately 586,000 gallons of groundwater had been pumped from the shallow bedrock unit, with a total mass removal of approximately 13 lbs of VOCs. The combined output of the wells averaged approximately 0.2 gpm during this period. The decrease in VOC concentrations in the bedrock aquifer, as noted in Section 1.2.2.2, may be attributable to the groundwater pumping activities.
2.0 SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) was conducted to evaluate current and potential risks to human health and to ecological receptors associated with contaminants present at the Site. The results demonstrated that the existing concentration of contaminants in environmental media pose risks to human and ecological receptors at a level sufficient to trigger the need for remedial actions. A detailed discussion of the analyses and methods used to determine risk can be found in the Remedial Investigation Report.

2.1 Risks to Human Health

The primary objectives of the Human Health Risk Assessment were to:

• Identify constituents that pose a significant risk to receptors (Data Evaluation)
• Identify the pathways and media of concern (Exposure Assessment)
• Determine toxicity levels of constituents in relevant media (Toxicity Assessment)
• Determine the likelihood and magnitude of any expected impact or threat (Risk Characterization)

2.1.1 Data Evaluation

For the purposes of the BRA, a chemical was classified as a chemical of potential concern (COPC) if it was detected in at least 5% of samples in a particular medium and if its maximum concentration was greater than one-tenth of the USEPA Region 9 PRG based upon residential use. A chemical was also retained as a COPC if a PRG was not available for the chemical.

2.1.2 Exposure Assessment

All pathways by which humans could be exposed to COPCs were evaluated and quantified for both current and future exposure scenarios.

The following receptors were identified and evaluated for the current use scenario:

• Grounds workers
• Construction workers
• Off-Site residents
• School-aged trespassers
• Children using Duck Creek for recreation
• Office employees
Future site scenarios evaluated in the risk assessment included continued industrial use of the property and residential use. Exposure scenarios for continued industrial use are similar to those under current use unless groundwater is used for drinking water. Hence, risks under a continued industrial use scenario are expected to be the same as for current use.

Under future land use, homes or other buildings may be constructed on-Site. The following population is associated with this scenario:

- Future construction workers
- Future adult residents
- Future child residents

### 2.1.3 Toxicity Assessment

Following the evaluation of current and future receptors and exposure pathways, the concentrations of COPCs in each medium were estimated from sampling results and mathematical modeling, and the potential human exposure levels were calculated. The estimate of human exposure (intake) was calculated as the average amount of a chemical taken into the body per unit of body weight per day (mg/kg/day).

The toxicity of each COPC was assessed by identifying the adverse health effects associated with exposure to each contaminant. Toxicity values for many frequently occurring chemicals have been developed by the USEPA for use in risk assessments. Separate toxicity values for carcinogenic (cancer-causing) and non-carcinogenic health effects have been developed. The “slope factor” represents the excess cancer risk per unit intake of a chemical over a lifetime (mg/kg/day). For non-cancer risk, a “reference dose” represents the acceptable chemical intake level (mg/kg/day) that is not expected to result in adverse health effects.

### 2.1.4 Risk Characterization

Risk characterization was conducted following the evaluation of all exposure and toxicity information. Both carcinogenic and non-carcinogenic risks were characterized. Lead risk is addressed separately and is described in the following sections.

Excess lifetime cancer risk (ELCR) is defined as the probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen(s) present at the Site, in addition to the probability of cancer risks from all other causes. ELCRs were calculated by multiplying projected intakes by chemical-specific slope factors (CSF). For pathways involving multiple chemicals, Total ELCRs were calculated by summing individual ELCRs.

As a benchmark in developing clean-up goals at contaminated sites, an acceptable ELCR range from one in one million (1 in 1,000,000) to one in ten thousand (1 in 10,000) has been established, with one in one million being the “point of departure”. The point of
departure represents the starting point and the initial goal for all remedial objectives. This risk goal can be “departed from” with good reason. Such reasons include, but are not limited to, technical infeasibility, engineering impracticality, and high cost. However, cost is not a primary consideration for making this determination.

The Hazard Quotient (HQ) was used to determine the severity of non-cancerous hazards posed by the Site. The HQ is calculated as the ratio of projected intake levels to acceptable intake levels (reference dose) for each COPC. If the HQ is less than or equal to 1, then the estimated exposure to a substance is judged to be below the threshold that can result in a toxic effect. If the HQ is greater than 1, there exists a potential for toxic non-cancerous effects.

To assess the overall potential for non-cancerous effects posed by multiple chemicals, a hazard index (HI) was calculated by summing the individual HQs for each pathway.

A summary of estimated ELCRs and HIs for all pathways is presented in Table 1 and is discussed in the following sections. These estimates represent the current and future risks associated with the Site assuming no remedial actions are taken.

2.1.4.1 Current Land Use

For the current land use scenario, hazard indices exceed the target level (e.g., greater than one) for grounds workers exposed to Site-wide soil 0-2 feet bgs. The primary risk drivers are potential dermal contact with and ingestion of antimony and copper. Hazard indices associated with construction workers, office workers, off-Site residents, and school-aged trespassers/recreational users are below the target level. For grounds workers (ELCR = 2 in 100,000) the driver of cancer risk is for potential dermal contact and ingestion of arsenic in Site-wide soil 0-2 feet bgs. For trespassers and recreational users (ELCR = 5 in 1,000,000) the drivers of cancer risk are potential ingestion of arsenic in WDA soil and Duck Creek sediment and potential dermal contact with arsenic in Duck Creek sediment. The ELCRs for these receptors exceed the point of departure, but are within the acceptable risk range.

For the current or continued commercial/industrial use scenario, a blood lead concentration of 16.9 ug/dl (micrograms per deciliter or micrograms per 100 cubic centimeters) is predicted for women workers of childbearing age due to continuous exposure to Site-wide soil 0-2 feet bgs, exceeding the USEPA target level of 10 ug/dl. The primary contributor to this predicted blood lead concentration is soil in the WDA.

2.1.4.2 Future Land Use

Under future land use scenarios, including the possibility of residential use, hazard indices exceed the target level for construction workers and on-Site adult and child residents exposed to Site-wide soil 0-10 feet bgs. The primary risk driver for soil is potential dermal contact with antimony and thallium; however, antimony has been detected only twice and
thallium only once in Site soils. For potential groundwater ingestion, hazard indices also exceed the target level for on-Site adult and child residents; the primary risk drivers for groundwater ingestion are benzene, TCE, and PCE.

All ELCRs are within the acceptable risk range except when considering the potential use of groundwater. For on-Site adult and child residents without groundwater use, risks exceed the point of departure, but are within the acceptable range (1 in 100,000 and 2 in 100,000, respectively). The primary risk driver for this case is potential dermal contact with, and ingestion of, arsenic in soil. For future on-Site adult and child residents, the ELCRs (7 in 10,000 and 4 in 10,000, respectively) associated with the ingestion of groundwater are unacceptable. The primary cancer risk drivers in groundwater are benzene, TCE, PCE, and arsenic. The BRA disclosed that potable use of groundwater is clearly the controlling factor for risk in the future use scenario (other than lead, discussed below).

For future residential use, an average blood lead concentration of 103 ug/dl is predicted for children aged 6 months to 7 years if continuously exposed to WDA soils 0-2 feet bgs. This exceeds the Center for Disease Control (CDC) Level of Concern of 10 ug/dl. For the stained soil/drainage culvert area, a blood lead concentration of 41.3 ug/dl was predicted for children aged 6 months to 7 years. This level also exceeds the 10 ug/dl Level of Concern. Excluding the WDA and stained soil/drainage culvert areas, which could be considered Site hot spots, the predicted blood lead concentration for the remaining Site-wide soils was 2.0 ug/dl for children aged 6 months to 7 years. This level is below the 10 ug/dl Level of Concern.

2.2 Risks to Ecological Receptors

An Ecological Risk Assessment (ERA) was performed for the Site to estimate the potential for adverse impacts to ecological receptors as a result of past disposal practices.

The ERA was based upon the following components:

- Site Characterization and Potential Receptors
- Selection of Chemicals, Species, and Endpoints for Risk Assessment
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

The complete documentation of these components and the evaluation process can be found in Section 9.0 of the RI Report. The following paragraphs summarize the risks associated with various receptors in various ecological environments present on Site.

For the upland soils (i.e., 0-2 feet bgs in the WDA) concentrations of antimony, arsenic, copper, and lead exceeded Ecological Risk-Based Concentrations (ERBCs) for the meadow vole. Beryllium, chromium, copper, lead, tin, and zinc concentrations also exceeded ERBCs for the American robin in upland soils, and concentrations of lead
exceeded the ERBC for the red-tailed hawk. Exceedances of the ERBCs are influenced primarily by elevated contaminant concentrations in soils of the WDA.

For wetland area sediments in cattail areas, concentrations of copper, lead, and tin exceeded ERBCs for the muskrat. Lead and tin concentrations exceeded ERBCs for the American woodcock and great blue heron. Ecotox Thresholds (taken as a Site-specific benchmark for the green frog) were exceeded for copper and lead by factors of over 20.

For Duck Creek surface water, copper and zinc concentrations exceeded Ecotox Thresholds. In Duck Creek sediment, arsenic concentrations exceeded the ERBC for the muskrat; arsenic, cadmium, and nickel concentrations exceeded Ecotox Thresholds.
3.0 FEASIBILITY STUDY

A Feasibility Study was conducted by the Site Respondents in order to define and analyze appropriate remediation alternatives. The Feasibility Study was conducted with oversight by Ohio EPA, and was approved on August 15, 2001. The Remedial Investigation and Feasibility Study were the basis for Ohio EPA’s selected alternative.

3.1 Development of Preliminary Remediation Goals

PRGs are target cleanup concentrations for each contaminant in a given medium. The Site Respondents evaluated whether PRGs developed by USEPA Region 9 could be used as target cleanup concentrations for the contaminants and media found at the Site. Region 9's PRGs were evaluated because Region 5 has not developed PRGs. Region 9's PRGs are generic, risk-based concentrations for direct contact exposures. Region 9's PRGs may not address conditions and/or indirect exposure pathways existing at a particular site. Therefore, the Site Respondents also evaluated PRGs based on applicable or relevant and appropriate requirements (ARARs), ecological benchmarks for representative species, and background concentrations at the Site before establishing final cleanup concentrations. The final cleanup concentrations are based upon established risk goals for exposure pathways that have been identified at the Site.

PRGs for all affected media at the Site were developed in the FS Work Plan. The following is a summary of this process. Table 2 provides a summary of the PRGs for each contaminant in each medium.

3.1.1 Site Soils PRGs

Ohio EPA required the Respondents to propose VOC and SVOC leach-based PRGs for soils beneath the Plant Area, the WDA, the former UST area, the RCRA unit, and for soils at the edge of the wetlands. Ohio EPA also required the Respondents to propose PRGs for metals for the WDA and the Plant Area. During the development of the PRG values for metals, Ohio EPA agreed that leach-based PRGs for metals in soils are not required because the RI concluded that metals have not been detected in Site groundwater. Therefore, the PRGs selected for metals will be the lowest risk-based concentrations which are considered protective of both human receptors and ecological receptors, unless those concentrations are lower than Site background levels. If Site background levels are higher than the concentrations which are considered protective of both human and ecological receptors, the background levels will be selected as the PRGs. Similarly, the final PRGs selected for VOC and SVOC contaminants for which leach-based values are available, as well as risk-based values for human and ecological receptors, are the lowest of those values, unless those values are lower than Site background levels.

