Final

Preliminary (30-Percent) Design Report – Industrial Waste Pit Removal Action

Waste Disposal Engineering (WDE) Closed Landfill
14437 Crosstown Boulevard
Andover, Minnesota

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11129194| Report No 5 | April 10, 2018

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1. Introduction

GHD Services Inc. (GHD) has prepared this Preliminary (30-Percent) Design Report for the removal of the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site). This preliminary design is based on the Revised Conceptual Design (GHD; February 15, 2018) and is intended to define the primary elements of the project scope before proceeding with the detailed design.

Preliminary design construction plans are provided in Appendix A, and a list of construction specifications is provided in Appendix B. The Site location is shown on Drawing G001 (Appendix A), and the Site plan is shown on Drawings C001 and C002 (Appendix A).

1.1 Overview and Background

Prior to Minnesota Pollution Control Agency (MPCA) permitting the WDE Site as a solid waste disposal facility in 1971, the WDE Site was operated as a solid waste dump ("dump") for at least nine years by previous owners of the property. The dump was established around 1963 by Leonard E. Johnson and was licensed, at least in the later years of the Johnson operation, by Grow Township. The dump was purchased by Waste Disposal Engineering, Incorporated (WDE, Inc.) in 1968.

In 1970, WDE, Inc. submitted a permit application to the MPCA to operate a solid waste disposal facility. A proposal to dispose industrial materials in a specially constructed trench (i.e. pit) within the landfill was included in the permit application. On March 30, 1971, the MPCA issued permit SW 28 to WDE, Inc. to operate the WDE Site as a solid waste disposal facility including construction and operation of the WDE industrial waste pit.

Construction of the industrial waste pit began in 1971, was completed in 1972, and subsequently approved by the MPCA. The design of the industrial waste pit consisted of 2-feet of clay liner overlain with a six inch thick bituminous liner followed by six inches of crushed limestone. Depth to the groundwater beneath the industrial waste pit was to be at least ten feet. Materials to be disposed in the industrial waste pit included solvents, oils, paint sludges, caustic, and acids. A permanent record of the disposal activities at the industrial waste pit was to be kept at the WDE Site by WDE, Inc. and the information reported monthly to the MPCA. It is believed that the industrial waste pit was operated from November 1972 to January 1974.

Site photographs of the industrial waste pit and aerial photos indicated that WDE, Inc. did not follow the plans approved by the MPCA for pit disposal operations. The MCPA ordered the WDE industrial waste pit closed effective February 1, 1974 due to changes in regulations and because the MPCA determined that a high potential for groundwater pollution existed at the WDE Site. WDE, Inc. submitted volume reports to Anoka County indicating that 2,318 55-gallon drums had been disposed at the WDE Site in 1973 and that a total of 3,354 drums had been disposed at the WDE Site during the two-year period between January, 1972 and January, 1974. It is unclear as to how many of these drums were disposed within the industrial waste pit.

The bulk of waste disposed at the WDE Closed Landfill was ordinary municipal waste. In addition to municipal waste, unknown quantities of demolition waste, industrial waste, and hazardous substances were deposited in the landfill. It has been estimated that, by volume, 95% of disposed hazardous substances disposed within the industrial waste pit are acids, oil, paint/paint sludge, and solvents.

Substantial site remediation actions were performed from 1992 to 1994 and included the construction of a multilayer soil cap, a slurry wall/NAPL control system around the industrial waste pit, a landfill gas venting system, two perimeter gas barrier membranes, stormwater management, and relocation of wetlands. The soil-bentonite slurry wall (slurry wall) was constructed to provide a low permeable perimeter barrier around the industrial waste pit and to contain groundwater and impacted soils. In addition, a groundwater extraction well (EW9) was installed inside the north end of the slurry wall to extract groundwater from inside the slurry wall.

The multilayer soil cap installed over the refuse and industrial waste pit consists of the following components (bottom to top); 2 to 4 foot original soil cover, 24-inch clay barrier layer, 12-inch sand drainage layer, 18-inch sand filter layer, 12-inch clean fill layer, 6-inch topsoil layer, and a vegetative cover.

1.2 Objectives and Scope

The primary objective of this preliminary design is to define the primary elements of the industrial waste pit removal action.

GHD understands that the MPCA has determined that the removal of the industrial waste pit at the WDE Closed Landfill is the most effective method to reduce long-term operation and maintenance costs associated with environmental concerns at the Site. Industrial waste drums and containers were buried in a clay and asphalt lined pit between November 1972 and January 1974. The Site plan showing existing conditions in the immediate vicinity of the pit area is shown on Drawing C002 (Appendix A).

MPCA finds that the industrial waste pit is leaking and contaminating the groundwater beneath it. Identified contaminants include polychlorinated biphenyls (PCBs), paint wastes, heavy metals, solvents, and other volatile organic compounds. Groundwater extraction and treatment systems, along with a vapor extraction system, installed in the pit, are operated at this Site to reduce health and environmental risks posed by this contamination.

Prior to operation of the groundwater extraction systems, surface water quality standards in nearby Coon Creek were exceeded due to impacted groundwater from the Site discharging into the creek. Most residents are served by a municipal water supply that is not impacted. However, even with these environmental controls in place, GHD understands that the WDE Closed Landfill ranks at the top of the list of Closed Landfill Program sites posing risks to human health and the environment.

GHD understands that the primary remedial action objectives of the industrial waste pit removal action are to:

1. Remove all materials (soil, drums, waste materials, clay liner, etc.) from within the disposal portion of the industrial waste pit and transport the material to an off-Site disposal facility
2. Remove unsaturated soil directly beneath the base of the industrial waste pit and transport the material to an off-Site disposal facility
3. No disturbance to the existing slurry wall near and below the groundwater table
4. Restore the groundwater extraction system for continued containment and treatment of groundwater from within the industrial waste pit slurry wall limits
5. Restore the removal action area to allow for potential future in-situ treatment of groundwater
6. Reduce environmental risks to nearby residents
7. Reduce on-going Site operation and maintenance (O&M) costs

2. Existing Site Conditions and Pre-Design Investigation Summary

Drums and containers were disposed within the industrial waste pit in the approximate timeframe of November 1972 to January 1974. The disposed materials were reported to include, but not limited to, spent solvents, oils, paint/paint sludges, caustics, and acids. The top of the waste interval within the pit ranges from approximately 10 to 15 feet below ground surface (bgs). The bottom of the waste ranges from approximately 18 to 24 feet bgs. The base of the pit and sidewalls are lined with an asphalt layer that was reportedly underlain by approximately 2-feet of clay. The dimensions of the constructed pit area are approximately 100 feet by 300 feet. However, the disposal fill area was determined to be approximately 100 feet by 150 feet due to early closure of the pit. At the time of closure in the mid 1970's, a 2 to 4 foot soil cover was placed over the pit waste materials.

A multi-layer soil cap was installed over the industrial waste pit in the early 1990's that resulted in the following soil materials overlaying the waste (bottom to top): 2 to 4 foot original soil cover, 24-inch clay barrier layer, 12-inch sand drainage layer, 18-inch sand filter layer, 12-inch clean fill layer, 6-inch topsoil layer, and a vegetative cover. The soil adjacent to the pit primarily consists of sand to unknown extent where municipal waste will then likely be encountered. The soil below the industrial waste pit primarily consists of sand to the groundwater table. The average groundwater table is approximately 13 feet below the bottom of the pit waste interval.

A soil-bentonite slurry wall (slurry wall) was constructed in the early 1990's to provide a low permeable perimeter barrier around the industrial waste pit to facilitate containment of the waste materials and impacted groundwater. A groundwater extraction well (EW9) installed inside the north end of the slurry wall extracts groundwater from beneath the pit area to minimize migration of impacted groundwater from the pit area. A groundwater extraction system also operates along the northern perimeter of the landfill to prevent impacted groundwater from migrating off-Site.

The results of a pre-design investigation for the pit removal action are documented in the Pre Design Investigation Report – Industrial Waste Pit Removal Action (GHD; June 1, 2017). From the investigation, concentrations of contaminants measured in most samples collected from within the pit waste area and between the bottom of the pit and the groundwater table exceeded the criteria for characteristic hazardous waste. Soil and waste materials within the pit exceeded the hazardous waste criteria for volatile organic compounds (VOCs) and metals and exceeded the Toxic Substances Control Act (TSCA) criteria for PCBs. Soil below the pit exceeded the hazardous criteria for VOCs and metals. Soil and waste materials within the pit and soil below the pit may potentially exceed the hazardous criteria for semi-volatile organic compounds (SVOCs). These parameters were not detected at concentrations exceeding the hazardous criteria; however, the laboratory detection limits exceeded the hazardous criteria. Based on the high contaminant concentrations, non-aqueous phase liquids (NAPLs) may be present.

3. Preliminary Design

This section describes the primary elements of the industrial waste pit removal action. The preliminary design was based on information obtained during the pre-design investigation and historical groundwater elevations. Figures 3.1 through 3.4 illustrate average groundwater elevation contours and industrial waste pit cross-sections.

3.1 General Project Approach and Strategy

Overburden soil will be excavated from the industrial waste pit and surrounding area. This will allow the construction of a work area bench within the pit area and to allow for a temporary enclosure to be constructed over the pit to control vapors during the removal activities.

The primary remedial action objective is to remove all materials (soil, drums, waste materials, and clay line) from within the industrial waste pit. Once the working bench is prepared and the temporary enclosure with vapor controls are set up, a ramp will be excavated to access the pit waste interval from the north. The drums/containers within the pit will be removed following a standard process including an in-place inspection/assessment, removal, preliminary staging/testing, potential consolidation, characterization, profiling, loading, transportation, and disposal.

MPCA is in the process of preparing a written determination for waste handling and disposal. This determination is expected to state that the removed materials from the industrial waste pit will not be considered a listed hazardous waste. Resource Conservation Recovery Act (RCRA) requirements will only apply if the materials exhibit a characteristic of hazardous waste. The determination is also expected to state that PCB containing waste will be assessed, handled, and disposed based on an “as found” basis. TSCA regulations will only apply to wastes with PCB concentrations exceeding 50 parts per million (ppm).

In addition to the removal of the drums/containers, fill soil within the pit will also be removed with the drums and containers. An additional remedial action objective is to remove the clay liner and unsaturated sandy subsoil directly beneath the industrial waste pit. Prior to beginning excavation, a sampling program will be implemented to characterize the clay liner and sandy subsoil. The sampling will attempt to delineate areas/intervals as characteristically hazardous and TSCA material. The intent of the sampling is to prevent mixing soil during excavation, thereby preventing increased amounts of soil to be disposed as TSCA material at significantly increased disposal costs.

GHD prepared a memorandum providing the basis for the subsoil excavation elevation. A copy of this memorandum (GHD; March 8, 2018) is provided in Appendix C. The design elevation was based on the considerations of historical groundwater elevations, capillary fringe interval based on pit subsoil type, and equipment loading/operations that would contribute to "pumping" with localized increase of the groundwater elevation and saturated conditions. This design uses an excavation elevation of 874 feet above mean sea level (AMSL). This elevation accounts for the average groundwater elevation of 872 feet AMSL and a capillary fringe interval of 2 feet to maximize the amount of source material to be removed without dewatering or working within saturated conditions. Low ground pressure equipment will be specified for the subsoil excavation to reduce capillary fringe rise from equipment operations. In addition, at least a 2 foot thick soil buffer will be maintained above the design excavation elevation of 874 AMSL for equipment to operate from as the work progresses. GHD and MPCA would provide direction to the contractor for the final excavation depth based on actual conditions encountered during the work.

Overburden soil excavated to create the work area bench is assumed not to be impacted by industrial waste but may contain municipal waste. This excavated material will be segregated and stockpiled at the site during the industrial waste pit removal. Following excavation of the pit and subsoil, the area will be backfilled using the stockpiled overburden soil. It is planned that final landfill grades will be constructed by utilizing all stockpiled overburden soil without importing fill soil from an offsite source. The final landfill grades will generally follow the current grades to prevent having to construct new stormwater control features.

Following backfilling and grading, the landfill gas extraction and groundwater extraction system components removed during the pit removal will be modified or replaced. The project will be completed by restoring vegetation and stormwater controls.

The Contractor will be required to collect and analyze waste and soil samples for characterization and waste profiling and prepare a Sampling and Analysis Plan (SAP) discussing sampling protocols, laboratory analyses, quantitation limits, and quality assurance / quality control. An example outline for the SAP is provided in Appendix D. A detailed example SAP will be included in the project specifications for the Contractor's reference in preparation of their own plan.

GHD will prepare a Construction Quality Assurance Project Plan (CQAPP) discussing the construction monitoring and oversight requirements to help ensure that the Contractor complies with all project construction plans and specifications. An outline for the CQAPP is provided in Appendix E.

3.2 Safety, Security, and Work Zones

The Contractor will be required to prepare a detailed Site-Specific Health and Safety Plan (HASP) in accordance with hazardous waste operations and emergency response (HAZWOPER) regulations (29 CFR 1910.120. The primary purpose of this plan is to provide protocols to help ensure the safety of Site workers. The HASP will provide details on physical, chemical, and biological hazards, air monitoring protocols, respiratory protection, personal protective equipment (PPE) requirements, site controls, and emergency procedures. The Contractor will determine the extent that engineering controls will be utilized to reduce PPE and respiratory protection requirements. It is anticipated that any worker who is working within the industrial waste pit or within the immediate vicinity of waste materials will wear Level A or B PPE.

The existing fence provides security around the perimeter of the Site and two locked entrance gates prevent unauthorized access. One gate is located at the north Site boundary along Crosstown Boulevard, and the other is located near the southeast corner of the Site boundary along Hanson Boulevard. The entrance gates will be kept closed during the work, except to allow vehicles and equipment to enter/exit the Site.

The Contractor will be required to implement additional security and safety measures including setting up designated work areas including the support zone, contaminant reduction zone, and exclusion zone. The perimeter of the exclusion zone will be delineated by a temporary fence with limited access. Decontamination will be required prior to exiting the exclusion zone. Site security features are shown on Drawing C003 (Appendix A).

3.3 Contingency and Emergency Response Planning

A draft Contingency and Emergency Response Plan (CERP) has been prepared to detail pre-emergency response planning, emergency response, and contingency plans in general accordance with 29 CFR 1926.65 (l) and 29 CFR 1910.120(l). A copy of the CERP is provided in Appendix F. The CERP includes a discussion of pre-emergency planning, emergency response, and contingency plans. Pre-emergency planning identifies emergency contacts, personnel roles and responsibilities, lines of authority, communication procedures, emergency recognition and prevention, Site security, equipment, and supplies. The CERP lists the emergency contacts and identifies the City of Andover Fire Chief as the Incident Commander. Emergency response planning will provide procedures for medical emergencies, fire/explosion emergencies, hazardous material release emergencies, and evacuation. Contingency planning will address severe weather and hazardous material releases/spills. An emergency response communication and lines of authority flow chart is shown on Figure 2.1 (Appendix F). Emergency decision flow charts are shown on Figures 3.2, 3.3, and 3.4.

A secondary access road will be constructed to allow for entrance to or exit from the site should an incident or weather conditions prevent use of the primary access road. The secondary access road will be located between the industrial waste pit area and the entrance near the southeast corner of the Site property along Hanson Boulevard. The access roads are shown on Figure 1.3 (Appendix F).

3.4 Site Feature Removals and Abandonments

Prior to beginning the industrial waste pit removal work, several existing Site features will be removed and/or abandoned or protected. These features include monitoring wells/points, extraction wells, landfill gas extraction wells, gas probes, piping, and electrical wiring/conduit. In addition, VEVOR system components will require removal prior to beginning the work. A summary of these features is included in Table 3.1. The locations of these features within the work area are shown on Drawing C004 (Appendix A).

Some features will be modified and/or replaced following completion of the work. Refer to Section 3.16.

3.5 Project Utilities

Primary utilities needed for completion of the work include water supply and electricity. The Contractor will provide water for decontamination and other needs. The Contractor will be allowed to utilize the onsite electrical supply for general construction needs. However, the onsite electrical supply will not be sufficient to operate the vapor control equipment for the temporary enclosure. The Contractor will be required to provide generators to operate this equipment.

3.6 Work Area Preparation

Overburden soil will be excavated from the industrial waste pit and surrounding area, extending approximately 50 to 200 feet from the pit. Overburden soil will be removed to within 3 to 5 feet of the top of the industrial waste pit interval. A minimum of 1 feet of soil will remain over the top of the pit to provide vapor control. This will allow the construction of a work area bench within the pit area and to allow for a temporary enclosure to be constructed over the pit to control vapors during the removal activities. The bench will provide working limits for waste management and equipment operation, allow for an organized work flow, and to limit disturbance to the remainder of the Site. The working bench will be graded to allow potential precipitation and surface water to drain from the area without contacting impacted materials and wastes. The work area and grading are shown on Drawing C005 (Appendix A).

3.7 Materials and Equipment Staging Areas

The Contractor will be required to provide a Site layout showing the material and equipment staging areas to be used during the industrial waste pit remedial action. The staging areas can be segregated into two primary categories, the support zone and the exclusion zone. The support zone represents a non-impacted area outside of the exclusion zone. The exclusion zone is where the primary work activities will occur, such as excavation and removal, waste testing and consolidation, characterization and profiling, and waste storage. The general staging plan is shown on Drawing C006 (Appendix A).

3.7.1 Support Zone

It is anticipated that the support zone will be located primarily within the immediate vicinity of the exclusion zone and within the general vicinity of the primary access road from the north property boundary to the work area. The Contractor and Engineer job trailers will likely be located near the existing gas to energy plant building.

3.7.2 Exclusion Zone

Three primary waste and soil staging areas will be utilized within the exclusion zone. All staging areas will be constructed to contain and control releases of materials during the drum removal work.

In addition, a path for emergency egress through each staging area will be present and maintained at all times during the work. The staging area locations are shown on Drawing C006 (Appendix A).

The preliminary waste staging area will be located within the vapor controlled temporary enclosure adjacent to the industrial waste pit. This area will be used for compatibility and categorization testing to determine if wastes are compatible and can be consolidated. Consolidated wastes will be moved to the waste characterization staging area.

The waste characterization staging area will be located outside of and adjacent to the temporary enclosure. Consolidated wastes, overpacked drums, and drum debris will be characterized within this staging area. Characterization samples will be collected and submitted for laboratory analysis to develop waste disposal profiles. Characterized and profiled wastes will be moved to the non-hazardous or hazardous waste storage area.

A temporary non-hazardous and hazardous waste storage and loading area will be located adjacent to the waste consolidation and characterization area. This area will used to load the containers and wastes onto vehicles for transportation to the authorized disposal facilities.

3.8 Temporary Enclosure

For the removal action, a temporary membrane-covered frame structure will be used to enclose the areas of soil/waste excavation, preliminary waste screening, waste/soil segregation and bulking, waste/soil loading and packaging, and decontamination of equipment, materials, and workers. In addition, the temporary enclosure structure will allow for the control of contaminant air emissions, dust control, prevent precipitation infiltration into the excavation area and spread of contamination, provide a visual barrier to most work activities, and also provide some noise control. Depending on the work area layout, a second temporary structure may be used. Following waste excavation from the waste pit within the temporary enclosure, the excavation will be backfilled with on-site soils and/or relocated municipal waste. A temporary cover will be placed over the backfilled and regraded working area and the temporary enclosure will be removed. Following completion of pit excavation, the temporary structure will be dismantled and demobilized from the Site.

A preliminary footprint of the structure is approximately 157 feet wide and 386 feet long and will be a one-time assembly and placement. The height of the enclosure is expected to be approximately 54 feet. The temporary enclosure footprint is shown on Drawing C005 (Appendix A). A cross-section of the temporary enclosure is provided in Appendix G. The tension membrane will consist of polytetrafluoroethylene (PTFE) or polyvinyl chloride (PVC) coated woven fiberglass. An aluminum frame/truss and clamping system will join the membrane panels together.

The structure will be placed on a prepared and graded ground surface. The building will be anchored using ballast and/or anchored into existing soils. The building will be designed with a sufficient number of man-doors with a maximum spacing of 100 feet to allow worker egress to/from the structure. A large cargo door will be used to allow movement of equipment and materials into and out of the structure. There will likely be several ventilation penetrations connected to contaminant emissions control equipment along with other building ventilation features for the control/venting of vehicle emissions. Supplemental lighting will be utilized if necessary.

Consistent with Chapters 16 and 31 of the Minnesota Building Code and Chapter 31 of the Minnesota Fire Code requirements for membrane and temporary structures, the enclosure will meet the following specifications:

- Risk category – IV
- Live load – 20 pounds per square foot (psf)
- Wind speed – 120 miles per hour (mph)
- Rain load – 3.25 in
- Snow load – 50 psf (if necessary)

The Contractor will be required to provide design calculations and fabrication drawings to demonstrate compliance with the project specifications.

Given the nature of the pit removal work with VOC emissions and other types of contaminants expected to be encountered, it is likely and assumed that the building membrane cannot be sufficiently decontaminated to the satisfaction of the building vendor. It is assumed and will be specified that the membrane will be a one-time purchase and disposed at the end of the project. Following membrane removal at the end of the project, the building frame/truss components will be decontaminated, disassembled, and demobilized from the Site.

3.9 Vapor and Dust Control

Given the magnitude of VOCs present in the waste and soil, vapor control and treatment will be implemented during the industrial waste pit removal. Vapor control within the temporary enclosure will consist of the use of multiple blowers to provide a negative pressure. The project specifications will require the Contractor operate the vapor control system to maintain negative pressure of at least 0.5 inches of water column within the temporary enclosure when waste and/or contaminated soil is exposed. This will ensure that no vapors will be emitted from the enclosure and discharged to atmosphere without undergoing treatment. The Contractor will determine the air exchange rate within the temporary enclosure, which will subsequently determine worker PPE/respiratory requirements. The discharge vapors will be treated with vapor phase carbon, which will be continuously monitored for breakthrough. In addition, air quality monitoring will be performed in accordance with the Perimeter Air Monitoring Plan and Exclusion Zone Air Monitoring Plan (refer to Section 3.10).

Each blower will provide an air/vapor extraction rate of 20,000 cubic feet per minute (cfm). Each blower motor will be 100 horsepower and require 400 amps for starting. Therefore, an individual generator will provide electricity for each blower. It is anticpated that multiple blowers and generators may be necessary to maintain the negative pressure requirement. Each blower will be connected to an adsorption unit/container filled with 16,000 pounds of vapor phase carbon. The footprint of each unit is approximately 8 feet by 30 feet. Ports within the units will allow monitoring of the adsorption levels and prior to breakthrough. Each unit will be connected via flexible tubing to two louvers in the building walls. Additional intake louvers in the building walls will allow for fresh air to enter the building. Treated vapors are discharged from two 20-inch diameter, 7 foot high outlets at the top of each unit. Additional details for typical vapor control equipment utilized for this scale of project are provided in Appendix H. The units vapor control blowers/units will be placed immediately outside of the building.

3.10 Perimeter Air Monitoring Program

Perimeter Site air quality monitoring will be performed from various air monitoring stations to confirm on-site containment of air contaminants generated in the remedial action. GHD prepared a Perimeter Air Monitoring Plan (PAMP) discussing the basis for the monitoring and specifying the general monitoring requirements. A copy of the PAMP is provide in Appendix I. The MPCA's representative will set up and manage the Site perimeter air monitoring program.

The Contractor will be required to set up and manage a separate air monitoring program at the perimeter of the exclusion zone and primary work area. As such, the Contractor will be required to prepare an Exclusion Zone Air Monitoring Plan (EZAMP). An example EZAMP outline is included in Appendix J. A detailed example EZAMP will be included with the project specifications for the Contractor's reference in preparation of their own plan.

The objectives of the PAMP include:

- Identify contaminants of interest
- Model potential emissions
- Define action levels and corrective action decision criteria
- Determine monitoring locations, equipment, and frequency
- Develop a perimeter air monitoring results reporting system
- Establish communication methods to distribute air monitoring and sampling data to the public, local agencies/municipality, and Site personnel
- Guide the establishment and implementation of procedures to ensure appropriate responses to elevated levels of airborne contaminants

The general perimeter air monitoring tasks and overall approach include the following:

- Conduct baseline air monitoring and sampling prior to starting the removal action to establish background conditions
- Perform direct read and real-time air monitoring around the perimeter of the Site during the removal action
- Collect periodic air samples for laboratory analyses to confirm the direct read air monitoring results during the removal action
- Report air monitoring and sampling results in a web-based system available for remote viewing
- Document a permanent record of perimeter air monitoring results

The PAMP identified the contaminants of interest as:

- VOCs; because tetrachloroethene (PCE) and trichloroethene (TCE) were detected at the greatest frequency and concentrations, they are of primary interest

- Oxides of Nitrogen as NO_2
- Particulate Matter (PM)
- Polyaromatic Hydrocarbons (PAHs)
- PCBs, which can be emitted as fugitive dusts.
- Oxides of Sulfur as SO_2

GHD utilized SAFER Real Time™ (SAFER) to perform atmospheric dispersion modeling for simulated release events. Based on the results of the modeling, monitoring will be required during the work to confirm air quality is acceptable at the Site and at the Site property boundaries. Placing monitors near the discharge and remediation enclosure will allow for rapid identification of fugitive emissions, so that Site personnel can perform mitigation measures and correct any problems. Additionally, real-time monitors will be placed at property boundaries and monitored by the MPCA's representative to serve as a general indicator of offsite air quality.

Air monitoring results will be discussed during weekly Site progress meetings, including elevated readings above the indicator values that occurred during the previous week and the engineering controls taken, if applicable. Text message alerts will be provided to project personnel capable of altering Site activities to reduce emissions, if necessary. These text alerts will be automatically sent to Site personnel for analytes which exceed designated criteria.

In the event of an exceedance of the indicator values for a 1-hour period, the GHD and MPCA project managers will be notified. In accordance with the Contingency and Emergency Response Plan, further notifications will be made within two hours if the exceedance is ten times the indicator value. In the event stop work action levels consisting of MDH HRVs, NAAQS, or OSHA PELs are exceeded, notification will be made to appropriate agencies within 24 hours. These agencies will include the MPCA PM, the MDH, and the Andover Fire Department (notification to additional agencies may be performed as needed). Notification will include an assessment of the overall situation, including description of the chemical exceedance and concentration, duration of exceedance, location of source(s) (if known), corrective action measures taken and those proposed, and any additional relevant information.

Results from the meteorological station, perimeter VOC/electrochemical monitoring units, and dust monitors will be communicated via cellular modem to a central web-based database at a minimum every one minute and available via the web-based system for remote viewing by GHD, MPCA, MDH, contractor management representative, incident commander, and others as appropriate.

3.11 Decontamination Facilities

All equipment and personnel leaving the exclusion zone will be decontaminated prior to exiting the exclusion zone area. The decontamination area location is shown on Drawing C006 (Appendix A). The Contractor will be required to provide a decontamination plan prior to beginning the work. The decontamination facilities will be sized to fully accommodate any equipment that may come in contact with contaminated material. A separate facility will be set up for decontamination of personnel. Personnel decontamination will likely include stations for washing and dropping outer

PPE (i.e., suits, gloves, and boots), removing respiratory protection equipment, dropping inner PPE, and washing hands and face.

All residual soil/waste removed through decontamination and used PPE will be placed in containers for characterization, profiling, and disposal. Decontamination water will be contained and managed as a wastewater (refer to Section 3.15).

3.12 Waste Pit Drum/Debris Removal

The primary remedial objective is removal of the industrial waste pit. The Contractor will be required to prepare a Drum/Drum Debris Management Plan (Drum Plan) discussing drum inspection/classification, removal, hazard categorization/compatibility testing, waste consolidation, waste characterization and profiling, and transportation and disposal. An example Drum Plan is provided in Appendix K. The example Drum Plan will be included in the project specifications for the Contractor's reference in preparation of their own plan.

3.12.1 In-Place Drum Inspection and Assessment

Upon encountering a buried drum during excavation activities, an in-place inspection will be performed prior to handling the drum. Once a drum has been exposed, the excavation crew's safety technician will screen for organic vapors, combustible gases, and radiation prior to physically handling the drum. In addition to the screening, the inspection will include observation of container material, size, condition, container type, manufacturer/origination, contents labeling, approximate volume, and content type (liquid/solid/sludge). A visual determination of the drum condition and contents will be used to group the drum into one of four different categories as follows: intact drum, non-intact liquid debris drum, non-intact solid/sludge debris drum, and RCRA empty drum. The initial assessment and categorization of each drum will determine the particular management method for that drum.

Any drum or container that has no holes, tears, punctures, or other non-manufactured openings, will be considered an intact drum, consistent with the definition in 40 CFR Part 268.2. Any intact drum that contains more than 1 inch of material will be assigned a unique container number. Any intact drum or container that contains less than 1 inch of material will be classified as a RCRA empty drum, consistent with the definition in 40 CFR Part 261.7. RCRA empty drums will not be assigned a unique container number but will be recorded on a preliminary screening checklist.

Any drum or container that contains more than 1 inch of liquid material and is not an intact drum will be classified as a non-intact liquid debris drum and will be assigned a unique container number. Exceptions may be made in certain circumstances, such as a non-intact drum that appears to contain none of the original contents, but has simply collected water due to its orientation within the waste. In the event of uncertainty, the Paint Filter Test will be used to determine whether a material will be considered a liquid.

Any drum or container that contains more than 1 inch of material, does not contain a measurable amount of liquid, and is not an intact drum will be classified as a non-intact solid/sludge debris drum and will be assigned a unique container number.

Drum fragments, lids, and other small pieces of metal that may formerly have been drums will not be recorded and will be placed on a polyethylene liner within the preliminary waste staging area.

Once all preliminary screening checklist items have been assessed, the excavation crew will proceed with removing the drum from the excavation.

3.12.2 Drum/Debris Removal

Removal of soils adjacent to the drum will be completed using mechanical means. An excavator equipped with an earth excavation non-toothed bucket, or a non-sparking plate to cover the bucket teeth, and/or a hydraulic drum grapple attachment (or rig) will complete the drum removal. A grappler will be used to carefully remove intact drums from the excavation and place into overpacks. Non-intact drums will be placed into repacks or overpacks. RCRA empty drums will be kept segregated from intact and non-intact drums.

3.12.3 Hazard Categorization/Compatibility Screening/Testing and Waste Consolidation

Hazard categorization (HazCat) sampling and compatibility screening will be performed separately for liquid and solid/sludge wastes and non-intact drums. The objective of this screening is to group similar materials based on categorization testing results and to determine if materials can be safely consolidated into bulk containers without chemical reaction based on compatibility testing results. HazCat testing will include the following:

- Water solubility
- Reactivity
- pH
- Hexane solubility
- Oxidizers
- Peroxide
- Sulfide
- Cyanide
- Ignition test
- Halogen test
- PCB screening

3.13 Waste Pit Soil Removal

A primary remedial objective is removal of the industrial waste pit fill soil, pit soil/clay liner, and subsoil. The Contractor will be required to prepare a Soil Management Plan (Soil Plan) discussing soil excavation and removal, soil characterization and profiling, and transportation and disposal. An example Soil Plan is provided in Appendix L. The example Soil Plan will be included in the project specifications for the Contractor's reference in preparation of their own plan.

Waste pit soil will be excavated from within the drummed interval, from the clay liner, and subsoil above the groundwater directly below the pit. Since the maximum soil excavation depth will be greater than 20 feet, a licensed professional engineer will be required to certify the Contractor's excavation plan in accordance with 29 CFR 1926.650 – 1926.652. The excavation will be designed with protective support through proper sloping. Based on the sandy soil type (Type C), the maximum allowable slope will be 1.5:1 (horizontal:vertical). Safe access and egress will be provided with a ramp on the north side of the excavation. The ramp will have a maximum allowable slope of 4:1 (horizontal:vertical). The excavation layout and slopes are shown on Drawing C007 (Appendix A), and excavation cross-sections are shown on Drawings C008 and C009 (Appendix A).

A competent person will make daily inspections of the excavation and adjacent areas for cave-ins, slope failure, air quality, and soil classification.

The soil surrounding the drums within the waste interval will likely be stockpiled or placed into containers within the staging area for final waste characterization, profiling, and shipping. Given the concentrations observed in the pre-design investigation waste interval soil samples, it is not likely that on-Site in-situ treatment can be performed to render a characteristically hazardous waste into a non-hazardous industrial waste within an acceptable timeframe. It is likely and assumed that most material will be disposed as a RCRA or RCRA/TSCA hazardous waste at an incinerator facility. However, it is assumed that a portion of the soil directly over the pit drums/containers and along the pit perimeter may be managed and disposed as a non-hazardous industrial waste (Subtitle D landfill) or a hazardous waste (Subtitle C landfill).

3.13.1 Waste Pit Soil

Excavation of the drummed waste interval will begin on the north side of the industrial waste pit. A ramp will be excavated in the soil north of the industrial waste pit to allow equipment to uncover and access the drummed interval horizontally from the north. The drummed waste will be excavated and removed by working from the north to the south. Soil surrounding the drums will be excavated as drums are removed. Loaders will move the excavated soil to the waste characterization area. The soil will be stockpiled or placed in bulk containers and covered.

3.13.2 Waste Pit Clay Liner and Subsoil Characterization

Following removal of the pit soil, an in-place clay liner and subsoil characterization program will be implemented to develop a subsoil excavation and segregation plan. The intent of this plan is to prevent mixing and disposing TSCA material with non-TSCA material.

Prior to excavating the pit subsoil, soil samples will be collected on a grid size of 20 feet by 20 feet. Soil samples will be collected within every 2-foot lift to be excavated. The soil sample locations are shown on Figure 1.2. Five discrete samples will be collected from each grid cell and mixed. One composite sample will then be collected from the mixed soil and submitted for laboratory analysis of PCBs and total VOCs and metals. Soil with PCB concentrations greater than 50 ppm will be classified as TSCA material. Soil with PCB concentrations less than 50 ppm will be classified as non-TSCA material. VOCs and metals concentrations evaluated to determine if the soil is a characteristic RCRA hazardous waste.

3.13.3 Waste Pit Clay Liner and Subsoil Excavation

The waste pit clay liner and subsoil will be excavated in 2-foot lifts from each 20-foot square grid cell. Each grid cell will contain approximately 30 cubic yards of soil. Loaders will move the excavated to the waste characterization area. Each lift will be placed in the appropriate stockpile or bulk container based on the subsoil characterization results. Stockpiles/containers will be designated as RCRA/TSCA, RCRA, or non-hazardous.

The excavation will proceed until saturated conditions are encountered. Excavation equipment loading near the capillary fringe has the potential to reduce pore sizes through compaction, thus increasing capillary action that can cause a localized draw-up of water from the capillary fringe. The result can be saturation of the soil above the capillary fringe which can cause soil pumping and destabilization. A minimum of 2 feet of soil between the excavation equipment and top of the capillary fringe will be maintained. In addition, low pressure ground equipment will be utilized for the bottom 5 feet of the excavation. MPCA will provide direction for the maximum excavation depth based on conditions and contamination encountered during the work.

3.14 Waste Characterization/Profiling and Container Labeling/Manifesting

The results of a pre design investigation finds that material within the industrial waste pit interval will be a characteristically hazardous waste for one or more of the following parameters (and respective Hazardous Waste Numbers):

- Cadmium (D006)
- Chromium (D007)
- Lead (D008)
- Benzene (D018)
- Carbon tetrachloride (D019)
- 1,4-Dichlorobenzene (D027)
- 1,2-Dichloroethane (D028)
- 1,1-Dichloroethene (D029)
- 2,4-Dinitrotoluene (D030)
- Hexachlorobenzene (D032)
- Hexachlorobutadiene (D033)
- Hexachloroethane (D034)
- 2-Butanone (D035)
- Nitrobenzene (D036)
- Pentachlorophenol (D037)
- Tetrachloroethene (D039)

- Trichloroethene (D040)
- 2,4,6-Trichlorophenol (D042)
- Vinyl chloride (D043)
- Cyanide (D003)

The hazardous waste types and designations are based on the laboratory performing total analyses versus TCLP. It is possible that TCLP testing in the removal action will find that some of the above parameters are below the criteria and the associated hazardous waste designations do not apply. It is unlikely that TCLP testing will show that the material is non-hazardous.

Due to the presence of PCBs, the material may be a TSCA hazardous waste. However, since PCBs were detected at concentrations above the TSCA criteria in only a small percentage of samples, not all waste may be required to be classified as TSCA hazardous waste.

Following placement of wastes into final containers, waste characterization analyses will be conducted on representative composite samples of the materials contained in drums and/or bulked containers to determine if the containerized material is hazardous and to determine the appropriate action for disposal of the material off-Site. Characterization results will be used to create waste profiles and prepare manifests. Sample preservation, packaging, shipment, and holding time requirements are outlined in the Contractor's SAP. Waste characterization tests will include:

- Ignitability
- Corrosivity
- Reactivity for cyanide and sulfides
- Totals analysis (VOCs, SVOCs, and metals)
- PCBs

Additional sampling and analysis requirements, if any, will be identified by the selected disposal facility and confirmed prior to the initiation of sampling activities.

Hazardous wastes, depending on characterization, are disposed at either Subtitle C landfills or incineration facilities. The State of Minnesota hazardous waste management contract currently authorizes waste to be disposed at specific facilities located in North Dakota, Michigan, Illinois, Nebraska, Oklahoma, Texas, and Utah. During the industrial waste pit excavation and removal, materials will be consolidated, if appropriate, and characterization samples will be collected for laboratory analysis to determine which waste stream disposal profile may be applicable or if development of additional waste profiles are necessary.

Based on a review of existing analytical data for the waste and soil to be removed, it is expected that at least four general waste disposal profiles will be set up:

- High VOC concentrations with metals and PCBs concentrations greater than 50 ppm (RCRA and TSCA waste - incineration)
- High VOC concentrations with metals and PCBs concentrations less than 50 ppm (RCRA waste - incineration)

- Moderate VOCs concentrations with metals (RCRA waste – Subtitle C landfill)
- Non-hazardous waste (Subtitle D landfill)

Characterization samples will determine which waste stream disposal profile may be applicable or if development of additional waste profiles are necessary.

3.15 Container Labeling and Manifesting

All containers will be labeled with a unique container identification number. This container ID will be associated in the drum database with all bulked unique container IDs within the bulk container. Overpacked drums will be clearly labeled on the top and side with the assigned unique container ID. Bulk containers to be used for transporting overpacked drums will also be labeled with a unique container identification number. This container identification will be associated with all unique container IDs within the bulk container.

Non-hazardous waste will be transported to the authorized disposal facility under a bill of lading. Hazardous waste will be transported to an authorized disposal facility under a hazardous waste manifest. The waste characterization and profiling analytical results will be used for manifesting purposes and for determining the necessary placarding of vehicles.

A Hazardous Waste Generator Number obtained from United States Environmental Protection Agency (USEPA) will be used on all manifests. Authorized MPCA staff will be responsible for signing all manifests as the waste generator.

3.16 Waste Loading, Transportation, and Disposal

Loading of all wastes on to transport vehicles will be conducted within the temporary waste storage area. All off-Site transport vehicles will be DOT-approved and will be prepared as appropriate prior to receiving waste. All bulk material transport containers will be leak-proof, lined with a continuous sheet of polyethylene prior to loading, and/or will have sealed tailgates. When transporting liquid wastes, container doors/tailgates will be packed with desiccant material to prevent liquids from leaking during transport. Drummed/containerized wastes will be loaded and secured in a manner, which will prevent damage to the containers. Container beds and walls will be smooth to prevent damaging drums. Drums will not be double stacked. Care will be taken to prevent contamination of transport vehicles during loading. All vehicles leaving the Exclusion Zone, if necessary, will be decontaminated.

Hazardous wastes, depending on characterization, are disposed at either Subtitle C landfills or incineration facilities. The State of Minnesota hazardous waste management contract currently authorizes waste to be disposed at specific facilities located in North Dakota, Michigan, Illinois, Nebraska, Oklahoma, Texas, and Utah. Any drums/containers deemed to be non-hazardous will be disposed at an authorized Subtitle D facility in accordance with applicable Federal and State regulations and facility specific permits.

Only transporters that are licensed by USEPA, US Department of Transportation (DOT), and the State of Minnesota will be used for the transport of hazardous materials. Transporters will have current licenses in the appropriate State(s) and comply with other applicable Federal laws including

DOT requirements for wastes scheduled for transport to facilities outside the State of Minnesota. If wastes are deemed to be non-hazardous, then transporters will be licensed for general transportation of non-hazardous wastes or as required by the State for the transport of Special Waste. Placards will be attached to each container and vehicle consistent with the waste manifest and in accordance with DOT regulations.

Transportation routes to off-Site facilities will be predetermined prior to commencing off-Site transport of waste materials. A primary route to each facility will be identified.

The appropriate documentation will be generated and maintained for material transport from the Site to an off-Site facility. A waste shipment record, waste manifest, or bill of lading that identifies the generator, transporter, and disposal facility, and corresponding USEPA identification number, the nature of the material, the date and time the material was transported from the Site, and the weight or volume of material will be provided with each loaded transport vehicle. The manifest or bill of lading will be retained by the Site Superintendent for documentation purposes. Bills of lading will be issued for non-hazardous material removed from the Site. Upon receipt of the material, the disposal facility will be required to sign the manifest. A copy of the signed manifest will be returned to the generator or generator's designated representative for record-keeping purposes.

An onsite portable truck scale will be utilized to weigh the wastes prior to leaving the Site. Truck scale information is provided in Appendix M.

3.17 Wastewater

It is anticipated that wastewater generated during the industrial pit removal will primarily be from equipment, materials, and personnel decontamination. It is assumed that generation of wastewater from any required dewatering will be minimal with the use of the temporary building. Wastewater collected during the remedial action may be used for dust control within the temporary building or treated and discharged to the facility treatment system that discharges into the local sanitary sewer. It is anticipated that the discharge of remedial action wastewater into the local sanitary sewer will be allowed using Metropolitan Council Environmental Services' (MCES) one-time industrial discharge approval process and requirements. The Contractor will be required to manage wastewater, treatment, and discharge and prepare a Wastewater Management Plan (WMP). An example outline for the WMP is provided in Appendix N. A detailed example WMP will be included in the project specifications for the Contractor's reference in preparation of their own plan.

3.18 Final Grading and Restoration

Following the industrial waste pit removal action, final grading and restoration will be completed. The landfill gas extraction and groundwater extraction system will be modified. A new synthetic landfill cover system will be installed over the industrial waste pit removal area, and an access road will be installed.

3.18.1 Excavation Backfill, Grading, and Stormwater Drainage

Following the removal of contaminated materials from designated areas, the excavation will be backfilled with overburden soil removed to construct the removal action work area bench. The disturbed areas will be graded and sloped for the positive drainage of surface water and will be blended into the existing cover topography and surface water control features. The final grading plan within the industrial waste pit removal area are shown on Drawing C010 (Appendix A).

3.18.2 Landfill Gas Extraction System

Upon completion of general grading, landfill gas extraction wells disabled during the pit removal action will be reconnected to the system, including wells GW-27, GW-28, GW-29, GW-44, GW-50, GW-52, and GW-53. Replacement header and lateral piping for these wells will be installed. The only landfill gas extraction well that will not be replaced is G-43 within the industrial waste pit.

3.18.3 Groundwater Extraction System and Monitoring Wells

Upon completion of general grading, one new groundwater extraction well will be to replace wells EW9, EW14, and EW15 within the former pit area. The new extraction well will be connected to the existing forcemain. New electrical wiring and conduit will be connected to the existing electrical supply and a new control panel will be installed.

New monitoring wells will be installed within the upper aquifer on the inside and outside of the slurry wall to replace the NW-1 through NW-4 well nests.

3.18.4 Landfill Cover

A final synthetic cover system will then be installed over the area where the multi-layer soil cover is removed. The cover system will include a 6-inch buffer layer (if backfill soil is not suitable for synthetic material placement), a 40-mil linear low density polyethylene geomembrane liner, a geocomposite drainage layer, an 18-inch rooting zone layer, and a 6-inch topsoil layer. The synthetic cover system will be “tied-in” with the existing clay landfill cover at the limits of landfill cover disturbance. The landfill cover details are shown on Drawing C011 (Appendix A). Existing landfill cover soil and topsoil removed during the work area bench construction will be utilized for the new landfill cover.

3.18.5 Access Road

A portion of the access road will be removed to complete the industrial waste pit removal. This portion will be replaced with a new aggregate access road with a turnaround will constructed from the remaining portion of the access road to the former pit area. Any portions of the existing access road damaged during the work will be repaired or replaced.

3.18.6 Site Restoration and Vegetation Establishment

Upon completion of general grading and system modifications, final grading will be completed and topsoil will be placed over the synthetic cover. All disturbed areas will be seeded to establish vegetation.

4. Permitting

This section discusses the permits that will be required to complete the industrial waste pit removal action.

4.1 General Stormwater Permit and SWPPP

The Contractor will be required to apply for and obtain a general stormwater permit for construction activity and prepare a Storm Water Pollution Prevention Plan (SWPPP). A copy of the online permit application and an example outline of the SWPPP are included in Appendix O. A detailed example SWPPP will be included in the project specifications for the Contractor's reference in preparation of their own SWPPP.

4.2 Industrial Stormwater Permit

MPCA will apply for and obtain an industrial stormwater permit. A copy of the permit will be provided to the Contractor to ensure that their activities are conducted in accordance with the requirements. MPCA will conduct all monitoring and sampling required by the permit.

4.3 MCES One-Time Discharge Approval

It is anticipated that wastewater collected during the remedial action may be used for dust control within the temporary building or treated and discharged to the facility treatment system that discharges into the local sanitary sewer. It is anticipated that the discharge of remedial action wastewater into the local sanitary sewer will be allowed using the MCES one-time industrial discharge approval process and requirements. On behalf of MPCA, GHD prepared and submitted a MCES One-Time Industrial Discharge Approval Request. A copy of this request is provided in Appendix P. Following contract award, MPCA will submit a One-Time Industrial Discharge Approval Transfer Form, which will bind the Contractor to the MPCA's discharge approval, MCES waste discharge rules, and applicable USEPA pretreatment standards and requirements.

4.4 Large Quantity Hazardous Waste Generator License

A copy of the MPCA's large quantity hazardous waste generator license is provided in Appendix Q.

4.5 Corrective Action Temporary Unit Approval

MPCA will provide written approval of the use of Corrective Action Temporary Units (TUs) for the placement of waste in tanks or containers is not considered land disposal. TUs are RCRA units established specifically for management of hazardous remediation waste. The regulations established non-land based units for treatment and storage of hazardous remediation waste. Under the TU regulations, an authorized state may modify existing minimum technology requirements (MTRs) design, operating and closure standards for temporary tank and container units used to treat and store hazardous remediation waste. TUs may operate for one year, with an opportunity for a one year extension. Therefore, waste does not have to be treated to meet land disposal restriction (LDR) treatment standards prior to being placed in a TU.

4.6 Temporary Building Permit

Prior to constructing the temporary building/enclosure over the industrial waste pit area, the Contractor will be required to apply for and obtain a building permit from the City of Andover. A copy of the permit application is provided in Appendix R.

4.7 Air Discharge Permit

GHD prepared a

memorandum providing a Potential to Emit evaluation of the potential emissions during the industrial waste pit removal. A copy of this memorandum (GHD; March 8, 2018) is provided in Appendix S. Given the magnitude of VOCs measured in the breathing zone during the pre-design investigation drilling, vapor control and treatment will be required during the industrial waste pit removal. A temporary enclosure will be erected over the pit to facilitate waste excavation, vapor control, waste characterization screening, and contaminated debris and soil staging. The temporary enclosed structure will allow for the control, contaminant, and treatment of vapor emissions prior to discharge to the atmosphere. Vapor control will consist of the use of multiple blowers to provide a negative pressure within the building with the discharge vapors treated with vapor phase carbon. The vapor phase carbon will be continuously monitored for breakthrough. In addition, air quality monitoring will be performed from various air monitoring stations at the Site perimeter and surrounding the work area to confirm on site management of air contaminants generated during the remedial action.

Three Site related sources represent potential for air emissions in evaluating the industrial waste pit removal action, including:

- Waste pit removal action emissions
- Landfill gas extraction system emissions
- Wastewater pond emissions

GHD calculated the total potential emissions to determine if they exceed state or federal thresholds. GHD finds that the calculated total potential emissions from all Site sources is well below the thresholds; therefore, an air discharge permit is not required. It is anticipated that MPCA will review the

Potential to Emit evaluation memorandum (Appendix S) and provide an applicability determination that an air permit is not required.

5. Bidding Approach

Based on discussions with MPCA and Minnesota Department of Administration (MDOA), GHD understands the project letting will use a best value approach. GHD understands that the best value approach is where responsive bidders are evaluated and a vendor is selected based on both price and pre-defined performance criteria. Performance criteria may include, but are not limited to the following:

- Project approach and work plan
- Project schedule
- Company experience
- Staff experience
- Subcontractor experience and performance
- Safety program

In addition, MPCA and GHD are working with MDOA to potentially include best value engineering incentive language in the project contract terms and conditions similar to language used in Minnesota Department of Transportation (MnDOT) contracts. Value engineering incentive provides an incentive to the Contractor awarded the project to initiate, develop, and present cost reduction proposals involving changes in the Contract requirements to the MPCA for consideration. If accepted by the MPCA, the contractor and MPCA equally share the net savings to the project.

6. Post-Remediation Alternatives Considerations

GHD considered post-remediation alternatives during the development of this preliminary design. This design focuses primarily on the industrial waste pit removal action. Contamination at and below the groundwater table will remain following removal of the pit and unsaturated subsoil.

This design generally restores the existing landfill gas extraction and groundwater extraction system components that will be impacted during the pit removal. The slurry wall is not expected to be impacted below the groundwater table; therefore, groundwater containment within the pit area will be maintained.

Following the pit removal, the excavation will be backfilled. However, the final grading plan reduces the thickness of soil over the pit area as compared to the existing grades but still maintains positive drainage. The portion of the existing access road to the pit area removed during the work will be replaced.

It is anticipated that an insitu soil and groundwater remediation system will be installed to mitigate contamination remaining below the pit area. The access road will provide access for equipment to the pit area for the construction of a future remediation system. The slopes over the pit area will allow equipment operation for construction of a future remediation system.

7. Community Relations

Although the value of an effective community relations program often cannot be measured financially, its importance can be critical in the development of a solution that can be accepted by the local community and local governments. The importance of clear communication to the public is critical to the ultimate success of a remedial program.

GHD recommends that a Community Relations Plan be developed to establish the following community involvement objectives and goals:

- Conduct early, frequent, and meaningful community involvement.
- Keep the public well-informed of ongoing and planned activities.
- Report air monitoring data/information in a web-based format in real-time for public viewing.
- Encourage and enable the public to get involved.
- Listen carefully to what the public is saying.
- Consider changing planned actions where public comments or concerns are considered by the site team.
- Provide an awareness of planned and on-going Site activities.
- Provide an awareness that their concerns are considered in the site decision-making process.
- Create a working relationship with the community based on trust and respect, which minimizes potential conflicts that may result in costly and unnecessary delays.

An outline for a Community Relations Plan is provided in Appendix T. Improved quality of decisions and increased community acceptance and support of Agency decisions. This in turn results in time and cost savings that allow cleanup goals to be accomplished more quickly and efficiently.

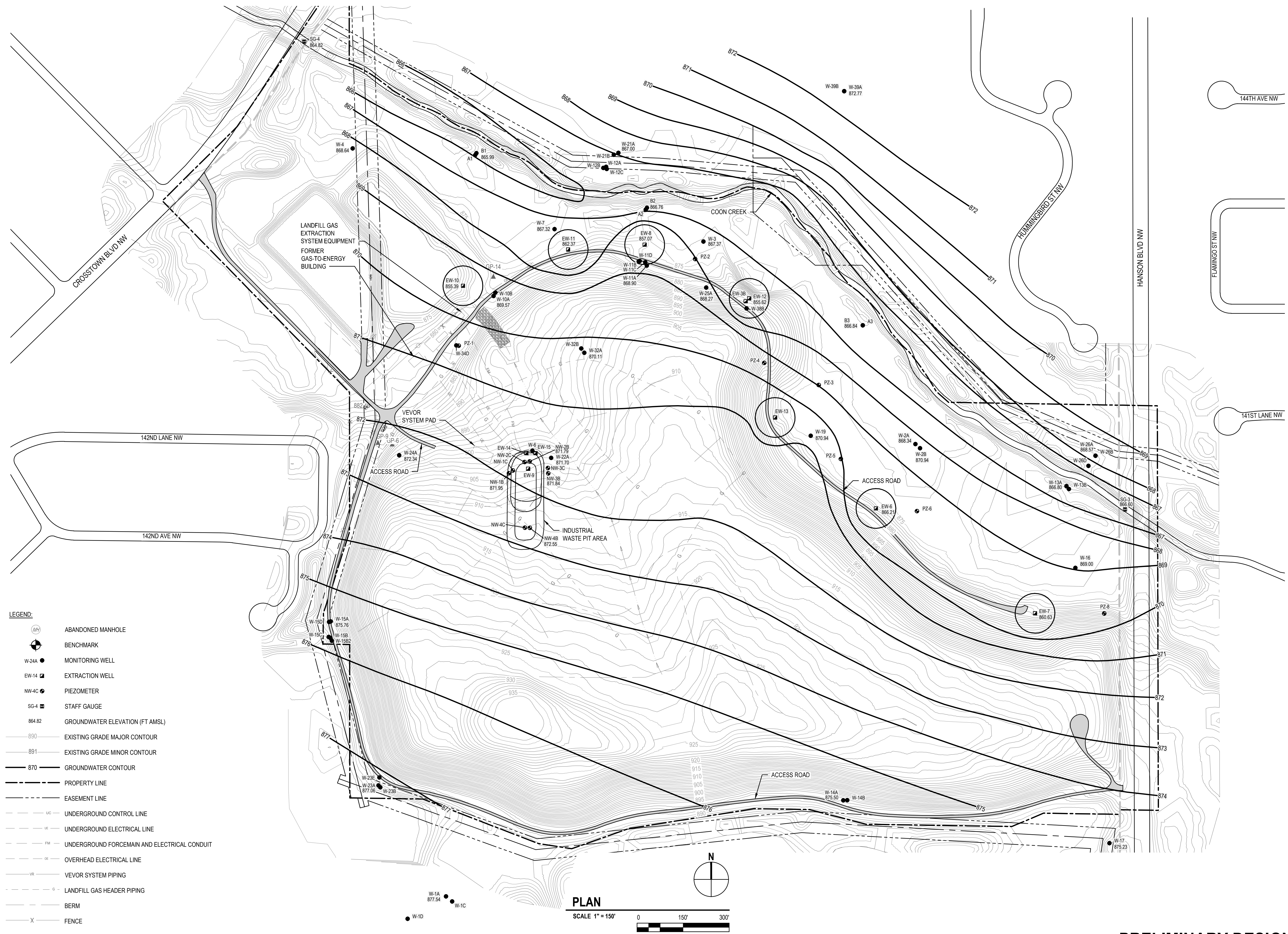
8. Preliminary Cost Estimate

A preliminary design level cost estimate was prepared based on the results of the pre-design investigation and conceptual design elements discussed above. The conceptual design level cost estimate is provided in Table 8.1. Project costs will continue to be refined and provided with each of the subsequent design phase documents (65, 95, and 100%). Some of the key assumptions used in the preliminary design level cost estimate include, but are not limited to:

- Approximately 6,000 drums are present in the industrial waste pit, of which approximately 3,000 drums remain intact
- Approximately 13,500 cubic yards of soil and waste will be removed from the industrial waste pit area and transported offsite for disposal
- All soil and waste within the industrial waste pit, all soil forming the bottom of the industrial waste pit, and all unsaturated (vadose) soil directly beneath the industrial waste pit will be removed and transported offsite for disposal; all unsaturated (vadose) soil adjacent to the industrial waste pit will remain onsite and will only be excavated as necessary to access and excavate hazardous subsoil
- Drawings C008 and C009 provide a summary of the assumed portions of each material that will be disposed as a RCRA/TSCA hazardous waste in an incinerator facility, as a RCRA hazardous waste at an incineration facility, as a RCRA waste at a Subtitle C landfill, and as a non-hazardous waste at a Subtitle D landfill

- MPCA will provide written confirmation that waste pit materials and contaminated media are not categorical listed wastes but characteristically hazardous waste based on laboratory analyses for disposal profile development
- All overburden cover soils removed and staged will be used as pit backfill and rough grading following the pit removal
- Sloping of 1.5 : 1.0 (horizontal : vertical) will be used to excavate to depths below 20 feet bgs
- Soil and waste will not be treated onsite due to types of contaminants and construction timeframe constraints
- Waste management, transportation, and disposal costs are based on waste disposal vendor estimates and their evaluation of site-specific information along with contract rates in the State of Minnesota Waste Disposal Contract.
- A temporary enclosure will be utilized with a vapor control and mitigation system during the industrial waste pit removal

The cost estimate excludes costs for developing and implementing a remedial action plan to address contaminated groundwater and saturated soils associated with the pit.



LEGEND:

- ABANDONED MANHOLE
- BENCHMARK
- W-24A MONITORING WELL
- EW-14 EXTRACTION WELL
- NW-4C PIEZOMETER
- SG-4 STAFF GAUGE
- 864.82 GROUNDWATER ELEVATION (FT AMSL)
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- 870 GROUNDWATER CONTOUR
- PROPERTY LINE
- EASEMENT LINE
- UC UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE

PRELIMINARY DESIGN

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Client

MINNESOTA POLLUTION CONTROL AGENCY

Project

WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn C. ROHRICH — Designer T. REE

Drafting Check — Design Check

Project Manager R. MARTIN — Date MAY 2017

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Original Size **ANSI D** — Bar is one inch on original size sheet 0 1"

Project No. **11129194**

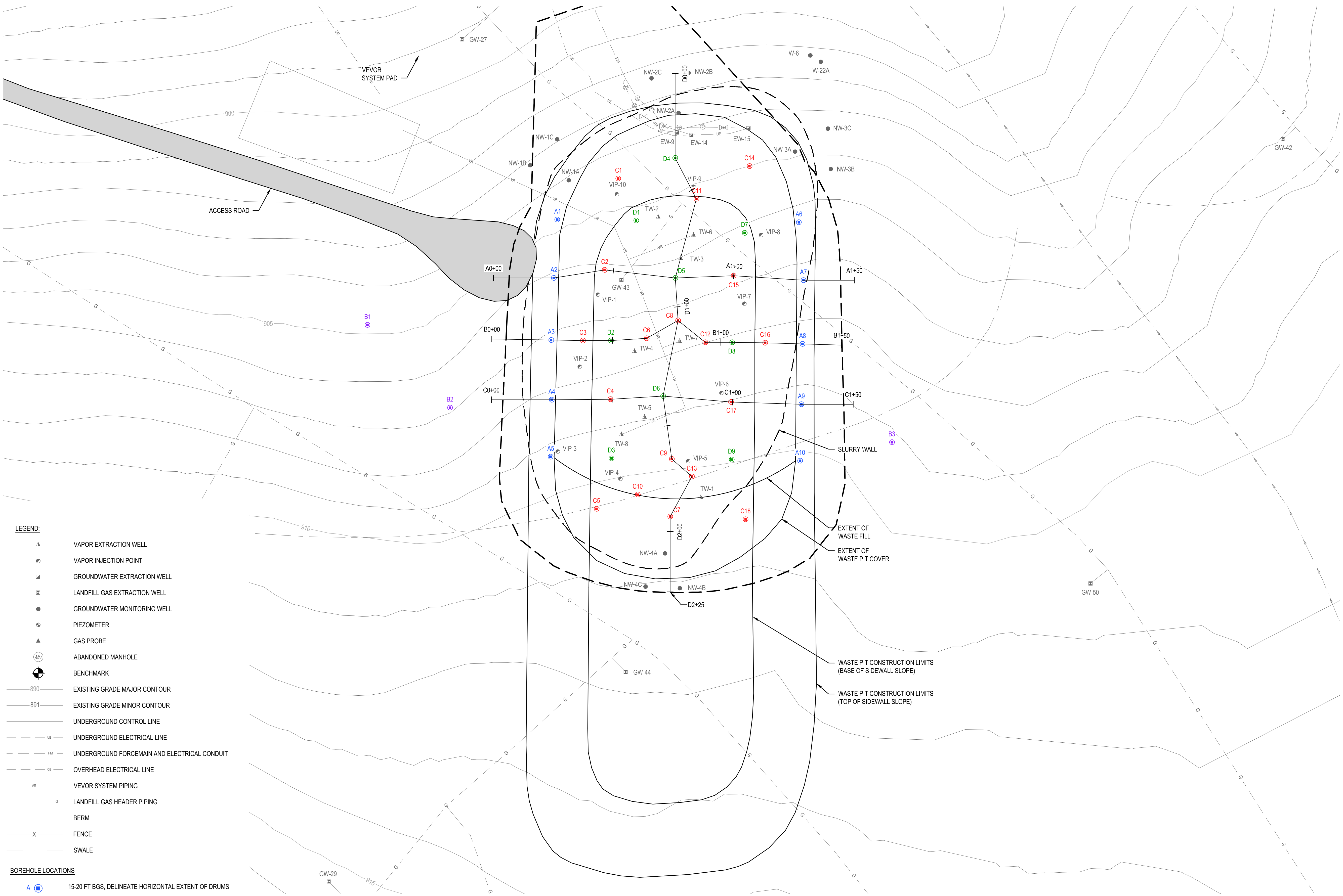
Title

GROUNDWATER ELEVATIONS JUNE 2016

Sheet No.

111-29194-FIG 3.1

Sheet 4 of 17



LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VE VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE

BOREHOLE LOCATIONS

- A — 15-20 FT BGS, DELINEATE HORIZONTAL EXTENT OF DRUMS
- B — 15-20 FT BGS, OBSERVE AND FIELD SCREEN MATERIAL OUTSIDE OF PIT
- C — 25-30 FT BGS, DELINEATE VERTICAL EXTENT OF WASTE, CHARACTERIZE WASTE
- D — 35-40 FT BGS, DELINEATE VERTICAL EXTENT OF WASTE, CHARACTERIZE WASTE AND UNDERLYING MATERIAL ABOVE GROUNDWATER TABLE

PLAN

SCALE 1" = 20'   0   20'   40'

PRELIMINARY DESIGN

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A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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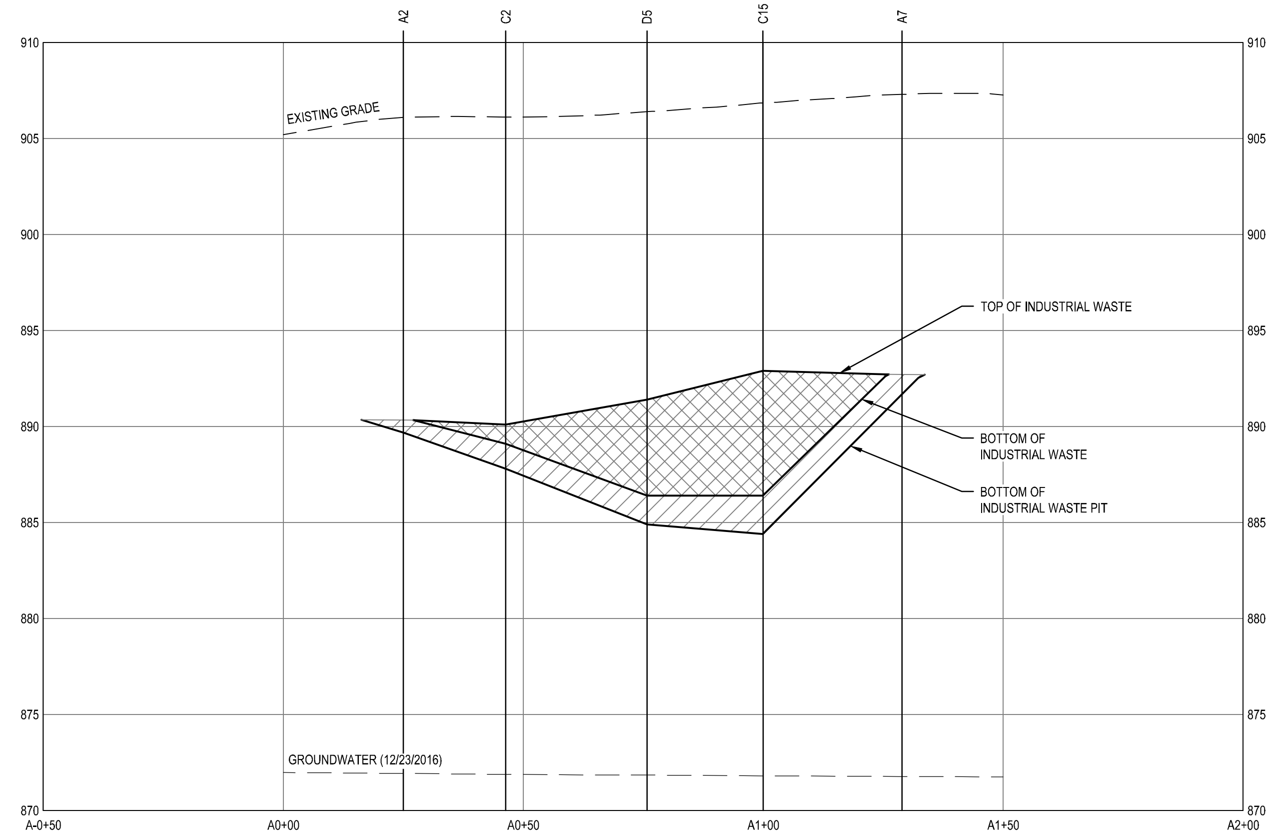
Project No. 11129194

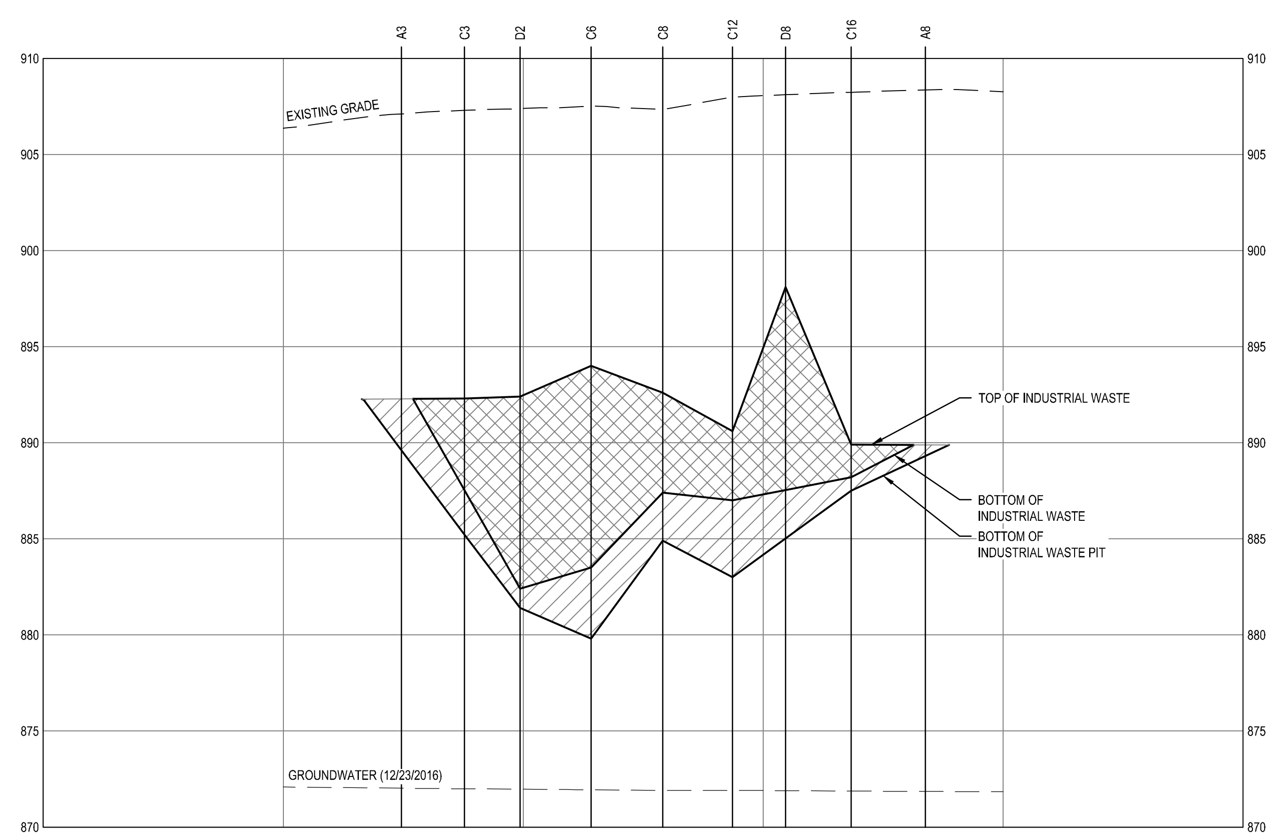
Title
PIT CROSS-SECTION LOCATIONS

Sheet No.
111-29194-FIG 3.2

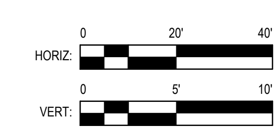
Sheet 5 of 17



A SECTION
FIGURE 3.2



B SECTION
FIGURE 3.2



PRELIMINARY DESIGN

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A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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Original Size	ANSI D	Bar is one inch on original size sheet 0 1"	

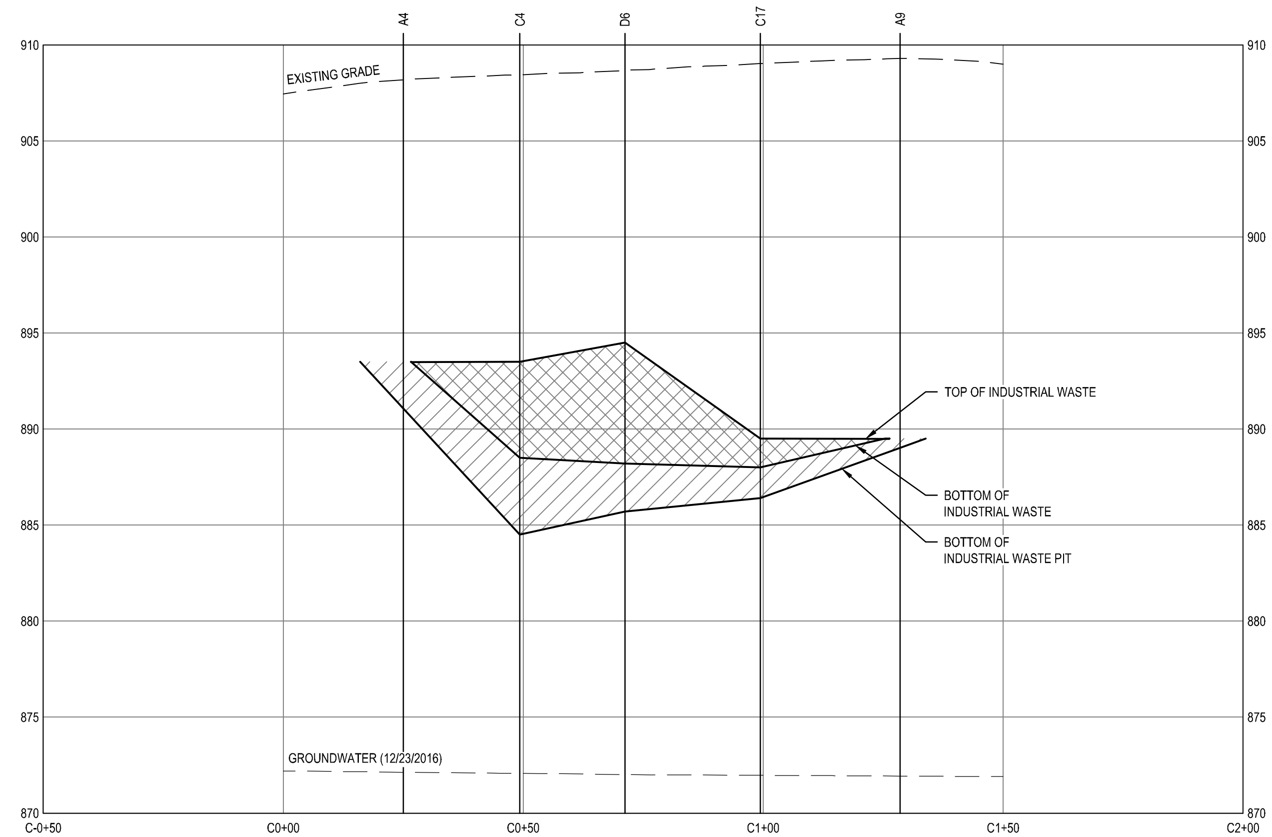
Project No. 11129194

Title
PIT CROSS-SECTIONS A AND B

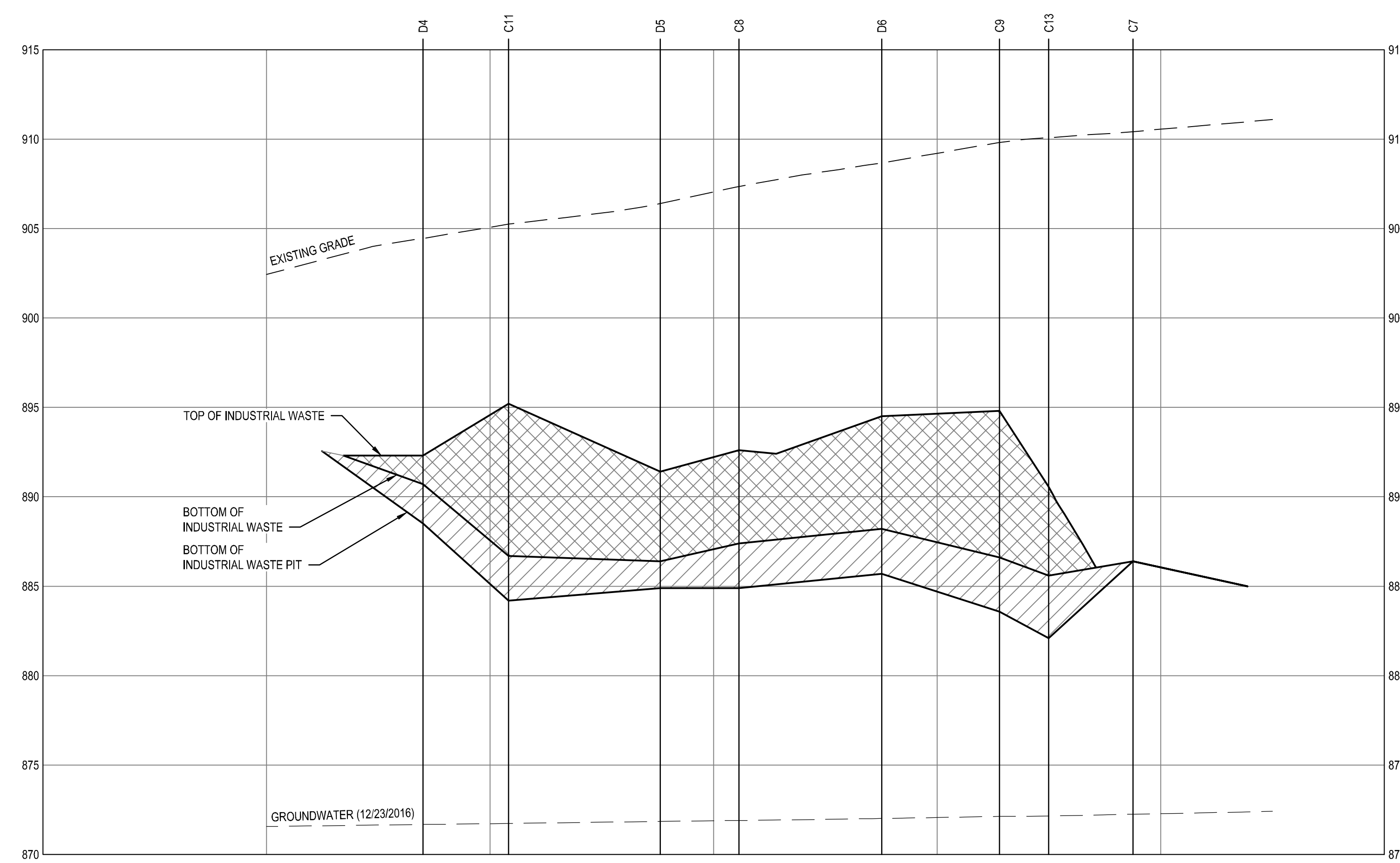
Sheet No.
111-29194-FIG 3.3

Sheet 6 of 17

Plot Date: 23 March 2018 - 10:52 AM Plotted By: Sean Pike Filename: \\buf-s1\shared\drawings-nia\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-FIG 3.3.dwg



C
FIGURE 3.2
SECTION



D
FIGURE 3.2
SECTION

HORIZ: 0 20' 40'

VERT: 0 5' 10'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
T 1 651 639 0913 **F** 1 651 639 0923 **W** www.ghd.com

Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
This document shall not be used for construction unless signed and sealed for construction.		Scale	H:1"=20' V:1"=5'
Original Size	ANSI D	Bar is one inch on original size sheet 0 1"	

Project No. 11129194

Title
PIT CROSS-SECTIONS C AND D

Sheet No.
111-29194-FIG 3.4

Sheet 7 of 17

Table 3.1

Site Feature Removals/Abandonments/Modifications Summary
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Feature	Action	Total Depth (ft)	Width (in)	Screened Interval (ft. bgs.)	Material	Description
EW-14	Abandon	48	8	28-48	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
EW-15	Abandon	46	8	26-46	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
EW-9	Abandon/ Replace	45	8	38-43	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation. Replace with new extraction well.
Extraction Well Forcemains	Remove/ Replace	5	2	N/A	SDR 11 HDPE	Remove excavated portions of forcemains and cleanouts. Reinstall below final grade and connect to remaining forcemain and new extraction well.
Extraction Well Panels	Remove/ Replace	N/A	N/A	N/A	N/A	Disconnect from power, remove panels. Replace with new panel and reconnect to new extraction well.
Gas Header GW-27 to GW-50	Remove		6	N/A	SDR 17 HDPE	Cap header downstream of GW-27, cap header just downstream of GW-50, remove header between GW-27 and GW-50.
Gas Header/Laterals GW-27, GW-28, GW-29, GW-44, GW-52, and GW-53	Remove/ Replace		8	N/A	SDR 17 HDPE	Cap header downstream of GW-28 and upstream of GW-44 and remove/replace.
GW-27	Protect					Place protective barrier around well. Reinstall and reconnect lateral.
GW-28	Protect					Place protective barrier around well. Reinstall and reconnect lateral.

Table 3.1

Site Feature Removals/Abandonments/Modifications Summary
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Feature	Action	Total Depth (ft)	Width (in)	Screened Interval (ft. bgs.)	Material	Description
GW-29	Protect					Place protective barrier around well. Reinstall and reconnect lateral.
GW-43	Abandon					Seal and abandon well. Cut down as necessary during excavation. Ensure disconnection from gas header first.
GW-44	Protect					Place protective barrier around well. Reinstall and reconnect lateral.
GW-50	Protect					Place protective barrier around well. Install new lateral.
GW-52	Protect					Place protective barrier around well. Reinstall and reconnect lateral.
GW-53	Protect					Place protective barrier around well. Keep operational.
MH	Remove	29	48 to 14'/ 24 to 29'	N/A	Concrete/Corrugated metal pipe	Concrete 4' dia. manhole to 14'. Corrugated metal pipe 2' dia. from bottom of manhole to 29' w/ metal cover at bottom of manhole. The manhole portion has been backfilled with cuttings/soil. Remove all portions of manhole.
NW-1A	Abandon/ Replace	44.5	6 to 34'/ 2 to 43'	38-43	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-1B	Abandon/ Replace	44.5	6 to 31'/ 2 to 44.5'	38-43	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-1C	Abandon/ Replace	67	6 to 57'/ 2 to 63'	61-66	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-2A	Abandon/ Replace	44.5	6 to 33'/ 2 to 43'	38-43	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.

Table 3.1

Site Feature Removals/Abandonments/Modifications Summary
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Feature	Action	Total Depth (ft)	Width (in)	Screened Interval (ft. bgs.)	Material	Description
NW-2B	Abandon/ Replace	44.5	6 to 33'/ 2 to 43'	38-43	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-2C	Abandon/ Replace	66	6 to 56'/ 2 to 65.6'	58-64	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-3A	Abandon/ Replace	43	6 to 31'/ 2 to 43'	36.5-41.5	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-3B	Abandon/ Replace	43.5	6 to 36'/ 2 to 42'	37-42	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-3C	Abandon/ Replace	66	6 to 55'/ 2 to 62'	58.5-63.5	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-4A	Abandon/ Replace	52	6 to 45.5'/ 2 to 50.5'	45.5-50.5	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-4B	Abandon/ Replace	52	6 to 36'/ 2 to 50.5'	45.5-50.5	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
NW-4C	Abandon/ Replace	76	6 to 66'/ 2 to 75'	69-74	Steel, S.S. Casing	Seal and abandon well. Cut down as necessary during excavation.
TW-1	Remove	26 bgs	4	16-26	Sch 80 PVC	Remove during excavation.
TW-2	Remove	20 bgs	4	10-20	Sch 80 PVC	Remove during excavation.
TW-3	Remove	24 bgs	4	13.9-23.9	Steel, S.S. Casing	Remove during excavation.
TW-4	Remove	22 bgs	4	12-22	Steel, S.S. Casing	Remove during excavation.

Table 3.1

Site Feature Removals/Abandonments/Modifications Summary
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Feature	Action	Total Depth (ft)	Width (in)	Screened Interval (ft. bgs.)	Material	Description
TW-5	Remove	22 bgs	4	11.7-21.7	Steel, S.S. Casing	Remove during excavation.
TW-6	Remove	15 bgs	4	5-15	Steel, S.S. Casing	Remove during excavation.
TW-7	Remove	20 bgs	4	10-20	Steel, S.S. Casing	Remove during excavation.
TW-8	Remove	20 bgs	4	10-20	Steel, S.S. Casing	Remove during excavation.
Underground Electric to EWs	Modify	2	N/A	N/A	2" Conduit	240V single phase. Upgrade from aluminum to copper wiring if necessary. May use to supply utilities during construction, then reconnect to extraction well control panels.
Underground Electric to VEVOR	Modify			N/A		480V 3 phase. Disconnect from VEVOR system, use to supply utilities during construction.
VEVOR Piping	Remove	N/A	4	N/A	Sch 80 PVC, Aluminum	Remove all piping. Dispose and/or salvage piping.
VEVOR Supports	Remove	N/A	N/A	N/A	Unistrut, Concrete 5-gal pails	Dig out supports and dispose off-site.
VEVOR Heat Trace	Remove	N/A	N/A	N/A		Disconnect from power, remove heat trace and dispose and/or salvage parts.
VIP-1	Remove	17	1	12.5-15	PVC	Remove during excavation.
VIP-2	Remove	15	1	12.5-15	PVC	Remove during excavation.

Table 3.1

Site Feature Removals/Abandonments/Modifications Summary
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Feature	Action	Total Depth (ft)	Width (in)	Screened Interval (ft. bgs.)	Material	Description
VIP-3	Remove	17	1	14.5-17	PVC	Remove during excavation.
VIP-4	Remove	18	1	15.5-18	PVC	Remove during excavation.
VIP-5	Remove	18	1	15.5-18	PVC	Remove during excavation.
VIP-6	Remove	19	1	16.5-19	PVC	Remove during excavation.
VIP-7	Remove	18	1	15.5-18	PVC	Remove during excavation.
VIP-8	Remove	17.5	1	15-17.5	PVC	Remove during excavation.
VIP-9	Remove	17.5	1	15-17.5	PVC	Remove during excavation.
VIP-10	Remove	18	1	14.5-17	PVC	Remove during excavation.
W-22A	Abandon	31 or 42.16	2	32.16-42.16 or 21-31	Stainless Steel	Seal and abandon well. Cut down as necessary during excavation.
W-6	Abandon	34.5	2	?	Steel	Seal and abandon well. Cut down as necessary during excavation.

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
1	Mobilization	Lump Sum	1	$250,000.00	$ 250,000.00
2	Bonds	Lump Sum	1	$150,000.00	$ 150,000.00
3	Insurance	Lump Sum	1	$300,000.00	$ 300,000.00
4	Administrative Tasks	Month	6	$5,000.00	$ 30,000.00
5	Field Offices and Facilities	Month	6	$5,000.00	$ 30,000.00
6	General Stormwater Permit for Construction Activities and Stormwater Pollution Prevention Plan	Lump Sum	1	$5,000.00	$ 5,000.00
7	MCES Special Industrial Discharge Permit Transfer	Lump Sum	1	$2,500.00	$ 2,500.00
8	Building Permit	Lump Sum	1	$5,000.00	$ 5,000.00
9	Wastewater Management Plan	Lump Sum	1	$5,000.00	$ 5,000.00
10	Sampling and Analysis Plan	Lump Sum	1	$7,500.00	$ 7,500.00
11	Soil Management Plan with Excavation Plan and Professional Engineer Certification	Lump Sum	1	$15,000.00	$ 15,000.00
12	Drum/Drum Debris Management Plan	Lump Sum	1	$7,500.00	$ 7,500.00
13	Waste Transportation Plan	Lump Sum	1	$5,000.00	$ 5,000.00
14	Health and Safety Plan	Lump Sum	1	$7,500.00	$ 7,500.00

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
15	Exclusion Zone Air Monitoring Plan	Lump Sum	1	$5,000.00	$ 5,000.00
16	Contingency and Emergency Response Planning and Equipment	Lump Sum	1	$5,000.00	$ 5,000.00
17	Decontamination Plan	Lump Sum	1	$2,500.00	$ 2,500.00
18	Portable Truck Scale	Month	3	$2,500.00	$ 7,500.00
19	Exclustion Zone and Support Zone Air Monitoring	Month	3	$41,000.00	$ 123,000.00
20	Temporary Building Rental and Mobilization	Lump Sum	1	$240,000.00	$ 240,000.00
21	Temporary Building Setup	Lump Sum	1	$180,000.00	$ 180,000.00
22	Temporary Building Removal and Demobilization and Fabric Disposal	Lump Sum	1	$120,000.00	$ 120,000.00
23	Temporary Building Ventilation Equipment and Vapor Phase Activated Carbon Mobilization	Lump Sum	1	$200,000.00	$ 200,000.00
24	Temporary Building Ventilation Equipment Operation	Month	3	$85,000.00	$ 255,000.00
25	Temporary Building Discharge Air Treatment Monitoring	Month	3	$12,750.00	$ 38,250.00
26	Spent Carbon Transportation and Disposal (bulk solids) to Subtitle C Landfill	Ton	50	$625.00	$ 31,250.00
27	Temporary Site Fencing	Lump Sum	1	$25,000.00	$ 25,000.00
28	Waste Staging Area	Lump Sum	1	$20,000.00	$ 20,000.00

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
29	Decontamination Facility and Equipment Decontamination	Lump Sum	1	$30,000.00	$ 30,000.00
30	Silt Fence	Linear Feet	2,100	$2.50	$ 5,250.00
31	Temporary Soil Erosion and Sedimentation Controls	Lump Sum	1	$5,000.00	$ 5,000.00
32	Temporary Soil Erosion and Sedimentation Control Inspection and Maintenance	Month	12	$1,000.00	$ 12,000.00
33	Existing Features Abandonments and Removals	Lump Sum	1	$50,000.00	$ 50,000.00
34	Vegetation and Topsoil Stripping	Square Feet	305,000	$0.10	$ 30,500.00
35	Work Area Excavation and Grading	Cubic Yards	61,025	$2.00	$ 122,050.00
36	Pit Overburden Soil Excavation	Cubic Yards	4,915	$2.00	$ 9,830.00
37	Pit Access Ramp Excavation	Cubic Yards	0	$2.00	$ -
38	Intact Drum Removal, Packaging, and Staging	Drum	3,000	$110.00	$ 330,000.00
39	Deteriorated Drum/Debris and Pit Fill Soils Removal and Staging	Cubic Yards	1,895	$30.00	$ 56,855.56
40	Clay Liner Excavation	Cubic Yards	1,230	$30.00	$ 36,900.00
41	Soil Excavation for Sidewall Sloping - Outside Pit Limits	Cubic Yards	2,331	$30.00	$ 69,930.00
42	Waste Pit Subsoil Characterization (drilling, sampling, analysis)	Lump Sum	1	$75,000.00	$ 75,000.00

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
43	Waste Pit Subsoil Excavation and Staging	Cubic Yards	4,520	$30.00	$ 135,600.00
44	Drum Material Field Screening, Compatibility Testing, and Categorization	Drum	3,000	$150.00	$ 450,000.00
45	Drum Over-Packing	Drum	1,500	$300.00	$ 450,000.00
46	Bulk Container Mobilization	Container	1,017	$750.00	$ 762,615.74
47	Bulk Solid Consolidation (hazardous)	Cubic Yards	12,560	$35.00	$ 439,606.48
48	Bulk Liquid Consolidation (hazardous)	Gallons	20,625	$1.20	$ 24,750.00
50	Bulk Liquid Solidification (hazardous)	Gallons	61,875	$2.40	$ 148,500.00
51	Waste Water Management, Treatment, and MCES Discharge	Gallons	100,000	$1.00	$ 100,000.00
52	Debris Management (hazardous)	Cubic Yards	1,000	$35.00	$ 35,000.00
53	Debris Transportaion and Disposal (hazardous)	Cubic Yards	1,000	$235.00	$ 235,000.00
54	Material Characterization and Profiling	Lump Sum	1	$215,000.00	$ 215,000.00
55	Hazardous Waste Inspection, Documentation, and Management	Month	6	$4,000.00	$ 24,000.00
56	Hazardous Waste Transportation and Disposal - RCRA Incineration	Tons	4,813	$625.00	$ 3,008,296.30
57	Hazardous Waste Transportation and Disposal - RCRA/TSCA Incineration	Tons	3,091	$650.00	$ 2,009,422.04

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
58	Hazardous Waste Transportation and Disposal - RCRA Subtitle C Landfill	Tons	3,153	$283.00	$ 892,348.26
59	Non-Hazrdous Waste Transportation and Disposal - Subtitle D Landfill	Tons	5,518	$35.00	$ 193,125.59
60	Hazardous Waste Transportation and Disposal (bulk liquids) for Incineration	Tons	83	$650.00	$ 53,625.00
61	Hazardous Waste Transportation and Disposal (drums) to Subtitle C Landfill	Drum	375	$150.00	$ 56,250.00
62	Hazardous Waste Transportation and Disposal (drums) for Incineration	Drum	1,125	$365.00	$ 410,625.00
63	Hazardous Waste Documentation/Reporting	Lump Sum	1	$20,000.00	$ 20,000.00
64	Backfilling and Grading	Cubic Yards	21,119	$6.00	$ 126,713.33
65	Buffer Layer and Subgrade Preparation	Square Feet	305,000	$0.30	$ 91,500.00
66	LLDPE Geomembrane Liner Placement	Square Feet	305,000	$0.60	$ 183,000.00
67	Geocomposite Drainage Placement	Square Feet	305,000	$0.85	$ 259,250.00
68	Rooting Zone Soil Placement	Square Feet	305,000	$0.25	$ 76,250.00
69	Erosion Control Blanket	Square Feet	250,000	$0.30	$ 75,000.00
70	Turf Reinforcement Matting	Square Feet	55,000	$1.20	$ 66,000.00
71	Topsoil, Seeding, Mulching, and Fertilization	Square Feet	380,000	$0.60	$ 228,000.00

Table 8.1

Cost Estimate - Preliminary Design Level
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

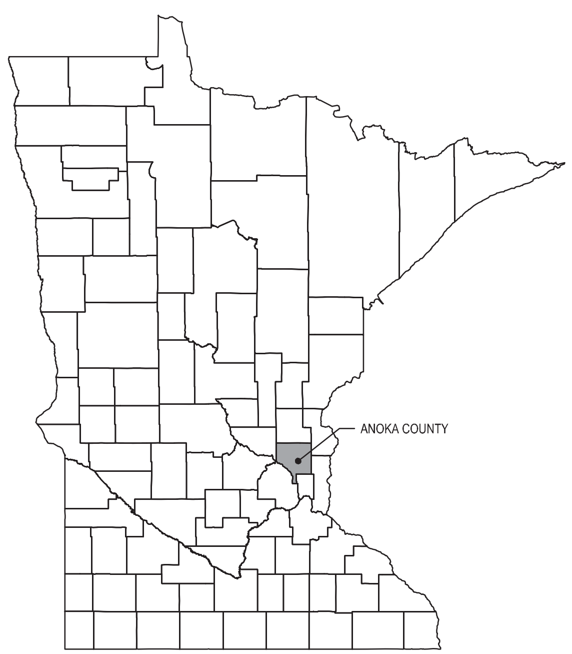
Item	Description	Unit	Estimated Quantity	Unit Price	Total Price
72	Vegetation Establishment and Maintenance	Lump Sum	1	$7,500.00	$ 7,500.00
73	Landfill Gas Extraction Piping and Groundwater Extraction System Restoration	Lump Sum	1	$40,000.00	$ 40,000.00
74	Surveying	Lump Sum	1	$25,000.00	$ 25,000.00
75	Project Close-Out and Demobilization	Lump Sum	1	$15,000.00	$ 15,000.00
			Subtotal		**$ 13,762,793.30**
			Supplemental Investigation		**$ 390,000.00**
			Design	**2.5%**	**$ 344,069.83**
			Construction Oversight	**5%**	**$ 688,139.67**
			Total		**$ 15,185,002.80**
		Cost Range	**(Minimim Contingency)**	**-10%**	**$ 13,666,502.52**
			(Maximum Contingency)	**20%**	**$ 18,222,003.36**

Appendix A
Construction Plans

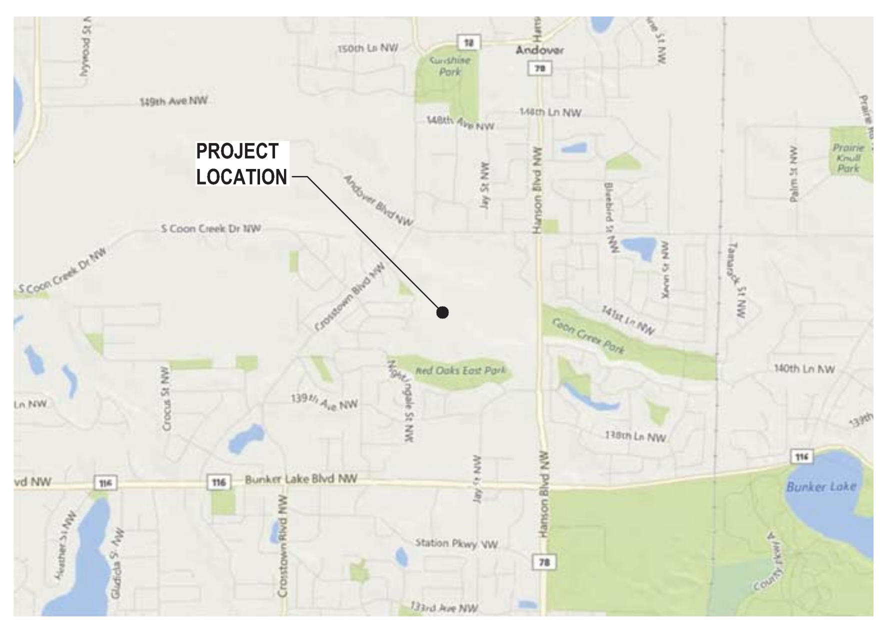
MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL
INDUSTRIAL WASTE PIT REMOVAL
PRELIMINARY DESIGN CONSTRUCTION PLANS

MARCH 2018

111-29194



AREA MAP



LOCATION MAP

SHEET INDEX		
SEQUENCE NUMBER	SHEET NUMBER	SHEET TITLE
CIVIL		
1	111-29194-C001	GENERAL SITE PLAN
2	111-29194-C002	PIT AREA SITE PLAN
3	111-29194-C003	SITE SECURITY PLAN
4	111-29194-C004	DEMOLITION, ABANDONMENT, AND REMOVAL PLAN
5	111-29194-C005	WORK AREA AND TEMPORARY ENCLOSURE LAYOUT
6	111-29194-C006	STAGING PLAN
7	111-29194-C007	EXCAVATION LAYOUT
8	111-29194-C008	CROSS SECTIONS E AND F
9	111-29194-C009	CROSS SECTIONS G AND H
10	111-29194-C010	FINAL GRADING PLAN
11	111-29194-C011	LANDFILL COVER RESTORATION DETAILS

PRELIMINARY DESIGN

GHD Services Inc.
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St. Paul MN 55112 USA
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Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

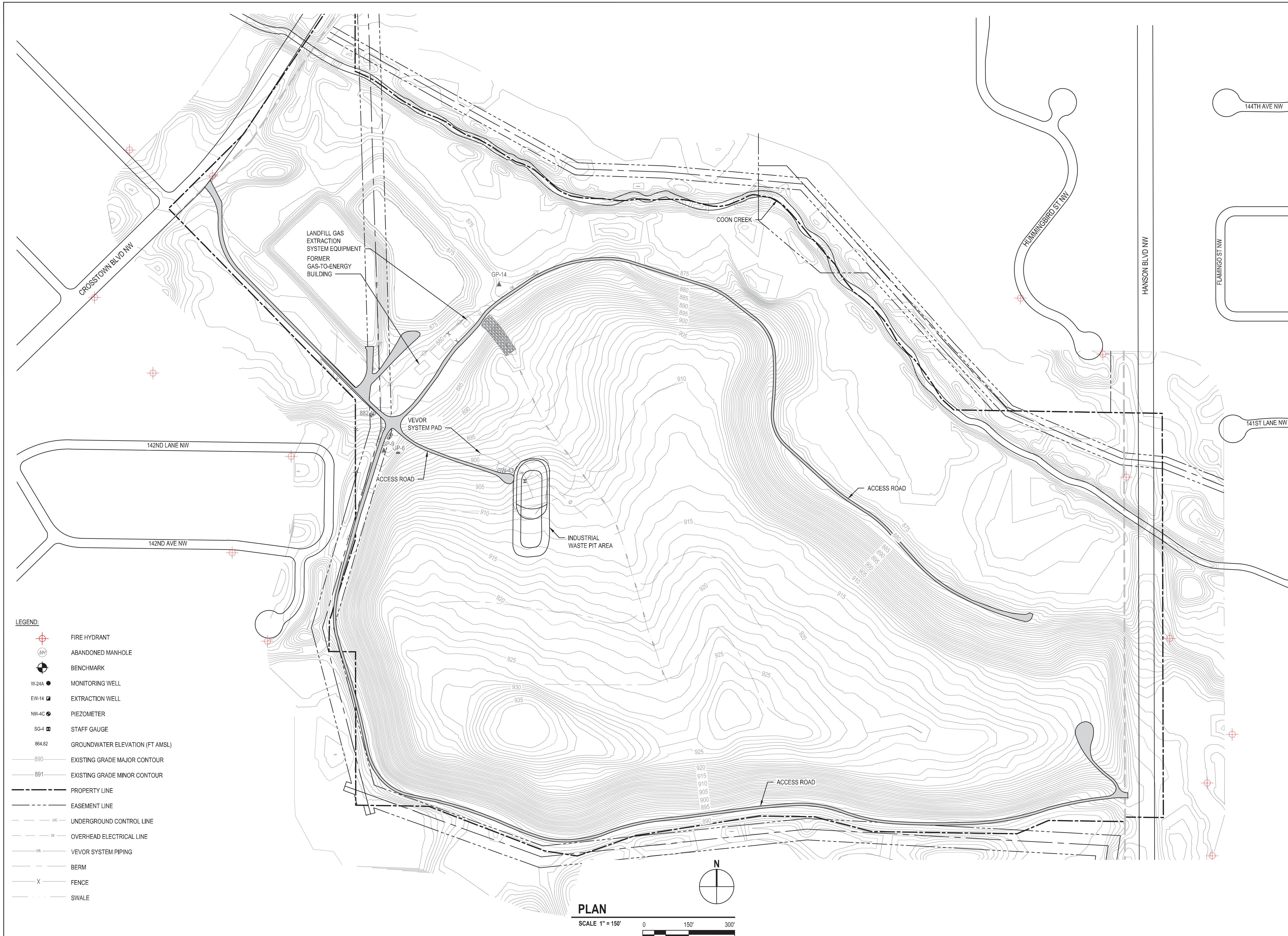
No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn **C. ROHRICH**	Designer **T. REE**
Drafting Check	Design Check
Project Manager **R. MARTIN**	Date **MAY 2017**
This document shall not be used for construction unless signed and sealed for construction.	Scale **NONE**
Original Size **ANSI D**	Bar is one inch on original size sheet 0 1"

Project No. **11129194**

Title
COVER SHEET

Sheet No.
111-29194-G001



PRELIMINARY DESIGN

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WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

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Drawn C. ROHRICH
Designer T. REE
Drafting Check
Design Check
Project Manager R. MARTIN
Date MAY 2017
This document shall not be used for construction unless signed and sealed for construction.
Scale 1" = 150'
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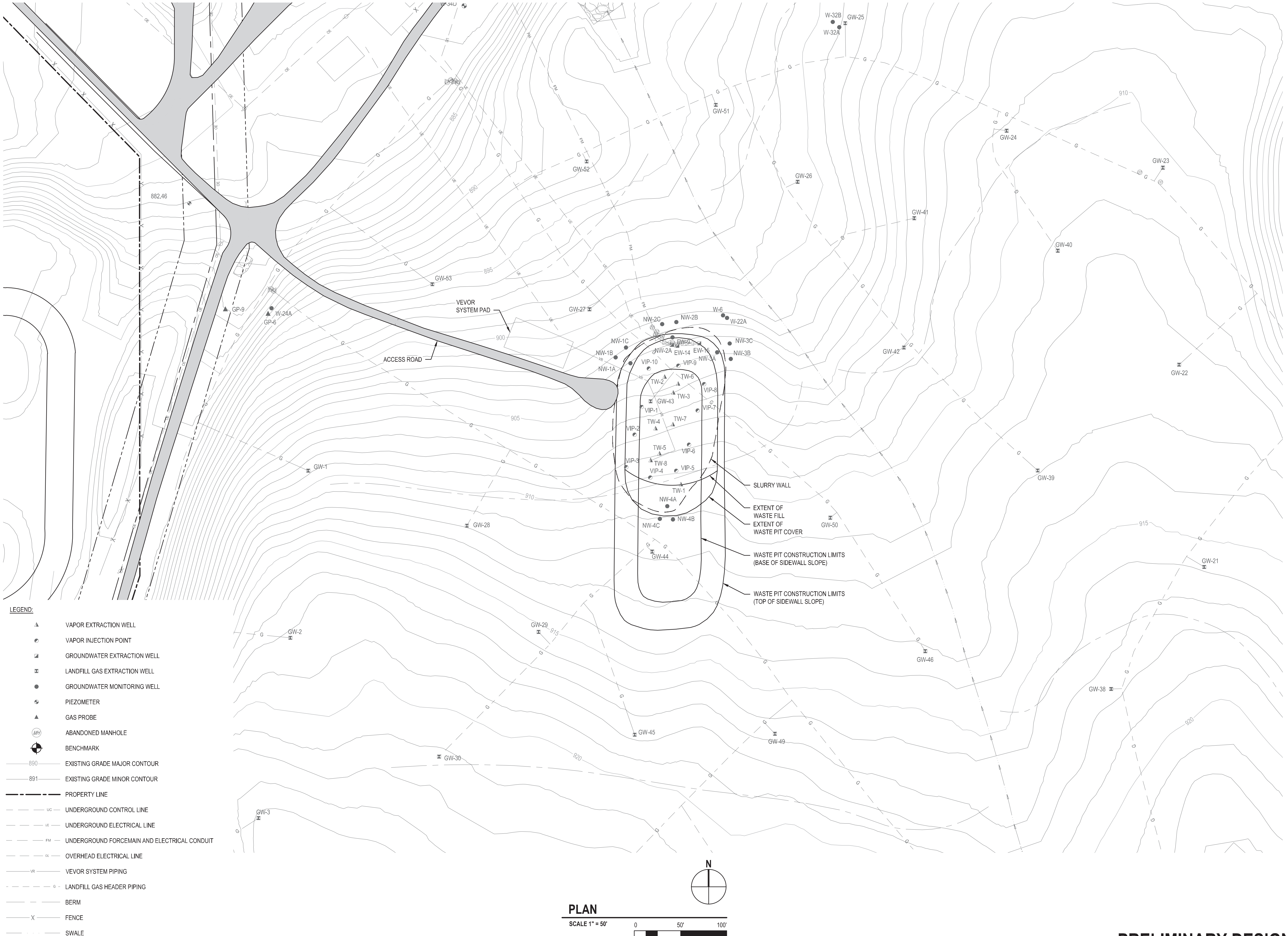
Bar is one inch on original size sheet 0 1"
Project No. 11129194

Title
GENERAL SITE PLAN

Sheet No.
111-29194-C001

Sheet 1 of 17

Plot Date: 26 March 2018 - 10:16 AM Plotted By: Christopher Rohrich Filename: p:\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-C001.dwg



LEGEND:

	VAPOR EXTRACTION WELL
	VAPOR INJECTION POINT
	GROUNDWATER EXTRACTION WELL
	LANDFILL GAS EXTRACTION WELL
	GROUNDWATER MONITORING WELL
	PIEZOMETER
	GAS PROBE
MH	ABANDONED MANHOLE
	BENCHMARK
890	EXISTING GRADE MAJOR CONTOUR
891	EXISTING GRADE MINOR CONTOUR
	PROPERTY LINE
UC	UNDERGROUND CONTROL LINE
UE	UNDERGROUND ELECTRICAL LINE
FM	UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
OE	OVERHEAD ELECTRICAL LINE
VR	VEVOR SYSTEM PIPING
G	LANDFILL GAS HEADER PIPING
	BERM
X	FENCE
	SWALE

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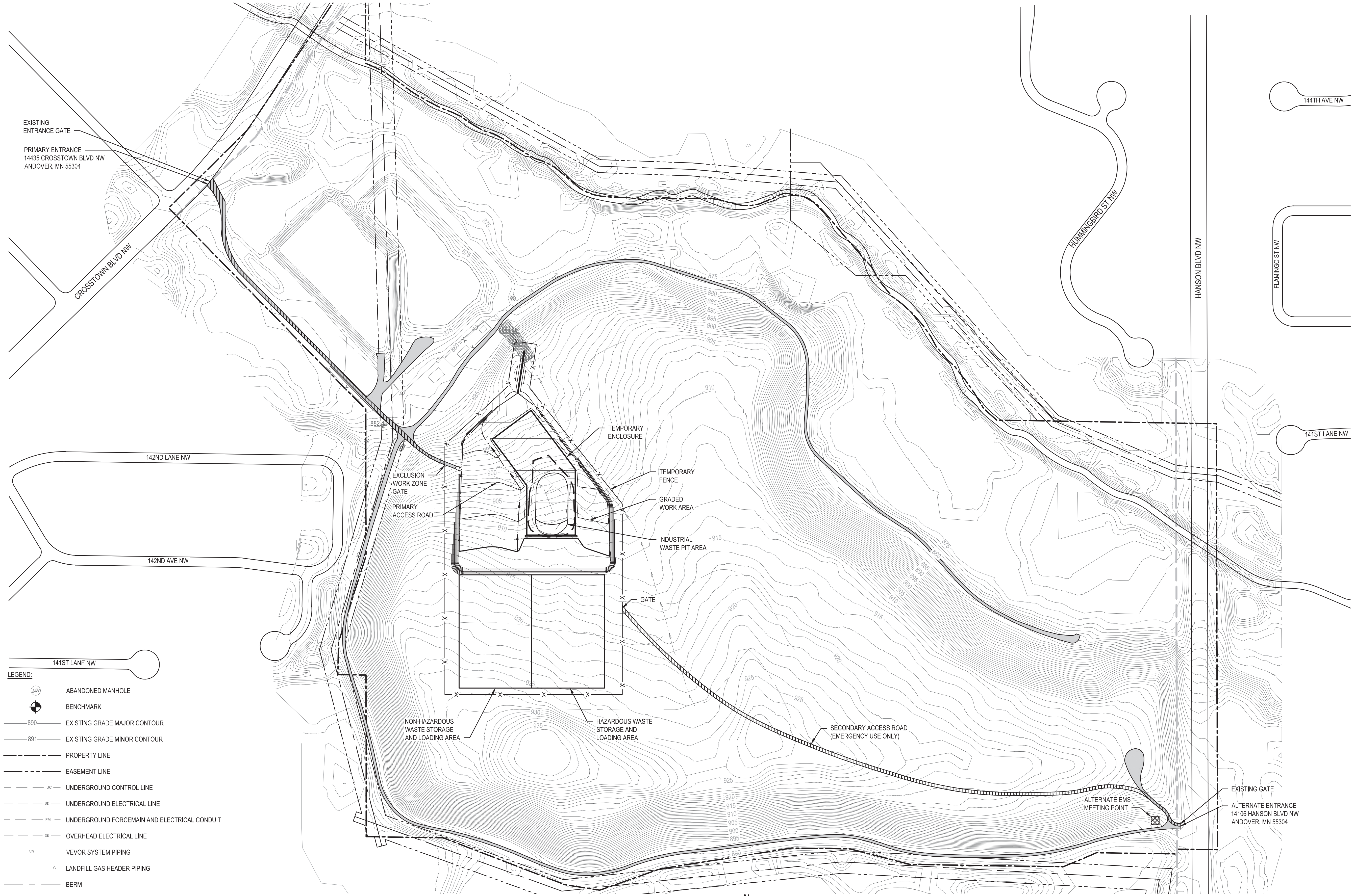
Project No. 11129194

Title
PIT AREA SITE PLAN

Sheet No.
111-29194-C002



LEGEND:

- ABANDONED MANHOLE
- BENCHMARK
- EXISTING GRADE MAJOR CONTOUR (890)
- EXISTING GRADE MINOR CONTOUR (891)
- PROPERTY LINE
- EASEMENT LINE
- UNDERGROUND CONTROL LINE
- UNDERGROUND ELECTRICAL LINE
- UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OVERHEAD ELECTRICAL LINE
- VEVOR SYSTEM PIPING
- LANDFILL GAS HEADER PIPING
- BERM
- FENCE
- SWALE
- PROPOSED MAJOR CONTOUR (890)
- PROPOSED MINOR CONTOUR (891)
- PROPOSED SWALE
- PROPOSED TEMPORARY FENCE

N

PLAN

SCALE 1" = 150'

0 150' 300'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
T 1 651 639 0913 F 1 651 639 0923 W www.ghd.com

Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSUED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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Project No. 11129194

Title
SITE SECURITY PLAN

Sheet No.
111-29194-C003

Sheet 8 of 17

LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UC UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR
- PROPOSED SWALE
- FEATURES TO BE ABANDONED/REMOVED
- FEATURES TO BE PROTECTED/MODIFIED
- FEATURES TO BE REMOVED AND REPLACED

PLAN

SCALE 1" = 150'

0 20' 40' 80'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
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St. Paul MN 55112 USA
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn C. ROHRICH — Designer T. REE

Drafting Check — Design Check

Project Manager R. MARTIN — Date MAY 2017

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Original Size ANSI D — Bar is one inch on original size sheet 0 1"

Project No. 11129194

Title
DEMOLITION, ABANDONMENT, AND REMOVAL PLAN

Sheet No.
111-29194-C004

Plot Date: 26 March 2018 - 10:17 AM Plotted By: Christopher Rohrich Filename: p:\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-C004.dwg

PLAN

SCALE 1" = 150'

0 20' 40' 80'

LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UC UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR
- PROPOSED SWALE

PRELIMINARY DESIGN

GHD

GHD Services Inc.
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn C. ROHRICH	Designer T. REE
Drafting Check	Design Check
Project Manager R. MARTIN	Date MAY 2017
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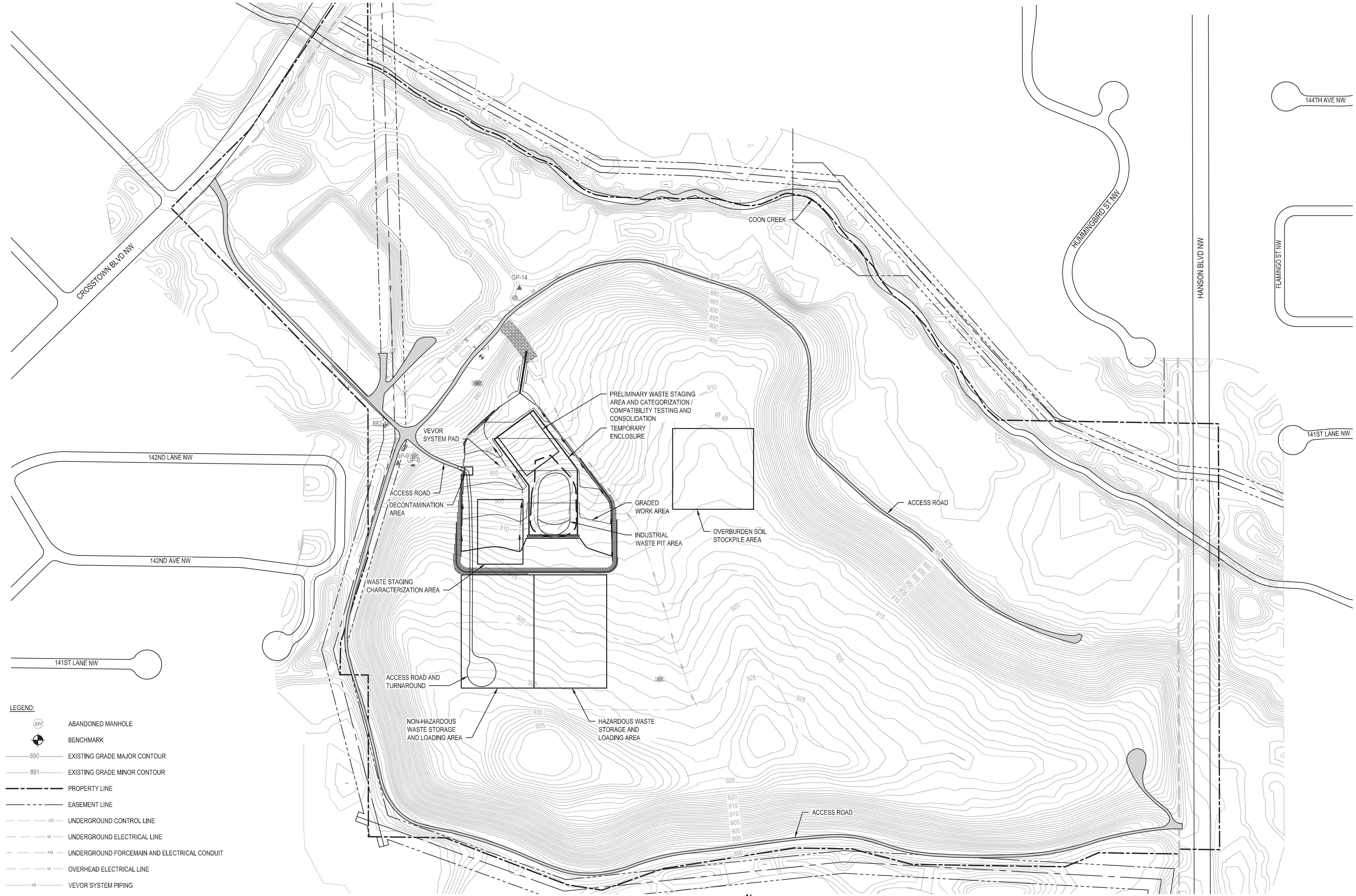
Project No. 11129194

Title
WORK AREA AND TEMPORARY ENCLOSURE LAYOUT

Sheet No.
111-29194-C005

Sheet 10 of 17



LEGEND:

MH	ABANDONED MANHOLE
	BENCHMARK
890	EXISTING GRADE MAJOR CONTOUR
891	EXISTING GRADE MINOR CONTOUR
	PROPERTY LINE
	EASEMENT LINE
UC	UNDERGROUND CONTROL LINE
UE	UNDERGROUND ELECTRICAL LINE
FM	UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
OE	OVERHEAD ELECTRICAL LINE
VR	VEVOR SYSTEM PIPING
G	LANDFILL GAS HEADER PIPING
	BERM
X	FENCE
	SWALE
890	PROPOSED MAJOR CONTOUR
891	PROPOSED MINOR CONTOUR

PLAN

SCALE 1" = 150'

0 150' 300'

PRELIMINARY DESIGN

GHD Services Inc.
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St. Paul MN 55112 USA
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
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Project Manager	R. MARTIN	Date	MAY 2017
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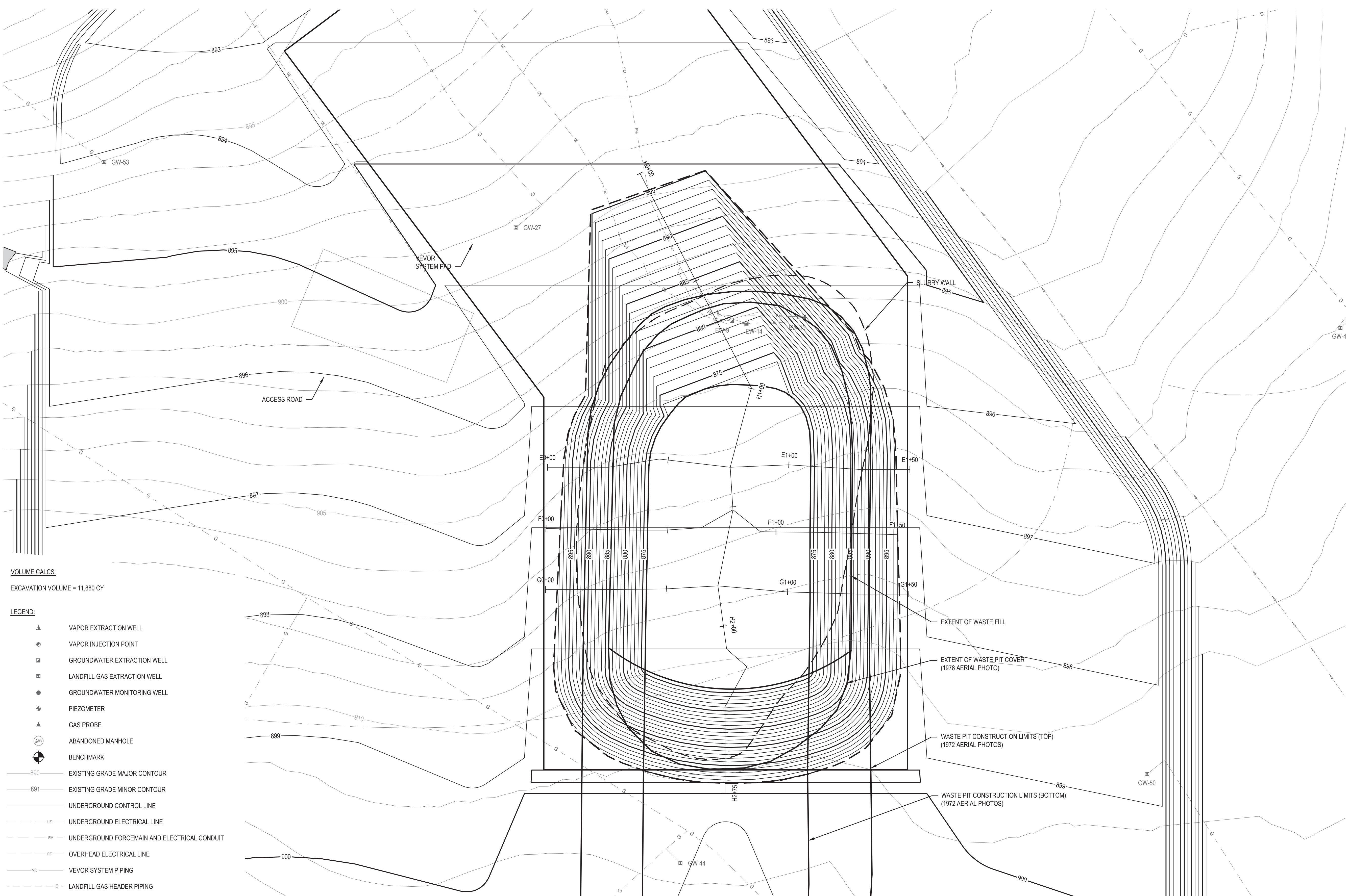
Project No. 11129194

Title
STAGING PLAN

Sheet No.
111-29194-C006

Sheet 12 of 17



VOLUME CALCS:

EXCAVATION VOLUME = 11,880 CY

LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR
- SLURRY WALL

N

PLAN

SCALE 1" = 20'

0 20' 40'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
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St. Paul MN 55112 USA
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Client

MINNESOTA POLLUTION CONTROL AGENCY

Project

WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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Project No. 11129194

Title

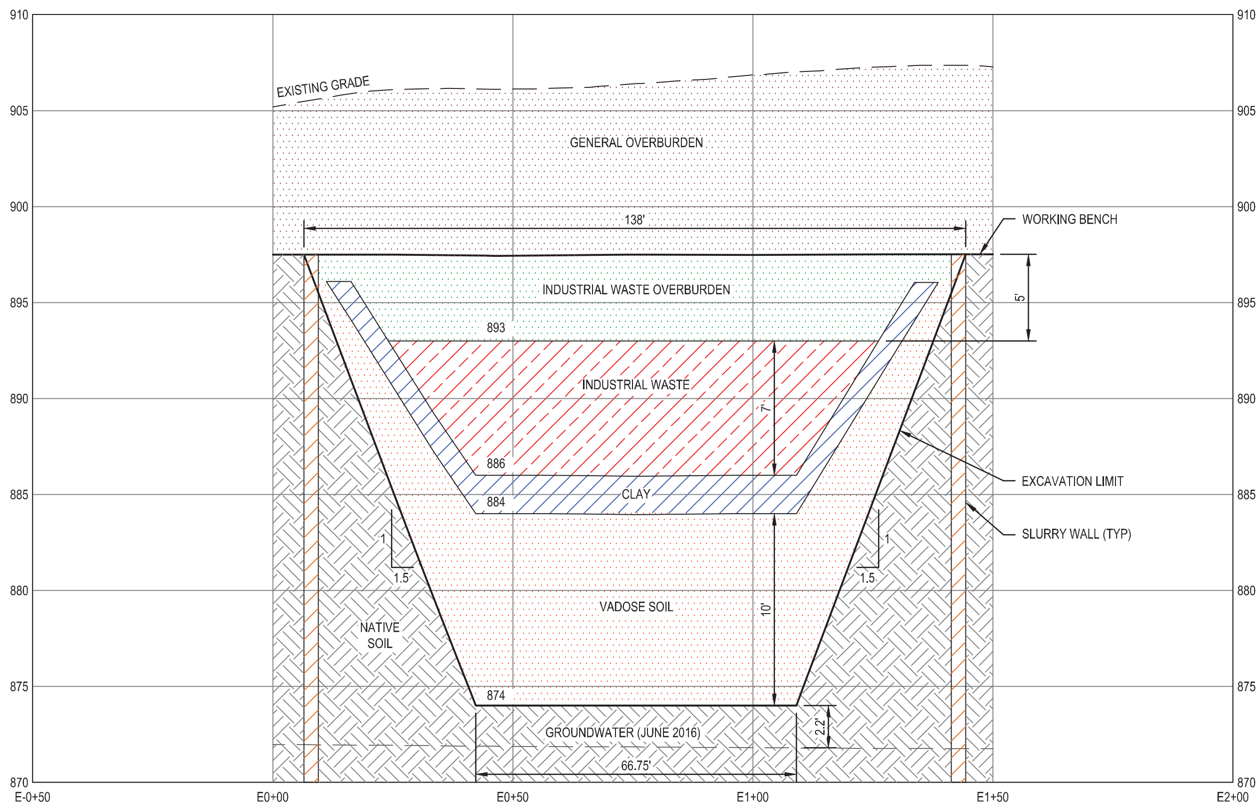
EXCAVATION LAYOUT

Sheet No.

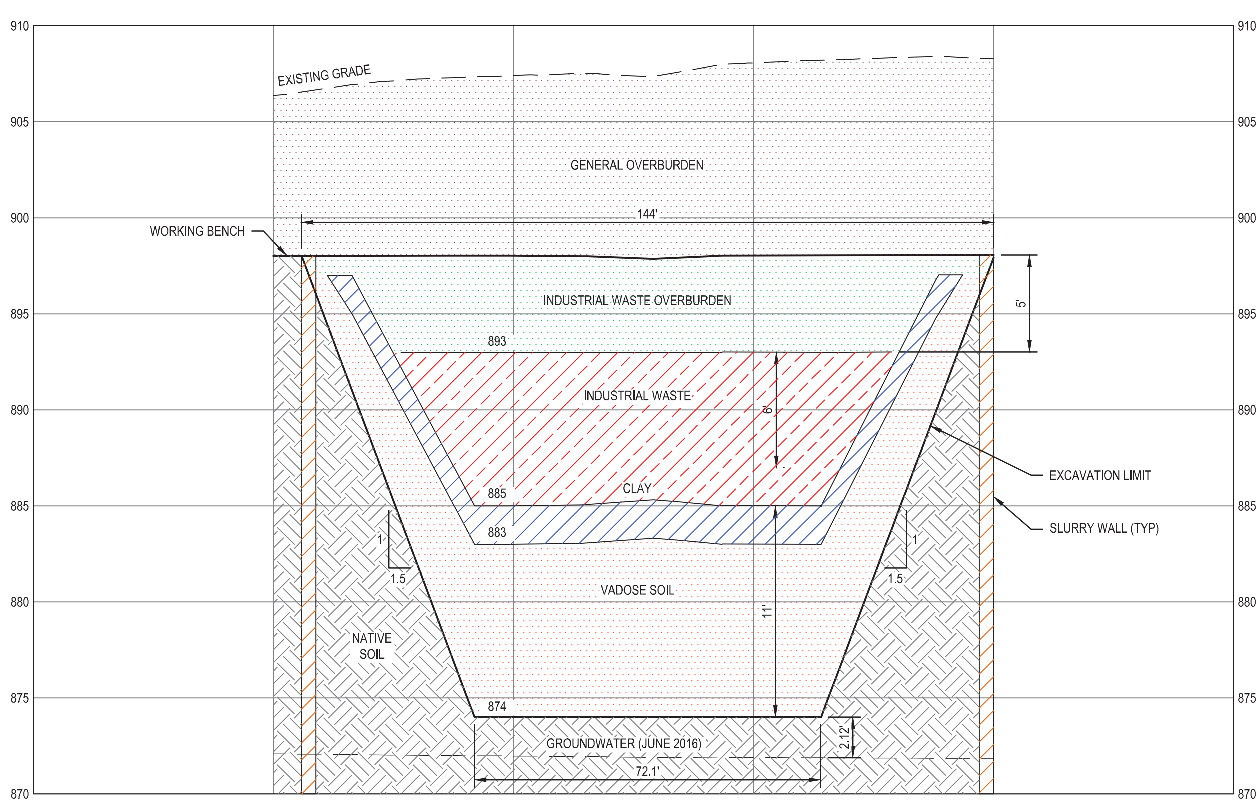
111-29194-C007

Plot Date: 26 March 2018 - 10:17 AM Plotted By: Christopher Rohrich Filename: p:\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-C007.dwg

WASTE DISPOSAL - CLASSIFICATION PORTIONS SUMMARY				
MATERIAL	RCRA/TSCA HAZARDOUS WASTE (INCINERATOR FACILITY)	RCRA HAZARDOUS WASTE (INCINERATOR FACILITY)	RCRA HAZARDOUS WASTE (SUBTITLE C LANDFILL)	NON-HAZARDOUS WASTE (SUBTITLE D LANDFILL)
INDUSTRIAL WASTE OVERBURDEN	0%	0%	20%	80%
INDUSTRIAL WASTE	70%	10%	10%	10%
CLAY	70%	10%	10%	10%
VADOSE SOIL (DIRECTLY BELOW INDUSTRIAL WASTE)	0%	70%	30%	0%
VADOSE SOIL (ADJACENT TO INDUSTRIAL WASTE)	0%	0%	0%	0%



E
C007
SECTION



F
C007
SECTION

HORIZ: 0 20' 40'

VERT: 0 5' 10'

PRELIMINARY DESIGN

GHD
GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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Original Size	ANSI D	Bar is one inch on original size sheet	0 1"

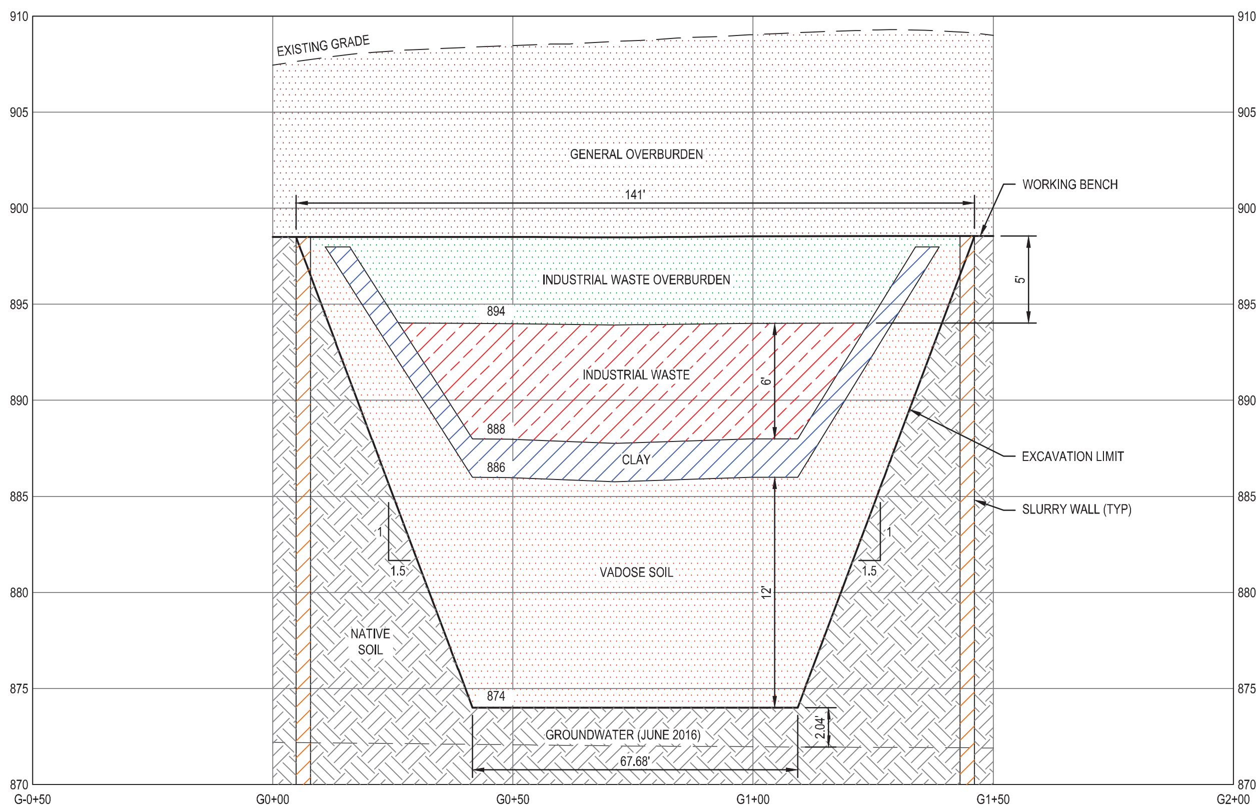
Project No. 11129194

Title
CROSS SECTIONS E AND F

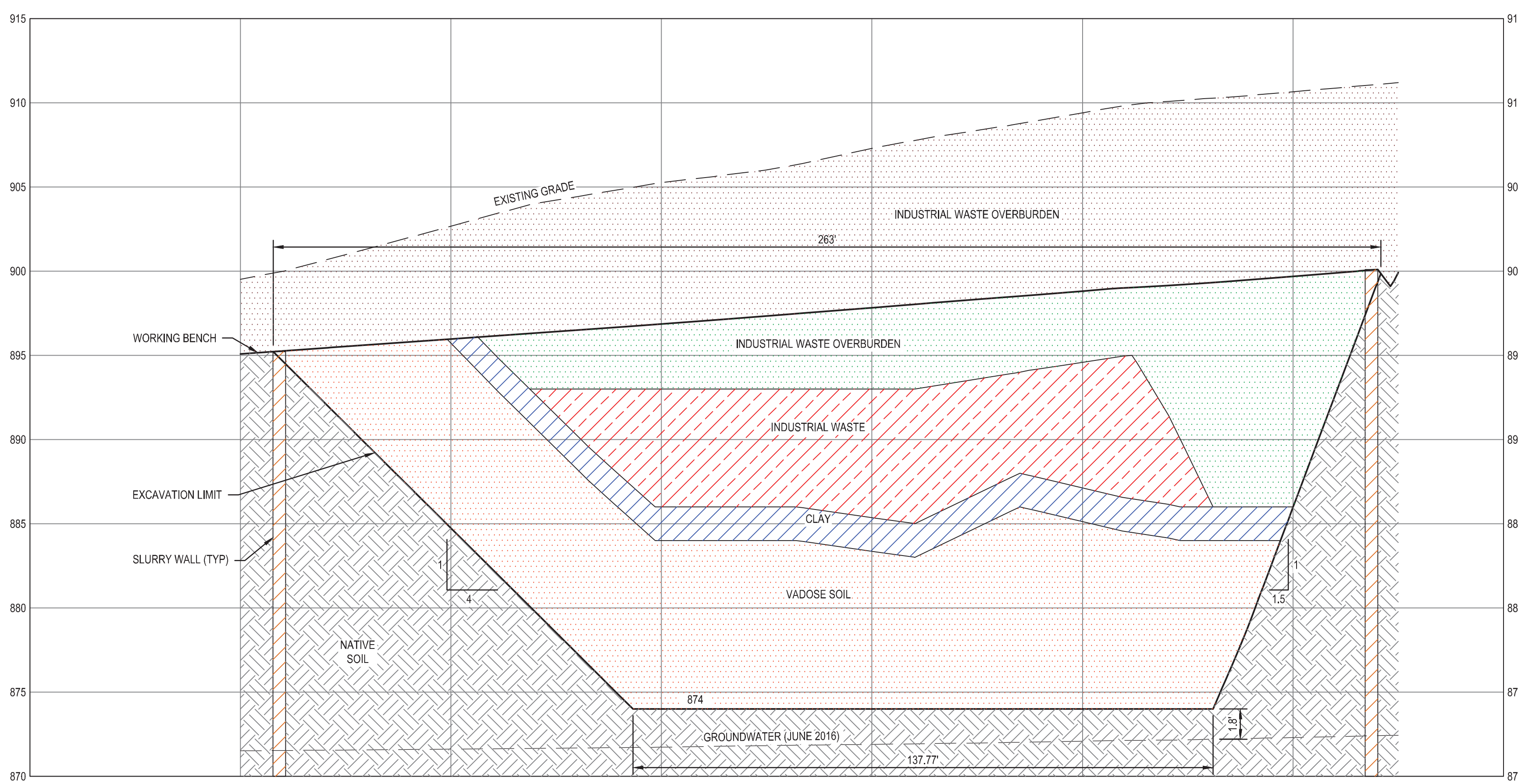
Sheet No.
111-29194-C008

Plot Date: 26 March 2018 - 10:18 AM Plotted By: Christopher Rohrich Filename: p:\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-C008.dwg

WASTE DISPOSAL - CLASSIFICATION PORTIONS SUMMARY				
MATERIAL	RCRA/TSCA HAZARDOUS WASTE (INCINERATOR FACILITY)	RCRA HAZARDOUS WASTE (INCINERATOR FACILITY)	RCRA HAZARDOUS WASTE (SUBTITLE C LANDFILL)	NON-HAZARDOUS WASTE (SUBTITLE D LANDFILL)
INDUSTRIAL WASTE OVERBURDEN	0%	0%	20%	80%
INDUSTRIAL WASTE	70%	10%	10%	10%
CLAY	70%	10%	10%	10%
VADOSE SOIL (DIRECTLY BELOW INDUSTRIAL WASTE)	0%	70%	30%	0%
VADOSE SOIL (ADJACENT TO INDUSTRIAL WASTE)	0%	0%	0%	0%



G
C007
SECTION



H
C007
SECTION

0 20' 40'
HORIZ:
0 5' 10'
VERT:

PRELIMINARY DESIGN

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn C. ROHRICH
Designer T. REE
Drafting Check
Design Check
Project Manager R. MARTIN
Date MAY 2017
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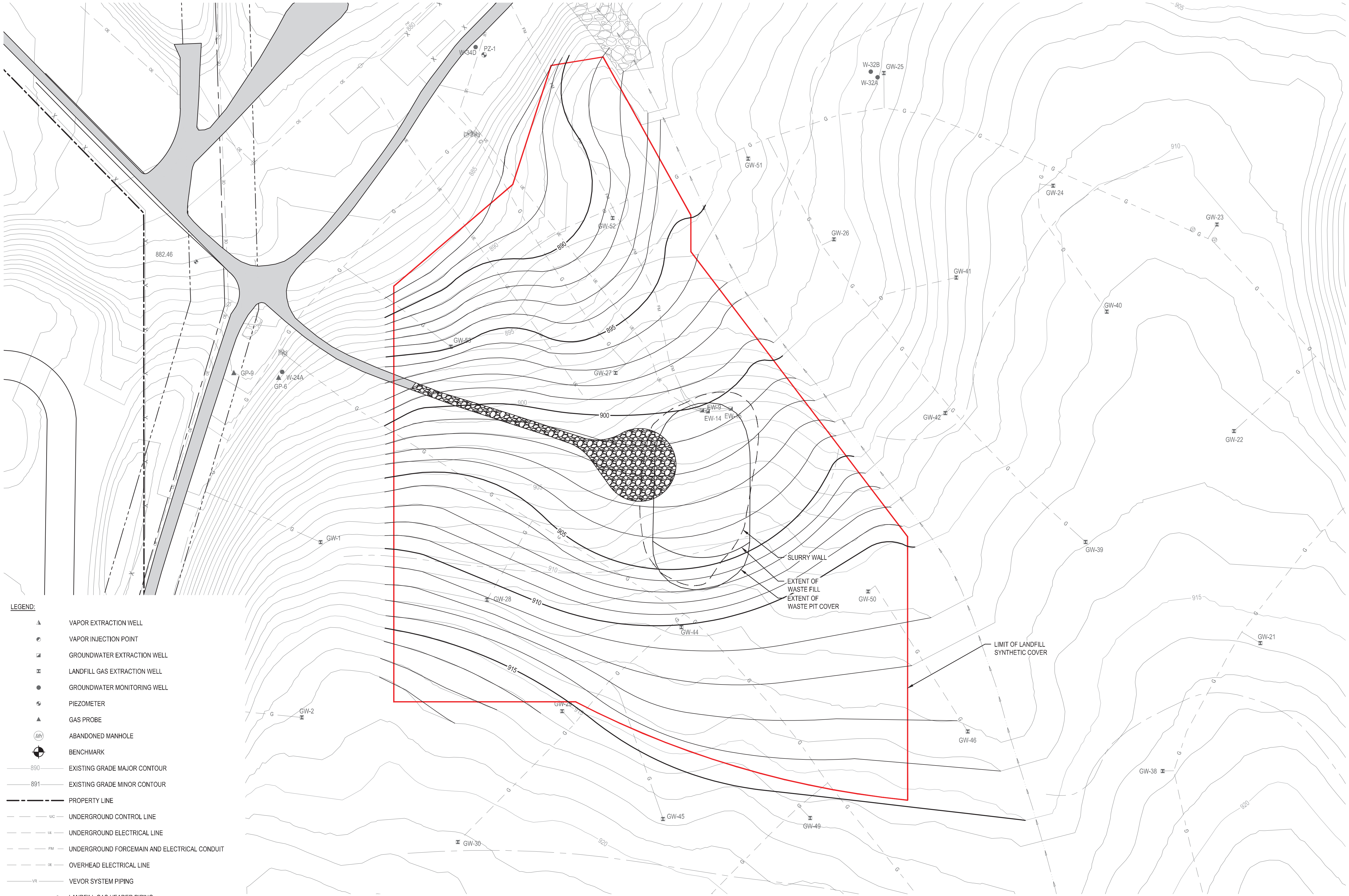
Original Size
ANSI D
Bar is one inch on original size sheet
0 1"

Project No. 11129194

Title
CROSS SECTIONS G AND H

Sheet No.
111-29194-C009

Sheet 15 of 17



LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- MH ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- PROPERTY LINE
- UC UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR

N

PLAN

SCALE 1" = 50'

0 50' 100'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
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Client

MINNESOTA POLLUTION CONTROL AGENCY

Project

WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
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Project No. 11129194

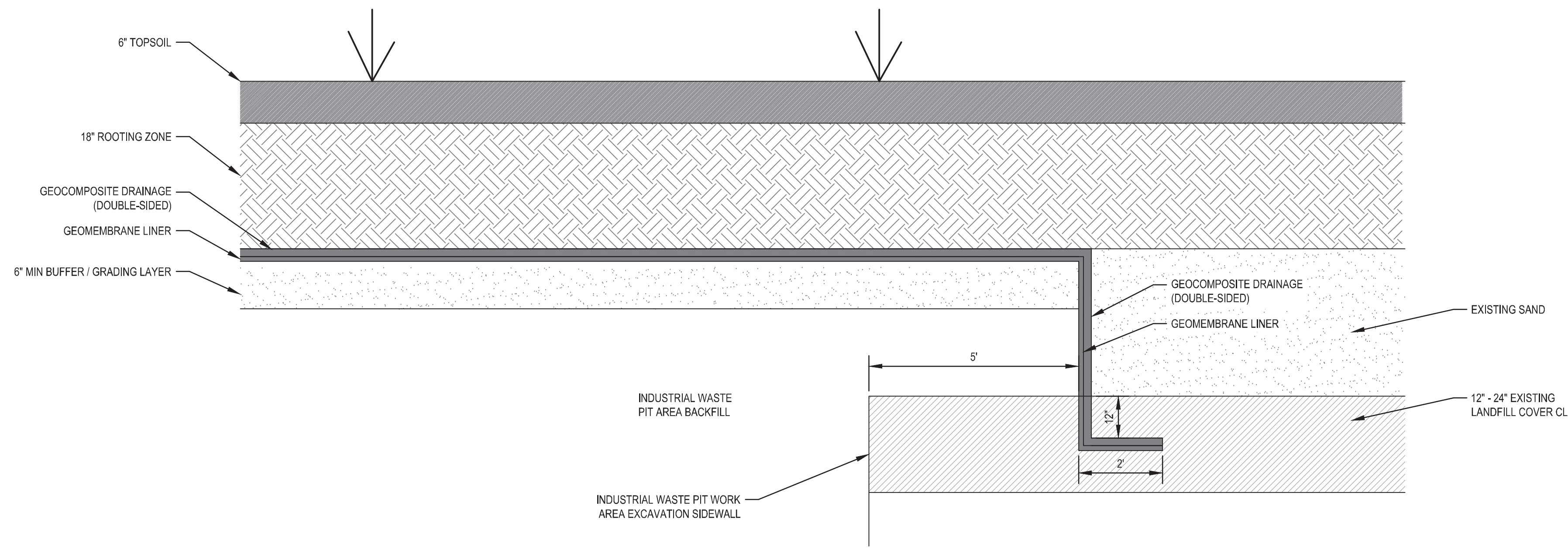
Title

FINAL GRADING PLAN

Sheet No.

111-29194-C010

Sheet 16 of 17



1 **FINAL COVER**
SCALE NTS

PRELIMINARY DESIGN

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn C. ROHRICH	Designer T. REE
Drafting Check	Design Check
Project Manager R. MARTIN	Date MAY 2017
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Original Size ANSI D	Bar is one inch on original size sheet 0 1"

Project No. 11129194

Title
LANDFILL COVER RESTORATION DETAILS

Sheet No.
111-29194-C011

Appendix B
Construction Specifications List

Section No.	Section Name
DIVISION 01 - GENERAL REQUIREMENTS	
01 00 00	General Requirements
01 10 00	Summary
01 30 00	Administrative Requirements
01 32 16	Construction Progress Schedule
01 33 00	Submittal Procedures
01 35 29.13	Health and Safety
01 35 46	Indoor Air Quality Procedures
01 40 00	Quality Requirements
01 41 00	Regulatory Requirements
01 50 00	Temporary Facilities and Controls
01 57 13	Temporary Soil Erosion and Sediment Controls
01 57 33	Temporary Indoor Air Quality Controls
01 60 00	Product Requirements
01 70 00	Execution and Closeout Requirements
01 74 19	Construction Waste Management and Disposal
01 91 00	Commissioning
DIVISION 02 - EXISTING CONDITIONS	
02 41 19.13	Selective Structure Demolition
02 61 16/19	Transportation and Disposal of Contaminated Materials
02 66 13	Landfill Gas Vent Modifications
02 72 23	Water Storage and Treatment
02 86 00	Hazardous Waste Drum Handling
DIVISION 13 - SPECIAL CONSTRUCTION	
	Tensile Membrane Structures
DIVISION 26 - ELECTRICAL	
26 05 00	Common Work Results for Electrical
26 50 00	Lighting - Interior, Exterior, and Emergency
DIVISION 31 - EARTHWORK	
31 05 13	Soils for Earthwork
31 05 16	Aggregates for Earthwork
31 05 19.13	Geotextiles for Earthwork
31 20 00	Earth Moving
31 22 13	Rough Grading
31 23 16	Excavation
31 23 16.13	Trenching
31 23 19	Dewatering
31 23 23	Fill
31 25 00	Erosion and Sedimentation Controls
31 35 26.16	Geomembrane and Geocomposite Materials
	Seeding
DIVISION 33 - UTILITIES	
33 21 00	Extraction Wells
33 34 00	Piping and Force Mains
33 71 73	Electrical Utility Services
DIVISION 43 - PROCESS GAS AND LIQUID HANDLING, PURIFICATION, AND STORAGE EQUIPMENT	
43 21 39	Submersible Liquid Pumps
DIVISION 46 - WATER AND WASTEWATER EQUIPMENT	
46 07 53	Packaged Wastewater Treatment Equipment

Appendix C
Subsoil Excavation Elevation Design Basis

Memorandum

March 8, 2018

To:	Ben Klismith, MPCA	Ref. No.:	11129194-31-02
	TDR		
From:	Tim Ree/sb/1	Tel:	651-639-0913
CC:	Pat Hanson, MPCA Bob Martin, GHD		

Subject: Design Basis – Subsoil Excavation Elevation
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal
Andover, Minnesota

1. Introduction

GHD Services Inc. (GHD) has prepared this memorandum providing an evaluation of groundwater elevations in the immediate vicinity of the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site). This evaluation will serve as the basis for the design of the industrial waste pit and subsoil excavation depth, design plans and specifications, and project costs. The objective of the subsoil excavation directly below the industrial waste pit is to maximize the amount of source material to be removed without dewatering or working within saturated conditions. Furthermore, shipping saturated soil long distances to a disposal facility will likely generate free liquids during transportation and increase disposal costs.

2. Groundwater Elevations

In an email dated February 27, 2018, the Minnesota Pollution Control Agency (MPCA) provided a summary of groundwater elevations between 2001 and 2017 for wells NW-1A, NW-1B, NW-2A, NW-2B, NW-3A, NW-3B, NW-4A, and NW-4B. The “A” wells are located within the slurry wall surrounding the industrial waste pit and show water levels under pumping conditions, and the “B” wells are located outside the slurry wall and show water levels that are relatively unaffected by pumping. All wells are screened within the upper portion of the upper sand unit at elevations generally ranging between 860 feet above mean sea level (AMSL) and 870 feet AMSL.

Hydrographs of groundwater elevations measured in the “A” and “B” wells are provided as Chart 1 and Chart 2, respectively. GHD focused this evaluation on groundwater elevations outside of the slurry wall (i.e., “B” wells) since these elevations would be representative of conditions to be encountered during the pit and subsoil removal work. The data shows that groundwater elevations outside the slurry wall predominantly ranged between 870 and 874 feet AMSL. However, the lowest elevations, ranging between approximately 868 and 869 feet AMSL, were recorded during a short period in 2009. Seasonal fluctuations of 1 to 2 feet occur with the lowest groundwater elevations typically observed in the summer/fall and highest elevations in the spring. The most recent groundwater elevations measured in 2017 ranged between 873 and 874 feet AMSL.

3. Design Considerations

GHD considered the following factors in determining a design excavation elevation:

- Groundwater elevations
- Pit subsoil type and capillary fringe interval
- Equipment loading/operation directly above the groundwater table contributing to “pumping” and a localized increase of the groundwater elevation and saturated conditions

The elevation at the base of the excavation has a direct impact on the quantity of material to be excavated, the size of the temporary enclosure over the excavation to contain vapors, vapor mitigation specifications, and associated costs. As compared to a more shallow excavation, a deeper excavation will require additional soil removal, a larger enclosure due to a wider excavation associated with additional sidewall sloping, a larger vapor mitigation system, and increased soil disposal costs.

The design excavation elevation will allow the contractor to select the appropriate excavation equipment. The elevation will also allow for appropriate temporary enclosure and vapor mitigation system sizing.

3.1 Design Groundwater Elevation

An assumed groundwater elevation of 872 feet AMSL will be used as the design basis. It is unknown when the industrial waste pit removal will occur. This represents the average elevation based on sixteen years of monitoring data.

Groundwater and/or perched water was pulled up into the VEVOR system during operation. Operation of the VEVOR system should be discontinued to prevent continued saturation of the industrial waste and subsoil to be excavated.

3.2 Pit Subsoil Type and Capillary Fringe Interval

Based on pre-design drilling and investigation activities within and surrounding the industrial waste pit, the bottom of the waste is 20 to 25 feet below ground surface (bgs) (883 to 888 feet AMSL) and is lined by a 6 inch to 2-foot thick clay layer. The waste pit is underlain by fine sand to fine silty sand that extends below the groundwater table to approximately 43 feet bgs on the north side to 50 feet bgs on the south side. Silty sand layers were also encountered at some drilling locations, but at a lower elevation and often below or near the water table. This unit is referred to as the upper portion of the upper sand unit. The groundwater table is within this upper sand unit approximately 10 to 15 feet below the bottom of the waste pit. Based on the sandy soil type, it is expected that groundwater would enter the excavation relatively quickly and dewatering would be required for the excavation to proceed below the groundwater table.

The capillary fringe is the soil area just above the water table where water can rise through the force of capillary action. Capillary action is the ability of a liquid to flow in narrow spaces without assistance of external forces. Capillary action is typically stronger within smaller soil pore spaces. It is assumed that the soils are fine to very fine sand for estimating the potential thickness of the capillary fringe interval. The capillary fringe thickness can be approximated based on the soil grain size. For fine to very fine sand, a capillary fringe of 2 to 3 feet would be expected.[1] An assumed capillary fringe of 2 feet will be used for the design basis.

3.3 Equipment Loading

Excavation equipment loading near the capillary fringe has the potential to reduce pore sizes through compaction, thus increasing capillary action that can cause a localized draw-up of water from the capillary fringe. The result can be saturation of the soil above the capillary fringe which can cause soil pumping and destabilization. An assumed buffer of 2 feet between excavation equipment and the top of the capillary fringe will be used for the design basis to prevent an increased capillary action.

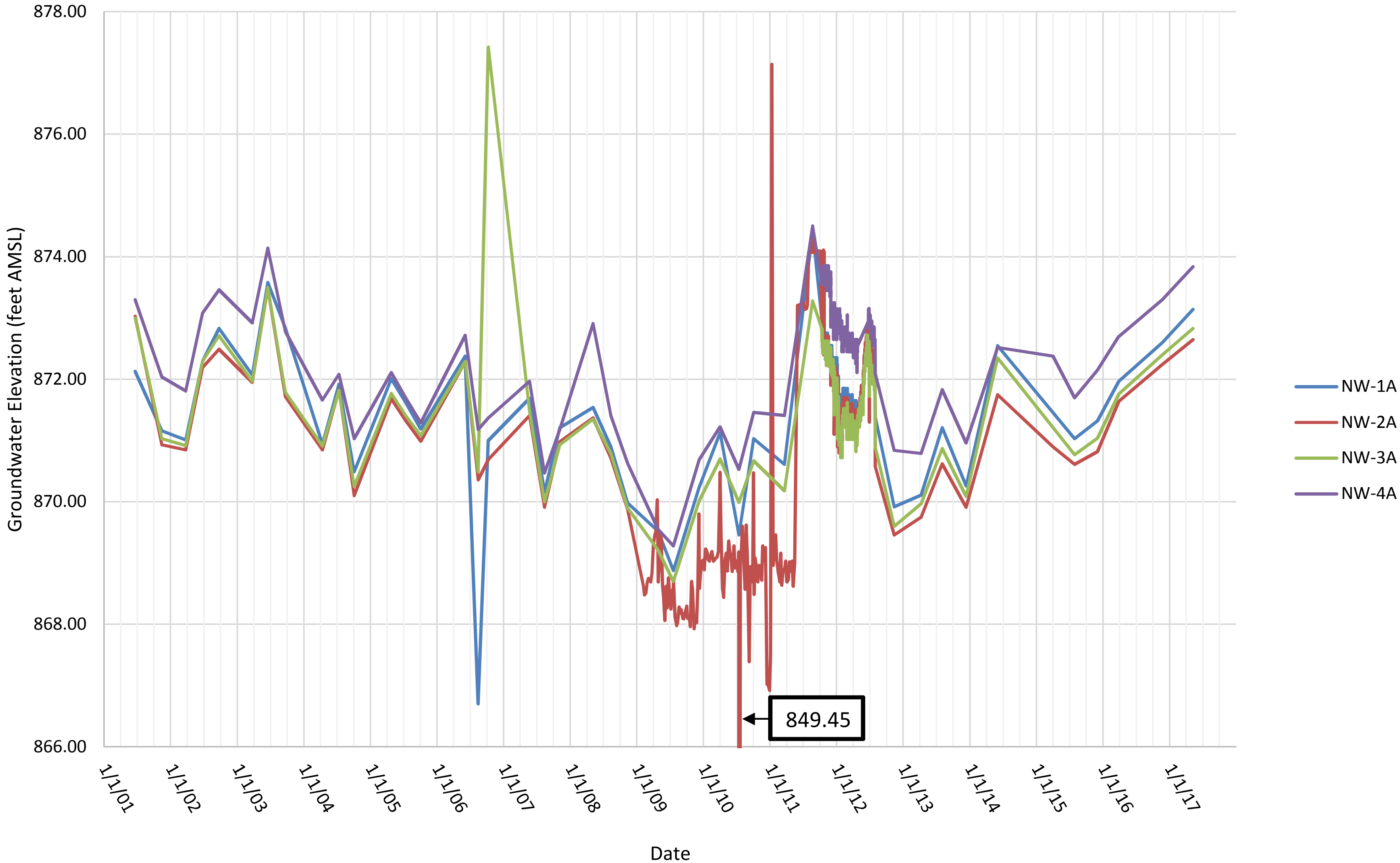
4. Conclusion

GHD is proceeding with the design of the industrial waste pit and subsoil removal using a design excavation elevation of 874 feet AMSL. This elevation accounts for the average groundwater elevation of 872 feet AMSL and a capillary fringe interval of 2 feet to maximize the amount of source material to be removed without dewatering or working within saturated conditions. It also allows for reasonable cost estimating and project planning.

Low ground pressure equipment will be specified for the subsoil excavation to reduce increased capillary action from equipment operations. In addition, at least a 2 foot thick soil buffer will be maintained above the design excavation elevation of 874 AMSL for equipment to operate from as the work progresses. GHD and MPCA would provide direction to the contractor for the final excavation depth based on actual conditions encountered during the work.

[1] Fetter, C. W., Applied Hydrogeology, 3rd ed., New York: Macmillan, 1994, Chapter 6, p. 182.

Chart 1
NW-"A" Well Hydrographs
Waste Disposal Engineering Closed Landfill
Andover, Minnesota



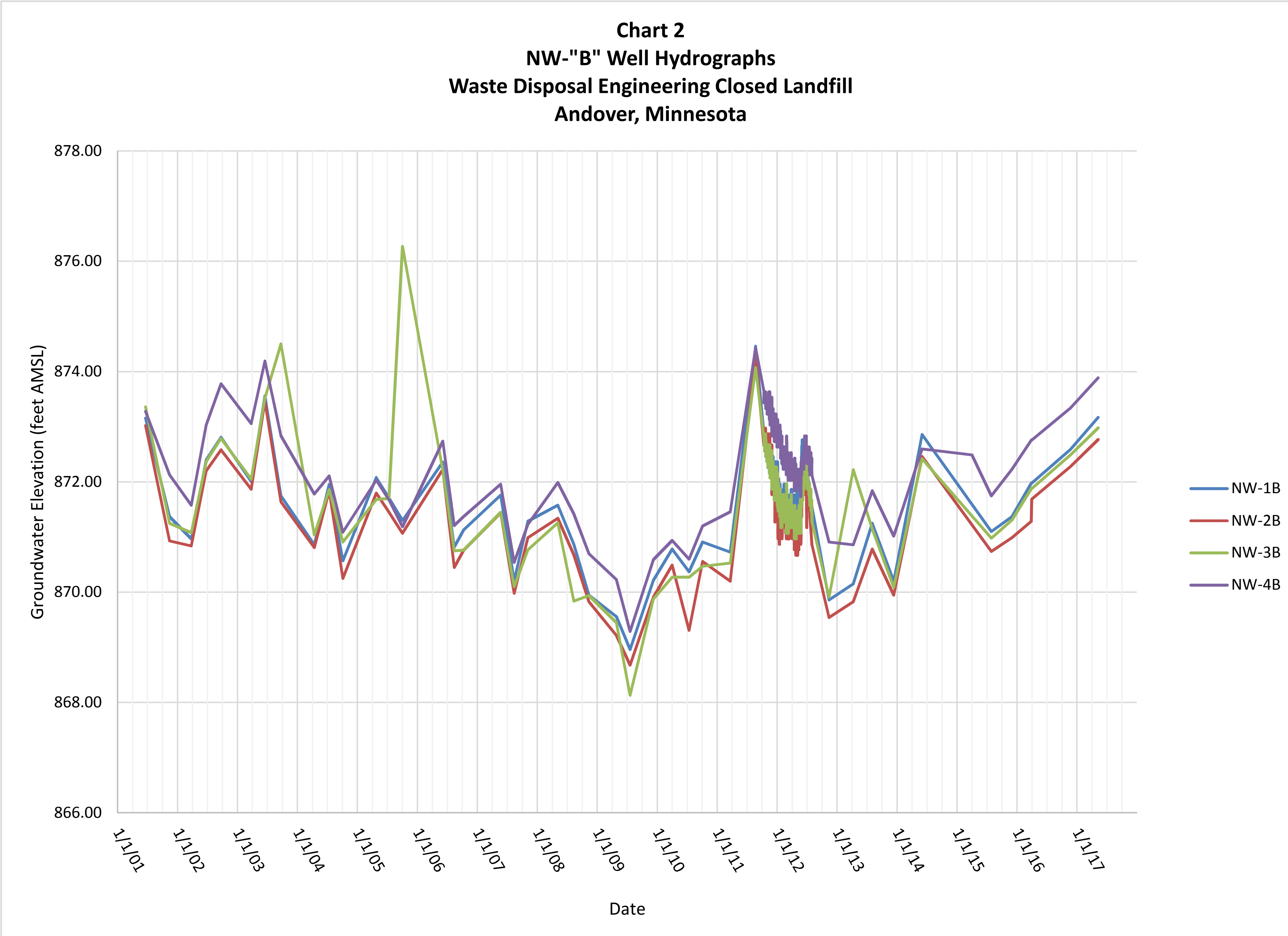


Chart 2
NW-"B" Well Hydrographs
Waste Disposal Engineering Closed Landfill
Andover, Minnesota
878.00
876.00
874.00
872.00
870.00
868.00
866.00
Groundwater Elevation (feet AMSL)
1/1/01
1/1/02
1/1/03
1/1/04
1/1/05
1/1/06
1/1/07
1/1/08
1/1/09
1/1/10
1/1/11
1/1/12
1/1/13
1/1/14
1/1/15
1/1/16
1/1/17
Date
NW-1B
NW-2B
NW-3B
NW-4B

Appendix D
Example Sampling and Analysis Plan Outline

Final

Sampling and Analysis Plan - Outline

Waste Disposal Engineering Closed Landfill
Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

11129194| Report No __ | April 10, 2018

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Appendix E
Construction Quality Assurance Project Plan Outline

Final

Construction Quality Assurance Project Plan - Outline

Waste Disposal Engineering Closed Landfill
Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

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Appendix F
Draft Contingency and Emergency Response Plan

Draft

Contingency and Emergency Response Plan

Waste Disposal Engineering (WDE) Closed Landfill
14437 Crosstown Boulevard
Andover, Minnesota

GHD | 1801 Old Highway 8 Northwest Suite 114, St. Paul, Minnesota 55112 USA

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Emergency Contacts

	Contact	Phone/Email
Site Owner/Generator		
Minnesota Pollution Control Agency 520 Lafayette Road St. Paul, Minnesota 55155	Project Manager: Patrick Hanson Project Engineer: Benjamin Klismith	patrick.hanson@state.mn.us 651-757-2409 benjamin.klismith@state.mn.us 651-757-2497
Engineer		
GHD Services Inc. 1801 Old Highway 8 NW Suite 114 St. Paul, Minnesota 55112	Project Manager: Robert Martin Engineer: Tim Ree	robert.Martin@ghd.com 612-524-6853 tim.Ree@ghd.com 612-524-6866
Contractor – TBD		
City of Andover 1685 Crosstown Boulevard Andover, Minnesota 55304	City Administrator: Jim Dickinson Emergency Manager: Jerry Streich (Fire Chief)	j.dickinson@andovermn.gov 763-767-5110 j.streich@andovermn.gov 763-767-5192
The City of Andover Fire Chief, or designate, will serve as the Incident Commander during this project.		
Anoka County	Emer. Management Director: Terry Stoltzman Emer. Management Coord.: Ryan Kelzenberg	terry.stoltzman@co.anoka.mn.us 763-324-4761 ryan.kelzenberg@co.anoka.mn.us 763-324-4763
Fire Department and Emergency Medical Services (response)		
City of Andover Fire 13875 Crosstown Boulevard Andover, Minnesota 55304	Fire Chief: Jerry Streich	j.streich@andovermn.gov 763-767-5192
Emergency Medical Services (ambulance)		
Allina Health Emergency Medical Services 167 Grand Avenue St. Paul, Minnesota 55102		651-241-4400

	Contact	Phone/Email
Police/Sheriff		
Anoka County Sheriff's Office 13301 Hanson Boulevard NW Andover, Minnesota 55304		sheriff@co.anoka.mn.us 763-324-5036
Hospital		
Mercy Hospital 4050 Coon Rapids Boulevard Coon Rapids, Minnesota 55433		763-236-6000
Minnesota Duty Officer (state spill reporting)		
Department of Public Safety 445 Minnesota Street St. Paul, Minnesota 55101	Duty Officer	651-649-5451 or 1-800-422-0798
National Response Center (federal spill reporting)		1-800-424-8802
United State Environmental Protection Agency (USEPA)		
US EPA Region 5 Ralph Metcalfe Federal Building 77 West Jackson Boulevard Chicago, Illinois 60604	Regional Response Center	312-353-2318
Minnesota Department of Transportation (MNDOT)		
395 John Ireland Boulevard St. Paul, Minnesota 55155		651-296-3000
Minnesota Department of Natural Resources (DNR)		
500 Lafayette Road St. Paul, Minnesota 55155		651-296-6157
Minnesota Department of Health (MDH)		
Environmental Health Division Site Assessment & Consultation Unit 625 Robert Street N. St. Paul, Minnesota 55164	Environmental Research Scientist: Daniel Pena	daniel.pena@state.mn.us 651-201-4920
Local Watershed		
Coon Creek Watershed District 12301 Central Avenue, Suite 100 Blaine, Minnesota 55434		763-755-0975 info@cooncreekwd.org
Poison Control Center		1-800-222-1222

1. Introduction

This Contingency and Emergency Response Plan (CERP) presents the procedures for preparing for, responding to, and mitigating emergencies or environmental releases related to the excavation and removal of waste materials from the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site). The CERP is organized as follows:

- **Section 1: Introduction.** Includes Site background, location, history, regulatory authority and compliance, and an overview of the project scope of work.
- **Section 2: Pre-Emergency Planning.** Includes identification of Site-related emergency contacts; personnel roles and responsibilities; lines of authority; communication procedures; emergency recognition and prevention; Site security and control measures; and personal protective equipment and emergency supplies.
- **Section 3: Emergency Response.** Includes procedures for response to medical emergencies; fire/explosion emergencies; hazardous material vapor release emergencies; hazardous material release to on-Site surface water emergencies; and evacuation routes/procedures.
- **Section 4: Contingency Plans.** Includes contingency plans and procedures for severe weather and hazardous material releases/spills.

1.1 Background

The WDE Closed Landfill is a former solid waste landfill that is comprised primarily of municipal solid waste (MSW). The Site also included an industrial waste pit where hazardous waste was disposed. The Minnesota Pollution Control Agency (MPCA) has determined that the removal of the industrial waste pit is the most effective method to reduce long-term operation and maintenance costs associated with the environmental concerns at the Site stemming from the pit. This CERP is prepared to provide the applicable emergency response and contingency planning necessary for the pit excavation/removal operations.

The CERP is prepared under the regulatory authority and compliance requirements of the following:

- Code of Federal Regulations (CFR), Title 29, Sections 1926.65(l) (29 CFR 1926.65(l)) and 1910.120(l) (29 CFR 1910.120(l)) (Emergency response by employees at uncontrolled hazardous waste sites – Emergency response plan)
- Minnesota Statutes 2017, Chapter 115E, Oil and Hazardous Substance Discharge Preparedness
- National Incident Management System (NIMS)

The emergency response plan requirements of 29 CFR 1926.65(l) and 29 CFR 1910.120(l) are as follows:

- Pre-emergency planning
- Personnel roles, lines of authority, and communication
- Emergency recognition and prevention

- Safe distances and places of refuge
- Site security and control
- Evacuation routes and procedures
- Decontamination procedures which are not covered by the Site safety and health plan
- Emergency medical treatment and first aid
- Emergency alerting and response procedures
- Critique of response and follow-up
- Personal protective equipment (PPE) and emergency equipment

In addition, this CERP is written to interface with local, state, regional, and federal contingency and emergency response plans including:

- City of Andover Emergency Operations Plan
- Anoka County All Hazards Mitigation Plan
- Anoka County Emergency Operations Plan
- Minneapolis/St. Paul Sub-Area Contingency Plan
- Minnesota State Hazard Mitigation Plan
- State of Minnesota Emergency Operations Plan
- United States Environmental Protection Agency (USEPA) Region 5 Regional Contingency Plan/Area Contingency Plan
- National Oil and Hazardous Substances Pollution Contingency Plan

1.1.1 Site Location and Description

The Site is located at 14437 Crosstown Boulevard in Andover Minnesota, as shown in Figure 1.1, and comprises approximately 120 acres. The area of concern and work areas for the excavation of the industrial waste pit are presented in Figure 1.2. The industrial waste pit is located in the western portion of the site, within the landfill footprint.

The Site's surrounding and adjacent property uses are as follows:

- Coon Creek, wooded areas, and residential to the north/north-east
- Hanson Boulevard and residential areas to the east
- Commercial property and Red Oaks East Park to the south
- Residential properties to the west

The prevailing wind at the Site is from the northwest, generally ranging from 0 to 15 miles per hour.

1.1.2 Site History

Prior to MPCA permitting the WDE Site as a solid waste disposal facility in 1971, the WDE Site was operated as a solid waste dump ("dump") for at least nine years by previous owners of the property. The dump was established around 1963 by Leonard E. Johnson and was licensed, at least in the later years of the Johnson operation, by Grow Township. The dump was purchased by Waste Disposal Engineering, Incorporated (WDE, Inc.) in 1968.

In 1970, WDE, Inc. submitted a permit application to the MPCA to operate a solid waste disposal facility. A proposal to dispose industrial materials in a specially constructed trench (i.e. pit) within the landfill was included in the permit application. On March 30, 1971, the MPCA issued permit SW 28 to WDE, Inc. to operate the WDE Site as a solid waste disposal facility including construction and operation of the WDE industrial waste pit.

Construction of the industrial waste pit began in 1971 and was completed in 1972. The MPCA approved the design of the industrial waste pit overlain with a six inch thick bituminous liner followed by six inches of crushed limestone. Depth to the groundwater beneath the industrial waste pit was to be at least ten feet. Materials to be disposed in the industrial waste pit included solvents, oils, paint sludges, caustic, and acids. A permanent record of the disposal activities at the industrial waste pit was to be kept at the WDE Site by WDE, Inc. and the information reported monthly to the MPCA. It is believed that the industrial waste pit was operated from November 1972 to January 1974.

Site photographs of the industrial waste pit and aerial photos indicated that WDE, Inc. did not follow the plans approved by the MPCA for pit disposal operations. The MCPA ordered the WDE industrial waste pit closed effective February 1, 1974 due to changes in regulations and because the MPCA determined that a high potential for groundwater pollution existed at the WDE Site. WDE, Inc. submitted volume reports to Anoka County indicating that 2,318 55-gallon drums had been disposed at the WDE Site in 1973 and that a total of 3,354 drums had been disposed at the WDE Site during the two-year period between January, 1972 and January, 1974. It is unclear as to how many of these drums were disposed within the industrial waste pit.

The bulk of waste disposed at the WDE Closed Landfill was ordinary municipal waste. In addition to municipal waste, unknown quantities of demolition waste, industrial waste, and hazardous substances were deposited in the landfill. It has been estimated that, by volume, 95% of disposed hazardous substances are acids, oil, paint/paint sludge, and solvents. A list of chemicals reportedly disposed of in the industrial waste pit is included in Appendix A.

Substantial site remediation actions were performed from 1992 to 1994 and included the construction of a multilayer soil cap, a slurry wall/NAPL control system around the industrial waste pit, a landfill gas venting system, two perimeter gas barrier membranes, stormwater management, and relocation of wetlands. The soil-bentonite slurry wall (slurry wall) was constructed to provide a low permeable perimeter barrier around the industrial waste pit and to contain groundwater and impacted soils. In addition, a groundwater extraction well (EW9) was installed inside the north end of the slurry wall to extract groundwater from inside the slurry wall.

The multilayer soil cap installed over the refuse and industrial waste pit consists of the following components (bottom to top); 2 to 4 foot original soil cover, 24-inch clay barrier layer, 12-inch sand drainage layer, 18-inch sand filter layer, 12-inch clean fill layer, 6-inch topsoil layer, and a vegetative cover.

In 2009 and 2010 a pilot-scale soil vapor extraction (SVE) system was operated in the industrial waste pit to evaluate volatile organic compound (VOC) removal capabilities. The SVE system employed a proprietary refrigeration system to condense VOC vapors into liquid form. Based upon the results of the pilot study, a full scale system was designed and installed in late 2012. The system was put into operation in February 2013 and is currently still in intermittent operation. The system is expected to be shut down in fall of 2017 and decommissioned in the spring of 2018.