Concentrations provided in Ohio EPA Derived Leach-Based Soil Values Technical Guidance Document dated July 1996 were proposed as the leach-based PRGs for VOC and SVOC contaminants detected in Site soils. For those organic contaminants that do not have leach-based PRGs listed in the above-referenced document, the Ohio EPA
approved use of a Weight-of-Evidence method for determining whether leach-based PRGs are necessary. The Weight-of-Evidence method was used to conclude that, if a contaminant was detected in soil but not groundwater, it had been demonstrated that the contaminant was not leaching; therefore, a leach-based PRG was not necessary for that contaminant. Leach-based PRGs were found to be necessary for four contaminants (bis(2-ethylhexyl)phthalate, di-n-octylphthalate, dichlorodifluoromethane, dichloromethane) that did not have PRGs established in the above-referenced Ohio EPA guidance. Leach-based PRGs are necessary for those contaminants because they were detected in groundwater. Ohio EPA approved the use of the Pennsylvania Act 2 soil-to-groundwater pathway concentrations as leach-based PRGs for those contaminants.

3.1.2 Groundwater PRGs

As directed by Ohio EPA, PRGs for Site groundwater are the USEPA MCLs or Action Levels for each contaminant.

3.1.3 Duck Creek Sediment PRGs

Of the metals detected in Duck Creek Sediments during RI sampling (arsenic, beryllium, cadmium, chromium, copper, lead, nickel, and zinc), only concentrations of arsenic, cadmium, and nickel exceeded the Ecotox Thresholds. In order to determine the background concentrations of these metals in Duck Creek sediment, additional sampling was performed for the FS. The PRG was then established as the higher of the background concentration or the respective Ecotox Threshold.

3.1.4 Wetland Area Sediment PRGs

Based on the wetland assessment, PRGs based on target ecological receptors are most appropriate for establishing cleanup levels in the cattail and non-cattail portions of the wetlands. During the FS approval process (as detailed in Appendix G of the FS Report), the muskrat and meadow vole were determined to be representative species for the cattail and non-cattail wetland habitats, respectively. Therefore, the PRGs for contaminants in these sediments are the ERBCs for the muskrat and meadow vole.
4.0 REMEDIAL ACTION OBJECTIVES

As part of the remedial investigation/feasibility study (RI/FS) process, remedial action objectives (RAOs) were developed in accordance with the National Contingency Plan, 40 CFR Part 300 (NCP) which was promulgated under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and USEPA guidance. The intent of the remedial action objectives is to set goals that a remedy should achieve in order to ensure the protection of human health and the environment. The goals are designed specifically to mitigate the potential adverse effects of Site contaminants present in environmental media. For environmental media, remediation levels were developed for a range of potential residual carcinogenic risk levels (i.e., 1 in 100,000, 1 in 1,000,000 etc.) and using a non-cancer hazard index of 1.0 for potentially exposed receptors, including:

- Grounds workers
- Construction workers
- Off-Site residents
- School-aged trespassers
- Children using Duck Creek for recreation
- Office employees
- Future construction workers
- Future adult residents
- Future child residents

Table 1 identifies the exposure pathways and media affecting each of these receptors, and summarizes the risk levels associated with each pathway. Carcinogenic risks are estimated as the unitless probability of an individual developing cancer over a lifetime as the result of exposure to the potential carcinogens related to the Site. Note that for any individual in the exposed population, this risk is in excess of the risk imparted to that individual by factors not related to the Site. (See Section 8.0 of the RI report for further discussion of Site-specific risks).

The remediation levels for human health were developed to ensure that remedial actions reduce the projected risk to humans to acceptable levels. The USEPA, through the NCP, defines acceptable Site remediation goals for known or suspected carcinogens to be concentration levels that represent an upper bound excess lifetime cancer risk, above that of the background, to an individual between 1 in 10,000 and 1 in 1,000,000 using information on the relationship between dose and response, with the 1 in 1,000,000 risk level as the point of departure. Likewise, noncarcinogenic risks are also to be reduced to an acceptable level. In a similar manner, ecological resources (e.g. wetlands, waters of the state, indicator (modeled) species) will also be protected.

The RAOs developed for the Site are as follows:

- Remediate or contain soil to prevent the migration of contaminants into groundwater;
• Remediate or contain upland soils to prevent the direct contact, ingestion, or inhalation of contaminants at levels which exceed human health or ecological risk-based levels;

• Remediate wetland sediment to prevent the direct contact or ingestion of contaminants at levels which exceed ecological risk-based levels;

• Prevent further expansion or off-Site migration of the groundwater contaminant plume and reduce contaminant concentrations in groundwater to achieve established cleanup goals;

• Monitor Duck Creek surface water and sediment to ensure that Site-related contaminants remain at levels below human health or ecological risk-based levels.
5.0 SUMMARY OF REMEDIAL ALTERNATIVES

A total of seventeen alternatives to address five separate media of concern were considered in the Feasibility Study (FS). A brief description of each medium and the major components of each remedial alternative are summarized in the following sections. More detailed information about these alternatives can be found in the Feasibility Study.

5.1 Western Disposal Area (WDA) and Plant Area Soils

The WDA soils contain elevated concentrations of lead, copper, and antimony which exceed PRGs. Although isolated detections of TCE above its PRG are present in the WDA, it is not considered the primary contaminant in this area. The Plant Area soils contain elevated lead concentrations which exceed the PRG. The following remedial alternatives were evaluated for the WDA and Plant Area soils.

5.1.1 No Action - FS Alternative 1 WDA/PA

- No remedial action planned for the WDA/Plant Area Soils; evaluated as a baseline scenario.

5.1.2 Institutional Controls - FS Alternative 2 WDA/PA

- Install security fence around the WDA;
- Add activity and use limitations to prevent future construction or other activities in the WDA, and convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.1.3 On-Site Containment - FS Alternative 3 WDA/PA

- Remove/excavate Plant Area soils which exceed the PRGs for metals and/or VOCs, and stained soils south of plant;
- Sample WDA soils to determine removal/capping limits for metals and TCE contamination;
- Transport and consolidate excavated soils and WDA soils within the WDA; grade soils to construct an optimized containment cell footprint in preparation for capping;
- Cap the WDA and other soils with a RCRA Subtitle C Hazardous Waste Facility Cap; install fence to secure the capped area; maintain cap per regulations;
- Restore excavated plant areas;
- Add activity and use limitations to prevent ion of future construction or other
destructive activity in the WDA; convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.1.4 Removal, On-Site Treatment, Off-Site Disposal - FS Alternative 5 WDA/PA

- Sample WDA soils to determine removal limits for metals and TCE contamination exceeding PRGs;
- Remove/excavate WDA and Plant Area soils exceeding PRGs for metals; excavate stained soils south of plant; restore excavated areas;
- For soils exceeding PRGs for metals, ex situ stabilization to non-hazardous levels as measured by Toxicity Characteristic Leaching Procedure (TCLP) analysis;
- Dispose of stabilized WDA soils and stained soils off-Site at a Subtitle C landfill, provided that Land Disposal Restriction (LDR) values are met;
- Dispose of Plant Area soils at a Subtitle D landfill provided LDR values are met;
- Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.2 Duck Creek Sediment

Sampling of Duck Creek sediment performed for the FS indicated that the mean concentrations of arsenic, cadmium, and nickel do not exceed the established PRGs. While some individual samples contained slightly elevated concentrations of arsenic and nickel, these values are not significantly greater than the corresponding PRGs. The following remedial alternatives were evaluated for Duck Creek sediment.

5.2.1 No Action - FS Alternative 1 DC

- No remedial action planned for Duck Creek sediment; evaluated as a baseline scenario.

5.2.2 Long-Term Monitoring - FS Alternative 2 DC

- Semi-annual sediment sampling for years 0-2, annual sampling for years 3-5;
- Semi-annual surface water sampling for years 0-2, annual sampling for years 3-5;
- Decision for further monitoring based on results of first five years of sediment and surface water sampling.
5.3 Wetland Sediments

Wetland area sediments contain elevated concentrations of copper, lead, and tin. The wetland contains both cattail and non-cattail areas. The PRGs for these areas were selected based upon the muskrat and meadow vole, respectively, as the target (indicator) species. The following remedial alternatives were evaluated for the wetland sediments.

5.3.1 No Action - FS Alternative 1 Wetland

- No remedial action planned for wetland sediments; evaluated as a baseline scenario.

5.3.2 Removal, On-Site Disposal within WDA - FS Alternative 3 Wetland

- Sample wetland sediment to determine removal limits;
- Excavate, dewater, and transport sediments for consolidation within the WDA;
- Restore and re-establish vegetation in excavated areas.

5.3.3 Removal, Off-Site Disposal - FS Alternative 4 Wetland

- Sample wetland sediment to determine removal limits;
- Excavate, dewater, and transport sediments to an off-Site landfill;
- Restore and reestablish vegetation in excavated areas.

5.4 Soluble Oil (SO) Line and Vapor Degreaser Soils

These soils are located beneath the GVI facility building and contain elevated concentrations of VOCs (primarily TCE, PCE). The PRGs were established using leach-based soil concentrations.

The Feasibility Study identified and screened several potential in situ remedial technologies for addressing the SO Line and Vapor Degreaser Soils, as described below.

Methane injection and co-metabolism is a process intended to promote and accelerate the aerobic degradation of VOCs via co-metabolic microbial processes. The process is innovative, and current technical literature has documented successful applications of this technology at some sites under favorable conditions. However, the injection of gas into the low-permeability soil might not prove successful at this site. The process also presents significant safety issues, involving the injection of an explosive gas beneath an operating facility. Based upon these limitations, this technology was not retained for further evaluation.
Soil vapor extraction (SVE) was also screened for potential application to these soils. Through the use of vacuum-extraction wells installed within or near an impacted soil area, SVE can remove VOC-laden soil vapor and promote additional volatilization of VOCs from the soil to the vapor phase. SVE is generally limited, however, by the ability of the soil to allow air flow through the pore space - a property known as intrinsic permeability. The RI indicated that soil permeability for the Site soils is in the range of $2.0 \times 10^{-6}$ to $2.7 \times 10^{-7}$ cm/sec, which indicates conditions that would severely restrict the flow of air. Based upon a review of USEPA guidance, this range of permeability was considered unfavorable for effective application of SVE. In addition, the added difficulties of installing and constructing an effective system within the confines of the active manufacturing areas were considered. Based upon these issues, SVE was not retained for further evaluation.