1.1.3 Investigation Results

During the spring of 2017, a pre-design investigation of the industrial waste pit area was completed. The investigation consisted of the completion of forty-two borings in and around the pit area to delineate the vertical and horizontal extents of the pit. Additionally, soil samples were collected from each of the borings within the pit area. Samples were analyzed for the following:

- Volatile organic compounds (VOCs)
- Semi-volatile organic compounds (SVOCs)
- Target Analyte List (TAL) metals
- Polychlorinated biphenyls (PCBs)
- Ignitability - Flashpoint
- Corrosivity - pH
- Reactivity - cyanide and sulfide

Table 1.1 presents a summary of parameters analyzed and the maximum concentrations found during the pre-design investigation. Analytical results for waste samples within and below the pit area revealed characteristic hazardous concentrations for primarily VOCs and metals. Additionally, Toxic Substance Control Act (TSCA) criterion levels for PCBs were also exceeded in places within the pit.

The resulting primary contaminants of concern are as follows:

- Lead
- Chromium
- PCBs
- Tetrachloroethene
- Trichloroethene

Results of the pre-design investigation work confirmed that the industrial pit excavation work will be potentially hazardous due to existing soil concentrations and potential vapor concentrations of hazardous constituents that could pose a risk to human health and/or the environment.

1.1.4 Project Overview and Schedule

The general scope of work for the pit removal work will consist of the following:

- Project mobilization and start-up, including mobilization of equipment and personnel; set-up of work, staging, office, and decontamination areas; administrative work; and pre-excavation removals and abandonments
- Removal and stockpiling of clean cover soils from the pit area
- Construction of a temporary building over the excavation site to allow control and containment of hazardous materials (including vapors)
- Removal of drums and drum waste from the pit area
- Excavation of bulk waste and contaminated sub-soils from the pit area
- Waste sampling, characterization, segregation, consolidation, and profiling
- Off-Site transportation and disposal of wastes
- Site grading and restoration activities
- Demobilization of equipment and personnel and project close-out

The industrial waste pit excavation work is expected to be completed during the summer of 2018.

2. Pre-Emergency Planning

2.1 Site-Related Emergency Contacts

Contact information for Site-related emergency personnel is provided below. These contacts are also provided in Table 2.1. Lines of authority and the incident command structure will be detailed in the following sections.

Site Owner/Generator

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, Minnesota 55155

Project Manager: Patrick Hanson; Patrick.hanson@state.mn.us; 651-757-2409
Project Engineer: Benjamin Klismith; benjamin.klismith@state.mn.us; 651-757-2497

Engineer

GHD Services Inc.
1801 Old Highway 8 NW
Suite 114
St. Paul, Minnesota 55112

Project Manager: Robert Martin; Robert.Martin@ghd.com; 612-524-6853
Engineer: Timothy Ree; Tim.Ree@ghd.com; 612-524-6866

Contractor

To be determined

City of Andover

1685 Crosstown Boulevard
Andover, Minnesota 55304

City Administrator: Jim Dickinson; j.dickinson@andovermn.gov; 763-767-5110
Emergency Manager: Jerry Streich (Fire Chief); j.streich@andovermn.gov; 763-767-5192

The City of Andover Fire Chief, or designate, will serve as the Incident Commander during this project.

Anoka County

Emer. Management Director: Terry Stoltzman; terry.stoltzman@co.anoka.mn.us; 763-324-4761
Emer. Management Coord.: Ryan Kelzenberg; ryan.kelzenberg@co.anoka.mn.us; 763-324-4763

Fire Department and Emergency Medical Services (response)

City of Andover Fire
13875 Crosstown Boulevard
Andover, Minnesota 55304

Fire Chief: Jerry Streich; j.streich@andovermn.gov; 763-767-5192

Emergency Medical Services (ambulance)

Allina Health Emergency Medical Services
167 Grand Avenue
St. Paul, Minnesota 55102

651-241-4400

Police/Sheriff

Anoka County Sheriff's Office
13301 Hanson Boulevard NW
Andover, Minnesota 55304

sheriff@co.anoka.mn.us; 763-324-5036

Hospital

Mercy Hospital
4050 Coon Rapids Boulevard
Coon Rapids, Minnesota 55433

763-236-6000

Minnesota Duty Officer (state spill reporting)

Department of Public Safety
445 Minnesota Street
St. Paul, Minnesota 55101

Duty Officer: 651-649-5451 or 1-800-422-0798

National Response Center (federal spill reporting)

1-800-424-8802

United State Environmental Protection Agency (USEPA)

US EPA Region 5
Ralph Metcalfe Federal Building
77 West Jackson Boulevard
Chicago, Illinois 60604

Regional Response Center; 312-353-2318

Minnesota Department of Transportation (MNDOT)

395 John Ireland Boulevard
St. Paul, Minnesota 55155

651-296-3000

Minnesota Department of Natural Resources (DNR)

500 Lafayette Road
St. Paul, Minnesota 55155

651-296-6157

Minnesota Department of Health (MDH)

Environmental Health Division Site Assessment & Consultation Unit
625 Robert Street N.
St. Paul, Minnesota 55164

Environmental Research Scientist: Daniel Pena; 651-201-4920; daniel.pena@state.mn.us

Local Watershed

Coon Creek Watershed District
12301 Central Avenue, Suite 100
Blaine, Minnesota 55434

info@cooncreekwd.org; 763-755-0975

Poison Control Center

1-800-222-1222

2.2 Personnel Roles, Authority, and Communication

Per regulations, any emergency or contingency response is under the responsibility and authority of the responsible party/Owner, in this case the MPCA. The MPCA will designate the City of Andover Fire Chief, or designate, as the primary Incident Commander that will be available 24 hours a day, 7 days a week throughout the pit excavation work. Contractor personnel (i.e. Site Supervisor) that will act as an interim/temporary Incident Commander will be required to have completed Incident Command System (ICS) training courses ICS-100 (Introduction to the Incident Command System) and ICS-200 (ICS for Single Resources and Initial Action Incidents).

At the first indication of potential emergency or hazardous material release, the Incident Commander, or alternate, shall be immediately notified. If there is an immediate danger to life and health, local authorities shall also be summoned via 911.

The Incident Commander shall be the point person for the incident response and shall direct the response action, including direction of any Owner, Contractor, or emergency response personnel in response action.

Off-Site emergency response roles shall start at the local level (City and County) and will transition to State, regional, and federal levels if/when additional resources are needed. Once emergency services have been activated, the Incident Commander will coordinate and direct the response action under a Unified Command. The local emergency response incident commander will have authority over all local responding resources, and will also be the point person for activating higher level resources, as necessary. As noted in the County and State Emergency Operation Plans, higher level responses will be requested directly by the lower level responder (i.e. local resources request state resources, state resources request regional/federal resources, etc.).

Communication shall flow through the applicable primary response organization at each level to the Incident Commander. Support agencies/resources shall report to the primary response organization at their respective resource level (local, state, federal, etc.).

Refer to Figure 2.1 for a flow-chart showing the general incident command structure and lines of authority for the Site.

2.3 Emergency Recognition and Prevention

Throughout the industrial pit excavation work, all Site personnel shall be briefed in emergency recognition and prevention. The following sections will detail Site prevention measures, emergency recognition, safe distances/places of refuge, and emergency reporting/critique/follow-up.

2.3.1 Emergency Prevention

During the course of the remediation work, various controls will be in place to prevent emergency situations. Controls in place will include at a minimum:

- Stormwater drainage control
- Spill controls
- Temporary building controls (vapor control and self-extinguishing fabric)

2.3.1.1 Stormwater Control

During the remediation work, stormwater controls will be put in place to prevent stormwater from coming into contact with hazardous materials, and also to contain and collect any water that may come into contact with hazardous materials. All controls will be constructed in accordance with the

Site Stormwater Pollution Prevention Plan (SWPPP) and National Pollutant Discharge Elimination System (NPDES) permit, and may include the following:

- Temporary building over the excavation and hazardous materials handling area to prevent stormwater from mixing with the waste in the industrial waste pit
- Grading and impervious drainage surfaces near the temporary buildings to direct water away from the buildings and excavation
- Impervious covers to be installed over any waste containers to prevent water contact (i.e. drums, dumpsters, roll-offs, etc.)
- Silt fence, sedimentation basins, catch basins, vegetation maintenance, and other standard best management practices (BMPs) to prevent stormwater contact with waste materials, and to prevent discharge of any contaminated or impacted stormwater.

2.3.1.2 Spill Controls

To prevent potentially hazardous material spills at the Site and to provide control and containment in the event of a spill, a hazardous materials management plan will be prepared and utilized by the Contractor. The plan will dictate the minimum containment requirements for any stored liquids, engineering controls to prevent spills, as well as the equipment required to be on-Site in the event of a spill. The plan will also detail the required inspections, monitoring, and maintenance for Site potentially hazardous liquid storage.

Preventative measures will include at a minimum:

- Secondary containment for all potentially hazardous liquid storage.
- Segregation of incompatible wastes through in-situ and ex-situ waste characterization.
- Minimization of quantity of liquids stored on-Site (i.e. frequent liquid disposal)
- Routine monitoring and inspection of liquid storage containers.
- Provision of a spill kit of adequate size to handle potential Site spills (i.e. sorbent pads, booms, powders, etc.)

In the event of a spill, the procedures outlined in the plan shall be followed to contain, control, and remediate the incident. At a minimum, Site personnel, at the direction of the Contractor foreman or Site supervisor, will use on-Site equipment to contain the spill and prevent further contamination, within their capabilities and resources.

The MPCA project leader, the Minnesota Duty Officer, and the National Response Center will be notified of any spill of potentially hazardous materials. The designated Incident Commander will direct all spill-response actions.

If the spill is unable to be contained by on-Site personnel/resources, and/or a potential threat to off-Site populations or resources exists, additional resources shall be obtained through the chain of command and procedures noted in Section 3.5.

2.3.1.3 Temporary Building Controls

During the industrial waste pit excavation, a temporary building will be constructed over the excavation area. To prevent the release of hazardous air pollutants, the building will be fitted with a ventilation system designed to keep the building under vacuum. Flexible ductwork will also be employed to remove vapors at the working face of the excavation to minimize the quantity of volatile compounds in the general building atmosphere. The ventilation system exhaust will be routed through granular activated carbon (GAC) or other treatment means to ensure discharge is below regulated levels for Site contaminants.

Monitoring and maintenance of the building ventilation system will be the responsibility of the Contractor. The Contractor will be required to provide back-up (generator) power in the event of a Site power failure.

If the Contractor finds that a release or potential release of hazardous air pollutants has occurred, they shall immediately notify the Incident Commander, and the procedures detailed in Section 3.4 will be followed.

In addition to the ventilation system, the temporary building will be constructed with self-extinguishing fabric in the event of a fire. Spare building fabric material shall be kept on-Site to provide patches, if necessary. Contractor personnel shall be trained in the procedures for patching building fabric.

If a fire occurs involving the building, the procedures set forth in Section 3.3 will be followed. Once the fire is contained/controlled/extinguished, depending on the severity of the damage, the Contractor shall patch the temporary building fabric in accordance with manufacturer instructions to restore building integrity.

2.3.1.4 Perimeter Air Monitoring

Prior to and during the course of the industrial waste pit excavation work, a perimeter air monitoring network will be in place. The perimeter air monitoring network will provide real-time air monitoring at the Site perimeter to ensure protection of off-Site populations. Air monitoring data will be immediately available to Site personnel and emergency response personnel via a dedicated website displaying the current data.

If potentially hazardous constituents are discovered in the perimeter air monitoring data, the procedures in Section 3.4 will be followed.

2.3.2 Emergency Recognition

All personnel that will provide on-Site services (Owner, Engineer, Contractor, etc.) shall be briefed on the recognition of potential Site emergencies. Due to the nature of the work, potential emergencies at the Site may include the following:

- Fire or explosion
- Medical emergency (contamination, injury, sickness, etc.)
- Hazardous vapor release

- Hazardous liquid release
- Reaction of incompatible wastes

Some emergencies will be easy to identify, however, others may only become evident through routine monitoring (i.e. vapor release). Personnel must always be aware and alert to signs of a potential emergency or hazardous situation.

Fire may be identifiable by visible smoke or flames.

The buddy system will be mandatory for entry into the exclusion zone, and thus medical emergencies should be identified by the affected personnel or their buddy.

A hazardous vapor release will be identified through the necessary Site air monitoring.

A hazardous liquid release may be identified visibly via surface liquids, staining, odors, containment damage, or through routine container inspections.

Chemical reactions can be identified by visible smoke or fumes, bulging of containers, contents under pressure, bubbling, etc.

At any sign of a potential emergency situation, personnel shall immediately notify their superior and the Incident Commander or alternate. If there is immediate danger to life or health, emergency services, via 911, shall be activated. The procedures detailed in Section 3 will be followed to respond to the emergency with the appropriate personnel and equipment. The Incident Commander will be responsible for coordinating the response action and communication through the chain of command. Depending on the nature of the emergency; local, state, or federal resources may be necessary.

2.3.3 Safe Distances and Places of Refuge

During the remediation work, Site personnel shall adhere to minimum safe distances from vehicles, heavy equipment, excavations, hazardous materials, and electric lines and equipment. Personnel that need to be within the safe distance zone to complete job duties will do so only with the necessary training, engineering controls, and personal protective equipment (PPE) specified in the Site HASP. Additionally, in the event of an emergency or severe weather situation necessitating evacuation, personnel will mobilize to specified places of refuge at the direction of the Contractor Site Supervisor or Incident Commander.

Details of minimum safe distances and places of refuge are provided in the following sections.

2.3.3.1 Safe Distances – Vehicles and Heavy Equipment

All Site personnel shall observe a minimum of 20-feet of distance from any vehicle or piece of heavy equipment that is in use. Drivers and operators shall maintain awareness of surroundings and personnel, and shall stop and warn personnel that are within their vehicles safe distance without need. Should personnel need to be within the safe distance area, they shall do so only with the knowledge and permission of the operator. No personnel shall enter a vehicle or heavy equipment safe distance zone without making eye contact with the operator and receiving permission from the operator to approach. The equipment operator shall bring the vehicle or equipment to rest and engage the parking brake prior to allowing personnel within the safe distance zone.

At a minimum, any personnel within a vehicle or equipment safe zone, will require the following PPE; hard-hat, steel-toed boots, high visibility vest, and safety glasses. Additional PPE may be required based on location (i.e. exclusion zone), as specified in the Site HASP.

At no time shall personnel be underneath suspended loads; the boom of an excavator, backhoe, or crane; or the bucket of a loader.

2.3.3.2 Safe Distances – Excavations

All personnel shall remain a minimum of 25-feet away from any excavations without need to be in the area. Any personnel needing to work within the excavation safe distance area will be required to be trained in excavation safety. At no time shall personnel be within 3-feet of the edge of an excavation greater than 4-feet in depth without adequate fall protection.

If excavation entry is required, all OSHA regulations will be adhered to; including ingress/egress requirements, proper shoring or sloping, location of spoils, and use of required PPE.

2.3.3.3 Safe Distances – Hazardous Materials

There will be potential for contact with hazardous materials throughout the pit excavation work. In general, exposed hazardous materials will be contained within the Site exclusion zone, where personnel will be required to wear the applicable HASP-specified PPE for potential contact with materials. However, personnel will maintain a minimum safe distance of 20 feet from potentially hazardous materials when work does not require them to be in close proximity, and will avoid direct contact. Personnel shall employ tools and equipment (i.e. sampling equipment) that allows necessary work without direct contact when possible.

In waste staging areas, personnel shall maintain a minimum safe distance of 20-feet from waste storage containers when work does not require them to be within the safe distance. Any personnel within the minimum safe distance to waste storage containers shall employ the necessary PPE specified in the Site HASP.

2.3.3.4 Places of Refuge

In the event of an emergency requiring a partial or full Site evacuation, personnel will follow pre-identified evacuation routes, as detailed in Section 3.6 to the applicable place of refuge.

Places of refuge will be employed in the event of a site evacuation (partial or full) or the need to shelter in place (i.e. severe weather). On-site and off-site places of refuge have been identified, and are noted on Figure 2.2.

In the event that personnel need to seek on-Site shelter (i.e. exclusion zone evacuation, severe weather), the on-Site place of refuge shall be the former Gas-to-Energy building located adjacent to the flare station in the northwest portion of the Site.

In the event of a full Site evacuation, or if the on-Site shelter is unreachable, the off-Site place of refuge shall be:

- City of Andover Fire Station
  13875 Crosstown Boulevard
  Andover, Minnesota

Personnel shall avoid vehicles and temporary structures (i.e. Site construction offices/trailers) as places of refuge. The Incident Commander (in the case of an emergency (spill, release, etc.)) or the Contractor foreman/manager (in the case of severe weather) or their designate will instruct personnel on where to seek refuge when necessary.

2.3.4 Emergency Follow-Up and Critique

After the occurrence of any emergency situation, a follow-up debriefing session will be performed to assess the positives and negatives of the emergency response action. Following this debriefing session, a follow-up report will be prepared with a critique of the response action and recommendations for any revisions to the emergency response procedures contained here-in, including revision of this plan.

Debriefing sessions will include at a minimum; the Site Owner, Contractor, Engineer, and any emergency response entity (i.e. fire, EMS, etc.).

2.3.5 Responder Capabilities

The general capabilities of response personnel are detailed below:

MPCA (Owner)

- Emergency Response/Clean-up via State contracted Emergency Response contractors

Contractor

- Minor spill containment and clean-up
- First aid
- Minor fire control (via fire extinguishers and fire suppression foam)
- Assistance with emergency vapor controls (via ventilation and/or fire suppression foam)
- Site security and control

Fire Department

- Emergency response Incident Command
- Fires/explosions where hazardous materials are not involved
- Fire/explosion assistance where hazardous materials are potentially involved
- Emergency medical services (first aid, etc.)

Ambulance Service

- Emergency medical services and ambulance transport

Police Department

- Site security
- Evacuation support/assistance
- Traffic control

County Emergency Management

- Evacuation support/assistance
- Emergency operation center supply
- Dispersion modeling for airborne contaminants

Chemical Assessment Team (CAT)

- Hazard assessment and technical assistance to local responders
- Monitoring and identification of unknown hazardous materials
- Assistance with hazardous material containment

2.4 Site Security and Control

Site security and control will be the responsibility of the Contractor. The Contractor will maintain security and control via the following:

- Closure and locking of all Site access gates when personnel are not on-Site.
- Maintenance of a command post/office at the Site entrance to restrict entry to authorized personnel only. Command post shall have a personnel and visitor log for anyone on-Site.
- Work zone physical demarcation (via fencing and signage) with access to exclusion zone restricted to the contamination reduction (decontamination) corridor. An additional personnel log will be maintained for entry and exit into the exclusion zone.
- Video surveillance when Site is unoccupied.

In addition to general Site security and control, the Contractor shall ensure that sensitive areas are protected from the pit excavation work. These areas include:

- Coon Creek to the north of the Site
- Residential areas surrounding the Site
- Playground/ball fields to the south
- Roads bordering the Site

2.5 Personal Protective Equipment and Emergency Equipment

Entry into the temporary building over the excavation will potentially require Level A PPE (fully encapsulating suit with supplied air) in an emergency response scenario. For this reason, emergency response personnel are restricted from entering the exclusion zone and contaminant reduction zones without adequate PPE.

Based on the PPE requirements, ________ (per fire chief direction) sets of Level A PPE will be available to emergency response personnel, as necessary. PPE designated for emergency response personnel will be stored in the command post area. Only those responders with a minimum of Hazardous Material Awareness level training will be allowed to enter the exclusion zone. Response personnel may use their own PPE if it meets the minimum protection levels specified in the Site HASP.

Whenever possible, emergency situations will be managed to prevent the need for off-Site emergency response personnel to enter the exclusion zone.

Additional emergency equipment, and their storage locations, that will be housed on-Site and available to Site personnel and emergency response personnel include:

- First aid kits (Command post and temporary building)
- Eye wash stations (Command post and decontamination facility)
- Emergency showers (Decontamination facility, State decontamination trailer, and outside temporary buildings)
- Portable stretcher (Command post and temporary buildings)
- Fire extinguishers (Site temporary building, offices, and vehicles/equipment)
- Air monitoring equipment (Contractor's office trailer)
- Spill containment and clean-up materials (Command post area)
- Decontamination facilities
- Sanitary facilities (Command post area)
- Fire/vapor suppression foam trailer (Class B foam) (Command post area)
- Stockpiled soil and heavy equipment for emergency pit coverage (Perimeter of excavation temporary building)

3. Emergency Response

3.1 Emergency Alerting and Response Procedures

In the event of an emergency, the personnel identifying the emergency shall initiate the emergency response procedures by first alerting the Incident Commander or designate. The Contractor's on-Site Supervisor will act as the interim Incident Commander until the City of Andover Fire personnel reach the Site. The lines of communication and authority are presented in Figure 2.1. For any situation that is immediately dangerous to life or health, local emergency services, via 911, will be immediately activated. Each successive responder may call on additional resources as they deem necessary including local, state, and federal resources.

For any situation requiring off-Site resources (i.e. fire department, EMS, etc.), the responding services shall be met at the primary Site entrance (Crosstown Boulevard entrance) by the Contractor Site Supervisor, or designate, and escorted to the Site command post. If the Crosstown Boulevard entrance is inaccessible, the responders will use the secondary Site entrance (Hanson Boulevard entrance). Depending on the nature of the emergency and responder's capabilities, access to certain areas of the Site may be restricted. The Incident Commander will instruct responding parties on applicable area restrictions. As noted in Section 2.5, emergency PPE will be stored at the Site for use by emergency response personnel at the direction of the Incident Commander.

Due to the relatively large Site area, the Contractor will supply two-way radios and a Site wide audible alarm (i.e. air horn). Emergency situations will be communicated to the Incident Commander or Contractor Site supervisor via two-way radio, cell phone, or in-person. All Site personnel, as part of the pre-entry health and safety briefing, will be briefed on activation of emergency response services.

In the event that it is necessary to seek on-Site refuge (partial evacuation or shelter in place), an air horn will be sounded with three short bursts. The signal will be repeated at 20-second intervals until the evacuation is complete. Additionally, a voice message will be transmitted over the two-way radios providing further instructions.

In the event a full Site evacuation is necessary, an air horn will be sounded with three long blasts, repeated at 20-second intervals to indicate personnel are to mobilize to the off-Site place of refuge. A voice message will also be transmitted over the two-way radios providing further instructions.

Evacuation routes and procedures are provided in additional detail in Section 3.6.

The Incident Commander or Contractor's Site Supervisor will take the personnel log book with to the place of refuge to account for all personnel via head count/roll call.

Details of the response actions and restrictions for specific emergencies are included in the following sections for:

- Medical Emergencies
- Fire/Explosion Emergencies
- Hazardous Material Vapor Release Emergencies
- Hazardous Material Release to Surface Water Emergencies (on-Site)

Prior to and during the course of the work, the Site Owner, in conjunction with the Contractor and local emergency response providers, will perform readiness response drills to test the emergency response procedures. Results of these drills will be evaluated to determine if emergency response procedures require revision. Drills will include at a minimum a severe weather drill (work zone evacuation to on-Site place of refuge), a medical emergency drill, and a fire and/or hazardous material release drill.

In all emergency situations, personnel decontamination procedures will be followed in accordance with the Site HASP, with the exception of immediately dangerous to life and health (IDLH) situations. In the event of an IDLH condition, personnel will complete decontamination as soon as it is safe to do so.

3.2 Medical Emergencies

Medical emergency response shall follow the Medical Emergency Decision Flow Chart provided in Figure 3.2, and as detailed below.

In the event of a medical emergency, the Incident Commander shall be immediately notified. Based on the severity of the emergency, the Incident Commander, or designate, will initiate work stoppage and/or Site evacuation, as deemed necessary.

If the medical issue is of a minor nature (i.e. cuts, scrapes, sprains, strains, etc.), first aid can be rendered by trained Site personnel. Affected personnel, may however, request higher level care (i.e. local EMS services). If the issue originated in the exclusion zone, the affected party will proceed through personnel decontamination to receive first aid in the support zone, when possible.

If the affected party has a non-life threatening condition, and needs to see a doctor, they can be transported to the hospital by Site personnel via the specified hospital route in the Site HASP. A map of the hospital route is presented in Figure 3.1

For serious medical emergencies, local emergency medical services (EMS) will be activated via 911. On-Site trained first aid providers, will provide interim care using Site resources until EMS is on-Site. EMS personnel shall be directed to the primary Site entrance (Crosstown Boulevard entrance) when available. If this entrance is unavailable, they shall be directed to the alternate entrance (Hanson Boulevard entrance). The Incident Commander, or designate, shall meet EMS personnel at the indicated Site entrance and escort them to the support zone command center.

When possible, the affected party will be transported to the EMS personnel in the safe zone via personnel decontamination. Patient transport supplies (i.e. portable stretcher, vehicles, etc.) will be available on-Site for emergency use. The affected personnel shall also be decontaminated to the maximum extent possible based on the medical emergency.

If it is not possible to remove the affected party from the exclusion zone or point of emergency, then EMS personnel will be mobilized to the affected party only after donning the necessary PPE (Owner-supplied) for the Site zone they will be entering. EMS personnel entering the contaminant reduction zone or exclusion zone will be under full-time supervision by Incident Commander-designated Site personnel. The supervising personnel will instruct EMS personnel in proper PPE use and decontamination on egress.

Once in EMS care, the necessity for higher level care (i.e. transport to hospital) will be determined by EMS personnel. When necessary, the Incident Commander will provide a list of potential contaminants that the affected personnel may have come in contact with to EMS personnel.

Following the incident, the Incident Commander and applicable Site personnel will complete all remaining notifications (OSHA, MDH) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the Site response and determine the need for any procedural changes.

3.3 Fire/Explosion Emergencies

Fire or explosion emergency response shall follow the Fire/Explosion Emergency Decision Flow Chart provided in Figure 3.3, and as detailed below.

In the event of a fire or explosion, the Incident Commander and Construction Site Supervisor shall be immediately notified. Work shall be immediately stopped and evacuation ordered via the evacuation procedures noted in Section 3.6. The City of Andover Fire Department shall be notified via 911. The fire department shall be provided as much information as possible regarding the size, location, and potential for hazardous materials in the area.

The fire department will be directed to the primary Site entrance (Crosstown Boulevard) when possible. If the primary entrance is inaccessible, emergency responders shall be directed to the alternate entrance on Hanson Boulevard. Site personnel will meet emergency response personnel at the designated entrance and escort them to the command post area for briefing and PPE as necessary. Any responding personnel not directly involved in the response action (i.e. fire-fighting) will be restricted to the Site safe zone/command post area.

In the event of a small-scale fire, Site personnel may attempt to extinguish or control the fire using on-Site fire extinguishers and fire suppression foam within their ability and resources. When using portable fire extinguishers, personnel shall remain upwind if possible and spray the base of the fire in a sweeping motion. Once fire personnel arrive on-scene, Site personnel will defer to the direction of fire personnel for further response actions. Fire hydrant locations near the Site are shown on Figure 1.3.

The fire chief, or on-Site designate, will serve as the Incident Commander in a unified command with Site personnel. PPE, emergency equipment, and trained Site personnel will be available to the Incident Commander, as needed.

The Incident Commander will be responsible for activating additional local resources in accordance with the City and County Emergency Operations Plan (i.e mutual aid fire response) command structures. State level resources (i.e. Chemical Assessment Team, Collapsed Structure Team, State Fire Marshal, etc.) will be requested by the Incident Commander only after local resource capabilities have been exhausted. Requests for state level resources will be made through the State of Minnesota Duty Officer.

The Incident Commander will determine if evacuation of off-Site areas is necessary. Evacuations will be coordinated by the Incident Commander with the Anoka County Sheriff's office and the Anoka County Emergency Management Center (for text message alerts).

As noted in Section 2.5, emergency equipment that will be on-Site and available for local emergency response use includes:

- Level A PPE
- First aid equipment
- Eye wash and emergency showers
- Fire extinguishers
- Fire suppression foam trailer (Class B foam)
- Stock-piled soil and heavy equipment (i.e. dozer) for emergency covering of the hazardous waste pit excavation
- Decontamination facilities
- Air monitoring equipment

If a fire or explosion causes damage to the temporary excavation enclosure allowing a potential hazardous vapor release, fire suppression foam will be applied to the open excavation area to aid in fire control and temporarily suppress vapors. If the building and ventilation system is unable to be repaired in a timely manner, the exposed waste pit will be covered with stock-piled soils or via grading of the excavation slopes to provide temporary cover and suppression of hazardous vapors. The Contractor will have the necessary equipment and operator available to complete this task, if needed.

Once the fire/explosion emergency is controlled or mitigated, all response personnel and equipment will egress through the decontamination facilities, if the incident occurred in the exclusion zone.

Following the incident, the Incident Commander and applicable Site personnel will complete all remaining notifications (OSHA, MDH) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the Site response and determine the need for any procedural changes.

3.4 Hazardous Material Vapor Release Emergencies

Hazardous Material Vapor Release emergency response shall follow the Hazardous Materials Emergency Decision Flow Chart provided in Figure 3.4, and as detailed below.

In the event of a Hazardous Material Vapor Release, the Incident Commander and Construction Site Supervisor shall be immediately notified. Work shall be immediately stopped and evacuation ordered via the evacuation procedures noted in Section 3.6. The City of Andover Fire Department shall be notified via 911. Additionally, the Minnesota Duty Officer will be notified of any hazardous material vapor releases.

Perimeter air monitoring will be conducted to determine whether further evacuation is necessary from off-Site properties.

The fire department will be directed to the primary Site entrance (Crosstown Boulevard) when possible. If the primary entrance is inaccessible, emergency responders shall be directed to the alternate entrance on Hanson Boulevard. Site personnel will meet emergency response personnel at the designated entrance and escort them to the command post area for briefing and PPE as necessary. Any responding personnel not directly involved in the response action will be restricted to the Site safe zone/command post area. If the hazardous vapor release intrudes into the safe zone/command post area, the Site will be evacuated of non-critical personnel, and the command post will relocate to the City of Andover Emergency Operations Center located at the City of Andover Fire Station.

The fire chief, or on-Site designate, will serve as the Incident Commander in a unified command with on-Site personnel. PPE, emergency equipment, and trained Site personnel will be available to the Incident Commander, as needed.

The Incident Commander will be responsible for activating additional local resources in accordance with the City and County Emergency Operations Plan command structures. State level resources (i.e. Chemical Assessment Team, Collapsed Structure Team, State Fire Marshal, etc.) will be requested by the Incident Commander only after local resource capabilities have been exhausted. Requests for state level resources will be made through the State of Minnesota Duty Officer. In the event of a hazardous material vapor release, it is anticipated that the regional Chemical Assessment Team (CAT) would be deployed immediately.

The Incident Commander, in consultation with Site personnel, will determine if evacuation of off-Site areas is necessary, based on the results of air monitoring, current weather conditions, and modeling. Evacuations will be coordinated by the Incident Commander with the Anoka County Sheriff's office and the Anoka County Emergency Management Center (for text message alerts).

As noted in Section 2.5, emergency equipment that will be on-Site and available for local emergency response use includes:

- Level A PPE
- Air monitoring equipment
- First aid equipment
- Eye wash and emergency showers
- Class B fire suppression foam for vapor suppression
- Ventilation equipment
- Stock-piled soil and heavy equipment (i.e. dozer) for emergency covering of the hazardous waste pit excavation
- Decontamination facilities

The response to a vapor release will consist of identification of the vapor source (i.e excavation area, storage container, etc.) and containment. If the source is a storage container, action will be taken to restore the integrity of the container; which may include over-packing, re-sealing, recovering, or installation of engineering controls (i.e. ventilation through carbon, etc.).

In the event of an uncontrollable vapor release from the excavation, the open excavation area will first be covered with Class B fire suppression foam to temporarily suppress vapors. A mobile foam trailer will be staged in the vicinity of the excavation area. If the necessary vapor controls are unable to be restored in a timely manner (prior to breakdown of foam), then the open excavation area will be temporarily covered with stock-piled soils or by grading soils from the excavation slopes. The Contractor will provide the equipment (dozers) and operators necessary to quickly cover the pit area.

Containment and mitigation of the vapor release will be verified through air monitoring with direct reading instruments (i.e. PID, FID, 4-gas meter, colorimetric tubes, etc.).

Following the incident, the Incident Commander and applicable Site personnel will complete all remaining notifications (OSHA, MDH) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the Site response and determine the need for any procedural changes.

3.5 Hazardous Material Release to Surface Water Emergencies (Onsite)

Hazardous material release to surface water emergency response shall follow the Hazardous Materials Emergency Decision Flow Chart provided in Figure 3.4, and as detailed below.

In the event of a Hazardous Material Release to On-Site surface waters, the Incident Commander and Construction Site Supervisor shall be immediately notified. Work shall be stopped and evacuation considered. Any necessary evacuation of Site personnel will be via the evacuation procedures noted in Section 3.6. In accordance with regulations, the Minnesota Duty Officer and the National Response Center will be notified of the spill.

If the release is of a minor nature, and within the mitigation capabilities of on-Site personnel and equipment, then the Incident Commander will direct the response action with the use of Contractor personnel. The Incident Commander, in consultation with the MPCA, may also choose to mobilize a State-contracted Emergency Response Contractor to aid in the response action.

If the release requires resources beyond Site capabilities, the City of Andover Fire Department shall be mobilized via 911.

The fire department will be directed to the primary Site entrance (Crosstown Boulevard) when possible. If the primary entrance is inaccessible, emergency responders shall be directed to the alternate entrance on Hanson Boulevard. Site personnel will meet emergency response personnel at the designated entrance and escort them to the command post area for briefing and PPE as necessary. Any responding personnel not directly involved in the response action will be restricted to the Site safe zone/command post area.

The fire chief, or on-Site designate, will serve as the Incident Commander in a unified command with the Site personnel. PPE, emergency equipment, and trained Site personnel will be available to the Incident Commander, as needed.

The Incident Commander will be responsible for activating additional local resources in accordance with the City and County Emergency Operations Plan command structures. State level resources (i.e. Chemical Assessment Team, Collapsed Structure Team, State Fire Marshal, etc.) will be requested by the Incident Commander only after local resource capabilities have been exhausted. Requests for state level resources will be made through the State of Minnesota Duty Officer. In the event of a hazardous material release to surface water, it is anticipated that the regional Chemical Assessment Team (CAT) would be deployed immediately.

The Incident Commander, in consultation with the Site personnel, will determine if evacuation of off-Site areas is necessary, based on the results of air monitoring and the extent of the release. Evacuations will be coordinated by the Incident Commander with the Anoka County Sheriff's office and the Anoka County Emergency Management Center (for text/phone alerts).

As noted in Section 2.5, emergency equipment that will be on-Site and available for local emergency response use includes:

- Level A PPE
- Spill containment and absorption equipment
- Air monitoring equipment
- First aid equipment
- Eye wash and emergency showers
- Stock-piled soil and heavy equipment (i.e. dozer) for emergency covering of the hazardous waste pit excavation
- Decontamination facilities

The response to a release to surface water will consist of identification of the source (i.e excavation area, storage container, etc.), containment, and clean-up. If the source is a storage container, action will be taken to restore the integrity of the container; which may include over-packing, re-sealing, recovering, or consolidation.

Concurrent with the source identification and mitigation, any released material will be contained if possible, collected, treated, and/or disposed of.

Containment and mitigation of the release will be verified through monitoring and sampling of affected areas.

Following the incident, the Incident Commander and applicable Site personnel will complete all remaining notifications (OSHA, MDH) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the Site response and determine the need for any procedural changes.

3.6 Evacuation Routes and Procedures

Various potential emergencies may require work zone or Site evacuations. These may include:

- Medical emergencies
- Fire or explosion emergencies
- Release of hazardous materials

- Severe weather

The following sections detail the procedures and routes for evacuation. In the event of any incident requiring evacuations, emergency response services will be contacted in accordance with the procedures in this plan.

3.6.1 On-Site Work Zone Evacuation

In the event that the work zone (exclusion zone and contaminant reduction zone) requires personnel evacuation, the Incident Commander or Site designate (i.e. Contractor Site Supervisor) will notify personnel through three (3) short bursts of an air horn, repeated at 20-second intervals until all personnel have cleared the work zone area. Additionally, verbal directions will be communicated over Site two-way radios providing instructions for mobilizing to on-Site place of refuge or general muster points (command post). All personnel not performing emergency response actions (under the direction of the Incident Commander) will be required to evacuate. All heavy equipment shall be shut down by operators with buckets grounded upon evacuation.

The work zone evacuation routes are detailed on Figure 2.2. The primary evacuation route will be northwest from the work zone to the command post/place of refuge. If personnel are unable to access the primary evacuation route, they will use the secondary route southeast from the work zone area to the south access road, and continue to the designated muster point.

Exclusion zone personnel will doff contaminated PPE as they evacuate the exclusion zone, through the decontamination corridor, if possible.

The Incident Commander, or designate, will bring the daily Site personnel log to the muster point to determine if all personnel are accounted for. If any personnel are unaccounted for, attempts will be made to communicate with them via two-way radios or cell phones to determine their whereabouts. If they are unreachable, emergency services (via 911) will be contacted and apprised of the situation.

Work may resume once the emergency situation is mitigated and the Incident Commander has confirmed it is safe to do so.

3.6.2 Site Evacuation

In the event that the Site requires personnel evacuation, the Incident Commander or Site designate (i.e. Contractor Site Supervisor) will notify personnel through three (3) long bursts of an air horn, repeated at 20-second intervals until all personnel have egressed from the Site. Additionally, verbal directions will be communicated over Site two-way radios providing instructions for mobilizing to the off-Site place of refuge/muster point. All personnel not performing emergency response actions (under the direction of the Incident Commander) will be required to evacuate. All heavy equipment shall be shut down by operators upon evacuation.

The Site evacuation routes are detailed on Figure 2.2. The primary evacuation route will be northwest from the construction areas to the primary Site entrance (Crosstown Boulevard entrance) and southwest to the City of Andover Fire Station via Crosstown Boulevard.

If personnel are unable to access the primary evacuation route, they will use the secondary route southeast from the work zone area to the Hanson Road Site secondary Site entrance. Personnel will muster near the entrance, and will be shuttled to the City of Andover Fire Department as vehicles are available.

Exclusion zone personnel will doff contaminated PPE as they evacuate the Site, through the decontamination corridor, if possible. Site evacuation will use Contractor, Owner, or personal vehicles to shuttle personnel from Site entrances to the off-Site place of refuge.

The Incident Commander, or designate, will bring the daily Site personnel log to the off-Site place of refuge to determine if all personnel are accounted for. If any personnel are unaccounted for, attempts will be made to communicate with them via two-way radios or cell phones to determine their whereabouts. If they are unreachable, emergency services (via 911) will be contacted and apprised of the situation.

Work may resume once the emergency situation is mitigated and the Incident Commander has confirmed it is safe to do so.

3.6.3 Evacuation of Off-Site Areas

Based on the nature of the emergency, evacuation of off-Site areas (i.e. residential areas) may be necessary. Any evacuation of off-Site areas will be determined by the Incident Commander (Fire Chief) based on the nature of the emergency, air monitoring results, wind direction, dispersion modeling, and consultation with the Site personnel.

Evacuation of off-Site areas will be carried out by the Anoka County Sheriff and the Anoka County Emergency Management division under the direction of the Incident Commander.

Air quality monitoring will continue to be performed throughout the applicable response action, as directed by the Fire Chief. Once the threat is mitigated and the off-Site areas deemed to be safe by the Fire Chief, the evacuation order will be lifted.

4. Contingency Plans

4.1 Severe Weather

Due to the nature of the work, various weather conditions may require work stoppage, evacuation, or shelter in place scenarios.

The weather forecast will be monitored at a minimum twice-daily by the Contractor to determine if any impending weather will affect Site work, and to allow implementation of any preventative measures. Additionally, Site personnel will be alert to the sounding of severe weather sirens that indicate either a severe thunderstorm or tornado is imminent. Warning sirens are tested on the first Wednesday of each month at 1:00 p.m.

Site personnel (Owner, Engineer, Contractor, and visitors) will be notified whenever forecasted weather may affect normal work. Weather events that may affect Site work will include thunderstorms, tornados, flash floods, snow, extreme temperatures, and high winds.

In the event of imminent severe weather, Site work shall be immediately stopped, with equipment shut down and staged in safe positions. Personnel will be, at a minimum, directed to shelter in place at the on-Site place of refuge (former Gas to Energy Building) through the evacuation procedures in Section 3.6. If the severe weather is forecasted to be prolonged, personnel may be instructed to demobilize from the Site if safe to do so, and notified when to return.

Following any severe weather events, the Incident Commander and Contractor Site Supervisor shall complete a safety inspection of Site work areas (excavation building, air monitoring equipment, command post buildings, stormwater controls, etc.) prior to allowing work to resume.

4.2 Release of Contaminants/Spill Emergencies

Due to the nature of the work and the contents of the industrial waste pit, there is a potential for a contaminant spill or release either on-Site or off-Site during waste transport. Hazardous materials may be in liquid, solid, or sludge form and may pose a threat to surface water, groundwater, or soils.

Storage of any potentially hazardous materials on the Site will be governed by a Site-specific hazardous materials temporary storage plan to be prepared by the Contractor. In accordance with the plan, the Contractor will provide equipment for the containment, control, and remediation of spills at the Site. Additionally, the plan will dictate the minimum inspection and monitoring requirements for on-Site hazardous liquid storage. Spill response equipment will be stored in the command post area.

4.2.1 On-Site Procedures

In the event of an on-Site contaminant release or spill, the Incident Commander and Contractor Site Supervisor will be immediately notified. If there is an immediate danger to life and health, emergency response services will be activated via 911. Additionally, the Minnesota Duty Officer and National Response Center will be notified of any spill of hazardous materials.

Following incident identification, the Incident Commander will evaluate the need for work zone or Site evacuations. If evacuations are necessary, the procedures detailed in Section 3.6 will be followed.

If the spill or release is minor, the Incident Commander will determine if sufficient on-Site resources are available to handle the containment and remediation of the spill. If so, the Incident Commander will direct on-Site resources in the response action which will include:

- Source control and/or removal
- Containment of the spill and prevention of spreading via absorbents, booms, grading, etc.
- Collection/excavation of contaminated materials into suitable containers
- Sampling and monitoring for clean-up verification
- Waste characterization and disposal

If the spill or release exceeds the capabilities of on-Site equipment and/or personnel, emergency response services will be activated via 911. The City of Andover Fire Chief will be the Incident Commander in unified command with the on-Site personnel.

The Incident Commander will determine if additional resources are necessary and will mobilize them accordingly. Additional resources needed may include:

- Additional fire personnel via mutual aid agreements
- State of Minnesota resources available through the Minnesota Duty Officer:
  - Chemical Assessment Team (CAT)
  - State-contracted Emergency Response Contractors
  - National Guard Civil Support Team
  - Minnesota Pollution Control Agency (MPCA) support
  - Minnesota Department of Health (MDH) support

Following the incident, the Incident Commander and applicable Site personnel will complete all remaining notifications (MPCA, EPA, MDH, etc.) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the Site response and determine the need for any procedural changes.

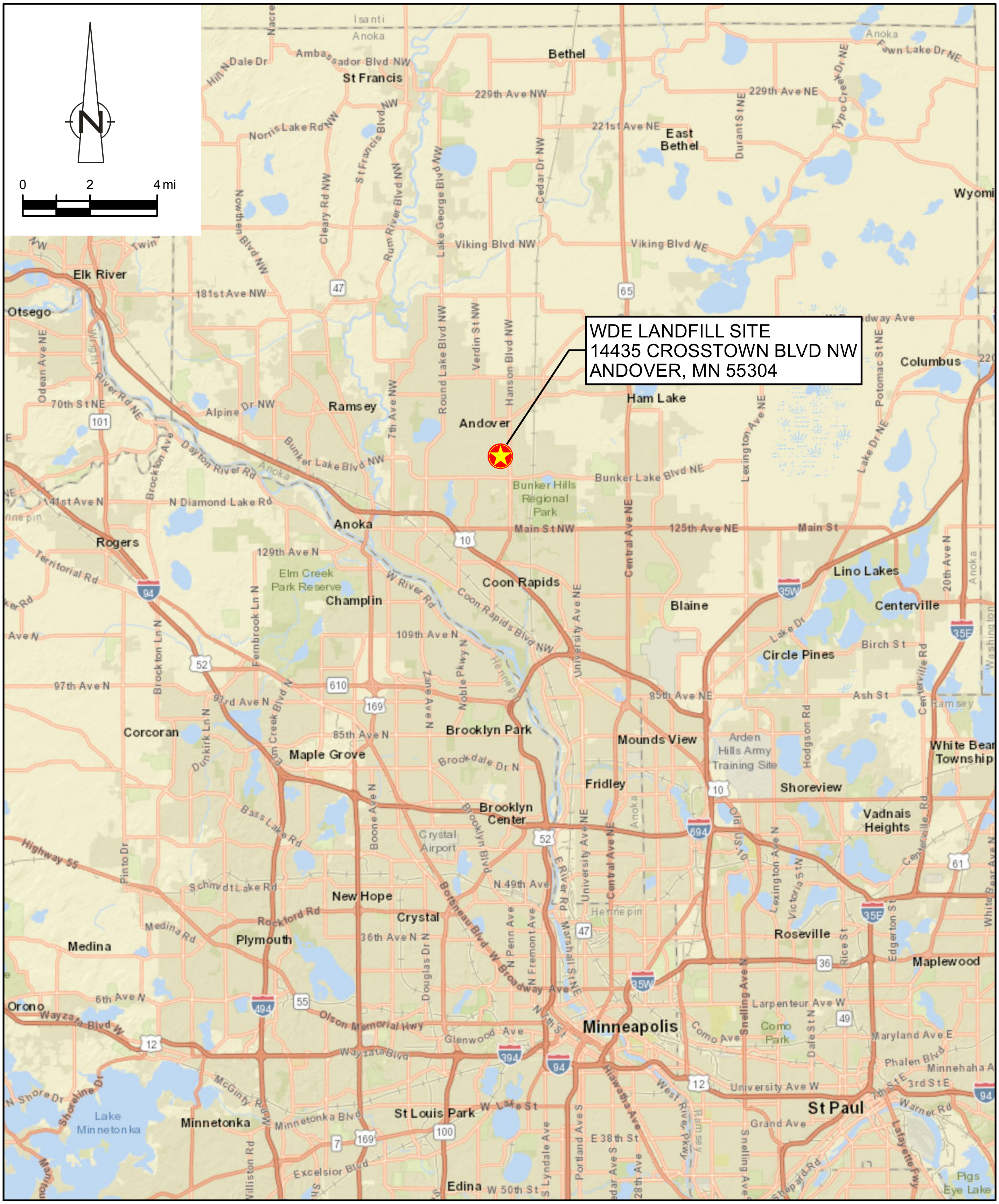
4.2.2 Off-Site Procedures

The potential for an off-Site spill of hazardous materials is present for transportation of the excavated wastes to the designated off-Site disposal facility. Detailed procedures for handling of a spill or material release during off-Site transportation will be provided in the Contractor's Waste Disposal Plan.

In the event of a spill or release during transportation, the Owner (MPCA) will be immediately notified, as well as local emergency response personnel via 911. For an incident in Minnesota, both the Minnesota Duty Officer and National Response Center will be notified of the spill. For an incident outside of Minnesota, the National Response Center will be notified, along with any applicable state contacts provided by the National Response Center.

For releases or spills that are minor in nature, the transporter will deploy containment materials when possible, from the transport vehicle's spill kit. The transporter shall restrict access to the area of the spill until local emergency responders arrive. The local emergency response personnel will assume incident command and will direct the response action based upon the emergency procedures and resources of their individual jurisdictions.

Following the incident, the applicable Site personnel will complete all remaining notifications (MPCA, EPA, MDH, etc.) and incident reports required by their respective organizations. Additionally, a post-incident debriefing session and critique will be performed to evaluate the cause of the incident and response and determine the need for any procedural changes.



Source: Esri Streets Basemap

WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

11129194-31
Feb 26, 2018

SITE LOCATION

FIGURE 1.1

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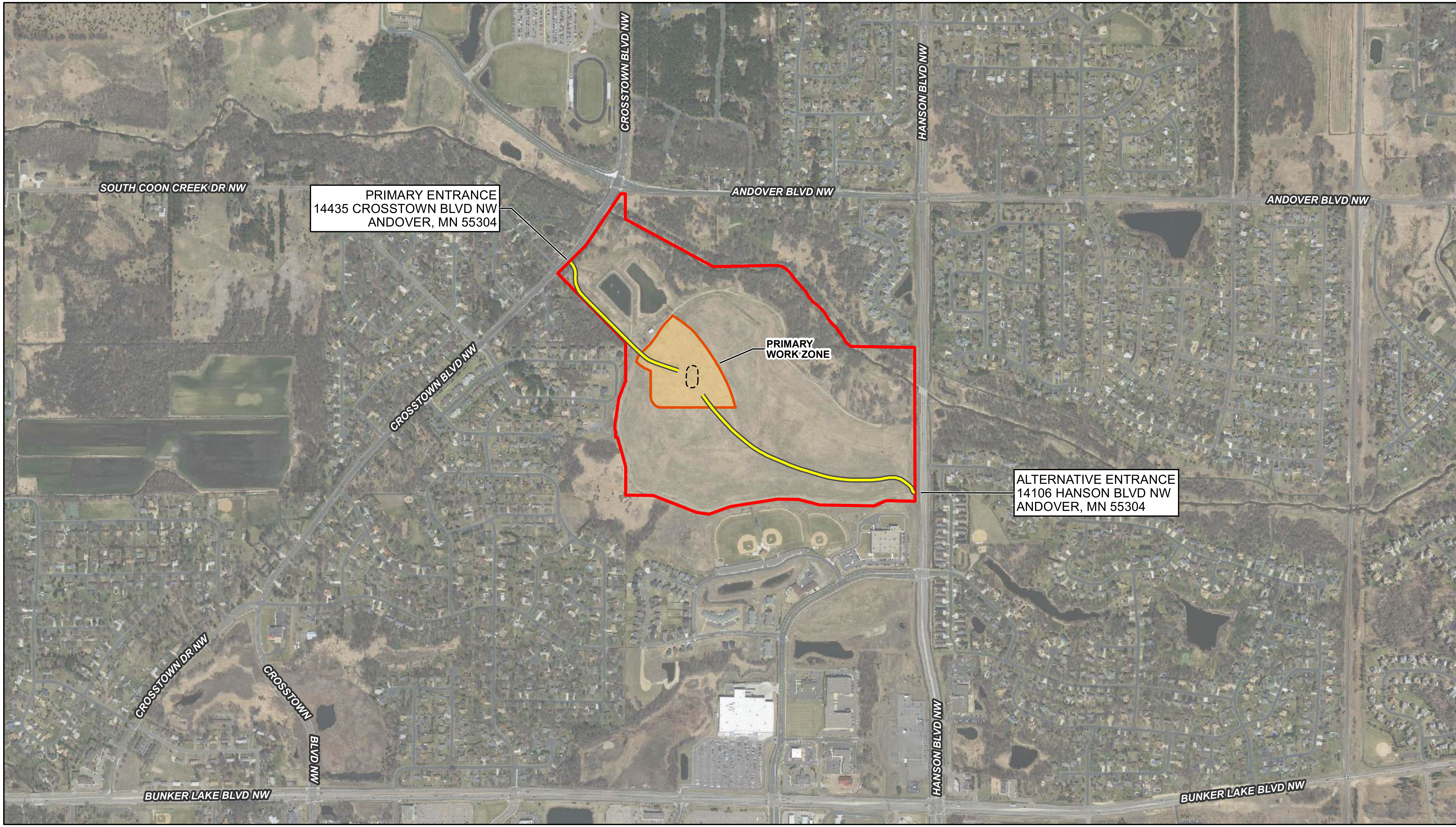

Source: Twin Cities Metropolitan Council, Spring 2016 Aerial Photography

0 400 800 ft

N

LEGEND

ACCESS ROAD

PRIMARY WORK ZONE

SITE PROPERTY BOUNDARY

GHD

WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

SITE AREA

11129194-31
Feb 26, 2018

FIGURE 1.2

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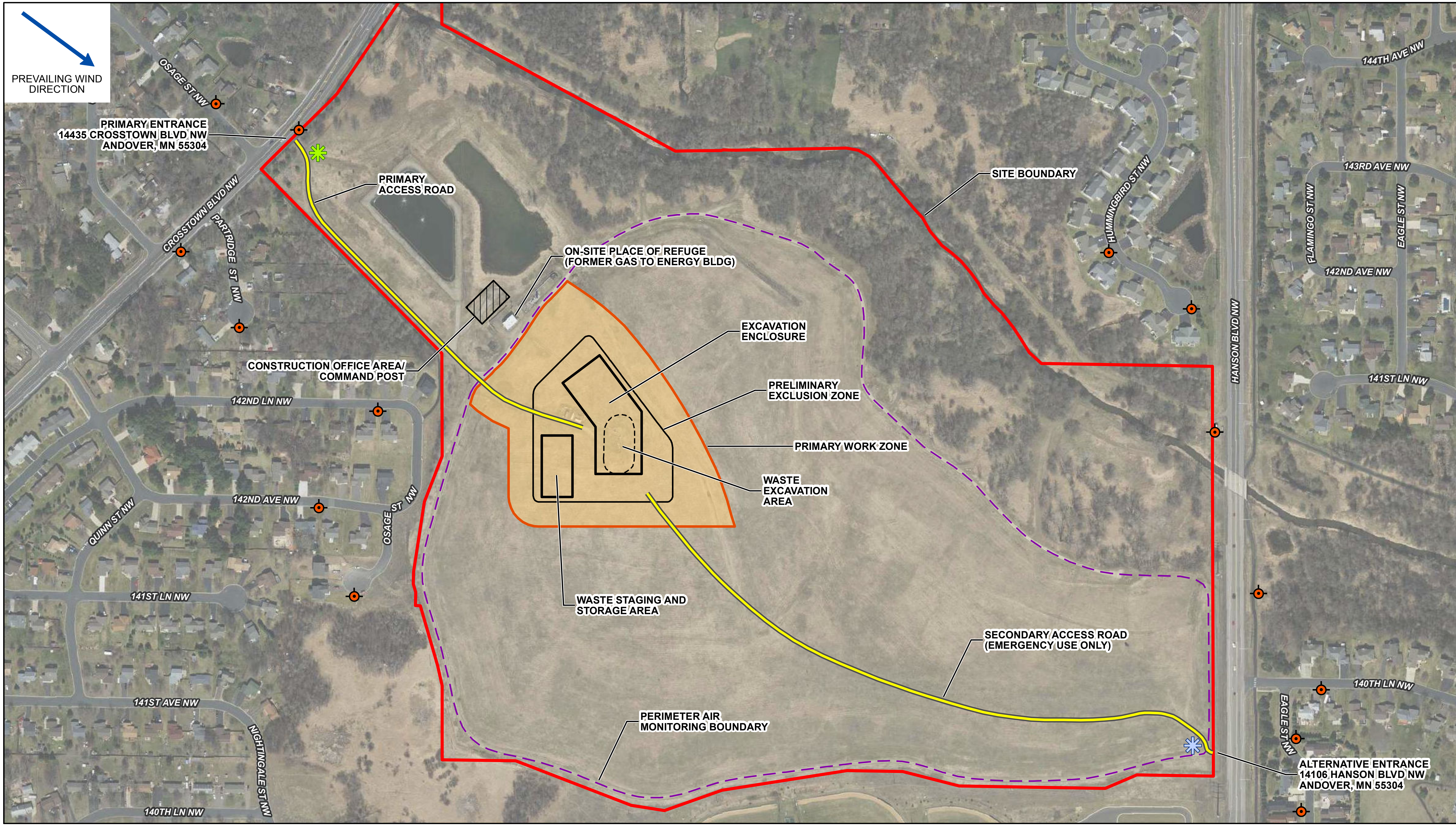


Source: Twin Cities Metropolitan Council, Spring 2016 Aerial Photography

0 100 200 300 ft

N

LEGEND

- PRIMARY EMS MEETING POINT
- ALTERNATE EMS MEETING POINT
- FIRE HYDRANT WITHIN 500 FEET OF LANDFILL
- CONSTRUCTION OFFICE AND COMMAND POST

GHD

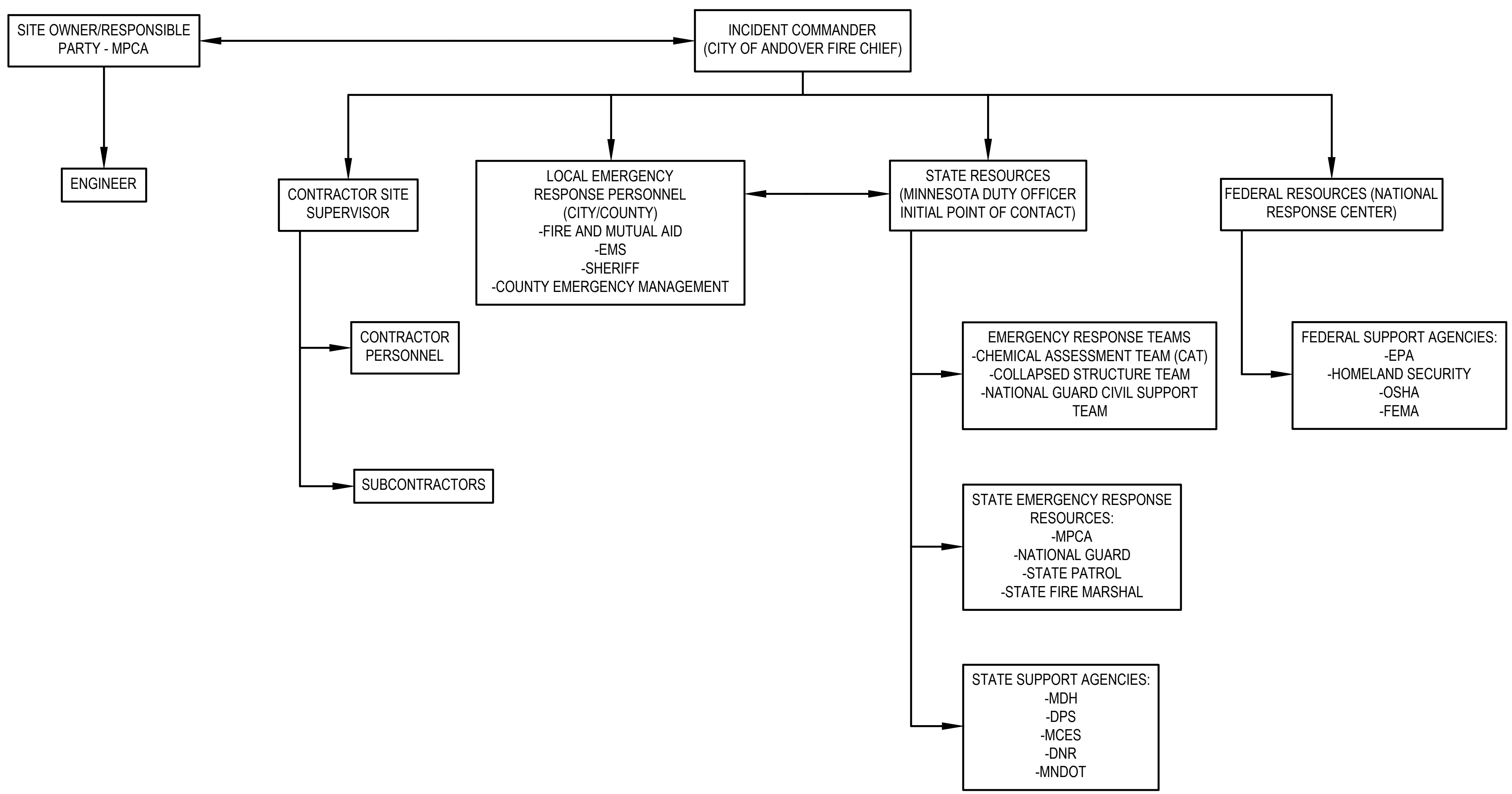
WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

PRELIMINARY SITE PLAN

11129194-31
Feb 27, 2018

FIGURE 1.3

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-REPORTS\11129194-31(006)\11129194-31(006)GIS-SP003.mxd



MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING
CLOSED LANDFILL - INDUSTRIAL WASTE PIT

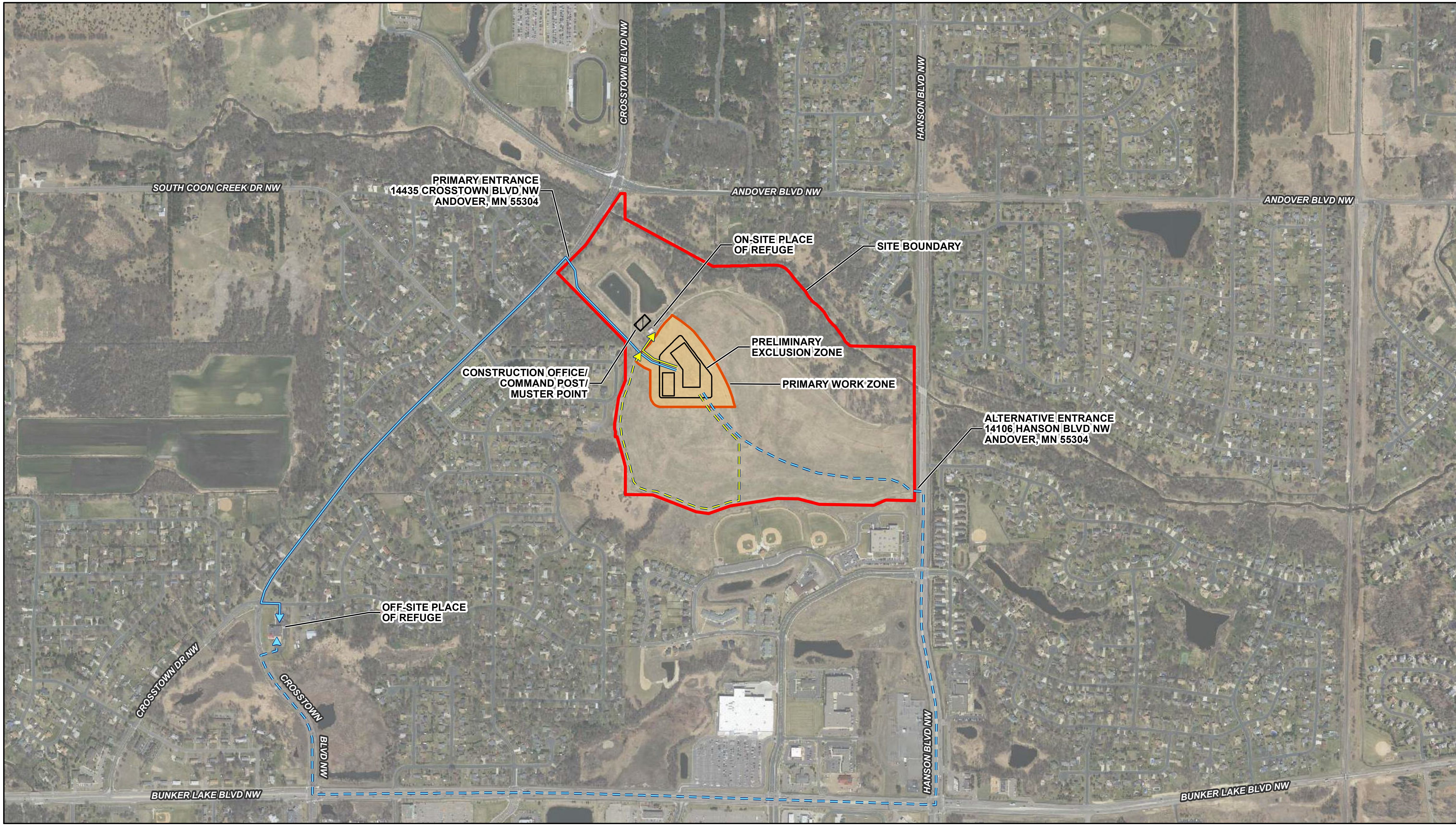
EMERGENCY RESPONSE COMMUNICATION AND LINES OF AUTHORITY FLOW CHART

Project No. **11129194**
Report No. **006**
Date **NOV 2017**

FIGURE 2.1

Filename: P:\Drawings\10000000's\11129194\11129194-REPORTS\11129194-00(006)\11129194-00(006)GN\11129194-00(006)GN-BU001.dwg
Plot Date: 30 November 2017 - 8:23 AM

Source:



Source: Twin Cities Metropolitan Council, Spring 2016 Aerial Photography

0 400 800 ft

N

LEGEND

PRIMARY ON-SITE EVACUATION ROUTE

SECONDARY ON-SITE EVACUATION ROUTE

PRIMARY OFF-SITE EVACUATION ROUTE

SECONDARY OFF-SITE EVACUATION ROUTE

GHD

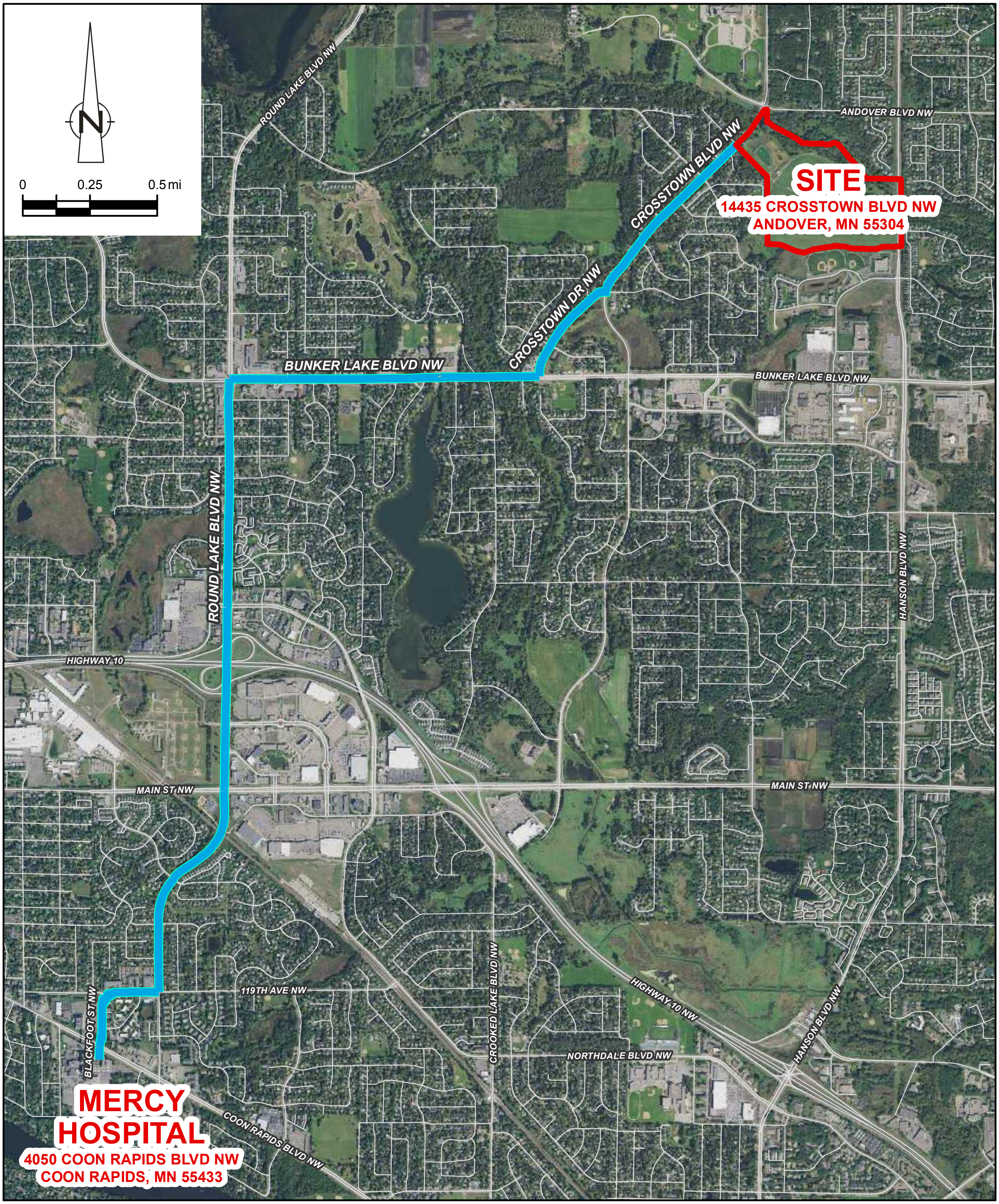
WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

11129194-31
Feb 27, 2018

EVACUATION ROUTES AND PLACES OF REFUGE

FIGURE 2.2

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-REPORTS\11129194-31(006)\11129194-31(006)GIS-SP004.mxd



Source: Anoka County; USDA FSA - National Agricultural Imagery Program, 2015

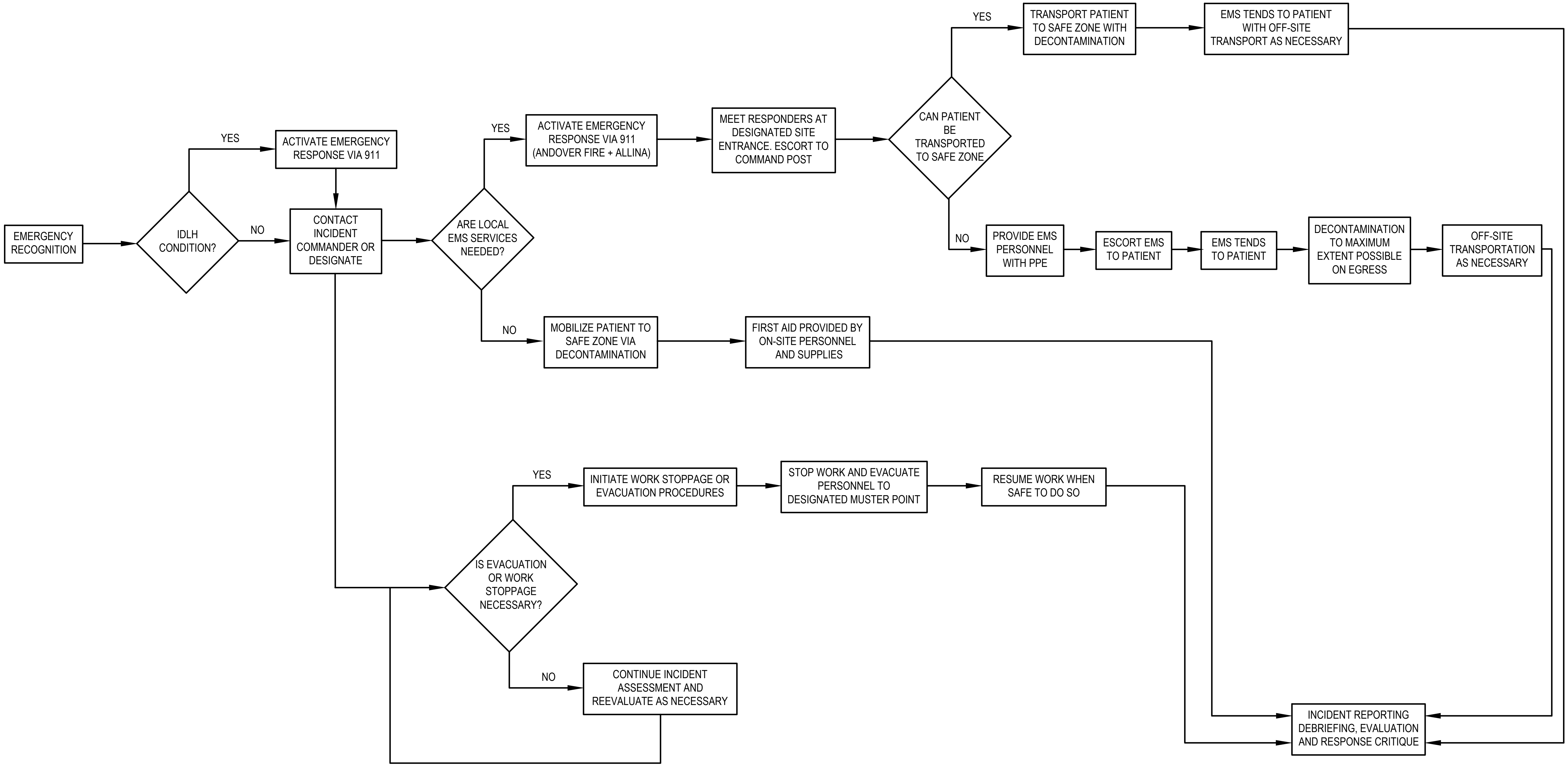
WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

11129194-31
Feb 27, 2018

HOSPITAL ROUTE

FIGURE 3.1

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-REPORTS\11129194-31(006)\11129194-31(006)GIS-SP005.mxd



GHD

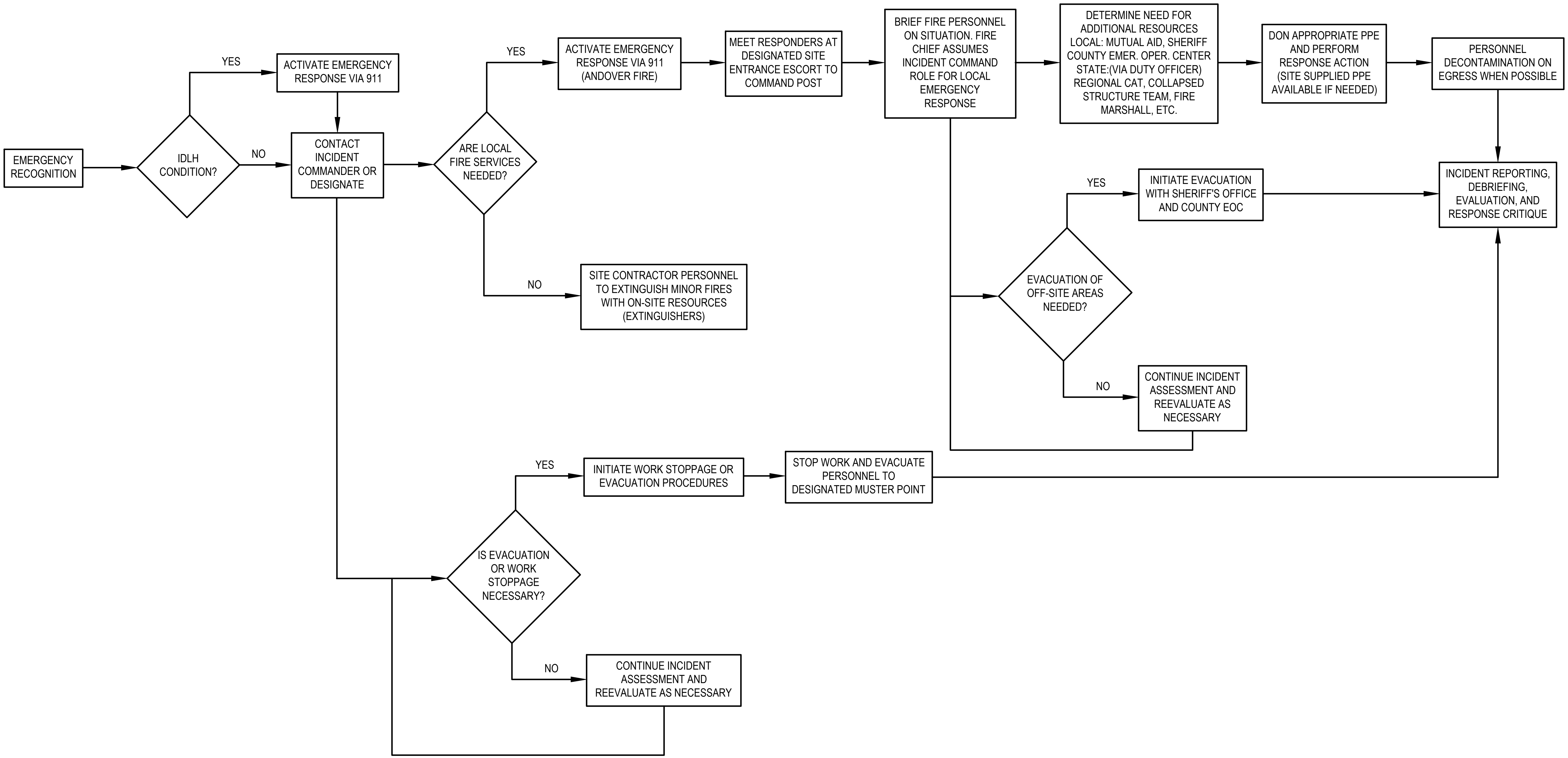
MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING
CLOSED LANDFILL - INDUSTRIAL WASTE PIT

MEDICAL EMERGENCY DECISION FLOW CHART

Project No. **11129194**
Report No. **006**
Date **NOV 2017**

FIGURE 3.2

Filename: P:\Drawings\10000000's\11129194\11129194-REPORTS\11129194-00(006)\11129194-00(006)GN\11129194-00(006)GN-BU001.dwg
Plot Date: 30 November 2017 - 8:23 AM
Source:



GHD

MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING
CLOSED LANDFILL - INDUSTRIAL WASTE PIT

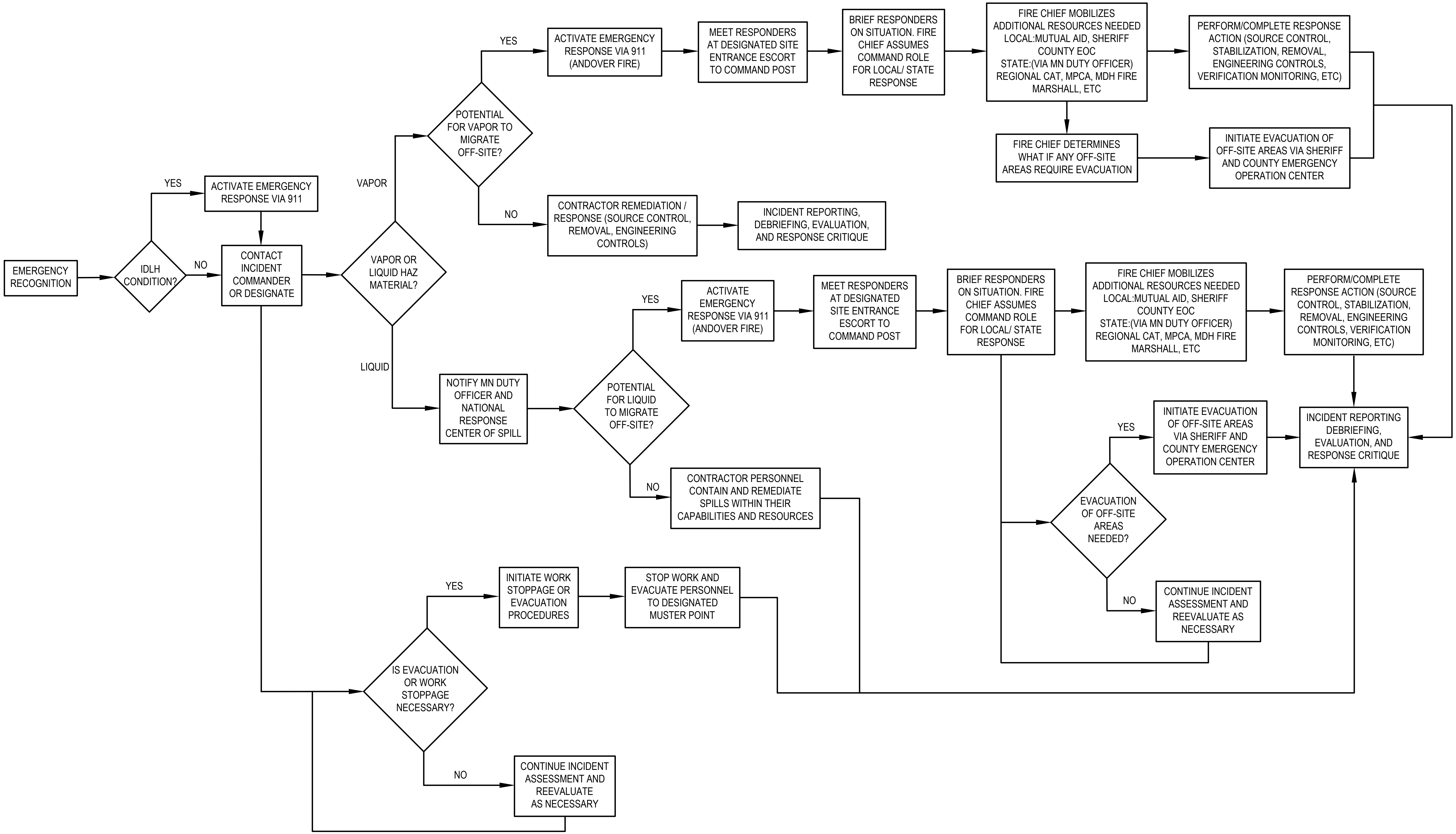
FIRE AND EXPLOSION EMERGENCY DECISION FLOW CHART

Project No. **11129194**
Report No. **006**
Date **NOV 2017**

FIGURE 3.3

Filename: P:\Drawings\10000000's\11129194\11129194-REPORTS\11129194-00(006)\11129194-00(006)GN\11129194-00(006)GN-BU001.dwg
Plot Date: 30 November 2017 - 8:23 AM

Source:



GHD

MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING
CLOSED LANDFILL - INDUSTRIAL WASTE PIT

HAZ MATERIAL RELEASE EMERGENCY DECISION FLOW CHART

Project No. **11129194**
Report No. **006**
Date **NOV 2017**

FIGURE 3.4

Filename: P:\Drawings\10000000's\11129194\11129194-REPORTS\11129194-00(006)\11129194-00(006)GN\11129194-00(006)GN-BU001.dwg
Plot Date: 30 November 2017 - 8:23 AM

Source:

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
pH (corrosivity)	2.6 (minimum) to 9.6 (maximum)	std. units
Flash Point (ignitability)	ND	oF
Cyanide (reactivity)	22.8	mg/kg
Sulfide (reactivity)	ND	mg/kg
Metals		
Aluminum	11,300.0	mg/kg
Antimony	2.0	mg/kg
Arsenic	3.5	mg/kg
Barium	904.0	mg/kg
Beryllium	0.099	mg/kg
Cadmium	80.0	mg/kg
Calcium	19,900.0	mg/kg
Chromium	8,800.0	mg/kg
Cobalt	15.3	mg/kg
Copper	3,840.0	mg/kg
Iron	40,400.0	mg/kg
Lead	7,710.0	mg/kg
Magnesium	8,250.0	mg/kg
Manganese	445.0	mg/kg
Mercury	0.37	mg/kg
Nickel	34.0	mg/kg
Potassium	2,650.0	mg/kg
Selenium	0.830	mg/kg
Silver	0.8	mg/kg
Sodium	4,970.0	mg/kg
Thallium	1.6	mg/kg
Vanadium	23.2	mg/kg
Zinc	4,620.0	mg/kg

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
Volatile Organic Compounds (VOCs)		
1,1,1,2-Tetrachloroethane	ND	ug/kg
1,1,1-Trichloroethane	727,000.0	ug/kg
1,1,2,2-Tetrachloroethane	ND	ug/kg
1,1,2-Trichloroethane	8,740.0	ug/kg
1,1,2-Trichlorotrifluoroethane	346,000.0	ug/kg
1,1-Dichloroethane	501,000.0	ug/kg
1,1-Dichloroethene	ND	ug/kg
1,1-Dichloropropene	ND	ug/kg
1,2,3-Trichlorobenzene	ND	ug/kg
1,2,3-Trichloropropane	ND	ug/kg
1,2,4-Trichlorobenzene	1,720.0	ug/kg
1,2,4-Trimethylbenzene	286,000.0	ug/kg
1,2-Dibromo-3-chloropropane	ND	ug/kg
1,2-Dibromoethane (EDB)	ND	ug/kg
1,2-Dichlorobenzene	1,100,000.0	ug/kg
1,2-Dichloroethane	2,310.0	ug/kg
1,2-Dichloropropane	ND	ug/kg
1,3,5-Trimethylbenzene	83,500.0	ug/kg
1,3-Dichlorobenzene	ND	ug/kg
1,3-Dichloropropane	ND	ug/kg
1,4-Dichlorobenzene	8,100.0	ug/kg
2,2-Dichloropropane	ND	ug/kg
2-Butanone (MEK)	6,030,000.0	ug/kg
2-Chlorotoluene	4,060.0	ug/kg
4-Chlorotoluene	4,790.0	ug/kg
4-Methyl-2-pentanone (MIBK)	425,000.0	ug/kg
Acetone	36,200,000.0	ug/kg
Allyl chloride	ND	ug/kg
Benzene	13,800.0	ug/kg

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
Volatile Organic Compounds (VOCs)		
Bromobenzene	ND	ug/kg
Bromochloromethane	1,030.0	ug/kg
Bromodichloromethane	ND	ug/kg
Bromoform	ND	ug/kg
Bromomethane	92.8	ug/kg
Carbon tetrachloride	ND	ug/kg
Chlorobenzene	1,830,000.0	ug/kg
Chloroethane	1,730.0	ug/kg
Chloroform	989.0	ug/kg
Chloromethane	75.7	ug/kg
Dibromochloromethane	ND	ug/kg
Dibromomethane	ND	ug/kg
Dichlorodifluoromethane	60,200.0	ug/kg
Dichlorofluoromethane	16,100.0	ug/kg
Diethyl ether (Ethyl ether)	ND	ug/kg
Ethylbenzene	2,830,000.0	ug/kg
Hexachloro-1,3-butadiene	ND	ug/kg
Isopropylbenzene (Cumene)	56,900.0	ug/kg
Methyl-tert-butyl ether	ND	ug/kg
Methylene Chloride	920,000.0	ug/kg
Naphthalene	261,000.0	ug/kg
Styrene	11,100,000.0	ug/kg
Tetrachloroethene	12,600,000.0	ug/kg
Tetrahydrofuran	334.0	ug/kg
Toluene	18,300,000.0	ug/kg
Trichloroethene	53,200,000.0	ug/kg
Trichlorofluoromethane	355,000.0	ug/kg
Vinyl chloride	1,310.0	ug/kg
Xylene (Total)	11,600,000.0	ug/kg

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
Volatile Organic Compounds (VOCs)		
cis-1,2-Dichloroethene	126,000.0	ug/kg
cis-1,3-Dichloropropene	ND	ug/kg
n-Butylbenzene	31,300.0	ug/kg
n-Propylbenzene	65,100.0	ug/kg
p-Isopropyltoluene	5,450.0	ug/kg
sec-Butylbenzene	10,000.0	ug/kg
tert-Butylbenzene	ND	ug/kg
trans-1,2-Dichloroethene	789.0	ug/kg
trans-1,3-Dichloropropene	ND	ug/kg
Semi-Volatile Organic Compounds (SVOCs)		
Acrolein	3,280.0	ug/kg
1,2,4-Trichlorobenzene	1,740.0	ug/kg
1,2-Dichlorobenzene	840,000.0	ug/kg
1,2-Diphenylhydrazine	350.0	ug/kg
1,3-Dichlorobenzene	ND	ug/kg
1,4-Dichlorobenzene	1,080.0	ug/kg
1-Methylnaphthalene	30,100.0	ug/kg
2,4,5-Trichlorophenol	114.0	ug/kg
2,4,6-Trichlorophenol	ND	ug/kg
2,4-Dichlorophenol	ND	ug/kg
2,4-Dimethylphenol	ND	ug/kg
2,4-Dinitrophenol	ND	ug/kg
2,4-Dinitrotoluene	ND	ug/kg
2,6-Dinitrotoluene	ND	ug/kg
2-Chloronaphthalene	ND	ug/kg
2-Chlorophenol	ND	ug/kg
2-Methylnaphthalene	53,700.0	ug/kg
2-Methylphenol(o-Cresol)	10,500.0	ug/kg

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
Semi-Volatile Organic Compounds (SVOCs)		
2-Nitroaniline	10,800.0	ug/kg
2-Nitrophenol	ND	ug/kg
3&4-Methylphenol(m&p Cresol)	24,100.0	ug/kg
3,3'-Dichlorobenzidine	ND	ug/kg
3-Nitroaniline	ND	ug/kg
4,6-Dinitro-2-methylphenol	ND	ug/kg
4-Bromophenylphenyl ether	ND	ug/kg
4-Chloro-3-methylphenol	2,020.0	ug/kg
4-Chloroaniline	ND	ug/kg
4-Chlorophenylphenyl ether	ND	ug/kg
4-Nitroaniline	ND	ug/kg
4-Nitrophenol	ND	ug/kg
Acenaphthene	574.0	ug/kg
Acenaphthylene	70.6	ug/kg
Anthracene	242.0	ug/kg
Benzo(a)anthracene	263.0	ug/kg
Benzo(a)pyrene	297.0	ug/kg
Benzo(b)fluoranthene	414.0	ug/kg
Benzo(g,h,i)perylene	396.0	ug/kg
Benzo(k)fluoranthene	177.0	ug/kg
Butylbenzylphthalate	73,900.0	ug/kg
Carbazole	143.0	ug/kg
Chrysene	400.0	ug/kg
Di-n-butylphthalate	2,780,000.0	ug/kg
Di-n-octylphthalate	43,100.0	ug/kg
Dibenz(a,h)anthracene	92.0	ug/kg
Dibenzofuran	485.0	ug/kg
Diethylphthalate	1,230.0	ug/kg
Dimethylphthalate	6,030.0	ug/kg

Table 1.1

Pre-Design Investigation - Waste and Subsoil Analytical Results
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Parameter	Maximum Concentration	Concentration Units
Semi-Volatile Organic Compounds (SVOCs)		
Fluoranthene	738.0	ug/kg
Fluorene	633.0	ug/kg
Hexachloro-1,3-butadiene	98.7	ug/kg
Hexachlorobenzene	ND	ug/kg
Hexachloroethane	ND	ug/kg
Indeno(1,2,3-cd)pyrene	249.0	ug/kg
Isophorone	135,000.0	ug/kg
N-Nitroso-di-n-propylamine	204.0	ug/kg
N-Nitrosodimethylamine	ND	ug/kg
N-Nitrosodiphenylamine	393.0	ug/kg
Naphthalene	206,000.0	ug/kg
Nitrobenzene	2,610.0	ug/kg
Pentachlorophenol	ND	ug/kg
Phenanthrene	5,200.0	ug/kg
Phenol	615,000.0	ug/kg
Pyrene	590.0	ug/kg
bis(2-Chloroethoxy)methane	ND	ug/kg
bis(2-Chloroethyl) ether	ND	ug/kg
bis(2-Chloroisopropyl) ether	ND	ug/kg
bis(2-Ethylhexyl)phthalate	547,000.0	ug/kg
Poly-Chlorinated Biphenyls (PCBs)		
PCB-1016 (Aroclor 1016)	ND	ug/kg
PCB-1221 (Aroclor 1221)	ND	ug/kg
PCB-1232 (Aroclor 1232)	ND	ug/kg
PCB-1242 (Aroclor 1242)	238,000.0	ug/kg
PCB-1248 (Aroclor 1248)	3,090.0	ug/kg
PCB-1254 (Aroclor 1254)	ND	ug/kg
PCB-1260 (Aroclor 1260)	ND	ug/kg
PCB-1262 (Aroclor 1262)	ND	ug/kg
PCB-1268 (Aroclor 1268)		ug/kg
PCB, Total	238,000.0	ug/kg

Table 2.1

Emergency Contacts
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Role	Agency/Company Name and Address	Contact	Title	Phone	Email
Site Owner/ Generator	**Minnesota Pollution Control Agency** 520 Lafayette Road St. Paul, MN 55155	Patrick Hanson Benjamin Klismith	Project Manager Project Engineer	(651) 757-2409 (651) 757-2497	patrick.hanson@state.mn.us benjamin.klismith@state.mn.us - -
Engineer	**GHD Services Inc.** 1801 Old Highway 8 NW, Suite 114 St. Paul, MN 55112	Robert Martin Timothy Ree	Project Manager Project Engineer	(612) 524-6853 (612) 524-6866	Robert.Martin@ghd.com Tim.Ree@ghd.com
Contractor	**To Be Determined**	-	-	-	-
City	**City of Andover** 1685 Crosstown Boulevard Andover, MN 55304	Jim Dickinson Jerry Streich	City Administrator Emergency Manager	(763) 767-5110 (763) 767-5192	j.dickinson@andovermn.gov j.streich@andovermn.gov
County	**Anoka County** 2100 3rd Avenue Anoka, MN 55303	Terry Stoltzman Ryan Kelzenberg	Emergency Management Director Emergency Management Coordinator	(763) 324-4761 (763) 324-4763	terry.stoltzman@co.anoka.mn.us ryan.kelzenberg@co.anoka.mn.us
Fire Department	**City of Andover Fire** 13875 Crosstown Boulevard Andover, MN 55304	Jerry Streich	Fire Chief, Incident Commander	(763) 767-5192	j.streich@andovermn.gov
Emergency Medical Services (Ambulance)	**Allina Health Emergency Medical Services** 167 Grand Avenue St Paul, MN 55102	-	-	(651) 241-4400	-
Police	**Anoka County Sheriff's Office** 13301 Hanson Boulevard Andover, MN 55304	-	-	(763) 324-5036	sheriff@co.anoka.mn.us
Hospital	**Mercy Hospital** 4050 Coon Rapids Boulevard Coon Rapids, MN 55433	-	-	(763) 236-6000	-
State Spill Reporting/ State Resource Dispatch	**Minnesota Department of Public Safety** 445 Minnesota Street St. Paul, MN 55101	-	Minnesota Duty Officer	(651) 649-5451 (800) 422-0798	-
Federal Spill Reporting	National Response Center	-	-	(800) 424-8802	-

Table 2.1

Emergency Contacts
Waste Disposal Engineering (WDE) Closed Landfill
Andover, Minnesota

Role	Agency/Company Name and Address	Contact	Title	Phone	Email
Federal Environmental	**United Stated Environmental Protection Agency** Region 5 Ralph Metcalfe Federal Building 77 West Jackson Boulevard Chicago, IL 60604	-	Regional Response Center	(312) 353-2318	-
State Transportation	**Minnesota Department of Transportation** 395 John Ireland Boulevard St. Paul, MN 55155	-	-	(651) 296-3000	-
State Health	**Minnesota Department of Health** Environmental Health Division Site Assessment & Consultation Unit 625 Robert Street N. St. Paul, MN 55164	Daniel Pena	Environmental Research Scientist	(651) 201-4920	daniel.pena@state.mn.us
State Natural Resources	**Minnesota Department of Natural Resources** 500 Lafayette Road St. Paul, MN 55155	-	-	(651) 296-6157	-
Local Watershed	**Coon Creek Watershed District** 12301 Central Avenue, Suite 100 Blaine, MN 55434	-	-	(763) 755-0975	info@cooncreekwd.org
Poison Control	**Poison Control Center**	-	Poison Control Hotline	(800) 222-1222	-

Appendix A
Industrial Waste Pit
Summary of Deposited Waste

Attachment B

Results of 1973 Survey

1973

Containerized

Survey Confirmed	Year 1973	
Industrial Steel Container	500	
Univac Plant #5	1319	
Univac Plant #4	316	
Univac Defense Systems	1439	
Midland	28-30	
Ford	1206-1330	
Economics Lab.	225	
Thermo King	153	
FMC	338	
Foley	32	
	5,556	@ 55 gallon containers

From Disposal Report		
Honeywell	528	
Minco	288	
Cornelius	184	
	1,000	@ 55 gallon containers

Survey Container Total	6,556 (55 gal bbls) (360,580 gals)

Survey Bulk

Ford (500 gal leads)	51,000 gals/yr)	91,600 gds
Onan	40,600 gals/yr)	1,665 bbls)

6100462

ATTACHMENT C

Types of Toxic and Hazardous material disposed of at Waste Disposal Engineering landfill as determined by a 1973 Survey conducted by the Anoka County Health Department.

1. Econ Labs (1973)
   Various chemical wastes, 225-55 gallon containers for 1973 - attached copy of chemicals.

2. FMC Corp. (July 1972 - July 1973)
   Mixed Sludge - 247@55 gallon containers

3. Foley Mfg. Co. (1973)
   Paint Sludge - 32 @ 55 gallon containers

4. Ford: (1973)
   Paint Sludge - 58,000 gal/yr. - 500 gallon tank trucks
   Grease Oil Solvents - 1,330 55 gallon containers

5. Honeywell - (1973)
   Degreaser Solvents - 46 @ 55 gallons
   Petroleum Solvents - 46 @ 55
   Oil - 74 @ 55
   Paint Sludge - 91 @ 55
   Misc. - 27 @ 55

6. Industrial Steel Container Co.
   Type of waste unknown, usually in solid form.

7. Midland Coop (1973)
   Waste Paint - 640 gallons

8. Onan - (1973)
   1. Grease and or Oil - 7,800 gal/yr.
   2. Solvents ie. lacquer thinner - 32,800 gal/yr.

Stoddart Solvent	Tri-Clene R
Synasol	Tri-Clene L
Xylene	Onan Special Solv.
Clearoll Solvent	Mineral Spirits
Tri Clene D	Deodorized Kerosene
Merso Paint Stripper	

   3. Chemical Sludge - 789,000 lb/yr, consisting of paint sludge and iron filings mixed with carborunin

9. Thermo-King Corp. (October 1972 - October 1973) - 153 @ 55 gallon containers

Tolyol	Mineral Seal Oil
Paint arrestros	Naphtaninic Oils
Chlorothane	Dimethyl Formanide
Antifreeze	Polyurethane Foam
Engine Oils	Methylene Chloride
Trimsol	Vythene

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JC:ck

AT[illegible] 6

[illegible] Laboratory, Inc. Date: 2/13/74

370 Wabasha, St. Paul, Minnesota 55102 Time:

Chemical Engineering Center

840 Lone Oak Road, St. Paul, Minnesota 55121

[illegible] Tom Petro Position: Manager-Semi-Works Plant

[illegible] records of Toxic & Hazardous Wastes produced: Yes

[illegible] Hazardous Wastes Hauled by: Waste Control, Inc.

[illegible] Hazardous Wastes Disposed at: Anoka Landfill SW-8

[illegible] Arrangements made with: Ron Roth - Waste Control, Inc.

[illegible] have a contract: no

[illegible] of Contract:

[illegible] are you billed: Monthly

Source of Information: Tom Petro

[illegible]	MATERIAL	QUANTITY		REMARKS	
2/5/73	Restore w/Bichromate	8 drums	3,800#	B.L. 886	alkaline
2/5/73	H.S.R.A.	5 drums	2,000#	B.L. 886	acid
2/5/73	Exp. Waterless Hand Cleaner	5 drums	1,680#	B.L. 886	neutral
[illegible]/73	Magnus MX-7013	6 drums	1,780#	B.L. 886	alkaline
2/[illegible]/73	KX-2404 Auto. Water C.	5 drums	1,900#	B.L. 886	neutral
2/5/73	Magnus Stripit 773	4 drums	1,048#	B.L. 886	alkaline-solvent
2/19/73	Liquid Spearhead NPC	3 drums	945#	B.L. 904	alkaline
3/26/73	Magnus MB-5024	4 drums	1,960#	B.L. 945	acid
3/26/73	KX-2418	2 drums	920#	B.L. 945	alkaline
3/26/73	Magnuwax 700	1 drum	375#	B.L. 945	neutral
3/26/73	Stripit 773	3 drums	1,572#	B.L. 945	alkaline-solvent
3/26/73	FOR-100	6 drums	2,700#	B.L. 945	neutral
3/26/73	Liquid Spearhead	3 drums	945#	B.L. 945	alkaline
4/26/73	Used Solvent	6 drums	910#	B.L. 978	solvent
4/26/73	Liquid used in titrating agglomeration	2 drums	200#	B.L. 978	alkaline
4/26/73	Unknown	3 drums	930#	B.L. 978	-
4/26/73	Molasses	4 drums	2,520#	B.L. 978	neutral
4/26/73	MX-7009	2 drums	153#	B.L. 978	solvent
4/26/73	Chlorolube 50L	2 drums	300#	B.L. 978	neutral
6/[illegible]/73	Klenzmation AC-30	5 drums	2,400#	B.L. 1077	acid
6/27/73	KX-2416 Con. Lubricant	1 drum	460#	B.L. 1077	alkaline
6/27/73	RU Silicate	2 drums	1,420#	B.L. 1077	alkaline
6/27/73	Molasses	1 drum	625#	B.L. 1077	neutral
6/27/73	Actrasol SR-75	1 drum	480#	B.L. 1077	neutral

6100460

Economics Labs

Date:

Time:

[illegible] viewed: Position:

[illegible] records of Toxic & Hazardous Wastes produced:

[illegible] Hazardous Wastes Hauled by:

[illegible] Hazardous Wastes Disposed at:

[illegible] Arrangements made with:

Do you have a contract:

Date of Contract:

How are you billed:

Source of Information:

DATE	MATERIAL	QUANTITY	REMARKS
6/27/73	H.S.R.A. Rinse Additive	31 drums 4,000#	B.L. 1077 acid
6/27/73	Unitol DSR	1 drum 140#	B.L. 1077 acid
6/27/73	Unknown Product	1 drum 660#	B.L. 1077' -
9/18/73	Bevro-Kleen	18 drums 8,100#	B.L. 1104 neutral
9/18/73	Magnu-Strip 786	1 drum 300#	B.L. 1104 alkaline-solven
9/ /73	MX-1343 Premix	1 drum 300#	B.L. 1104 neutral
10/4/73	RO 55 3A Liquid	4 drums 1,780#	B.L. 1136 alkaline
10/4/73	RO-55 3B Liquid	6 drums 3,000#	B.L. 1136 alkaline
10/8/73	RO-54 B	10 drums 5,175#	B.L. 1142 neutral
10/8/73	RO-55 3A	6 drums 4,000#	B.L. 1142 alkaline
10/8/73	RO-55 3B	2 drums 1,000#	B.L. 1142 alkaline
10/8/73	Armeen T	2 drums 1,220#	B.L. 1142 neutral
10/8/73	Silicate of Soda	3 drums 2,800#	B.L. 1142 alkaline
12/4/73	Silicate of Soda	10 drums 7,040#	B.L. 1238 alkaline
12/4/73	RU Silicate	8 drums 5,680#	B.L. 1238 alkaline
12/4/73	Grease Strip	3 drums 1,317#	B.L. 1238 alkaline
12/26/73	Solvent J	16 drums 7,440#	B.L. 1263 solvent
12/26/73	Magnicide 18	18 drums [illegible],600#	B.L. 1263 acid
	TOTAL	225 drums	

6100459

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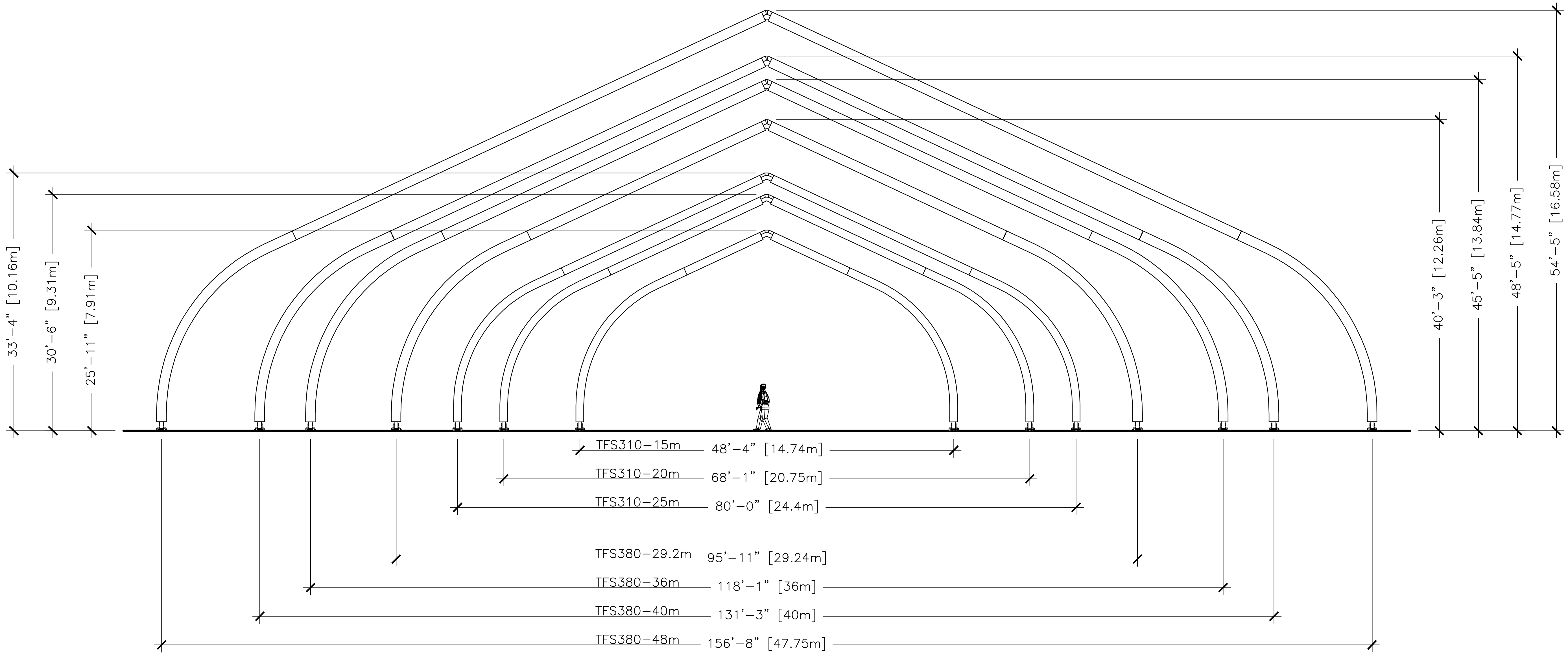
Appendix G
Potential Temporary Enclosure Information



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Project Title: ALLSITE – TFS SERIES – ALL SIZES

Drawing Title: ELEVATION

Scale: NTS | Date: 01-02-13

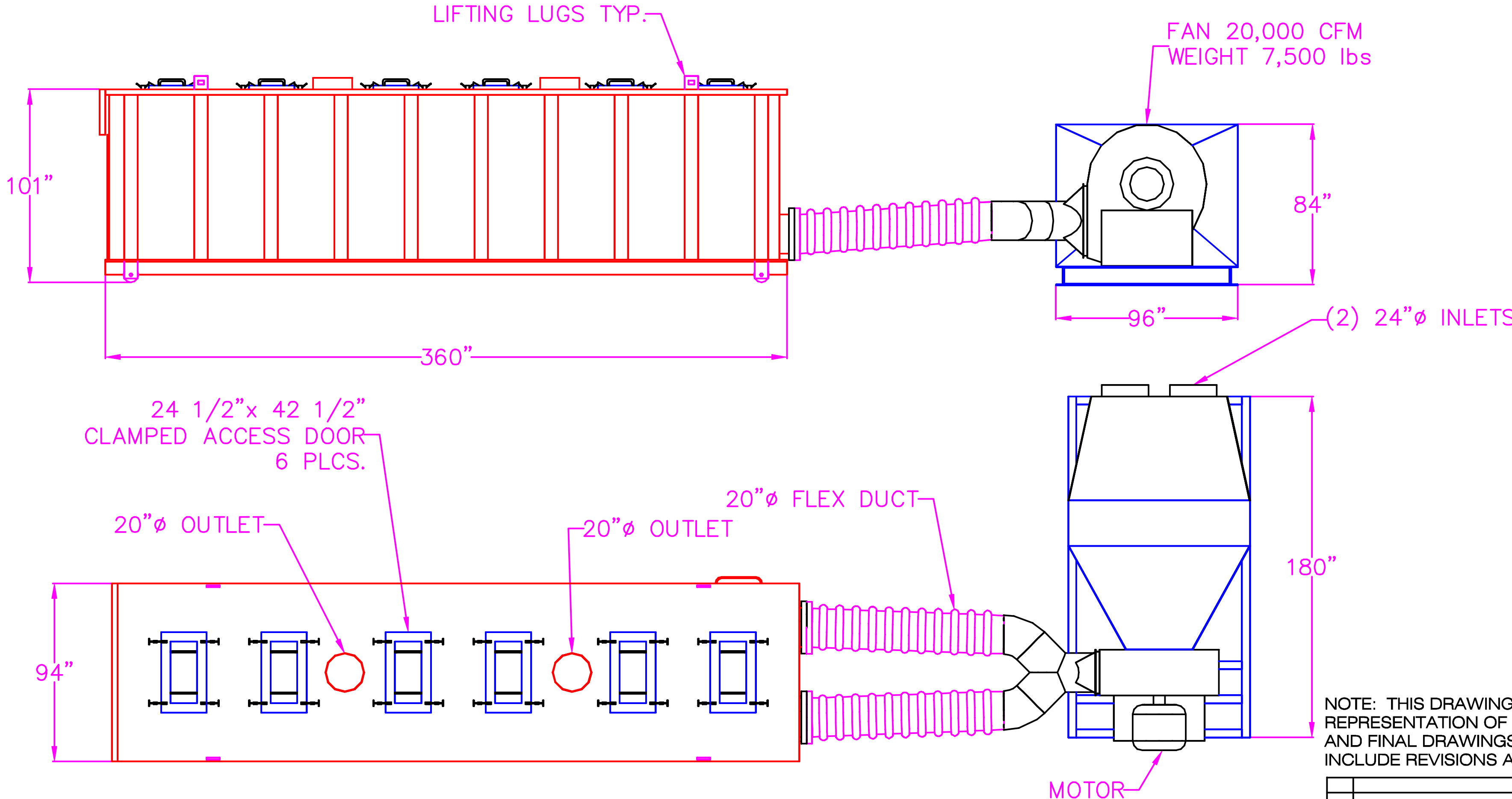
Drawn By: AC | Checked By: JJ | Passed By: DG

Drawing No: TFS-SERIES-SK1

Drawing Status: INFORMATION ONLY

Mark	Date	By	Revision

Appendix H
Potential Vapor Control and Treatment Equipment Information



NOTE: THIS DRAWING IS A REPRESENTATION OF THE DESIGN AND FINAL DRAWINGS WILL INCLUDE REVISIONS AS REQUIRED.

NOTE: TIGG CORPORATION RESERVES THE RIGHT TO CHANGE ANY AND ALL DIMENSION-DESIGNS OVERALL OUT TO OUT DIMENSIONS AND INLET/OUTLET LOCATIONS ARE FIXED.

NOTE: CONTAMINATED AIR SHALL ENTER UNIT THROUGH BOTH INLETS AND MUST EXIT USING BOTH OUTLETS.

NO.	REVISION	BY	DATE
1	CHANGE BLOWER	JB	10/04/01

PROJECT	GENERAL LAYOUT
PROJ. NO.	
P.O. NO.	
DRAWN BY	JB
DESIGN BY	BB
CHKD. BY	
DATE	10/03/01
SCALE	NTS

TIGG corporation

CARBON ADSORBER,
AIR HANDLING SYSTEM

DWG. NO. NB-20-1002 REV. 1

Appendix I
Perimeter Air Monitoring Plan

Final

Perimeter Air Monitoring Plan

Waste Disposal Engineering (WDE) Closed Landfill
14437 Crosstown Boulevard
Andover, Minnesota

GHD | 1801 Old Highway 8 Northwest Suite 114 St. Paul Minnesota 55112 USA

11129194**|** Report No 8 **|** April 10, 2018

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Appendix Index

1. Introduction

This perimeter air monitoring plan (PAMP) presents the basis and approach for potential contaminant emissions associated with the excavation and removal of waste materials from the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site).

1.1 Site Background

The MPCA has determined that the removal of the industrial waste pit at the WDE Closed Landfill is the most effective method to reduce long-term operation and maintenance costs associated with environmental concerns at the Site. Industrial waste drums and containers were buried in a clay and asphalt lined pit between November 1972 and January 1974. The pit where the drums of industrial waste were disposed is estimated to be about a third of an acre in size.

The bulk of waste disposed at the WDE Closed Landfill was ordinary municipal waste. In addition to municipal waste, unknown quantities of demolition waste, industrial waste, and hazardous substances were deposited in the landfill. It has been estimated that, by volume, 95% of disposed hazardous substances are acids, oil, paint/paint sludge, and solvents.

MPCA finds that the industrial waste pit is leaking and contaminating the groundwater beneath it. Identified contaminants include polychlorinated biphenyls (PCBs), paint wastes, heavy metals, solvents, and other volatile organic compounds. Groundwater extraction and treatment systems, along with a vapor extraction system, installed in the pit, are operated at this Site to reduce health and environmental risks posed by this contamination.

Prior to operation of the groundwater extraction systems, surface water quality standards in nearby Coon Creek were exceeded due to impacted groundwater from the Site discharging into the creek. Most residents are served by a municipal water supply that is not impacted. However, even with these environmental controls in place, the WDE Closed Landfill ranks at the top of the list of Closed Landfill Program sites posing risks to human health and the environment.

1.2 Removal Action Scope of Work

The primary elements of the removal action associated with perimeter air monitoring include the industrial waste pit excavation, temporary enclosure, and vapor control.

1.2.1 Industrial Waste Pit Excavation Overview

At this stage of the project, GHD envisions the removal of the 5 to 10 feet of cover soils over the industrial waste pit to at least 50 feet beyond the extents of the pit. Excavation of the waste interval and underlying clay would extend to a maximum depth of 26 feet below the existing ground surface and 16 feet below the benched ground surface. Excavation of sandy soil below the clay liner and directly below the pit will extend to an expected maximum depth of 36 feet below the existing ground surface.

1.2.2 Temporary Enclosures

A temporary enclosure will be erected over the pit to facilitate waste excavation and preliminary waste characterization screening. Following preliminary screening, the waste will be moved into a designated area of the temporary enclosure for waste categorization, bulking, and packaging. The packaged material will then be moved from the temporary enclosure to outside staging areas for final characterization/profiling and subsequent loading and transport to offsite disposal facilities. The temporary enclosure and ventilation/vapor control system will facilitate containment of vapors off-gassing from the waste, treatment of vapors prior to discharge, and prevent precipitation from entering the excavation area. The bottom of each excavation layer will likely be covered with soil, polyethylene sheeting, or foam as the excavation proceeds and waste is removed. This will assist in reducing the amount of vapors off-gassing from impacted soil underlying the waste. Following removal of the waste interval, contaminated subsoil will be excavated to a depth near the groundwater table. Following removal of the subsoil, the excavation will be backfilled with onsite soil. A temporary cover will then be placed over the backfilled area and the temporary enclosure will be removed.

1.2.3 Vapor Control

Given the magnitude of VOCs present in the breathing zone during the pre-design investigation drilling, vapor control and treatment will be required during the industrial waste pit removal. A vapor mitigation system consisting of carbon will treat the vapors prior to discharge to the atmosphere.

1.3 Perimeter Air Monitoring Objectives and Approach

The primary objective of perimeter air monitoring is to measure and confirm that containments associated with the waste pit removal action remain below Site specific action levels at the property boundary. The purpose of this plan is to present the perimeter air monitoring objectives, basis, and overall approach during industrial waste pit removal action activities. The goals and objectives in preparing the perimeter air monitoring plan include the following:

- Identify contaminants of interest
- Model potential emissions
- Define action levels and corrective action decision criteria
- Determine monitoring locations, equipment, and frequency
- Develop a perimeter air monitoring results reporting approach
- Establish a communication approach to distribute air monitoring and sampling data to designated parties (i.e., public, local agencies/municipality, and Site personnel)
- Guide the establishment and implementation of procedures to ensure appropriate responses to elevated levels of airborne contaminants

The general perimeter air monitoring tasks and overall approach include the following:

- Conduct baseline air monitoring and sampling prior to starting the removal action to establish background conditions
- Perform direct read and real-time air monitoring around the perimeter of the Site during the removal action
- Collect periodic air samples for laboratory analyses to confirm the direct read air monitoring results during the removal action
- Report air monitoring and sampling results in a web-based system available for remote viewing
- Document a permanent record of perimeter air monitoring results

1.4 Roles and Responsibilities

GHD personnel will set up and manage this perimeter air monitoring program. Key roles and responsibilities related to air monitoring have been identified:

- MPCA - Owner
- GHD – Engineer (manage perimeter air monitoring and reporting system)
- Contractor – To be determined (manage exclusion zone vapor control and air monitoring system)
- City of Andover Fire Department – Incident Commander (should perimeter air monitoring conditions warrant)

Procedures outlined in the project Contingency and Emergency Response Plan will be implemented if the perimeter air monitoring conditions warrant.

2. Perimeter Air Monitoring Program (PAMP)

2.1 Overview

During the progress of active industrial waste pit excavation and removal work, on-Site air quality will be monitored as described herein. Monitoring will be conducted on a continuous basis using real-time monitoring equipment capable of detecting the contaminants of interest (COI). The site area is shown on Figure 2.1.

The daily perimeter air monitoring program will consist of monitoring with photoionization detectors (for non-specific volatile organic compounds), Dusttrak DRXs (for particulate matter, segregated by size fractions), combustible gas, oxygen , hydrogen sulfide, sulfur dioxide, nitrogen dioxide, and chlorine sensors. All equipment will be calibrated in accordance with manufacturers' recommendations. Perimeter Site air quality monitoring will be performed from various air monitoring stations to confirm on-site containment of air contaminants generated in the remedial action. Perimeter air monitoring results will be reported in a web-based system setup and managed by GHD. The monitoring results will be posted to the web-based system in real-time for viewing remotely, with a secure login system to permit access to the appropriate stakeholders.

2.2 Contaminants of Interest

This PAMP has been developed to monitor the performance of dust and contaminant control measures during remediation activities to mitigate the potential impact of contaminants of interest (COIs) on the general public. Exposure of on-Site workers will be addressed in the appropriate Site-specific Health and Safety Plan (HASP). The following chemicals have been identified at the Site and were considered in the development of this PAMP:

- Volatile Organic Compounds (VOCs) will be detected using a using photoionization detectors (PID). Because tetrachloroethene (PCE) and trichloroethene (TCE) were detected at the greatest frequency and concentrations, they are of primary interest and have the potential to exceed relevant screening criteria. The other VOCs detected in significant quantities include acetone, benzene, toluene, ethylbenzene, xylene (all isomers), styrene, and methyl ethyl ketone. Vinyl chloride, which has been detected in groundwater below the pit, is of special interest due to low exposure limits.

- Oxides of Nitrogen as NO_2, which may be a product of oxidation during excavation activities and is a common emission of all combustion processes, including internal combustion engines.
- Particulate Matter (PM), including PM less than 10 microns in diameter (PM_{10}), PM less than 2.5 microns in diameter ($PM_{2.5}$), and metals detected during the pre-design investigation.
- Polyaromatic Hydrocarbons (PAHs), using naphthalene as a surrogate. Naphthalene is chosen as the primary interest due to its low volatility and ability to be detected using a PID.
- Polychlorinated Biphenyls (PCBs), which can be emitted as fugitive dusts.
- Oxides of Sulfur as SO_2. Under certain conditions, the degradation of waste sulfuric acid can produce SO_2.

As removal action work progresses, the perimeter air monitoring data will be evaluated to determine whether any additional compounds should be added to the perimeter air monitoring program.

2.3 Air Modeling

Air dispersion modeling has been conducted in preparation for the monitoring program, in order to attempt to assess the potential impacts of emissions from the system and determine the monitoring station locations. Although the building vapor control/capture systems will be designed to remove COIs from the exhaust stream leaving the enclosure, this modeling reflects expected concentrations in the event of the system going down, a catastrophic failure of the building, or other upset conditions which will be avoided through process design to the extent possible.

GHD utilized SAFER Real Time™ (SAFER) to perform atmospheric dispersion modeling for the simulated release events. SAFER is a sophisticated dispersion modeling software that utilizes well known algorithms to determine the buoyancy of emissions from stack releases, cloud dispersion, changes in cloud temperature and the temperature of any pooled material, and other processes important to dispersion. The model is a Gaussian Puff model, which simulates cloud dispersion by integrating discrete masses of material released at regular intervals over time. This method of simulation allows for examination of the evolution of clouds of released materials over time. It also enables an analysis of how the terrain, changes in wind direction, wind speeds, or other phenomena affect the transport of the cloud. Given constant meteorological conditions, the downwind distances to levels of interest are similar to those which would be predicted by other Gaussian models. In addition to estimating source term release rates, the thermodynamic package also allows the user to evaluate the effects of temperature changes within a vapor cloud.

Detailed model inputs and outputs for the dispersion model are provided in Appendix A. Meteorological conditions are described by the semi-quantitative Pasquill-Gifford stability classes, ranked A through F. A stability class of A indicates conditions that yield more dispersion through turbulence in the atmosphere. A stability class of F indicates conditions, which are calm and not conducive to dispersion (worst case). GHD modeled each dispersion scenario under neutral meteorological conditions. The modeling inputs used included:

- Wind speed – 5 miles per hour (mph) and 20 mph
- Wind direction – various
- Ambient temperature – 50 degree Fahrenheit
- Relative humidity – 50 percent
- Atmospheric stability – neutral
- Total vent stack discharge rate - 140,000 cubic feet per minute (cfm), which equates to approximately three building air exchanges per hour

GHD utilized the Agency for Toxic Substances Disease Registry (ATSDR) Minimal Risk Levels (MRLs) for isopleth limits during this modeling. The ATSDR MRLs are an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. In this plan, chronic inhalation MRLs are referenced and are intended for exposures lasting more than 365 days.

2.3.1 Modeling Scenarios

GHD estimated air emissions during the industrial waste pit removal activities based on the pre-design investigation results. GHD estimated that trichloroethene and tetrachloroethene will have the highest air emissions during the waste pit interval removal and pit subsoil interval removal, respectively. For this reason, trichloroethene and tetrachloroethene are appropriate for modeling as they provide a sense magnitude of potential emissions in the release scenarios discussed in the subsequent sections of this report.

Modeling Scenario 1 – Trichloroethene at Vent Stack

Modeling Scenario 1 shows the trichloroethene emissions from vent stack assuming a failure of the carbon filtration system during active excavation activities. Emission calculations estimate that trichloroethene will be emitted at a rate of 8.4 pounds per hour during the pit excavation activities. GHD calculated the steady state trichloroethene concentration at the vent stack opening at 2.983 ppm. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL (0.0004 ppm), 0.1 ppm, and 1 ppm. Table 2.1 below provides a summary of the estimated downwind distances to each concentration band.

Table 2.1 Modeling Scenario 1 – Downwind Distances for Trichloroethene Concentrations

Trichloroethene Concentration	Distance (Meters)
0.0004 ppm	6,664 (5 mph) 4,226 (20 mph)
0.1 ppm	105 (5 mph) 135 (20 mph)
1.0 ppm	29 (5 mph) 31 (20 mph)

Modeling Scenario 2 – Tetrachloroethene at Vent Stack

Modeling Scenario 2 shows the tetrachloroethene emissions from vent stack assuming a failure of the carbon filtration system during active excavation activities. Emission calculations estimate that trichloroethene will be emitted at a rate of 18.8 pounds per hour during the pit subsoil excavation activities. GHD calculated the steady state tetrachloroethene concentration at the vent stack opening at 5.29 ppm. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL (0.006 ppm), 0.1 ppm, and 1 ppm. Table 2.1 below provides a summary of the estimated downwind distances to each concentration band.

**Table 2.2 Modeling Scenario 2 –
Downwind Distances for Tetrachloroethene Concentrations**

Tetrachloroethene Concentration	Distance (Meters)
0.01 ppm	2,342 (5 mph) 968 (20 mph)
0.1 ppm	280 (5 mph) 170 (20 mph)
1.0 ppm	59 (5 mph) 52 (20 mph)
Note: The SAFER modeling software rounds the ATSDR MRL (0.006 ppm) up to 0.01 ppm.	

Modeling Scenario 3 – Trichloroethene Reduced By 90 Percent

Modeling Scenario 3 assumes that the carbon filter present in the stack has begun to saturate, and that trichloroethene is being emitted through the stack as 10% of the steady state concentration. This scenario represents a more likely scenario that a complete failure of the carbon scrubbing system. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL for Trichloroethene (0.0004 ppm), 0.1 ppm, and 1 ppm. Table 2.3 below provides a summary of the estimated downwind distances to each concentration band.

**Table 2.3 Modeling Scenario 3 –
Downwind Distance for Trichloroethene**

Tetrachloroethene Concentration	Distance (Meters)
0.0004 ppm	2,084 (5 mph) 818.8 (20 mph)
0.1 ppm	29.3 (5 mph) 30.7 (20 mph)
1.0 ppm	0 (5 mph) 0 (20 mph)

Modeling Scenario 4 – Tetrachloroethene Reduced By 90 Percent

Modeling Scenario 4 assumes that the carbon filter present in the stack has begun to saturate, and that tetrachloroethene is being emitted through the stack as 10% of the steady state concentration. This scenario represents a more likely scenario that a complete failure of the carbon scrubbing system. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL for Tetrachloroethene (0.006 ppm), 0.1 ppm, and 1 ppm. Table 2.4 below provides a summary of the estimated downwind distances to each concentration band.

Table 2.4 Modeling Scenario 4 – Downwind Distance for Tetrachloroethene

Tetrachloroethene Concentration	Distance (Meters)
0.01 ppm	434.6 (5 mph) 200.5 (20 mph)
0.1 ppm	58.5 (5 mph) 51.6 (20 mph)
1.0 ppm	0 (5 mph) 0 (20 mph)
Note: The SAFER modeling software rounds the ATSDR MRL for tetrachloroethene (0.006 ppm) up to 0.01 ppm.	

Modeling Scenario 5 – Remediation Enclosure Collapse – Trichloroethene

Modeling Scenario 5 shows the predicted trichloroethene emissions associated with a collapse of the temporary structure erected over the remediation. The tent collapse assumes a 1 minute puff of unmitigated trichloroethene emissions from the collapsing structure. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL for Trichloroethene (0.0004 ppm), 0.1 ppm, and 1 ppm. Table 2.5 below provides a summary of the estimated downwind distances to each concentration band.

Table 2.5 Modeling Scenario 5 – Downwind Distance for Trichloroethene

Tetrachloroethene Concentration	Distance (Meters)
0.0004 ppm	6,972 (5 mph) 5,521.7 (20 mph)
0.1 ppm	709.0 (5 mph) 647.5 (20 mph)
1.0 ppm	318.2 (5 mph) 290.5 (20 mph)

Modeling Scenario 6 – Remediation Enclosure Collapse – Tetrachloroethene

Modeling Scenario 6 shows the predicted tetrachloroethene emissions associated with a collapse of the temporary structure erected over the remediation. The tent collapse assumes a 1 minute puff of unmitigated tetrachloroethene emissions from the collapsing structure. The SAFER output has been provided for three isopleth limits, which include the ATSDR Chronic MRL for Tetrachloroethene

(0.006 ppm), 0.1 ppm, and 1 ppm. Table 2.6 below provides a summary of the estimated downwind distances to each concentration band.

Table 2.6 Modeling Scenario 6 – Downwind Distance for Tetrachloroethene

Tetrachloroethene Concentration	Distance (Meters)
0.01 ppm	2,815.0 (5 mph) 2529.1 (20 mph)
0.1 ppm	728.7 (5 mph) 806.6 (20 mph)
1.0 ppm	393.2 (5 mph) 351.3 (20 mph)
Note: The SAFER modeling software rounds the ATSDR MRL for tetrachloroethene (0.006 ppm) up to 0.01 ppm.	

2.3.2 Modeling Conclusions

Based on the above concentration bands and distances, monitoring will be required during the work to confirm air quality is acceptable at the Site and at the Site property boundaries. Placing monitors near the discharge and remediation enclosure will allow for rapid identification of fugitive emissions, so that site personnel can perform mitigation measures and correct any problems. Additionally, real-time monitors will be placed at property boundaries and monitored by the MPCA's representative to serve as a general indicator of offsite air quality.

2.4 Baseline Air Monitoring

Baseline air monitoring will be conducted on Site when no other activities are being conducted and within 2 weeks prior to removal action activities to establish background air quality conditions. Samples will be collected on two separate precipitation-free days, with sampling to occur for a minimum of 8 hours. One total suspended particulate (TSP) sample will be collected from the disposal area where work will occur, for analysis each day. A total of two TSP samples will therefore be collected using NIOSH Method 0500. In addition, a Radiello® passive monitor will sample over the two-week sampling period to determine the average concentrations of various VOCs. Data will be recorded from the on-property meteorological station concurrent with the baseline air monitoring.

2.5 Meteorological Monitoring

An on-Site meteorological station will be placed in a representative, unobstructed location approximately 10 feet above ground surface during intrusive activities. The station will provide at a minimum, temperature, barometric pressure, wind direction, and wind speed. These parameters will be monitored and recorded at a minimum every one minute throughout the duration of work activities. This data will be communicated to a PLC and displayed along with other perimeter air monitoring data via the web-based system. Data will be used to determine the downwind property line location.

2.6 Air Monitoring Methods and Equipment

2.6.1 Real-Time Air Monitoring

Each perimeter air monitoring station will include the use of a photoionization detector, electrochemical sensors, and particulate matter monitors capable of reading varying size fractions simultaneously. Real-time perimeter air monitoring will be performed on a continuous basis during intrusive removal activities and during non-intrusive activities conducted during the remedial action work. The equipment will be connected via cellular modem to the internet, through which all data will be available for display in tabular and graphical format. The real-time VOC and particulate matter concentrations at each perimeter air monitoring station will be compared to Site-specific action levels, and will be used to guide appropriate responses to measured concentrations.

The Site-specific VOCs to be monitored were chosen based upon those chemicals that were identified in Summa canister air samples and waste sample analytical results during the pre-design investigation work. The primary compounds expected to contribute most specifically to the VOC readings include naphthalene, tetrachloroethene, trichloroethene, acetone, benzene, toluene, ethylbenzene, xylene (all isomers), styrene, and methyl ethyl ketone.

Data will be recorded from the on-property meteorological station on each work day. The wind direction data will be used to determine the placement of the VOC and dust monitor units. Each of the four monitoring stations will consist of one PID, seven electrochemical sensors, one dust monitor, and a solar powered battery source. Four stations will be positioned immediately outside of the exclusion zone and primary work area as appropriate for Site conditions/operations and in consideration of daily-anticipated wind direction. The four exclusion zone stations will be monitored by the Contractor. Four additional stations will be set up along the property boundary and monitored by MPCA's representative. One station will be permanently set up along the western perimeter fence between the nearest residential houses and the waste pit. The other three monitoring stations will be mobile. One station will be placed directly upwind along the perimeter fence, and two others will be placed downwind. The location for placement of monitoring devices at the perimeter air monitoring stations will be made, at a minimum, twice per workday based upon wind direction as determined from the on-Site weather station. The placement of the downwind units will be spaced to subtend an angle of approximately 45 degrees between the downwind left and downwind right units, using the center of the excavation, or primary working location, as the apex. The monitoring station locations are shown on Figure 2.2.

2.6.2 Air Sampling

Two Radiello® samplers will be collected and analyzed for (by an off-Site laboratory) VOCs each week. The Radiellos will be collected from the western perimeter nearest the waste pit and from directly downwind of the excavation or work area. In the event of an exceedance of the action level for VOCs, Radiello samples will be collected as soon as possible that day and sent to the laboratory for analysis.

Data will be recorded from the on-property meteorological station on each work day. The wind direction data will be used to determine the upwind and downwind sample placement. In the event of an exceedance of the action level for dust, an air sample will be collected at the Site perimeter stations and analyzed for total suspended particulate matter and metals. At a minimum, one set of upwind, downwind and western fence Site perimeter air samples for particulate matter will be sent to the laboratory for analysis each week, during intrusive work activities, and will be analyzed for total suspended particulate matter and metals.

Results of the air sampling analyses will be evaluated from each week in order to determine whether any additional compounds should be added to the perimeter air monitoring program.

2.7 Quality Assurance and Control Measures

Quality control and assurance measures will be used to maintain records of instrument calibration, and ensure proper sample collection and handling procedures. All instrumentation will be calibrated according to manufacturer's recommendations prior to use each day. Records of these calibrations will include equipment manufacturer and model, serial number, factory calibration date, and daily field calibration information.

All air samples will be submitted to the laboratory following standard chain-of-custody procedures. Field blanks will be collected and analyzed for quality control purposes with a frequency of one per week or sample set as described in the Quality and Assurance Project Plan (QAPP).

3. Action Levels

3.1 Exposure Standards and Guidelines

The project team will rely on the standards and guidelines established in the United States and the State of Minnesota for ambient air quality in the community. The air monitoring/sampling results collected during the project will be compared to the applicable community guidelines. These standards and guidelines are referenced here to provide a basis by which air monitoring data may be evaluated, and to aid in the establishment of "indicator values" or levels at which control measures will be recommended, such that exceedances of the standards and guidelines will not be realized.

The Minnesota Department of Health (MDH) publishes health-based rules and guidance to evaluate potential human health risks from exposures to chemicals in ambient air. These published rules and guidelines include Health Risk Values (HRVs), Health-Based Values (HBVs), and Risk Assessment Advice (RAA). An HRV is the concentration of a chemical that is likely to pose little or no risk to human health, and has been promulgated as described in the Administrative Procedures Act (Minnesota Statutes Chapter 14). An HBV is also the concentration of a chemical that is likely to pose little or no risk to human health and was developed using the same methodologies as HRVs. However, HBVs have not been promulgated, and are instead provided as technical guidance by MDH. An RAA is technical guidance concerning exposures and risks to human health. Generally, RAA contains greater uncertainty than HRVs and HBVs because the available information is more limited. RAAs are developed when Minnesota agencies need guidance for chemicals that do not have an HRV or an HBV. Like HBVs, RAAs have not been promulgated into law. RAAs and HBVs serve as screening tools for public health professionals to evaluate potential exposure to hazardous substances.

Under the Clean Air Act (CAA) of 1970, the US Environmental Protection Agency (USEPA) promulgates National Ambient Air Quality Standards (NAAQS) including particulate matter (specifically, particles less than 10 microns in diameter, PM_{10}, and particles less than 2.5 microns in diameter, $PM_{2.5}$). The NAAQS are derived at levels designed to protect public health, including the health of "sensitive" populations such as asthmatics, children and the elderly. The State of Minnesota also promulgates Minnesota Ambient Air Quality Standards (MAAQS). MAAQS are established in the same way as the NAAQS, but contain additional specific averaging times.

No established short-term ambient/community guidelines exist for inhalation of PCBs. The US Occupational Safety and Health Administration (OSHA) promulgates workplace standards to protect the safety and health of workers. OSHA requires the employer to reduce airborne exposures below the established permissible exposure limits (PELs). The OSHA PEL for PCBs is 0.5 mg/m^3. Based on data collected in the pre-design investigation, the maximum PCB concentration in the soil/waste samples collected from the area to be excavated is 238 mg/kg. Assuming this soil concentration, a total dust concentration of 2,100,840 µg/m^3 (averaged over an 8 hour period) is required to reach the OSHA PEL of 0.5 mg/m^3 for airborne PCBs. This total dust concentration is unlikely (and is far above the dust standard of 150 µg/m^3 for PM_{10}), therefore PCB-specific exposure sampling is not required during remediation activities of the Site. The formula for calculating this is:

$$DC = \frac{OEL \times 10^9}{SC} = \frac{0.5\,\frac{\mathrm{mg}}{\mathrm{m}^3}}{238\,\frac{\mathrm{mg}}{\mathrm{kg}}} \times \frac{10^9 \mu\mathrm{g}}{\mathrm{kg}} = 2{,}100{,}840\ \mu g/\mathrm{m}^3$$

$$DC = \text{ Dust concentration in mg/m}^3$$

$$OEL = \text{ Occupational exposure limit in mg/m}^3$$

$$SC = \text{ Soil content of contaminant in mg/kg}$$

The standards and guidelines may not correlate directly with the monitoring data being collected; however, they are listed here to aid in the establishment of indicator values for the COI. For example, the NAAQS are not intended to be compared with direct read instrument data, nor are they intended to be source-specific monitoring criteria. In other words, the NAAQS are intended to apply over a broad area with a number of sources. Despite the lack of a direct correlation, the NAAQS will be used to establish indicator values to guide the control of emissions of COI during the project.

Specifically, air monitoring data for $PM_{2.5}$ and PM_{10}. NO_2 and SO_2 will be compared to the NAAQS. H_2S and VOC monitoring data will be compared to MDH HRV values. The inhalation exposure guideline values for the identified COI are summarized in Table 3.1.

Table 3.1 Exposure Limits and Guidelines

Analyte	Standard	Exposure Guideline	Units
H_2S	MDH HRV for H_2S [1]	10	µg/m³
	MAAQS for H_2S [2]	70	µg/m³
	MAAQS for H_2S [3]	42	µg/m³
Naphthalene	MDH HBV for NA [4]	200	µg/m³
	MDH HBV for NA [5]	9	µg/m³
	OSHA PEL for NA[6]	0.1	ppm
NO_2	MAAQS and NAAQS for NO_2 [7]	188	µg/m³
	MAAQS for NO_2 [8]	100	µg/m³
	MDH HBV for NO_2 [9]	470	µg/m³
Particulate Matter (PM_{10})	MAAQS and NAAQS for PM_{10} [10]	150	µg/m³
Particulate Matter ($PM_{2.5}$)	MAAQS and NAAQS for $PM_{2.5}$ [11]	35	µg/m³
	MAAQS for $PM_{2.5}$ [12]	12	µg/m³
Total Suspended Particulate (TSP)	MAAQS for TSP [13]	60	µg/m³
	MAAQS for TSP [14]	150	µg/m³
SO_2	MAAQS and NAAQS for SO_2 [16]	197	µg/m³
	MAAQS for SO_2 [17]	1,310	µg/m³
	MAAQS for SO_2 [18]	367	µg/m³
	MAAQS for SO_2 [19]	79	µg/m³
Tetrachloroethene	MDH HRV for PCE [20]	20,000	µg/m³
	MDH RAA_{14} for PCE [21]	2	µg/m³
Trichloroethene	MDH HRV for TCE [22]	2,000	µg/m³
	MDH RAA_{13} for TCE [23]	2	µg/m³
Vinyl Chloride	MDH HRV for VC [24]	1	µg/m³
Toluene	MDH HRV for Toluene[25]	37,000	µg/m³
		400	µg/m³
Ethylbenzene	MDH HRV for Ethyl Benzene[26]	10,000	µg/m³
Xylenes	MDH HRV for Xylenes[27]	43,000	µg/m³
Acetone	OSHA PEL for Acetone	1,000	ppm
Methyl Ethyl Ketone (MEK)	MDH HRV for MEK	10,000	µg/m³
	OSHA PEL for NA	200	ppm
Styrene	MDH HRV for Styrene	1,000	ppm
	OSHA PEL for Styrene	100	ppm

Notes:

1. MDH HRV for hydrogen sulfide is averaged over a 13-week period
2. MAAQS for H_2S is averaged over a 30-minute period, and is not to be exceeded more than two times per year
3. MAAQS for H_2S is averaged over a 30-minute period, and is not to be exceeded more than two times in five consecutive days
4. MDH HBV for NA is averaged over a 1-hour period
5. MDH HBV for NA is averaged over a 1-year period
6. OSHA PEL for NA is and 8-hour time weighted average

Table 3.1 Exposure Limits and Guidelines

Analyte	Standard	Exposure Guideline	Units

7. MAAQS and NAAQS for NO_2 is averaged over a 1-hour period, and is not to be exceeded by the 98^{th} percentile detection on average, for a period of 3 years.
8. MAAQS for NO_2 is averaged over a one year period
9. MDH HBV for NO_2 is averaged over a 1-hour period
10. MAAQS and NAAQS for PM_{10} is averaged over a 24-hour period, and is not to be exceeded more than once per year on average, for a period of three years.
11. MAAQS and NAAQS for $PM_{2.5}$ is averaged over a 24-hour period, and is not to be exceeded by the 98^{th} percentile detection on average, for a period of three years
12. MAAQS for $PM_{2.5}$ is averaged over a one-year period, and is not to be exceeded by the 98^{th} percentile detection on average, for a period of three years
13. MAAQS for TSP is calculated as an average geometric mean concentration
14. MAAQS for TSP is averaged over a 24-hour period, and is not to be exceeded more than once per year
15. OSHA PEL for PCBs is an 8-hour time weighted average
16. MAAQS and NAAQS for SO_2 is averaged over a 1-hour period, and is not to be exceeded by the 98^{th} percentile detection on average, for a period of 3 years
17. MAAQS for SO_2 is averaged over a 3-hour period, and is not to be exceeded more than once per year
18. MAAQS for SO_2 is averaged over a 24-hour period, and is not to be exceeded more than once per year
19. MAAQS for SO_2 is averaged over a 1-year period
20. MDH HRV for tetrachloroethene is averaged over a 1-hour period
21. MDH RAA for tetrachloroethene is for an annual average exposure concentration
22. MDH HRV for trichloroethene is averaged over a 1-hour period
23. MDH RAA for trichloroethene is for all durations of time
24. MDH HRV for vinyl chloride is for an annual average exposure concentration
25. MDH HRVs for toluene are for a 1-hour average and annual average concentration respectively
26. MDH HRV for ethylbenzene is averaged over a 1-hour period
27. MDH HRV for xylenes is averaged over a 1-hour period
28. USEPA NAAQS is based upon the 99^{th} percentile 1-hour average over a 3 year period

3.2 Indicator Criteria and Exceedance Criteria

In the event any downwind station records a constituent above its respective indicator value for a 1-hour period, an evaluation will be performed to locate the potential source, and if necessary, to implement additional engineering controls. The intent of the indicator values are to provide an early warning to prevent exceedances of federal standards or the action levels established by the Minnesota Department of Health. A concentration of the daily downwind average for any parameter that is higher than its respective indicator level will also warrant an evaluation of the Site activities and may necessitate changing work conditions to prevent an actual exceedance.

The indicator values are calculated by applying a safety factor of 10 times less than the exceedance criteria (as established by MDH, NAAQS, or OSHA), by selecting MDH's guidance levels (HBV and RAA), or by using the instrument's lowest detectable concentration, as appropriate. An exceedance of the indicator value for one hour will trigger an evaluation to locate the potential source, and if necessary, implement additional engineering controls. An exceedance of the indicator values for four consecutive hours or an exceedance of the exceedance criteria for two consecutive hours will trigger stop-work action levels. Stop-work action levels are established by MDH, NAAQS, and OSHA.

Table 3.2 Indicator Values and Exceedance Criteria

Analyte	Indicator Criteria [1]	Exceedance Criteria [2]
H_2S		10 µg/m^3, 13-week average concentration

Table 3.2 Indicator Values and Exceedance Criteria

Analyte	Indicator Criteria [1]	Exceedance Criteria [2]
	1 ppm, instantaneous value*	*note that a 1-hour average concentration of 15 ppm, followed by zero exposure, leads to exceedance.
Naphthalene	1 ppm, instantaneous value	200 µg/m^3, 1-hour average concentration *note that a 1-minute average concentration of 2 ppm, followed by zero exposure, leads to exceedance.
NO_2	1 ppm, instantaneous value	470 µg/m^3, 1-hour average concentration *note that a 1-minute average concentration of 15 ppm, followed by zero exposure, leads to exceedance
Particulate Matter (PM_{10})	150 µg/m^3, instantaneous value	150 µg/m^3, annual average concentration *dusty activities should be addressed promptly if indicator criteria is exceeded
Particulate Matter ($PM_{2.5}$)	12 µg/m^3, one-hour average value	12 µg/m^3, annual average concentration *dusty activities should be addressed promptly if indicator criteria is exceeded
SO_2	1 ppm, instantaneous value	1.0 ppm, 1-minute average *note that a 1 minute average of 5 ppm constitute an exceedance of the National Ambient Air Quality Standard (NAAQS) for SO_2 (1-hour Primary Standard)
VOCs	1 ppm instantaneous value	NA
Tetrachloroethene	0.2 ppm, instantaneous value	20,000 µg/m^3, one-hour average *note that a 1-minute average concentration of 175 ppm, followed by zero exposure, leads to exceedance
Trichloroethene	0.04 ppm, instantaneous value	2,000 µg/m^3, one-hour average *note that a 1-minute average concentration of 22 ppm, followed by zero exposure, leads to exceedance
Vinyl Chloride	1 ppm, instantaneous value	1 µg/m^3, one-hour average *note that a 1-minute average concentration of 200 ppm, followed by zero exposure, leads to exceedance
Toluene	1 ppm, instantaneous value	37,000 µg/m^3, 1-hour average *note that a 1-minute average concentration of 600 ppm, followed by zero exposure, leads to exceedance
Ethyl Benzene	1 ppm, instantaneous value	10,000 µg/m^3, 1-hour average *note that a 1-minute average concentration of 140 ppm, followed by zero exposure, leads to exceedance
Xylenes	1 ppm, instantaneous value	43,000 µg/m^3, 1-hour average *note that a 1-minute average concentration of 600 ppm, followed by zero exposure, leads to exceedance

Notes:
1. Indicator Value levels indicate the level at which corrective action will be taken to mitigate COI emissions
2. Exceedance Criteria levels indicate the level which shall not be exceeded during the project

Based on these Indicator Criteria, a detection on the PID of 1 ppm or greater will constitute a need to perform chemical-specific monitoring. This chemical specific monitoring will be conducted using colorimetric detector tubes specific to the COI above. Detector tubes for vinyl chloride, tetrachloroethene, trichloroethene, naphthalene, toluene, ethylbenzene, and xylene will be available to verify chemical-specific presence of these COI upon generic detection by PID. Chemical specific electrochemical sensors for SO_2, NO_2, and H_2S will be used to direct appropriate responses for those chemicals.

3.3 Source and Engineering Controls

In the event of an exceedance of the indicator values, an evaluation will be performed to ascertain the source. PID values collected at the edge of the excavation and outside the fabric building will be evaluated in an attempt to determine the source.

In the event that a source is identified, engineering controls will be implemented. VOC/odor control measures may include the use of non-toxic, bio-degradable odor counteractants (i.e., Ecosorb), and temporary liner covers. In addition, an encapsulating material such as a spray-applied, biodegradable slurry (i.e., Concover) or foam suppressant may be used to limit the emissions of VOCs and/or odors emanating from open excavations. If necessary, dust suppressants will be applied to areas to reduce dust generation). Other engineering controls may include covering of temporary stockpiles or storage areas, immediate overpacking of drums, bulking of drums, use of high volume fans, modification of work practices, cessation of specific activities, or possible shutdown of all Site activities. The type of control used will be specifically dependent upon several parameters, including the location of the source or sources, the type and concentration of the contaminant, the frequency with which the elevated concentrations occur, and the past effectiveness of various control measures with respect to the specific event. Any one control measure, or combination of controls, may be used to fully mitigate potential future exceedances of the defined action levels.

3.4 Notification Procedures

Air monitoring results will be discussed during weekly Site progress meetings, including elevated readings above the indicator values that occurred during the previous week and the engineering controls taken, if applicable. Text message alerts will be provided to project personnel capable of altering Site activities to reduce emissions, if necessary. These text alerts will be automatically sent to Site personnel for analytes which exceed their Indicator Criteria, as summarized above.

In the event of an exceedance of the indicator values for a 1-hour period, the GHD and MPCA project managers will be notified. In accordance with the Contingency and Emergency Response Plan, further notifications will be made within two hours if the exceedance is ten times the indicator value. In the event stop work action levels consisting of MDH HRVs, NAAQS, or OSHA PELs are exceeded, notification will be made to appropriate agencies within 24 hours. These agencies will include the MPCA PM, the MDH, and the Andover Fire Department (notification to additional agencies may be performed as needed). Notification will include an assessment of the overall situation, including description of the chemical exceedance and concentration, duration of exceedance, location of source(s) (if known), corrective action measures taken and those proposed, and any additional relevant information.

4. Reporting

4.1 Real-Time Screening Results

Results from the meteorological station, perimeter VOC/electrochemical monitoring units, and dust monitors will be communicated via cellular modem to a central web-based database at a minimum every one minute and available via the web-based system for remote viewing by GHD, MPCA, MDH, contractor management representative, incident commander, and others as appropriate. Perimeter VOC/electrochemical sensor monitor and dust monitor data will be recorded and evaluated each day, with the upwind concentration for each constituent used to evaluate whether off-Site sources may be impacting the Site or contributing to elevated values at the downwind perimeter. In the event that upwind concentrations are determined to have an effect on the Site, the difference between upwind and downwind concentrations will be used to evaluate the Site. The downwind data will be averaged and compared to indicator values.

The reported concentration measurements from air quality monitoring units will be performed on a one-hour average recalculated every 60 minutes (rolling average).

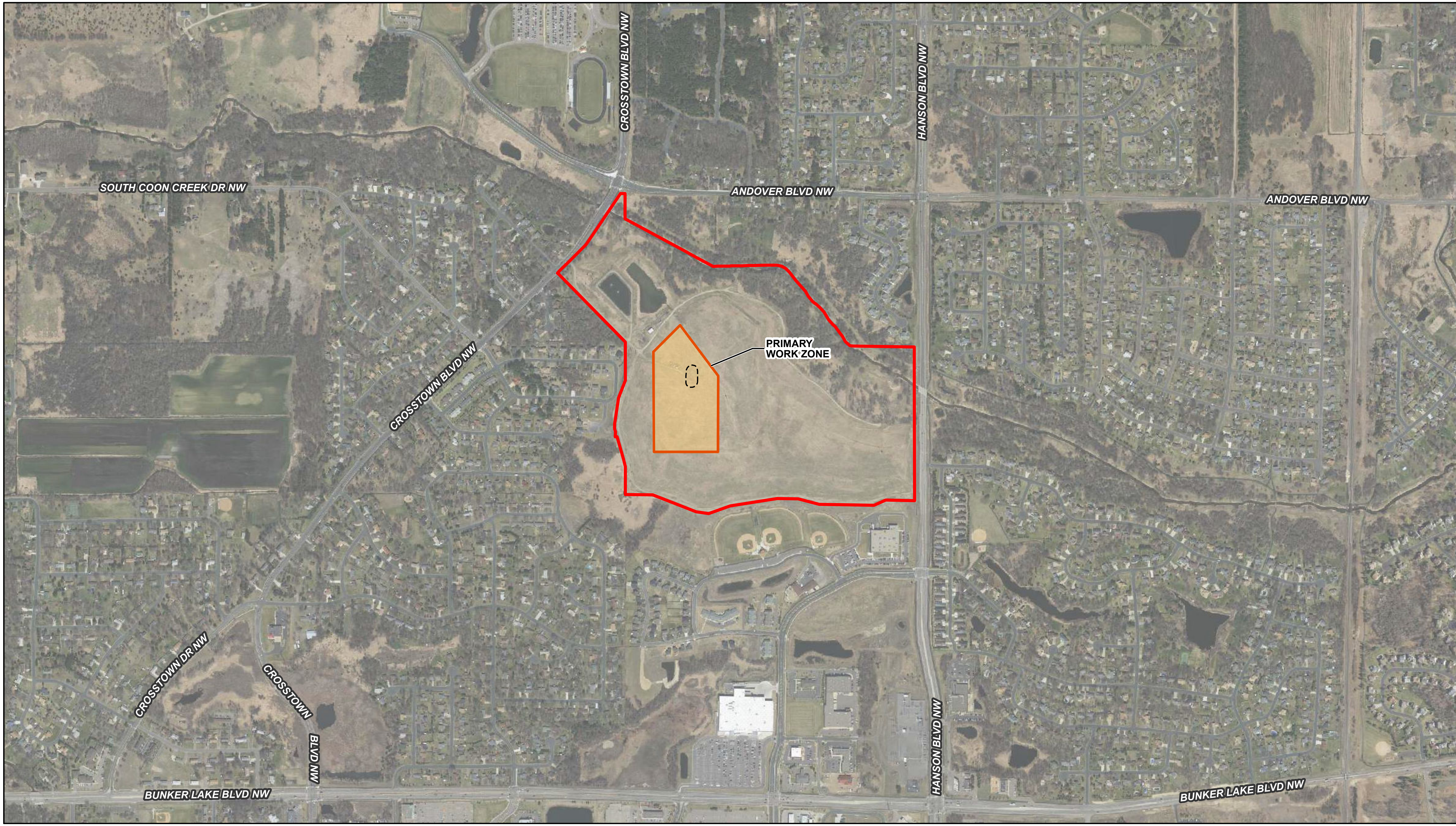
5. Quality Assurance/Quality Control (QA/QC)

The implementation of this air monitoring plan will be under the direction of a project team certified industrial hygienist (CIH) and a Professional Engineer (PE). The plan will be managed by personnel with experience in soil remediation/construction projects and the air sampling/monitoring described previously. The project team anticipates that the baseline survey will be performed by a CIH/PE and another Industrial Hygienist (IH) Technician.

A CIH/PE will also be on-site during the first start of excavation to ensure the PAMP is being implemented appropriately and to make any necessary modifications to the PAMP. This time on-site will also be used to train local personnel to continue implementation of the PAMP for the duration of the project

All manually-collected direct read data and integrated sampling information will be reviewed to ensure accuracy and completeness. The manually-collected monitoring/sampling data will be uploaded into an electronic database and will undergo a daily QA/QC review. All data entry forms and field notes will be retained for reference upon completion of the project. Any errors identified during the QA/QC process in field notes or data will be noted appropriately, while retaining original information to ensure a proper historical record. If necessary, full laboratory analysis data packages will be provided and associated data validation processes will be arranged. All instruments will be calibrated and operated in accordance with the manufacturer's specifications or applicable test/method specifications.

During the project, interim reporting of results will be initially conducted on a weekly basis and may be reduced to a monthly basis as the project progresses, if appropriate. This may include data summaries, maps, or other presentations of preliminary monitoring and sampling results. Such reporting will be considered preliminary, as a final QA/QC of the data will not be complete. At the completion of the project, a report will be prepared in which all data collected through direct read monitoring and integrated sampling analyses will be compiled, summarized, and reported to the project team. All data contained in the final report will have been through the QA/QC process, will be reviewed by a GHD CIH and PE, and will be considered final.



Source: Twin Cities Metropolitan Council, Spring 2016 Aerial Photography

0 400 800 ft

N

LEGEND

PRIMARY WORK ZONE

SITE PROPERTY BOUNDARY

GHD

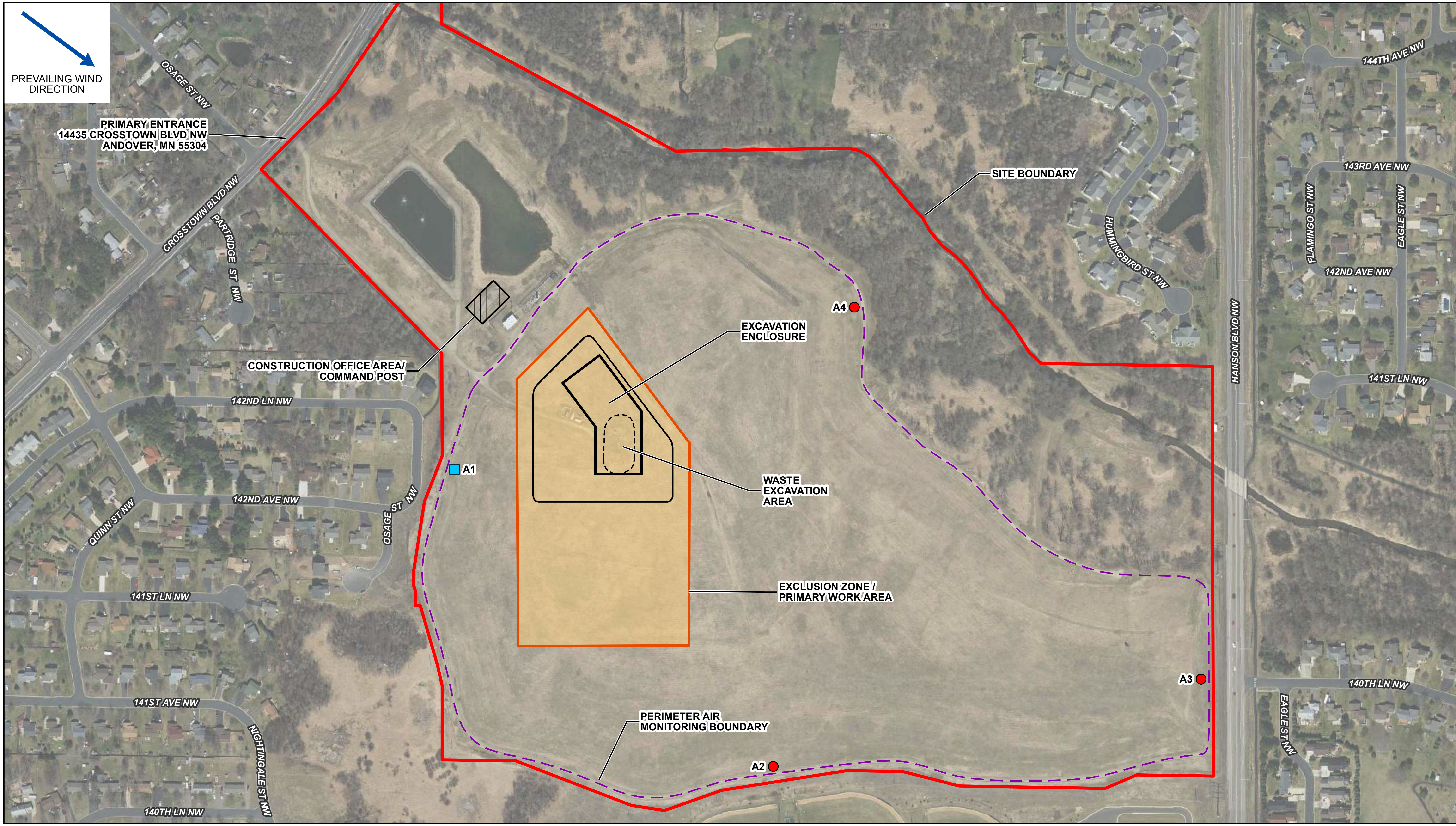
WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

SITE AREA

11129194-31
Mar 26, 2018

FIGURE 2.1

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-REPORTS\11129194-31(008)\11129194-31(008)GIS-SP001.mxd



Source: Twin Cities Metropolitan Council, Spring 2016 Aerial Photography

0 100 200 300 ft

N

LEGEND
- FIXED POSITION AIR MONITORING STATION
- MOBILE AIR MONITORING STATION
- CONSTRUCTION OFFICE AND COMMAND POST

WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
ANDOVER, MINNESOTA
INDUSTRIAL WASTE PIT

11129194-31
Mar 26, 2018

AIR QUALITY MONITORING STATION PLAN

FIGURE 2.2

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-REPORTS\11129194-31(008)\11129194-31(008)GIS-SP002.mxd

Appendix A
Air Dispersion Model Inputs and Outputs

Chemical Release Report

Release time	3/20/2018 11:43:00 AM

Release Scenario

General

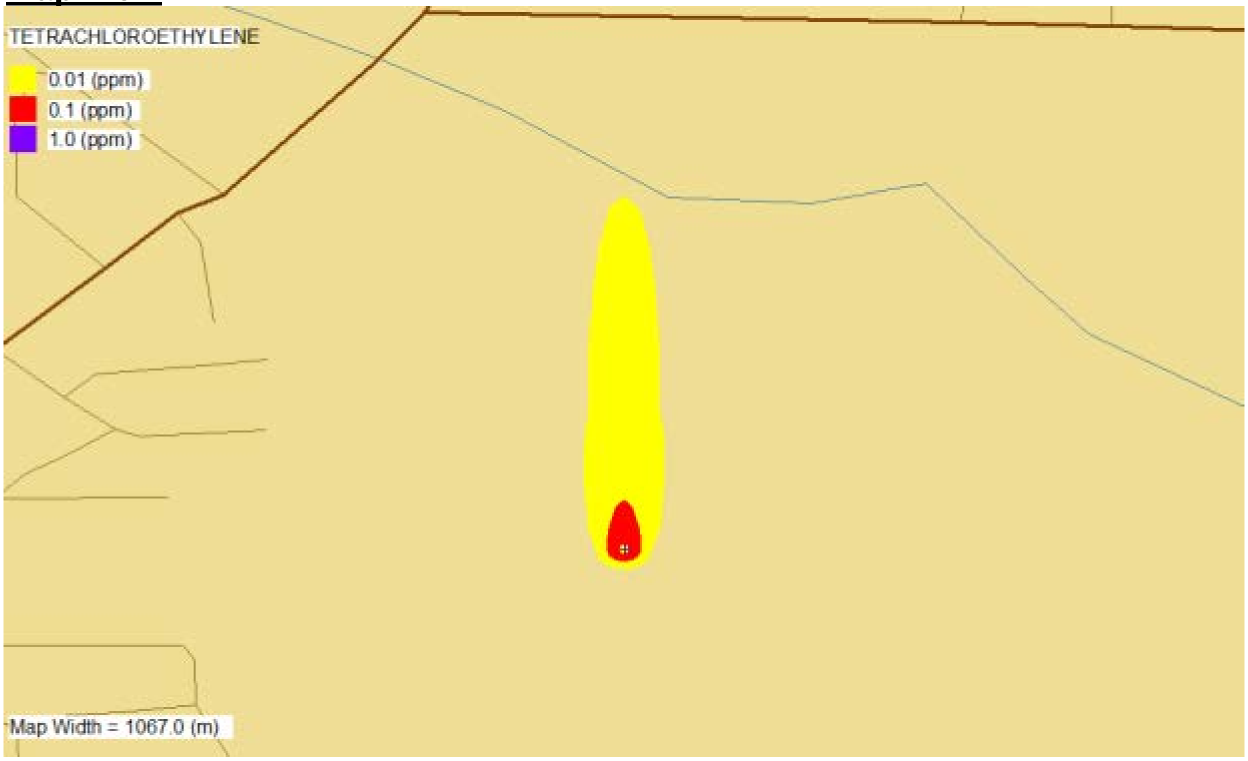
Chemical	TETRACHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.0001 (%)

Release site on map	-93.31443, 45.227663

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation	No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.01	> 434.6
0.1	> 58.5
1.0	0.0

Chemical Release Report

Release time 3/20/2018 11:43:00 AM

Release Scenario

General

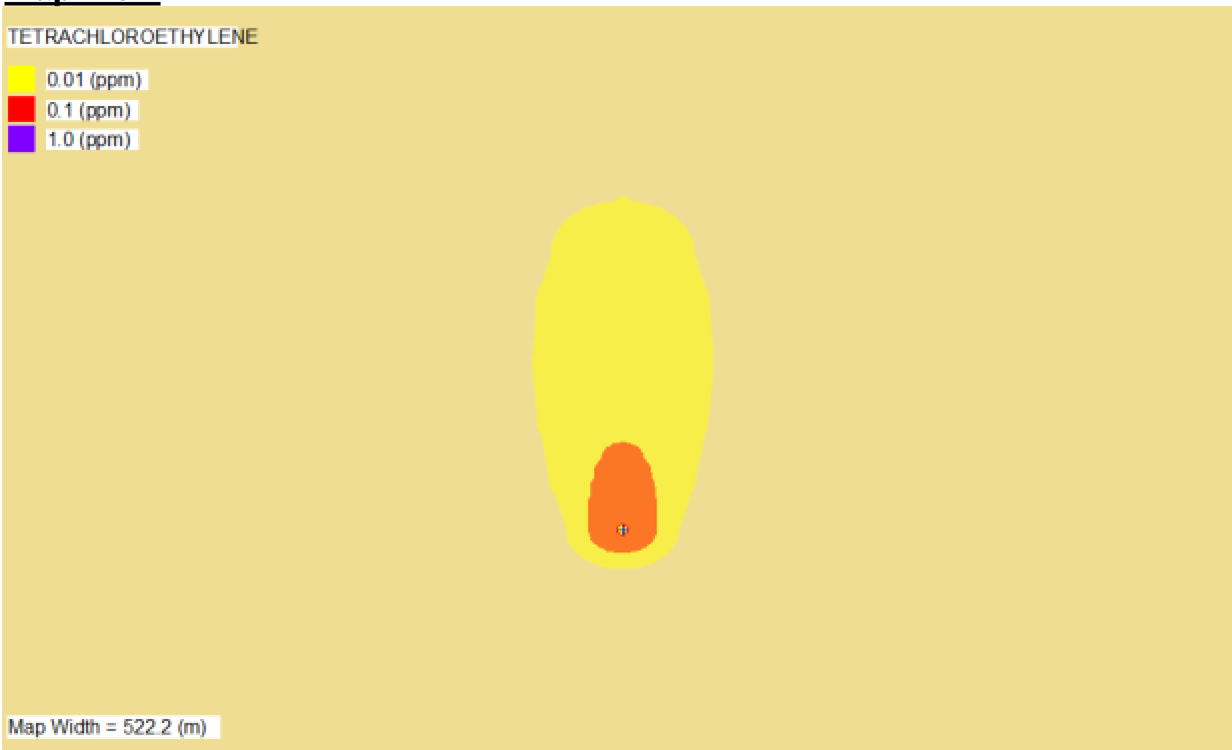
Chemical TETRACHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.0001 (%)

Release site on map -93.31443, 45.227663

Map View



Meteorology - Manual Met

Surface roughness 0.5 (m)
Ceiling height 10000.0 (m)
Upper stability class 4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.01	> 200.5
0.1	> 51.6
1.0	0.0

Chemical Release Report

Release time	3/20/2018 3:19:00 PM

Release Scenario

General

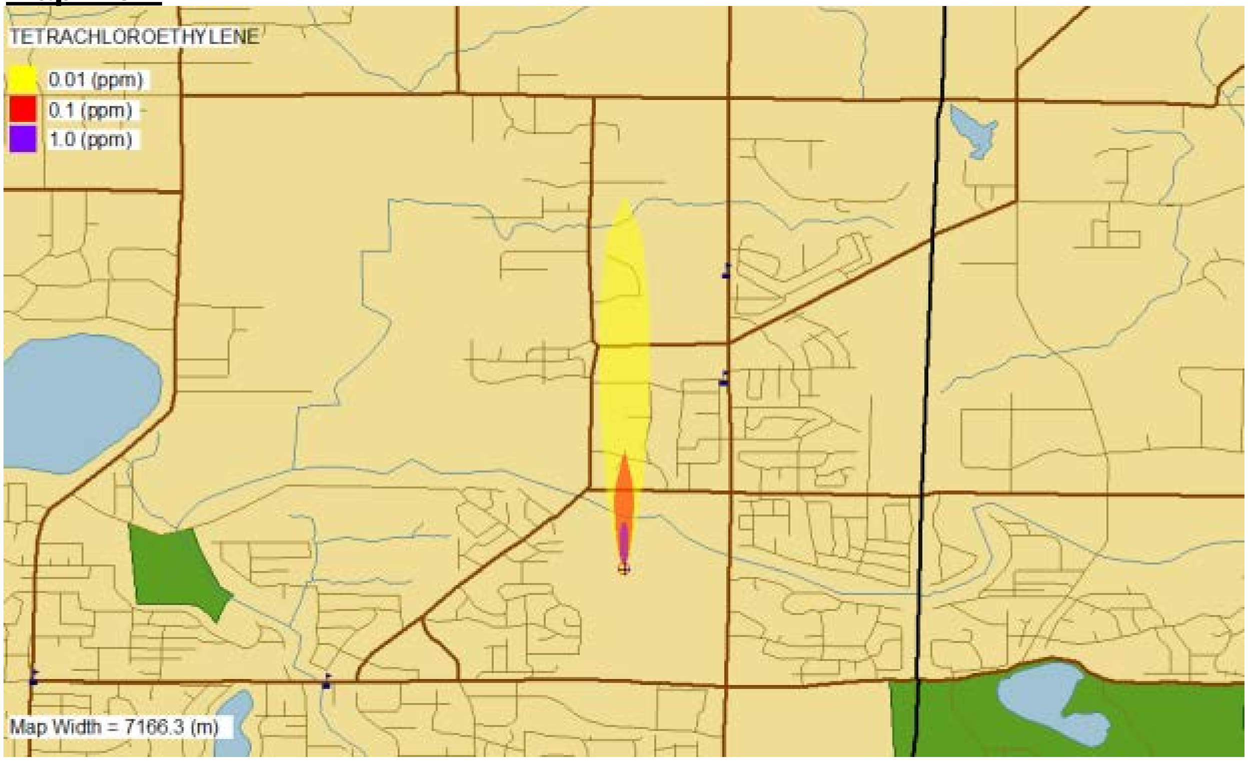
Chemical	TETRACHLOROETHYLENE

Steady state

The release stream contains	Gas
The release type is	Continuous
Release temperature	50.0 (deg F)
Release height	0.0 (ft)
Total release rate (mass)	0.3 (lb/min)
Release duration	1.0 (min)
Percent chemical (dilution)	100.0 (%)

Release site on map	-93.31382, 45.227663

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval (min)	Ambient Temperature (deg F)	Horizontal Stability	Vertical Stability	Solar Radiation (W/m^2)	Humidity (%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation	No

Downwind Distance Report

Isopleth Limits	**Downwind distance**
(ppm)	**(m)**
0.01	2815.0
0.1	728.7
1.0	393.2

Chemical Release Report

Release time	3/20/2018 3:19:00 PM

Release Scenario

General

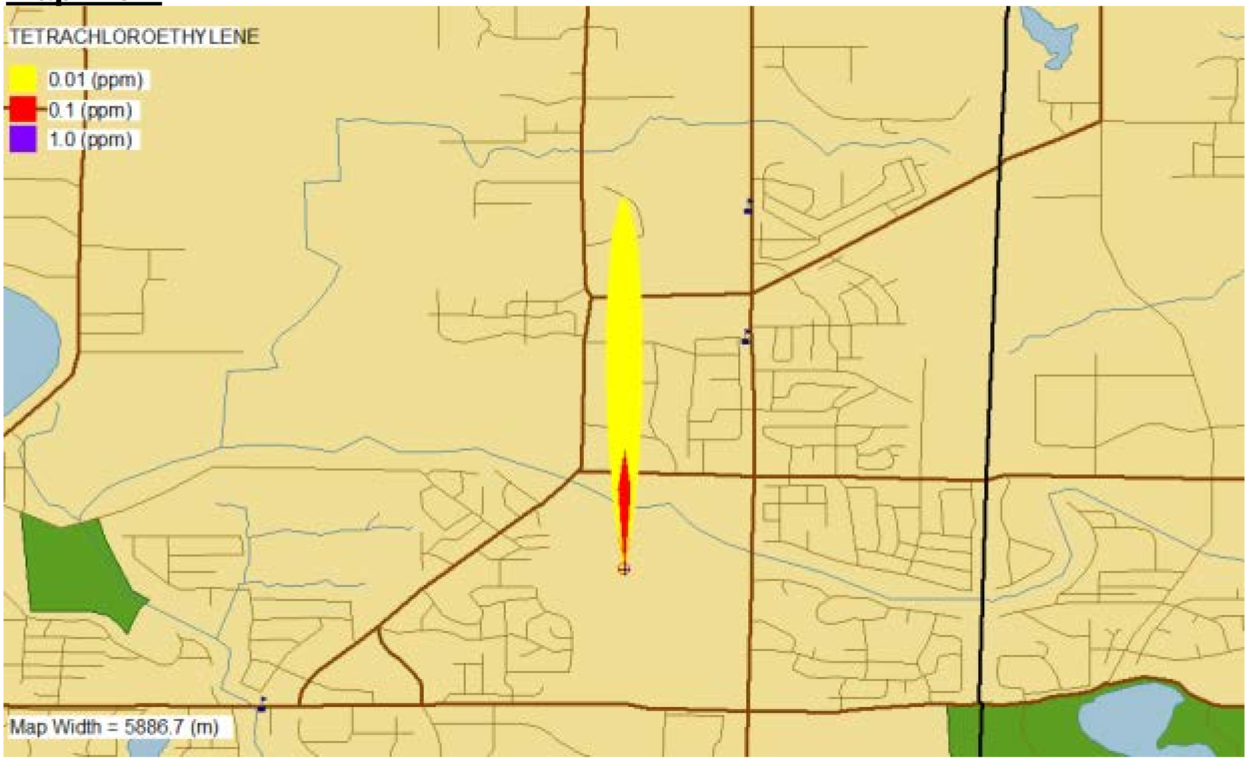
Chemical	TETRACHLOROETHYLENE

Steady state

The release stream contains	Gas
The release type is	Continuous
Release temperature	50.0 (deg F)
Release height	0.0 (ft)
Total release rate (mass)	0.3 (lb/min)
Release duration	1.0 (min)
Percent chemical (dilution)	100.0 (%)