The third technology identified and screened in the FS was the application of a hydrogen-release compound to stimulate anaerobic microbial activity which, in turn, can produce reductive dechlorination and breakdown of VOCs. The compound is typically injected under pressure as a slurry or semi-viscous liquid. With the low permeability soils present beneath the facility, the effective delivery of this compound into the target areas would likely require an extensive array of injection points. The installation of such an array would prove difficult or non-attainable, given the areas involved and the potential impact to the manufacturing line and other facility operations. There would also be a potential for the injection process and the resulting hydraulic head to provide a driving force capable of mobilizing additional VOCs from the soil medium to the underlying groundwater. Because of the difficulties presented, this alternative was not retained for further evaluation.

As described above, three in situ technologies were evaluated for addressing the SO Line and Vapor Degreaser Soils. Unfavorable soil characteristics, safety concerns, and general accessibility issues posed by the active facility resulted in these alternatives being eliminated from further evaluation. An additional alternative for addressing SO Line and Vapor Degreaser Soils was developed and evaluated by Ohio EPA during the process of preparing the Preferred Plan and initial Decision Document. The alternative consists of the excavation and off-Site disposal of soils that exceed the leaching-based PRGs. The alternative was included to provide an active remedial option for addressing these soils.

The following alternatives were retained for additional evaluation. Each alternative is described in more detail in Section 6.

5.4.1 No Action - FS Alternative 1 SO/VD

- No remedial action planned for SO Line and Vapor Degreaser Soils; evaluated as a baseline scenario.

5.4.2 Institutional Controls - FS Alternative 2 SO/VD

- Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.;
• Add activity and use limitations regarding the performance of a Focused Feasibility Study (FFS) when the building is removed;

• Monitor groundwater for potential future impact from contaminated soils.

5.4.3 Excavation and Off-Site Disposal - Alternative 3 SO/VD

• Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.;

• Utilize the GVI facility building and loading dock as temporary control measures to prevent exposure and leaching of VOCs from soil at the SO Line, Vapor Degreaser, and loading dock areas;

• Upon future removal of the facility building and/or loading dock, excavate and remove soils that exceed leaching-based PRGs; alternatively, evaluate and potentially implement other remediation technologies or actions that will achieve the RAO’s and equally protect the environment.

• Dispose of the excavated soils at a Subtitle C landfill, provided that Land Disposal Restriction (LDR) values are met.

5.4.4 On-Site Containment - Amended Alternative 4 SO/VD

• Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.;

• Utilize the GVI facility building and loading dock as control measures to prevent exposure and leaching of VOCs from soil at the SO Line, Vapor Degreaser, and loading dock areas;

• Upon future removal of the facility building and/or loading dock, conduct a Focused Feasibility Study to evaluate other remediation technologies or actions that are expected to achieve the RAOs for any soils that continue to exceed PRGs; absent Ohio EPA approval of another remediation technology, the second phase of the remedy will be implemented to cap soils in place using a multimedia cap that meets RCRA Subtitle C hazardous waste facility cap performance standards. It will be permissible to incorporate the remaining components of the facility foundation and/or loading dock into the cap, provided that the resulting cap meets applicable standards for protection of human health and the environment.

5.5 Groundwater

Groundwater, present in both alluvium and bedrock at the Site, contains concentrations of VOCs above PRGs. The following remedial alternatives were evaluated for groundwater.
5.5.1 No Action - FS Alternative 1 GW

- No remedial action planned; evaluated as a baseline scenario.
- Discontinue operation of interim groundwater recovery and treatment system;
- Enforce current deed restrictions.

5.5.2 Continued Operation of Interim System - FS Alternative 2 GW

- Continue pumping from on-Site wells, as well as monthly operation, maintenance, and performance sampling of treatment system;
- Sample select monitoring wells on an annual basis;
- Install and operate additional recovery pumps in existing wells, for additional removal efficiency, if necessary;
- Periodically evaluate effectiveness of pumping system to determine long-term benefits and determine if natural attenuation is sufficient to attain long-term goals;
- Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.5.3 Enhanced Monitoring with Interim System - FS Alternative 3GW

- Implement expanded groundwater natural attenuation monitoring plan, to determine the rate at which contaminants are undergoing biodegradation;
- Continue operation, maintenance, and performance monitoring of current interim system;
- Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.5.4 Enhanced Monitoring with Expanded System - FS Alternative 3a GW

- Implement expanded groundwater natural attenuation monitoring plan;
- Install additional groundwater pumping components (e.g., additional wells) as determined during the design phase;
- Continue operation, maintenance, and monitoring of the expanded pumping system;
- Discontinue pumping system operation after an acceptable time frame;
• Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.5.5 Enhanced Monitoring with Phytoremediation, Interim System - FS Alternative 4 GW

• Install a plot of poplar (or other appropriate) trees downgradient of the contaminant plume. The trees would be utilized for the high rates of groundwater uptake through the root systems, and would serve as additional protection to Duck Creek from potential seepage of VOC-impacted groundwater.

• Implement expanded groundwater natural attenuation monitoring plan;

• Continue operation, maintenance, and monitoring of the current pumping system;

• Discontinue pumping system operation after an acceptable time frame;

• Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.

5.5.6 Enhanced Monitoring with In-Situ Enhancements, Interim System - FS Alternative 5 GW

• Injection of Hydrogen Release Compound (HRC™), or similar, to enhance anaerobic degradation of chlorinated VOCs;

• Implement expanded groundwater natural attenuation monitoring plan;

• Continue operation, maintenance, and monitoring of the current pumping system;

• Discontinue pumping system operation after an acceptable time frame;

• Convert current deed restrictions for the Site to activity and use limitations, in a recorded environmental covenant in accordance with ORC §5301.80 et seq.
6.0 COMPARISON AND EVALUATION OF ALTERNATIVES

6.1 Evaluation Criteria

In selecting the remedy for this Site, Ohio EPA considered the following eight criteria as outlined in U.S. EPA’s National Contingency Plan (NCP) promulgated under CERCLA (40 CFR 300.430):

1. **Overall protection of human health and the environment** - Remedial alternatives shall be evaluated to determine whether they can adequately protect human health and the environment, in both the short- and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site.

2. **Compliance with ARARs** - Remedial alternatives shall be evaluated to determine whether a remedy will meet all of the applicable or relevant and appropriate requirements under State and Federal and Local environmental laws;

3. **Long-term effectiveness and permanence** - Remedial alternatives shall be evaluated to determine the ability of a remedy to maintain reliable protection of human health and the environment over time, once pollution has been abated and RAOs have been met. This includes assessment of the residual risks remaining from untreated wastes, and the adequacy and reliability of controls such as containment systems and institutional controls;

4. **Reduction of toxicity, mobility, or volume through treatment** - Remedial alternatives shall be evaluated to determine the degree to which recycling or treatment is employed to reduce toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site;

5. **Short-term effectiveness** - Remedial alternatives shall be evaluated to determine the following: (1) Short-term risks that might be posed to the community during implementation of an alternative; (2) Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures; (3) Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and (4) Time until protection is achieved;

6. **Implementability** - Remedial alternatives shall be evaluated to determine the ease or difficulty of implementation and shall include the following as appropriate: (1) Technical difficulties and unknowns associated with the construction and operation of a technology, the reliability of the technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy; (2) Administrative feasibility, including activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and (3) Availability of services and materials, including the availability of adequate off-site treatment, storage
capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies;

7. **Cost** - Remedial alternatives shall evaluate costs and shall include the following: (1) Capital costs, including both direct and indirect costs; (2) Annual operation and maintenance costs (O&M); and (3) Net present value of capital and O&M costs. The cost estimates include only the direct costs of implementing an alternative at the Site and do not include other costs, such as damage to human health or the environment associated with an alternative. The cost estimates are based on figures provided by the Feasibility Study.

8. **Community acceptance** - Remedial alternatives shall be evaluated to determine which of their components interested persons in the community either support (accept), have reservations about, or oppose.

Evaluation Criteria 1 and 2 are threshold criteria required for acceptance of an alternative that has accomplished the goal of protecting human health and the environment and complied with the law. Any acceptable remedy must comply with both of these criteria. Evaluation Criteria 3 through 7 are the balancing criteria for picking the best remedial alternatives. Evaluation Criteria 8, community acceptance, was determined, in part, by written responses received during the public comment period and statements offered at the public meeting.

**6.2 Analyses of Evaluation Criteria**

This section looks at how each of the evaluation criteria is applied to each of the remedial alternatives found in Section 5.0 and compares how the alternatives achieve the criteria.

**6.2.1 Western Disposal Area (WDA) and Plant Area Soils**

**6.2.1.1 Overall Protection of Human Health and the Environment**

This criteria can be met by the *On-Site Containment*, and the *Removal, On-Site Treatment and Off-Site Disposal* alternatives. Both of these alternatives would serve to prevent direct contact with contaminants by human and ecological receptors. The *Institutional Controls* alternative would minimize direct human contact with contaminants in the WDA, but would not reduce the lead risks for women workers with potential exposure to Plant Area soils. The *Institutional Controls* alternative also would not prevent exposure of the ecological receptors to metals found in the WDA and Plant Area soils. The *No Action* alternative does not meet this criteria, as it would not prevent human or ecological receptor contact with soils contaminated with metals above PRGs.
6.2.1.2 Compliance with Applicable Requirements

The On-Site Containment alternative and the Removal, On-Site Treatment and Off-Site Disposal alternatives would comply with applicable Federal and State regulatory requirements. On-Site Containment would require a RCRA Subtitle C hazardous waste facility cap; consolidation of the soils within the WDA would not trigger LDRs or treatment, storage or disposal facility requirements, based on U.S. EPA's "area of contamination" policy, see 55 Federal Register 8758-8760 (March 8, 1990). Removal, On-Site Treatment and Off-Site Disposal would require disposal of contaminated soil in a Subtitle C facility - TCLP requirements would apply to the WDA and Plant Area soils for off-Site disposal, in order to meet LDRs.

For Institutional Controls and No Action, activity and use limitations which govern future property use or activities within the areas of contamination must meet Ohio EPA environmental covenant requirements. However, these alternatives would not meet requirements for closure of waste disposal units.

6.2.1.3 Long-Term Effectiveness and Permanence

The Removal, On-Site Treatment, and Off-Site Disposal alternative permanently removes the contaminated materials from the Site, and does not require long term monitoring or maintenance to ensure effectiveness. On-Site Containment would provide an effective remedy, making use of a multi-media cap to prevent direct contact with contaminants and minimizing infiltration and the potential for contaminant leaching to groundwater. Properly designed and maintained caps have been used as a permanent remedy on a wide variety of sites, but require the appropriate long-term monitoring and maintenance. For consolidation and capping of soils within the WDA, adequate design and construction would be required to provide long-term erosion protection during flood events. Institutional Controls, through access restrictions and activity and use limitations, would aid in restricting human exposure to contaminants, but would require an effective regulatory mechanism for ensuring compliance over the long term. Proper maintenance of the fencing preventing access to the WDA would be required. This alternative, however, would not prevent exposure of ecological receptors to WDA contaminants. The No Action alternative provides no long-term effectiveness or permanence.