Release site on map	-93.31382, 45.227663

<u>**Map View**</u>



<u>**Meteorology - Manual Met**</u>

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation	No

Downwind Distance Report

Isopleth Limits (ppm)	**Downwind distance (m)**
0.01	2529.1
0.1	806.6
1.0	351.3

Chemical Release Report

Release time 3/9/2018 3:26:00 PM

Release Scenario

General

Chemical TETRACHLOROETHYLENE

Stack / Jet

Total release rate (volume) 140000.0 (ft^3/min)
Release duration 120.0 (min)
Release temperature 50.0 (deg F)
Release height 7.0 (ft)
Source diameter 74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical) 90.0 (deg)
Percent chemical (dilution) 0.001 (%)

Release site on map -93.312989, 45.227014

Meteorology - Manual Met

Surface roughness 0.5 (m)
Ceiling height 10000.0 (m)
Upper stability class 4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits	Downwind distance
(ppm)	(m)
0.01	> 2342.3
0.1	> 280.5
1.0	> 58.8

Chemical Release Report

Release time 3/9/2018 3:26:00 PM

Release Scenario

General

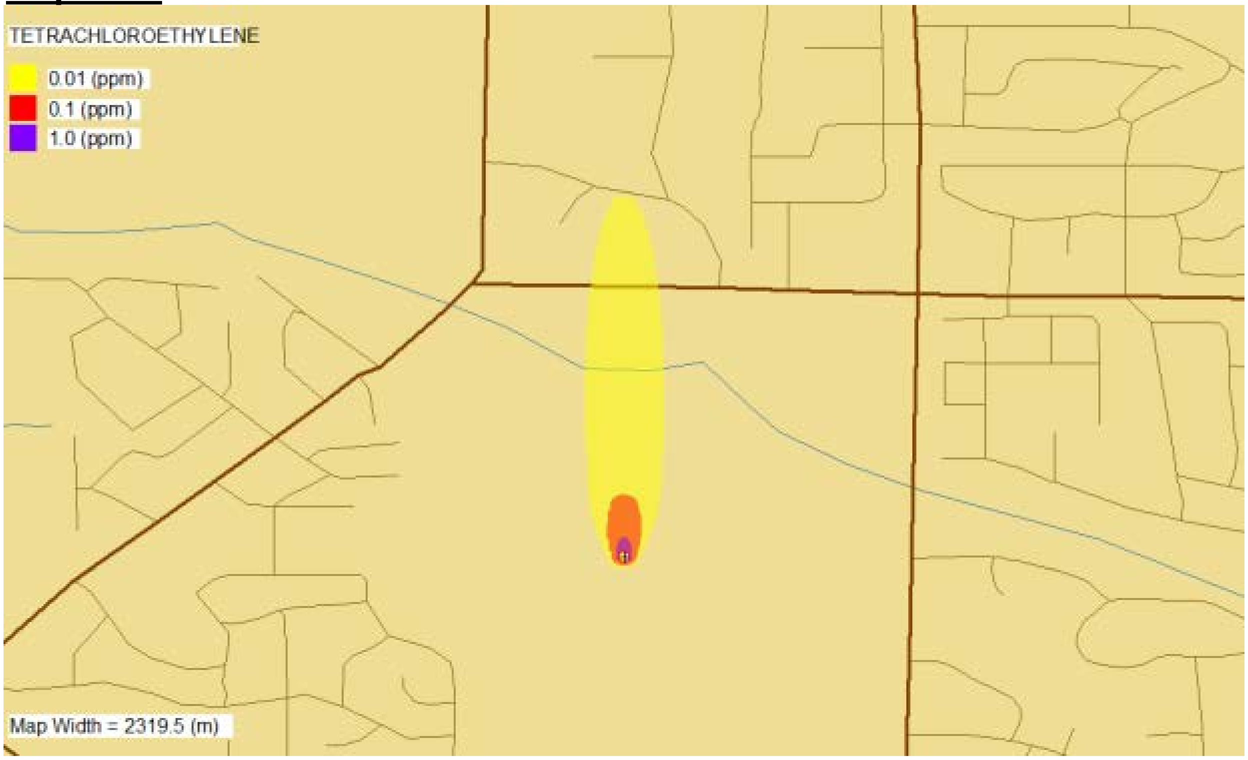
Chemical TETRACHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.001 (%)

Release site on map -93.312989, 45.227014

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval (min)	Ambient Temperature (deg F)	Horizontal Stability	Vertical Stability	Solar Radiation (W/m^2)	Humidity (%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.01	> 967.6
0.1	> 169.5
1.0	> 52.1

Chemical Release Report

Release time 3/19/2018 3:55:00 PM

Release Scenario

General

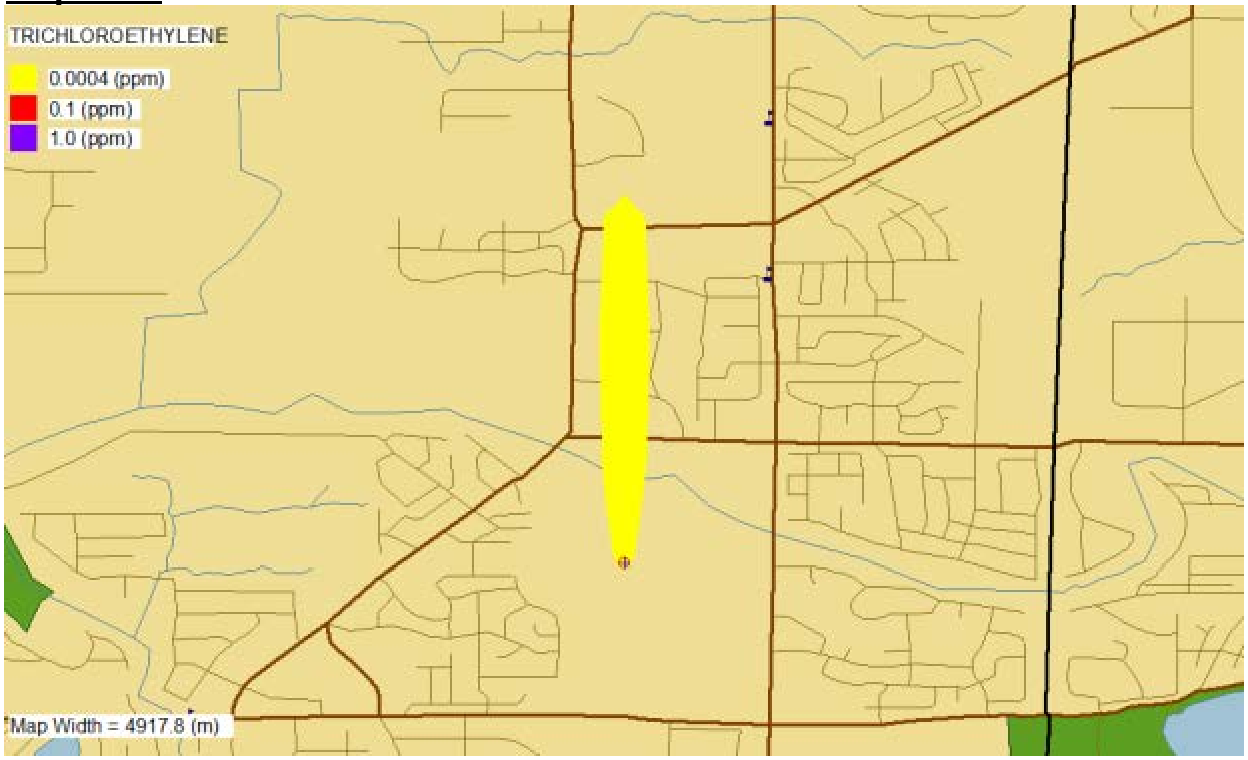
Chemical TRICHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.00003 (%)

Release site on map -93.313667, 45.227206

Map View



Meteorology - Manual Met

Surface roughness 0.5 (m)
Ceiling height 10000.0 (m)
Upper stability class 4.0

Interval (min)	Ambient Temperature (deg F)	Horizontal Stability	Vertical Stability	Solar Radiation (W/m^2)	Humidity (%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.0004	> 2084.6
0.1	> 29.3
1.0	0.0

Chemical Release Report

Release time 3/19/2018 3:55:00 PM

Release Scenario

General

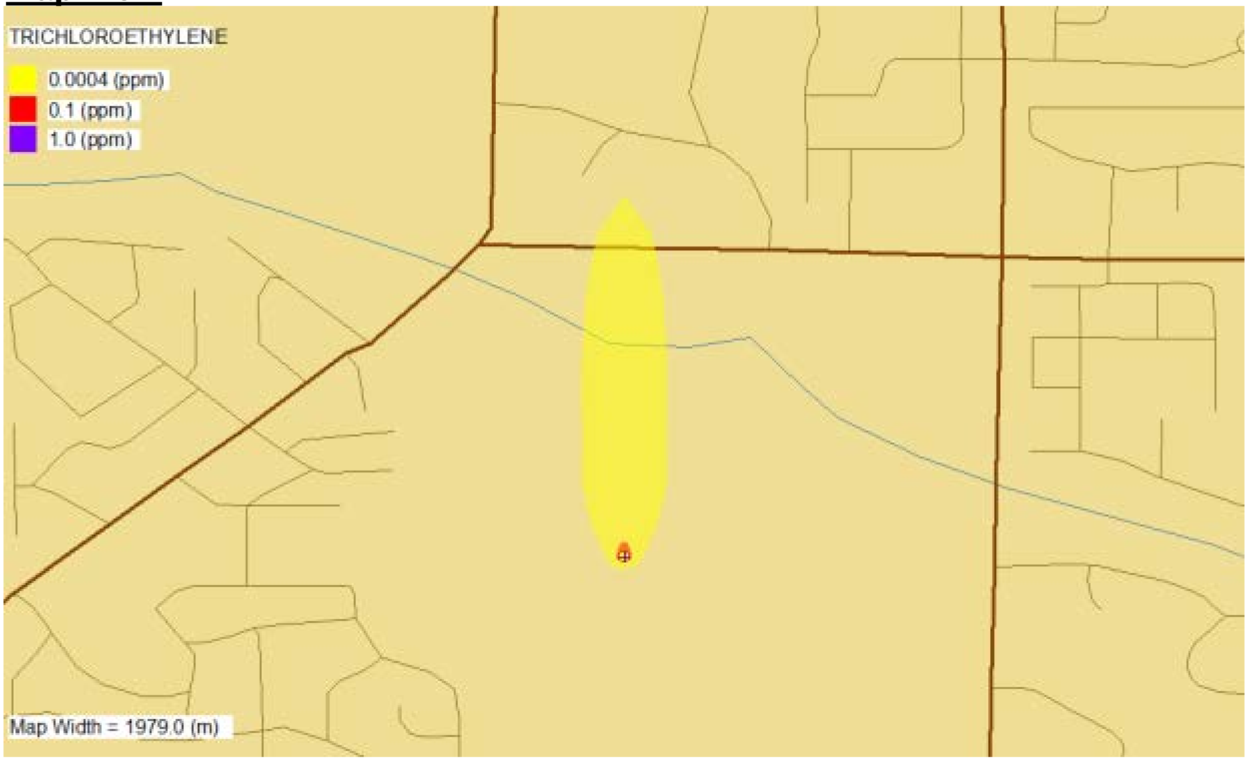
Chemical TRICHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.00003 (%)

Release site on map -93.313667, 45.227206

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits (ppm)	**Downwind distance (m)**
0.0004	> 818.8
0.1	> 30.7
1.0	0.0

Chemical Release Report

Release time	3/20/2018 2:57:00 PM

Release Scenario

General

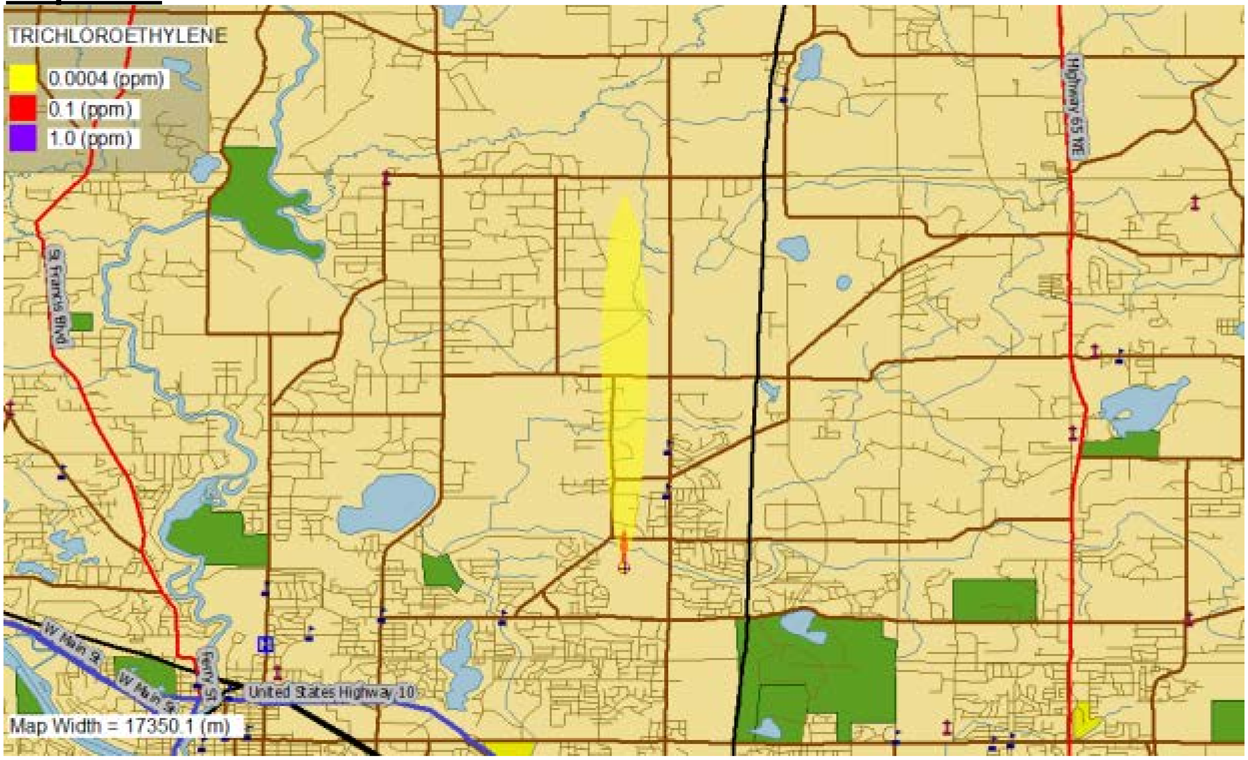
Chemical	TRICHLOROETHYLENE

Steady state

The release stream contains	Gas
The release type is	Continuous
Release temperature	50.0 (deg F)
Release height	0.0 (ft)
Total release rate (mass)	0.1 (lb/min)
Release duration	1.0 (min)
Percent chemical (dilution)	100.0 (%)

Release site on map	-93.314125, 45.228121

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation	No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.0004	6972.3
0.1	709.0
1.0	318.2

Chemical Release Report

Release time 3/20/2018 2:57:00 PM

Release Scenario

General

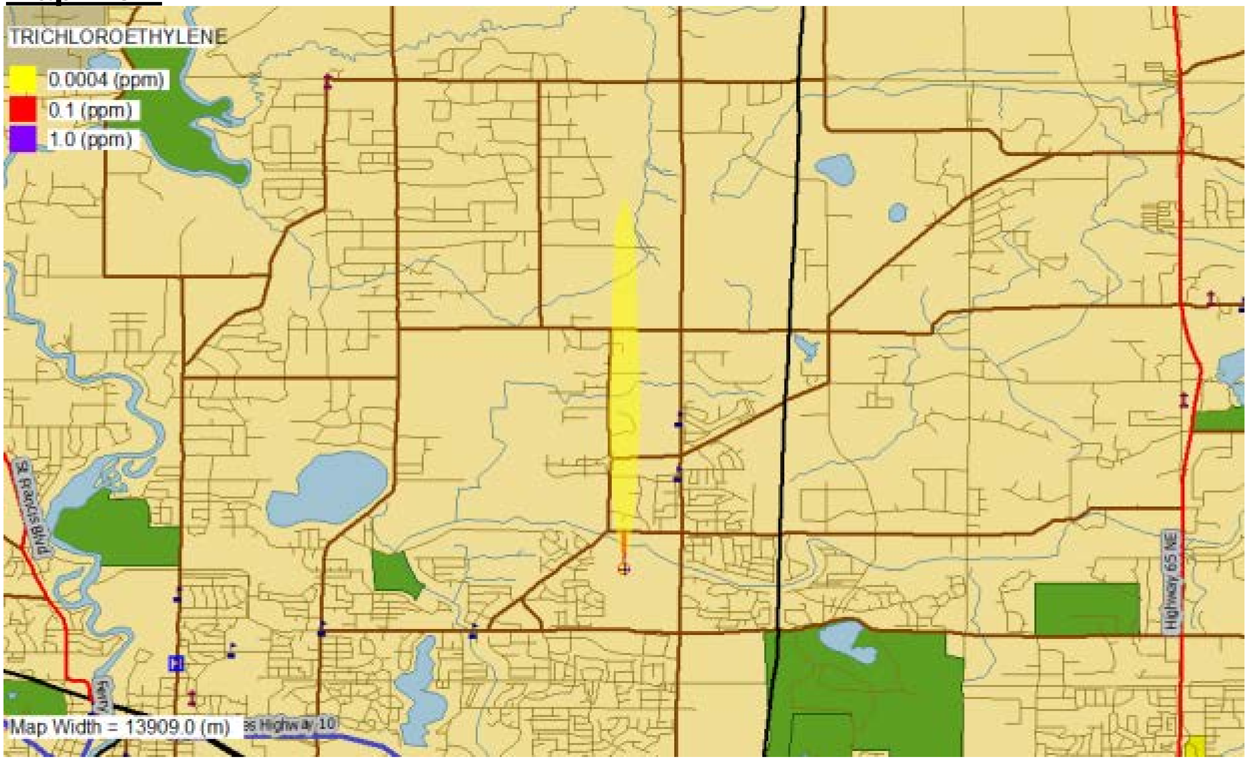
Chemical TRICHLOROETHYLENE

Steady state

The release stream contains	Gas
The release type is	Continuous
Release temperature	50.0 (deg F)
Release height	0.0 (ft)
Total release rate (mass)	0.1 (lb/min)
Release duration	1.0 (min)
Percent chemical (dilution)	100.0 (%)

Release site on map -93.314125, 45.228121

Map View



Meteorology - Manual Met

Surface roughness 0.5 (m)
Ceiling height 10000.0 (m)
Upper stability class 4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation	No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.0004	5521.7
0.1	647.5
1.0	290.5

Chemical Release Report

Release time 3/9/2018 3:14:00 PM

Release Scenario

General

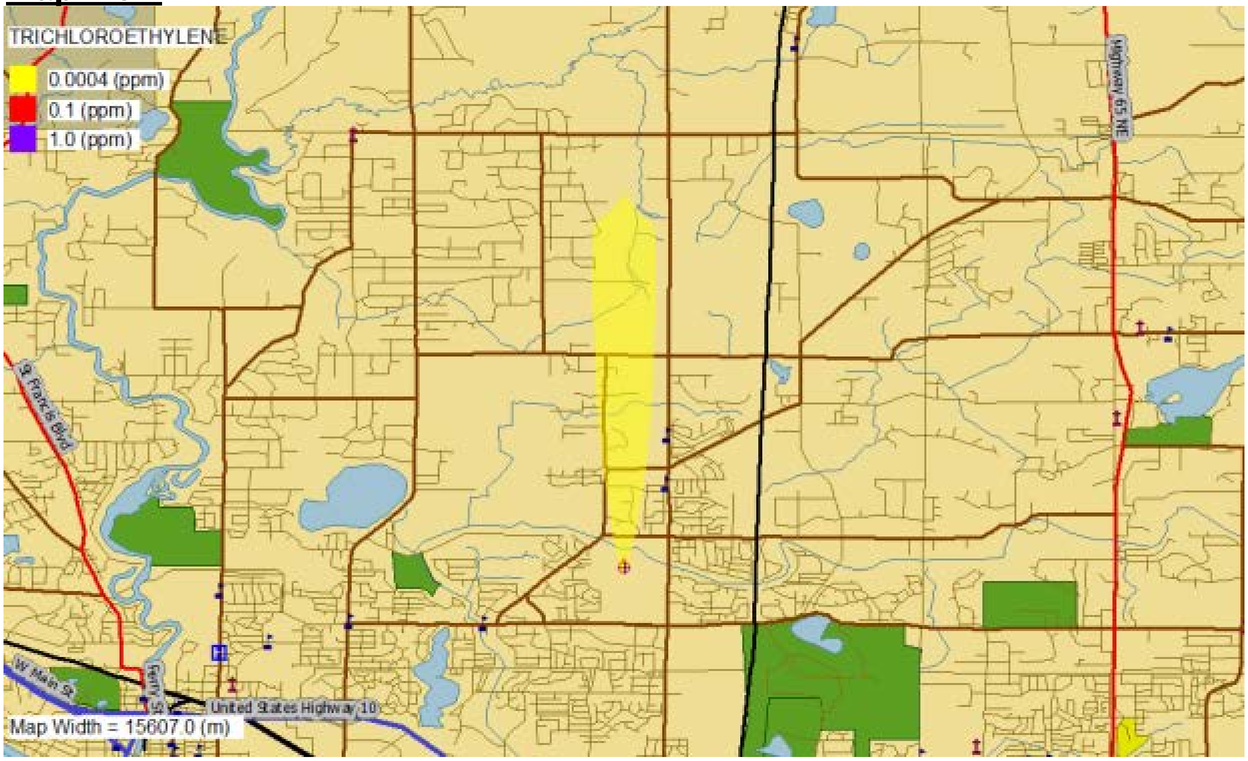
Chemical TRICHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.0003 (%)

Release site on map -93.313112, 45.228369

Map View



Meteorology - Manual Met

Surface roughness	0.5 (m)
Ceiling height	10000.0 (m)
Upper stability class	4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	5.0	South
10.0	5.0	South
15.0	5.0	South
20.0	5.0	South
25.0	5.0	South
30.0	5.0	South
35.0	5.0	South
40.0	5.0	South
45.0	5.0	South
50.0	5.0	South
55.0	5.0	South
60.0	5.0	South
65.0	5.0	South
70.0	5.0	South
75.0	5.0	South
80.0	5.0	South
85.0	5.0	South
90.0	5.0	South
95.0	5.0	South
100.0	5.0	South
105.0	5.0	South
110.0	5.0	South
115.0	5.0	South
120.0	5.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits	**Downwind distance**
(ppm)	**(m)**
0.0004	> 6664.0
0.1	> 164.7
1.0	> 29.4

Chemical Release Report

Release time 3/9/2018 3:14:00 PM

Release Scenario

General

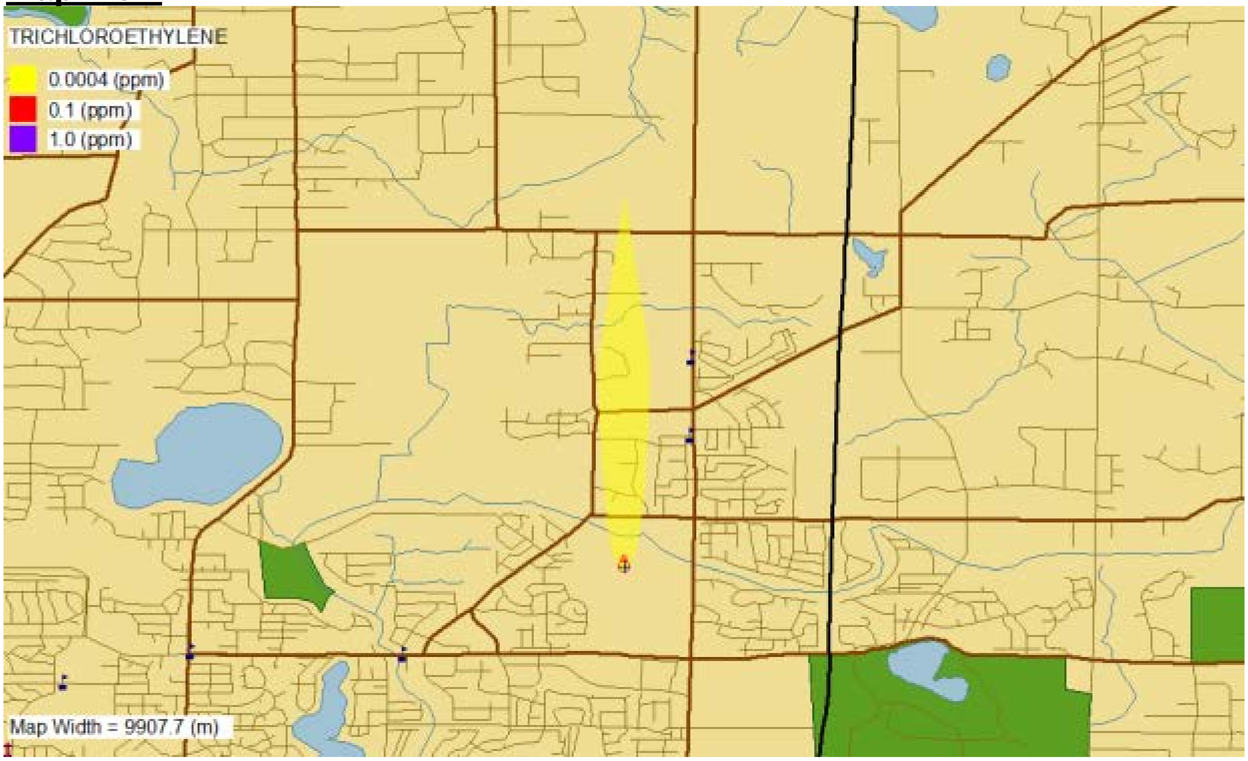
Chemical TRICHLOROETHYLENE

Stack / Jet

Total release rate (volume)	140000.0 (ft^3/min)
Release duration	120.0 (min)
Release temperature	50.0 (deg F)
Release height	7.0 (ft)
Source diameter	74.2 (in)
Angle (0=Horizontal, 90 deg =Vertical)	90.0 (deg)
Percent chemical (dilution)	0.0003 (%)

Release site on map -93.313112, 45.228369

Map View



Meteorology - Manual Met

Surface roughness 0.5 (m)
Ceiling height 10000.0 (m)
Upper stability class 4.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
5.0	50.0	4.0	4.0	400	50.0
10.0	50.0	4.0	4.0	400	50.0
15.0	50.0	4.0	4.0	400	50.0
20.0	50.0	4.0	4.0	400	50.0
25.0	50.0	4.0	4.0	400	50.0
30.0	50.0	4.0	4.0	400	50.0
35.0	50.0	4.0	4.0	400	50.0
40.0	50.0	4.0	4.0	400	50.0
45.0	50.0	4.0	4.0	400	50.0
50.0	50.0	4.0	4.0	400	50.0
55.0	50.0	4.0	4.0	400	50.0
60.0	50.0	4.0	4.0	400	50.0
65.0	50.0	4.0	4.0	400	50.0
70.0	50.0	4.0	4.0	400	50.0
75.0	50.0	4.0	4.0	400	50.0

Interval	Ambient Temperature	Horizontal Stability	Vertical Stability	Solar Radiation	Humidity
(min)	(deg F)			(W/m^2)	(%)
80.0	50.0	4.0	4.0	400	50.0
85.0	50.0	4.0	4.0	400	50.0
90.0	50.0	4.0	4.0	400	50.0
95.0	50.0	4.0	4.0	400	50.0
100.0	50.0	4.0	4.0	400	50.0
105.0	50.0	4.0	4.0	400	50.0
110.0	50.0	4.0	4.0	400	50.0
115.0	50.0	4.0	4.0	400	50.0
120.0	50.0	4.0	4.0	400	50.0

INTERNET WEATHER

Reference Height 30.0 (ft)

Interval	Wind Speed	Wind Direction
(min)	(mph)	(deg [from])
5.0	20.0	South
10.0	20.0	South
15.0	20.0	South
20.0	20.0	South
25.0	20.0	South
30.0	20.0	South
35.0	20.0	South
40.0	20.0	South
45.0	20.0	South
50.0	20.0	South
55.0	20.0	South
60.0	20.0	South
65.0	20.0	South
70.0	20.0	South
75.0	20.0	South
80.0	20.0	South
85.0	20.0	South
90.0	20.0	South
95.0	20.0	South
100.0	20.0	South
105.0	20.0	South
110.0	20.0	South
115.0	20.0	South
120.0	20.0	South

Summary of source characteristics

Occurrence of flash No

Pool formation No

Downwind Distance Report

Isopleth Limits (ppm)	Downwind distance (m)
0.0004	> 4225.5
0.1	> 135.1
1.0	> 30.8

Appendix J
Example Exclusion Zone Air Monitoring Plan Outline

Final

Exclusion Zone Air Monitoring Plan - Outline

Waste Disposal Engineering Closed Landfill
Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

11129194| Report No __ | April 10, 2018

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Appendix K
Example Drum/Drum Debris Management Plan

Final

Drum/Drum Debris Management Plan

Waste Disposal Engineering (WDE) Closed Landfill
14437 Crosstown Boulevard
Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112

11129194| Report No 9 | April 10, 2018

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Appendix Index

1. Introduction

This Waste Pit Area Drum/Drum Debris Management Plan provides drum management methods associated with the removal of the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site).

1.1 Objectives and Scope

The primary objective of this plan is to address drum and drum debris management during the industrial waste pit removal action. The drum removal activities will be conducted in general accordance with 29 CFR 1910.120. The off-Site disposal of this material will be completed in accordance with the United States Environmental Protection Agency (USEPA) Off-Site Rule (40 CFR Part 300.440). This plan is intended to provide protocols to be implemented during the drum removal activities after all Site preparation work has been completed, including, but not limited to, mobilization, work area grading, decontamination facility setup, staging/storage facility setup, temporary enclosure construction, vapor control system installation, and environmental protection systems setup (i.e., stormwater controls, erosion and sediment controls, dust controls, utilities, wastewater management).

The tasks associated with the drum removal activities described in this plan are listed below:

- In-place drum inspection and assessment
- Preparation of materials, supplies, equipment, and PPE for removal
- Intact drum removal and placement into over-pack or bulk container
- Non-intact liquid debris drum removal and placement into over-pack and/or bulk container
- Non-intact solid/sludge debris drum removal and placement into over-pack and/or bulk container
- Preliminary drum/drum related material staging
- Intact drum opening
- Hazard categorization/compatibility screening/testing
- Non-intact drum/solid debris shredding and bulking
- Drum liquid bulking
- Waste characterization and profiling
- Container labeling and manifesting
- Temporary waste storage/staging
- Loading
- Transportation and disposal

All work will be conducted in general accordance with the Contractor's Site-specific health and safety plan (HASP). The Contractor's HASP will specify the air quality requirements within the temporary enclosure and the associated ventilation requirements and level of personal protective equipment (PPE) and respiratory protection.

1.2 Drum/Drum Debris Sampling Overview

Sampling activities will be required throughout the various stages of the drum removal action. Preliminary screening will be performed in-place to identify initial safety concerns and categorize the drums into groups which will determine the appropriate management methods. Following removal from the industrial waste pit, drum contents will be sampled for initial hazard categorization testing. The results of the hazard categorization testing are used to sort drums into potentially compatible waste streams. Samples of drums within the same potentially compatible waste stream will be composited for compatibility testing. The results of the testing will confirm the compatibility of drums for bulking. Hazard categorization and compatibility testing and analyses will be performed on-Site to the extent possible to increase efficiency by receiving real-time results. Once a waste stream has been consolidated and placed in a container, characterization sampling and analyses will be performed. The characterization results will be used to develop a waste disposal profile and to determine manifesting, transportation, and final disposal requirements. Specific sampling procedures are described in further detail in the following sections and will follow the Sampling and Analysis Plan and Quality Assurance Project Plan prepared for the Site.

1.3 Staging Areas Overview

Three primary staging areas will be utilized within the exclusion zone. All staging areas will be constructed to contain and control releases of materials during the drum removal work. In addition, a path for emergency egress through each staging area will be present and maintained at all times during the work. The staging area locations are shown on Figure 1.1. A flow chart summarizing waste management activities is provided on Figure 1.2.

The preliminary waste staging area will be located within the vapor controlled temporary enclosure adjacent to the industrial waste pit. This area will be used for compatibility and categorization testing to determine if wastes are compatible and can be consolidated. The preliminary waste staging area and activities are further described in Sections 2.6, 2.7, 2.8, 2.9, and 2.10. Consolidated wastes will be moved to the waste characterization staging area.

The waste characterization staging area will be located outside of and adjacent to the temporary enclosure. Consolidated wastes, overpacked drums, and drum debris will be characterized within this staging area. Characterization samples will be collected and submitted for laboratory analysis to develop waste disposal profiles. The waste consolidation and characterization staging area and activities are further described in Section 2.11 and 2.12. Characterized and profiled wastes will be moved to the non-hazardous or hazardous waste storage area.

A temporary non-hazardous and hazardous waste storage and loading area will be located adjacent to the waste consolidation and characterization area. This area will be used to load the containers and wastes onto vehicles for transportation to the authorized disposal facilities. The temporary waste storage and loading area and activities further described in Section 2.13 and 2.14

Detailed logs will be kept of the wastes/containers as they are moved between the staging areas during the waste management process. The staging areas will be inspected daily to confirm all waste is properly contained and to identify potential leaks or damage.

2. Excavation and Drum Removal Plan

2.1 General Methods and Equipment for Drum Excavation, Removal, and Handling

Excavation of the industrial waste pit area will begin by removing the clean soil overburden to within approximately 3 feet of the drummed waste or until impacted soil is encountered above the drummed waste. A minimum of 1 foot of overburden soil will remain over the drummed waste to help control vapors. Excavation of the drummed waste interval will begin on the north side of the industrial waste pit. A ramp will be excavated in the soil north of the industrial waste pit to allow equipment to uncover and access the drum containing interval horizontally from the north. The ramp will be constructed with a slope of maximum steepness of 4:1 (horizontal:vertical). The drummed waste will be excavated and removed by working from the north to the south.

Excavation of the drummed waste interval will be performed using a minimum of one excavator. A bucket attachment will be used for removal of soil, drum debris, and non-contained drum contents. A separate hydraulic drum grappler attachment will be used for removal of intact drums. The teeth of the excavator bucket will be removed or covered with a non-sparking plate to reduce the potential of damaging drums while excavating. Each crew performing excavation will consist of a minimum of one excavator operator, two drum removal technicians, and one safety technician.

A team of personnel specifically trained and experienced in the handling of drummed waste will be designated to perform excavation and removal of drummed waste. A Waste Manager will direct and oversee all waste related activities at the Site. During the handling of drummed waste, visual contact will be maintained between members of the working team at all times. All team members will be able to communicate through the use of hand signals or with two-way radios.

Upon encountering a drum or drum debris and prior to handling, an in-place inspection will be conducted to determine the condition of the drum as detailed in Section 2.2 to determine the removal method. Removal methods are detailed in Sections 2.3, 2.4, and 2.5.

All handling and transport equipment will be equipped with Class ABC fire extinguishers. All equipment used for the handling and transport of containers will be regularly inspected and maintained. In particular, the ignition, manifold, and exhaust components will be maintained to prevent backfiring or generation of sparks within the exhaust gases. Portions of equipment that contact drums will be constructed of non-ferrous materials. Contact portions of steel construction equipment will be coated or lined to prevent spark generation. Portable pumps, if used, will be intrinsically safe.

In the event that a drum or container of liquid is spilled outside of the excavation area, the drum handling team will immediately respond to the spill. If possible, a leak or spill will be contained by immediately placing a portable high density polyethylene (HDPE) tub to collect leaking/spilling material prior to contact with soil. The spilled liquids will be confined by diking around the spill with native material or with an inert absorbent. Any residual liquids, which cannot be pumped, will be absorbed with a sufficient quantity of inert absorbent to ensure that no free liquids remain.

Attempts will be made to recover liquids if spilled during the drum removal work within excavations with the use of a chemical pump. Recovered liquids will be placed into a repack drum. Impacted soil at the spill area will also be removed to prevent the spread of contamination. Materials underlying the spill zone will be treated as contaminated materials based on a visual determination of spill contamination.

2.2 In-Place Drum Inspection and Assessment

Upon encountering a buried drum during excavation activities, an in-place inspection will be performed prior to handling the drum. A preliminary screening checklist (Appendix A) will be completed for each intact drum and non-intact drum encountered. Drum fragments, lids, and other small pieces of metal that may formerly have been drums will be removed without completing a checklist. Once a drum has been exposed, the excavation crew's safety technician will screen for organic vapors, combustible gases, and radiation prior to physically handling the drum. In addition to the screening, the inspection will include observation of container material, size, condition, container type, manufacturer/origination, contents labeling, approximate volume, and content type (liquid/solid/sludge).

If any drum is determined to exhibit radiation above background, a health physicist will be immediately contacted. In the event that lab-pack drums are discovered, a chemist will be used to identify the materials and supervise repackaging if required. If gauze, blood, body parts, or other infectious medical wastes are discovered the local authorities and law enforcement agencies will be called upon before packaging the materials in the appropriate containers for transportation and disposal. Any compressed gas containers will be left in place until further identification can be made. No drums that have been determined to be radioactive, lab-packed, medical, compressed gas, or labeled explosive will be handled until persons with the appropriate expertise have been consulted. Work will stop within the industrial waste pit should radioactive or explosive drums/containers be encountered. The Waste Manager will direct when work may resume after radioactive/explosive risks are mitigated. Work will be allowed to continue within the industrial waste pit if lab-packed, medical, or compressed gas containers/drums can be relocated safely out of the immediate work area within the pit,

A visual determination of the drum condition and contents will be used to group the drum into one of four different categories as follows: intact drum, non-intact liquid debris drum, non-intact solid/sludge debris drum, and RCRA empty drum. The initial assessment and categorization of each drum will determine the particular management method for that drum.

Any drum or container that has no holes, tears, punctures, or other non-manufactured openings, will be considered an intact drum, consistent with the definition in 40 CFR Part 268.2. Any intact drum that contains more than 1 inch of material will be assigned a unique container number. Any intact drum or container that contains less than 1 inch of material will be classified as a RCRA empty drum, consistent with the definition in 40 CFR Part 261.7. RCRA empty drums will not be assigned a unique container number but will be recorded on a preliminary screening checklist.

Any drum or container that contains more than 1 inch of liquid material and is not an intact drum will be classified as a non-intact liquid debris drum and will be assigned a unique container number. Exceptions may be made in certain circumstances, such as a non-intact drum that appears to contain none of the original contents, but has simply collected water due to its orientation within the waste. In the event of uncertainty, the Paint Filter Test will be used to determine whether a material will be considered a liquid.

Any drum or container that contains more than 1 inch of material, does not contain a measurable amount of liquid, and is not an intact drum will be classified as a non-intact solid/sludge debris drum and will be assigned a unique container number.

Drum fragments, lids, and other small pieces of metal that may formerly have been drums will not be recorded and will be placed on a polyethylene liner within the preliminary waste staging area.

Once all preliminary screening checklist items have been assessed, the excavation crew will proceed with removing the drum from the excavation.

2.3 Intact Drum Removal

Prior to physically handling a drum, a preliminary screening checklist will be completed (Appendix A). Extreme caution will be used if a pressurized, bulging drum is encountered. Any handling of pressurized drums will be performed with a grappler unit constructed for explosive containment. Removal of soils adjacent to the drum will be completed using mechanical means. An excavator equipped with an earth excavation non-toothed bucket, or a non-sparking plate to cover the bucket teeth, and/or a hydraulic drum grapple attachment (or rig) will complete the drum removal. A grappler will be used to carefully remove the drum from the excavation and place the drum into an 85-gallon or 110-gallon overpack. Soil or other material adhering to intact and structurally sound drums will be removed to the extent practical prior to transferring the drum into an overpack. Each intact drum will be assigned a unique container identification number. The unique container number will be easily visible and labeled both on the top and on the side of the overpack drum.

Upon removal, intact drums within overpacks will be transported to the drum staging pad within the preliminary waste staging area pending opening, categorization testing. It is unlikely that waste can be efficiently removed from intact drums for potential consolidation. Transport of the overpacked drums may be completed using front-end loaders, rough terrain forklifts, or drum carts configured with a suitable carrying apparatus.

RCRA empty drums will be placed on a polyethylene liner within the preliminary waste staging area. Once a sufficient quantity of drums have been accumulated, the drums will be crushed/shredded, placed in a bulk container, and moved to the waste storage staging area. RCRA empty drums will be transported for disposal as a non-hazardous waste at a Subtitle D landfill.

2.4 Non-Intact Liquid Debris Drum Removal

Prior to physically handling a non-intact drum, a preliminary screening checklist will be completed (Appendix A). If, during the initial inspection, an open or leaking drum is observed to contain liquids, the liquids will be pumped with the use of a chemical pump or bailed into a repack drum prior to moving the drum. Removal of soils adjacent to the drum will be completed using mechanical means. An excavator equipped with an earth excavation non-toothed bucket, or a non-sparking plate to cover the bucket teeth, and/or a hydraulic drum grapple attachment (or rig) will complete the drum removal. A grappler will be used to carefully remove the drum from the excavation, taking special care to prevent spilling any liquid that may remain within the drum. If, once removed, a drum still contains a measureable amount of liquid, the remaining liquid will be bailed or pumped into the repack drum. Any liquids spilled within excavations will be pumped with the use of a chemical pump into the repack drum. If not practical to bail or pump, absorbent material may be used to remove residual liquid. Each repacked liquid drum will be assigned a unique container identification number. The unique container number will be easily visible and labeled both on the top and on the side of the repack drum.

Upon removal from the pit, liquids within repacks will be transported to the drum staging pad within the preliminary waste staging area pending categorization, compatibility testing, and potential consolidation of the waste. Transport of the repacked drums may be completed using front-end loaders, rough terrain forklifts, or drum carts configured with a suitable carrying apparatus.

Upon removal from the pit, drum debris will be placed on polyethylene sheeting within the preliminary waste staging area pending shredding and consolidation.

2.5 Non-Intact Solid/Sludge Debris Drum Removal

Prior to physically handling a non-intact drum, a preliminary screening checklist will be completed (Appendix A). Removal of soils adjacent to the drum will be completed using mechanical means. An excavator equipped with an earth excavation non-toothed bucket, or a non-sparking plate to cover the bucket teeth, and/or a hydraulic drum grapple attachment (or rig) will complete the drum removal. A grappler will be used to carefully remove the drum from the excavation, taking special care to prevent spilling any materials from within the drum. Each non-intact solid/sludge drum will be placed into an 85-gallon or 110-gallon overpack. Each solid/sludge drum will be assigned a unique container identification number and will have all subsequent information associated with it documented in the drum database. The unique container number will be easily visible and labeled both on the top and on the side of the overpack drum.

Upon removal from the pit, non-intact solid/sludge drum debris within overpacks will be transported to the drum staging pad within the preliminary waste staging area pending categorization, compatibility testing, and potential consolidation of the waste. Transport of the overpacked drums may be completed using front-end loaders, rough terrain forklifts, or drum carts configured with a suitable carrying apparatus.

2.6 Preliminary Waste Staging

A preliminary waste staging area will be utilized within the vapor controlled enclosure adjacent to the industrial waste pit. The preliminary staging area will be located in the north half of the temporary enclosure as shown on Figure 1.1. This staging area will be subdivided into the following staging pads:

- Non-intact debris drums and shredding pad

- RCRA empty drum pad
- Drum pad - repack, intact drums, and overpack drums and hazard categorization/compatibility sampling
- Waste consolidation pad

Drums will be segregated and recorded according to whether they are intact, liquid non-intact, solid/sludge non-intact, or empty. The preliminary waste staging area will be used for the interim storage of excavated drums/debris while conducting sampling and compatibility testing prior to the consolidation of wastes. All intact drums will be staged on and secured to pallets on the drum pad. Non-intact debris drums will be staged on the shredding pad. RCRA empty drums will be staged separately on a polyethylene liner near the shredding pad.

A minimum of 20-mil polyethylene sheeting will be placed under the pallets. Sufficient sheeting will be used to prevent the potential dripping of waste onto the ground surface during sample collection. Drums will be placed in rows that are two drums wide. The designated area will allow for an approximate 10-foot aisle space between each double row of drums.

Following hazard categorization (HazCat) testing as described in Section 2.8, wastes will be consolidated accordingly on the consolidation pad. Waste consolidation will be completed as described in Sections 2.9 and 2.10.

All wastes will remain within the preliminary waste staging area until consolidated and/or placed in containers to be used for transportation to disposal facilities. All containers will be covered and/or sealed and moved to the waste characterization staging area.

2.7 Intact Drum Opening

All intact drum opening will occur on the drum pad within the preliminary waste staging area. Extreme care will be exercised while opening intact drums in which the contents are unknown or known to be dangerous. All metal drums will be grounded prior to opening. A metal grounding rod will be driven into the ground adjacent to the staging pad. A grounding wire, leading from the rod, will then be clipped to the drum. Personnel will stay at a safe distance. If personnel must be located near the drums, explosion-resistant plastic shields will be placed between them and the drums. Controls for drum opening equipment, monitoring equipment, and fire suppression equipment will be located behind the shield. Monitoring as described in the HASP will be continuous during opening activities. Sensors such as colorimetric tubes, radiation instruments, explosion meter, organic vapor analyzers, and oxygen meters will be located as close as practical to the drum opening.

Extreme care will be exercised in opening drums or other sealed containers in which the contents may be harmful to sampling personnel. If the bung can be removed, sampling of contents will be performed through the bung hole. Drums will be opened in such a manner that excess interior pressure, as evidenced by bulging or swelling, has been safely relieved. Pressure will be relieved using a pneumatic impact wrench, backhoe spike, or hydraulic penetration device. An intact drum with unknown contents that has a badly rusted bung or cover bolt will be entered using a non-sparking penetrating device, operated remotely. If pressure cannot be relieved from a remote location, appropriate explosion-resistant shielding will be placed between sampling personnel and the drums to deflect any gas, liquid, or solids which may be expelled. Hand operated, non-sparking tools including bung wrenches and drum deheaders may be used to penetrate an intact drum.

Open bungs and spike openings will be re-sealed immediately following sampling if possible to prevent vapor generation. Bungs will be replaced with new bungs while other openings may be plugged. Pressurized drums will be fitted with pressure-venting caps set to a 5-psi release to allow venting of vapor pressure.

After opening the drum, the classification and sampling form (Appendix B) will be updated with applicable information. Sampling of drums will be completed once the drums have been opened as described in Section 2.8. Once sampling is completed, the drums will be staged with visually distinct solid/sludge/liquid waste streams. If after opening and sampling, the drum contents do not appear to match one of the established visually distinct waste streams, the drum will be segregated.

2.8 Hazard Categorization/Compatibility Screening/Testing

Hazard categorization (HazCat) sampling and compatibility screening will be performed separately for liquid and solid/sludge wastes and non-intact drums. All drum and materials sampling will be conducted in accordance with the Sampling and Analysis Plan. All drums identified for sampling will be placed in overpack drums, on a drum sampling tray, or on polyethylene sheeting prior to sampling. All sampling will be performed at the sampling pad within the preliminary waste staging area.

Drums will be opened by loosening bungs or ringbolts manually as described in section 2.7. Under most circumstances, this will allow sufficient access to the contents for sampling. Drums with lids or bungs which are rusted and/or are unable to be opened manually will be opened by alternative methods including deheading, remote punching, or manual punching. Sampling may also be performed through existing holes in drums that are sufficient for sample collection.

A drum classification and sampling form (Appendix B) will be completed as the sample is being collected. Items to be recorded will include:

- Unique container number
- Drum type
- Drum size
- Drum condition
- Drum classification (i.e. intact, liquid, solid/sludge)
- Contents – physical state (i.e. solid, liquid, liquid-phase layered, sludge, semi-solid, combination, lab-pack)
- Contents – physical properties (i.e. color, thickness, texture)
- Contents – approximate volume
- Results of field screening
- Sample IDs

- Temporary storage location

Specific sampling procedures are described in detail in the Sampling and Analysis Plan. Representative samples will be collected to the extent practical by combining multicolored and distinct differences from within the sample matrix for solids/sludges and by sampling the full liquid column and all phases via a glass tube (thief) or glass coliwasa.

Solid and semi-solid materials will be collected by scooping the material into the sample container with clean disposable sampling equipment. Hardened resins may need to be broken with a hammer and chisel or cut with a knife. A representative sample is often not achievable when the solid material cannot be penetrated. In these cases, sampling technicians will sample within the top 6 inches of the drum contents, and a trowel or similar device will be used to dig into material to look for variation in the container contents below 6 inches.

Where multicolored or distinct differences in the sample matrix exists, sampling technicians will collect aliquots of each portion and combine them in the same container. Hardened resins will be assumed uniform and sampling technicians will collect a sample from the top 6 inches.

Liquids or loose sludges will be either sampled using a 4-foot glass tube (thief), or a glass coliwasa. The sampling device is slowly lowered into the liquid material. After the bottom of the drum or resistance is felt, a suction is created by sealing the top end of the device. The device is withdrawn and the contents placed into the sample container. This process is repeated until the appropriate sample volume is achieved.

Samples of drum contents will be evaluated to determine their chemical hazards and the suitability for comingling. When possible, contents will be characterized using an on-Site laboratory to provide data as rapidly as possible. The HazCat testing involves the use and manipulation of very small amounts of sample material under specific test procedures. Testing will be completed on each sample. A small aliquot will be withdrawn from the sample container and tested. It is possible to test the same aliquot for different parameters, based upon the experience of the chemist. Specific HazCat analytical categories and procedures are detailed below.

Water Solubility: Each layer of waste within the sampling container will be tested for water solubility. A gram sized aliquot of sample will be removed from the sample container and placed on a spot plate, weigh boat, or in a test tube. A milliliter of water is added to the sample. The following observations will be made:

- Soluble, partially soluble, or insoluble
- High or low density
- Bubbling, fizzing, popping, or effervescence
- Fume or mist generation
- Heat generation
- Fire evolution

The abbreviations S, PS, or I will be used to designate soluble, partially soluble, or insoluble, respectively. These abbreviations will be recorded onto the compatibility log sheet.

Reactivity Testing: The procedure for water solubility will be followed. A sample is considered water reactive when contact with water causes:

- Bubbling, fizzing, popping, or effervescence;
- Fume or mist generation;
- Heat generation; or
- Fire evolution.

A + or - symbol will be logged onto the compatibility log sheet.

pH: The sample will be tested for pH by using pH test strips. The pH testing will be done after completion of water solubility testing. The pH of a solid material will be determined using the solution from the water solubility test. A numerical designation of the pH value will be entered onto the compatibility log sheet.

Hexane Solubility: Each layer of waste within the container will be tested for hexane solubility. A gram sized aliquot of sample will be removed from the sample container and placed on a watch plate, weigh boat, or in a test tube. A milliliter of hexane will be added on the top of the sample. The following observations are made:

- Soluble, partially soluble, or insoluble; and
- High or low density.

The abbreviations S, PS, or I will be used to designate soluble, partially soluble, or insoluble respectively. These abbreviations will be recorded onto the compatibility log sheet.

Oxidizers: The sample will be tested for oxidizing properties using a starch/iodide test strip. The starch iodide test strip will be placed directly into the water solubility test solution. A blue color change indicates that the material is an oxidizer. A + or - will be used to indicate a positive or negative response and will be entered onto the compatibility log sheet.

Peroxide: The sample will be tested for peroxide by using peroxide test strips. The peroxide testing will be done after completion of the oxidizer test. Peroxide testing of a solid material will be conducted on the water solubility test solution. A+ or - will be used to indicate a positive or negative response and will be entered onto the compatibility log sheet.

Sulfide: The sample will be tested for free sulfide by using a sulfide test strip. The sulfide test strip is premoistened with acetic acid. A black precipitate forms on the test strip changing it to dark brown/black in color. The chemist may elect not to premoisten the test strip after quality control samples of known sulfide bearing spike samples have been run to demonstrate validity. Sulfide testing of a solid material will be collected on the water solubility test solution. A+ or - will be used to indicate a positive or negative response and will be entered onto the compatibility log sheet.

Cyanide: Samples will be tested for the presence of cyanide using the free cyanide spot test described in Method 4500-CN- K of "Standard Methods for the Examination of Water and Wastewater". This test will be used only for aqueous (water soluble) waste samples with a pH greater than 4. If the sample (or water solubility test solution for solid samples) pH is greater than 10, an aliquot must be neutralized using a 10 percent HCl solution to a pH of approximately 8. The test consists of placing three drops of aqueous waste sample (or water solubility test solution for solid samples) into the cavity of a spot plate and adding three drops each of pyridine-barbaturic acid and chloramine-T. A positive result for free cyanide is characterized by the formation of a pink or red color.

Ignition Test: A small aliquot of sample will be tested for ignitability using an open cup flame test at room temperature. The flame test will involve slowly placing a match over the sample. Instant flame formation from the match to the sample surface indicates a flammable material. If ignition does not occur instantly, the chemist will slowly bring the flame closer to the sample to warm the sample surface. Materials will light based upon their degree of flammability relative to the flash point. Samples igniting rapidly will be marked positive (+) for ignitability. Samples requiring slight warming will be marked positive for ignitability. Samples which require prolonged flame contact to ignite will be recorded as non-flammable but combustible.

Halogen Test: A small aliquot of sample will be tested for halogen content by the Beilstein test. A small trace of material is placed in contact with a copper wire. The copper wire containing the sample residue is heated over a propane torch flame until the copper has turned red. A positive test for chlorine and other halogenated compounds is indicated by a green flame during the test method. The copper wire will be reused after all residue has been combusted and the copper test area submerged into distilled water.

PCB Screening: Samples will be tested for PCBs at an off-Site laboratory. Ten representative grab samples from a group of ten drums or waste samples will be combined into one composite sample, and analyzed for total PCBs. If the results of the sample analysis indicate that the concentration of total PCBs is 50 ppm or greater, the material represented by the composite sample will be bulked only with other similar material for which PCB screening indicates PCB concentrations of 50 ppm or greater.

Based upon the individual HazCat results and PCB results for samples of non-intact drum contents and liquids, a test bulking sequence will be developed for the samples. Samples with similar chemical properties may be comingled together. The need for any bulking of waste is highly dependent on the amount of material recovered. The Waste Manager and the Chemist will determine the number of bulk groups to be composited based on chemical compatibility, PCB, and HazCat results.

Test bulking will be accomplished by withdrawing a small amount of material from each container and mixing it by manually stirring the composite with other compatible waste. A thermometer will be used during compositing to measure temperature rise in the composite. Visual observations will be made to determine whether color change, phase separations, off-gassing, phase change, or other indicators of chemical reactions are occurring.

Evidence of a chemical reaction will indicate that two or more chemicals within the composite are incompatible with one another. The chemist conducting the test bulking will review HazCat results to determine if the cause of the reaction can be determined. The chemical test bulking will be discontinued until consultation with the Project Manager. The Waste Manager and chemist will decide whether test bulking will be continued. Should a reaction be observed and bulking is continued, the container from which the sample that generates the response will be removed from the other samples as an incompatible waste. The procedure would then be reinitiated without the addition of the incompatible waste sample until all compatible wastes are identified for bulking. Incompatible waste streams will be segregated.

2.9 Non-Intact Drum/Debris Shredding and Bulking

Compatible solid/sludge non-intact drums will be sent to the consolidation pad within the preliminary waste staging area for shredding and bulking prior to characterization and disposal profiling. Bulking of solid/sludge drums will be performed based on a review of the HazCat testing, compatibility testing, RCRA hazardous characteristics, and PCB analytical results as described in Section 2.8 and the Sampling and Analysis Plan. Drum debris and residual contents will be placed, into a steel mixing box. Shredding and mixing will be accomplished through the use of mechanical means by tearing pieces with excavators or through the use of a drum shredder. Drums will be sufficiently ripped and shredded to meet disposal facility requirements. Following shredding of the drums and mixing of contents, the contents will be transferred to a polyethylene lined roll-off container. Each bulk container will be associated with a waste consolidation form (Appendix C) that will list the waste categories and all unique container numbers that were consolidated.

Shredding and bulking will be performed by a crew of at least two personnel: an equipment operator and a safety technician. The safety technician will be responsible for observing and monitoring the shredding and mixing activities to ensure that only compatible wastes are consolidated. Each drum will be verified as compatible before mixing with other bulked materials. If, at any point, an observation of color change, gas generation, reaction, or temperature change is observed, the mixing and shredding activities will be ceased immediately.

When a waste stream destined for bulking that is composed of up to 100 drums has accumulated and compatibility testing been completed, the drum group will be transported to the appropriate final staging location. The drum group will be staged until the appropriate comingling of the waste stream can be performed. Compatible drum contents will be either mixed/shredded and transferred to a roll-off box or pumped into a tank depending on the material. Each bulk container will be assigned a unique container number that will be associated in the drum database with all unique container IDs within the bulk container. Bulking will be performed within the vapor-controlled building. Individual drums not destined for bulk disposal will be staged in sealed overpacks outside of the vapor-controlled building.

Bulked solids will be kept several inches below the top of the container. If necessary, loads may be covered with encapsulating foam to minimize vapor emissions. Once a container has been packed, the topmost layer of waste will be covered with sufficient desiccant material to absorb any liquid phase separation that may occur during transportation. A tarp will be provided and secured over each shipment leaving the Site, with the exception of enclosed box transport units. An inspection of each container will be performed to remove any residual materials prior to transferring bulked materials. This will prevent reactions between incompatible chemicals. Liquid transfer procedures will comply with Section 2.10.

2.10 Liquid Material Handling and Bulking

Bulking of liquids will be performed based on a review of the HazCat/compatibility testing, RCRA hazardous characteristics, and PCB analytical results, as described in Section 2.8 and the Sampling and Analysis Plan. Prior to consolidating liquids in a storage tank, drummed contents will be emptied into a drum tray to allow measurement of the volume of the liquid within each drum. The contents will be subsequently pumped from the drum tray into the waste tank pending off-Site disposal. An inspection of each tank will be performed to remove any residual materials prior to transferring liquid to the container to prevent reactions between incompatible chemicals. Liquid containers will be fitted with pressure-venting caps set to a 5-psi release to allow venting of vapor pressure. Only pumps which are properly rated to handle chemicals, and that have a safety relief valve with a splash shield will be used to move liquids. Prior to pumping, an inspection will be performed on the pumping equipment. This inspection will ensure that all lines, fittings, valves, and gaskets are intact and secure. Hoses will be protected from vehicular and pedestrian traffic. All personnel involved in the transfer of liquids will wear the appropriate PPE as described in the HASP including boots, poly coated suits, gloves, face shields and goggles.

Bulking will be performed by a crew of at least two personnel: an equipment operator and a safety technician. The safety technician will be responsible for observing and monitoring the transfer activities to ensure that only compatible wastes are consolidated. Each drum will be verified as compatible before mixing with other bulked liquids. If, at any point, an observation of color change, gas generation, reaction, or temperature change is observed, the bulking activities will be ceased immediately. Each bulk container will be associated with a waste consolidation form (Appendix C) that will list the waste categories and all unique container numbers bulked within.

When a waste stream destined for bulking that is composed of up to 100 drums has accumulated and compatibility testing been completed, the drum group will be transported to the appropriate final staging location. The drum group will be staged until the appropriate comingling of the waste stream can be performed. Compatible drum contents will be either mixed/shredded and transferred to a roll-off box or pumped into a tank depending on the material. Each bulk container will be assigned a unique container number that will be associated in the drum database with all unique container IDs within the bulk container. Bulking will be performed within the vapor-controlled building. Individual drums not destined for bulk disposal will be staged in sealed overpacks outside of the vapor-controlled building.

2.11 Waste Characterization and Profiling

Waste characterization analyses will be conducted on representative composite samples of the materials contained in drums and/or bulked containers to determine if the containerized material is hazardous and to determine the appropriate action for disposal of the material off-Site. Characterization results will be used to create waste profiles and prepare manifests.

Individual drums will be sampled following the sample collection methods discussed in Section 2.8. For bulked drum solids waste, samples will be collected at a frequency of one 6-point composite sample per bulk container. Samples will be collected from a depth of 1 foot from the top of the waste.

For bulked liquid waste, samples will be collected from all layers in the tank to produce one composite sample, with a maximum of 6,000 gallons per composite sample. Samples will be collected using a 4-foot glass tube (thief) or a glass coliwasa. The sampling device will be lowered into the container to its full length. A suction will then be created by sealing the top end of the device. The sampling device will then be withdrawn and the contents placed into the sample container(s).

Sample containers will be pre-cleaned by the laboratory or purchased pre-cleaned. Sample containers will be inspected for damaged lids, cracks, or similar defects. Samples collected for off-Site analysis will be stored in cooled conditions (with ice or at 4°C). Samples will be shipped via overnight courier or hand delivered to the analytical laboratory using chain-of-custody protocols. Samples for off-Site analysis will be analyzed by a qualified, certified laboratory and standard laboratory QA/QC protocols. Sample preservation, packaging, shipment, and holding time requirements are outlined in the Sampling and Analysis Plan. Waste characterization tests will include:

- Ignitability
- Corrosivity
- Reactivity for cyanide and sulfides
- Totals analysis (VOCs, SVOCs, and metals)
- PCBs

Additional sampling and analysis requirements, if any, will be identified by the selected disposal facility and confirmed prior to the initiation of sampling activities.

2.12 Container Labeling and Manifesting

All containers will be labeled with a unique container identification number. This container ID will be associated in the drum database with all bulked unique container IDs within the bulk container. Overpacked drums will be clearly labeled on the top and side with the assigned unique container ID. Bulk containers to be used for transporting overpacked drums will also be labeled with a unique container identification number. This container identification will be associated with all unique container IDs within the bulk container.

Non-hazardous waste will be transported to the authorized disposal facility under a bill of lading. Hazardous waste will be transported to an authorized disposal facility under a hazardous waste manifest. The waste characterization and profiling analytical results will be used for manifesting purposes and for determining the necessary placarding of vehicles. The manifest forms and records will be consistent with 40 CFR Part 262 “Standards Applicable to Generators of Hazardous Waste”, and 40 CFR Part 263 “Standards Applicable to Transporters of Hazardous Waste”.

A Hazardous Waste Generator Number will be obtained from USEPA and will be used on all manifests. Authorized Minnesota Pollution Control Agency (MPCA) staff will be responsible for signing all manifests as the waste generator.

2.13 Temporary Waste Storage/Staging

The temporary waste storage area will be located outside of the vapor-controlled building as shown on Figure 1.1. Following characterization and profiling, wastes will be moved to the temporary waste storage area. Hazardous and non-hazardous wastes will be kept segregated within this storage area.

All bulk solid containers will be covered to minimize vapors during temporary storage at the Site. Tanks and drum overpacks will be sealed during temporary storage at the Site. Sufficient space will be maintained between the containers and segregated waste streams to allow for equipment operation and loading. The staging areas will be inspected daily to confirm all waste is properly contained and to identify potential leaks or damage. Inspections will be documented on a waste storage inspection form (Appendix D).

2.14 Loading

Loading of all wastes on to transport vehicles will be conducted within the temporary waste storage area. All off-Site transport vehicles will be DOT-approved and will be prepared as appropriate prior to receiving waste. All bulk material transport containers will be leak-proof, lined with a continuous sheet of polyethylene prior to loading, and/or will have sealed tailgates. When transporting liquid wastes, container doors/tailgates will be packed with desiccant material to prevent liquids from leaking during transport. Drummed/containerized wastes will be loaded and secured in a manner, which will prevent damage to the containers. Container beds and walls will be smooth to prevent damaging drums. Drums will not be double stacked.

Care will be taken to prevent contamination of transport vehicles during loading. All vehicles leaving the Exclusion Zone, if necessary, will be decontaminated at a decontamination station located at the Exclusion Zone exit point. In the event effective decontamination cannot be accomplished using dry methods, a high-pressure wash will be performed. Decontamination water will be collected and contained at the decontamination station for subsequent removal and off-Site disposal. The Site Superintendent will inspect the Site entrance and street to ensure contamination/debris is not being tracked off Site.

2.15 Transportation and Disposal

Only transporters that are licensed by USEPA, US Department of Transportation (DOT), and the State of Minnesota will be used for the transport of hazardous materials. Transporters will have current licenses in the appropriate State(s) and comply with other applicable Federal laws including DOT requirements for wastes scheduled for transport to facilities outside the State of Minnesota. Transporters must comply with DOT regulations (49 CFR Parts 171-178) and EPA regulations (40 CFR Part 263) for shipment of hazardous wastes. If wastes are deemed to be non-hazardous, then transporters will be licensed for general transportation of non-hazardous wastes or as required by the State for the transport of Special Waste. Placards will be attached to each container and vehicle consistent with the waste manifest and in accordance with DOT regulations.

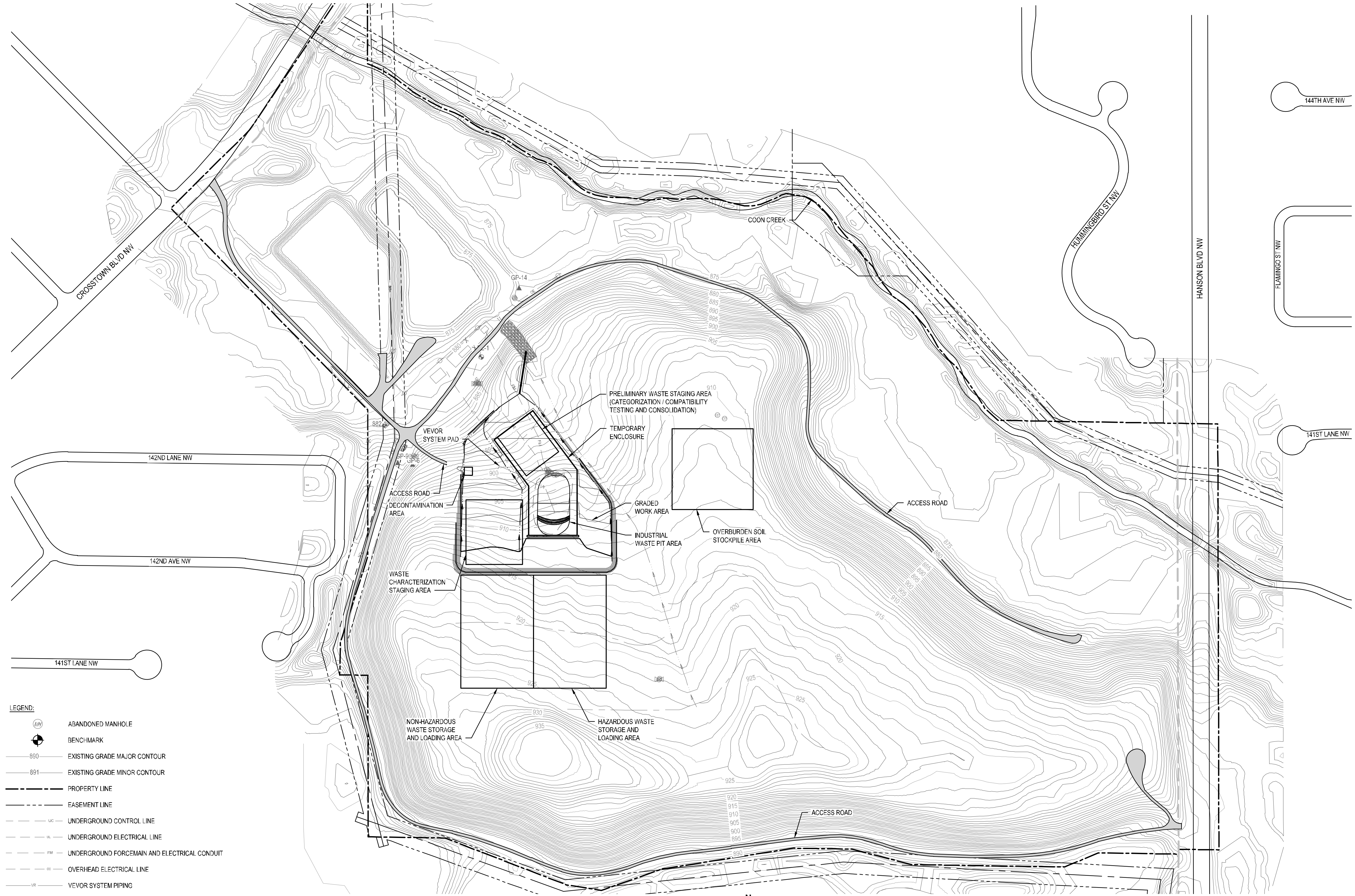
Transportation routes to off-Site TSD facilities will be predetermined prior to commencing off-Site transport of waste materials. A primary route to each TSD facility will be identified. Prior to the transport of any materials, the appropriate State and interstate officials will be consulted as to whether any proposed routes are scheduled for construction or seasonal closures during implementation of this project. Additionally, precautions will be taken in determining transport routes to minimize exposure to high-traffic areas, sensitive populations, and pedestrians.

All off-Site shipments of waste will be appropriately disposed at a facility in compliance with EPA's Off-Site Rule, 40 CFR 300.440. All facilities will be RCRA compliant and/or Toxic Substances Control Act (TSCA) compliant, as applicable, and will comply with the Federal and State regulations and facility specific permits.

Any drums/containers deemed to be non-hazardous will be disposed at an authorized Subtitle D facility in accordance with applicable Federal and State regulations and facility specific permits.

Each designated disposal facility will provide an agreement to accept the waste from the Site. This agreement can be on any form typically used by the facility (such as a waste profile form) and will specify the total estimated quantities of wastes and the intended method of disposal for each waste stream. Each agreement will provide the facility name and USEPA Identification Number, facility location, name of responsible contact for facility, telephone number for the contact, and any additional waste characterization requirements.

The appropriate documentation will be generated and maintained for material transport from the Site to an off-Site facility. A waste shipment record, waste manifest, or bill of lading that identifies the generator, transporter, and disposal facility, and corresponding USEPA identification number, the nature of the material, the date and time the material was transported from the Site, and the weight or volume of material will be provided with each loaded transport vehicle. The manifest or bill of lading will be retained by the Site Superintendent for documentation purposes. Bills of lading will be issued for non-hazardous material removed from the Site. Upon receipt of the material, the disposal facility will be required to sign the manifest. A copy of the signed manifest will be returned to the generator or generator's designated representative for record-keeping purposes.



LEGEND:

- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- PROPERTY LINE
- EASEMENT LINE
- UC UNDERGROUND CONTROL LINE
- UL UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR

PLAN

SCALE 1" = 150'   0   150'   300'

PRELIMINARY

GHD

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Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date

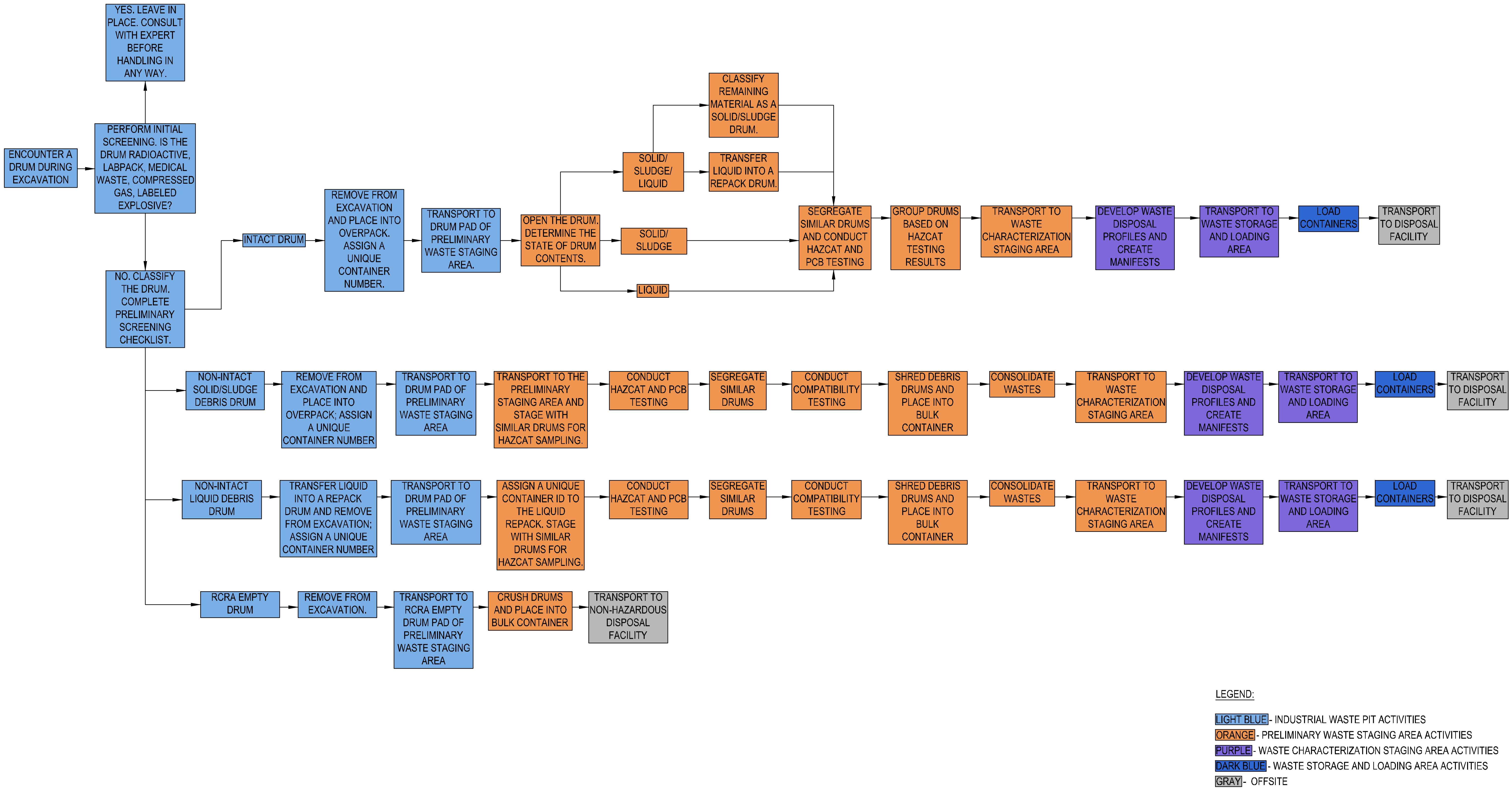
Drawn T. DAHMER	Designer T. REE
Drafting Check	Design Check
Project Manager R. MARTIN	Date MAY 2017
This document shall not be used for construction unless signed and sealed for construction.	Scale 1" = 150'
Original Size ANSI D	Bar is one inch on original size sheet 0 1"

Project No. 11129194

Title
STAGING PLAN

Sheet No.
FIGURE 1.1

Sheet of 2



MINNESOTA POLLUTION CONTROL AGENCY
WASTE DISPOSAL ENGINEERING
CLOSED LANDFILL - INDUSTRIAL WASTE PIT

WASTE MANAGMENT FLOW CHART

Project No. **11129194**
Report No. **006**
Date **NOV 2017**

FIGURE 1.2

Filename: P:\Drawings\10000000's\11129194\11129194-REPORTS\11129194-00(009)\11129194-00(009)GN\FIGURE 1.2 WASTE MANAGMENT FLOW CHART.dwg
Plot Date: 26 March 2018 - 3:24 PM

Source:

Appendix A
Preliminary Screening Checklist

Appendix A

Preliminary Screening Checklist
Waste Disposal Engineering Closed Landfill
Andover, Minnesota

Field Observer: ____________________
In-Place Assessment: **Date:**

Drum Class: □ Intact □ Non-Intact □ RCRA Empty

Screening: □ Labpack □ Medical Waste □ Compressed Gas
PID ________ ppm Combustible Gas: ________ %LEL Radiation: ________ mR

Drum Size: □ 55-gallon □ 30-gallon □ Other, Specify: ____________________

Drum Type: □ Carbon Steel □ Stainless Steel □ Plastic □ Other, Specify ________

Drum Opening: □ Ring Top □ Closed Top □ Open Top □ Other, Specify ________

Drum Condition: □ Crushed □ Punctured □ Bent □ Corroded □ Ruptured
□ Bulging □ Head seal broken/missing □ Unrecognizable

Drum Marking Keywords: ______________________________

Post-Removal Assessment:

Contents Volume: □ Full □ Empty □ Partial ________ %

Drum Contents:

Primary	Secondary
□ Liquid	□ Liquid
□ Solid	□ Solid
□ Sludge	□ Sludge
□ Gas	□ Gas
□ Gel	□ Gel
□ Unknown	□ Unknown
	□ N/A

Management:

Primary	Secondary
□ 85-gallon overpack	□ 85-gallon overpack
□ 110-gallon overpack	□ 110-gallon overpack
□ Staged for Crushing	□ Staged for Crushing
□ Staged with Intacts	□ Staged with Intacts
□ Staged with Non-Intact Liquids	□ Staged with Non-Intact Liquids
□ Staged with Non-Intact Solids	□ Staged with Non-Intact Solids
	□ N/A

	Primary	Secondary
Unique Container Number:	____________________	____________________
Photograph(s):	____________________	____________________

Comments: ______________________________

____

Appendix B
Waste Classification and Hazard Categorization/Compatibility Testing Form

Appendix B

Waste Classification And Sampling Form
Waste Disposal Engineering Closed Landfill
Andover, Minnesota

Field Sampler: ____________________
Chemist: ____________________
Unique Container Number: ____________________ **Date:** ____________________

Drum Contents: □ Liquid □ Solid □ Sludge □ Gas □ Gel □ Dirt

Drum Size: □ 55-gallon □ 30-gallon □ Other, Specify: ____________________

Overpack Size: □ 85-gallon □ 110-gallon

Contents Volume: □ Full □ Empty □ Partial ________ %

Number of Layers: ________

Contents Color:

Primary		Secondary		Tertiary	
□ Cream	□ Pink	□ Cream	□ Pink	□ Cream	□ Pink
□ Clear	□ Orange	□ Clear	□ Orange	□ Clear	□ Orange
□ Black	□ Yellow	□ Black	□ Yellow	□ Black	□ Yellow
□ White	□ Gray	□ White	□ Gray	□ White	□ Gray
□ Red	□ Purple	□ Red	□ Purple	□ Red	□ Purple
□ Green	□ Amber	□ Green	□ Amber	□ Green	□ Amber
□ Blue	□ Brown	□ Blue	□ Brown	□ Blue	□ Brown
□ Other	________	□ Other	________	□ Other	________

Physical Description: ____

Sample ID Number: ____________________

Screening Data:

Yes	No		
□	□	Radioactive (≥ 1 mR over background)	________ mR
□	□	Acidic (pH ≤ 3)	________ pH
□	□	Caustic (pH ≥ 12)	________ pH
□	□	Air Reactive (Reaction of ≥ 10°F temp change)	________ °F
□	□	Water Reactive (Reaction of ≥ 10°F temp change)	________ °F
□	□	Water Soluble (Dissolves in water)	
□	□	Hexane Soluble (Dissolves in hexane)	
□	□	Water Bath OVA (≥ 10 ppm = Yes)	________ ppm
□	□	Combustible (Catches fire when torched in water bath)	
□	□	Halide (Green flame when heated with copper)	
□	□	Inorganic (Water Bath OVA and Combustible = No)	
□	□	Organic (Inorganic = No)	
□	□	Alcohol/Aldehyde (Water Bath OVA, Water Soluble and Combustible = Yes)	
□	□	Cyanide (Draeger tube over water bath ≥ 2 ppm, or Method 4500-CN)	________ ppm
□	□	Sulfide (Sulfide test strip shows positive reaction)	
□	□	Flammable (Combustible = Yes, and SETA flashpoint ≤ 140°F)	
□	□	Oxidizer (Starch iodine paper shows positive reaction)	
□	□	Peroxide (Peroxide test strip shows positive reaction)	
□	□	PCB (Off-Site laboratory result ≥ 50 ppm)	________ ppm
□	□	Inert or Other (Everything "No" except Inorganic or Organic)	

Preliminary Staging Location:

____________________ Row
____________________ Compatibility Group Number
□ Compatibility with group confirmed
____________________ Waste Profile Number

Comments: ____

____

Appendix C
Waste Consolidation Form

Appendix C

Waste Consolidation Form
Waste Disposal Engineering Closed Landfill
Andover, Minnesota

Field Observer: ____________________

Bulk Container Unique Number: **Date:**

Bulk Container Type: ◻ Roll-off ◻ Tank ◻ Other, Specify ____________________

Bulk Container Volume: ____________________

Contents State: ◻ Liquid ◻ Solid ◻ Other, Specify ____________________

Screening Results:

- ◻ Radioactive
- ◻ Acid/Oxidizer
- ◻ Caustic/Reducer/Cyanide
- ◻ Flammable Organic
- ◻ Nonflammable Organic
- ◻ Peroxide
- ◻ Air or Water Reactive
- ◻ Inert
- ◻ Other, Specify ____________________

Compatibility: ____________________ Compatibility Group Number

◻ Compatibility with group confirmed

Unique Container Numbers included in bulk container:

Sample ID Number: ____________________

PCB Detection: ____________ ppm

Waste Codes: ◻ TSCA ◻ D007 ◻ D008 ◻ D018 ◻ D028 ◻ D035
◻ D039 ◻ D040 ◻ D043 ◻ Other, Specify: ____________________

Final Staging Location:

____________________ Row
____________________ Waste Profile Number
____________________ Bill of Lading Number
____________________ Manifest Number

Appendix D
Waste Storage Area Inspection Form

Appendix D

Waste Storage Inspection Form
Waste Disposal Engineering Closed Landfill
Andover, Minnesota

Field Observer: ____________________

Container Storage Area: **Date:** ____________________

Comments regarding all "No" responses:

Are secondary containments free of waste/liquid?	Yes □	No □	____________
Are all containers in good condition?	Yes □	No □	____________
Are container tops free of spillage?	Yes □	No □	____________
Are all wastes within 90 days of accumulation date?	Yes □	No □	____________
Is leak detection equipment working/visible?	Yes □	No □	____________
Are all lids closed?	Yes □	No □	____________
Are all containers properly labeled, legible, and visible?	Yes □	No □	____________

Unique Container ID Number	Accumulation Date	Container Type (D=Drum, B=Bin, T=Tank)

Corrective Actions: ____________________

Appendix L
Example Soil Management Plan

Final

Waste Pit Area Soil Management Plan

Waste Disposal Engineering (WDE) Closed Landfill
14437 Crosstown Boulevard
Andover, Minnesota

GHD | 1801 Old Highway 8 Northwest Suite 114 St. Paul Minnesota

11129194| Report No 10 | April 10, 2018

Table of Contents

Figure Index

1. Introduction

GHD Services Inc. (GHD) has prepared this Draft Waste Pit Area Soil Management Plan providing soil characterization, excavation, and management methods during the industrial waste pit removal action at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota (Site).

1.1 Objectives and Scope

The primary objective of this plan is to address soil characterization, excavation, and disposal during the industrial waste pit removal action. The soil excavation activities will be conducted in general accordance with 29 CFR 1910.120. The offsite disposal of the excavated materials will be completed in accordance with the United States Environmental Protection Agency (USEPA) Off-Site Rule (40 CFR Part 300.440).

The primary components of the soil excavation and management work include:

- Pit soil excavation
- Pit clay liner excavation
- Preliminary pit subsoil characterization sampling
- Pit subsoil excavation
- Soil characterization and disposal profiling
- Loading
- Transportation
- Disposal

All work will be conducted in general accordance with the Contractor's Site-specific health and safety plan (HASP).

1.2 Soil Excavation Overview

Soil excavation will begin with the removal of the 5 to 10 feet of overburden soil from the industrial waste pit area to at least 50 feet beyond the extents of the pit. A polyethylene liner will be immediately placed over the pit area and left in place until the temporary building is constructed in order to prevent precipitation infiltration and provide vapor control. A temporary enclosure will be erected over the pit to facilitate waste and soil excavation and vapor control. Excavation of the waste interval and underlying clay would extend to a maximum depth of 26 feet below the existing ground surface and 16 feet below the benched ground surface. Excavation of sandy soil below the clay liner and directly below the pit will extend to an expected maximum depth of 36 feet below the existing ground surface. A soil ramp will be constructed for access into and out of the pit.

Soil surrounding the drums within the industrial waste pit will be excavated and removed as necessary to expose and remove the drums. This excavated soil will be field screened/visually inspected and segregated into like stockpiles. These stockpiles will be designated as: not likely contaminated, moderately contaminated, and heavily contaminated. This material may stockpiled in bulk or placed in containers within the waste characterization area and kept covered. Following removal of the pit soil, an in-place soil characterization program will be implemented to develop an excavation and segregation plan for clay liner soils and pit subsoils. The intent of this plan is to prevent mixing and disposing TSCA material with non-TSCA material. The excavated soil will be stockpiled or stored in bulk containers within the waste characterization area and kept covered.