6.2.1.4 Reduction of Toxicity, Mobility or Volume by Treatment

Removal, On-Site Treatment, and Off-Site Disposal will serve to reduce the mobility of contaminants through a soil stabilization process. Stabilization is a process which chemically binds, encapsulates, or otherwise alters contaminants to a more stable form which reduces the likelihood of contaminant release to the environment. There is no evidence, however, that this process would reduce the toxicity of the contaminants; there would also be an associated increase in volume of the soil materials. Neither On-Site Containment nor Institutional Controls would reduce toxicity, mobility or volume by treatment.
6.2.1.5 Short-Term Effectiveness

The *No Action* alternative would have no short-term risks for Site workers, the general public, or the environment. For the implementation of *Institutional Controls*, there would be some short-term risk for workers installing fencing around the WDA, involving potential contact with surface soils containing metals above PRGs. Due to the limited time frame required for installation of fencing, this alternative can quickly achieve short-term effectiveness in terms of preventing access and direct contact with WDA soils.

The estimated time frame for implementation of *On-Site Containment* is 4 to 6 months. During this time, excavation and consolidation of soils would create the potential for fugitive dust emissions, thus increasing short-term human health risks. In addition, the disturbance of soils and increased exposure to precipitation and flooding would create the potential for off-Site releases of contaminants. Potential short-term impacts associated with this alternative could be addressed through the appropriate controls for worker health and safety, water and sediment pollution, and air pollution.

The *Removal, On-Site Treatment, and Off-Site Disposal* alternative could be implemented in less than one year, yet has a greater level of short-term health risk than *On-Site Containment*, due to the additional handling required for mixing of soils and stabilizing agents. These activities create a greater potential for airborne as well as water-borne releases of contaminants. Off-Site transportation also has inherent risks of vehicular accidents and spills, as well as other safety risks related to noise and increased traffic volume. Potential short-term impacts associated with this alternative could be addressed through the appropriate controls for worker health and safety, water and sediment pollution, and air pollution.

6.2.1.6 Implementability

The *No Action* alternative is considered as a baseline for comparison with other alternatives, and has no remedial elements to be implemented. However, it does include the continuation of existing deed restrictions, and will require that these restrictions be effectively enforced. *Institutional Controls* will also require the enforcement of access restrictions and activity and use limitations and, in addition, will require the installation of fencing around the WDA to prevent physical access and direct contact with contaminated soils. The installation of fencing can easily be implemented from a construction standpoint.

*On-Site Containment* would require the construction of a RCRA Subtitle C hazardous waste facility cap over the consolidated WDA and Plant Area soils. This alternative is easily implemented. Numerous qualified vendors are available for design and construction of the cap. The potential for flooding and wetlands protection will require special engineering consideration, including a hydraulic analysis of the flood plain, but should be adequately addressed by the appropriate design and erosion protection.

*Removal, On-Site Treatment and Off-Site Disposal* would require the performance of a treatability study to determine the effectiveness and optimum mixture for the stabilizing
reagents. Ex situ stabilization is a proven technology for metals-contaminated soils, and is typically performed using a pugmill or other commercially available, ancillary equipment. There are many qualified vendors capable of implementing this process option, and the implementation time would likely be less than one year.

6.2.1.7 Cost

The net present worth costs (see Table 3), including capital and long-term operation and maintenance, for each of the four alternatives for WDA and Plant Area soils, are summarized as follows:

- No Action - $0;
- Institutional Controls - $372,000
- On-Site Containment - $1,316,900
- Removal, On-Site Treatment, Off-Site Disposal - $2,657,900

6.2.2 Duck Creek Sediment

6.2.2.1 Overall Protection of Human Health and the Environment

Neither the Long-Term Monitoring nor the No Action alternatives would change the current conditions of Duck Creek sediment, in which concentrations of arsenic and nickel slightly exceed the PRGs. Long-Term Monitoring would serve to identify any future increases in contaminant concentrations in sediment and surface water, thus allowing assessment of potentially adverse effects, and implementation of additional measures, if necessary.

6.2.2.2 Compliance with Applicable Requirements

Neither Long-Term Monitoring nor No Action would include performance of remedial activities that would involve compliance with ARARs.

6.2.2.3 Long-Term Effectiveness and Permanence

Long-Term Monitoring would provide for some degree of long-term effectiveness and permanence, in that it would serve to identify future increases in contaminant concentrations, and allow for the assessment and remediation of potentially adverse effects. The No Action alternative would not satisfy this criteria.

6.2.2.4 Reduction of Toxicity, Mobility or Volume by Treatment

Neither the Long-Term Monitoring nor the No Action alternatives have treatment components; therefore, there are no associated reductions of toxicity, mobility, or volume of contaminants.
6.2.2.5  Short-Term Effectiveness

For Long-Term Monitoring, current conditions would be maintained. Sediment and surface water sampling would require only normal safety considerations. No Action would also provide short-term effectiveness, since the current concentrations of metals in sediment do not appear to be adversely affecting human or ecological receptors.

6.2.2.6  Implementability

The No Action alternative is considered as a baseline for comparison with other alternatives, and has no remedial elements to be implemented. Long-Term Monitoring can be readily implemented, and has no special administrative or technical requirements. Only routine safety considerations would be required during collection of sediment and surface water samples.

6.2.2.7  Cost

The net present worth costs (see Table 4), including capital and long-term operation and maintenance, for each of the two alternatives for Duck Creek Sediment, are summarized as follows:

- No Action - $0;
- Long-Term Monitoring - $39,600

6.2.3  Wetland Sediment

6.2.3.1  Overall Protection of Human Health and the Environment

Both the Removal and On-Site Disposal and the Removal and Off-Site Disposal alternatives would meet this criteria equally well. Through removal activities, both alternatives meet the remedial objective of preventing direct contact exposure of ecological receptors to sediments contaminated with metals above the PRGs. PRGs were based upon ecological risk-based concentrations (ERBCs) modeled for the muskrat in cattail areas and the meadow vole in non-cattail areas. There are no current risks to human health posed by the contaminants in the wetland sediment.

The No Action alternative would not affect human health risks, since minimal human health risks currently exist. However, this alternative would allow continued exposure of ecological receptors to contaminated sediments and vegetation. This exposure is predicted to cause chronic, adverse effects on indicator species (muskrat and meadow vole) populations over time.

6.2.3.2  Compliance with Applicable Requirements

Both of the Removal alternatives would result in large scale disruption and damage to the existing wetlands. Since the wetlands appear to meet the definition of Category 2
wetlands, under OAC 3745-1-54, proper restoration would be required. The activities fall under Nationwide Permit (NWP) No. 38, Cleanup of Hazardous and Toxic Waste, of Section 404 of the Clean Water Act. Prior to performance of either remedial alternative, a Section 404 permit from the Army Corps of Engineers and a Section 401 certification from Ohio EPA would be required. The No Action alternative would not include performance of remedial activities that would involve compliance with ARARs.

### 6.2.3.3 Long-Term Effectiveness and Permanence

Both of the Removal alternatives would meet this criteria equally well by assuring the removal of wetland sediments with metals concentrations exceeding the PRGs for ecological receptors. In conjunction with the on-Site containment or off-Site disposal of the WDA soils, there will also be a permanent elimination of the WDA as a source of metals contamination to the wetland area.

The No Action alternative does not include the performance of remedial activities. There may be a long-term decrease in the average contaminant concentrations in the wetland sediments, due to the deposition of clean sediments from upgradient drainage areas. However, the overall mass, toxicity, and mobility of the contaminants would not be expected to change significantly in the short- or long-term, with continuing exposure of ecological receptors to metals concentrations exceeding the PRGs.

### 6.2.3.4 Reduction of Toxicity, Mobility or Volume by Treatment

Removal and Off-Site Disposal might require ex situ stabilization in order to meet requirements at the disposal facility. Soil stabilization is a process which chemically binds, encapsulates, or otherwise alters contaminants to a more stable form which reduces mobility and the likelihood of contaminant release to the environment. This process may or may not reduce toxicity of the contaminants, and the stabilization process would likely produce an increased volume of soil materials. Neither the Removal and On-Site Disposal nor No Action alternatives would reduce toxicity, mobility or volume by treatment.

### 6.2.3.5 Short-Term Effectiveness

The No Action alternative would have no short-term risks for Site workers or the general public. Risks to ecological receptors would remain, however. Both of the Removal alternatives would result in significant disruption and damage to the existing wetland habitat. However, it is expected that the cattail areas in particular would quickly revegetate and the ecological balance in those areas would recover. The Removal alternatives would not be expected to create health and safety risks other than those associated with the use of construction equipment and the coordination of activities at an active industrial facility. Because the excavated materials would be moist or wet, dust generation would be minimal and would not create a significant risk of airborne contaminant migration. It is estimated that sediment removal and wetland restoration activities could be completed within a 3 to 6 month time frame.
6.2.3.6 Implementability

Both of the Removal alternatives will require pre-design sampling of the wetland area to establish the appropriate removal limits. Excavation activities may require specialized amphibious or low ground pressure excavation equipment. Silt fence or silt curtains may also be required to prevent the movement of suspended sediments into non-excavation areas. Although wetland sediment excavation may present some technical challenges, these alternatives can be readily implemented by qualified, experienced contractors.

Removal and On-Site Disposal would require the construction of a RCRA Subtitle C hazardous waste facility cap over the consolidated WDA and Plant Area soils, with adequate area to incorporate the excavated wetland sediments. Numerous qualified vendors are available for design and construction of the cap. Additional activities that might be required include the dewatering or stabilization of sediments prior to placement and incorporation into the WDA containment area. Removal and Off-Site Disposal would also require sufficient dewatering or stabilization of sediments to meet the requirements of the off-Site disposal facility, as well as to enable transport off-Site.

The No Action alternative is considered as a baseline for comparison with other alternatives, and has no remedial elements to be implemented.

6.2.3.7 Cost

The net present worth costs (see Table 5), including capital and long-term operation and maintenance, for each of the three alternatives for wetland sediments, are summarized as follows:

• No Action - $0;
• Removal and On-Site Disposal - $539,000
• Removal and Off-Site Disposal - $654,500

6.2.4 Soluble Oil (SO) Line and Vapor Degreaser Soils

6.2.4.1 Overall Protection of Human Health and the Environment

This criteria can be met by the On-Site Containment and the Excavation and Off-Site Disposal alternatives. The On-Site Containment alternative would serve to prevent direct contact with contaminants by human and ecological receptors, and would prevent leaching of contaminants to groundwater. The Excavation and Off-Site Disposal alternative would result in permanent removal of the impacted soils and placement in a permitted Subtitle C landfill, which would provide the appropriate protection of human health and the environment.

In their current condition, the SO Line and Vapor Degreaser soils pose a minimal risk for direct exposure to human or ecological receptors. In addition, the existing building and dock structures serve to reduce leaching potential, provided they are not removed and/or
significantly altered. During a construction scenario beneath the building (e.g., to replace or install a utility) short-term exposure to workers would occur. However, an evaluation of this scenario using soil data from 0-12 feet bgs showed that this potential exposure would not exceed acceptable levels (i.e., Hazard Index less than 1, ELCR less than 1 in 1,000,000). Theoretical risks from vapor emissions into the building were also shown to be below applicable thresholds.

The risks associated with direct contact with soils primarily would affect potential future residents at the Site. However, the property is presently deed-restricted to prohibit residential, non-industrial, and non-commercial use. The use of Institutional Controls, through an environmental covenant, could also notify prospective buyers of the presence, nature, and extent of soil contamination beneath the facility building. The No Action alternative would assume continued enforcement of the current deed restrictions, but would not provide the environmental covenant.

The RI concluded that groundwater beneath the facility exists only in the bedrock unit and does not rise into the impacted soil unit, thereby eliminating the exposure pathway for leaching to groundwater. Ohio EPA believes that this data is inconclusive and that leaching of soil contaminants to groundwater continues to represent a viable exposure pathway. A deed restriction currently in place prohibits the potable use of groundwater at the Site. Under the No Action and Institutional Controls alternatives, this deed restriction would continue to be enforced and human health related to ingestion of groundwater would remain protected. However, neither of these alternatives addresses the leaching pathway in the event that the facility is demolished or the soils are otherwise exposed. The Excavation and Off-Site Disposal alternative would provide for removal and proper disposal of the soils to prevent leaching under this scenario. The On-Site Containment alternative would prevent leaching through the construction of a multi-media cap over the contaminated soils.

6.2.4.2 Compliance with Applicable Requirements

The On-Site Containment and Excavation and Off-Site Disposal alternatives would comply with applicable Federal and State regulatory requirements. On-Site Containment would require a multimedia cap that satisfies performance standards for a RCRA Subtitle C hazardous waste facility cap. Excavation and Off-Site Disposal would require disposal of contaminated soil in a Subtitle C facility - TCLP requirements would apply to the soil for off-Site disposal, in order to meet LDRs.

Neither the No Action nor Institutional Controls alternatives require performance of remedial activities. Therefore, compliance with applicable State and Federal environmental laws would not be an issue.

6.2.4.3 Long-Term Effectiveness and Permanence

As discussed above, Ohio EPA believes that the leaching of soil contaminants to groundwater will continue to represent a potential exposure pathway. The No Action
alternative would be expected to prevent the future potable use of groundwater through enforcement of the current deed restriction. The long-term effectiveness and permanence of this alternative would depend upon a reliable mechanism for enforcement. The Institutional Control alternative would be expected to prevent the future potable use of groundwater through enforcement of activity and use limitations, in a recorded in an environmental covenant in accordance with ORC §5301.80 et seq.

As long as the facility building and the loading dock remain intact, there would be limited potential for future direct contact or exposure to VOC-contaminated soils, as well as limited leaching potential. In the event of facility demolition, however, only the On-Site Containment and Excavation and Off-Site Disposal alternatives would permanently address the leaching pathway via soil capping or soil removal, respectively. Neither the Institutional Controls nor No Action alternatives would provide an equally effective long-term remedy.

6.2.4.4 Reduction of Toxicity, Mobility or Volume by Treatment

The No Action, Institutional Controls, On-Site Containment and Excavation and Off-Site Disposal alternatives do not include treatment components; therefore, there are no associated reductions of toxicity, mobility, or volume of contaminants by treatment.

6.2.4.5 Short-Term Effectiveness

Neither the No Action nor Institutional Controls alternatives would result in short-term risks associated with implementation.

The estimated time frame for implementation of the On-Site Containment alternative is 2 to 3 months. The potential for minor excavation and consolidation of the SO Line/Vapor Degreaser Soils beneath a multi-media cap could create fugitive dust emissions, thus increasing short-term human health risks. In addition, the disturbance of soils and increased exposure to precipitation could lead to off-Site releases of contaminants. The potential short-term impacts associated with this alternative could be addressed effectively through the appropriate controls for worker health and safety, water and sediment pollution, and air pollution.

The estimated time frame for implementation of the Excavation and Off-Site Disposal alternative is 2 to 3 months. This alternative has a greater level of short-term health risk than On-Site Containment due to the larger scale of excavation and worker exposure to contaminated soils. The activity also creates a greater potential for airborne as well as water-borne releases of contaminants. Off-Site transportation has inherent risks of vehicular accidents and spills, as well as other safety risks related to noise and increased traffic volume. Potential short-term impacts associated with this alternative could be addressed through the appropriate controls for worker health and safety, water and sediment pollution, and air pollution.
6.2.4.6 Implementability

The No Action alternative is considered as a baseline for comparison with other alternatives, and has no remedial elements to be implemented. VOC-contaminated soils would remain in place beneath the facility building and loading dock area. This alternative would rely on the long-term enforcement of the existing deed restriction, which prevents non-industrial or non-commercial use of the property and prevents potable use of groundwater.

Institutional Controls would also rely on the long-term enforcement of the existing deed restrictions, converted to an environmental covenant in accordance with ORC §5301.80 et seq., but would add activity and use limitations related to the presence, nature, and extent of contaminated soils in the SO Line, Vapor Degreaser, and loading dock areas. These activity and use limitations could be readily implemented. This alternative, as originally contemplated in the FS, would incorporate an additional requirement for a future evaluation of remedial alternatives for SO Line, Vapor Degreaser, and loading dock soils in the event of facility demolition. However, this requirement could not be implemented through an environmental covenant; rather, an operation and maintenance (O&M) plan would be a more appropriate mechanism. An O&M plan would be necessary to ensure the performance of, and financial assurance for, the study and remedy implementation.

On-Site Containment would require the construction of a multimedia cap that meets RCRA Subtitle C hazardous waste facility cap performance standards, over the SO Line and Vapor Degreaser soils. It will be permissible to incorporate the remaining components of the facility foundation and/or loading dock into the cap, provided that the resulting cap meets applicable standards for protection of human health and the environment. This alternative is easily implemented, with numerous qualified vendors available for design and construction of the cap.

Excavation and Off-Site Disposal is readily implementable, and would utilize common equipment for excavating, loading, and transporting soils to an off-Site disposal facility. Once the facility structure was removed, this alternative would require limited preparation and planning efforts prior to implementation.

6.2.4.7 Cost

The net present worth costs (see Table 6), including capital and long-term operation and maintenance, for each of the alternatives for SO Line and Vapor Degreaser Soils, are summarized as follows:

- No Action - $0;
- Institutional Controls - $9,300 (does not include cost for evaluation of a contingent remedy or future remedy implementation);
- On-Site Containment - $337,416
- Excavation and Off-Site Disposal - $5,914,000 (estimate for management, engineering, design, characterization, excavation, transportation, and disposal).
6.2.5 Groundwater

6.2.5.1 Overall Protection of Human Health and the Environment

The groundwater contaminant plume at the Site currently exceeds PRGs for several VOCs. While natural attenuation appears to be limiting the migration of contaminants, there is the potential that the VOC plume could further migrate to downgradient receptors, including Duck Creek surface water, wetland waters, and off-Site human and ecological receptors. As presented in Section 5.5, six remedial alternatives were evaluated for addressing groundwater contamination at the Site. With the exception of the No Action alternative, each of these alternatives includes continued enforcement of the current deed restriction, converted to an environmental covenant in accordance with ORC §5301.80 et seq., to prevent potable use of Site groundwater.

The No Action alternative relies only on the enforcement of the potable use restriction, and would include discontinuing the operation of the interim pump-and-treat system. While on-Site human health risks would be minimized through the potable use restriction, there would no longer be an active mechanism for plume containment or source reduction, and there would not be continued monitoring of the nature and extent of the plume. This alternative would not meet PRGs or provide protection to the environment.

The Continued Operation of Interim System and Enhanced Monitoring with Interim System alternatives would both rely on the existing pump-and-treat system to provide some hydraulic containment near the primary VOC source areas (SO Line, RCRA sand filter beds, UST areas). Both would utilize groundwater monitoring of sufficient frequency and scope to track the areal distribution of contaminants and the contaminant levels in individual wells. For the Enhanced Monitoring with Interim System alternative, the measurement and/or analysis of MNA parameters would be added to the sampling program. The installation of additional monitoring wells might also be required to collect data in the appropriate locations for accurately measuring natural attenuation processes. This alternative would provide a means to track contaminant levels and also would provide data that might be used to calculate degradation rates and projections for future plume concentration, extent, etc. Both alternatives would provide some degree of containment and monitoring. However, neither alternative would be expected to provide additional protection to off-Site human or ecological receptors, other than the monitoring of plume extent.

The alternatives for Enhanced Monitoring with Expanded System and Enhanced Monitoring with Phytoremediation and Interim System would each provide added removal of contaminants and additional protection to prevent or limit off-Site migration of contaminants to human or ecological receptors. The Expanded System would provide added source area removal through expansion of the recovery well network, while Phytoremediation would provide additional uptake of contaminated groundwater in areas with potential discharge to Duck Creek. However, the Phytoremediation component would provide a less effective mechanism during the winter season due to the dormant state of the trees.
The alternative for Enhanced Monitoring with In-Situ Enhancements and Interim System incorporates the addition or injection of compounds (e.g. HRC™) which can enhance the biodegradation rates for chlorinated compounds in groundwater. Under favorable conditions, the enhanced rates of biodegradation can be much more effective at source reduction than groundwater pumping, particularly in low permeability units where diffusion often becomes the limiting factor for contaminant removal through pumping. If effective, this alternative can provide added protection through source removal, reduction of contaminant plume concentrations, and the reduction in potential risks to off-Site human or ecological receptors. This alternative is the most likely to meet groundwater PRGs.

6.2.5.2 Compliance with Applicable Requirements

Of the six alternatives evaluated for groundwater, only two would require additional steps to be taken for compliance with applicable regulations. For the Enhanced Monitoring with Expanded System alternative, additional system components (e.g., recovery wells, piping, treatment) would be installed in accordance with State and Federal regulatory requirements, and the existing permit would be modified to include the new components. This alternative would satisfy the applicable RCRA groundwater requirements. The alternative for Enhanced Monitoring with In-Situ Enhancements and Interim System would utilize the injection of HRC™ or similar compounds, and thus would require conformance with State regulations regarding injection into Class V wells.

6.2.5.3 Long-Term Effectiveness and Permanence

Alternatives which provide source control and removal, as well as long-term groundwater monitoring, would provide some degree of long-term effectiveness and permanence. The alternatives for Continued Operation of Interim System, Enhanced Monitoring with Interim System, Enhanced Monitoring with Phytoremediation and Interim System, Enhanced Monitoring with Expanded System, and Enhanced Monitoring with In Situ Enhancements and Interim System each would provide long-term groundwater monitoring to track the areal extent and concentrations within the VOC plume. Each of these five alternatives would continue the operation of the existing pump-and-treat system or an expanded system. While groundwater pumping serves to remove contaminants near source areas, the low conductivity of the alluvium and bedrock results in low pumping rates as well as a limited zone of capture around each recovery well. For the Enhanced Monitoring with In Situ Enhancements and Interim System alternative, the injection of HRC™ or similar compounds has the potential to achieve a relatively rapid reduction of contaminants in source areas through enhanced biodegradation. If the delivery process were to be proven effective, this alternative could provide a much higher degree of long-term effectiveness and permanence than other alternatives.