The staging areas are shown on Figure 1.1 and the excavation layout is shown on Figure 1.2.

Characterization samples will be collected from all stockpiles and containers to develop soil disposal profiles. After profiles are developed, the soil would be loaded, and transported to an authorized facility.

Soil sampling procedures are described in further detail in the following sections and will follow the Sampling and Analysis Plan (SAP) prepared for the Site.

2. Soil Excavation and Management Plan

2.1 Excavation Plan

A work area bench will be constructed by removing the top 5 to 10 feet of overburden soil. The bench will extend 50 to 200 feet from the industrial waste pit excavation limits. The top soil will be kept segregated for future restoration use. Dozers and scrapers will be the primary equipment used for the majority of the overburden soil removal. Excavators reaching over and drawing soils from over the pit area will be used as the excavation approaches the top of the drum layer.

Since the maximum soil excavation depth will be greater than 20 feet, a licensed professional engineer will be required to certify an excavation plan in accordance with 29 CFR 1926.650 – 1926.652. The excavation will be designed with protective support through proper sloping. Based on the sandy soil type (Type C), the maximum allowable slope will be 1.5:1 (horizontal:vertical). Safe access and egress will be provided with a ramp on the north side of the excavation. The ramp will have a maximum allowable slope of 4:1 (horizontal:vertical). Air monitoring will be conducted within the excavation. The excavation layout and slopes are shown on Figure 1.2.

A competent person will make daily inspections of the excavation and adjacent areas for cave-ins, slope failure, air quality, and soil classification. Inspections will be conducted by the competent person prior to the start of the work and as needed throughout the shift. All inspections will be documented in writing. The competent person must:

- Have training in soil analysis
- Have training in the use of protective systems
- Be knowledgeable about trenching and shoring requirements
- Have the authority to immediately stop work and eliminate a hazard

The primary equipment to be utilized for the excavation work will be tracked excavators and rubber tired loaders.

Dewatering is not anticipated to be necessary. The bottom of the excavation will be a minimum of 2 feet above the encountered saturated conditions.

2.2 Staging Areas Overview

Two primary staging areas will be utilized within the exclusion zone. The staging area locations are shown on Figure 1.1.

The waste/soil characterization staging area will be located outside of and adjacent to the temporary enclosure. Stockpiled or containerized soil will be characterized within this staging area. Characterization samples will be collected and submitted for laboratory analysis to develop waste disposal profiles. Characterized and profiled soil will be moved to the non-hazardous or hazardous waste storage area.

A temporary non-hazardous and hazardous waste storage and loading area will be located adjacent to the waste consolidation and characterization area. This area will used to load the containers and wastes onto vehicles for transportation to the authorized disposal facilities.

2.3 Overburden Soil Excavation and Temporary Stockpiling

Soil excavation will begin with the removal of the 5 to 10 feet of cover soils over the industrial waste pit to at least 50 feet beyond the extents of the pit to create a work are bench. The area will be graded to drain surface water from the pit area to the excavation perimeter. A minimum of 1 foot of overburden soil will remain over the drummed waste to help control vapors. This clean overburden soil is presumed clean and will be stockpiled at the Site outside of the exclusion zone as shown on Figure 1.1. This soil will be utilized following the industrial waste pit and subsoil removal work to backfill the excavation and create final landfill grades. A polyethylene liner will be immediately placed over the pit area and left in place until the temporary building is constructed in order to prevent precipitation infiltration and provide vapor control

2.4 Pit Soil Excavation and Removal

Excavation of the drummed waste interval will begin on the north side of the industrial waste pit. A ramp will be excavated in the soil north of the industrial waste pit to allow equipment to uncover and access the drummed interval horizontally from the north. The drummed waste will be excavated and removed by working from the north to the south.

Soil surrounding the drums will be excavated as drums are removed. Loaders will move the excavated soil to the waste characterization area. This excavated soil will be field screened/visually inspected and segregated into like stockpiles. These stockpiles will be designated as: not likely contaminated, moderately contaminated, and heavily contaminated. This material may stockpiled in bulk or placed in stockpiled or stored in bulk containers within the waste characterization area and kept covered.

2.5 Pit Clay Liner and Subsoil Characterization

Following removal of the pit soil, an in-place soil characterization program will be implemented to develop a pit clay liner and subsoil excavation and segregation plan. The intent of this plan is to prevent mixing and disposing Toxic Substances Control Act (TSCA) material with non-TSCA material.

Prior to excavating the pit subsoil, soil samples will be collected on a grid size of 20 feet by 20 feet. Soil samples will be collected within every 2-foot lift to be excavated. The soil sample locations are shown on Figure 1.2. Five discrete samples will be collected from each grid cell and mixed. One composite sample will then be collected from the mixed soil and submitted for laboratory analysis of polychlorinated biphenyls (PCBs) and total volatile organic compounds (VOCs) and metals. Soil with PCB concentrations greater than 50 parts per million (ppm) will be classified as TSCA material. Soil with PCB concentrations less than 50 ppm will be classified as non-TSCA material. VOCs and metals concentrations evaluated to determine if the soil is a characteristic Resource Conservation and Recovery Act (RCRA) hazardous waste.

2.6 Pit Clay Liner and Subsoil Excavation and Removal

The pit clay liner and subsoil will be excavated from the south to the north. Soil will be excavated in 2-foot lifts from each 20-foot square grid cell. Each grid cell will contain approximately 30 cubic yards of soil. Loaders will move the excavated to the waste characterization area. Each lift will be placed in the appropriate stockpile or bulk container based on the subsoil characterization results. Stockpiles/containers will be designated as RCRA/TSCA, RCRA, or non-hazardous.

The excavation will proceed until saturated conditions are encountered. Excavation equipment loading near the capillary fringe has the potential to reduce pore sizes through compaction, thus increasing capillary action that can cause a localized draw-up of water from the capillary fringe. The result can be saturation of the soil above the capillary fringe which can cause soil pumping and destabilization. A minimum of 2 feet of soil between the excavation equipment and top of the capillary fringe will be maintained. In addition, low pressure ground equipment will be utilized for the bottom 5 feet of the excavation. MPCA will provide direction for the maximum excavation depth based on conditions encountered during the work.

2.7 Soil Disposal Characterization and Profiling

Excavated soil will be placed in stockpiles no larger than 100 cubic yards. Soil characterization analyses will be conducted on representative composite samples of the stockpiled soil and/or bulk containers to determine if the material is hazardous and to determine the appropriate action for disposal of the material off-Site. Characterization results will be used to create waste profiles and prepare manifests. Composite sampling will be conducted at a frequency of one sample per 100 cubic yards of material, in general accordance with the stockpile sampling protocols in the MPCA Draft Guidelines Risk Based Site Characterization and Sampling Guidance (September 1998). At minimum of ten discrete samples will be collected from each stockpile and mixed. One composite sample will then be collected from the mixed soil and submitted for laboratory analysis.

Sample containers will be pre-cleaned by the laboratory or purchased pre-cleaned. Sample containers will be inspected for damaged lids, cracks, or similar defects. Samples collected for off-Site analysis will be stored in cooled conditions (with ice or at 4°C). Samples will be shipped via overnight courier or hand delivered to the analytical laboratory using chain-of-custody protocols. Samples for off-Site analysis will be analyzed by a qualified, certified laboratory and standards laboratory QA/QC protocols. Sample preservation, packaging, shipment, and holding time requirements are outlined in the Sampling and Analysis Plan. Soil characterization tests will include:

- Ignitability
- Corrosivity
- Reactivity for cyanide and sulfides
- Totals analysis (VOCs, SVOCs, and metals)
- PCBs

Additional sampling and analysis requirements, if any, will be identified by the selected disposal facility and confirmed prior to the initiation of sampling activities.

2.8 Loading

Loading of all soil on to transport vehicles will be conducted within the temporary waste storage area. All off-Site transport vehicles will be DOT-approved and will be prepared as appropriate prior to receiving waste. All bulk material transport containers will be leak-proof, lined with a continuous sheet of polyethylene prior to loading, and/or will have sealed tailgates. All container doors/tailgates will be packed with desiccant material to prevent liquids from leaking during transport.

Care will be taken to prevent contamination of transport vehicles during loading. All vehicles leaving the Exclusion Zone, if necessary, will be decontaminated at a decontamination station located at the Exclusion Zone exit point. In the event effective decontamination cannot be accomplished using dry methods, a high-pressure wash will be performed. Decontamination water will be collected and contained at the decontamination station for subsequent removal and off-Site disposal. The Site Superintendent will inspect the Site entrance and street to ensure contamination/debris is not being tracked off Site.

2.9 Transportation and Disposal

Only transporters that are licensed by USEPA, US Department of Transportation (DOT), and the State of Minnesota will be used for the transport of hazardous materials. Transporters will have current licenses in the appropriate State(s) and comply with other applicable Federal laws including DOT requirements for wastes scheduled for transport to facilities outside the State of Minnesota. Transporters must comply with DOT regulations (49 CFR Parts 171-178) and EPA regulations (40 CFR Part 263) for shipment of hazardous wastes. If wastes are deemed to be non-hazardous, then transporters will be licensed for general transportation of non-hazardous wastes or as required by the State for the transport of Special Waste. Placards will be attached to each container and vehicle consistent with the waste manifest and in accordance with DOT regulations.

Transportation routes to off-Site disposal facilities will be predetermined prior to commencing off-Site transport of waste materials. A primary route to each disposal facility will be identified. Prior to the transport of any materials, the appropriate State and interstate officials will be consulted as to whether any proposed routes are scheduled for construction or seasonal closures during implementation of this project. Additionally, precautions will be taken in determining transport routes to minimize exposure to high-traffic areas, sensitive populations, and pedestrians.

All off-Site shipments of soil will be appropriately disposed at a facility in compliance with EPA's Off-Site Rule, 40 CFR 300.440. All facilities will be RCRA compliant and/or TSCA compliant, as applicable, and will comply with the Federal and State regulations and facility specific permits.

Any soil deemed to be non-hazardous and excavated from the pit area, excluding overburden soil, will be disposed at an authorized Subtitle D facility in accordance with applicable Federal and State regulations and facility specific permits.

Each designated disposal facility will provide an agreement to accept the waste from the Site. This agreement can be on any form typically used by the facility (such as a waste profile form) and will specify the total estimated quantities of wastes and the intended method of disposal for each waste stream. Each agreement will provide the facility name and USEPA Identification Number, facility location, name of responsible contact for facility, telephone number for the contact, and any additional waste characterization requirements.

The appropriate documentation will be generated and maintained for material transport from the Site to an off-Site facility. A waste shipment record, waste manifest, or bill of lading that identifies the generator, transporter, and disposal facility, and corresponding USEPA identification number, the nature of the material, the date and time the material was transported from the Site, and the weight or volume of material will be provided with each loaded transport vehicle. The manifest or bill of lading will be retained by the Site Superintendent for documentation purposes. Bills of lading will be issued for non-hazardous material removed from the Site. Upon receipt of the material, the disposal facility will be required to sign the manifest. A copy of the signed manifest will be returned to the generator or generator's designated representative for record-keeping purposes.

LEGEND:

- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- PROPERTY LINE
- EASEMENT LINE
- UC UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR

PLAN

SCALE 1" = 150'

0 150' 300'

PRELIMINARY

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
T 1 651 639 0913 **F** 1 651 639 0923 **W** www.ghd.com

Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

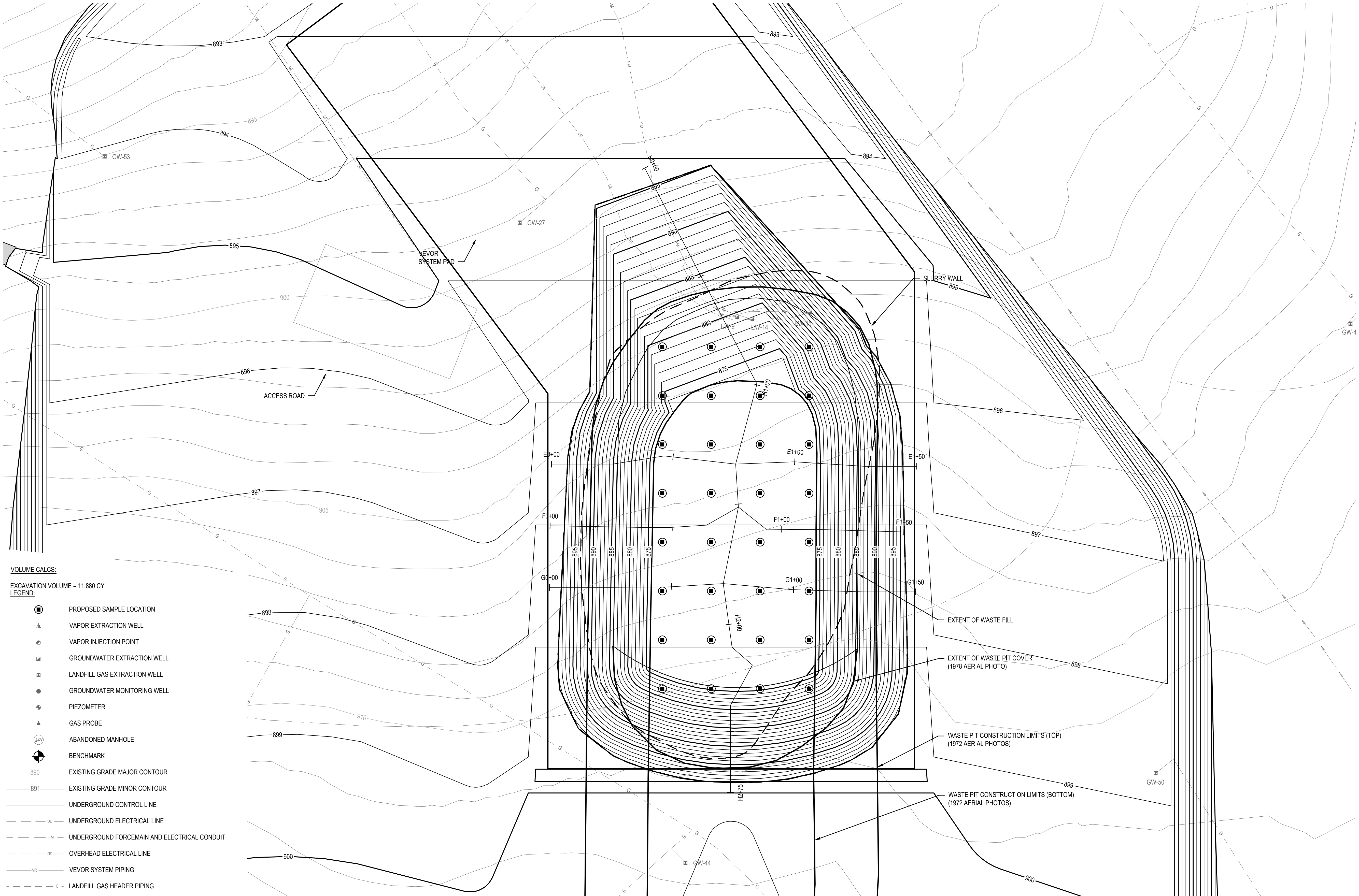
No.	Issue	Drawn	Approved	Date

Drawn C. ROHRICH	Designer T. REE
Drafting Check	Design Check
Project Manager R. MARTIN	Date MARCH 2018
This document shall not be used for construction unless signed and sealed for construction.	Scale 1" = 150'
Original Size ANSI D	Bar is one inch on original size sheet 0 1"
Project No. 11129194	

Title
STAGING PLAN

Sheet No.
FIGURE 1.1

Plot Date: 26 March 2018 - 4:20 PM Plotted By: Sean Pike Filename: p:\Drawings\11129000s\11129194\report 10\CADD\Drawings\Figures\11129194-FIG1.1.dwg



VOLUME CALCS:

EXCAVATION VOLUME = 11,880 CY

LEGEND:

- PROPOSED SAMPLE LOCATION
- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE
- 890 PROPOSED MAJOR CONTOUR
- 891 PROPOSED MINOR CONTOUR
- SLURRY WALL

PLAN

SCALE 1" = 20'

0 20' 40'

PRELIMINARY

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
St. Paul MN 55112 USA
T 1 651 639 0913 F 1 651 639 0923 W www.ghd.com

Client
MINNESOTA POLLUTION CONTROL AGENCY

Project
WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MARCH 2018
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 20'
Original Size	ANSI D	Bar is one inch on original size sheet 0 1"	

Project No. 11129194

Title
EXCAVATION LAYOUT

Sheet No.
FIGURE 1.2

Sheet 13 of 17

Appendix M
Potential Portable Truck Scale Information

WEIGH-TRONIX

BridgePort
Portable Truck Scales

For mining, road construction, asphalt installations, timber operations, construction, quarries—Anywhere there is an immediate need for a portable truck scale.

BridgePort Portable Truck Scales

Features and benefits

Installs anywhere—The self-contained modules install on any stable surface: bridge planks, concrete piers or blocks, a concrete slab or swamp pad, for example.

Easy to install or disassemble—In as little as four hours you can have a working scale. Only four bolts per module. Each module arrives pre-wired with quick-connectors between modules.

Built-in durability—BridgePort's sub-frame of strong, tubular steel increases stiffness and durability for frequent moves. Weigh Bar cable sheathed in stainless steel and routed through this tubular steel provides excellent protection from moisture, wear and rodents.

Dual layer deck design—Extra ruggedness to handle frequent moves. Each module is framed by 14" outside beams that run the length of the scale. The scale's 3/8" deck plate is supported by a grid of 5-inch beams running the length of the scale supported by 5" cross beams.

Proven Weigh Bar® reliability—In a three-year study on 250 truck scales, the Weigh Bar exhibited an annual failure rate of just 0.31%—compared with an industry standard of 3 to 5% for load cells.

Specifications

Dual Tandem Axle Rating: 80,000 lb

"r" factor rating: 2.35

Concentrated Load Capacity (CLC): 40 ton

Weight sensors: Four 50K Weigh Bars per module

Top plate: 3/8" checkered top plate

Profile: 19 inches

Finish: Sandblasted steel components with epoxy primer and alkyd top coat.

Junction boxes: Stainless steel NEMA 4

Approvals: NTEP

Surge Voltage Protection: Standard

Cable: Stainless steel sheathed

Model	Capacity	Platform length	Est. Ship. Wt.
BPV-2010-60T	120,000	20'	12,800
BPV-2510-60T	120,000	25'	14,200
BPV-3010-60T	120,000	30'	17,550
BPV-3510-60T	120,000	35'	21,158
BPV-4010-100T	200,000	20' +20'	25,600
BPV 5010-100T	200,000	25' + 25'	28,400
BPV 6010-100T	200,000	30' + 30'	35,100
BPV 7010-100T	200,000	35'+ 35'	42,300
BPV 7510-100T	200,000	25' + 25' + 25'	42,600
BPV 8010-100T	200,000	25' + 25' + 30'	45,950
BPV 9010-100T	200,000	30' + 30' + 30'	52,650
BPV 10510-100T	200,000	35' + 35' + 35'	63,450

OPTIONS

Battery operated or AC powered instrumentation

14' winged bulkheads

Welded guide rails

Steel gap cover (t-strips)

Accessory box for storage

Guide rails

11 and 12-foot platform widths

Weigh-Tronix
1000 Armstrong Dr.
Fairmont, MN 56031 USA
Telephone: 507-238-4461
Facsimile: 507-238-4195
e-mail: industrial@weigh-tronix.com
www.wtxweb.com

Weigh-Tronix Canada, ULC
217 Brunswick Blvd.
Pointe Claire, QC H9R 4R7 Canada
Telephone: 514-695-0380
Facsimile: 514-695-6820

WEIGH-TRONIX
Weighing Products & Systems

5/01 B-PORT_L.P65 PN 09697-0009A Printed in USA

WEIGH-TRONIX

BridgePort Truck Scale Rental Program

Renting truck scales has never been this easy!

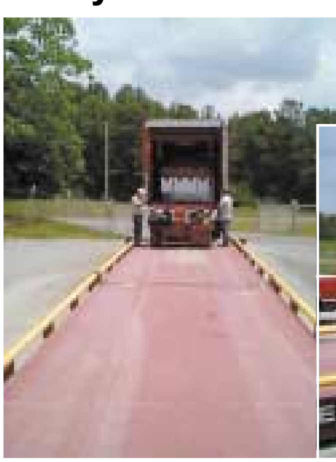
Do you have customers in temporary need of a truck scale for a quarry site, construction project, or any of a hundred other possible requirements? Weigh-Tronix is now stocking 70’ x 10’ and 35’ x 10’ truck scales at 6 strategic locations nationwide. Truck scales are available for short or long term rental needs, where and when you need them.

Rent the 70’ or 35’ size BridgePort truck scale complete with Model WI-127 instrument and printer from a location near you. The BridgePort is a ruggedly designed, self-contained, totally portable truck scale that has a capacity of 100 tons, an 80,000# DTA, and 3/8” steel deck.

The BridgePort comes equipped with bulkheads and safety guide rails. Installation can be accomplished in as little as 4 hours. Put down temporary piers, install the deck modules, grade material for a ramp, calibrate, and you’re ready to weigh.

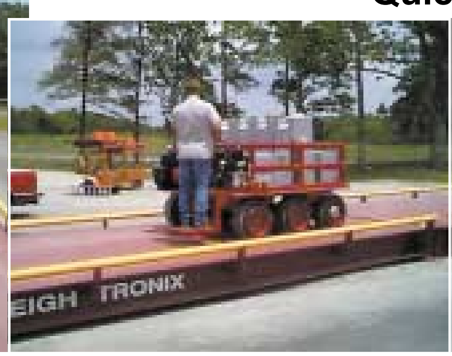
Rent the BridgePort by the month or for a longer term. Minimum rental period is one month. Call the customer service representatives in Fairmont, MN at 800-368-2044 for details and availability. The BridgePort is the perfect scale that will get your customer’s job done day after day—maybe starting the day after tomorrow.

Easy Installation



Great Service

Quick Setup



Weigh-Tronix
1000 Armstrong Dr.
Fairmont, MN 56031 USA
Telephone: 507-238-4461
Facsimile: 507-238-4195
e-mail: industrial@weigh-tronix.com
www.weigh-tronix.com

Weigh-Tronix Canada, ULC
217 Brunswick Blvd.
Pointe Claire, QC H9R 4R7 Canada
Telephone: 514-695-0380
Facsimile: 514-695-6820

WEIGH-TRONIX
Weighing Products & Systems

Appendix N
Example Wastewater Management Plan Outline

Final

Wastewater Management Plan - Outline

Waste Disposal Engineering Closed Landfill
Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

11129194| Report No __ | April 10, 2018

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Appendix O
General Stormwater Permit for Construction Activity Online Application and Example SWPPP Outline

1 - Application Readiness
2 - Prevention Opportunities
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7 - Project Information
8 - Permanent Stormwater Management
9 - Waterbodies
10 - Attachments
11 - Certification
12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Application Readiness

This online application is for coverage under MPCA's General Permit MN R100001 for stormwater discharge from construction activity. You must read the permit and complete all activities required prior to making the application for coverage.

Select all of the following check boxes to confirm your readiness to apply.

- [x] I have read the permit and my project is eligible according to the permit
- [x] I understand that incomplete applications cannot be processed
- [x] I am ready to make payment
- [x] My project is not taking place within the boundary of an Indian reservation

About eligibility:

- This online permit application is intended for new permit applications only. If your project is taking place on an already permitted site (e.g., you have purchased a residential lot that has been graded by the previous permit holder), you may use the Notice of Termination/Permit Modification Form to transfer the permit responsibilities to one or more parties. There is no fee associated with with this process. Email, mail, fax, or deliver the transfer application to the Minnesota Pollution Control Agency (MPCA). To see if a permit already exists, you can search construction stormwater permits. You also have the option to continue with this online application to obtain permit coverage, but the fee will still apply.
- A project commencing within designated Indian tribal land must obtain permit coverage from the U.S. Environmental Protection Agency (USEPA), not the MPCA.

About Payment:

- Payment of $400 is required. Transactions are done using U.S Bank's secure transaction service. You can pay using your bank account information (e-check) or by credit card (Visa or MasterCard). You will receive a separate electronic confirmation from U.S. Bank when your payment transcation is complete.

Continue

PREVENTION OPPORTUNITIES

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4 - Stormwater Pollution Prevention Plan
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6 - Project Location
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10 - Attachments
11 - Certification
12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Although it is not required, we'd appreciate that you answer the following questions, as well as additional questions that will appear depending on your answer.

To select a value in the list box, click an option. To select additional options, hold down the Control (Ctrl) key while you click.

Have you implemented any prevention activities in the past year?: No

Why not?:
Existing P2, further efforts infeasible
Insufficient capital
Lack of technical information
New facility, site or project
Not economically feasible

Check out MPCA's Pollution Prevention resources website to get started now.

Would you like to be contacted to discuss prevention opportunities?: No

** Required*

Continue

Environmental Review

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Please Note
You may click on a previously visited page (above) to navigate back to that screen.

*1. Was an environmental review required for this project or any part of a common plan of development or sale that includes this project?

*2. If Yes to #1, is the environmental review process complete?

3. If Yes to #2, please provide the following information:

*Responsible governmental unit (e.g., city, township, county, state or federal agency):

*Type of environmental review document:

*Completion date for environmental review (mm/dd/yyyy):

*4. If Yes to #2, has mitigation identified in the environmental review been incorporated into a stormwater pollution prevention plan (SWPPP)?

Continue

** Required*

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Stormwater Pollution Prevention Plan

A stormwater pollution prevention plan (SWPPP) is required for each project. Review the following questions to make sure that you have properly prepared a SWPPP.

SWPPP

*Has a SWPPP been developed for this project and incorporated into the project's plans and specifications as required in the General Stormwater Permit Part III.A? | Yes

Discharges to Special or Impaired Waters

*Does your project have a discharge point within one mile (aerial radius measurement) of a special water or a water that is impaired for sediment or a sediment related parameter (see Appendix A, Part B.10)? | Yes

*If your project has a discharge point within one mile (aerial radius measurement) of a special water or a water that is impaired for sediment or a sediment related parameter (see Appendix A, Part B.10), does the SWPPP contain the additional requirements found in Appendix A, Parts A-C? | Yes

(If the project does not have a discharge point within one mile of a special water or a water that is impaired for sediment or a sediment related parameter of the permit, select Not Applicable).

Continue

** Required*

1 - Application Readiness
2 - Prevention Opportunities
3 - Environmental Review
4 - Stormwater Pollution Prevention Plan
5 - Contacts
6 - Project Location
7 - Project Information
8 - Permanent Stormwater Management
9 - Waterbodies
10 - Attachments
11 - Certification
12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

CONTACTS

1. Owner | 2. Contractor

1. Owner

Save to My Favorite Contacts

Enter information for the owner of the company or organization for which this construction project is being done.

If there is an owner contact who is different from the owner, also add an Owner Contact. From the Available Contact Types list at the bottom of the page, select Owner Contact and click Add Contact.

Note: *Selecting an option below will replace all information for this contact.*
Insert From Existing Contact(s)...

***First Name:**	Patrick	***Address Line 1:**	520 Lafayette Road
Middle Initial:		**Address Line 2:**	
***Last Name:**	Hanson	**Address Line 3:**	
Title:		***State:**	Minnesota
***E-Mail Address:**	pat.hanson@state.mn.us	***County:**	Ramsey
***Confirm E-Mail:**	pat.hanson@state.mn.us	***City:**	Saint Paul
***Organization Name:**	Minnesota Pollution Control Agency	***ZIP Code:**	55155

*** At least 1 phone number is required.**

*Type	*Contact Number	Extension	Comments	Remove
Office Phone Number	(651) 757-2409			

Add Number

** Required*

CONTACTS

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

1. Owner | 2. Contractor

2. Contractor

Save to My Favorite Contacts

Enter information for the party in contract with the owner to construct the project.

If there is a construction site contact who is different from the contractor, also add a Construction Site Contact. From the Available Contact Types list at the bottom of the page, select Construction Site Contact and click Add Contact.

If you are an applicant who is different from the owner or contractor, also add a Third-Party Applicant contact. From the Available Contact Types list at the bottom of the page, select Third-Party Applicant and click Add Contact.

Note: *Selecting an option below will replace all information for this contact.*
Insert From Existing Contact(s)...

***First Name:**
Middle Initial:
***Last Name:**
Title:
***E-Mail Address:**
***Confirm E-Mail:**
***Organization Name:**

***Address Line 1:**
Address Line 2:
Address Line 3:
***State:** Minnesota
***County:**
***City:**
***ZIP Code:**

*** At least 1 phone number is required.**

*Type	*Contact Number	Extension	Comments	Remove

Add Number

** Required*

1 - Application Readiness
2 - Prevention Opportunities
3 - Environmental Review
4 - Stormwater Pollution Prevention Plan
5 - Contacts
6 - Project Location
7 - Project Information
8 - Permanent Stormwater Management
9 - Waterbodies
10 - Attachments
11 - Certification
12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Project Location

Enter the following information to describe the project location that will be covered by this permit. Either an address or location description is required.

To enter the latitude and longitude for a location, either type the coordinate values or click Map to find the coordinates on a map. After clicking Map, zoom in closely to your site, click the approximate center of the site, and then the latitude and longitude will transfer to this page. After the coordinates transfer, you can close the Map window. You can also verify typed coordinates by clicking Map.

Tip: If the map isn't displayed in Internet Explorer, click Show All Content at the bottom of the window. In other browsers, click the shield icon at the top of the window and select to unblock content.

Address Line 1:

Address Line 2:

Address Line 3:

***State:** Minnesota

***County:**

City:

***Zip/Postal Code:**

Location Description:

Coordinate System:

***Latitude:**

***Longitude:**

***Collection Method:**

Map

Continue

** Required*

1 - Application Readiness
2 - Prevention Opportunities
3 - Environmental Review
4 - Stormwater Pollution Prevention Plan
5 - Contacts
6 - Project Location
7 - Project Information
8 - Permanent Stormwater Management
9 - Waterbodies
10 - Attachments
11 - Certification
12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Project Information

Enter the following information to describe the project that will be covered by this permit.

General Project Information

*Project name:	Hazardous Waste Pit Excava
*Project type:	Other
If Other, please describe:	Environmental
*Construction start date (mm/dd/yyyy):	
*Estimated completion date (mm/dd/yyyy):	

Project Size

*Disturbed area of project in acres (Example: 15.50):	
*Existing area of impervious surface in acres within the disturbed area of the project (Example: 6.33):	
*Post-construction area of impervious surface in acres within the disturbed area of the project (Example: 10.75):	

Continue

** Required*

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

Waterbodies

Are there surface waters within one mile of the project boundary that will receive stormwater from the site or discharge from a permanent stormwater management system? Yes

If Yes, identify the surface waters below. Include waters shown on a USGS 7.5 minute quad map or equivalent *and* all waters identified in Appendix A of the permit. For each waterbody, enter a unique name. If waterbodies have the same given name (e.g., pond, pond), add a number after each name to make it unique (e.g., pond 1, pond 2).

If No, continue to the next page.

*Waterbody Name	*Type	*Special Water?	*Impaired Water?	Remove
Coon Creek	Stream	No	Yes	

Add Row

Continue

** Required*

- 1 - Application Readiness
- 2 - Prevention Opportunities
- 3 - Environmental Review
- 4 - Stormwater Pollution Prevention Plan
- 5 - Contacts
- 6 - Project Location
- 7 - Project Information
- 8 - Permanent Stormwater Management
- 9 - Waterbodies
- 10 - Attachments
- 11 - Certification
- 12 - Payment

Please Note
You may click on a previously visited page (above) to navigate back to that screen.

CERTIFICATION

To sign electronically, please click on the blue ribbon.

Required	Name	Signature Type	Signature Status	Sign Electronically
✓		Certifier	Not Signed	

Clicking a column title will sort the table by that column.

Continue

Final

Stormwater Pollution Prevention Plan

Waste Disposal Engineering Closed Landfill

Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

11129194| Report No __ | April 10, 2018

Table of Contents

Figure Index

Table Index

Appendix Index

Appendix P
MCES One Time Industrial Discharge Approval Request

March 20, 2018 Reference No. 11129194

Mr. Michael Flaherty
Industrial Waste and Pollution Prevention Section
Metropolitan Council Environmental Services
390 North Robert Street
St. Paul, Minnesota 55101-1805

Dear Mr. Flaherty:

Re: One-Time Industrial Discharge Approval Request Form
Waste Disposal Engineering (WDE) Closed Landfill
14437 NW Crosstown Blvd
Andover, Minnesota

Please find enclosed the One-Time Industrial Discharge Approval Request form related to the discharge of remediation equipment/materials decontamination fluids and dewatering fluids expected to be generated during industrial waste pit removal activities at the WDE Closed Landfill in Andover, Minnesota.

Should you have any questions regarding this matter, please do not hesitate to call.

Sincerely,

GHD

Tim Ree

JH/sb/1

Encl.

Metropolitan Council Environmental Services
Industrial Waste & Pollution Prevention Section
390 North Robert Street
St. Paul, Minnesota 55101-1805

For MCES Use Only
Date Received: ______
Staff: ______
Approval No: ______

ONE-TIME INDUSTRIAL DISCHARGE APPROVAL REQUEST FORM

A. General Information:

1. **Responsible Party/Company Name:** Minnesota Pollution Control Agency

   Responsible Person: Ben Klismith **Title:** Project Manager

   Email Address: Benjamin.klismith@state.mn.us **Phone:** 651-757-2497

   Mailing Address: 520 Lafayette Road North
   St. Paul, MN 55155-4194

2. **Site Name:** WDE Closed Landfill

   Site Address: 14437 NW Crosstown Blvd
   Andover, MN 55304

3. **Requester Name/ Company:** Robert Martin / GHD

   Requester Address: 1801 Old Hwy 8 NW Suite 114
   St. Paul, MN 55112 **Phone:** 651-639-0913

   Email Address: robert.martin@ghd.com

4. **Billing Contact Name:** Ben Klismith **Phone:** 651-639-0913

5. **Federal Tax ID No. of Financially Responsible Party:** __ __-__ __ __ __ __ __ __

6. **MCES Engineer Contact:** Michael Flaherty

B. Waste Characteristics/Site Information:

1. Describe waste: Liquid wastes generated during excavation activities including decontamination fluids, and dewatering liquids. See Attachment A for additional detail.
2. Are there any MSDS sheets applicable to the waste? ___ Yes _X_ No
   (Attach relevant MSDS sheets.)
3. Location of waste (tank, sump, barrel, etc.): Wastes will be containerized in tanks.
4. Volume of waste: 5,000-10,000-gallon tanks
5. Frequency of discharge: ___ One-time _X_ On-going

   If on-going, please note the number or frequency of discharge events per year: Weekly for 2-3 months
6. How soon does the waste need to be removed? Waste needs to be discharged weekly.
7. Means of disposal into the Metropolitan Disposal System (MDS):

   ___Transport to MCES Disposal Site. Hauler's Name: ______

   _X_ Discharge on site to sanitary sewer. Identify proposed point of discharge and attach a map: Discharge at edge of aeration pond – see attached figure

8. List below the analytes specified by MCES for analysis. **Attach copies of all laboratory data sheets to this request.**

√	Analyte
	Chemical Oxygen Demand (COD)
	Total Suspended Solids (TSS)
√	pH
√	Cadmium
√	Chromium
√	Copper
√	Lead
√	Mercury
√	Nickel
√	Zinc
	Phosphorus

√	Additional Analyte(s)
√	Cyanide - total
√	VOCs
√	SVOCs
√	Pesticides/Polychlorinated Biphenyls

C. Additional Pertinent Information: (Attach additional information if necessary)

Figure 1: Site Location

Figure 2: One-Time Discharge Approval Proposed Location

Attachment A – One-Time Industrial Discharge Approval Request Summary

Attachment B – Pre-Design Investigation Decontamination Liquid Analytical Results

Attachment C - Community Review Form – Special Discharge to Sanitary Sewer

Attachment D - One-Time Industrial Discharge Approval Transfer Form

D. Public Information Policy

Most documents required by MCES, are considered to be public information. However, if a person considers specific information submitted to MCES to be "trade secret information" as defined by state and federal laws, the person may mark each page containing such information as "trade secret information." If the marked items are determined to be "trade secret information," then to the extent allowed by law, MCES will make reasonable efforts to maintain their non-public status. However, MCES is not liable to any persons for disclosure of such information.

E. Certification of Information

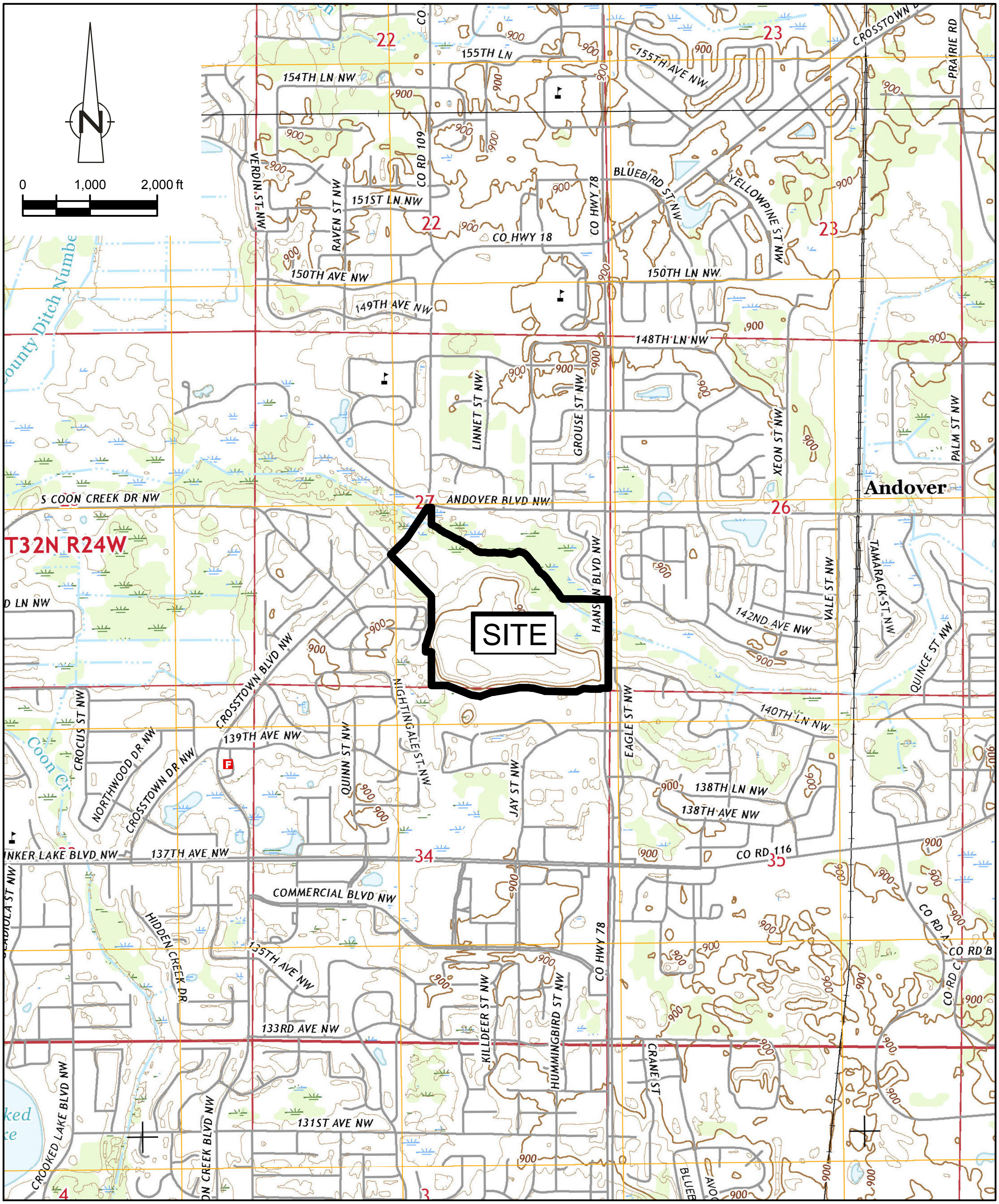
I hereby certify that the information supplied in this request is correct and complete to the best of my knowledge.

Name (Print): Benjamin Klismith Title: Project Manager

Signature: Ben Klismith Date: 3/14/18

Email: Benjamin.klismith@state.mn.us Phone: 651-757-2497

Send completed request to address at the top of this form. For further questions regarding this request, contact the Industrial Waste & Pollution Prevention Office at: 651-602-4703, Fax: 651-602-4730.



Source: USGS US Topo 7.5-Minute Series - Coon Rapids 2016; Cedar 2016

WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
14437 NW CROSSTOWN BLVD
ANDOVER, MINNESOTA

11129194-31
Nov 1, 2017

SITE LOCATION

FIGURE 1

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-MISC\11129194-31(MISC004)\11129194-31(MISC004)GIS-SP001.mxd

0 25 50 75 100 ft

N

WASTE DISPOSAL ENGINEERING INC. CLOSED LANDFILL
14437 NW CROSSTOWN BLVD
ANDOVER, MINNESOTA

ONE-TIME DISCHARGE APPROVAL PROPOSED LOCATION

11129194-31
Nov 1, 2017

FIGURE 2

GIS File: I:\GIS\Projects\8-chars\11------\1112----\111291--\11129194\11129194-MISC\11129194-31(MISC004)\11129194-31(MISC004)GIS-SP002.mxd

Attachment A
One-Time Industrial Discharge Approval Request Summary

Attachment A

One-Time Industrial Discharge Approval Request Summary

The Minnesota Pollution Control Agency (MPCA) is preparing design and bid documents for the removal of an industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill located at 14437 NW Crosstown Blvd, Andover, MN. The Site location is shown in Figure 1. GHD Services Inc. (GHD) has prepared this One-Time Industrial Discharge Approval Request on behalf of the Minnesota Pollution Control Agency (MPCA). This application seeks MCES approval for the discharge of remediation equipment/materials decontamination fluids and dewatering fluids into the sanitary sewer during the removal action. Following award of the project to the selected contractor, it is expected that the industrial discharge approval and associated requirements will be transferred from the MPCA to the awarded contractor using the attached One-Time Industrial Discharge Approval Transfer Form. Also attached to this application is a Community Review Form. The industrial waste pit removal action is expected to take place in the timeframe of September-November 2018.

GHD is preparing design and bid documents for the removal of the industrial waste pit. The industrial waste pit was constructed using a 2-foot clay layer overlain with an asphalt liner and aggregate layer. Industrial wastes were disposed in the pit from 1972 to approximately 1975 and consisted primarily of drummed solvents, acids, paints, oils, etc. It has been estimated that approximately 6,000 drums were placed in the pit. Contaminants identified at the Site that have the potential to impact liquid generated in the removal action include, but are not limited to:

- Cadmium
- Chromium
- Lead
- Benzene
- Carbon tetrachloride
- 1,4-Dichlorobenzene
- 1,2-Dichloroethane
- 1,1-Dichloroethene
- 2,4-Dinitrotoluene
- Hexachlorobenzene
- Hexachlorobutadiene
- Hexachloroethane
- 2-Butanone
- Nitrobenzene
- Pentachlorophenol
- Tetrachloroethene
- Trichloroethene
- 2,4,6-Trichlorophenol

- Vinyl Chloride
- Cyanide
- PCBs

The majority of liquids proposed to be discharged to the sanitary sewer will be from the decontamination of materials and equipment along with any dewatering needs. If dewatering is needed, it is expected to be the result of precipitation entering the excavation as no work is planned below the groundwater table. The need for dewatering will be minimized with the use of temporary buildings erected above the excavation and storage areas. It is expected that liquids generated during the pit removal will be stored in temporary tanks that will likely range in size from 5,000-10,000 gallons. Discharge will be conducted on an as-needed basis when a tank approaches capacity. Prior to discharge, the tank contents will be sampled to confirm compliance with MCES special discharge approval requirements. If necessary, the contents will be treated to meet special discharge approval requirements. Once confirmed, MCES will be provided the analytical results and discharge will commence following MCES approval. It is expected that the waste liquids will be loaded/transported from the pit location to the on-Site aeration pond. The on-Site aeration pond discharges to a sanitary sewer on Crosstown Boulevard. Tank liquids will be either pumped or gravity drained into the aeration pond at a flow rate of up to 100-gpm. Discharge volume will be measured using a metered discharge line or determined and recorded using a tank calibration chart.

Analytical results of decontamination liquids generated in a pre-design investigation is attached to this application for reference and provides an estimation of constituents and concentrations that will likely be encountered. It is expected that a significant amount of the liquid generated will not meet MCES discharge requirements. Prior to each discharge, liquids will be tested according to the one-time discharge approval requirements. If a parameter is detected above the MCES requirements, the liquid will be either treated on-Site to meet the discharge approval requirements or transported off-Site for treatment and/or disposal. Due to the quantity of potential contaminants, it is expected that liquids will require carbon treatment and transfer of treated water to temporary tanks. If on-Site treatment is performed, the treated water will again be tested to confirm compliance with the discharge approval requirements prior to requesting MCES review and approval for tank discharge. The discharge location will be at the southeast corner of the on-Site aeration pond. The discharge location is depicted along with coordinates in the attached Figure 2.

Attachment B
Pre-Design Investigation Decontamination Liquid Analytical Results

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719001	**LWM-042717-JH-001**					
EPA 8082A	PCB-1242 (Aroclor 1242)	5.5	ug/L	0.20	05/08/17 14:47	
EPA 6010C	Aluminum	17700	ug/L	200	05/05/17 12:31	
EPA 6010C	Antimony	4.5J	ug/L	20.0	05/05/17 12:31	
EPA 6010C	Arsenic	4.8J	ug/L	20.0	05/05/17 12:31	
EPA 6010C	Barium	175	ug/L	10.0	05/05/17 12:31	
EPA 6010C	Beryllium	1.4J	ug/L	5.0	05/05/17 12:31	
EPA 6010C	Cadmium	1.6J	ug/L	3.0	05/05/17 12:31	
EPA 6010C	Calcium	85200	ug/L	500	05/05/17 12:31	
EPA 6010C	Chromium	775	ug/L	10.0	05/05/17 12:31	
EPA 6010C	Cobalt	18.9	ug/L	10.0	05/05/17 12:31	
EPA 6010C	Copper	330	ug/L	10.0	05/05/17 12:31	
EPA 6010C	Iron	12400	ug/L	50.0	05/05/17 12:31	
EPA 6010C	Lead	189	ug/L	10.0	05/05/17 12:31	
EPA 6010C	Magnesium	20900	ug/L	500	05/05/17 12:31	
EPA 6010C	Manganese	2400	ug/L	5.0	05/05/17 12:31	
EPA 6010C	Nickel	35.9	ug/L	20.0	05/05/17 12:31	
EPA 6010C	Potassium	6030	ug/L	2500	05/05/17 12:31	
EPA 6010C	Sodium	342000	ug/L	1000	05/05/17 12:31	
EPA 6010C	Vanadium	24.4	ug/L	15.0	05/05/17 12:31	
EPA 6010C	Zinc	1270	ug/L	20.0	05/05/17 12:31	
EPA 7470A	Mercury	0.64	ug/L	0.20	05/03/17 19:10	
EPA 8270D	Phenol	28500	ug/L	10200	05/10/17 21:04	
EPA 8270D	1,2-Dichlorobenzene	733	ug/L	102	05/10/17 20:32	
EPA 8270D	2-Methylphenol(o-Cresol)	47.3J	ug/L	102	05/10/17 20:32	
EPA 8270D	3&4-Methylphenol(m&p Cresol)	121J	ug/L	204	05/10/17 20:32	
EPA 8270D	Isophorone	1130	ug/L	102	05/10/17 20:32	
EPA 8270D	Naphthalene	37.3J	ug/L	102	05/10/17 20:32	
EPA 8270D	Di-n-butylphthalate	34.5J	ug/L	102	05/10/17 20:32	
EPA 8270D	bis(2-Ethylhexyl)phthalate	289	ug/L	102	05/10/17 20:32	
EPA 8260B	Acetone	376000	ug/L	20000	05/09/17 17:42	C0,CH
EPA 8260B	Benzene	110J	ug/L	200	05/07/17 13:33	
EPA 8260B	2-Butanone (MEK)	47200	ug/L	1000	05/07/17 13:33	
EPA 8260B	Chlorobenzene	2450	ug/L	200	05/07/17 13:33	
EPA 8260B	1,2-Dichlorobenzene	1310	ug/L	200	05/07/17 13:33	
EPA 8260B	1,1-Dichloroethane	2670	ug/L	200	05/07/17 13:33	
EPA 8260B	1,2-Dichloroethane	72.1J	ug/L	200	05/07/17 13:33	
EPA 8260B	cis-1,2-Dichloroethene	464	ug/L	200	05/07/17 13:33	
EPA 8260B	Dichlorofluoromethane	58.4J	ug/L	200	05/07/17 13:33	
EPA 8260B	Ethylbenzene	8560	ug/L	200	05/07/17 13:33	
EPA 8260B	Isopropylbenzene (Cumene)	88.4J	ug/L	200	05/07/17 13:33	
EPA 8260B	Methylene Chloride	44300	ug/L	800	05/07/17 13:33	
EPA 8260B	4-Methyl-2-pentanone (MIBK)	5600	ug/L	1000	05/07/17 13:33	
EPA 8260B	Naphthalene	60.0J	ug/L	800	05/07/17 13:33	B
EPA 8260B	n-Propylbenzene	76.7J	ug/L	200	05/07/17 13:33	
EPA 8260B	Styrene	697	ug/L	200	05/07/17 13:33	
EPA 8260B	Tetrachloroethene	4410	ug/L	200	05/07/17 13:33	
EPA 8260B	Tetrahydrofuran	4870	ug/L	2000	05/07/17 13:33	
EPA 8260B	Toluene	46700	ug/L	1000	05/09/17 17:42	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719001	**LWM-042717-JH-001**					
EPA 8260B	1,1,1-Trichloroethane	45100	ug/L	800	05/07/17 13:33	
EPA 8260B	1,1,2-Trichloroethane	131J	ug/L	200	05/07/17 13:33	
EPA 8260B	Trichloroethene	69300	ug/L	400	05/09/17 17:42	
EPA 8260B	Trichlorofluoromethane	265	ug/L	200	05/07/17 13:33	
EPA 8260B	1,2,4-Trimethylbenzene	398	ug/L	200	05/07/17 13:33	
EPA 8260B	1,3,5-Trimethylbenzene	131J	ug/L	200	05/07/17 13:33	
EPA 8260B	Xylene (Total)	39500	ug/L	600	05/07/17 13:33	
SM 4500-H+B	pH at 25 Degrees C	8.4	Std. Units	0.10	05/04/17 10:05	H6
10386719002	**LWM-042717-JH-002**					
EPA 8082A	PCB-1242 (Aroclor 1242)	1.3	ug/L	0.10	05/07/17 06:12	
EPA 6010C	Aluminum	5730	ug/L	200	05/05/17 13:04	
EPA 6010C	Antimony	5.8J	ug/L	20.0	05/05/17 13:04	
EPA 6010C	Barium	40.9	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Beryllium	1.7J	ug/L	5.0	05/05/17 13:04	
EPA 6010C	Cadmium	1.4J	ug/L	3.0	05/05/17 13:04	
EPA 6010C	Calcium	76000	ug/L	500	05/05/17 13:04	
EPA 6010C	Chromium	1260	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Cobalt	24.0	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Copper	232	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Iron	5360	ug/L	50.0	05/05/17 13:04	
EPA 6010C	Lead	15.2	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Magnesium	18500	ug/L	500	05/05/17 13:04	
EPA 6010C	Manganese	2850	ug/L	5.0	05/05/17 13:04	
EPA 6010C	Nickel	45.8	ug/L	20.0	05/05/17 13:04	
EPA 6010C	Potassium	4970	ug/L	2500	05/05/17 13:04	
EPA 6010C	Silver	0.29J	ug/L	10.0	05/05/17 13:04	
EPA 6010C	Sodium	90400	ug/L	1000	05/05/17 13:04	
EPA 6010C	Vanadium	4.8J	ug/L	15.0	05/05/17 13:04	
EPA 6010C	Zinc	1930	ug/L	20.0	05/05/17 13:04	
EPA 8270D	Phenol	50900	ug/L	10400	05/10/17 22:07	
EPA 8270D	1,2-Dichlorobenzene	1220	ug/L	104	05/10/17 21:35	
EPA 8270D	2-Methylphenol(o-Cresol)	72.8J	ug/L	104	05/10/17 21:35	
EPA 8270D	3&4-Methylphenol(m&p Cresol)	231	ug/L	207	05/10/17 21:35	
EPA 8270D	Isophorone	1600	ug/L	207	05/11/17 13:45	
EPA 8270D	Naphthalene	50.6J	ug/L	104	05/10/17 21:35	
EPA 8260B	Acetone	440000	ug/L	20000	05/09/17 17:58	C0,CH
EPA 8260B	Benzene	134J	ug/L	200	05/07/17 13:49	
EPA 8260B	2-Butanone (MEK)	58400	ug/L	1000	05/07/17 13:49	
EPA 8260B	Chlorobenzene	2630	ug/L	200	05/07/17 13:49	
EPA 8260B	1,2-Dichlorobenzene	1660	ug/L	200	05/07/17 13:49	
EPA 8260B	1,1-Dichloroethane	3080	ug/L	200	05/07/17 13:49	
EPA 8260B	1,2-Dichloroethane	71.3J	ug/L	200	05/07/17 13:49	
EPA 8260B	cis-1,2-Dichloroethene	624	ug/L	200	05/07/17 13:49	
EPA 8260B	Dichlorofluoromethane	67.0J	ug/L	200	05/07/17 13:49	
EPA 8260B	Ethylbenzene	10400	ug/L	200	05/07/17 13:49	
EPA 8260B	Isopropylbenzene (Cumene)	103J	ug/L	200	05/07/17 13:49	
EPA 8260B	Methylene Chloride	72300	ug/L	4000	05/09/17 17:58	

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SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719002	**LWM-042717-JH-002**					
EPA 8260B	4-Methyl-2-pentanone (MIBK)	3460	ug/L	1000	05/07/17 13:49	
EPA 8260B	Naphthalene	59.6J	ug/L	800	05/07/17 13:49	B
EPA 8260B	n-Propylbenzene	91.1J	ug/L	200	05/07/17 13:49	
EPA 8260B	Styrene	69.2J	ug/L	200	05/07/17 13:49	
EPA 8260B	Tetrachloroethene	5120	ug/L	200	05/07/17 13:49	
EPA 8260B	Toluene	59100	ug/L	1000	05/09/17 17:58	
EPA 8260B	1,1,1-Trichloroethane	44500	ug/L	800	05/07/17 13:49	
EPA 8260B	Trichloroethene	75800	ug/L	400	05/09/17 17:58	
EPA 8260B	Trichlorofluoromethane	323	ug/L	200	05/07/17 13:49	
EPA 8260B	1,2,4-Trimethylbenzene	401	ug/L	200	05/07/17 13:49	
EPA 8260B	1,3,5-Trimethylbenzene	130J	ug/L	200	05/07/17 13:49	
EPA 8260B	Xylene (Total)	47400	ug/L	600	05/07/17 13:49	
SM 4500-H+B	pH at 25 Degrees C	6.2	Std. Units	0.10	05/04/17 10:09	H6
10386719003	**LWM-042717-JH-003**					
EPA 6010C	Aluminum	8810	ug/L	200	05/05/17 13:07	
EPA 6010C	Barium	104	ug/L	10.0	05/05/17 13:07	
EPA 6010C	Beryllium	0.41J	ug/L	5.0	05/05/17 13:07	
EPA 6010C	Calcium	41500	ug/L	500	05/05/17 13:07	
EPA 6010C	Chromium	110	ug/L	10.0	05/05/17 13:07	
EPA 6010C	Cobalt	4.6J	ug/L	10.0	05/05/17 13:07	
EPA 6010C	Copper	80.8	ug/L	10.0	05/05/17 13:07	
EPA 6010C	Iron	4640	ug/L	50.0	05/05/17 13:07	
EPA 6010C	Lead	7.9J	ug/L	10.0	05/05/17 13:07	
EPA 6010C	Magnesium	12000	ug/L	500	05/05/17 13:07	
EPA 6010C	Manganese	655	ug/L	5.0	05/05/17 13:07	
EPA 6010C	Nickel	8.7J	ug/L	20.0	05/05/17 13:07	
EPA 6010C	Potassium	3530	ug/L	2500	05/05/17 13:07	
EPA 6010C	Sodium	64100	ug/L	1000	05/05/17 13:07	
EPA 6010C	Vanadium	9.0J	ug/L	15.0	05/05/17 13:07	
EPA 6010C	Zinc	251	ug/L	20.0	05/05/17 13:07	
EPA 8270D	Phenol	4870	ug/L	515	05/10/17 23:10	
EPA 8270D	1,2-Dichlorobenzene	386	ug/L	51.5	05/10/17 22:39	
EPA 8270D	2-Methylphenol(o-Cresol)	10.1J	ug/L	10.3	05/08/17 21:36	
EPA 8270D	3&4-Methylphenol(m&p Cresol)	28.7	ug/L	20.6	05/08/17 21:36	
EPA 8270D	Isophorone	621	ug/L	51.5	05/10/17 22:39	
EPA 8270D	Naphthalene	33.0	ug/L	10.3	05/08/17 21:36	
EPA 8270D	2-Methylnaphthalene	2.5J	ug/L	10.3	05/08/17 21:36	
EPA 8270D	Diethylphthalate	1.9J	ug/L	10.3	05/08/17 21:36	
EPA 8260B	Acetone	45200	ug/L	2000	05/09/17 14:12	CH,L1
EPA 8260B	Benzene	19.7J	ug/L	100	05/09/17 14:12	
EPA 8260B	2-Butanone (MEK)	7310	ug/L	500	05/09/17 14:12	CH,L1
EPA 8260B	Chlorobenzene	239	ug/L	100	05/09/17 14:12	
EPA 8260B	1,2-Dichlorobenzene	520	ug/L	100	05/09/17 14:12	
EPA 8260B	1,1-Dichloroethane	733	ug/L	100	05/09/17 14:12	
EPA 8260B	cis-1,2-Dichloroethene	128	ug/L	100	05/09/17 14:12	
EPA 8260B	Ethylbenzene	1710	ug/L	100	05/09/17 14:12	
EPA 8260B	Methylene Chloride	10200	ug/L	400	05/09/17 14:12	

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SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719003	**LWM-042717-JH-003**					
EPA 8260B	4-Methyl-2-pentanone (MIBK)	1310	ug/L	500	05/09/17 14:12	
EPA 8260B	Naphthalene	52.5J	ug/L	400	05/09/17 14:12	B
EPA 8260B	Styrene	93.6J	ug/L	100	05/09/17 14:12	
EPA 8260B	Tetrachloroethene	1700	ug/L	100	05/09/17 14:12	
EPA 8260B	Toluene	8700	ug/L	100	05/09/17 14:12	
EPA 8260B	1,1,1-Trichloroethane	13100	ug/L	400	05/09/17 14:12	
EPA 8260B	Trichloroethene	10900	ug/L	40.0	05/09/17 14:12	
EPA 8260B	Trichlorofluoromethane	51.1J	ug/L	100	05/09/17 14:12	
EPA 8260B	1,2,4-Trimethylbenzene	73.2J	ug/L	100	05/09/17 14:12	B
EPA 8260B	Xylene (Total)	7740	ug/L	300	05/09/17 14:12	
SM 4500-H+B	pH at 25 Degrees C	6.9	Std. Units	0.10	05/04/17 10:11	H6
10386719004	**LWM-042717-JH-004**					
EPA 6010C	Aluminum	5510	ug/L	200	05/05/17 13:10	
EPA 6010C	Arsenic	4.0J	ug/L	20.0	05/05/17 13:10	
EPA 6010C	Barium	106	ug/L	10.0	05/05/17 13:10	
EPA 6010C	Beryllium	0.29J	ug/L	5.0	05/05/17 13:10	
EPA 6010C	Cadmium	0.34J	ug/L	3.0	05/05/17 13:10	
EPA 6010C	Calcium	36000	ug/L	500	05/05/17 13:10	
EPA 6010C	Chromium	45.6	ug/L	10.0	05/05/17 13:10	
EPA 6010C	Cobalt	3.0J	ug/L	10.0	05/05/17 13:10	
EPA 6010C	Copper	81.9	ug/L	10.0	05/05/17 13:10	
EPA 6010C	Iron	4010	ug/L	50.0	05/05/17 13:10	
EPA 6010C	Lead	8.0J	ug/L	10.0	05/05/17 13:10	
EPA 6010C	Magnesium	10900	ug/L	500	05/05/17 13:10	
EPA 6010C	Manganese	389	ug/L	5.0	05/05/17 13:10	
EPA 6010C	Nickel	5.5J	ug/L	20.0	05/05/17 13:10	
EPA 6010C	Potassium	3330	ug/L	2500	05/05/17 13:10	
EPA 6010C	Sodium	60700	ug/L	1000	05/05/17 13:10	
EPA 6010C	Vanadium	7.8J	ug/L	15.0	05/05/17 13:10	
EPA 6010C	Zinc	103	ug/L	20.0	05/05/17 13:10	
EPA 8270D	Phenol	660	ug/L	51.0	05/10/17 23:42	
EPA 8270D	1,2-Dichlorobenzene	322	ug/L	51.0	05/10/17 23:42	
EPA 8270D	Isophorone	520	ug/L	51.0	05/10/17 23:42	
EPA 8270D	Naphthalene	36.6J	ug/L	51.0	05/10/17 23:42	
EPA 8260B	Acetone	2050	ug/L	500	05/07/17 12:29	
EPA 8260B	Benzene	5.8J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	2-Butanone (MEK)	1380	ug/L	125	05/07/17 12:29	
EPA 8260B	Chlorobenzene	20.5J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Chloroform	7.0J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	1,2-Dichlorobenzene	364	ug/L	25.0	05/07/17 12:29	
EPA 8260B	1,1-Dichloroethane	404	ug/L	25.0	05/07/17 12:29	
EPA 8260B	1,2-Dichloroethane	17.9J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	cis-1,2-Dichloroethene	68.0	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Dichlorofluoromethane	9.0J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Ethylbenzene	691	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Isopropylbenzene (Cumene)	7.4J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Methylene Chloride	2330	ug/L	100	05/07/17 12:29	

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SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719004	**LWM-042717-JH-004**					
EPA 8260B	4-Methyl-2-pentanone (MIBK)	1110	ug/L	125	05/07/17 12:29	
EPA 8260B	Naphthalene	19.9J	ug/L	100	05/07/17 12:29	B
EPA 8260B	Styrene	94.4	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Tetrachloroethene	1290	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Toluene	1990	ug/L	25.0	05/07/17 12:29	
EPA 8260B	1,1,1-Trichloroethane	7640	ug/L	400	05/09/17 17:26	
EPA 8260B	Trichloroethene	3160	ug/L	10.0	05/07/17 12:29	
EPA 8260B	1,2,4-Trimethylbenzene	30.8	ug/L	25.0	05/07/17 12:29	
EPA 8260B	1,3,5-Trimethylbenzene	11.0J	ug/L	25.0	05/07/17 12:29	
EPA 8260B	Xylene (Total)	3250	ug/L	75.0	05/07/17 12:29	
SM 4500-H+B	pH at 25 Degrees C	7.1	Std. Units	0.10	05/04/17 10:13	H6
10386719005	**LWM-042717-JH-005**					
EPA 8082A	PCB-1242 (Aroclor 1242)	0.41	ug/L	0.10	05/07/17 06:55	
EPA 6010C	Aluminum	2090	ug/L	200	05/05/17 13:13	
EPA 6010C	Arsenic	4.1J	ug/L	20.0	05/05/17 13:13	
EPA 6010C	Barium	57.2	ug/L	10.0	05/05/17 13:13	
EPA 6010C	Beryllium	0.13J	ug/L	5.0	05/05/17 13:13	
EPA 6010C	Calcium	24300	ug/L	500	05/05/17 13:13	
EPA 6010C	Chromium	4.8J	ug/L	10.0	05/05/17 13:13	
EPA 6010C	Cobalt	1.1J	ug/L	10.0	05/05/17 13:13	
EPA 6010C	Copper	5.3J	ug/L	10.0	05/05/17 13:13	
EPA 6010C	Iron	2390	ug/L	50.0	05/05/17 13:13	
EPA 6010C	Lead	3.8J	ug/L	10.0	05/05/17 13:13	
EPA 6010C	Magnesium	7530	ug/L	500	05/05/17 13:13	
EPA 6010C	Manganese	160	ug/L	5.0	05/05/17 13:13	
EPA 6010C	Nickel	2.1J	ug/L	20.0	05/05/17 13:13	
EPA 6010C	Potassium	8440	ug/L	2500	05/05/17 13:13	
EPA 6010C	Sodium	78400	ug/L	1000	05/05/17 13:13	
EPA 6010C	Vanadium	3.8J	ug/L	15.0	05/05/17 13:13	
EPA 6010C	Zinc	61.8	ug/L	20.0	05/05/17 13:13	B
EPA 8270D	Phenol	287	ug/L	50.8	05/11/17 00:14	
EPA 8270D	1,2-Dichlorobenzene	263	ug/L	50.8	05/11/17 00:14	
EPA 8270D	Isophorone	256	ug/L	50.8	05/11/17 00:14	
EPA 8270D	Naphthalene	29.5J	ug/L	50.8	05/11/17 00:14	
EPA 8260B	Acetone	6010J	ug/L	20000	05/07/17 14:05	
EPA 8260B	1,2-Dichlorobenzene	238J	ug/L	1000	05/07/17 14:05	
EPA 8260B	Ethylbenzene	636J	ug/L	1000	05/07/17 14:05	
EPA 8260B	Methylene Chloride	3460J	ug/L	4000	05/07/17 14:05	B
EPA 8260B	4-Methyl-2-pentanone (MIBK)	716J	ug/L	5000	05/07/17 14:05	
EPA 8260B	Tetrachloroethene	841J	ug/L	1000	05/07/17 14:05	
EPA 8260B	Toluene	2090	ug/L	1000	05/07/17 14:05	
EPA 8260B	1,1,1-Trichloroethane	4720	ug/L	4000	05/07/17 14:05	
EPA 8260B	Trichloroethene	104000	ug/L	400	05/07/17 14:05	
EPA 8260B	Xylene (Total)	2220J	ug/L	3000	05/07/17 14:05	
SM 4500-H+B	pH at 25 Degrees C	7.1	Std. Units	0.10	05/04/17 10:14	H6

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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SUMMARY OF DETECTION

Project: 11129194 WDE Landfill
Pace Project No.: 10386719

Lab Sample ID / Method	Client Sample ID / Parameters	Result	Units	Report Limit	Analyzed	Qualifiers
10386719006	**LWM-042717-JH-006**					
EPA 6010C	Aluminum	6590	ug/L	200	05/05/17 13:15	
EPA 6010C	Arsenic	7.9J	ug/L	20.0	05/05/17 13:15	
EPA 6010C	Barium	296	ug/L	10.0	05/05/17 13:15	
EPA 6010C	Beryllium	0.28J	ug/L	5.0	05/05/17 13:15	
EPA 6010C	Calcium	18000	ug/L	500	05/05/17 13:15	
EPA 6010C	Chromium	4.6J	ug/L	10.0	05/05/17 13:15	
EPA 6010C	Cobalt	1.7J	ug/L	10.0	05/05/17 13:15	
EPA 6010C	Copper	7.4J	ug/L	10.0	05/05/17 13:15	
EPA 6010C	Iron	4100	ug/L	50.0	05/05/17 13:15	
EPA 6010C	Lead	7.1J	ug/L	10.0	05/05/17 13:15	
EPA 6010C	Magnesium	6240	ug/L	500	05/05/17 13:15	
EPA 6010C	Manganese	85.0	ug/L	5.0	05/05/17 13:15	
EPA 6010C	Nickel	2.9J	ug/L	20.0	05/05/17 13:15	
EPA 6010C	Potassium	3610	ug/L	2500	05/05/17 13:15	
EPA 6010C	Sodium	101000	ug/L	1000	05/05/17 13:15	
EPA 6010C	Vanadium	8.3J	ug/L	15.0	05/05/17 13:15	
EPA 6010C	Zinc	84.4	ug/L	20.0	05/05/17 13:15	
EPA 8270D	Phenol	132	ug/L	20.3	05/11/17 00:46	
EPA 8270D	1,2-Dichlorobenzene	86.9	ug/L	20.3	05/11/17 00:46	
EPA 8270D	Isophorone	28.5	ug/L	20.3	05/11/17 00:46	
EPA 8270D	Butylbenzylphthalate	9.2J	ug/L	20.3	05/11/17 00:46	
EPA 8260B	Acetone	531	ug/L	500	05/07/17 12:45	
EPA 8260B	Allyl chloride	29.7J	ug/L	100	05/07/17 12:45	
EPA 8260B	Benzene	9.1J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	2-Butanone (MEK)	252	ug/L	125	05/07/17 12:45	
EPA 8260B	Chlorobenzene	14.0J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	1,2-Dichlorobenzene	120	ug/L	25.0	05/07/17 12:45	
EPA 8260B	1,1-Dichloroethane	94.5	ug/L	25.0	05/07/17 12:45	
EPA 8260B	1,2-Dichloroethane	56.5	ug/L	25.0	05/07/17 12:45	
EPA 8260B	cis-1,2-Dichloroethene	23.0J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	Ethylbenzene	173	ug/L	25.0	05/07/17 12:45	
EPA 8260B	Methylene Chloride	1890	ug/L	100	05/07/17 12:45	
EPA 8260B	4-Methyl-2-pentanone (MIBK)	737	ug/L	125	05/07/17 12:45	
EPA 8260B	Naphthalene	6.3J	ug/L	100	05/07/17 12:45	B
EPA 8260B	Styrene	16.0J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	Tetrachloroethene	155	ug/L	25.0	05/07/17 12:45	
EPA 8260B	Tetrahydrofuran	768	ug/L	250	05/07/17 12:45	
EPA 8260B	Toluene	967	ug/L	25.0	05/07/17 12:45	
EPA 8260B	1,1,1-Trichloroethane	666	ug/L	100	05/07/17 12:45	
EPA 8260B	Trichloroethene	217000	ug/L	1000	05/09/17 18:14	
EPA 8260B	Trichlorofluoromethane	15.4J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	1,2,4-Trimethylbenzene	12.1J	ug/L	25.0	05/07/17 12:45	
EPA 8260B	Xylene (Total)	1230	ug/L	75.0	05/07/17 12:45	
SM 4500-H+B	pH at 25 Degrees C	6.8	Std. Units	0.10	05/04/17 10:23	H6

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ANALYTICAL RESULTS

Project: 11103105_ Albert Lea Closed LF
Pace Project No.: 10385328

Sample: LT00049 **Lab ID: 10385328001** Collected: 04/17/17 12:25 Received: 04/18/17 15:27 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 rev.2 (1993) Preparation Method: EPA 351.2 rev.2 (1993)								
Nitrogen, Kjeldahl, Total	**5.3**	mg/L	0.60	0.15	1	04/25/17 12:40	04/26/17 12:04	7727-37-9	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3020								
Arsenic	**20.6**	ug/L	0.50	0.091	1	04/20/17 08:02	04/20/17 11:53	7440-38-2	
Cadmium	**0.20 U**	ug/L	0.20	0.013	1	04/20/17 08:02	04/20/17 11:53	7440-43-9	
Chromium	**1.1**	ug/L	1.0	0.14	1	04/20/17 08:02	04/20/17 11:53	7440-47-3	
Copper	**1.3**	ug/L	1.0	0.40	1	04/20/17 08:02	04/20/17 11:53	7440-50-8	
Lead	**0.078J**	ug/L	0.10	0.012	1	04/20/17 08:02	04/20/17 11:53	7439-92-1	
Nickel	**16.4**	ug/L	0.50	0.099	1	04/20/17 08:02	04/20/17 11:53	7440-02-0	
Silver	**0.50 U**	ug/L	0.50	0.0092	1	04/20/17 08:02	04/20/17 11:53	7440-22-4	
Zinc	**7.8**	ug/L	6.0	0.78	1	04/20/17 08:02	04/20/17 11:53	7440-66-6	
7470A Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A								
Mercury	**0.20 U**	ug/L	0.20	0.031	1	04/20/17 07:56	04/20/17 15:45	7439-97-6	
Hach 10360 Rev 1.1 BOD	Analytical Method: Hach 10360 Rev 1.1 Preparation Method: Hach 10360								
BOD, 5 day	**18.1**	mg/L	6.0	3.0	3	04/19/17 11:23	04/24/17 11:32		B4
1664 SGT-HEM, TPH	Analytical Method: EPA 1664 TPH								
Total Petroleum Hydrocarbons	**1.9J**	mg/L	5.4	0.57	1		05/02/17 08:11		
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**172**	mg/L	20.0	10.0	1		04/21/17 10:50		
SM4500CN-E Cyanide	Analytical Method: SM 4500-CN-E Preparation Method: SM 4500-CN-E								
Cyanide	**14.9**	ug/L	10.0	4.2	1	04/27/17 10:29	04/27/17 15:35	57-12-5	
SM4500P-E, Total Phosphorus	Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B								
Phosphorus	**0.021J**	mg/L	0.050	0.014	1	04/28/17 09:47	04/28/17 18:07	7723-14-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 11103105_ Albert Lea Closed LF
Pace Project No.: 10385328

Sample: LT00048 **Lab ID: 10385328002** Collected: 04/17/17 13:00 Received: 04/18/17 15:27 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 rev.2 (1993) Preparation Method: EPA 351.2 rev.2 (1993)								
Nitrogen, Kjeldahl, Total	**1.0**	mg/L	0.60	0.15	1	04/25/17 12:40	04/26/17 12:05	7727-37-9	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3020								
Arsenic	**1.5**	ug/L	0.50	0.091	1	04/20/17 08:02	04/20/17 11:56	7440-38-2	
Cadmium	**0.20 U**	ug/L	0.20	0.013	1	04/20/17 08:02	04/20/17 11:56	7440-43-9	
Chromium	**0.16J**	ug/L	1.0	0.14	1	04/20/17 08:02	04/20/17 11:56	7440-47-3	
Copper	**0.61J**	ug/L	1.0	0.40	1	04/20/17 08:02	04/20/17 11:56	7440-50-8	
Lead	**0.10 U**	ug/L	0.10	0.012	1	04/20/17 08:02	04/20/17 11:56	7439-92-1	
Nickel	**4.3**	ug/L	0.50	0.099	1	04/20/17 08:02	04/20/17 11:56	7440-02-0	
Silver	**0.50 U**	ug/L	0.50	0.0092	1	04/20/17 08:02	04/20/17 11:56	7440-22-4	
Zinc	**46.9**	ug/L	6.0	0.78	1	04/20/17 08:02	04/20/17 11:56	7440-66-6	
7470A Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A								
Mercury	**0.20 U**	ug/L	0.20	0.031	1	04/20/17 07:56	04/20/17 15:47	7439-97-6	
Hach 10360 Rev 1.1 BOD	Analytical Method: Hach 10360 Rev 1.1 Preparation Method: Hach 10360								
BOD, 5 day	**1.2J**	mg/L	2.0	1.0	1	04/19/17 11:23	04/24/17 11:35		B4
1664 SGT-HEM, TPH	Analytical Method: EPA 1664 TPH								
Total Petroleum Hydrocarbons	**1.9J**	mg/L	5.1	0.54	1		05/02/17 08:11		
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**5.0J**	mg/L	10.0	5.0	1		04/21/17 10:50		
SM4500CN-E Cyanide	Analytical Method: SM 4500-CN-E Preparation Method: SM 4500-CN-E								
Cyanide	**10.0 U**	ug/L	10.0	4.2	1	04/27/17 10:29	04/27/17 15:36	57-12-5	
SM4500P-E, Total Phosphorus	Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B								
Phosphorus	**0.025J**	mg/L	0.050	0.014	1	04/28/17 09:47	04/28/17 18:08	7723-14-0	

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 11103105_ Albert Lea Closed LF
Pace Project No.: 10385328

Sample: LT00021 **Lab ID: 10385328003** Collected: 04/17/17 14:15 Received: 04/18/17 15:27 Matrix: Water

Parameters	Results	Units	Report Limit	MDL	DF	Prepared	Analyzed	CAS No.	Qual
351.2 Total Kjeldahl Nitrogen	Analytical Method: EPA 351.2 rev.2 (1993) Preparation Method: EPA 351.2 rev.2 (1993)								
Nitrogen, Kjeldahl, Total	**33.4**	mg/L	12.0	3.0	20	04/25/17 12:40	04/26/17 12:14	7727-37-9	
6020A MET ICPMS	Analytical Method: EPA 6020A Preparation Method: EPA 3020								
Arsenic	**37.3**	ug/L	0.50	0.091	1	04/20/17 08:02	04/20/17 11:59	7440-38-2	
Cadmium	**0.17J**	ug/L	0.20	0.013	1	04/20/17 08:02	04/20/17 11:59	7440-43-9	
Chromium	**7.7**	ug/L	1.0	0.14	1	04/20/17 08:02	04/20/17 11:59	7440-47-3	
Copper	**64.1**	ug/L	1.0	0.40	1	04/20/17 08:02	04/20/17 11:59	7440-50-8	
Lead	**12.3**	ug/L	0.10	0.012	1	04/20/17 08:02	04/20/17 11:59	7439-92-1	
Nickel	**21.6**	ug/L	0.50	0.099	1	04/20/17 08:02	04/20/17 11:59	7440-02-0	
Silver	**0.50 U**	ug/L	0.50	0.0092	1	04/20/17 08:02	04/20/17 11:59	7440-22-4	
Zinc	**95.4**	ug/L	6.0	0.78	1	04/20/17 08:02	04/20/17 11:59	7440-66-6	
7470A Mercury	Analytical Method: EPA 7470A Preparation Method: EPA 7470A								
Mercury	**0.20 U**	ug/L	0.20	0.031	1	04/20/17 07:56	04/20/17 15:54	7439-97-6	
8260B VOC	Analytical Method: EPA 8260B								
Tetrahydrofuran	**281**	ug/L	10.0	1.5	1		04/26/17 17:31	109-99-9	
Surrogates									
1,2-Dichloroethane-d4 (S)	85	%.	75-137		1		04/26/17 17:31	17060-07-0	
Toluene-d8 (S)	95	%.	75-125		1		04/26/17 17:31	2037-26-5	
4-Bromofluorobenzene (S)	94	%.	75-125		1		04/26/17 17:31	460-00-4	
Hach 10360 Rev 1.1 BOD	Analytical Method: Hach 10360 Rev 1.1 Preparation Method: Hach 10360								
BOD, 5 day	**3.2**	mg/L	2.0	1.0	1	04/19/17 11:23	04/24/17 11:38		B4
1664 SGT-HEM, TPH	Analytical Method: EPA 1664 TPH								
Total Petroleum Hydrocarbons	**1.8J**	mg/L	5.4	0.58	1		05/02/17 08:11		
2540D Total Suspended Solids	Analytical Method: SM 2540D								
Total Suspended Solids	**5.0J**	mg/L	10.0	5.0	1		04/21/17 10:50		
SM4500CN-E Cyanide	Analytical Method: SM 4500-CN-E Preparation Method: SM 4500-CN-E								
Cyanide	**10.0 U**	ug/L	10.0	4.2	1	04/27/17 10:29	04/27/17 15:36	57-12-5	
SM4500P-E, Total Phosphorus	Analytical Method: SM 4500-P E Preparation Method: SM 4500-P B								
Phosphorus	**0.27**	mg/L	0.050	0.014	1	04/28/17 09:47	04/28/17 18:08	7723-14-0	

Attachment C
Community Review Form – Special Discharge to Sanitary Sewer

Metropolitan Council Environmental Services
Industrial Waste & Pollution Prevention Section
390 North Robert Street
St. Paul, Minnesota 55101-1805

For MCES Use Only
Date Received: ________
Request ID: ___________

COMMUNITY REVIEW FORM - SPECIAL DISCHARGE TO SANITARY SEWER

A. Community Notification Information

The Authorized Representative or Environmental Consultant, in cooperation with a Community Representative (i.e., authorized personnel from the Engineering Department or Public Works Department), must complete Section A of this form and forward the form to the Community Representative for review.

1. Waste Description: Liquid wastes generated during excavation activities including decontamination fluids, and dewatering liquids

2. Applicant (Corporation, Proprietorship, or Government Unit): Minnesota Pollution Control Agency

3. Site Name: Waste Disposal Engineering Closed Landfill

4. Site Address: 14437 NW Crosstown Blvd, Andover, MN 55304

5. MCES IWPP Engineer:	Email: Michael.Flaherty@metc.state.mn.us	
Michael Flaherty	Phone: 651-602-4715	Fax: 651-602-4730

6. Discharge Location Information: Attach a site map that shows the proposed discharge location(s). If there are multiple discharge locations, provide the information requested in Items 6.A.- 6.G. as an attachment.

A. Discharge Location Description (include GPS coordinates if available): Facility aeration pond (See attached Figure 2)
Lat: 45°13'51.37" Long: -93°18'58.74"

B. Proposed Discharge Start Date: September 2017	C. Estimated Discharge Duration: 3 Months	
D. Discharge Type:	☐ Continuous Discharge	☒ Intermittent Discharges
E. Sanitary Sewer Connection Type:	☒ Community Connection	☐ MCES Connection
F. Maximum Discharge Rate [gpm]: 100 gpm	G. Total Discharge Volume [gal]: ~10,000	

H. Proposed Flow Measuring Method: Metered discharge line or via tank calibration chart

7. Community billing arrangements for sewer volume ☐ No Charge ☐ Regular Charge ☐ Other - describe below:

8. Indicate the corporation, proprietorship, or government unit that will be financially responsible for paying Community volume charges: Minnesota Pollution Control Agency

B. Community Representative Information

Upon receipt of this form the Authorized Representative or Environmental Consultant, the Community Representative completes this section and forwards (Email or Fax) to the MCES IWPP Engineer assigned to this application (see Item #5 in Section A).

After reviewing this form and any attachments, please check the appropriate box:

☐ I have reviewed and **approve** of the information provided for **Items #6, 7 & 8.**

☐ I have reviewed and **approve** of the information provided for **Items #6, 7 & 8**, subject to the conditions listed below.

☐ I have reviewed and **do not approve** of the information provided for **Items #6, 7 & 8.** List the reason(s) for denial below.

Conditions/ Concerns:

Community conditions and concerns will be evaluated by and included as needed in the MCES approval process.

Community Contact Name:	Department:
Contact Title:	Phone:
Email Address:	

Attachment D
One-Time Industrial Discharge Approval Transfer Form

Metropolitan Council | Environmental Services
Industrial Waste and Pollution Prevention
390 Robert Street North
St. Paul, Minnesota 55101-1805

ONE-TIME INDUSTRIAL DISCHARGE APPROVAL TRANSFER FORM

By completing and submitting this form, the New Owner is requesting transfer of a Metropolitan Council Environmental Services (MCES) One-Time Industrial Discharge Approval from one entity to another.

1. Facility Name:____
2. New Responsible Party: ____
3. Contact Name: ____Title:________________________________
4. Mailing Address: ______________________________________ City: _______________ State: ____ Zip: _______
5. Billing Address: _______________________________________ City:_______________ State: _____ Zip:_______
6. Anticipated or actual date of One-Time Industrial Discharge Approval transfer: _______________________
7. Will there be any significant changes in approved disposal methods/actions detailed in application? ☐ Yes ☐ No

   If yes, please attach an explanation of changes.
8. Agreement Signature:

   I am familiar with and agree to be bound by the conditions of the prior owner's One-Time Industrial Discharge Approval, the MCES Waste Discharge Rules, and applicable U.S. EPA Pretreatment Standards and Requirements.

____ ______________________________________

Signatory (print name) *Title*

____ ________________ ___________________

Signature *Date* *Phone*

1. MCES approval of this permit transfer shall in no way limit the new Permittee's obligations.

For MCES Use Only

Engineer Review: ____ Date: _____________

SAC Review: ____ Date: _____________

IWPP Section Manager: ____ Date: _____________

Approval: ____ Date: _____________

Assistant General Manager, SSBU Department

Appendix Q
Large Quantity Hazardous Waste Generator License

Minnesota Pollution Control Agency

Hazardous Waste

GENERATOR LICENSE

Valid July 1, 2017 to June 30, 2018

Non-Transferable

Issued to Location:
MNS000153601
WDE Landfill
14437 Crosstown Blvd NW
Andover, MN 55304

Post this license in a public area.

This Generator License is issued based on annual waste generation information from 2015 and is subject to all conditions found on the reverse side of this license. The issuance of a license does not release the licensee from any liability, penalty or duty imposed by the Minnesota or federal statutes or rules or local ordinances, except the obligation to obtain the license.

520 Lafayette Road, St. Paul, MN 55155-4194, 651-296-2412 or, 1-800-677-4169, or TDD (for hearing and speech impaired only) (651) 282-5332
or email at hw-licensing.pca@state.mn.us

Conditions of Generator License

The following conditions, found in Minnesota Rules Part (Minn. R. pt.) 7045.0243, subp. 3, apply to the Minnesota Pollution Control Agency Generator License, valid from July 1 of the year issued through June 30, of the following year.

General Conditions:

A. The commissioner's issuance of a license does not release the licensee from any liability, penalty or duty imposed by Minnesota or federal rules or local ordinances,except the obligation to obtain the license.

B. The commissioner's issuance of a license does not prevent the future adoption by the Agency of pollution control rules, standards, or orders more stringent than those not in existence and does not prevent the enforcement of this chapter (Minn. R. 7045, Regarding Hazardous Waste), standards, or orders against the licensee.

C. The commissioner's issuance of a license does not obligate the Agency to enforce local laws, rules, or plans beyond that authorized by the Minnesota statutes.