6.2.5.4 Reduction of Toxicity, Mobility or Volume by Treatment

With the exception of the No Action alternative, all groundwater alternatives result in some degree of reduction of toxicity, mobility, or volume by treatment. The five alternatives for utilizing the existing or an expanded pump-and-treat system would reduce toxicity and
mobility by removing contaminated groundwater in source areas. A reduction in volume would also be provided by the concentration of contaminants within the activated carbon of the adsorption system. The carbon would either be disposed of or treated off-Site (via hazardous waste landfill or hazardous waste incinerator) or regenerated off-Site in accordance with applicable regulations.

The alternative for *Enhanced Monitoring with In Situ Enhancement and Interim System*, if effective, would provide additional reduction in toxicity, mobility, and volume through enhanced biodegradation and the resulting breakdown of VOCs to otherwise harmless by-products.

### 6.2.5.5 Short-Term Effectiveness

All groundwater alternatives rely upon the existing deed restriction to prevent potable use of groundwater at the Site; with the exception of the *No Action* alternative, each of the groundwater alternatives would convert the existing deed restrictions to activity and use limitations in accordance with ORC §5301.80 et seq. The *No Action* alternative requires no remedial activities, and would pose no short-term risks to the community, on-Site workers, or the environment. The *Continued Operation of Interim System* and *Enhanced Monitoring with Interim System* alternatives include future groundwater sampling to monitor the VOC plume, but the sampling activities would not require special health or safety considerations beyond those normally involved.

The alternative for *Enhanced Monitoring with Expanded System* would require additional remedial activities in the form of additional well installation, piping installation, and treatment system modification. These activities would create short-term concerns related to the health and safety of remediation contractors and GVI facility workers during implementation. The alternative for *Enhanced Monitoring with Phytoremediation and Interim System* would present a short-term impact to existing habitat related to clearing of trees and brush in preparation for planting of the poplar trees. The construction component of this alternative would also create short-term concerns related to health and safety of contractors and GVI workers during implementation. The alternative for *Enhanced Monitoring with In Situ Enhancements and Interim System* would require pilot and bench scale studies to determine the appropriate parameters for injection of compounds to enhance biodegradation. Implementation of this alternative would require additional remedial activities, including injection point installation, which would have health and safety issues for contractors as well as GVI workers. However, these concerns would be manageable through an effective worker health and safety program.

### 6.2.5.6 Implementability

The *No Action* alternative for groundwater represents a baseline for comparison, and involves no implementation other than discontinuing operation of the interim system.

Under the *Continued Operation of Interim System* and *Enhanced Monitoring with Interim System* alternatives, the current conditions at the Site would be maintained. Operation and
maintenance of the pump-and-treat system would continue on a monthly basis. Potential future malfunctions could be repaired and replacement parts would be readily available. Activated carbon adsorption is a proven technology, and the performance of these systems is predictable and requires minimal oversight. MNA is a passive process which requires no additional remedial activities for implementation. The Feasibility Study indicated that MNA processes are currently occurring at the Site, though the long-term degradation rates for chlorinated compounds are uncertain. Both the current and expanded sampling programs could be readily implemented.

The Enhanced Monitoring with Expanded System alternative would involve installation of additional wells, pumps, and treatment capacity to provide localized containment and removal of contaminant hot spots. Vendors, equipment, and materials to implement this alternative would be readily available. However, the ability of newly installed wells to remove adequate quantities of water is uncertain, due to the low hydraulic conductivity of the alluvium and bedrock units.

The alternative for Enhanced Monitoring with Phytoremediation and Interim System would involve planting of poplar trees to provide an enhancement to MNA and as an additional protection against VOC migration (via groundwater seepage) to Duck Creek. The vendors, equipment, and materials required to implement the alternative would be readily available. The clearing of existing trees and vegetation in the designated phytoremediation area would be easily accomplished. Planning considerations for this alternative would include determination of the specific spacing and number of trees to be utilized, as well as coordination with remedial activities occurring in the adjacent WDA. Continued operation of the interim pump-and-treat system would be relatively easy to implement, as discussed above.

The alternative for Enhanced Monitoring with In-Situ Enhancements and Interim System would utilize a series of injection points for delivering compounds to enhance biodegradation of chlorinated VOCs. Pilot and bench scale studies would be required to determine the appropriate number of injection points, quantity and type of enhancement materials to achieve the remedial objectives. Due to the low conductivity of alluvium and bedrock materials, delivery and dispersion of the materials may be impeded and may require multiple rounds of injection. Proper pilot and design studies may be able to overcome these difficulties. Hydrogen Release Compound (HRC) is a proprietary polylactate ester that is available as an injectable, moderately fluid liquid or as an implantable hard gel. The use of this product or similar products is a proven technology for enhancing the biodegradation of chlorinated VOCs. Vendors, equipment, and materials for implementation of this alternative would be readily available.

6.2.5.7 Cost

The net present worth costs (see Table 7), including capital and long-term operation and maintenance, for each of the alternatives for groundwater, are summarized as follows:

- No Action - $0;
- Continued Operation of Interim System - $1,091,500;
- Enhanced Monitoring with Interim System - $1,264,800;
- Enhanced Monitoring with Expanded System - $1,330,200
- Enhanced Monitoring with Phytoremediation and Interim System - $1,355,600
- Enhanced Monitoring with In-Situ Enhancements and Interim System - $1,525,400

6.3 Community Acceptance

On December 7, 2006, Ohio EPA held a public meeting at the Noble County Health Department. At the meeting, Ohio EPA described the components of the amended remedy and answered questions from interested parties in attendance. Ohio EPA solicited comments at the meeting and during the public comment period, which ended on December 15, 2006. No comments were received.
7.0 SELECTED REMEDIAL ALTERNATIVE

The selected remedial alternative addresses contamination in surface and subsurface soils, wetland sediments, Duck Creek sediments, and groundwater.

The WDA and Plant Area soils, as well as wetland sediments, will be consolidated and covered in the WDA using a RCRA Subtitle C hazardous waste facility cap. This action includes the components of FS Alternative 3 WDA/PA and FS Alternative 3 Wetland. Using a modified application of Alternative 2 DC, Duck Creek sediments will be the focus of monitoring to detect potential increases in Site-related contaminants arising from construction of the final remedy in the WDA.

In addressing the impacted soils of the SO Line, Vapor Degreaser, and loading dock areas, an important factor is the presence of the Dana-Glacier Vandervell manufacturing line that currently operates at the facility. This operation and the associated equipment severely limit the access to impacted areas of soil beneath the structure. In selecting an appropriate remedy for these soils, Ohio EPA has recognized the importance of minimizing both short-term and long-term impact to the manufacturing operations as well as addressing the leaching potential from contaminated soils.

Soils of the SO Line, Vapor Degreaser, and loading dock areas will be addressed using Amended Alternative 4 SO/VD to provide a phased remedy. The initial phase will utilize the facility structure and loading dock as temporary engineering controls to prevent infiltration of precipitation and potential leaching of contaminants to groundwater. An operation and maintenance (O&M) plan will be implemented to monitor and maintain the effectiveness of these controls while the facility is actively used for industrial or commercial purposes. When the facility building and/or loading dock areas are removed in the future, the second phase of the remedy will require construction of a multimedia cap that meets RCRA Subtitle C hazardous waste facility cap performance standards, over any soils where remaining contamination exceeds the leach-based cleanup level. Given the extended time frame that may be involved, it is conceivable that a technology for effective in situ treatment or remediation of the SO/VD soils could be developed prior to the “triggering” of the second phase. At such time, Ohio EPA may require the Respondents to conduct a Focused Feasibility Study to evaluate capping and other remediation technologies or actions that may achieve the RAOs. Due to the phased nature of this remedy, the Respondents will be required to provide an adequate level of financial assurance for future implementation of the second phase.

Groundwater contamination will be addressed using Alternative 3a GW. The remedy will utilize an expanded groundwater recovery system to provide for additional source control or removal. USEPA’s OSWER Directive 9200.4-17P, “Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites”, emphasizes the importance of source controls to ensure timely attainment of remediation objectives. For this Site, Ohio EPA considers the expansion of the groundwater recovery system in key areas of the plume to be an appropriate level of effort for affecting source reduction. The remedy will also include an expanded groundwater monitoring plan to
measure natural attenuation parameters, and will require the enforcement of existing deed restrictions, converted to activity and use limitations in a recorded environmental covenant in accordance with ORC § 5301.80 et seq., preventing potable use of on-Site groundwater. In the event that they become exposed and/or subject to leaching, the SO Line soils, Vapor Degreaser soils, and additional soils beneath the loading dock will be addressed as contaminant source areas through either a cap or other equally-effective technology to prevent leaching.

The estimated costs for the selected remedial alternative are as follows:

<table>
<thead>
<tr>
<th>Component of Selected Remedial Alternative</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>WDA/Plant Area Soils</td>
<td>$1,316,900</td>
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<tr>
<td>Duck Creek Sediments</td>
<td>$39,600</td>
</tr>
<tr>
<td>Wetland Sediments</td>
<td>$539,000</td>
</tr>
<tr>
<td>SO Line/Vapor Degreaser Soils</td>
<td>$337,416</td>
</tr>
<tr>
<td>Groundwater</td>
<td>$1,330,200</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$3,563,116</strong></td>
</tr>
</tbody>
</table>

Brief descriptions of the remedial alternatives selected for each medium are presented below.

7.1 Surface Soils

Ohio EPA’s selected alternative for addressing metals and VOC contamination in surface soils is On-Site Containment. Under this alternative, Plant Area soils and additional areas of isolated soil contamination which exceed PRGs for metals and VOCs will be consolidated within the WDA. WDA soils will be sampled and analyzed for metals and TCE to determine removal and capping limits. Soil removal will not extend beneath the existing enclosed accessway in the rear of the manufacturing facility or beneath the southeast loading dock area (see Figure 11). All soils consolidated within the WDA will be graded to the appropriate contours, and a RCRA Subtitle C Hazardous Waste Facility Cap will be constructed over the soils. Excavated plant areas will be properly restored and a security fence will be installed to secure the capped area. Activity and use limitations will be imposed to prevent future construction or other destructive activities on the capped area.

Performance Standards

- Excavate, consolidate, and contain, through capping, WDA and Plant Area soils that exceed either human or ecological PRGs for metals and TCE, and to provide confirmatory sampling to document achievement of this standard. Confirmatory sampling of the Plant Area soils and the WDA will be performed consistent with the methodology and findings of the risk assessment and the basis for establishing the
PRGs. Sampling of the Plant Area soils outside of the WDA and the wetlands will focus on the areas specifically identified as “areas of [metals or VOCs] impacted soil” on Figures 4 and 5.

- Minimize impact to the existing wetland area, using appropriate engineering methods and construction practices.

- Construct a RCRA Subtitle C Hazardous Waste Facility Cap which will meet the appropriate regulatory standards of design and construction, including a 24-inch layer of compacted clay with maximum permeability of $1 \times 10^{-7}$ cm/sec (or equivalent geosynthetic clay liner), and a flexible membrane barrier with a minimum 40-mil thickness. Ensure that all components of cap design and installation are approvable by Ohio EPA.

- Implement a long-term O&M program which will preserve the integrity of the cap, such that the cap will successfully pass regularly scheduled inspections during the O&M period.

### 7.2 Subsurface Soils

As discussed above, Ohio EPA’s remedial alternative for subsurface soils has been selected with the goal of minimizing impact to ongoing manufacturing operations at the Site while addressing the leaching pathway. The selected alternative will utilize the facility structure and loading dock as temporary engineering controls to prevent infiltration of precipitation and leaching of VOCs from the SO Line, Vapor Degreaser, and loading dock soils to groundwater. An operation and maintenance (O&M) plan will be implemented to ensure the continued protectiveness of the remedy. The O&M plan will stipulate that, if the facility building and/or loading dock are removed at a future time, Ohio EPA may require a Focused Feasibility Study to evaluate capping and other remediation technologies or actions that are expected to achieve RAOs. Absent Ohio EPA approval of another remediation technology, the second phase of the remedy will be implemented to require construction of a multimedia cap over the underlying soils that continue to exceed the leach-based cleanup level (PRGs), in accordance with RCRA Subtitle C hazardous waste facility cap performance standards. It will be permissible to incorporate the remaining components of the facility foundation and/or loading dock into the cap, provided that the resulting cap meets applicable standards for protection of human health and the environment.

#### Performance Standards

- Utilize the facility building and loading dock areas as engineering controls for preventing exposure of soils where contaminants exceed the PRGs for leaching to groundwater.
• Implement an O&M program for providing periodic inspection and evaluation of the engineering controls, reporting, and taking appropriate corrective action, when needed.

• In the event of removal of the facility building or loading dock, conduct a Focused Feasibility Study to fully evaluate capping and other remediation technologies or actions that are expected to achieve RAOs.

• Unless Ohio EPA modifies the remedy in accordance with applicable policies and laws based on the results of the Focused Feasibility Study, construct a multimedia cap that meets the performance standards for a RCRA Subtitle C Hazardous Waste Facility Cap, over all soils where contaminant concentrations exceed the PRGs for leaching to ground water. The cap must include a 24-inch layer of compacted clay with maximum permeability of $1 \times 10^{-7}$ cm/sec (or equivalent geosynthetic clay liner) and a flexible membrane barrier with a minimum 40-mil thickness. Incorporation of the remaining components of the facility foundation and/or loading dock into any such cap will be permissible, provided that the cap meets RCRA Subtitle C Hazardous Waste Facility Cap performance standards and is protective of human health and the environment. All components of cap design and installation must be approved by Ohio EPA. It will be permissible to incorporate the remaining components of the facility foundation and/or loading dock into the cap, provided that the resulting cap meets applicable standards for protection of human health and the environment.

• Record at the Noble County Recorder’s Office an environmental covenant that serves to notify prospective buyers of the property of the presence of soil contamination beneath the facility building and loading dock areas.

7.3 Wetland Sediments

Ohio EPA’s selected alternative for wetland sediments is Removal and On-Site Disposal in the WDA. Under this alternative, wetland area sediments impacted by copper, lead, and tin will be sampled to establish removal limits based upon the ERBCs for the muskrat and meadow vole as representative ecological receptors. Sediments will be excavated, transported to the WDA, and consolidated with Plant Area and WDA soils. The consolidated materials will be contained using a RCRA Subtitle C Hazardous Waste Facility Cap as described in Section 7.1. Excavated wetland areas will be restored and seeded to re-establish vegetative growth.

Performance Standards

• Excavate and remove wetland sediments containing copper, lead, and tin that exceed the ERBCs for the muskrat and meadow vole (as documented in the Feasibility Study), and to provide confirmatory sampling to document achievement of this standard. Geostatistical modeling of the pre-design investigation sampling
results, as defined in the Feasibility Study, will be used to define the excavation limits relative to the PRGs.

• Restore basic surface water features in excavated areas to pre-remediation conditions.

• Restore and seed excavated areas to re-establish vegetation.

7.4 Duck Creek Sediments

Ohio EPA’s selected alternative for Duck Creek sediments is a monitoring-based approach. This alternative will include the sampling of surface water and sediments from the portion of Duck Creek adjacent to the Site, as well as from background locations. The sampling program will be conducted according to the following performance standards and decision-making criteria.

Performance Standards

• Sample surface water and sediments in Duck Creek on a semiannual basis for one year, and on an annual basis for the following two years. The first semi-annual events will be performed within one month prior to commencement of excavation and consolidation of soils and sediments in the WDA. The second semi-annual event will be performed within one month following completion of capping and earth-moving activities in the WDA. The remaining annual events will be performed during October of the two subsequent years.

• For the four anticipated sampling events, analyze all samples for antimony, arsenic, cadmium, copper, lead, nickel, and tin.

• Provide sampling summary reports, including analytical and statistical data, to Ohio EPA within 90 days of sampling.

• If metals concentrations adjacent to the Site remain at levels less than the higher of two times the background concentrations or the eco-tox thresholds, additional sampling (beyond three years) will not be required.

7.5 Groundwater

Ohio EPA’s selected alternative for VOC-contaminated groundwater at the Site includes an Expanded Groundwater Recovery System (Alternative 3a GW), consisting of additional recovery wells, to provide additional removal and treatment of contaminants near the core of the groundwater plume. Coupled with this anticipated increase in mass removal will be an Enhanced Monitoring program that will not only assess contaminant concentrations within the plume, but will also measure key parameters necessary to determine the effectiveness and rate of the natural attenuation process.
Performance Standards

- Optimize the removal rate of contaminated groundwater near the higher-concentration areas of the plume. It is expected that this can be effected through the installation of six (6) additional groundwater recovery wells of a design that is optimized for the Site-specific hydrogeology and plume configuration.

- Implement an expanded groundwater monitoring program of sufficient scope to assess natural attenuation at the Site. This monitoring will provide analytical data showing the extent and concentration of VOC contaminants within the groundwater plume, as well as additional chemical or hydraulic data relevant to determining plume characteristics. The groundwater monitoring program will be implemented in accordance with the scope and frequency detailed in Table 8.

- Provide effective long-term monitoring and enforcement of the current deed restriction, converted to activity and use limitations in a recorded environmental covenant in accordance with ORC § 5301.80 et seq., that prevents potable use of Site groundwater.

- Ensure that groundwater along any portion of the downgradient property line continuously meets MCLs for any Site-related contaminant of concern.

- Achieve MCLs for Site-wide groundwater, as measured by any and all on-Site or off-Site monitoring wells, within 30 years.

- Evaluate the efficacy of long-term groundwater recovery activities in accordance with the following methods and decision-making criteria:

  1) Using both historical data and baseline groundwater monitoring data to be collected prior to operation of the expanded recovery system, refine the data trends that were initially developed in the Feasibility Study.

  2) Monitor the groundwater at the established frequency (Table 8). Compare the contaminant concentrations to those predicted by the data trends, and continue to refine the predictions based on the accumulated data.

  3) Compare the quantity of VOCs collected by the recovery system to the estimated decrease of mass within the plume; if possible, separate the effects of groundwater recovery from the effects of natural attenuation.

  4) When the data trends indicate that the groundwater will achieve the performance standards of the Amended Decision Document through natural attenuation alone, or that groundwater recovery and treatment is not meaningfully reducing the length of time required to meet the performance standards, consideration will be given to shutting down all, or perhaps portions, of the system.

  5) Groundwater monitoring will continue at the specified frequency (Table 8), comparing the results against the refined predictions for natural attenuation processes.
8.0 GLOSSARY

Aquifer - An underground geological formation capable of holding and yielding water.

Baseline Risk Assessment - An evaluation of the risks to humans and the environment posed by a site.

Carcinogen - A chemical that causes cancer.

CERCLA - Comprehensive Environmental Response, Compensation and Liability Act. A federal law that governs cleanup of hazardous materials sites under the Superfund Program.


Decision Document - A statement issued by the Ohio Environmental Protection Agency giving the Director’s selected remedy for a site and the reasons for its selection.

Ecological Receptor - Animals or plant life exposed to chemicals released from a site.

Environmental Covenant - A servitude arising under an environmental response project that imposes activity and use limitations and that meets the requirements established in section 5301.82 of the Revised Code.

Exposure Pathway - Route by which a chemical is transported from the site to a human or ecological receptor.

Feasibility Study - A study conducted to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to a decision-maker and an appropriate remedy selected.

Hazardous Substance - A chemical that may cause harm to humans or the environment.

Hazardous Waste - A waste product, listed or defined by the RCRA, which may cause harm to humans or the environment.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Receptor -</td>
<td>A person exposed to chemicals released from a site.</td>
</tr>
<tr>
<td>NCP -</td>
<td>National Contingency Plan. The framework for remediation of hazardous materials sites specified in CERCLA.</td>
</tr>
<tr>
<td>O&amp;M -</td>
<td>Operations and Maintenance. Those long-term measures taken at a site, after the initial remedial actions, to assure that a remedy remains protective of human health and the environment.</td>
</tr>
<tr>
<td>Preferred Plan -</td>
<td>The plan chosen by the Ohio EPA to remediate the site in a manner that best satisfies the evaluation criteria.</td>
</tr>
<tr>
<td>Remedial Action Objectives -</td>
<td>Specific goals of the remedy for reducing risks posed by the site.</td>
</tr>
<tr>
<td>Remedial Investigation -</td>
<td>A study conducted to collect information necessary to adequately characterize the site for the purpose of developing and evaluating effective remedial alternatives.</td>
</tr>
<tr>
<td>Responsiveness Summary-</td>
<td>A summary of all comments received concerning the Preferred Plan and the Ohio EPA’s response to all issues raised in those comments.</td>
</tr>
<tr>
<td>Water Quality Criteria -</td>
<td>Chemical and thermal standards that define whether a body of surface water is unacceptably contaminated. These standards are intended to ensure that a body of water is safe for fishing, swimming and as a drinking water source.</td>
</tr>
<tr>
<td>TCE -</td>
<td>Trichloroethylene. A common industrial solvent and cleaner.</td>
</tr>
<tr>
<td>PCE -</td>
<td>Perchloroethylene. A common industrial solvent and cleaner, often used for dry cleaning.</td>
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### TABLE 1. Summary of Hazard Indices and Excess Lifetime Cancer Risks (cont)

<table>
<thead>
<tr>
<th>Populations</th>
<th>Exposure Media</th>
<th>Exposure Pathway</th>
<th>Hazard Index</th>
<th>ELSP</th>
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<tr>
<td>Construction Workers</td>
<td>Site-Wide 9'-10' Soil</td>
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<td>6.6-11</td>
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<tr>
<td></td>
<td></td>
<td>Inhalation of VOCs</td>
<td>1.1E-03</td>
<td>6.6-10</td>
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<tr>
<td></td>
<td></td>
<td>Dermal Contact</td>
<td>2.2E-01</td>
<td>4.6-07</td>
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<td></td>
<td>Soil Ingestion</td>
<td>4.8E-01</td>
<td>1.6-03</td>
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<td></td>
<td></td>
<td>Population Totals:</td>
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<td>1.2-06</td>
</tr>
<tr>
<td>On-Site Adult Residents</td>
<td>Site-Wide 9'-10' Soil</td>
<td>Inhalation of Fugitive Dusts</td>
<td>6.3E-03</td>
<td>1.2-08</td>
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<td></td>
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<td></td>
<td></td>
<td>Soil Ingestion</td>
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<td></td>
<td></td>
<td>Groundwater Ingestion</td>
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<td>1.2-06</td>
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<tr>
<td></td>
<td></td>
<td>Population Totals:</td>
<td>1.0E+01</td>
<td>1.2-04</td>
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<td>On-Site Child Residents</td>
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<td>Inhalation of Fugitive Dusts</td>
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<td>9.6-09</td>
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<td></td>
<td>Wetlands Sediment</td>
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<td>Duck Creek Surface Water</td>
<td>Dermal Contact</td>
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<td></td>
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<td>Population Totals:</td>
<td>4.9E-01</td>
<td>4.6-04</td>
</tr>
</tbody>
</table>