D. The licensee may not knowingly make a false statement, representation, or certification in a record, report or other document required to be submitted to the Agency or to the commissioner by the license or this chapter. The licensee must immediately upon discovery, report to the the commissioner any error or omission in these records, reports, or other documents. E. When authorized by Minn.Stat. §§ 115.04 and 115B.17, subd. 4; and Minn. Stat. § 116.091, and upon presentation of proper credentials, the Agency, or an authorized employee or agent of the Agency, shall be allowed by the licensee to enter at reasonable times upon the licensed property of the licensee to examine and copy books, papers, records, or memoranda pertaining to the activity covered by the license; and to conduct surveys and investigations, including sampling or monitoring, pertaining to the activity covered by the license.

F. If the licensee discovers, through any means, including notification by the commissioner, that noncompliance with a condition of the license has occurred, the licensee shall take all reasonable steps to minimize the adverse impacts on human health, public drinking water supplies, or the environment resulting from the noncompliance.

G. If the licensee begins generation of a hazardous waste that was not included on the license application and is therefore not authorized under the existing license, the licensee must submit an amended application providing information required in Minn. R. pt. 7045.0230 (Content of License Application) within 75 days of first producing the new hazardous waste. The generator must at all times manage the new waste in full compliance with Minn. R. pts. 7045.0205 to 7045.0320 (Standards Applicable to Generators of Hazardous Waste). The generator must not treat, dispose of, or relinquish control of the new waste until at least 15 days after the amended license application is submitted to the commissioner. In the period between 15 days after submittal and the commissioner's action under Minn. R. pt. 7045.0245(Hazardous Waste Management) until written response to the generator's amended license application is received under Minn. R. pt. 7045.0245(License Approval and Issuance). After the commissioner acts on the amended license application, the generator must manage the new waste according to the amended license conditions and the requirements of this chapter or the generator must cease producing the new waste if the amended license application is denied. H. If the licensee changes management of a hazardous waste during the term of the license, the licensee must report the change in the next license renewal application required under Minn. R. pt. 7045.0248 (License Renewal Application).

I. The license is not transferable. If the owner or operator to whom the license has been issued changes, the new owner or operator must apply for a new license not later than 30 days after the change.

J. The license authorizes the licensee to perform the activities described in or referenced by the license under the conditions of the license. In issuing the license, the State and Agency assume no responsibility for damage to persons, property, or the environment caused by the activities of the licensee in the conduct of its actions, including those activities authorized under the license. To the extent the State and Agency may be liable for the activities of its employees, that liability is explicitly limited to that provided in the Tort Claims Act, Minn. Stat. § 3.736.

Registered hazardous waste generators and transporters

Hazardous Waste ID Search Results

Click a column heading to sort results.

Preferred ID	Name	Address	City	Zip	County	Generator Size	Status
MNS000153601	WDE Landfill	14437 Crosstown Blvd NW	Andover	55304	Anoka	Generation, LQG	Active

Appendix R
Building Permit Application

CITY OF ANDOVER

BUILDING PERMIT APPLICATION

1685 CROSSTOWN BOULEVARD NW, ANDOVER, MINNESOTA 55304 (763) 755-8700 • FAX (763) 755-8923 • WWW.ANDOVERMN.GOV

Project Address:

Legal Description	**Lot**	**Block**	**Development**

Owner	**Telephone**	**E-Mail Address**
Contractor	**License Number**	**E-Mail Address**
Mail Address		
Contact Person	**Telephone**	**Mobile Telephone**

Property Type (CHECK ONE)

☐ Single Family Residential ☐ Two-Family Residential ☐ Multifamily Residential ☐ Townhome ☐ Agricultural
☐ Commercial ☐ Industrial ☐ Institutional ☐ Public / Gov't ☐ OTHER

Project Type (CHECK ONE)

☐ New Construction ☐ Addition ☐ Remodel / Alteration ☐ Basement Finish ☐ Moving ☐ Garage/Shed *Attached or Detached*
☐ Roofing ☐ Siding ☐ Deck ☐ Pool ☐ Demolition ☐ OTHER *(Describe Below)*

Description:	Area: ______ SQUARE FEET Height: ______ STORIES / FT ABOVE GRADE	**Estimated Building Valuation:** $

Signature & Acknowledgement of Contractor or Owner Authorized Agent — **Date** (MMMM, DD, YYYY)

Signature & Acknowledgement of Owner *(If Owner is Builder)* — **Date** (MMMM, DD, YYYY)

I hereby apply for a building permit and acknowledge: the information above is complete and accurate; the work will be in conformance with the ordinances and codes of the City of Andover and Minnesota State Building Code; I understand this is not a permit but only an application for permit; work is not to start without permit; work will be in accordance with the Approved Plan when City plan approval required. Separate permits are required for electrical, plumbing, mechanical, fire suppression and required fire alarm systems. This application and any issued permit may become null and void if permit is not issued or work is not commenced within 180 days, or if work is suspended or abandoned for a period of 180 days. I hereby certify that I have read and examined this application. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other state or local law regulating construction or the performance of construction.

BELOW - FOR CITY USE ONLY

Land Use Zone	**Occupancy Group/s**	**Division**	**Construction Type**
Engineering/Natural Resources Tree Preservation Fee YES ☐ NO ☐	**Building Area** Basement ______ 1st Floor ______ 2nd Floor ______ TOTAL ______	**Inspections** ☐ Footing ☐ Framing ☐ Foundation ☐ Insulation ☐ CMU ☐ Stucco/Lath ☐ Poured ☐ Plbg Final ☐ Plbg RI ☐ Mech Final ☐ Mech RI ☐ Elect Final ☐ Elect RI ☐ Fireplace Final ☐ Fireplace RI ☐ Final ☐ OTHER	**Utilities** ☐ City Sewer ☐ City Water ☐ Private Sewer ☐ Private Well **Building Valuation**
Natural Resources Approval	**Zoning Approval**		**Approved for Issuance**
Date	Date		Date

Building Permit Fees

Building permit fees are based on the building valuation determined by multiplying the areas of the building times the per square foot valuations published by Minnesota Department of Labor and Industry [DOLI]. Once the building valuation is calculated, the building permit fee is from the 1997 Uniform Building Code [UBC] Fee Schedule.

Plan review fees are charged when a plan is required and reviewed for compliance with the building code. The plan review fee is 65% of the building permit fee; except for plans that are "similar" in design to a plan that has previously been reviewed at full cost and accepted by the City for repetitive plan review. Then the plan review fee is 25% of the building permit fee.

Depending on the complexity of the work being permitted, various fees may be charged with building permit and plan review fees. Those fees may include:

- **Contractor License Verification**
- **Building Permit State Surcharge**
- **Water Meter & Horn**
- **Water Connection / Inspection Fee**
- **Sewer Connection / Inspection Fee**
- **Water Access Charge [WAC Fee]**
- **Sewer Access Charge [SAC Fee]**
- **Assessments**
- **Sureties Escrows**

And occasionally penalties:

- **Re-inspection Fee**
- **Investigation Fee**
- **Work Without Permit Fee**

The fees associated with building permit issuance are sometimes complex and though consistent may vary widely. For building permit fee estimates, please contact the City Building Inspections Department by telephone at (763)-755-8700 or via e-mail at building@andovermn.gov .

CITY OF ANDOVER — NEW COMMERCIAL BUILDING PERMITS

1685 CROSSTOWN BOULEVARD NW, ANDOVER, MINNESOTA 55304 (763) 755-8700 • FAX (763) 755-8923 • WWW.ANDOVERMN.GOV

Apply for permits at City Hall on weekdays between the hours of 8:00 a.m. and 4:30 p.m. Complete permit applications may be mailed. Electronic/digital submittals may be accepted subject to pre-approval of the City. Commercial and industrial permitting time depends on complexity of the work and completeness of plans.

Three (3) weeks may be required for permit processing for new buildings and major additions.
Work must not begin until permit/s and job copy of the plan are on the job site.

BUILDING PERMIT SUBMITTALS:

1. Building Permit Application — Separate electrical, plumbing and mechanical permits are required.
   Forms available online: Plumbing Permit Application; Electrical Permit Application; Mechanical Permit Application; Fire Protection Application

2. **Submit five (5) complete sets of the following plans and specifications to City Hall which may include:**
   - ☐ Land Survey (Boundary or topographic may be required – See Land Survey Standards Handout)**
   - ☐ Civil/Site Development Plans for Grading, Erosion Control, Drainage, Paving, Site Lighting (Photometric w/Fixture Specs.)**
   - ☐ Civil/Site Development Plans for Utilities – Water Mains, Sanitary Sewer, Storm Sewer**
   - ☐ Site Plans
   - ☐ Building Plans & Code Analysis**
   - ☐ Soils Analysis**
   - ☐ Landscape and Irrigation Plans**

3. **Submit three (3) complete sets of the following plans and specifications to City Hall which may include:**
   - ☐ Mechanical Plans**
   - ☐ Plumbing Plans**
   - ☐ Structural Plans**
   - ☐ Fire Suppression**
   - ☐ Special Inspections Schedule**
   - ☐ Fire Alarm System**
   - ☐ Energy Calculations
   - ☐ Environmental Remediation**
   - ☐ Electrical Plans and Energy Calculations
   - ☐ Recycling Space Plans *(Per MN 1303.1500)*
   - ☐ Shop drawings, structural calculations and other documents as necessary
   - ☐ SAC Determination Letter *(SAC Determination must be made by either the City or Metropolitan Council / MCES)*
   - ☐ Food Establishment Kitchen Equipment Plans and Specifications *(Anoka Dept. of Health approval is required.)*

NOTE: ** Plans and specifications must be prepared and certified by a Minnesota licensed design professional per rules of the AELSLAGID Board. When a Nurseryman, Master Plumber or Master Electrician prepares plans and specifications for his own work, plans and specifications must be certified with the signature and license number of that individual, as applicable.

- **When required, land use permits, recording of land use documents, and an on-site development surety must be approved and in place prior to building permit issuance.**

  Required on-site development sureties include bond, letter of credit or approved equal to insure the installation and maintenance of required landscaping materials such as trees, shrubs, sod, irrigation system, etc.. Additional sureties may be required if there is a developers agreement for your project.
- **Deferral of permit submittals must be pre-approved by the Building Official. The Architect or Engineer of record must coordinate submittal documents and must list deferred submittals on the plans submitted for building permit.**

PLEASE ADDRESS INQUIRIES TO:

City Administrator	Jim Dickinson	j.dickinson@andovermn.gov	(763) 767 – 5110
Community Development / Economic Development	Joe Janish	j.janish@andovermn.gov	(763) 767 – 5140
City Planner / Land Use	Stephanie Hanson	s.hanson@andovermn.gov	(763) 767 – 5147
Chief Building Official	Fred Patch	f.patch@andovermn.gov	(763) 767 – 5123
Assistant Building Official	Herb Blommel	h.blommel@andovermn.gov	(763) 767 – 5124
Building Permit Technician	Dorothy Adair	d.adair@andovermn.gov	(763) 767 – 5120
Building Permit Technician	Jenny Bailey	j.bailey@andovermn.gov	(763) 767 – 5119
Fire Chief	Jerry Streich	j.streich@andovermn.gov	(763) 767 – 5192
Fire Marshall	Robbie Bartholomew	r.bartholomew@andovermn.gov	(763) 767 – 5193
Site Design/Grading/Trees & Erosion Control	Kameron Kytonen	k.kytonen@andovermmn.gov	(763) 767 – 5137
City Engineer / Public Utilities & Public Works	Dave Berkowitz	d.berkowitz@andovermn.gov	(763) 767 – 5133
Public Utilities Manager	Brian Kraabel	b.kraabel@andovermn.gov	(763) 767 – 5180

PLUMBING PERMITS

1. Completed Application Form
2. Plumbing plans, specifications and riser diagrams when necessary (*Master Plumber or Professional Engineer Certification Required)*

HEATING/MECHANICAL PERMITS

1. Completed Application Form *(City License Required) – See http://www.andovermn.gov/345/Mechanical-Contractor-Licensing*
2. Heat Loss and Heat Gain Calculations
3. Mechanical plans, shop drawings and specifications when necessary (*Professional Engineer Certification Required)*

SEWER PERMITS

1. Completed Application Form
2. Site utilities plan, specifications (*Master Plumber or Professional Engineer Certification Required)*

WATER PERMITS

1. Completed Application Form
2. Site utilities plan, specifications and riser diagrams (*Master Plumber or Professional Engineer Certification Required)*

FIRE SUPPRESSION SYSTEM / FIRE ALARM SYSTEM PERMITS

1. Fire Suppression System:
   a. Completed Application Form
   b. Three (3) sets of Site Utilities Plans, Fire Suppression/Sprinkler Plans, Specifications, Riser Diagrams and Hydraulic Calculations when necessary (Signed by Fire Protection Engineer, Minnesota Master Plumber or Professional Engineer as required)
2. Fire Alarm System:
   a. Completed Application Form
   b. Two (2) sets of plans and specifications including cut sheets of equipment and devices

ELEVATORS/LIFTS

Permitted by the MN Department of Labor & Industry – See Building Codes & Standards Division & Elevator Permit Application

State or City license may be required for any work in the building trades.

This informational document may not comprehensively address all laws related to the subject addressed. It is provided to serve only as a helpful guide. Site preparation or permitted work is not allowed until permits have been issued by the City of Andover.

CITY OF ANDOVER — ELECTRICAL PERMIT APPLICATION

1685 CROSSTOWN BOULEVARD NW, ANDOVER, MINNESOTA 55304 (763) 755-8700 • FAX (763) 755-8923 • WWW.ANDOVERMN.GOV

Project Address

Legal	Lot	Block	Development

Owner	Telephone	E-Mail Address
Electrical Contractor or Technology System Contractor	License Number	E-Mail Address

Mail Address

Contact Person	Telephone	Mobile Telephone

Property Type (CHECK ONE)

☐ Single Family Residential ☐ Two-Family Residential ☐ Multifamily Residential ☐ Townhome ☐ Agricultural
☐ Commercial ☐ Industrial ☐ Institutional ☐ Public / Gov't ☐ OTHER

Brief Project Description *(Scope, directions or other information to help the inspector provide inspection services.)*

ITEM DESCRIPTION	Quantity	Fee	Subtotal
Single Family Residential Electrical Permits			
NEW RESIDENTIAL SERVICE: Per Living Unit, Includes 30 new circuits and/or feeders per service, and 3 inspection trips.		$150.00 ea.	$ 0.00
EXISTING RESIDENTIAL SERVICE:			
Electrical Service Alteration - Includes 1 inspection trip (Work Examples Include: Power Supply / Feeder to Separate Structure / Detached Garage, Electrical Service Upgrade, Repair or Replacement, Riser or Mast, Meter Socket)		$ 45.00 ea.	$ 0.00
New Circuits / Feeders, Remodeling, Additions - Includes all circuits / feeders and 2 inspection trips (Work Examples Include: Panel Change-out, Subpanel Addition, Basement Finish, Swimming Pool / Spa, Solar Electric, Remodeling and Additions)		$ 90.00 ea.	$ 0.00
Replacement or Alteration of Hard-Wired Equipment / Appliance - Includes 1 inspection trip (Work Examples Include: Water Heater, HVAC – Furnace/Boiler, Air Conditioning, Radiant Heat, Pumps, Appliances, Machinery and Equipment)		$ 45.00 ea.	$ 0.00
ADDITIONAL RESIDENTIAL CIRCUITS / FEEDERS		$ 8.00 ea.	$ 0.00
ADDITIONAL RESIDENTIAL PER INSPECTION TRIP CHARGES		$ 45.00 ea.	$ 0.00
Multifamily / Commercial / Industrial / Institutional Electrical Permits			
NEW COMMERCIAL SERVICE: Per Individual Service, Includes 3 inspection trips, BUT NO CIRCUITS OR FEEDERS.		$150.00 ea.	$ 0.00
EXISTING COMMERCIAL SERVICE:			
Electrical Service Alteration - Includes 1 inspection trip (Work Examples Include: Power Supply/Feeder to Separate Structure OR Tenant Space, Electrical Service Upgrade / Repair / Replacement, Riser/Mast, Meter Socket)		$ 75.00 ea.	$ 0.00
New Circuits / Feeders, Remodeling, Additions - Includes all circuits / feeders and 2 inspection trips (Work Examples Include: Panel Change-out, Subpanel Addition, Basement Finish, Swimming Pool/Spa, Solar Electric, Remodeling and Additions)		$ 90.00 ea.	$ 0.00
Replacement or Alteration of Hard-Wired Equipment / Appliance - Includes 1 inspection trip (Work Examples Include: Water Heater, HVAC/Furnace/Boiler, Air Conditioning, Radiant Heat, Pumps, Appliances, Machinery and Equipment)		$ 45.00 ea.	$ 0.00
SPECIAL COMMERCIAL ELECTRICAL INSTALLATIONS:			
Multifamily Units With Common Service – Per Apartment or Condominium Unit - Includes one (1) inspection trip 1. Add in one new commercial service above, 2. Add in total number of dwelling units here; 3. Add in total number of circuits below; then, 4. Add in total number of expected inspection trip charges below.		$ 75.00 ea.	$ 0.00
Fire Alarm, Fire Sprinkler Monitoring, Remote Control, Signal Circuit - > 50 Volts – Includes circuits and inspections		$ 45.00 ea.	$ 0.00
Traffic Signal - Includes all circuits and inspections		$225.00 ea.	$ 0.00
Transformer (light / heat / power) - Includes all circuits and inspections		$ 45.00 ea.	$ 0.00
ADDITIONAL COMMERCIAL CIRCUITS / FEEDERS		$ 8.00 ea.	$ 0.00
ADDITIONAL COMMERCIAL PER INSPECTION TRIP CHARGES		$ 45.00 ea.	$ 0.00
Minnesota State Surcharge must be paid in addition to permit fees			$ 1.00
TOTAL ELECTRICAL PERMIT & INSPECTION FEES Refresh Total Prior to Printing: Delete/Enter		$	1.00

THE CITY OF ANDOVER ACCEPTS PAYMENT BY CASH, CHECK OR CREDIT CARD (Visa/MasterCard/Discover)

Signature of Electrical Contractor, Technology System Contractor or Resident Homeowner **Date**

Electrical Permit Fees

Electrical wiring installed or altered in any new or existing buildings shall have an electrical permit filed on or before any work has been started. Permits and permit fees shall be filed by the responsible individual/electrical contractor that is providing the electrical work.

SINGLE FAMILY RESIDENTIAL

1. **NEW RESIDENTIAL SERVICE** - Per Living Unit, Includes thirty (30) new circuits and/or feeders per service, and three (3) inspection trips	$ 150.00
2. **EXISTING RESIDENTIAL SERVICE**	
a. **Electrical Service Alteration** - Includes one (1) inspection trip (Work Examples Include: Power Supply/Feeder to Separate Structure/Detached Garage, Electrical Service Upgrade / Repair/ Replacement, Riser/Mast, Meter Socket)	$ 45.00
b. **New Circuits / Feeders, Remodeling, Additions** - Includes all circuits / feeders and two (2) inspection trips (Work Examples Include: Electrical Panel Change-out, Subpanel Addition, Basement Finish Swimming Pool/Spa, Solar Electric, Remodeling and Additions)	$ 90.00
c. **Replacement or Alteration of Hard-Wired Equipment / Appliance** Includes one (1) inspection trip (Work Examples Include: Water Heater, HVAC/Furnace/Boiler, Air Conditioning, Baseboard or Radiant Heat, Pumps, Appliances, Machinery and Equipment)	$ 45.00
3. **ADDITIONAL RESIDENTIAL CIRCUITS / FEEDERS**	$ 8.00 each
4. **ADDITIONAL PER INSPECTION TRIP CHARGES**	$ 45.00 each
5. **ELECTRICAL WORK WITHOUT A PERMIT**	$ double the inspection fee

NOTE: ** Add $1.00 per permit for State Surcharge **

MULTIFAMILY / COMMERCIAL / INDUSTRIAL / INSTITUTIONAL

1. **NEW COMMERCIAL SERVICE** - Per Individual Service, Includes three (3) inspection trips, but NO CIRCUITS OR FEEDERS are included.	$ 150.00
2. **EXISTING COMMERCIAL SERVICE**	
a. **Electrical Service Alteration** - Includes one (1) inspection trip (Work Examples Include: Power Supply/Feeder to Separate Structure OR Tenant Space, Electrical Service Upgade / Repair / Replacement, Riser/Mast, Meter Socket)	$ 75.00
b. **New Circuits / Feeders, Remodeling, Additions** - Includes two (2) inspection trips, but NO CIRCUITS OR FEEDERS are included. (Work Examples Include: Electrical Panel Change-out, Subpanel Addition, Tenant Finish, Swimming Pool/Spa, Solar Electric, Remodeling and Additions)	$ 90.00
c. **Replacement or Alteration of Hard-Wired Equipment / Appliance** - Includes one (1) inspection trip (Work Examples Include: Water Heater, HVAC/Furnace/Boiler, Air Conditioning, Baseboard or Radiant Heat, Pumps, Appliances, Machinery and Equipment)	$ 45.00
3. **SPECIAL COMMERCIAL ELECTRICAL INSTALLATIONS**	
a. **Multifamily Units With Common Service** – Per Apartment or Condominium Unit - Includes one (1) inspection trip 1. Add in one new commercial service above, 2. Add in total number of dwelling units here; 3. Add in total number of circuits below; then 4. Add in total number of expected inspection trip charges below.	$ 75.00
b. **Fire Alarm, Fire Sprinkler Monitoring, Remote Control, Signal Circuit** - Less Than 50 Volts – Includes all circuits and inspections	$ 45.00
c. **Traffic Signal** -- Includes all circuits and inspections	$ 225.00
d. **Transformer** (light / heat / power) - Includes all circuits and inspections	$ 45.00
4. **ADDITIONAL COMMERCIAL CIRCUITS / FEEDERS**	$ 8.00 each
5. **ADDITIONAL COMMERCIAL PER INSPECTION TRIP CHARGES**	$ 45.00 each
6. **ELECTRICAL WORK WITHOUT A PERMIT**	$ double the inspection fee

NOTE: ** Add $1.00 per permit for State Surcharge **

APPLICATIONS FOR PERMIT MAY BE SUBMITTED IN PERSON AT CITY HALL OR BY POST MAIL, E-MAIL OR FAX.

CHECKS MAY BE POST MAILED. NEVER MAIL CASH AND DO NOT INCLUDE OR WRITE CREDIT CARD INFORMATION WITH THIS PERMIT APPLICATION.

ANDOVER BUILDING INSPECTIONS DEPARTMENT TELEPHONE: 763-755-8700

MECHANICAL PERMIT APPLICATION

CITY OF ANDOVER

1685 CROSSTOWN BOULEVARD NW, ANDOVER, MINNESOTA 55304 (763) 755-8700 • FAX (763) 755-8923 • WWW.ANDOVERMN.GOV

Project Address:

Legal	Lot	Block	Development

Owner	Telephone	E-Mail Address
Mechanical Contractor	License Number	E-Mail Address

Mail Address

Contact Person	Telephone	Mobile Telephone

Property Type *(CHECK ONE)*

- ☐ Single Family Residential ☐ Two-Family Residential ☐ Multifamily Residential ☐ Townhome ☐ Agricultural
- ☐ Commercial ☐ Industrial ☐ Institutional ☐ Public / Gov't ☐ OTHER

Mechanical Permit Type *(CHECK ONE)*

- ☐ New Single Family Residential
- ☐ Existing Single Family Residential
- ☐ Commercial & All Other Permit Types

Specify Number For Each Fixture Type

QUANTITY SUBTOTAL

NEW RESIDENTIAL COMPLETE HVAC COMBINATION PERMIT *(Do not specify fixtures below except mechanical fireplaces.)*										$175.00	
Furnace/AC Combination	Furnace ONLY	Air Condition A/C ONLY	Heat Pump	Direct Fired Heater	Boiler	Air-to-Air Exchanger	Radon System	Exhaust Ventilator	0	$ 75.00 each	$ 0.00
Gas Fireplace	Garage/ Unit Heater	Make-Up Air	Commercial Hood Type 1	GeoThermal Heat/Cool	In-Floor/ Hydronic Heat	Refrig. System	Ductwork Only	Other			

GAS PIPING: Number of Gas Openings Not Associated With A Fixture ________ X $12.00 = $ 0.00 or $75.00, Whichever is Greater $ ________

PROJECT DESCRIPTION / OTHER *(Specify Fixture Type & Number)*:

COMMERCIAL WORK ONLY - PLAN REVIEW FEE IS CHARGED ONLY IF VALUATION OF WORK EXCEEDS $50,000.00 — Add Plan Review

Commercial Work Valuation $ 0.00 If greater than $50,000 then Plan Review fee is .10 X permit fee = $ 0.00 $ ________

Minnesota State Surcharge must be paid in addition to permit fees $ 1.0000

TOTAL FEE - MECHANICAL PERMIT, PLAN REVIEW & STATE SURCHARGE $ 1.00

Signature of Mechanical Contractor Date mmmm dd,yyyy

Signature of Owner *(If Owner is Builder)* Date mmmm dd,yyyy

I hereby apply for a Mechanical permit and acknowledge: the information above is complete and accurate; the work will be in conformance with the ordinances and codes of the City of Andover and Minnesota State Building Code; I understand this is not a permit but only an application for permit; work is not to start without permit; work will be in accordance with the Approved Plan when City plan approval required. This application and any issued permit may become null and void if permit is not issued or work is not commenced within 180 days, or if work is suspended or abandoned for a period of 180 days. I hereby certify that I have read and examined this application. The granting of a permit does not presume to give authority to violate or cancel the provisions of any other state or local law regulating construction or the performance of construction.

BELOW - FOR CITY USE ONLY

☐ PLAN CHECK REQUIRED FOR VALUATION > $ 50,000	Plans Checked By	
	Approved for Issuance	Date

Mechanical Permit Fees

New Residential Complete HVAC Combination Permit	$175.00 *(Does not include Gas Fireplaces – permitted separately, see below)*
Existing Residential Repair/Replacement Mechanical Permit	$75.00 per Fixture *("Fixture" includes: Heating/Air Conditioning Combination, Air to Air Exchanger, Gas Fireplace, Geo-Thermal Heating/Cooling, Boiler, In-Floor Heating & Boiler, Exhaust Fan, Direct Fired Heater, Unit Heater, Heat Pump and other mechanical equipment)*
Commercial Mechanical Permit	$75.00 per Fixture or 1.5% of project valuation, **whichever is greater** *("Fixture" includes: Furnace, Air Conditioning, Air to Air Exchanger, Gas Fireplace, Geo-Thermal Heating / Cooling, Boiler, In-Floor Heating & Boiler, Exhaust Fan, Direct Fired Heater, Unit Heater, Heat Pump, Commercial Hood, Make-Up Air Unit, and other mechanical equipment)* **Commercial Mechanical Plan Review Fee is charged at a rate of 10% of permit fee only when the total project valuation exceeds $50,000.00**
Gas Piping Permit - *Not Associated With a Fixture*	$75.00 minimum or $12.00 per gas opening, whichever is greater
Minnesota State Surcharge must be paid in addition to permit fees:	$1.00 Minimum or .0005 x Permit Fee Value

CITY OF ANDOVER
1685 CROSSTOWN BOULEVARD NW, ANDOVER, MINNESOTA 55304 (763) 755-8700 • FAX (763) 755-8923 • WWW.ANDOVERMN.GOV

Special Structural Testing and Inspection Program Summary Schedule

PRINT IN INK or TYPE your responses.

PROJECT NAME	PROJECT NO.
LOCATION	PERMIT NO.

Technical (2)		Description (3)	Type of Inspector (4)	Specific Report Frequency (5)	Assigned Firm (6)
Section	Article				

Note: **This schedule shall be filled out and included in a Special Structural Testing and Inspection Program.**
(If not otherwise specified, assumed program will be "Guidelines for Special Inspection & Testing" as contained in the State Building Code and as modified by the state adopted IBC.)
A complete specification-ready program can be downloaded directly by visiting CASE/MN at www.cecm.org

(1) Permit No. to be provided by the Building Official
(2) Referenced to the specific technical scope section in the program.
(3) Use descriptions per IBC Chapter 17, as adopted by Minnesota State Building Code.
(4) Special Inspector – Technical (SIT); Special Inspector – Structural (SIS)
(5) Weekly, monthly, per test/inspection, per floor, etc.
(6) Name of Firm contracted to perform services.

ACKNOWLEDGEMENTS
(Each appropriate representative shall sign below)

Owner: ______________ Firm: ______________ Date: ______________

Contractor: ______________ Firm: ______________ Date: ______________

Architect: ______________ Firm: ______________ Date: ______________

SER: ______________ Firm: ______________ Date: ______________

SI-T ______________ Firm: ______________ Date: ______________

SI-S: ______________ Firm: ______________ Date: ______________

TA: ______________ Firm: ______________ Date: ______________

F: ______________ Firm: ______________ Date: ______________

If requested by engineer/architect of record or building official, the individual names of all prospective special inspectors and the work they intend to observe shall be identified as an attachment.

Legend: SER = Structural Engineer of Record SI-T = Special Inspector - TechnicalTA = Testing Agency
SI-S = Special Inspector - Structural F = Fabricator

Accepted for the Building Department By ______________________ Date ______________

Appendix S
Potential to Emit Evaluation

Memorandum

April 10, 2018

To:	Ben Klismith, MPCA	Ref. No.:	11129194-31-02
	TDR		
From:	Tim Ree/sb/2	Tel:	651-639-0913
CC:	Pat Hanson, MPCA Bob Martin, GHD Pete Romzick, GHD Sube Vel, GHD		

Subject: **Potential to Emit Evaluation**
Waste Disposal Engineering Closed Landfill
Industrial Waste Pit Removal Action
Andover, Minnesota

1. Introduction

GHD Services Inc. (GHD) is pleased to provide this Potential to Emit evaluation of potential emissions in the removal of the industrial waste pit at the Waste Disposal Engineering (WDE) Closed Landfill in Andover, Minnesota. This evaluation also provides an opinion as to if a facility air permit may be required, and at what permitting level, in order to complete the industrial waste pit removal action.

GHD understands that the WDE Closed Landfill ranks at the top of the list of Closed Landfill Program sites posing risks to human health and the environment. The MPCA has determined that the removal of the industrial waste pit at the WDE Closed Landfill is the most effective method to reduce long-term operation and maintenance costs and potential risks associated with environmental concerns at the Site. Industrial waste drums and containers were buried in a clay and asphalt lined pit between November 1972 and January 1974. A Site plan showing existing conditions in the immediate vicinity of the pit area is shown in Attachment A.

2. Background

Prior to MPCA permitting the WDE Site as a solid waste disposal facility in 1971, the WDE Site was operated as a solid waste dump ("dump") for approximately nine years by previous owners of the property. The dump was established around 1963 and was licensed, at least in the later years, by Grow Township. The dump was purchased by Waste Disposal Engineering, Incorporated (WDE, Inc.) in 1968. In 1970, WDE, Inc. submitted a permit application to the MPCA to operate a solid waste disposal facility. A proposal to dispose industrial materials in a specially constructed trench (i.e., pit) within the landfill was included in the permit application. On March 30, 1971, the MPCA issued permit SW 28 to WDE, Inc. to operate the WDE Site as a solid waste disposal facility including construction and operation of the WDE industrial waste pit.

Construction of the industrial waste pit began in 1971 and was completed in 1972. The MPCA approved the design of the industrial waste pit with a bottom/base consisting of a 6-inch clay layer overlain with six inches of bituminous liner followed by six inches of crushed limestone. Depth to groundwater beneath the industrial waste pit was to be at least ten feet. Materials to be disposed in the industrial waste pit included solvents, oils, paint. sludges, caustics, and acids. A permanent record of the disposal activities at the industrial waste pit was to be kept at the WDE Site by WDE, Inc. and the information reported monthly to the MPCA. It is reported that the industrial waste pit was operated from November 1972 to January 1974.

MPCA site inspections found that WDE, Inc. did not follow the plans approved by the MPCA for pit disposal operations. The MPCA ordered the WDE industrial waste pit closed effective February 1, 1974 due to changes in regulations and because the MPCA determined that a high potential for groundwater contamination existed at the WDE Site. WDE, Inc. submitted volume reports to Anoka County indicating that 2,318 55-gallon drums had been disposed at the WDE Site in 1973 and that at total of 3,354 drums had been disposed at the WDE Site during the two-year period between January 1972 and January 1974. It is unclear as to how many of these drums were disposed within the industrial waste pit. Other Site documentation indicates that approximately 6,000 drums/containers may have been disposed within the pit.

The bulk of waste disposed at the WDE Closed Landfill, outside of the industrial waste pit, was reportedly ordinary municipal waste. In addition to municipal waste, unknown quantities of demolition waste, industrial waste, and hazardous substances were deposited in the landfill outside of the pit. It has been estimated that, by volume, 95% of disposed hazardous substances within the pit are acids, oil, paint/paint sludge, and solvents.

Substantial site remedial actions were performed from 1992 to 1994 and included the construction of a multilayer soil cap, a slurry wall/NAPL control system around the industrial waste pit, a perimeter groundwater control system, a landfill gas venting system, two perimeter gas barrier membranes, stormwater management, and relocation of wetlands. The slurry wall was constructed with soil and bentonite to provide a low permeable perimeter barrier around the industrial waste pit and to contain groundwater and impacted soils.

In the late 1990's, a landfill gas extraction/control system with an enclosed flare station was installed to contain and combust landfill gas generated from decomposition of municipal waste within the landfill. The landfill gas extraction and flare system have been in continuous operation since installation.

3. Remedial Action Overview

A pre-design investigation was conducted during the spring of 2017 to delineate the horizontal and vertical limits of the industrial waste pit and develop a removal action plan. The industrial waste pit removal action plan generally consists of the removal and on-Site staging of the existing cover/cap, excavation and off-Site disposal of the drum/waste materials, excavation and off-Site disposal of pit liner materials, excavation and off-Site disposal of contaminated soils below and adjacent to the pit above groundwater.

It is expected that the removal action will start with the removal of approximately 5 to 10 feet of non-contaminated cover soils over the waste pit and adjacent work areas. The non-contaminated cover soils will be used as fill to construct a work area staging platform with excess soils staged at a designated area on the landfill cover for later reuse.

Excavation of the drum/waste disposal zone and underlying clay will extend to maximum depths ranging between approximately 25 and 28 feet below ground surface (bgs). Excavation of vadose zone soil directly below the drum/waste zone will extend to maximum depths ranging between approximately 31 and 34 feet bgs. Access and removal of the drum/waste materials will occur using a horizontal approach with the use of a ramp for labor and equipment access into the pit. It is anticipated that many containers will be deteriorated and that intact containers can be handled in a manner to minimize container breakage and release/spillage of contents. Following removal of the drum/waste and clay liner zone, contaminated pit subsoils will be excavated, loaded, and removed from the Site for off-Site treatment and disposal.

Given the magnitude of VOCs measured in the breathing zone during the pre-design investigation drilling, vapor control and treatment will be required during the industrial waste pit removal. A temporary enclosure will be erected over the pit to facilitate waste excavation, vapor control, waste characterization screening, and contaminated debris and soil staging. The temporary membrane covered frame structure/building will be used to enclose the areas of soil/waste excavation, waste/soil segregation and bulking, waste/soil loading and packaging, decontamination of equipment, materials, and workers. The temporary enclosed structure will allow for the control, contaminant, and treatment of vapor emissions prior to discharge to the atmosphere. The temporary enclosure will also provide dust control, prevent precipitation infiltration into the excavation area and spread of contamination, provide a visual barrier for the public to most work activities, and provide some noise control. Vapor control will consist of the use of multiple blowers to provide a negative pressure within the building with the discharge vapors treated with vapor phase carbon. The vapor phase carbon will be continuously monitored for breakthrough. In addition, air quality monitoring will be performed from various air monitoring stations at the Site perimeter and surrounding the work area to confirm on site management of air contaminants generated during the remedial action.

4. Emission Calculations

Three Site related sources represent potential for air emissions in evaluating the industrial waste pit removal action. These are::

- Waste pit removal action emissions
- Landfill gas extraction system emissions
- Wastewater pond emissions

4.1 Waste Pit Removal Emissions

Emissions from the removal of the waste pit were calculated using methods described in EPA-450/1-92-00: Estimation of Air Impacts for the Excavation of Contaminated Soil. A copy of this document is located in Attachment B (bookmark individual tables and attachments). This calculation method estimates the emission rates from the soil pore space and diffusion through the soil.

Analytical results from a recent extensive investigative sampling program for drum/waste material and contaminated soil were used to calculate estimated emissions during the removal action. The calculations were based on the assumption that the drum/waste layer and the pit subsoils layer will be excavated in separate phases. As discussed above, waste pit cover soils will be removed down to the top of the drum/waste layer. Then the drum/waste layer will be removed by starting at one end and moving horizontally to the other end. The cross sectional profile of the drum/waste layer is estimated to be on average 10 feet high and 70 feet wide and approximately 150 feet long. After the drum/waste layer is removed, the contaminated soil layer below the pit will be removed in a similar manner and using a similar working face of 10 feet high and 70 feet wide and approximately 150 feet long.

Key elements of the emission calculations include:

- GHD used the average concentration of each detected organic chemical in each layer within the industrial waste pit removal area. This is considered a conservative approach because it does not include any non-detected chemicals to reduce the calculated average concentration in each layer.
- GHD assumed the entire volume of each layer (i.e., waste interval and pit subsoil interval) contained the average concentration of each chemical (layer specific).
- The calculation method used the partial pressure of each chemical. The partial pressure of each chemical was calculated using Raoult's Law (assumes ideal liquid mixture). Vapor pressures were calculated at a temperature of 10 degrees Celsius.
- GHD assumed 50 percent (3,000 drums) remain intact and will require special handling during removal. The remaining non-intact drums and soil will be removed as the intact drums are removed. Removing an average of 10 drums per hour results in approximately 300 hours of excavation effort on the drum waste layer. The excavated soil and non-intact drums and waste will be staged and stored at the Site during disposal characterization and profiling. GHD included estimated emissions during storage of this material. There is an estimated total of approximately 2,500 cubic yards (CY) of drum waste and soil.
- GHD estimated approximately 4,200 CY of contaminated soil will be excavated beneath the industrial waste pit with an assumed excavation rate of 100 CY per 10 hour day/shift (8-hours of actual excavation work) resulting in approximately 336 hours of excavation effort. It is assumed this material will be excavated and directly loaded into containers, sealed, and relocated to a staging area outside the temporary enclosure. .
- GHD included both working and non-working periods in the emissions calculations.

Tables 1 through 3 summarize the chemical concentrations and vapor pressures with the calculated emission rates and total emissions based on the excavation rates discussed above. The calculated total emissions are as follows:

- Total VOC emissions are 9.81 tons
- Total HAP emissions are 9.71 tons
- Largest single HAP emission is 4.14 tons (tetrachloroethene)

The above emissions represent the Potential to Emit (PTE) for completing the industrial waste pit and subsoil removal action.

4.2 Landfill Gas Extraction System Emissions

Short Elliott Hendrickson Inc. (SEH) conducted and assessment of fugitive emissions associated with the landfill gas from the non-hazardous waste portion of the landfill for the MPCA in 2009. MPCA provided GHD a copy of their draft letter report which is presented in Attachment C.

SEH estimated fugitive emissions based on landfill gas generation rates calculated using the LandGEM model (based on waste in place and the age of the landfill) and sampled concentrations of various compounds in the landfill gas. SEH used the LandGEM data and sampled concentrations at the blower to determine the estimated potential fugitive emissions of federal hazardous air pollutants (HAPs). The results are presented in Table 3 of the SEH report. SEH estimates the maximum PTE of an individual HAP to be 0.81 ton per year (tpy) and the total PTE of all HAPS to be 2.31 tpy.

4.3 Wastewater Pond Emissions

The Site has a perimeter groundwater extraction system and aeration pond for the containment and treatment of impacted groundwater. Six groundwater extraction wells operate continuously in the extraction of groundwater at a rate of approximately 65 gallons per minute. The water is discharged into a lined holding pond that is mechanically aerated. GHD estimated the air emissions by using the average flow rate for each extraction well and associated analytical sampling results for each well. GHD conservatively assumed that all VOCs are removed from the extracted groundwater by pond aeration. Calculation of the PTE of all HAPS is determined to be negligible (<10/lbs/year).

5. Air Permit Requirements

GHD understands that the Minnesota Pollution Control Agency (MPCA) issues several types of air permits to facilities with potential emissions above state or federal thresholds. The factor that determines whether a permit is the amount of the facility's potential emissions. GHD calculated the total potential emissions to determine if they exceed state or federal thresholds for any of the pollutants summarized below.

Pollutant	MPCA Threshold (tpy)	Federal Threshold (tpy)
CO	100	100
NOx	100	100
SO2	50	100
PM	100	100
PM10	25	100
PM2.5	100	100
VOC	100	100
Lead (Pb)	0.5	10
Single HAP	10	10

Pollutant	MPCA Threshold (tpy)	Federal Threshold (tpy)
Total HAPs	25	25
CO2e	100,000	100,000

GHD finds that the calculated total potential emissions for the industrial waste pit removal action and other Site operations is well below the above thresholds; therefore, an air permit is not required. However, given the industrial waste pit removal action is unique in scope with many variables that cannot be fully defined, GHD recommends that the MPCA Air Quality Permit program complete a review of the project and provide an applicability determination that an air permit is not required.

Table 1

VOC and HAP Emissions from Waste Layer Excavation
Waste Disposal Engineering Closed Landfill - Industrial Waste Pit Removal Action
Andover, Minnesota

Emission Rate from Soil Pore Space (ER_{PS}) | **Emission Rate from Diffusion (ER_{DIFF})**

										During Active Excavation			During Weekend Non-active hours			During Weekday Non-active hours			Total					
Chemical	Partial Vapor Pressure[1] (mmHg)	Molecular Weight (g/gmol)	ER_{PS} Emission Rate_PS (g/sec)	ER_{PS} Emission Rate (lb/hr)	ER_{PS} Emission Rate (ton/duration of waste excavation)[2]	C Conc. In Soil Avg. (ug/kg)	C Conc. In Soil Avg. (g/cm^3)	Pure Chemical VP	Ratio: Partial Press to Pure VP[3]	During Active Excavavation ER_{DIFF} (g/sec)	Emission Rate_DIFF (lb/hr)	ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	During Weekend Non-active hours ER_{DIFF} (g/sec)	Emission Rate_DIFF (lb/hr)	ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	During Weekday Non-active hours ER_{DIFF} (g/sec)	Emission Rate_DIFF (lb/hr)	ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	CAS	HAP?	HAPs Only ER_{DIFF} Emission Rate (ton/duration of waste excavation)	TOTAL EMISSIONS ER_{PS} + ER_{DIFF} (Ton)	TOTAL HAP EMISSIONS ER_{PS} + ER_{DIFF} (Ton)
1,1,1-Trichloroethane	2.093	133.4	0.00	0.0	0.010	971,006	1.46E-03	64.4	0.033	0.2	1.2	0.2	0.0	0.1	0.0	0.0	0.3	0.0	0.3	71556	HAP	0.26	0.27	0.27
1,1,2-Trichloroethane	0.001	133.4	0.00	0.0	0.000	4,021	6.03E-06	10.3	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79005	HAP	0.00	0.00	0.00
1,1-Dichloroethane	0.335	99.0	0.00	0.0	0.001	63,789	9.57E-05	116.4	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75343	HAP	0.00	0.00	0.00
1,2,4-Trichlorobenzene	0.000	181.4	0.00	0.0	0.000	741	1.11E-06	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120821	HAP	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.001	120.2	0.00	0.0	0.000	30,778	4.62E-05	0.7	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95636			0.00	
1,2-Dichlorobenzene	0.002	147.0	0.00	0.0	0.000	124,655	1.87E-04	0.5	0.004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95501			0.00	
1,2-Dichloroethane	0.005	99.0	0.00	0.0	0.000	3,235	4.85E-06	37.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107062	HAP	0.00	0.00	0.00
1,2-Diphenylhydrazine	0.000	184.2	0.00	0.0	0.000	129	1.94E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122667	HAP	0.00	0.00	0.00
1,3,5-Trimethylbenzene	0.000	120.2	0.00	0.0	0.000	10,293	1.54E-05	0.8	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108678			0.00	
1,4-Dichlorobenzene	0.000	147.0	0.00	0.0	0.000	1,943	2.91E-06	0.6	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106467	HAP	0.00	0.00	0.00
1-Methylnaphthalene	0.000	142.2	0.00	0.0	0.000	3,421	5.13E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90120			0.00	
2,4,5-Trichlorophenol	0.000	197.4	0.00	0.0	0.000	0	0.00E+00	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95954	HAP	0.00	0.00	0.00
2-Butanone (Methyl ethyl ketone) (MEK)	0.981	72.1	0.00	0.0	0.002	348,100	5.22E-04	45.5	0.022	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	78933			0.06	
2-Chlorotoluene	0.000	126.6	0.00	0.0	0.000	1,817	2.73E-06	1.4	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95498			0.00	
2-Methylnaphthalene	0.000	142.2	0.00	0.0	0.000	5,213	7.82E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91576			0.00	
2-Methylphenol	0.000	108.2	0.00	0.0	0.000	5,613	8.42E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95487	HAP	0.00	0.00	0.00
2-Phenylbutane (sec-Butylbenzene)	0.000	134.2	0.00	0.0	0.000	1,988	2.98E-06	0.6	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135988			0.00	
3&4-Methylphenol	0.000	108.1	0.00	0.0	0.000	61,634	9.25E-05	0.0	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108394	HAP	0.00	0.00	0.00
4-Chloro-3-methylphenol	0.000	142.6	0.00	0.0	0.000	1,240	1.86E-06	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59507			0.00	
4-Chlorotoluene	0.000	126.6	0.00	0.0	0.000	1,806	2.71E-06	1.4	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106434			0.00	
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.015	100.2	0.00	0.0	0.000	62,959	9.44E-05	5.4	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108101	HAP	0.00	0.00	0.00
Acenaphthene	0.000	154.2	0.00	0.0	0.000	242	3.63E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83329			0.00	
Acetone	38.259	58.1	0.03	0.3		8,144,400	1.22E-02	61.1	0.626											67641				
Acrolein	0.004	56.1	0.00	0.0	0.000	390	5.85E-07	142.5	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107028			0.00	
Anthracene	0.000	178.2	0.00	0.0	0.000	143	2.14E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120127			0.00	
Benzene	0.007	78.1	0.00	0.0	0.000	2,570	3.86E-06	45.5	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71432			0.00	
bis(2-Ethylhexyl)phthalate (DEHP)	0.000	390.6	0.00	0.0	0.000	74,866	1.12E-04	0.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	117817			0.00	
Butyl benzylphthalate (BBP)	0.000	312.4	0.00	0.0	0.000	13,074	1.96E-05	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85687			0.00	
Chlorobenzene	0.022	112.6	0.00	0.0	0.000	114,944	1.72E-04	4.9	0.005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108907	HAP	0.00	0.00	0.00
Chloromethane (Methyl chloride)	0.016	50.5	0.00	0.0	0.000	67	1.00E-07	2728.9	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74873	HAP	0.00	0.00	0.00
cis-1,2-Dichloroethene	0.063	96.9	0.00	0.0	0.000	13,255	1.99E-05	102.9	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	156592			0.00	
Cymene (p-Isopropyltoluene)	0.000	134.2	0.00	0.0	0.000	1,630	2.44E-06	0.5	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99876			0.00	
Dibenzofuran	0.000	168.2	0.00	0.0	0.000	718	1.08E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	132649	HAP	0.00	0.00	0.00
Dichlorodifluoromethane (CFC-12)	0.000	120.9	0.00	0.0	0.000	9,525	1.43E-05	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75718			0.00	
Diethyl phthalate	0.000	222.3	0.00	0.0	0.000	677	1.02E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84662			0.00	
Dimethyl phthalate	0.000	194.2	0.00	0.0	0.000	6,030	9.05E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	131113	HAP	0.00	0.00	0.00
Di-n-butylphthalate (DBP)	0.000	278.8	0.00	0.0	0.000	183,042	2.75E-04	0.0	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84742	HAP	0.00	0.00	0.00
Ethylbenzene	0.051	106.2	0.00	0.0	0.000	318,640	4.78E-04	3.8	0.013	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100414	HAP	0.03	0.03	0.03
Fluoranthene	0.000	202.3	0.00	0.0	0.000	374	5.61E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	206440			0.00	
Fluorene	0.000	166.2	0.00	0.0	0.000	716	1.07E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86737			0.00	
Isophorone	0.000	138.2	0.00	0.0	0.000	34,370	5.16E-05	0.1	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78591	HAP	0.00	0.00	0.00
Isopropyl benzene	0.001	120.2	0.00	0.0	0.000	10,465	1.57E-05	1.7	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98828	HAP	0.00	0.00	0.00
Methylene chloride	1.748	84.9	0.00	0.0	0.005	143,965	2.16E-04	231.0	0.008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75092	HAP	0.01	0.01	0.01
Naphthalene	0.000	128.2	0.00	0.0	0.000	10,938	1.64E-05	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91203	HAP	0.00	0.00	0.00
N-Butylbenzene	0.000	134.2	0.00	0.0	0.000	3,890	5.84E-06	0.3	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104518			0.00	
Nitrobenzene	0.000	123.1	0.00	0.0	0.000	0	0.00E+00	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98953	HAP	0.00	0.00	0.00
N-Nitrosodiphenylamine	0.000	198.2	0.00	0.0	0.000	154	2.31E-07	3.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86306			0.00	
N-Propylbenzene	0.000	120.2	0.00	0.0	0.000	8,867	1.33E-05	1.2	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103651			0.00	
o-Xylene	0.019	106.2	0.00	0.0	0.000	172,969	2.59E-04	2.5	0.007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95476	HAP	0.01	0.01	0.01
Phenanthrene	0.000	178.2	0.00	0.0	0.000	1,075	1.61E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85018			0.00	
Phenol	0.000	94.1	0.00	0.0	0.000	69,884	1.05E-04	0.1	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108952	HAP	0.00	0.00	0.00
Pyrene	0.000	202.3	0.00	0.0	0.000	539	8.09E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129000			0.00	
Styrene	0.068	104.2	0.00	0.0	0.000	679,568	1.02E-03	2.3	0.029	0.1	0.8	0.1	0.0	0.1	0.0	0.0	0.2	0.0	0.2	100425	HAP	0.16	0.16	0.16
tert-Butylbenzene	0.000	134.2	0.00	0.0	0.000	438	6.57E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98066			0.00	
Tetrachloroethene	0.083	165.8	0.00	0.0	0.000	394,357	5.92E-04	7.8	0.011	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	127184	HAP	0.03	0.03	0.03
Toluene	0.665	92.2	0.00	0.0	0.002	1,104,636	1.66E-03	12.4	0.054	0.3	2.3	0.3	0.0	0.3	0.0	0.1	0.5	0.1	0.5	108883	HAP	0.48	0.48	0.48
Trichloroethene	3.023	131.4	0.01	0.0	0.014	2,514,271	3.77E-03	35.4	0.085	1.1	8.4	1.3	0.1	0.9	0.1	0.2	1.9	0.3	1.7	79016	HAP	1.74	1.75	1.75
Trichlorofluoromethane (CFC-11)	0.795	137.4	0.00	0.0	0.004	53,575	8.04E-05	456.2	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75694			0.00	
Trifluorotrichloroethane (CFC-113)	0.185	187.4	0.00	0.0	0.001	43,626	6.54E-05	177.5	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76131			0.00	
m&p-Xylenes	0.078	106.2	0.00	0.0	0.000	536,446	8.05E-04	3.5	0.023	0.1	0.5	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	108383	HAP	0.10	0.10	0.10
Xylenes (total)	0.199	106.2	0.00	0.0	0.001	1,363,189	2.04E-03	3.5	0.057	0.4	3.1	0.5	0.0	0.3	0.1	0.1	0.7	0.1	0.6	1330207	HAP	0.63	0.63	0.63
			Subtotal:	0.396	**0.042**	17,736,902					17.1	2.6		1.9	0.3		3.8	0.7	3.5			3.47	3.58	3.50

VP Temperature	10	(C)
VP Temperature	283	(K)
E_a Air filled porosity	0.440	(Dimensionless)
ExC Soil-gas to atmosphere exchange constant	0.33	(Dimensionless)
Q Excavation Rate	0.0018	(m^3/sec)
Q Excavation Rate	0.14	(yd^3/min)
R Gas constant	62,361	(mmHg-cm^3/gmol-K)
Soil Bulk Density	1.5	g/cm^3 (1.5 is typical for uncompacted soil)

SA Surface area	1060	(ft^2)	Based on uncovered 10x70 working face, 8x20 rolloff, and 10'x20' storage pile
SA Surface area	98.5	(m^2)	
E_a Air-filled porosity	0.440	(Dimensionless)	
K_{eq} Equilibrium coefficient	0.613	(Dimensionless)	
k_g Gas-phase mass transfer coefficient	0.15	k_g Gas-phase mass transfer coefficient (cm/sec)	
t, Time	453	(sec)	Time since start of excavation for active excavation working hours
t, Time	38,400	(sec)	Time since start of excavation for weekend non-working hours
t, Time	9,600	(sec)	Time since start of excavation for weekday non-working hours
D_e Effective diffusivity in air	0.0269	(cm^2/sec)	

Notes:

[1]Parital pressure based on Raoult's law.

[2]Excavation assumes material is handled twice, once for initial excavation and a second time for removing from stockpiles. Concentrations is assumed to remain constant which is conservative. In addition, the second time the was material is handled there will be no drums so excavation will be quicker resulting in less pore space emissions, so emissions are conservative because it is assumed the material is handled as slowly as when excavation with the drums was occurring.

[3]The calculated diffusion emission rate for each chemical is multiplied by the ratio of the chemicals partial pressure to the pure vapor pressure to account for the reduced tendancy of each chemical to vaporize in a mixture.

Table 2

VOC AND HAP Emissions from Subsoil Below Waste Layer Excavation
Waste Disposal Engineering Closed Landfill - Industrial Waste Pit Removal Action
Andover, Minnesota

Emission Rate from Soil Pore Space (ER_{PS}) / **Emission Rate from Diffusion (ER_{DIFF})**

Chemical	Partial Vapor Pressure[1] (mmHg)	Molecular Weight (g/gmol)	ER_{PS} Emission Rate_PS (g/sec)	ER_{PS} Emission Rate (lb/hr)	ER_{PS} Emission Rate (ton/duration of waste excavation)[2]	C Conc. In Soil Avg. (ug/kg)	C Conc. In Soil Avg. (g/cm^3)	Pure VP	Ratio: Partial Press to Pure VP	During Active Excavation: During Active Excavation ER_{DIFF} (g/sec)	During Active Excavation: Emission Rate_DIFF (lb/hr)	During Active Excavation: ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	During Weekend Non-active hours: During Weekend Non-active hours ER_{DIFF} (g/sec)	During Weekend Non-active hours: Emission Rate_DIFF (lb/hr)	During Weekend Non-active hours: ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	During Weekday Non-active hours: During Weekday Non-active hours ER_{DIFF} (g/sec)	During Weekday Non-active hours: Emission Rate_DIFF (lb/hr)	During Weekday Non-active hours: ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	Total: ER_{DIFF} Emission Rate (ton/duration of waste excavaton)	CAS	HAP?	HAPs Only Proratede based on partial to true VP ER_{DIFF} Emission Rate (ton/duration of waste excavation)	TOTAL EMISSIONS ER_{PS} + ER_{DIFF} (Ton)	TOTAL HAP EMISSIONS ER_{PS} + ER_{DIFF} (Ton)
1,1,1-Trichloroethane	5.365	133.4	0.02	0.1	0.042	263,314	3.95E-04	64.4	0.083	0.1	1.1	0.2	0.0	0.1	0.0	0.0	0.2	0.0	0.2	71556	HAP	0.23	0.27	0.27
1,1,2-Trichloroethane	0.005	133.4	0.00	0.0	0.000	1,402	2.10E-06	10.3	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	79005	HAP	0.00	0.00	0.00
1,1-Dichloroethane	0.224	99.0	0.00	0.0	0.001	4,507	6.76E-06	116.4	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75343	HAP	0.00	0.00	0.00
1,2,4-Trichlorobenzene	0.000	181.4	0.00	0.0	0.000	641	9.62E-07	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120821	HAP	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.005	120.2	0.00	0.0	0.000	19,375	2.91E-05	0.7	0.007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95636			0.00	
1,2-Dichlorobenzene	0.009	147.0	0.00	0.0	0.000	64,860	9.73E-05	0.5	0.019	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95501			0.01	
1,2-Dichloroethane	0.023	99.0	0.00	0.0	0.000	1,430	2.15E-06	37.0	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107062	HAP	0.00	0.00	0.00
1,2-Diphenylhydrazine	0.000	184.2	0.00	0.0	0.000	193	2.89E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	122667	HAP	0.00	0.00	0.00
1,3,5-Trimethylbenzene	0.002	120.2	0.00	0.0	0.000	6,239	9.36E-06	0.8	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108678			0.00	
1,4-Dichlorobenzene	0.000	147.0	0.00	0.0	0.000	1,240	1.86E-06	0.6	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106467	HAP	0.00	0.00	0.00
1-Methylnaphthalene	0.000	142.2	0.00	0.0	0.000	1,046	1.57E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90120			0.00	
2,4,5-Trichlorophenol	0.000	197.4	0.00	0.0	0.000	114	1.71E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95954	HAP	0.00	0.00	0.00
2-Butanone (Methyl ethyl ketone) (MEK)	0.434	72.1	0.00	0.0	0.002	16,291	2.44E-05	45.5	0.010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78933			0.00	
2-Chlorotoluene	0.001	126.6	0.00	0.0	0.000	1,853	2.78E-06	1.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95498			0.00	
2-Methylnaphthalene	0.000	142.2	0.00	0.0	0.000	1,435	2.15E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91576			0.00	
2-Methylphenol	0.000	108.2	0.00	0.0	0.000	45	6.72E-08	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95487	HAP	0.00	0.00	0.00
2-Phenylbutane (sec-Butylbenzene)	0.000	134.2	0.00	0.0	0.000	1,040	1.56E-06	0.6	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	135988			0.00	
3&4-Methylphenol	0.000	108.1	0.00	0.0	0.000	185	2.77E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108394	HAP	0.00	0.00	0.00
4-Chloro-3-methylphenol	0.000	142.6	0.00	0.0	0.000	189	2.83E-07	0.1	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59507			0.00	
4-Chlorotoluene	0.001	126.6	0.00	0.0	0.000	2,543	3.81E-06	1.4	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106434			0.00	
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.001	100.2	0.00	0.0	0.000	245	3.67E-07	5.4	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108101	HAP	0.00	0.00	0.00
Acenaphthene	0.000	154.2	0.00	0.0	0.000	126	1.89E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83329			0.00	
Acetone	0.151	58.1	0.00	0.0	0.001	3,400	5.10E-06	61.1	0.002	0.0	0.0		0.0	0.0		0.0	0.0		0.0	67641			0.00	
Acrolein	0.352	56.1	0.00	0.0	0.001	3,280	4.92E-06	142.5	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107028			0.00	
Anthracene	0.000	178.2	0.00	0.0	0.000	38	5.73E-08	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120127			0.00	
Benzene	0.003	78.1	0.00	0.0	0.000	121	1.81E-07	45.5	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71432			0.00	
bis(2-Ethylhexyl)phthalate (DEHP)	0.000	390.6	0.00	0.0	0.000	3,657	5.49E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	117817			0.00	
Butyl benzylphthalate (BBP)	0.000	312.4	0.00	0.0	0.000	54	8.12E-08	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85687			0.00	
Chlorobenzene	0.003	112.6	0.00	0.0	0.000	1,370	2.06E-06	4.9	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108907	HAP	0.00	0.00	0.00
Chloromethane (Methyl chloride)	0.071	50.5	0.00	0.0	0.000	31	4.68E-08	2728.9	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74873	HAP	0.00	0.00	0.00
cis-1,2-Dichloroethene	0.059	96.9	0.00	0.0	0.000	1,326	1.99E-06	102.9	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	156592			0.00	
Cymene (p-Isopropyltoluene)	0.000	134.2	0.00	0.0	0.000	1,301	1.95E-06	0.5	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99876			0.00	
Dibenzofuran	0.000	168.2	0.00	0.0	0.000	159	2.38E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	132649	HAP	0.00	0.00	0.00
Dichlorodifluoromethane (CFC-12)	0.000	120.9	0.00	0.0	0.000	235	3.53E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75718			0.00	
Diethyl phthalate	0.000	222.3	0.00	0.0	0.000	962	1.44E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84662			0.00	
Dimethyl phthalate	0.000	194.2	0.00	0.0	0.000	173	2.60E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	131113	HAP	0.00	0.00	0.00
Di-n-butylphthalate (DBP)	0.000	278.8	0.00	0.0	0.000	1,322	1.98E-06	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	84742	HAP	0.00	0.00	0.00
Ethylbenzene	0.181	106.2	0.00	0.0	0.001	121,017	1.82E-04	3.8	0.048	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	100414	HAP	0.06	0.06	0.06
Fluoranthene	0.000	202.3	0.00	0.0	0.000	130	1.95E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	206440			0.00	
Fluorene	0.000	166.2	0.00	0.0	0.000	306	4.59E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86737			0.00	
Isophorone	0.001	138.2	0.00	0.0	0.000	18,134	2.72E-05	0.1	0.006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	78591	HAP	0.00	0.00	0.00
Isopropyl benzene	0.003	120.2	0.00	0.0	0.000	4,911	7.37E-06	1.7	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98828	HAP	0.00	0.00	0.00
Methylene chloride	1.292	84.9	0.00	0.0	0.006	11,252	1.69E-05	231.0	0.006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75092	HAP	0.00	0.01	0.01
Naphthalene	0.000	128.2	0.00	0.0	0.000	3,432	5.15E-06	0.1	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	91203	HAP	0.00	0.00	0.00
N-Butylbenzene	0.000	134.2	0.00	0.0	0.000	1,371	2.06E-06	0.3	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	104518			0.00	
Nitrobenzene	0.000	123.1	0.00	0.0	0.000	2,610	3.92E-06	0.1	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98953	HAP	0.00	0.00	0.00
N-Nitrosodiphenylamine	0.000	198.2	0.00	0.0	0.000	220	3.30E-07	3.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86306			0.00	
N-Propylbenzene	0.002	120.2	0.00	0.0	0.000	4,858	7.29E-06	1.2	0.002	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103651			0.00	
o-Xylene	0.065	106.2	0.00	0.0	0.000	63,844	9.58E-05	2.5	0.025	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	95476	HAP	0.02	0.02	0.02
Phenanthrene	0.000	178.2	0.00	0.0	0.000	526	7.89E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85018			0.00	
Phenol	0.000	94.1	0.00	0.0	0.000	6,595	9.89E-06	0.1	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	108952	HAP	0.00	0.00	0.00
Pyrene	0.000	202.3	0.00	0.0	0.000	246	3.69E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129000			0.00	
Styrene	0.008	104.2	0.00	0.0	0.000	8,090	1.21E-05	2.3	0.003	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100425	HAP	0.00	0.00	0.00
tert-Butylbenzene	0.000	134.2	0.00	0.0	0.000	612	9.18E-07	0.0	0.000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98066			0.00	
Tetrachloroethene	2.468	165.8	0.01	0.1	0.024	1,241,386	1.86E-03	7.8	0.316	2.4	18.8	3.2	0.2	1.7	0.3	0.4	3.4	0.6	4.1	127184	HAP	4.08	4.10	4.10
Toluene	1.251	92.2	0.00	0.0	0.007	219,736	3.30E-04	12.4	0.101	0.1	1.1	0.2	0.0	0.1	0.0	0.0	0.2	0.0	0.2	108883	HAP	0.23	0.24	0.24
Trichloroethene	1.951	131.4	0.01	0.0	0.015	171,669	2.58E-04	35.4	0.055	0.1	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1	79016	HAP	0.10	0.11	0.11
Trichlorofluoromethane (CFC-11)	0.506	137.4	0.00	0.0	0.004	3,610	5.41E-06	456.2	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75694			0.00	
Trifluorotrichloroethane (CFC-113)	0.108	187.4	0.00	0.0	0.001	2,706	4.06E-06	177.5	0.001	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76131			0.00	
m&p-Xylenes	0.274	106.2	0.00	0.0	0.002	198,977	2.98E-04	3.5	0.079	0.1	0.8	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.2	108383	HAP	0.16	0.17	0.17
Xylenes (total)	0.748	106.2	0.00	0.0	0.005	542,785	8.14E-04	3.5	0.216	0.7	5.6	0.9	0.1	0.5	0.1	0.1	1.0	0.2	1.2	1330207	HAP	1.22	1.22	1.22
			Subtotal:	0.334	**0.112**	3,034,762					28.2	4.7		2.5	0.5		5.1	0.9	6.1			6.10	6.23	6.20

VP Temperature	10	(C)
VP Temperature	283	(K)
E_a Air filled porosity	0.440	(Dimensionless)
ExC Soil-gas to atmosphere exchange constant	0.33	(Dimensionless)
Q Excavation Rate	0.0027	(m^3/sec)
Q Excavation Rate	0.21	(yd^3/min)
R Gas constant	62,361	(mmHg-cm^3/gmol-K)
Soil Bulk Density	1.5	g/cm^3 (1.5 is typical for uncompacted soil)

SA Surface area	1060	(ft^2)	Based on uncovered 10x70 working face, 8x20 rolloff, and 10'x20' storage pile
SA Surface area	98.5	(m^2)	
E_a Air-filled porosity	0.440	(Dimensionless)	
K_{eq} Equilibrium coefficient	0.613	(Dimensionless)	
k_g Gas-phase mass transfer coefficient	0.15	k_g Gas-phase mass transfer coefficient (cm/sec)	
t, Time	302	(sec)	Time since start of excavation for active excavation working hours
t, Time	38,400	(sec)	Time since start of excavation for weekend non-working hours
t, Time	9,600	(sec)	Time since start of excavation for weekday non-working hours
D_e Effective diffusivity in air	0.0269	(cm^2/sec)	

Notes:
[1]Parital pressure based on Raoult's law.

[2]Excavation assumes material is handled twice, once for initial excavation and a second time for removing from stockpiles. Concentrations is assumed to remain constant which is conservative. In addition, the second time the was material is handled there will be no drums so excavation will be quicker resulting in less pore space emissions, so emissions are conservative because it is assumed the material is handled as slowly as when excavation with the drums was occurring.
[3]The calculated diffusion emission rate for each chemical is multiplied by the ratio of the chemicals partial pressure to the pure vapor pressure to account for the reduced tendancy of each chemical to vaporize in a mixture.

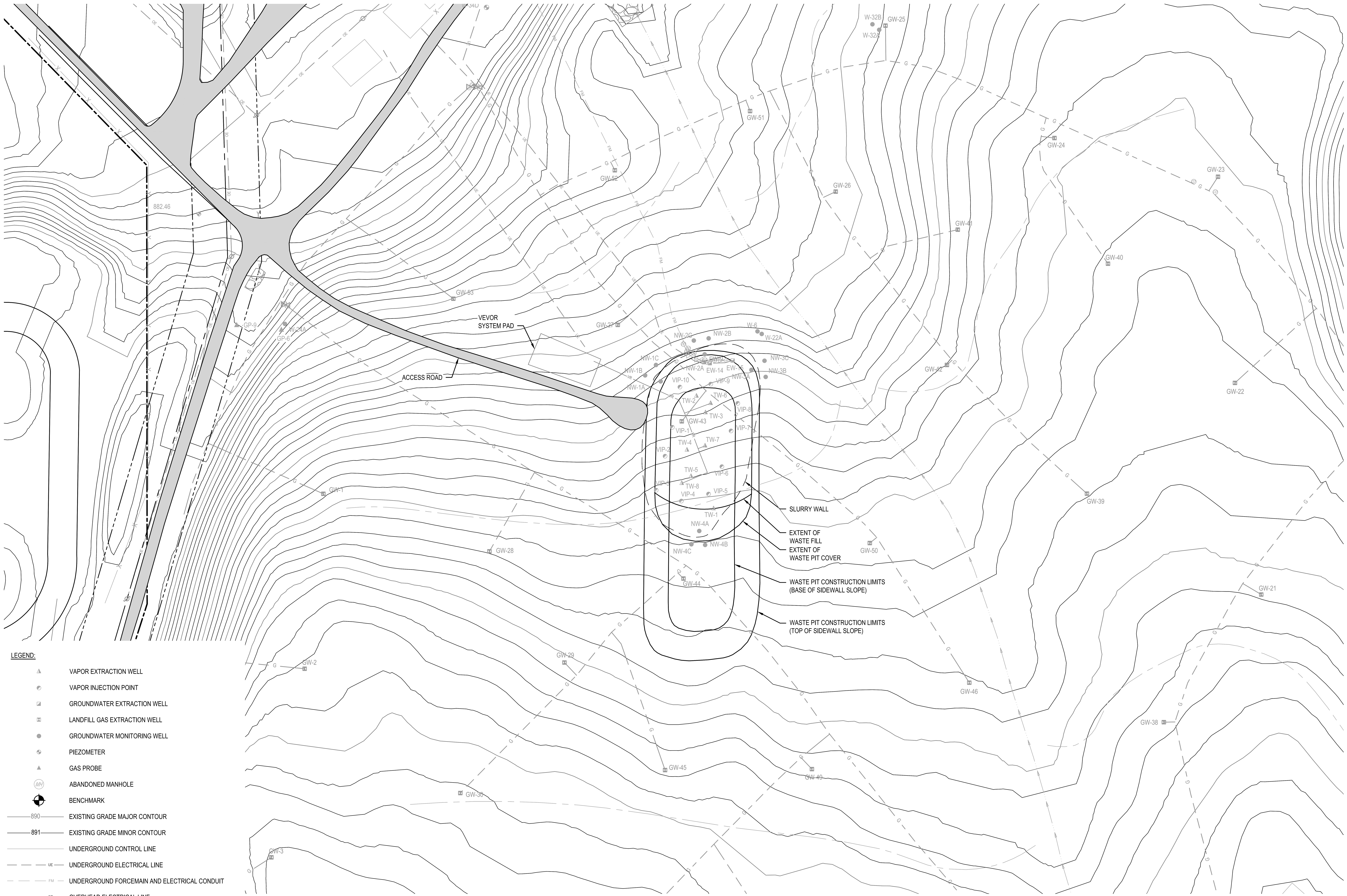
Table 3

Total VOC and HAP Emissions
Waste Disposal Engineering Closed Landfill - Industrial Waste Pit Removal Action
Andover, Minnesota

Emissions from Soil Pore Space (ER_{PS}) and Diffusion (ER_{DIFF})

Chemical	Waste Excavation Emissions $ER_{PS} + ER_{DIFF}$ (Ton)	Waste Excavation HAP Emissions $ER_{PS} + ER_{DIFF}$ (Ton)	Beneath Waste Excavation Emissions $ER_{PS} + ER_{DIFF}$ (Ton)	Beneath Waste HAP Emissions $ER_{PS} + ER_{DIFF}$ (Ton)	Excavation Total Emissions $ER_{PS} + ER_{DIFF}$ (Ton)	Excavation Total HAP Emissions $ER_{PS} + ER_{DIFF}$ (Ton)
1,1,1-Trichloroethane	0.27	0.27	0.27	0.27	0.54	0.54
1,1,2-Trichloroethane	0.00	0.00	0.00	0.00	0.00	0.00
1,1-Dichloroethane	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-Trichlorobenzene	0.00	0.00	0.00	0.00	0.00	0.00
1,2,4-Trimethylbenzene	0.00		0.00		0.00	
1,2-Dichlorobenzene	0.00		0.01		0.02	
1,2-Dichloroethane	0.00	0.00	0.00	0.00	0.00	0.00
1,2-Diphenylhydrazine	0.00	0.00	0.00	0.00	0.00	0.00
1,3,5-Trimethylbenzene	0.00		0.00		0.00	
1,4-Dichlorobenzene	0.00	0.00	0.00	0.00	0.00	0.00
1-Methylnaphthalene	0.00		0.00		0.00	
2,4,5-Trichlorophenol	0.00	0.00	0.00	0.00	0.00	0.00
2-Butanone (Methyl ethyl ketone) (MEK)	0.06		0.00		0.07	
2-Chlorotoluene	0.00		0.00		0.00	
2-Methylnaphthalene	0.00		0.00		0.00	
2-Methylphenol	0.00	0.00	0.00	0.00	0.00	0.00
2-Phenylbutane (sec-Butylbenzene)	0.00		0.00		0.00	
3&4-Methylphenol	0.00	0.00	0.00	0.00	0.00	0.00
4-Chloro-3-methylphenol	0.00		0.00		0.00	
4-Chlorotoluene	0.00		0.00		0.00	
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.00	0.00	0.00	0.00	0.00	0.00
Acenaphthene	0.00		0.00		0.00	
Acetone						
Acrolein	0.00		0.00		0.00	
Anthracene	0.00		0.00		0.00	
Benzene	0.00		0.00		0.00	
bis(2-Ethylhexyl)phthalate (DEHP)	0.00		0.00		0.00	
Butyl benzylphthalate (BBP)	0.00		0.00		0.00	
Chlorobenzene	0.00	0.00	0.00	0.00	0.00	0.00
Chloromethane (Methyl chloride)	0.00	0.00	0.00	0.00	0.00	0.00
cis-1,2-Dichloroethene	0.00		0.00		0.00	
Cymene (p-Isopropyltoluene)	0.00		0.00		0.00	
Dibenzofuran	0.00	0.00	0.00	0.00	0.00	0.00
Dichlorodifluoromethane (CFC-12)	0.00		0.00		0.00	
Diethyl phthalate	0.00		0.00		0.00	
Dimethyl phthalate	0.00	0.00	0.00	0.00	0.00	0.00
Di-n-butylphthalate (DBP)	0.00	0.00	0.00	0.00	0.00	0.00
Ethylbenzene	0.03	0.03	0.06	0.06	0.10	0.10
Fluoranthene	0.00		0.00		0.00	
Fluorene	0.00		0.00		0.00	
Isophorone	0.00	0.00	0.00	0.00	0.00	0.00
Isopropyl benzene	0.00	0.00	0.00	0.00	0.00	0.00
Methylene chloride	0.01	0.01	0.01	0.01	0.02	0.02
Naphthalene	0.00	0.00	0.00	0.00	0.00	0.00
N-Butylbenzene	0.00		0.00		0.00	
Nitrobenzene	0.00	0.00	0.00	0.00	0.00	0.00
N-Nitrosodiphenylamine	0.00		0.00		0.00	
N-Propylbenzene	0.00		0.00		0.00	
o-Xylene	0.01	0.01	0.02	0.02	0.03	0.03
Phenanthrene	0.00		0.00		0.00	
Phenol	0.00	0.00	0.00	0.00	0.00	0.00
Pyrene	0.00		0.00		0.00	
Styrene	0.16	0.16	0.00	0.00	0.16	0.16
tert-Butylbenzene	0.00		0.00		0.00	
Tetrachloroethene	0.03	0.03	4.10	4.10	4.14	4.14
Toluene	0.48	0.48	0.24	0.24	0.72	0.72
Trichloroethene	1.75	1.75	0.11	0.11	1.87	1.87
Trichlorofluoromethane (CFC-11)	0.00		0.00		0.01	
Trifluorotrichloroethane (CFC-113)	0.00		0.00		0.00	
m&p-Xylenes	0.10	0.10	0.17	0.17	0.26	0.26
Xylenes (total)	0.63	0.63	1.22	1.22	1.86	1.86
Totals:	3.58	3.50	6.23	6.20	9.81	9.71
					Limit is 100 tons per year VOCs for all sources	Limits are 25 tons per year HAPS from all sources and 10 tons per year for any individual HAP from all sources

Attachment A
Site Plan



LEGEND:

- VAPOR EXTRACTION WELL
- VAPOR INJECTION POINT
- GROUNDWATER EXTRACTION WELL
- LANDFILL GAS EXTRACTION WELL
- GROUNDWATER MONITORING WELL
- PIEZOMETER
- GAS PROBE
- ABANDONED MANHOLE
- BENCHMARK
- 890 EXISTING GRADE MAJOR CONTOUR
- 891 EXISTING GRADE MINOR CONTOUR
- UNDERGROUND CONTROL LINE
- UE UNDERGROUND ELECTRICAL LINE
- FM UNDERGROUND FORCEMAIN AND ELECTRICAL CONDUIT
- OE OVERHEAD ELECTRICAL LINE
- VR VEVOR SYSTEM PIPING
- G LANDFILL GAS HEADER PIPING
- BERM
- X FENCE
- SWALE

PLAN

SCALE 1" = 50'

0 50' 100'

PRELIMINARY DESIGN

GHD

GHD Services Inc.
1801 Old Highway 8 Northwest, Suite 114
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Client

MINNESOTA POLLUTION CONTROL AGENCY

Project

WASTE DISPOSAL ENGINEERING CLOSED LANDFILL - INDUSTRIAL WASTE PIT REMOVAL

No.	Issue	Drawn	Approved	Date
A	ISSED FOR REVIEW	CRR	TDR	03/26/18

Drawn	C. ROHRICH	Designer	T. REE
Drafting Check		Design Check	
Project Manager	R. MARTIN	Date	MAY 2017
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 50'
Original Size	ANSI D	Bar is one inch on original size sheet	0 1"

Project No. 11129194

Title

PIT AREA SITE PLAN

Sheet No.

111-29194-C003

Sheet 3 of 17

Plot Date: 8 March 2018 - 10:11 AM Plotted By: Christopher Rohrich Filename: p:\Drawings\10000000's\11129194\11129194-reports\11129194-00(005)\11129194-00(005)CI\111-29194-C003.dwg

Attachment B
Estimation of Air Impacts

United States
Environmental Protection
Agency

Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/1-92-004
March 1992

PB92-171925

Air/Superfund

EPA

AIR/SUPERFUND NATIONAL TECHNICAL GUIDANCE STUDY SERIES

Estimation of Air Impacts for the Excavation of Contaminated Soil

c

EPA - 450/1-92-004

AIR/SUPERFUND NATIONAL TECHNICAL
GUIDANCE STUDY SERIES

Estimation of Air Impacts for the Excavation of Contaminated Soil

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EPA Contract Number 68-D1-0031
Work Assignment 013

Prepared for:

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Office of Air and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

March 18, 1992

DISCLAIMER

This report has been reviewed by the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, and has been approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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INTRODUCTION

The U.S. Environmental Protection Agency's Office of Air Quality Planning and Standards and the Regional Air Offices have been given the responsibility to evaluate air impacts from Superfund sites. An important part of this program is the analysis of air impacts from various alternatives for cleaning up Superfund sites. Since these analyses are frequently required for planning purposes prior to actual cleanup they depend on estimated emissions and ambient concentrations rather than on field measurements.

This report provides procedures for roughly estimating the ambient air concentrations associated with the excavation of contaminated soil. These procedures are analogous to procedures for air strippers and soil vapor extraction systems that have previously been published[1,2]. Excavation is an integral part of any Superfund site remediation that involves removal or ex-situ treatment such as incineration, thermal desorption, bioremediation, or solidification/stabilization. Procedures are given to evaluate the effect of concentration and physical properties of the contaminants in the soil on the emission rates and on the ambient air concentrations at selected distances from the the excavation site.

Health-based ambient air action levels are also provided for comparison to the estimated ambient concentrations. Many of the health levels have not been verified by EPA or are based on extrapolations of oral exposures or occupational exposures. Their indiscriminate use could either under or over estimate the potential health effects. The statements and conclusions presented in this report are those of the authors and do not reflect U.S. EPA policy.

PROCESS DESCRIPTION

Excavation and removal of soils contaminated with Volatile Organic Compounds (VOCs) is a common practice at Superfund sites. Excavation and removal may be the selected remediation approach or it may be a necessary step in a remediation approach involving treatment. If removal is the preferred approach, the excavated soil is typically transported off-site for subsequent disposal at a landfill. If the soil contains large amounts of fuel or highly toxic contaminants, the soil may need to be treated off-site prior to final disposal. Excavation activities are also typically part of on-site treatment processes such as incineration, thermal desorption, batch biotreatment, landtreatment, and certain chemical and physical treatment methods. The soil is excavated and transported to the process unit and the treated soil is typically put back into place on the site.

VOC emissions from handling operations result from the exchange of contaminant-laden soil-pore gas with the atmosphere when soil is disturbed and from diffusion of contaminants through the soil. There are multiple potential emission points for each of the various soils handling operations. For excavation, the main emission points of concern are emissions from:

- exposed waste in the excavation pit;
- material as it is dumped from the excavation bucket; and
- waste/soil in short-term storage piles.

An idealized excavation scenario is shown in Figure 1 and assumes that each scoop of excavated soil has dimensions of 1m x 2m x 1m and that the soil is removed as a series of blocks that retain their shape and are stacked in a temporary storage pile.

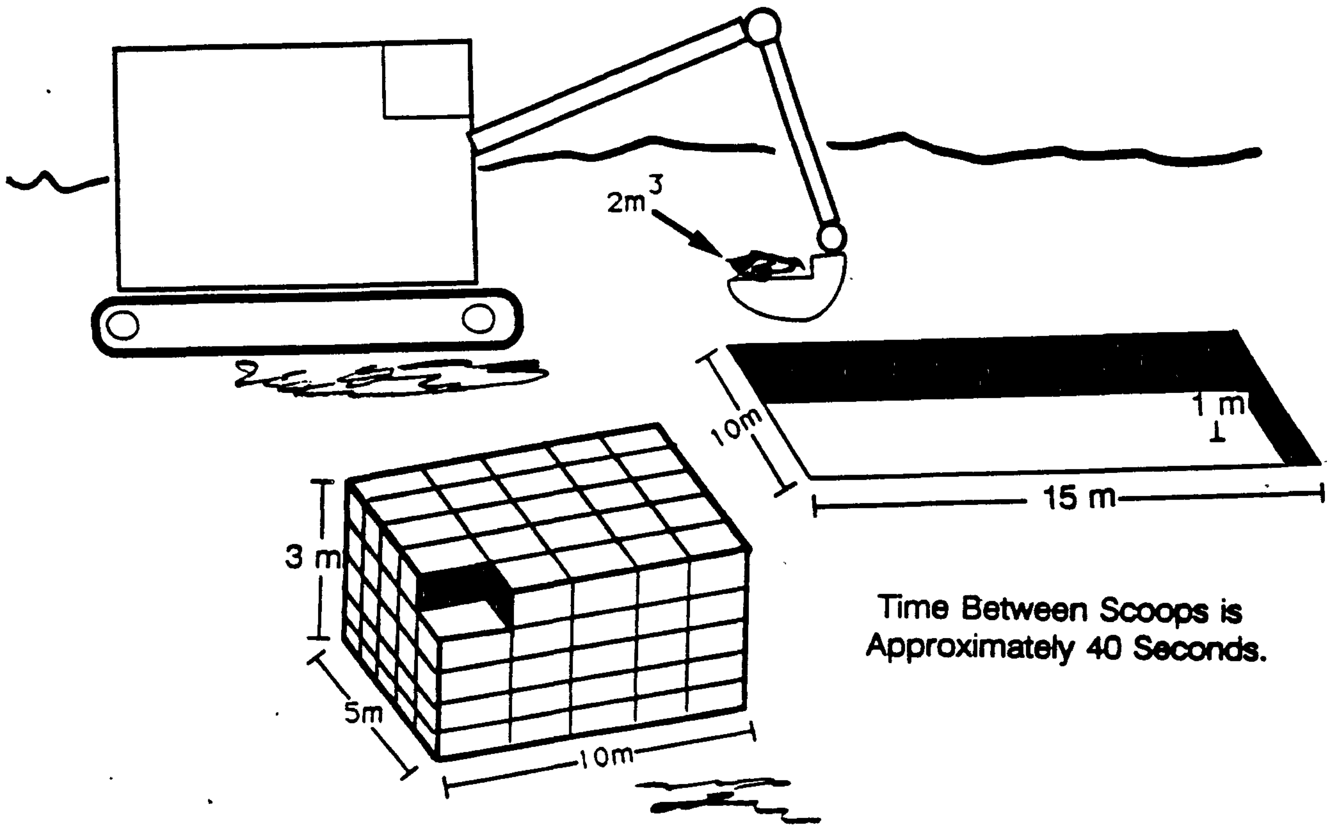

Figure 1. Idealized Excavation Scenario

The magnitude of VOC emissions depends on a number of factors, including the type of compounds present in the waste, the concentration and distribution of the compounds, and the porosity and moisture content of the soil. The key operational parameters are the duration and vigorousness of the handling, and the size of equipment used. The longer or more energetic the moving and handling, the greater likelihood that organic compounds will be volatilized. The equipment size influences volatilization by affecting the mean distance a volatilized molecule has to travel to reach the air/solid interface at the surface of the soil. In general, the larger the volumes of material being handled per unit operation, the lower the percentage of VOCs that are stripped from the soil.

The success of excavation for a given application depends on numerous factors with the three key criteria being: 1) the nature of the contamination; 2) the operating practices followed; and 3) the proximity of sensitive receptors. Each of these criteria is described below.

The magnitude of emissions from soils handling operations will vary with the operating conditions. Add-on control technologies are available for minimizing VOC emissions, but they are relatively ineffective and costly to implement. VOC emission control can also be achieved by controlling the operating conditions within preset parameters. The rate of excavation and dumping, the drop height, the amount of exposed surface area, the length of time that the soil is exposed, the shape of the storage piles, and the dryness of the surface soil layers will all influence the levels of VOC emissions. Large reductions in emissions can be achieved by identifying, and operating within, acceptable ranges of operating conditions.

Since some release of volatile contaminants is inevitable during excavation and removal unless extreme measures are taken (e.g. enclose the remediation within a dome), the proximity of downwind receptors (i.e. people) will influence whether or not excavation is an acceptable option. Excavation of contaminated areas that abut residential areas, schoolyards, etc. may require more extensive controls, relocation of the affected population, or remediation only during certain periods (e.g. summertime for school sites).