Cancer risk exceeds point of departure but within risk range
Hazard index or cancer risk exceeds risk range
Carcinogenic risk data Not Available

1 Note the following relationships:

1.E-5 = 1 in 100,000
1.E-6 = 1 in 1,000,000
1.E-7 = 1 in 10,000,000
1.E-8 = 1 in 100,000,000
1.E-9 = 1 in 1,000,000,000
1.E-10 = 1 in 10,000,000,000
1.E-11 = 1 in 100,000,000,000

Example, 3.2E-5 = 3.2 in 100,000
<table>
<thead>
<tr>
<th>Constituent</th>
<th>Group</th>
<th>WDA/Plant Area Soils (mg/kg)</th>
<th>Duck/Creosol</th>
<th>Sediment (mg/kg)</th>
<th>Wetland Sediment (mg/kg)</th>
<th>Non-Catalytic Wetland Sediment (mg/kg)</th>
<th>Groundwater (ug/l)</th>
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<tbody>
<tr>
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<td>Metal</td>
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<td>Cadmium</td>
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<td>Copper</td>
<td>Metal</td>
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<td>---</td>
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<td>3000</td>
<td>1300</td>
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<tr>
<td>Lead</td>
<td>Metal</td>
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<td>Nickel</td>
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<td>Tin</td>
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<td>---</td>
<td>290</td>
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<td>Benz(a)pyrene</td>
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<td>Benz(b)fluoranthene</td>
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<td>Benz(ghi)perylene</td>
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<td>96</td>
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<td>Benzo(k)fluoranthene</td>
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<tr>
<td>Bis(2-ethylhexyl)phthalate</td>
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<td>34</td>
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<td>Di-n-butyl phthalate</td>
<td>SVOC</td>
<td>17,033</td>
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<td>Di-n-octyl phthalate</td>
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<td>Fluoranthene</td>
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<td>Naphthalene</td>
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<tr>
<td>Pentachlorophenol</td>
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<td>Phenanthrene</td>
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<td>Pyrene</td>
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<td>1,1,1-Trichloroethane</td>
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<td>1.3</td>
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<tr>
<td>1,3-Dichlorobenzene</td>
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<td>133</td>
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<td>1,4-Dichlorobenzene</td>
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<td>---</td>
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<td>Benzene</td>
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<tr>
<td>Bromodichloromethane</td>
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<td>---</td>
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<tr>
<td>Chloroform</td>
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<td>Chloromethane</td>
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<td>cis-1,2-Dichloroethene</td>
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<td>0.12</td>
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<td>70</td>
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<td>Dichlorodifluoromethane</td>
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<tr>
<td>Dichloromethane</td>
<td>VOC</td>
<td>3.2</td>
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<td>Ethylbenzene</td>
<td>VOC</td>
<td>16</td>
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<tr>
<td>Methylene Chloride</td>
<td>VOC</td>
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<tr>
<td>Tetrachloroethane</td>
<td>VOC</td>
<td>0.27</td>
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<td>Toluene</td>
<td>VOC</td>
<td>7.7</td>
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<td>100</td>
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<tr>
<td>trans-1,2-Dichloroethane</td>
<td>VOC</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>100</td>
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<tr>
<td>Trichloroethene</td>
<td>VOC</td>
<td>0.046</td>
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<tr>
<td>Vinyl chloride</td>
<td>VOC</td>
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<td>Xylenes, total</td>
<td>VOC</td>
<td>190</td>
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<td>10000</td>
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<tr>
<td>1,3-Dichloroethene</td>
<td>VOC</td>
<td>---</td>
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<td>---</td>
<td>7</td>
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</tr>
<tr>
<td>1,2-Dichloroethane</td>
<td>VOC</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>6</td>
<td>---</td>
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</tr>
</tbody>
</table>

Notes:
--- Not Applicable, PRG Not Established
SVOC - Semivolatile Organic Compound
VOC - Volatile Organic Compound
mg/kg - milligrams per kilogram
ug/l: micrograms per liter
### TABLE 3. Cost Evaluation - WDA and Plant Area Soils Remedial Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Initial Cost</th>
<th>O&amp;M Cost Year 1</th>
<th>O&amp;M Cost Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Institutional Controls</td>
<td>$72,800</td>
<td>$18,900</td>
<td>$372,100</td>
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<tr>
<td>On-Site Containment</td>
<td>$973,300</td>
<td>$26,100</td>
<td>$1,319,100</td>
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<tr>
<td>Removal, On-Site Treatment, Off-Site Disposal</td>
<td>$2,853,139</td>
<td>$0</td>
<td>$2,857,851</td>
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</tbody>
</table>

### TABLE 4. Cost Evaluation - Duck Creek Sediment Remedial Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Initial Cost</th>
<th>O&amp;M Cost Year 1</th>
<th>O&amp;M Cost Year 2</th>
<th>Total Present Monthly Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Long-Term Monitoring</td>
<td>$0</td>
<td>$7,000-12,000</td>
<td>$38,600</td>
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### TABLE 5. Cost Evaluation - Wetland Sediment Remedial Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Initial Cost</th>
<th>O&amp;M Cost Year 1</th>
<th>O&amp;M Cost Year 2</th>
<th>Total Present Monthly Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Removal and On-Site Disposal within the WDA</td>
<td>$561,700</td>
<td>$10,000</td>
<td>$591,700</td>
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<tr>
<td>Removal and Off-Site Disposal</td>
<td>$3,845,200</td>
<td>$10,000</td>
<td>$4,645,200</td>
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## TABLE 6. Cost Evaluation - SO Line and Vapor Degreaser Soils Remedial Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>50</th>
<th>50</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Institutional Controls</td>
<td>$10,000</td>
<td>$0</td>
<td>$9,300</td>
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<tr>
<td>On-Site Containment</td>
<td>$337,416</td>
<td>$0</td>
<td>$337,416</td>
</tr>
<tr>
<td>Excavation and Off-Site Disposal</td>
<td>$6,500,000</td>
<td>$0</td>
<td>$5,914,000</td>
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</tbody>
</table>

1 Assumption minimum 10-yr time frame prior to implementation

## TABLE 7. Cost Evaluation - Groundwater Remedial Alternatives

<table>
<thead>
<tr>
<th>Alternative</th>
<th>50</th>
<th>50-577,500</th>
<th>50-1,081,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Action</td>
<td>$0</td>
<td>$625,000-577,500</td>
<td>$1,081,500</td>
</tr>
<tr>
<td>Continued Operation of Interim System</td>
<td>$0</td>
<td>$625,000-577,500</td>
<td>$1,081,500</td>
</tr>
<tr>
<td>Enhanced Monitoring with Interim System</td>
<td>$0</td>
<td>$677,500-1,276,500</td>
<td>$1,264,800</td>
</tr>
<tr>
<td>Enhanced Monitoring with Expanded System</td>
<td>$70,400</td>
<td>$677,500-1,276,500</td>
<td>$1,264,800</td>
</tr>
<tr>
<td>Enhanced Monitoring with Phytoremediation and Interim System</td>
<td>$82,300</td>
<td>$699,500-1,209,500</td>
<td>$1,255,500</td>
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<tr>
<td>Enhanced Monitoring with In-Situ Enhancements and Interim System</td>
<td>$214,000</td>
<td>$675,500-$177,800</td>
<td>$1,525,400</td>
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# Table 8: Groundwater Monitoring Scope and Frequency

<table>
<thead>
<tr>
<th>Well Group</th>
<th>Monitoring Type</th>
<th>Monitoring Frequency</th>
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<tbody>
<tr>
<td><strong>Long-Term Plume Assessment Wells</strong></td>
<td></td>
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</tr>
<tr>
<td>MW-6 (b:790) &amp; MW-7 (b:796) MW-8 (b:677)</td>
<td>Analytical - VOCs and MNA parameters</td>
<td>• Two baseline sampling events prior to system startup.</td>
</tr>
<tr>
<td>MW-13 (a:723) &amp; MW-16 (a:713)</td>
<td></td>
<td>• Years 1 and 2 - Quarterly</td>
</tr>
<tr>
<td>MW-21 (b:690) &amp; MW-22 (b:709)</td>
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<td>• Years 3 to 10 - Annually</td>
</tr>
<tr>
<td>MW-24 (a:13) &amp; MW-25 (b:702)</td>
<td></td>
<td>• Years 11 to 30 - Every Five Years</td>
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<tr>
<td>MW-31 (a:694)</td>
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<tr>
<td><strong>Un-Gradient and Down-Gradient Property Line Wells</strong></td>
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<tr>
<td>MW-3 (a:698) &amp; MW-4 (b:658) MW-5 (a:760)</td>
<td>Analytical - VOCs and MNA parameters</td>
<td>• Two baseline sampling events prior to system startup.</td>
</tr>
<tr>
<td>MW-6 (b:694) &amp; MW-7 (a:722)</td>
<td></td>
<td>• Years 1 to 10 - Annually</td>
</tr>
<tr>
<td>MW-8 (a:720) &amp; MW-9 (a:696)</td>
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<td>• Years 11 to 30 - Every Five Years</td>
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<tr>
<td><strong>Groundwater Control Wells</strong></td>
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<tr>
<td>MW-6 (b:730) &amp; MW-7 (b:738) MW-9 (b:700)</td>
<td>Groundwater elevation measurement</td>
<td>• Years 1 to 5 - Quarterly</td>
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<tr>
<td>MW-10 (b:673) &amp; MW-11 (b:695)</td>
<td></td>
<td>• Long-term frequency to be determined at 5 yr. review.</td>
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<tr>
<td>MW-12 (b:694) &amp; MW-13 (a:723)</td>
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<tr>
<td>MW-14 (a:713) &amp; MW-15 (a:718)</td>
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<td>MW-17 (a:718) &amp; MW-18 (a:717)</td>
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<tr>
<td>MW-19 (a:705) &amp; MV-20 (a:707)* MV-21 (a:712)</td>
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<tr>
<td><strong>No Further Sampling</strong></td>
<td>No further sampling anticipated</td>
<td>Not Applicable</td>
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<tr>
<td>MW-1 (a:698) &amp; MW-2 (a:697)</td>
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<td>MW-3 (a:694) &amp; MV-2 (a:718)* MV-3 (a:717)</td>
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<td>MW-4 (a:716) &amp; MW-5 (a:718)</td>
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<tr>
<td>MV-6 (b:696) &amp; MV-7 (b:698)</td>
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