ESTIMATION OF AIR EMISSIONS

Only limited guidance is currently available for estimating the air emissions from soils handling operations. The emissions of concern from soils handling operations such as excavation, dumping, grading, transport, and storage are typically volatile organic compounds (VOCs), though emissions of particulate matter and associated metals and semi-volatile compounds may be of concern at some sites.

There are several alternative approaches for estimating the emissions from excavafion. The best method is to directly measure the emissions during full-scale or pilot-scale soils handling activities. The next best method is to estimate the emissions using predictive equations with site-specific inputs. If site-specific inputs are not available, a very conservative estimate can be made by using default values for the input parameters. Equations are given below for estimating an average long-term emission rate and a short-term emission rate.

Average Long-Term Emission Rate

A simple check of the total emissions potential for the site should be made by dividing the total mass of a given contaminant to be removed by the expected duration of the clean-up:

$$ER = (S_V)(C)(\beta)(1) \,/\, t_R \qquad \text{(Eq. 1)}$$

where:

ER = Average emission rate (g/sec);
S_V = Volume of contaminated soil to be excavated (m^3);
C = Average contaminant concentration (ug/g);

ß	=	Bulk density of soil (g/cm^3);
1	=	Constant ($g/10^6 ug * 10^6 cm^3/m^3$); and
t_R	=	Duration of remediation (sec).

The volume of contaminated soil and the total mass of each contaminant of concern present are typically determined during the remedial investigation (RI) of the site, while the fraction of contaminated soil that must be removed or treated is typically determined during the feasibility study (FS) of the site. Final clean-up criteria should also be considered when calculating the volume of soil to be excavated. The duration of the clean-up will usually be limited by the rate at which contaminants can be transported off-site or treated on-site. For Equation 1, a typical default value for bulk density of uncompacted soil is 1.5 g/cm^3. The following paragraphs discuss the key variables influencing air emissions from the excavation of contaminated soil and present an empirical equation for estimating a short-term emission rate.

Short-Term Emission Rate

A number of assumptions were made to develop a typical scenario for soil excavation. It is assumed that an infinite, homogeneous body of waste or contaminated soil exists under a cap of clean soil. The cap is removed and then contaminated soil/waste is excavated for 50 min/hour. Each scoop of soil contains 2 m^3 of soil and 75 scoops moved per hour (= 150 m^3 of soil moved per hour). Each scoop has dimensions of 1m x 2m x 1m and adds 2 m^2 of surface area to the pile of excavated material. The pit, after one hour has dimensions of 10m x 15m x 1m. Furthermore, each scoop of dumped soil is assumed to maintain its 1x2x1 dimensions (the pile of dumped soil is equivalent to a series of stacked blocks). After one hour, a pile 5m x 10m x 3m is established. The total exposed surface area is 140 m^2 for the pile and another 150 m^2 for the pit. The pile is assumed to thereafter be covered with some type of impermeable cover that acts as a barrier to further emissions. Both soil and air temperatures are assumed to be near 25°C.

Since it is rarely feasible or efficient to dig soil and immediately transfer the soil directly to transport vehicles or treatment systems, the equations presented below must be applied to each event in which the soil is handled. In most cases, soil will be excavated and placed in a temporary holding area and then moved one to two more times on-site. Elevated levels of VOC emissions are possible each time the soil is handled. When estimating emissions from sequential soil handling steps, it may be important to adjust the starting concentrations for each step to account for contaminants emitted during prior steps.

The detailed equation (model) for estimating emissions from excavation is given below followed by a simple screening equation to estimate excavation emissions. Appendix A presents the derivation of the simple screening equation, contains a discussion of the various input variables, and has an example calculation. The more detailed equation should be used in place of the screening equation whenever there are significant deviations from the assumptions used for air-filled porosity, air temperature, or the time that the soil is exposed to the atmosphere before being covered with additional soil. Field data should be used whenever possible and default values used only when no valid data are available.

Average Emission Rate (Detailed Model)

The average emission rate (ER, with units of g/sec) from excavation is equal to the sum of emission rates from the soil pore space (ER_{PS}, g/sec) and from diffusion (ER_{DIFF}, g/sec):

$$ER = ER_{PS} + ER_{DIFF} \qquad \text{(Eq. 2)}$$

$$ER_{PS} = \frac{P \; MW \; 10^{6} \; E_{a} \; Q \; ExC}{R \; T} \qquad \text{(Eq. 3)}$$

$$ER_{DIFF} = \frac{(C)(10{,}000)(SA)}{\left(\frac{E_a}{K_{eq}\,k_g}\right) + \left(\frac{\pi t}{D_e\,K_{eq}}\right)^{1/2}} \quad \text{(Eq. 4)}$$

The term ExC in Equation 3 is the fraction of the VOC in the pore space that is emitted to the atmosphere during excavation. All variables in Equations 2, 3, and 4 are defined in Table 1. Also shown in Table 1 are the units of each variable and a typical default value to use if valid field data are not available. Values of molecular weight, vapor pressure at 25°C, and diffusivity in air at 25°C are given in Appendix B. Equation 3 is based on the assumption that the soil pore gas is saturated with the compound of interest. If this is not the case, then Equation 3 may overpredict the emission rate. The output from Equation 3 should be multiplied by the duration of excavation and compared to the total mass of contaminants present in the soil:

$$M = C * S_V * 10^6 cm^3/m^3 \quad \text{(Eq. 5)}$$

where: M = Total mass of contaminant in a given volume of soil (g).

If Equation 3 gives a value that exceeds one-third of M, then the following equation should be substituted for Equation 3:

$$ER_{PS} = M * 0.33/t_{SV} \quad \text{(Eq. 6)}$$

where: t_{SV} = Time to excavate a given volume, S_v, of soil (sec).

Average Emission Rate (Simplified Model)

The average emission rate from excavation is again equal to the sum of emission rates from the soil pore space and from diffusion:

$$ER = ER_{PS} + ER_{Diff} \quad \text{(Eq. 2)}$$

Table 1

Input Variables for Emission Equations

Default Variable	Definition	Units	Default Value
P	Vapor pressure	mm Hg	35
MW	Molecular weight	g/g-mol	100
R	Gas constant	mm Hg-cm^3/g-mol °K	62,361
T	Temperature	Degrees Kelvin	298
E_a	Air-filled porosity	Dimensionless	0.440
S_V	Volume of soil moved	m^3	150
Q	Excavation rate	m^3/sec	0.042
10^6	Conversion factor	cm^3/m^3	--
ExC	Soil-gas to atmosphere exchange constant	Dimensionless	0.33
C	Concentration in soil	g/cm^3	$1.35x10^{-4}$
10,000	Conversion factor	cm^2/m^2	--
SA	Emitting surface area	m^2	290
K_{eq}	Equilibrium coefficient	Dimensionless	0.613
k_g	Gas-phase mass transfer coefficient	cm/sec	0.15
π	Pi	Dimensionless	3.14
t	Time[a]	sec	60
D_e	Effective diffusivity in air	cm^2/sec	0.0269
0.98	Conversion factor	g/mm Hg-m^3	--
1.22×10^6	Conversion factor	cm^2-sec-mmHg/g	--
1.79×10^9	Conversion factor	sec^2-cm-mmHg/g	--

Table 1 (Continued)

Default Variable	Definition	Units	Default Value
M	Total mass of contaminant	g	--
C'	Concentration in soil	ug/g	100
Other Variables Required to Calculate Certain Variables Listed Above			
t_{SV}	Time to excavate a given volume of soil	sec	--
ß	Bulk density	g/cm^3	1.5
ρ	Particle density	g/cm^3	2.65
D_a	Diffusivity in air	cm^2/sec	0.1
U	Wind speed	m/sec	2.0
μ_a	Viscosity of air	g/cm-sec	1.81×10^{-4}
ρ_a	Density of air	g/cm^3	0.0012
d_e	Diameter of excavation	m	24

[a]See Page 11 of Appendix A for discussion of time term.

$$ER_{PS} = P * Q * 0.91 \qquad \text{(Eq. 7)}$$

$$ER_{Diff} = \frac{(C)(10{,}000)(SA)}{\left(1.22x10^{6}\ \dfrac{C}{P}\right) + \left(1.79x10^{9}\ \dfrac{C}{P}\right)^{\frac{1}{2}}} \qquad \text{(Eq. 8)}$$

Variables are defined in Table 1. The derivation of these equations is presented in Appendix A (Equation 7 equals Equation A-13 in Appendix A and Equation 8 equals Equation A-20). Assuming a typical bulk density of undisturbed soil, C can be modified to a soil concentration term: $C' = C * 1cm^3/1.5g * 10^6$ ug/g; where: C' = Concentration of species i in soil (ug/g). The emission rate obtained using Equation 7 should be compared to the total mass of contaminant present in the volume of soil excavated - M. If Equation 7 gives a value that exceeds ⅓ of M, then Equation 6 should be substituted for Equation 7.

Worst-Case Emission Rate

The worst-case (i.e. maximum) instantaneous emission rate, ER_{MAX}, for contaminated soil occurs when the exposed surface area is at a maximum and immediately after a bucket load of soil is dumped onto the storage pile. This emission rate can be approximated by considering the case where a pure chemical is exposed to the atmosphere. This emission rate can be determined from Equation 6 (there is no need to consider pore space gas concentrations and diffusion since the pure chemical is already exposed to the atmosphere). Set the time term, t, equal to zero and replace the K_{eq} term with the equivalent expression: $P*MW*E_a/R*T*C$. Equation 6 then reduces to:

$$ER_{MAX} = \frac{(k_g)(P)(MW)(SA)(10,000)}{RT} \qquad \text{(Eq. 9)}$$

ESTIMATION OF AMBIENT AIR CONCENTRATIONS

Estimates of short-term, worst-case ambient concentrations should be obtained by using site specific release parameters in the EPA's TSCREEN model[3]. Estimates of long term concentrations should be obtained by using EPA's Industrial Source Complex (ISCLT) model. Here, for simplicity, the annual average estimates are derived by multiplying the short term estimate obtained from the TSCREEN model, by a conversion factor to account for variations of wind direction over time. This approach results in a higher estimate of the annual average concentration than if the ISCLT model, with site specific data, is used.

Table 2 presents three excavation scenarios that vary in excavation rate and physical dimensions. The scenarios were developed based on a review of the existig literature[5] and field experience. The worst-case, short-term downwind dispersion of emitted gases from each of these scenarios for an emission rate of 1 gram per second, is illustrated in Figure 2. Of the variables listed in Table 2, only the physical dimensions of the excavation pit and storage pile factor into the estimated downwind dispersion. Two additional curves in Figure 2 indicate the downwind dispersion for excavation areas of larger dimensions (500 m^2 and 1,000 m^2, respectively). The curves were calculated according to the following assumptions: 1) the combined emission rate for the excavation pit and storage pile is 1 gram per second; 2) the excavation pit and storage pile are sufficiently close to one another so that the size of the area emission source is equal to the combined horizontal areas of the pit and storage pile; 3) a flat terrain without any structures near the excavation site was assumed; and 4) downwash was not applicable. The emission source and the receptors were assumed to be at ground level. Downwind concentration estimates for emission rates other than 1 gram per second can be extrapolated from Figure 2 by multiplying the indicated y-axis value (dispersion factor) for the applicable downwind distance by the actual emission rate.

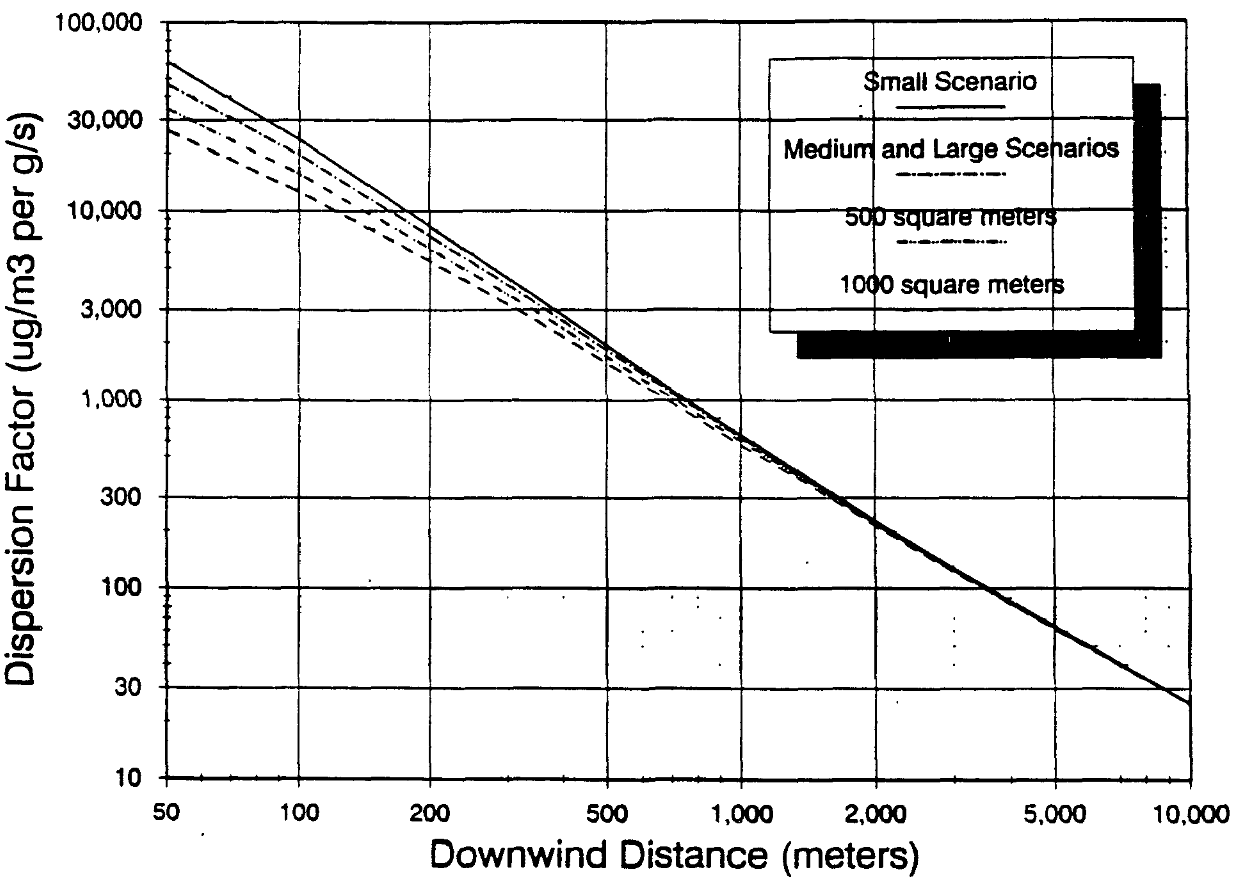

Figure 2. One-Hour Average Downwind Dispersion Factor Versus Distance for Excavation With No Air Controls

Table 2.

Example Scenarios for Excavation of Contaminated Soil

Parameter	Units	Scenario		
		Small	Medium	Large
Soil Moved Per Scoop	m^3	1	2	4
No. Scoops Per Hour	#/hr	50	75	60
Total Volume of Soil Moved	m^3/hr	50	150	240
Excavation Pit:				
Dimensions	m	10x5x1	10x15x1	10x12x2
Area	m^2	50	150	120
Storage Pile:				
Dimensions	m	5x5x2	5x10x3	8x10x3
Area	m^2	65	140	188

Figure 2 can be used to estimate the maximum hourly ambient air concentration for an emission rate of 1 gram per second at selected distances downwind from an excavation pit. If the excavation rate is not known, a medium rate scenario should be assumed. The dispersion factor, in micrograms/m^3 per g/sec, obtained from Figure 2 can be substituted into Equation 10 to estimate the maximum hourly ambient concentration and into Equation 11 to estimate the annual average ambient air concentration for a given downwind distance. Since TSCREEN provides maximum short-term estimates, the factor of 0.05 in Equation 11 is used to convert the short-term estimate to a maximum annual average estimate. A conservative factor of 0.05 assumes that the wind blows downwind 5% of the time over one year and that the terrain is relatively flat. This assumption has been recently revised by EPA; it is still under review by EPA, however, and is subject to further change.

$$C_m = (ER)(F) \qquad \text{(Eq. 10)}$$

$$C_a = (ER)(F)(0.05) \qquad \text{(Eq. 11)}$$

where: C_m = Maximum hourly ambient air concentration($\mu g/m^3$);
C_a = Annual average ambient air concentration ($\mu g/m^3$);
ER = Emission rate (g/sec); and
F = Dispersion Factor from Figure 2 ($\mu g/m^3/g/sec$).

ESTIMATION OF HEALTH EFFECTS

Cancer Effects Due to Long-Term Exposure

Potential cancer effects resulting from long-term exposure to substances emitted to the air can be evaluated using inhalation unit risk factors. Inhalation unit risk factors are a measure of the cancer risk for each $\mu g/m^3$ of concentration in the ambient air. They are available on EPA's Integrated Risk Information System (IRIS), the Agency's preferred source of toxicity information. User Support can be contacted at (513) 569-7254. Table 3 provides inhalation unit risk factors listed in IRIS as of January 1991 for selected organic compounds.

The next best source of inhalation unit risk factors is EPA's Health Effects Assessment Summary Tables (HEAST) which are updated quarterly.[5]

Equation 12 can be used to estimate the cancer risk at a specified distance downwind of the excavation area. Cancer risk is a measure of the increased probability of developing cancer in a lifetime as a result of the exposure in question. Equation 12 assumes continuous exposure (24 hours/day, 365 days/year for 70 years) to the estimated annual average concentration in air.

$$R = (C_a)(IUR) \qquad \text{(Eq. 12)}$$

R is the cancer risk from long-term exposure to a specific VOC in air, dimensionless; C_a is the annual average ambient concentration estimated from Equation 11, $\mu g/m^3$; IUR is the inhalation unit risk factor, $(\mu g/m^3)^{-1}$ obtained from Table 3.

If the source operates for less than 70 years, multiply C_a by x/70, where x is the expected operating time of the source in years before using Equation 12. If more than one VOC is present, the cancer risks for each VOC can be summed to derive the total cancer risk at a specified distance downwind of the source.

Non-Cancer Effects Due to Long-Term Exposure

Non-cancer effects can be evaluated by using chronic inhalation reference concentrations (RfCs). An inhalation RfC is the an estimate (with uncertainty spanning perhaps an order of magnitude) of continuous exposure to the human population that is likely to be without appreciable risk of deleterious effects during a lifetime. RfCs for a limited number of compounds are available in IRIS and HEAST.

Table 3.

Long-Term and Short-Term Health-Based Action Levels for Ambient Air

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels			Short-Term Action Levels[d]
					Risk-Specific Concentrations for Carcinogenicity	RfC-Based Concentrations for Non-Carcinogenic Effects ($\mu g/m^3$)	Concentrations Based on Occupational Exposure[d]	
			Inhalation Unit Risk $1/(\mu g/m^3)$	Inhalation RfC (mg/m^3)	10-6 70-year Risk ($\mu g/m^3$)		Lowest OEL/1000 ($\mu g/m^3$)	Lowest OEL/100 ($\mu g/m^3$)
1	Acetaldehyde	75-07-0	–	–	–	–	180	1,800
2	Acetic Acid	64-19-7	–	–	–	–	25	250
3	Acetic anhydride	108-24-7	–	–	–	–	20	200
4	Acetone	67-64-1	–	(4e-01)[b]	–	400	1,780	17,800
5	Acetonitrile	75-05-8	–	5e-02	–	50	67	670
6	Acrolein	107-02-8	ND[c,e]	1e-04[c]	–	0.1	0.23	2.30
7	Acrylic acid	79-10-7	–	3e-04	–	0.3	5.90	59
8	Acrylonitrile	107-13-1	6.8e-05	–	1.5e-02[c]	–	4.30	43
9	Allyl alcohol	107-18-6	–	(2e-02)[b]	–	20	4.80	48
10	Allyl chloride	107-05-1	ND[c,e]	1e-03	–	1	3.00	30
11	Aniline	62-53-3	(1.6e-06)[b]	–	6.3e-01	–	7.60	76
12	Anthracene	120-12-7	–	(1e+00)[b]	–	1,000	0.20	2.00
13	Benzaldehyde	100-52-7	–	(4e-01)[b]	–	400	–	–
14	Benzene	71-43-2	8.3e-06	–	1.2e-01[c]	–	0.30	3.00
15	Benzoic acid	65-85-0	–	(1e+01)[b]	–	10,000	–	–
16	Benzyl alcohol	100-51-6	–	(1e+00)[b]	–	1,000	–	–
17	Benzyl chloride	100-44-7	–	–	–	–	5	50
18	Bromoform	75-25-2	1.1e-06[c]	(7e-02)[b]	9.1e-01	70	5	50
19	1,3-Butadiene	106-99-0	2.8e-04	–	3.6e-03	–	22	220
20	n-Butane	106-97-8	–	–	–	–	1,900	19,000
21	2-Butanol	15892-23-6	–	–	–	–	303	3,030
22	n-Butanol	71-36-3	–	(4e-01)[b]	–	400	152	1,520
23	n-Butyl-Acetate	123-86-4	–	–	–	–	710	7,100
24	Tert-Butyl-Alcohol	75-65-0	–	–	–	–	300	3,000
25	Carbon disulfide	75-15-0	–	1e-02	–	10	12	120

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels			Short-Term Action Levels[d]
					Risk-Specific Concentrations for Carcinogencity	RfC-Based Concentrations for Non-Carcinogenic Effects (µg/m³)	Concentrations Based on Occupational Exposure[d]	
			Inhalation Unit Risk 1/(µg/m³)	Inhalation RfC (mg/m³)	10-6 70-year Risk (µg/m³)		Lowest OEL/1000 (µg/m³)	Lowest OEL/100 (µg/m³)
26	Carbon Tetrachloride	56-23-5	1.5e-05	(2e-03)[b]	6.7e-02	2	12.60	126
27	Carbonyl Sulfide	463-58-1	–	–	–	–	–	–
28	Catechol	120-80-9	–	–	–	–	20	200
29	Chlorine	7782-50-5	–	–	–	–	1.5	15
30	Chlorobenzene	108-90-7	–	2e-02	–	20	46	460
31	Chlorodifluoromethane	75-45-6	–	–	–	–	3,540	35,400
32	Chloroform	67-66-3	2.3e-05	(4e-02)[b]	4.3e-02[c]	40	9.78	98
33	Chloromethyl methyl ether	107-30-2	ND	–	–	–	–	–
34	Chloropentafluoroethane	76-15-3	–	–	–	–	6,320	63,200
35	Chloroprene	126-94-8	–	1e-03[c]	–	1	35	350
36	m-Cresol	108-39-4	ND[e]	(2e-01)[b]	–	200	22	220
37	o-Cresol	95-48-7	ND[e]	(2e-01)[b]	–	200	22	220
38	p-Cresol	106-44-5	ND[e]	(2e-01)[b]	–	200	22	220
39	Cyanogen	460-19-5	–	(1e-01)[b]	–	100	20	200
40	Cyclohexane	110-82-7	–	–	–	–	1,030	10,300
41	Cyclohexanol	108-93-0	–	–	–	–	200	2,000
42	Cyclohexanone	108-94-1	–	–	–	–	100	1,000
43	Cyclohexene	110-83-8	–	–	–	–	1,010	10,100
44	Cyclopentane	287-92-3	–	–	–	–	1,720	17,200
45	Diazomethane	334-88-3	–	–	–	–	0.34	3.4
46	Dibutyl-O-Phthalate	84-74-2	–	(4e-01)[b]	–	400	5.00	50
47	o-Dichlorobenzene	95-50-1	–	2e-01	–	200	300	3,000
48	p-Dichlorobenzene	106-46-7	(6.9e-06)[b]	7e-01[c]	1.4e-01	700	450	4,500
49	Dichloroethylether	111-44-4	3.3e-04[c]	–	3.0e-03	–	29	290
50	Dichlorodifluoromethane	75-71-8	–	2e-01	–	200	4,950	49,500

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels: Risk-Specific Concentrations for Carcinogencity	Long-Term Action Levels: RfC-Based Concentrations for Non-Carcinogenic Effects (µg/m³)	Long-Term Action Levels: Concentrations Based on Occupational Exposure[d]	Short-Term Action Levels[d]
			Inhalation Unit Risk 1/(µg/m³)	Inhalation RfC (mg/m³)	10-6 70-year Risk (µg/m³)		Lowest OEL/1000 (µg/m³)	Lowest OEL/100 (µg/m³)
51	1,1-Dichloroethane	75-34-3	ND[e]	5e-01	–	500	400	4,000
52	1,2-Dichloroethane	107-06-2	2.6e-05	–	3.8e-02[c]	–	4.00	40
53	1,1-Dichloroethylene	75-35-4	5e-05	(3e-02)[b]	2.0e-02	30	4.00	40
54	cis-1,2-dichloroethylene	156-59-2	–	(4e-02)[b]	–	40	790	7,900
55	trans-1,2-dichloroethylene	156-60-5	–	(7-02)[b]	–	70	790	7,900
56	Dichloromethane	75-09-2	4.7e-07	3e+00[c]	2.1e-00	3,000	174	1,740
57	Dichloromonofluoromethane	75-43-4	–	–	–	–	40	400
58	1,2-Dichloropropane	78-87-5	(1.9e-05)[b]	–	5.3e-02	–	347	3,470
59	1,3-Dichloropropene	542-75-6	3.7e-05[c]	2e-02[c]	2.7e-02	20	4.5	45
60	1,2-Dichloro-1,1,2,2-Tetrafluoroethane	76-14-2	–	–	–	–	6,990	69,900
61	Diethanolamine	111-42-2	–	–	–	–	13	130
62	Diethyl amine	109-89-7	–	–	–	–	30	300
63	N,N-Dimethylaniline	121-69-7	–	–	–	–	25	250
64	Diethyl ether	60-29-7	–	–	–	–	1,200	12,000
65	Dimethylamine	124-40-3	–	–	–	–	18	180
66	Dimethyl formamide	68-12-2	–	3e-02	–	30	30	300
67	1,1-Dimethyl hydrazine	57-14-7	(2.5e-03)[b]	–	4.0e-04	–	1	10
68	2,4-Dinitrophenol	51-28-5	–	(7e-03)[b]	–	7	–	–
69	1,4-Dioxane	123-91-1	(3.1e-06)[b]	–	3.2e-01	–	90	900
70	Diphenyl	92-52-4	–	–	–	–	1.00	10
71	Epichlorohydrin	106-89-8	1.2e-06[c]	3e-04[c]	8.3e-01	0.3	7.6	76
72	1,2-Epoxybutane	106-88-7	–	–	–	–	–	–
73	Ethanol	64-17-5	–	–	–	–	1,880	18,800
74	Ethyl acetate	141-78-6	–	(3.0e+00)[b]	–	3,000	1,400	14,000
75	Ethyl acrylate	140-88-5	(1.4e-05)[b]	–	7.1e-02	–	20	200

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels: Risk-Specific Concentrations for Carcinogenicity	Long-Term Action Levels: RfC-Based Concentrations for Non-Carcinogenic Effects ($\mu g/m^3$)	Long-Term Action Levels: Concentrations Based on Occupational Exposure[d]	Short-Term Action Levels[d]
			Inhalation Unit Risk $1/(\mu g/m^3)$	Inhalation RfC (mg/m^3)	10-6 70-year Risk ($\mu g/m^3$)		Lowest OEL/1000 ($\mu g/m^3$)	Lowest OEL/100 ($\mu g/m^3$)
76	Ethyl amine	75-04-7	–	–	–	–	18	180
77	Ethylbenzene	100-41-4	–	1e-00	–	1,000	434	4,340
78	Ethyl bromide	74-96-4	–	–	–	–	22	220
79	Ethyl carbamate	51-79-6	–	–	–	–	–	–
80	Ethyl chloride	75-00-3	–	1e+01	–	10,000	2,600	26,000
81	Ethylenediamine	107-15-3	–	(7.0e-02)[b]	–	70	25	250
82	Ethylene dibromide	106-93-4	2.2e-04[c]	–	4.5e-03	–	–	–
83	Ethylene glycol	107-21-1	–	(7.0e+00)[b]	–	7,000	125	1,250
84	Ethylene imine	151-56-4	–	–	–	–	0.88	8.80
85	Ethylene oxide	75-21-8	1.0e-04	–	1.0e-02	–	1.80	18
86	Formaldehyde	50-00-0	1.3e-05	–	7.7e-02	–	0.37	3.70
87	Formic Acid	64-18-6	–	(7e+00)	–	7,000	9.00	90
88	Furan	110-00-9	–	(4.0e-03)[b]	–	4	–	–
89	Glycerol	56-81-5	–	–	–	–	5.00	50
90	n-Heptane	142-82-5	–	–	–	–	1,600	16,000
91	n-Hexane	110-54-3	–	2e-01	–	200	176	1,760
92	Hydrazine	302-01-2	4.9e-03[c]	–	2.0e-04	–	0.13	1.3
93	Hydrochloric acid	7647-01-0	–	–	–	–	7.5	75
94	Hydrogen cyanide	74-90-8	–	–	–	–	11	110
95	Hydrogen Sulfide	7783-06-4	–	9e-04[c]	–	0.9	14	140
96	Isobutanol	78-83-1	–	1e+00	–	1,000	150	1,500
97	Isobutyl acetate	110-19-0	–	–	–	–	700	7,000
98	Isopropyl alcohol	67-63-0	–	–	–	–	980	9,800
99	Isopropyl amine	75-31-0	–	–	–	–	12	120
100	Isopropylbenzene	98-82-8	–	9e-03[c]	–	9	245	2,450

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels			Short-Term Action Levels[d]
					Risk-Specific Concentrations for Carcinogenicity	RfC-Based Concentrations for Non-Carcinogenic Effects ($\mu g/m^3$)	Concentrations Based on Occupational Exposure[d]	
			Inhalation Unit Risk $1/(\mu g/m^3)$	Inhalation RfC (mg/m^3)	10-6 70-year Risk ($\mu g/m^3$)		Lowest OEL/1000 ($\mu g/m^3$)	Lowest OEL/100 ($\mu g/m^3$)
101	Methanol	67-56-1	–	(2e+00)[b]	–	2,000	260	2,600
102	Methyl acetate	79-20-9	–	(4e+00)[b]	–	4,000	606	6,060
103	Methyl acrylate	96-33-3	–	(1e-01)[b]	–	100	35	350
104	Methyl amine	74-89-5	-	–	–	–	12	120
105	Methyl bromide	74-83-9	–	(6e-03)[b]	–	6	19	190
106	Methyl-tert-butyl-ether	1634-04-4	–	–	–	–	–	–
107	Methyl chloride	74-87-3	1.8e-06	–	5.5e-01	–	103	1,030
108	Methylcyclohexane	108-87-2	–	–	–	–	1,600	16,000
109	Methyl-ethyl-ketone	78-93-3	ND	3e-01	–	300	590	5,900
110	Methyl formate	107-31-3	–	–	–	–	246	2,460
111	Methyl hydrazine	60-34-4	(3.1e-04)[b]	–	3.2e-03	–	0.019	0.19
112	Methyl iodide	74-88-4	–	–	–	–	10	100
113	Methyl-Isobutyl-Ketone	108-10-1	–	8e-02	–	80	205	2,050
114	Methyl isocyanate	624-83-9	–	–	–	–	0.047	0.47
115	Methyl-Isopropyl-Ketone	563-80-4	–	–	–	–	705	7,050
116	Methyl mercaptan	74-93-1	–	–	–	–	0.98	10
117	Methyl methacrylate	80-62-6	–	(3e-01)[b]	–	300	410	4,100
118	Methyl-n-Propyl-ketone	107-87-9	–	–	–	–	700	7,000
119	Alpha-methyl-styrene	98-83-9	–	(2e-01)[b]	–	200	240	2,400
120	Monoethanolamine	141-43-5	–	–	–	–	7.50	75
121	Morpholine	110-91-8	–	–	–	–	70	700
122	Naphthalene	91-20-3	–	(1e-02)[b]	–	10	50	500
123	2-Nitropropane	79-46-9	2.7e-03	2e-02[c]	3.7e-04	20	35	350
124	N-Nitrosodimethylamine	62-75-9	1.4e-02[c]	–	7.1e-05	–	--	--
125	N-Nitrosomorpholine	59-89-2	–	–	–	–	–	–

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a]	Chronic Toxicity[a]	Long-Term Action Levels: Risk-Specific Concentrations for Carcingogencity	Long-Term Action Levels: RfC-Based Concentrations for Non-Carcinogenic Effects ($\mu g/m^3$)	Long-Term Action Levels: Concentrations Based on Occupational Exposure[d]	Short-Term Action Levels[d]
			Inhalation Unit Risk $1/(\mu g/m^3)$	Inhalation RfC (mg/m^3)	10-6 70-year Risk ($\mu g/m^3$)		Lowest OEL/1000 ($\mu g/m^3$)	Lowest OEL/100 ($\mu g/m^3$)
126	n-Nonane	111-84-2	–	–	–	–	1,050	10,500
127	n-Octane	111-65-9	–	–	–	–	1,400	14,000
128	n-Pentane	109-66-0	–	–	–	–	1,770	17,700
129	Phenanthrene	85-01-9	–	–	–	–	0.20	2
130	Phenol	108-95-2	–	(2e+00)[b]	–	2,000	19	190
131	Phosgene	75-44-5	–	–	–	–	0.4	4
132	Phosphine	7803-51-2	–	3e-05	–	0.03	0.4	4
133	Phthalic anhydride	85-44-9	–	(7e+00)[b]	–	7,000	6.00	60
134	Propane	74-98-6	–	–	–	–	1,800	18,000
135	1,2-Propanediol	57-55-6	–	6e+00	–	6,000	–	–
136	1-Propanol	71-23-8	–	–	–	–	492	4,920
137	beta-Propiolactone	57-57-8	–	–	–	–	1.5	15
138	Propionaldehyde	123-38-7	–	–	–	–	–	–
139	Propionic acid	79-09-4	–	–	–	–	30	300
140	n-Propyl-Acetate	109-60-4	–	–	–	–	835	8,350
141	Propylene oxide	75-56-9	3.7e-06	3e-02	2.7e-01	30	48	480
142	1,2-Propylenimine	75-55-8	–	–	–	–	5	50
143	Pyridine	110-86-1	–	4e-03	–	4	15	150
144	Quinone	106-51-4	–	–	–	–	0.4	4
145	Styrene	100-42-5	5.7e-07	(7e-01)[b]	1.8e+00	700	213	2,130
146	1,1,1,2-Tetrachloro-2,2-Difluoroethane	76-11-9	–	–	–	–	4,170	41,700
147	1,1,2,2-Tetrachloroethane	79-34-5	5.8e-05	–	1.7e-02	–	6.90	69
148	Tetrachloroethylene	127-18-4	5.2e-07	(4e-02)[b]	1.9e+00	40	170	1,700
149	Tetrahydrofuran	109-99-9	–	–	–	–	590	5,900
150	Toluene	108-88-3	–	2e+00[c]	–	2,000	375	3,750

Table 3.
(Continued)

No.	Chemical	CAS Number	Carcinogenicity[a] Inhalation Unit Risk $1/(\mu g/m^3)$	Chronic Toxicity[a] Inhalation RfC (mg/m^3)	Long-Term Action Levels: Risk-Specific Concentrations for Carcinogenecity 10-6 70-year Risk $(\mu g/m^3)$	Long-Term Action Levels: RfC-Based Concentrations for Non-Carcinogenic Effects $(\mu g/m^3)$	Long-Term Action Levels: Concentrations Based on Occupational Exposure[d] Lowest OEL/1000 $(\mu g/m^3)$	Short-Term Action Levels[d] Lowest OEL/100 $(\mu g/m^3)$
151	p-Toluidine	106-49-0	(5.4e-05)[b]	–	1.9e-02	–	8.80	88
152	1,1,1-Trichloroethane	71-55-6	–	1.0e+00	–	1,000	1,900	19,000
153	1,1,2-Trichloroethane	79-00-5	1.6e-05	(1.0e-02)[b]	6.3e-02	10	45	450
154	Trichloroethylene	79-01-6	1.7e-6	–	5.9e-01	–	269	2,690
155	Trichlorofluoromethane	75-69-4	–	7.0e-01	–	700	5,620	56,200
156	1,2,3-Trichloropropane	96-18-4	–	(2.0e-02)[b]	–	20	60	600
157	1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	–	(2.7e+01)[b]	–	27,000	7,600	76,000
158	Triethylamine	121-44-8	–	–	–	–	40	400
159	Trifluorobromomethane	75-63-8	–	–	–	–	6,090	60,900
160	1,2,3-Trimethylbenzene	526-73-8	–	–	–	–	123	1,230
161	1,2,4-Trimethylbenzene	95-63-6	–	–	–	–	123	1,230
162	1,3,5-Trimethylbenzene	108-67-8	–	–	–	–	123	1,230
163	Vinyl acetate	108-05-4	–	2e-01	–	200	30	300
164	Vinyl bromide	593-60-2	3.2e-05	–	3.1e-02	–	20	200
165	Vinyl-chloride	75-01-4	8.4e-05	–	1.2e-02	–	2.60	26
166	m-Xylene	108-38-3	–	7.0e-01	–	700	434	4,340
167	o-Xylene	95-47-6	–	7.0e-01	–	700	434	4,340
168	p-Xylene	106-42-3	–	3.0e-01	–	300	434	4,340

INSTRUCTIONS ON USE:

Read short-term action level directly from last column. For the three columns of long-term action levels, use the 10-6 risk data, if available, then the RfC data; use the OEL/1000 if no other data exists.

[a] EPA does not necessarily endorse the use of oral slope factors or oral RfDs to derive inhalation values. These are intended to serve as screening levels only and do not represent EPA guidance.
[b] Derived based on oral slope factor (or oral RfD).
[c] Verified, available on IRIS or Workgroup concurrence on final database file, and IRIS input pending.
[d] EPA does not necessarily endorse the use of occupational exposure limits to derive short- and long-term action levels for ambient air. These are intended to serve as screening levels only and do not represent EPA guidance. Intended changes for OEL values are included, where applicable.
[e] EPA Class C or D carcinogen.

If inhalation RfCs were not available from either IRIS or HEAST, then chronic oral reference dose (RfD) data (in mg/kg/day) were multiplied by 70 kg (average body weight of an adult), then divided by 20 m^3/day (average adult inhalation rate), and finally multiplied by 1000 μg/mg to derive a value in $\mu g/m^3$.

Ambient air action levels based on extrapolated oral data should be used cautiously. Before extrapolating data an array of factors should be assessed on a compound by compound basis to determine the feasibility of route-to-route extrapolations. Important factors include the absorption, distribution, metabolism and excretion of the compound; portal of entry effects; acute and chronic toxicities, and other information.

For compounds lacking RfC or RfD values, action levels were based on occupational exposure levels recommended by the Occupational Safety and Health Administration (OSHA)[6] and the American Conference of Governmental Industrial Hygienists (ACGIH)[7]. The action levels were estimated by using the lower of the OSHA Permissible Exposure Limit-Time Weighted Average (PEL-TWA) level (or ceiling value) or the ACGIH Threshold Limit Value - Time Weighted Average (TLV-TWA) level (or ceiling value). The lower value was divided by 1000 to compensate for differences between occupational and residential exposures.

Long-term ambient air action level concentrations for non-carcinogens based on RfCs, extrapolated RfDs and occupational exposure levels for 168 compounds are also listed in Table 3. The action levels are in units of $\mu g/m^3$ to facilitate comparison to the ambient air concentrations estimated from Equation 11.

Short-Term Exposure

The short term (one hour) action levels, in $\mu g/m^3$, are presented in the last column of Table 3. The listed values were obtained by dividing the lowest of (1) the OSHA PEL-TWA or (2) the ACGIH TLV-TWA (or ceiling limits if 8-hour averages are not available) by 100. Division by 100 accounts for variations in human sensitivity (occupational levels are designed to protect healthy adult workers) and for uncertainties in using occupational exposure levels to derive ambient air action levels.

The occupational exposure levels on which the short-term action levels are based are subject to change. To check the values in Table 3 (or to derive values for compounds not listed in Table 3), determine the current OSHA PEL-TWA values by consulting 29 CFR Section 1910 and the most recent edition of the ACGIH publication entitled Threshold Limit Values and Biological Exposure Indices.

The short-term action levels listed in Table 3 can be compared directly with the estimated maximum hourly ambient air concentrations obtained by using Equation 10 and Figure 2. Use of the short term action levels should consider that no EPA accepted method exists to determine the short-term concentrations of airborne chemicals acceptable for community exposure.

EXAMPLE

The following steps illustrate the use of the estimation procedures presented in this document. The goal is to estimate the maximum hourly and annual average ambient air concentrations at the nearest receptor to an excavation area and compare these values to the action level concentrations listed in Table 3.

Step 1 For this example, assume a site that has approximately 10,000 m^3 of soil contaminated with chloroform, 1,1,1-trichloroethane, and trichloroethylene at concentrations in the soil of 0.1, 10, and 1.0 ug/g, respectively. The volume of contaminated soil is not known with any certainty. The bulk density of the soil at the site averages about 1.5 g/cm^3. The rate of excavation has not yet been determined, nor has the need for air emission controls, so a medium excavation rate of 150 m^3/hour and no air emission controls is assumed. The removal is expected to be in continual operation for 20 days (1.728×10^6 seconds). The nearest off-site downwind receptor is 400 meters away.

Step 2 Estimate the total emissions potential for the site. Using Equation 1, the average long-term emission rate of chloroform would be:

$$ER = \frac{(10{,}000)(0.1)(1.5)(1)}{(1.728 \times 10^6)} = 8.68 \times 10^{-4}$$

The average long-term emission rate for 1,1,1-trichloroethane is 8.68×10^{-2} g/sec, and for trichloroethylene is 8.68×10^{-3} g/sec.

Step 3 Estimate the emission rate of each compound. The data are plugged into Equations 7 and 8 along with the assumed excavation rate of 0.042 m^3/sec. For chloroform, the emission rate would be:

$$ER_{PS} = (208)(0.042)(0.98) = 8.56 \text{ g/sec}$$

$$ER_{DIFF} = \frac{(1.5 \times 10^{-7})(10{,}000)(290)}{\left[(1.22 \times 10^6)\left(\frac{1.5 \times 10^{-7}}{208}\right)\right] + \left[(1.79 \times 10^9)\left(\frac{1.5 \times 10^{-7}}{208}\right)\right]^{1/2}}$$

Step 4 Compare the results of the emissions from the pore space gas to the total mass of the contaminant present in the soil. For chloroform for one hour's excavation (i.e., 150 m^3):

$$C_{TOT} = (1.50 \times 10^{-7})(150)(10^6) = 22.5 \text{ g}$$

$$E_{PS} = (8.56 \text{ g/sec})(3600 \text{ sec}) = 30{,}820 \text{ g.}$$

Since ER_{PS} overpredicts, use Equation 6 instead of Equation 7.

$$ER_{PS} = (22.5 \text{ g})(0.33)/(3600 \text{ sec}) = 2.08 \times 10^{-3} \text{ g/sec}$$

The overall emission rates for all three compounds are given below. In all cases, Equation 6 was used in place of Equation 7.

Step 5 Compare the estimated emission rates from Step 3 and 4 to those from Step 2. The comparison is:

Compound	Equation 1 Emission Rate (g/sec)	Equation 6 Emission Rate (g/sec)
Chloroform	0.000868	0.38
1,1,1-Trichloroethane	0.0868	3.1
Trichloroethylene	0.00868	0.74

Given the excavation is not to be performed continuously over the twenty day period, it is expected that the short-term emission rates exceed the long-term emission rates. Each rate will be used to calculate the downwind risk over the appropriate time period.

Step 6 Estimate the downwind ambient air concentrations. From Figure 2, the maximum hourly ambient air concentration at a distance of 400 meters is approximately 2800 ug/m^3 per g/sec emission rate. This corresponds to an annual average dispersion factor of 140 ug/m^3 per g/s (2900 x 0.05 = 140). The ambient air concentrations estimated from Equations 10 and 11 are presented in Table 4. Using Equation 10, the hourly average ambient air concentration for chloroform would be:

$$C_m = (0.38)(2800) = 1100 \text{ ug/m}^3$$

Using Equation 11, the annual average air ambient concentration for chloroform would be:

$$C_a = (0.000868)(140) = 0.12 \text{ ug/m}^3$$

Step 7 Compare the downwind concentrations to the action level ambient air concentrations. The short-term and long-term action levels from Table 3 for the compounds of interest are presented in Table 5. Of the estimated maximum hourly ambient concentrations, only chloroform exceeds the applicable action levels. The estimated value is about one order of magnitude greater than the action level. The annual average ambient concentrations show exceedances of the long-term action levels for both chloroform and trichloroethylene, by a factor of 2 to 3.

Step 8 Document the results of the air pathway analysis and define a future course of action. Based on these screening level results, a more rigorous analysis of the air impacts is warranted. This would most likely involve refining the emission rate, dispersion, and health risk estimates. The emission rate estimate could be improved by using the actual or proposed operating conditions or by making field measurements at the excavation site. The dispersion estimates could be improved by using a less conservative model (e.g. EPA's Industrial Source Complex model) and site-specific meteorological conditions. The health risk estimate could be improved by using the expected operational lifetime of the SVE system rather than assuming a 70-year exposure. If the more rigorous analysis still indicates that adverse air impacts may occur, then the addition of air emission controls or altering the operating conditions to control emissions (e.g. limiting the excavation rate and the total exposed surface area) should be considered.

CONCLUSIONS

The procedures presented here are not intended to negate the need for rigorous analyses that consider site specific meteorological conditions and the health effects of the specific compounds involved. Although the procedures are based on what is typical and reasonable for cleaning up Superfund sites, the underlying assumptions need to be kept in mind. Emission models assume steady-state conditions, dispersion models assume Gaussian distribution of the plume contaminant concentration, and many of the health levels are not endorsed by the Environmental Protection Agency. EPA's Regional Toxicologist should be contacted for general toxicological information and technical guidance on evaluation of chemicals without established toxicity values.

Table 4.

Estimated Emission Rates and Ambient Air Concentrations

	Soil Concentration For Example Problem (g/cm^3)	Emission Rate (g/s)	Ambient Concentrations ($\mu g/m^3$)	
			Maximum Hourly	Annual Average
Chloroform	1.5×10^{-7}	Long Term: 8.7×10^{-4} Short Term: 0.38	1100	0.12
1,1,1-Trichloroethane	1.5×10^{-5}	Long Term: 8.7×10^{-2} Short Term: 3.1	9000	12
Trichloroethylene	1.5×10^{-6}	Long Term: 8.7×10^{-3} Short Term: 0.74	2100	1.2

Table 5.

Action Level Concentrations

	Table 3 Action Levels $\mu g/m^3$	
	Short-Term	Long-Term
Chloroform	98	0.043[1]
1,1,1-Trichlòroethane	19,000	1,000[2]
Trichloroethylene	2,690	0.59[1]

[1]Based on 10^{-6}, 70-year risk.
[2]Based on reference dose concentrations (RfCs).

ACKNOWLEDGEMENTS

Jawad Touma and Norman Huey of EPA contributed to the overall direction of this project. The health effects sections were prepared in consultation with Fred Hauchman of EPA.

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APPENDIX A

MODEL DERIVATION

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Derivation of a Screening Model for
VOC Emissions From Soils Handling Activities

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March 11, 1992

Screening Model for VOC Emissions from Soils Handling Activities
APPENDIX A - MODEL DERIVATION

A.1 INTRODUCTION

Background information about the modeling problem is presented in this appendix followed by a presentation of an emission model for estimating VOC emissions from the excavation of contaminated soil. A simplified version of the model is developed, then the models are evaluated.

Objective

Develop simple predictive model for estimating VOC emissions from soils handling activities, such as excavation.

Intended Use

The model will be used for assessing potential emissions during remediation of Superfund sites. At a minimum, the model should provide an emission factor to estimate emissions per unit time or unit operation. Ideally, it should also be appropriate for evaluating the effect of different remediation scenarios, e.g. starting waste concentrations, excavation rates, and control efficiencies.

Requirements

1. Model should be conservative, since the data may be used in some cases for health risk assessment.

2. Model should require as few input parameters as is feasible for ease of use.

Assumptions

1. During excavation, the surface area of soil in contact with the atmosphere is greatly increased. This results in up to one-third of the soil gas being released to the atmosphere. In dry soils containing very low levels of VOCs, most of the contaminants are present in the soil pore spaces, thus the percentage of the VOCs emitted is relatively high.

2. Once the soil has been dumped into place, the organic liquid to soil gas equilibrium is quickly re-established. The emissions can be estimated by a modification of the RTI landtreatment model.[1]

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[1]p. 5-14 and 5-15 of EPA-450/3-87-026, Review Draft, November 1989.

3. The freshly dumped soil is soon covered by relatively deep layers of subsequently excavated soil. These layers of soil result in longer-term emissions from the deeper layers being diffusion controlled, i.e., low. Therefore, the significant period for emissions is during excavation and the first six minutes or so afterwards. Subsequent (i.e. $t > 6$ min) emissions from this material are assumed to be zero.

4. The total exposed surface area of contaminated soil is assumed to remain constant. New material is exposed at the same rate that previously exposed material is covered.

5. The emissions from the pit are approximately equivalent to the emissions from the pile of excavated soil. The emissions from the soil in the backhoe bucket are negligible.

6. Wet soils are assumed to have relatively low levels of VOC emissions, even if the soil VOC concentrations are high. Wet soils may have little air-filled porosity and therefore the rate of diffusion of VOCs through wet soils is relatively low.

Possible Excavation Scenarios

Two general scenarios are followed during excavations at waste sites.

1. Soil is excavated using a backhoe and placed into a short-term storage pile. The soil is later picked up from the pile and dumped directly into transport vehicles (e.g. trucks or railcars) that are subsequently covered to minimize further emissions. Overall, <u>each m^3 of soil is excavated and dumped two times</u>.

2. Soil is excavated using a backhoe and placed into a temporary storage pile. The soil is moved from the pile using a front-end loader (and/or backhoe) to a staging area where a large storage pile is established. The pile is typically covered to minimize leaching and air emissions. The soil is eventually re-excavated and dumped into transport vehicles (e.g. trucks or railcars) that are subsequently covered to minimize further emissions. Alternatively, the soil may be re-excavated and fed to an on-site treatment system. Overall, <u>each m^3 of soil is excavated and dumped three times</u>.

It is rarely feasible or efficient to dig soil and immediately transfer the soil directly to transport vehicles or treatment systems. The excavation scenario and the emission equations shown below are designed to predict the emissions from a single soil handling event. To predict the total emissions from excavation, the equations must be sequentially applied to each event where the soil is handled (i.e., two or three times in most cases). The values for certain input parameters to the equations, such as the concentration of the contaminant in the soil and the bulk density of the soil, will be altered by the act of excavation and a separate (different) value will be required for these parameters when modeling each soil handling event of the overall excavation process.

Details of Excavation Scenario

Soil is excavated for 50 min/hour[2]. Each scoop of soil contains 2 m^3 of material and has dimensions of 1m x 2m x 1m. The cycle time is 40 seconds[3], so 75 scoops are moved per hour (= 150 m^3 of soil moved per hour). The excavation pit, after one hour of operation, has dimensions of 10m x 15m x 1m.

Each scoop of dumped soil is assumed to maintain its 1x2x1 dimensions, so that the pile of dumped soil is equivalent to a series of stacked blocks. After one hour, a pile 5m x 10m x 3m high is established. The total exposed surface area of the pile is 140 m^2 and the bottom of the pit has another 150 m^2 of exposed area (the sides of the excavation pit are assumed to be clean overburden). The exposed surface areas are assumed to remain constant during further hours of operation with any additional area being covered with some type of impermeable cover that acts as a barrier to further emissions.

A.2 DERIVATION OF EMISSION MODELS

The models are based on adding the emissions resulting from the release of soil-gas (pore space gas) to the atmosphere when excavation soil is dumped onto a storage pile to the emissions resulting from diffusion from contaminated soil present in the excavation pit and in the storage pile. A discussion of the input parameters and typical input values are given in Sections A.4 and A.5. Limitations of the models are also given in those sections.

Pore-Space Gas Model

The general form of the equation used to estimate the emission rate from the pore space gas for any given compound is the ideal gas law:

$$P\,V = nR\,T \qquad \text{(Eq. A-1)}$$

where:

	P	=	Vapor pressure of compound i (mm Hg);
	V	=	Volume (cm^3);
	n	=	Number of moles of gas;

[2]Page 8-35 of the Excavation Handbook by H.K. Church (MCGraw-Hill, 1981) states that excavation equipment can be assumed to be in use for 30 to 50 minutes per hour.

[3]Page 12-38, op cit, gives a cycle time of 0.67 minutes for a 25 foot hoist distance and a 90° angle of swing return.

R	=	Gas constant; and
T	=	Temperature (°K).

The mass of contaminants present in the pore space of soil can be determined as follows. First substitute M_{PS}/MW for n and then solve for M_{PS}:

$$M_{PS} = \frac{P\ V\ MW}{R\ T} \tag{Eq. A-2}$$

where:	M_{PS}	=	Mass of pore space contaminants (g); and
	MW	=	Molecular weight of species i (g/g-mole).

Then substitute soil volume and air-filled porosity terms for V to account for the volume of air within a given volume of soil. Air-filled porosity is the fraction of the total soil volume that is air. A factor of 10^6 to convert from cm^3 to m^3 is also needed:

$$M_{PS} = \frac{P\ MW}{RT}(10^6)(E_a)(S_V) \tag{Eq. A-3}$$

where:	E_a	=	Air-filled porosity (dimensionless);
	10^6	=	Conversion factor (cm^3/m^3);
	S_V	=	Volume of soil moved (m^3); and
	R	=	Gas constant, 62,361 (mm Hg - cm^3/g-mole °K).

To derive an emission rate, Equation A-3 must be modified to account for the rate at which soil is being moved and to account for the percentage of soil gas that is released or exchanged with the atmosphere:

$$ER_{PS} = \frac{P\ MW}{RT}(10^6)(E_a)(Q)(ExC) \tag{Eq. A-4}$$

where:	ER_{PS}	=	Average emission rate from the pore space gas (g/sec);
	ExC	=	Soil gas to atmosphere exchange constant (%/100); and
	Q	=	Excavation rate (m^3/sec).

The excavation rate term, Q, is equal to S_V divided by the total time period in seconds over which the given volume of soil is being moved. Equation A-4 assumes that the instantaneous emission rate is equivalent throughout the excavation cycle, whereas the emissions from each scoop of soil are probably due primarily to two emission puffs: one when the backhoe bucket enters the soil and initially disturbs the soil and the second, larger puff, when the bucket dumps the soil onto the storage pile. Equation A-4 also assumes that the pore space is saturated with the contaminant vapor.

Diffusion Model

The general form of the equation used to estimate the emission rate from the contaminated soil in the excavation pit and in the storage pile is the RTI landtreatment model:

$$EF = \frac{M_o}{l}\left[\frac{1}{\left(\frac{E_a}{K_{eq}\ k_g}\right) + \left(\frac{\pi\ t}{D_e\ K_{eq}}\right)^{\frac{1}{2}}}\right] e^{-t/tb} \qquad \text{(Eq. A-5)}$$

where:	EF	=	Emission flux through the soil at some time t (g/cm^2-sec);
	M_o	=	Initial loading of contaminant in soil (g/cm^2);
	l	=	Depth to which contaminant is mixed in soil (cm);
	K_{eq}	=	Weight fraction of VOC in air space (dimensionless);
	k_g	=	Gas-phase mass transfer coefficient (cm/sec);
	D_e	=	Effective diffusivity (cm^2/sec);
	t	=	Time since start of excavation of soil of interest (sec); and
	t_b	=	Time constant for biological decay of contaminant i (sec).

Several modifications to the model were made to make it applicable to excavation. First, the biological expoential decay term ($e^{-t/tb}$) was set equal to one since the timeframes of interest are very short. Second, the initial loading term (M_o) and the depth to which the waste is mixed term (l) were combined into a waste loading term, designated C. Third, a factor of 10,000 was added to convert the emission units from mass per cm^2 to mass per m^2. Fourth, a term was added to account for the surface area of the emitting soil. The resulting equation is:

$$ER_{Diff} = \frac{(C)(10{,}000)}{\left(\frac{E_a}{K_{eq}\ k_g}\right) + \left(\frac{\pi\ t}{D_e\ K_{eq}}\right)^{\frac{1}{2}}}\,[SA] \qquad \text{(Eq. A-6)}$$

where:	ER_{Diff}	=	Instantaneous emission rate from diffusion through the soil (g/sec);
	C	=	Soil concentration of species of interest (g/cm^3);
	10,000	=	Conversion factor (cm^2/m^2); and
	SA	=	Surface area of emission source (m^2).

The surface area term, SA, includes the area of the exposed contaminated soil for both the excavation pit and the storage pile. It is assumed that the surface area of the emission source remains constant, i.e., excavation was already underway before the particular soil being modeled was handled and excavated soil is moved off-site or covered to reduce emissions at the same rate that new soil is being uncovered and excavated. To model the case where no contaminanted soil is initially exposed, the surface area term in Equation A-6 can be divided by a factor of two to yield an average amount of exposed surface area.

A.3 EMISSION MODELS

The overall emission rate equation is formed by adding Equations A-4 and A-6. Note that the timeframes of the two equations as shown are not equivalent. Equation A-4 describes the emissions over the course of excavating and dumping one scoop of soil (40 seconds in the assumed scenario), while Equation A-6 gives an instantaneous emission rate at some time t since the contaminated material was first exposed to the air. An average value for t is discussed in Section A.4 and the timeframe of the two models are reconciled so that they yield an average emission rate.

The general form of the emission models for estimating an "average" emission rate for the excavation of contaminated soil is given as Equation A-7 and a worst-case emission rate is given as Equation A-8. It is a simple matter to modify either of these equations to calculate an emission flux (i.e., rate per area) or total emissions for a given period of time.

Emission Rate

An emission rate in g/sec for excavation was derived in the previous section and is:

$$ER = \frac{P\ MW}{RT}(10^6)(E_a)(Q)(ExC) + \frac{(C)(10{,}000)}{\left(\frac{E_a}{K_{eq}k_g}\right) + \left(\frac{\pi\ t}{D_e\ K_{eq}}\right)^{\frac{1}{2}}}(SA) \qquad \text{(Eq. A-7)}$$

Worst-Case Emission Rates

The worst-case (i.e., maximum) instantaneous emission rate, ER_{MAX}, for contaminated soil occurs when the exposed surface area is at a maximum and immediately after a bucket load of soil is dumped onto the storage pile. This emission rate can be approximated by considering the case where a pure chemical is exposed to the atmosphere. This emission rate can be determined from Equation A-6 (there is no need to consider pore space gas concentrations and diffusion since the pure chemical is already exposed to the atmosphere). Set the time term, t, equal to zero and replace the K_{eq} term with the equivalent expression: $P{*}MW{*}E_a/R{*}T{*}C$. Equation A-6 then reduces to:

$$ER_{MAX} = \frac{(k_g)(P)(MW)(SA)(10{,}000)}{RT} \qquad \text{(Eq. A-8)}$$

A.4 SIMPLIFIED EMISSION MODELS

The first half of Equation A-7 is simplified first, followed by simplification of the second half of Equation A-7.

Simplified Pore-Space Gas Model

The first half of Equation A-7 can be simplified as follows. Assume the following:

R	=	62,361;
MW	=	100;
T	=	298;
ExC[4]	=	0.33.

Substituting these values into the first half of Equation A-7 yields an emission rate for pore space gas, ER_{PS}, of:

$$ER_{PS} = \frac{P\ MW}{RT}(10^6)(E_a)(Q)(ExC) = \frac{(P)(E_a)(Q)(100)(10^6)(0.33)}{(62{,}361)(298)} \qquad \textbf{(Eq. A-9)}$$

$$ER_{PS} = \left(\frac{5.4\ g/m^3}{mm\ Hg}\right) * P * E_a * Q * 0.33 \qquad \text{(Eq. A-10)}$$

[4]Assume ExC = 0.33 for dry, sandy soils and ExC = 0.10 for wet soils or those with a high clay content.

Vapor pressures for most VOCs of interest are available in tabluated physical constants in Appendix B. These values are for 25°C, but P can be estimated at other temperatures[5]. According to SEAMs, the air-filled porosity (E_a) can be assumed to be:

E_a	Soil Conditions
0.35	Wet, or compacted soil
0.55	Dry, uncompacted soil

E_a can be assumed to be 0.05 for sludges, tarry wastes, and saturated soils. Alternatively, E_a can be calculated as follows:

(Eq. A-11)

$$E_a = 1 - \left[\frac{ß + (ß)(M_{FRAC})}{p}\right]$$

where:
- ß = Bulk density of soil (g/cm³);
- M_{FRAC} = Moisture fraction in soil (Wt.% Moisture/100); and
- p = Particle density (g/cm³).

Default values are as follows. Bulk density (ß) usually is in the range of 1.0 to 2.0 and can be assumed to be about 1.5 for uncompacted soils prior to excavation. After excavation, the bulk density is lower and a value of 1.2 may be assumed. Particle density (p) is typically about 2.65 ± 5% for soils. These default values yield an E_a for dry soil of 0.43 before excavation and 0.55 after excavation.

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[5]Vapor pressure can be roughly estimated at temperatures other than 25°C by the following equation:

$$P = P^o\, e^{\left(\frac{-21T_B}{1.987}\left(\frac{1}{T} - \frac{1}{T_o}\right)\right)}$$

(Eq. A-12)

where:
- P = Vapor pressure of compound i at temperature T (mmHg);
- P^o = Vapor pressure of compound i at temperature T_o (mmHg);
- T_B = Normal boiling point of compound i (°K);
- T = Temperature (°K);
- T_o = Reference Temperature (°K) - Usually 298°K;
- 1.987 = Gas constant (cal/g-mol °K); and
- 21 = Heat of vaporization constant (cal/g-mol °K).

Using the SEAMS value for E_a (0.55), Equation A-10 for dry soil then reduces down to:

$$ER_{PS} = P * Q * 0.98 \text{ g/mmHg-m}^3 \qquad \text{(Eq. A-13)}$$

Equation A-13 is the simple screening model. If desired, it can be further reduced. Using the excavation scenario described above, Q can be assumed to be 150 m^3/3600 sec. Equation A-13 for dry soil then reduces down to:

$$ER_{PS} = (0.04 \text{ g/mm Hg})*P \qquad \text{(Eq. A-14)}$$

Simplified Landtreatment Model

The second half of Equation A-7 can be simplified as follows. The following equations[6,7] can be used to describe the terms K_{eq} and D_e, which appear in Equation A-7:

$$K_{eq} = \frac{P \; MW \; E_a}{RT \; C} \qquad \text{(Eq. A-15)}$$

$$D_e = \frac{D_a \, (E_a)^{3.33}}{(E_T)^2} \qquad \text{(Eq. A-16)}$$

where: D_a = Diffusivity in air of species i (cm^2/sec); and
E_T = Total porosity (dimensionless).

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[6]The equation shown for calculating K_{eq} assumes that the contaminant is an oily waste. For dilute aqueous wastes, K_{eq} = H/RT, where H = Henry's Law constant in mm Hg-cm^3/g-mol.

[7]Strictly speaking, the concentration term, C, in Equations A-15 and A-7 should be adjusted to account for the mass of contaminant lost with the pore-space gas. This adjustment has not been included in the model for the sake of simplicity.

K_{eq} represents the relative saturation of the soil-gas with respect to a given compound and cannot realistically exceed 1. Calculated values of K_{eq} using Equation A-15 will exceed 1 if the soil-gas is below saturation with respect to that compound. If the output of Equation A-15 is $K_{eq} > 1$, then a value of $K_{eq} = 1$ should be used in all equations having a K_{eq} term. Alternatively, K_{eq} could be determined by field measurements of the pore space concentration in the soil ratioed to the total concentration of the contaminant in the soil.

E_T can be calculated by Equation A-11 if the moisture fractic is set to zero.

Assume the following:

R	=	62,361;
MW	=	100;
T	=	298;
D_a	=	0.1;
E_a	=	0.55;
E_T	=	0.625;

Substitute these values into Equations A-15 and A-16 to yield:

(Eq. A-17)

$$K_{eq} = \frac{P}{C\ 332{,}200}$$

$$D_e = 0.035 \qquad \text{(Eq. A-18)}$$

The second half of Equation A-7 can then be simplified by inserting Equations A-17 and A-18, and by assuming that $E_a = 0.55$ and that $k_g = 0.15$. Equation A-7 then reduces to:

(Eq. A-19)

$$ER_{Diff} = \frac{(C)(10{,}000)}{\left(1.22x10^6\ \frac{C}{P}\right) + \left(2.98x10^7\ \frac{C\ t}{P}\right)^{\frac{1}{2}}}\ (SA)$$

Equation A-19 provides an instantaneous emission rate at time = t. It is assumed that emissions from freshly excavated soil are significant for a period of 360 seconds, after which the soil is covered by subsequent layers of excavated material. The emission rate versus time over this 360 second period for a given scoop of soil will generally exhibit an exponential decay. The exact shape of this decay curve will vary as the input parameters such as vapor pressure and air-filled porosity vary. Therefore, it is necessary to determine at what time t the instantaneous emission rate approximates the average emission rate over the 360 second period. This can be done by calculating the instantaneous emission rates at t = 0 second, t = 15 seconds, t = 30 seconds, and so on. The emission rate is calculated for every 15 second period up to t=360 and the results plotted. The average emission rate is calculated by summing the instantaneous emission rates and dividing the sum by the number of data points (in this example, 24). The value for the average emission rate is then found on the plot of emission rate versus time, and the corresponding time found on the x-axis. This time t is then used in Equation A-19. For the typical case, the instantaneous rate at t = 60 seconds is a good approximation of the overall emission rate for the first 360 seconds. Using this value Equation A-19 yields the simple screening equation:

$$ER_{Diff} = \frac{(C)(10{,}000)}{\left[\left(1.22 \times 10^6 \frac{C}{P}\right) + \left(1.79 \times 10^9 \frac{C}{P}\right)^{\frac{1}{2}}\right]} (SA) \qquad \text{(Eq. A-20)}$$

Equation A-20 assumes that the emission flux arising from diffusion is equal for both the excavation pit and the excavated soil in the storage pile. Equation A-20 will overpredict emissions if $K_{eq} > 1$. P at temperatures other than 25°C can be estimated using Equation A-12. From the excavation scenario described earlier, SA can be assumed to be 290 m^2.

Assuming a typical bulk density of undisturbed soil, C can be modified to a weight basis as follows:

$$C' = C * \frac{1\ cm^3}{1.5\ g} * 10^6\ \mu g/g \qquad \text{(Eq. A-21)}$$

where: C' = Concentration of species in soil ($\mu g/g$).

The overall emission rate is determined by adding Equations A-13 and A-20. This estimated value should be checked to see whether or not it exceeds the total mass of contaminants present in the soil that is moved, which is equal to the theoretical maximum emissions (not considering emissions from the un-excavated soil in the pit). To do this, the emission rate should be multiplied by 3,600 seconds to get the total emissions over a reasonably long period of time, one hour. The mass of contaminants present in the soil can be determined by:

$$C_{TOT} = C * S_V * 10^6\ cm^3/m^3 \qquad \text{(Eq. A-22)}$$

where: C_{TOT} = Total starting mass of contaminant in excavated soil (g).

Equations A-4 and A-13 are based on the assumption that the soil pore gas is saturated with the compound of interest. If this is not the case, then Equations A-4 or A-13 may overpredict the emission rate. The output from Equations A-4 or A-13 should be multiplied by the duration of excavation and compared to the total mass of contaminants present in the soil. If Equations A-4 or A-13 gives a value that exceeds one-third of C_{TOT}, then they should be replaced with the following equation:

$$ER_{PS} = C_{TOT} * 0.33/t_{sv} \qquad \text{(Eq. A-23)}$$

where: t_{sv} = Time to excavate a given volume of soil (sec).

A.5 MODEL EVALUATION

The emission model was evaluated to determine the sensitivity of the model to various input parameters. All the independent variables in Equation A-7 are listed in Table A-1. For each variable a typical value is given along with the range of values likely to be encountered at Superfund site excavations. The uncertainty associated with measuring each variable is also estimated in Table A-1. The range of physical properties was based on n-butane being the lightest VOC likely to be encountered at a site and naphthalene being the heaviest compound likely to be of concern. Typical physical property values were based on C6 to C8 compounds (e.g. benzene to xylene). The soil volume term was kept constant to show the variability in surface area for a given volume of soil. The gas-phase mass transfer coefficient (k_g) was estimated using the correlations given with the RTI landtreatment model and the following input values:

Parameter	Units	Minimum Value	Maximum Value	Typical Value
Wind Speed	m/sec	1.0	4.47	2.0
Viscosity of air	g/cm-sec		$1.81x10^{-4}$	
Density of air	g/cm^3		$1.2x10^{-3}$	
Diffusity. in air	cm^2/sec	0.25	0.059	0.1
Diameter of excavation	m		24	

The minimum and maximum values for the independent input parameters from Table A-1 were combined to generate a best-case and worst-case set of emission scenarios. These are shown in Table A-2 along with the case using the typical input parameters. As seen in Table A-2, the three cases shown differ greatly in the estimated average emission rate.

To identify which parameters had the greatest effect on the overall emissions, a set of calculations were performed using the base or typical case as the starting point. The effect of each parameter was examined by substituting the minimum and maximum value for each into the base case conditions. The results of this first-order sensitivity analysis are shown in Table A-3. The two independent variables having the largest effect on the overall emission rate are the starting concentration of the contaminant in the soil and the vapor pressure of the contaminant. Note that temperature has a small effect, but that emissions are inversely proportional to temperature. This is, of course, contrary to the overall effect of temperature on emissions: emissions increase as temperature increases. This seeming anomaly is due to

Table A-1.
Input Parameters for Emission Equations

Equation Parameter	Units	Typical Input Values			Typical Uncertainty (±%)	Comments
		Minimum	Maximum	Typical		
Independent Variables						
Concentration	ug/Kg (ppbw)	50	5,000,000	100,000	50	
Bulk Density	g/cm3 (dry)	1.0	2.0	1.35	10	
Moisture	%	5.0	25	10	5	
Particle Density	g/cm3	2.55	2.8	2.65	5	
Temperature	K	273	313	298	2	
Da	cm2/sec	0.059	0.25	0.1	25	Varies w/temperature
P	mm Hg	0.053	1820	35	300	Varies w/temperature
MW	g/gmol	41	166	100	1	
R	mm Hg-cm3/gmol-K	62361	62361	62361	1	
pi	--	3.14	3.14	3.14	1	
kg	cm/sec	0.062	0.52	0.15	25	
t	sec	60	60	60	25	
Q	m3/sec	0.042	0.042	0.042	30	
Surface Area	m2	290	435	290	50	
Exchange Constant	%	1	50	33	200	
Dependent Variables						
C	g/cm3	5.00×10^{8}	0.010	1.35×10^{-4}		
Ea	vol/vol	0.588	0.107	0.440		
Et	vol/vol	0.608	0.286	0.491		
De	cm2/sec	0.0273	0.0018	0.0296		
Keq	g/g	1.50	0.166	0.613		
Keq	g/g (max)	1				Keq cannot exceed one

Table A-2.
Emission Scenarios

Parameter	Units	Typical Input Values			Emission Scenarios		
		Minimum	Maximum	Typical	Best Case	Worst Case	Typical Case
Concentration	ug/Kg (ppbw)	50	5,000,000	100,000	50	5000000	1000
Bulk Density	g/cm3 (dry)	1.0	2.0	1.35	2.0	1.0	1.35
Moisture	%	5.0	25	10	25	5.0	10
Particle Density	g/cm3	2.55	2.8	2.65	2.55	2.8	2.65
Temperature	K	273	313	298	273	313	298
C	g/cm3	5.00×10^{-8}	1.00×10^{2}	1.35×10^{-4}	1.00×10^{-7}	5.00×10^{-3}	1.35×10^{-4}
Ea	vol/vol				0.020	0.625	0.440
Et	vol/vol				0.216	0.643	0.491
Da	cm2/sec	0.059	0.25	0.1	0.059	0.25	0.1
P	mm Hg	0.053	1820	35	0.053	1820	35
MW	g/gmol	41	166	100	166	41	100
R	mm Hg-cm3/gmol-K	62361	62361	62361	62361	62361	62361
pi	--	3.14	3.14	3.14	3.14	3.14	3.14
Kg	cm/sec	0.062	0.52	0.15	0.062	0.52	0.15
De	cm2/sec				3×10^{-6}	0.1265	0.0269
Keq	g/g				0.101	0.478	0.613
Keq	g/g (max)						
t	sec	60	60	60	60	60	60
Excavation Rate	m3/sec	0.042	0.042	0.042	0.042	0.042	0.042
Surface Area	m2	290	435	290	290	435	290
Exchange Constant	%	1	50	33	1	50	33
Emission Rate	g/sec				1.51×10^{-5}	422	4.65

Notes: 1. Use Keq(max) if Keq is >1.

Table A-3.
Results of Sensitivity Analysis

Equation Parameter	Units	Typical Input Values			Change in Emission vs Base Case	
		Minimum	Maximum	Typical	Minimum Value (± %)	Maximum Value (± %)
<u>Independent Variables</u>						
Concentration	ug/Kg (ppbw)	50	5,000,000	100,000	-99.9	348
Bulk Density	g/cm3 (dry)	1.0	2.0	1.35	21.9	-66.4
Moisture	%	5.0	25	10	10.7	-29.1
Particle Density	g/cm3	2.55	2.8	2.65	-6.1	8.4
Temperature	K	273	313	298	5.8	-3.1
Da	cm2/sec	0.059	0.25	0.1	-16.9	41.0
P	mm Hg	0.053	1820	35	-98.5	38.0
MW	g/gmol	41	166	100	-42.7	38.0
R	mm Hg-cm3/gmol-K	62361	62361	62361	NA	NA
pi	--	3.14	3.14	3.14	NA	NA
kg	cm/sec	0.062	0.52	0.15	-4.3	2.4
t	sec	1	3600	60	1688	-65.4
Excavation Rate	m3/sec	0.042	0.042	0.042	NA	NA
Surface Area	m2	290	435	290	0.0	37.7
Exchange Constant	%	1	50	33	-23.8	12.6
<u>Dependent Variables</u>						
C	g/cm3	1.00×10^{-7}	5.00×10^{-3}	1.35×10^{-4}	-99.9	302
Ea	vol/vol	0.020	0.625	0.440	-98.8	89.0
Et	vol/vol	0.216	0.643	0.491	87.1	-17.3
De	cm2/sec	3.00×10^{-6}	0.1265	0.0269	-74.7	80.4
Keq	--	1.00×10^{-4}	1	0.613	-75.3	21.8

main effect of temperature being to increase the vapor pressure and diffusivity terms. If these terms are not corrected for temperature, then the model will become less accurate as the temperature deviation from 25°C increases.

Equation A-7 requires the input of the time after the start of excavation (t). It was assumed earlier that the emission rate at $t=60$ seconds was equal to the average emission rate over $t=0$ to $t=360$ seconds. It was further assumed that after 360 seconds, the excavated soil would be covered with additional layers of soil and the diffusion of further material (emissions) would be minimal. The effect of time (t) was examined by substituting a range of times into the base case conditions. The results of these trials are given in Table A-4 and depicted in Figure A-1 and A-2.

The effect of the initial soil concentration of the contaminant on the predicted emission rate was examined by using the same base case assumptions and varying the concentration from 1 ppbw to 10,000 ppmw. These results are shown in Table A-5 and are plotted in Figure A-3. As the concentration increases, the percentage of the total mass of material emitted decreases. Also, the relative contribution of pore-space gas to the total emissions also decreases. The effect of vapor pressure (and molecular weight) was examined by inserting the values for vapor pressure and molecular weight for several common organic species into the base case. All compounds were assumed to be present at 100 ppmw in the soil. These results are shown in Table A-6.

A final check of the models was made by comparing model predictions to field data (Eklund, et al. Field Measurement of VOC Emissions From Soils Handling Operations at Superfund Sites. EPA Contract No. 68-02-4392, Work Assignment 64. September 1990). Comparisons of both the detailed (Equation A-7) and simple models (Equations A-13 and A-20) to field data are shown in Table A-7. Total emissions for twenty minute sampling periods are shown for two different field sites. The detailed model using site-specific input data agrees with the field measurements within a factor of five in all but two cases. The simplified model shows equally good agreement.

The equations presented here are a first attempt to model emissions from soils handling operations. The equations are limited by a lack of laboratory or field data to define certain key relationships between the variables. For example, the excavation rate and the total exposed area are assumed in the equations to have a direct linear relationship with the emission rate. No data, however, exist to support this assumption. Similarly, the effects of temperature, scoop size, and surface area to volume ratio on emissions have not been investigated. Another limiting assumption is that 33% of the pore space gas is exchanged with the atmosphere. This value is arbitrary and was selected since it fit reasonably well with the very limited field data that are available.

Measurements of emission rates from dynamic processes such as excavation are very difficult to perform and are of limited accuracy. Limitations exist for dispersion models used in indirect approaches (e.g., transect) and in the sampling and analytical precision when attempting to determine emission rates using a mass balance approach. Emerging measurement technologies, such as remote optical sensing, may allow more detailed evaluation of the effect of these parameters in the future.

Table A-4.

Effect of Time (t) on Emissions

Time (sec)	Diffusion Emission Rate (mg/sec)	Total Emission Rate (mg/sec)
0	81.9	83.1
5	11.0	12.1
10	8.09	9.23
20	5.89	7.03
30	4.87	6.01
40	4.25	5.39
50	3.83	4.96
60	3.51	4.65
90	2.89	4.02
120	2.51	3.65
180	2.06	3.20
240	1.79	2.93
300	1.61	2.74
360	1.47	2.61
420	1.36	2.50
480	1.28	2.41
540	1.20	2.34
600	1.14	2.28
1200	0.81	1.95
1800	0.66	1.80
2400	0.58	1.71
3000	0.51	1.65
3600	0.47	1.61

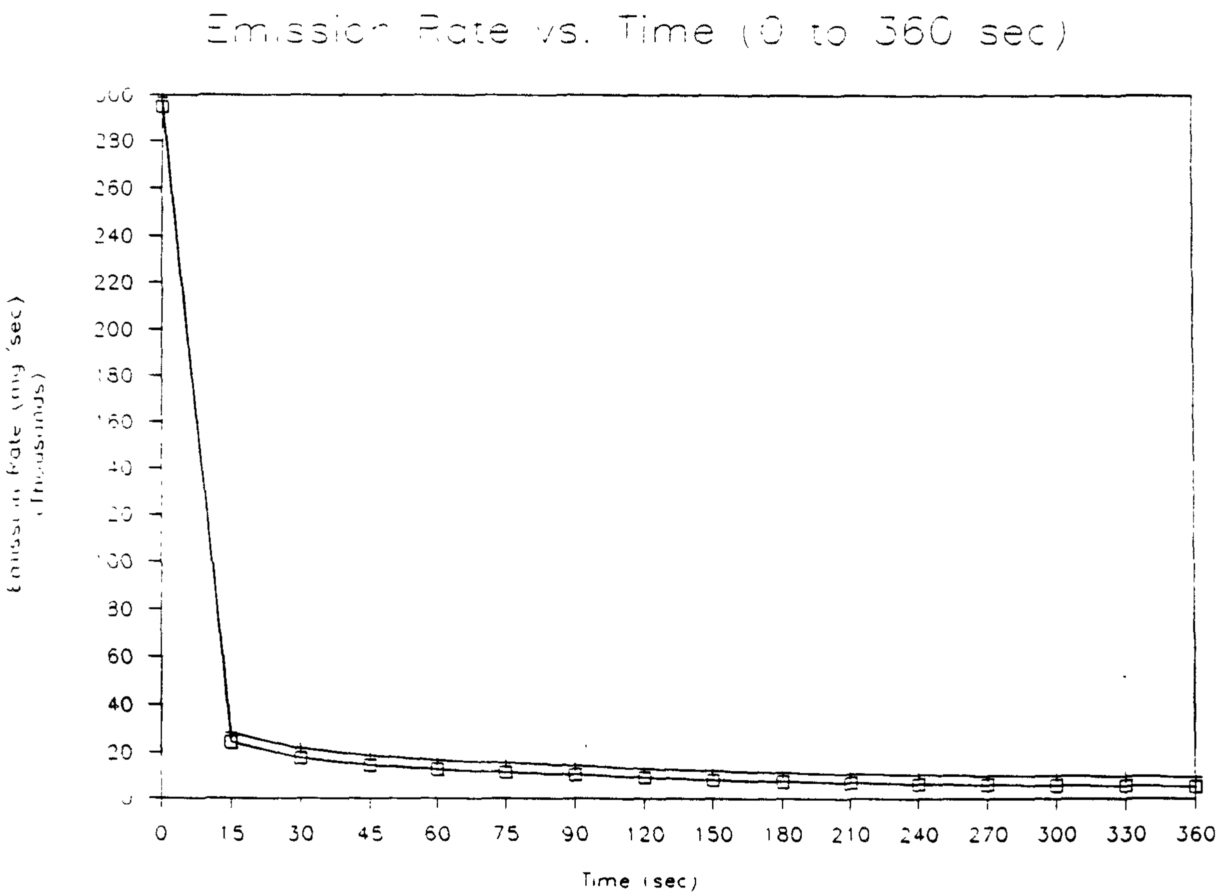

Figure A-1. Emission Rate vs. Time for Base Case Conditions for 0 to 360 seconds.

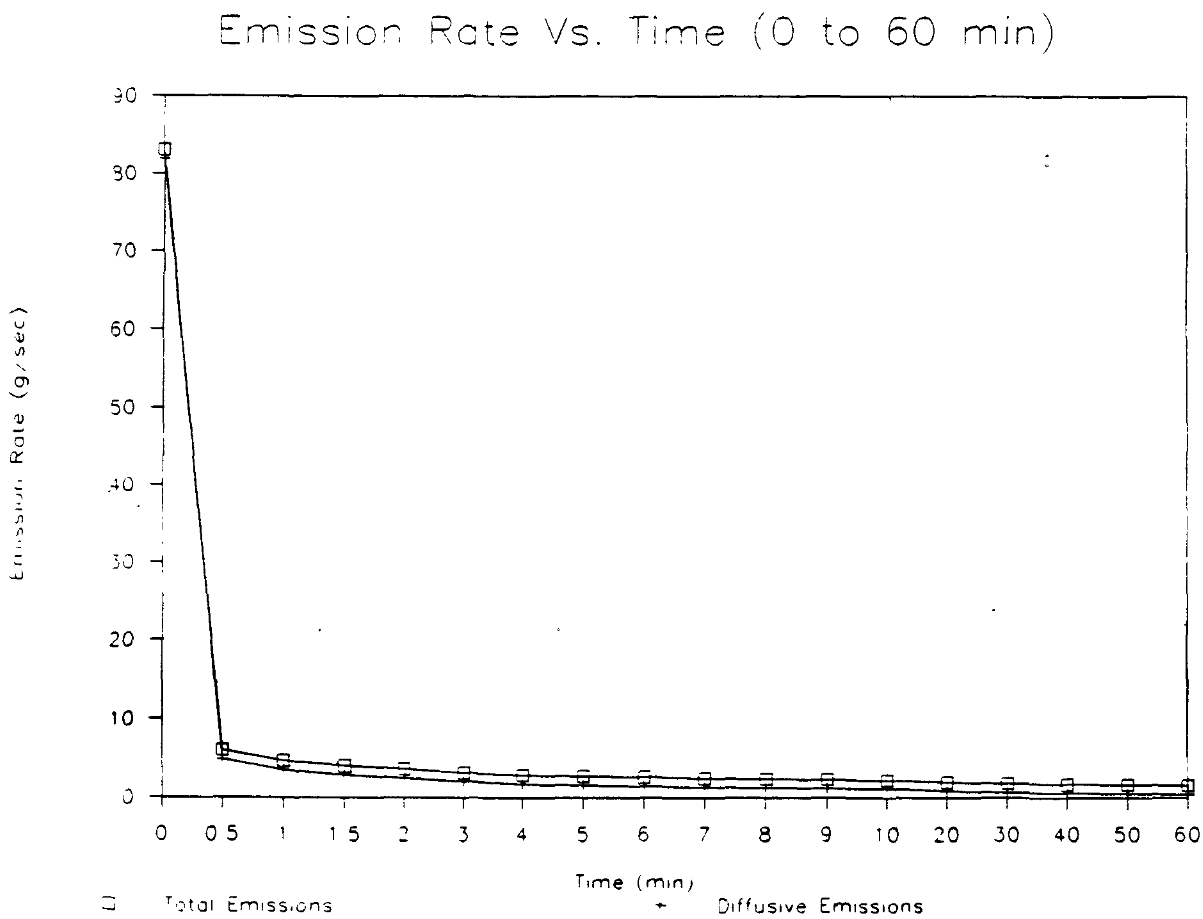

Figure A-2. Emision Rate vs. Time for Base Case Conditions for 0 to 60 Minutes.

Table A-5.

Effect of Conc. (C) on Emissions

Conc (ug/Kg)	Log Conc (ug/Kg)	Pore Gas Emission Rate (g/sec)	Diffusive Emission Rate (g/sec)	Total Emission Rate (g/sec)	Emissions* Vs. Total Mass (%)
1	1	1.88×10^{-5}	4.52×10^{-5}	6.40×10^{-5}	114
10	2	1.88×10^{-4}	4.52×10^{-4}	6.40×10^{-4}	114
100	3	1.87×10^{-3}	4.52×10^{-3}	6.40×10^{-3}	114
1000	4	0.019	0.045	0.06	114
10000	5	0.188	1.14	1.33	236
100000	6	1.138	3.51	4.65	82.6
1000000	7	1.138	10.15	11.29	20.1
10000000	8	1.138	25.32	26.46	4.7

* Includes only mass of contaminants in excavated soil

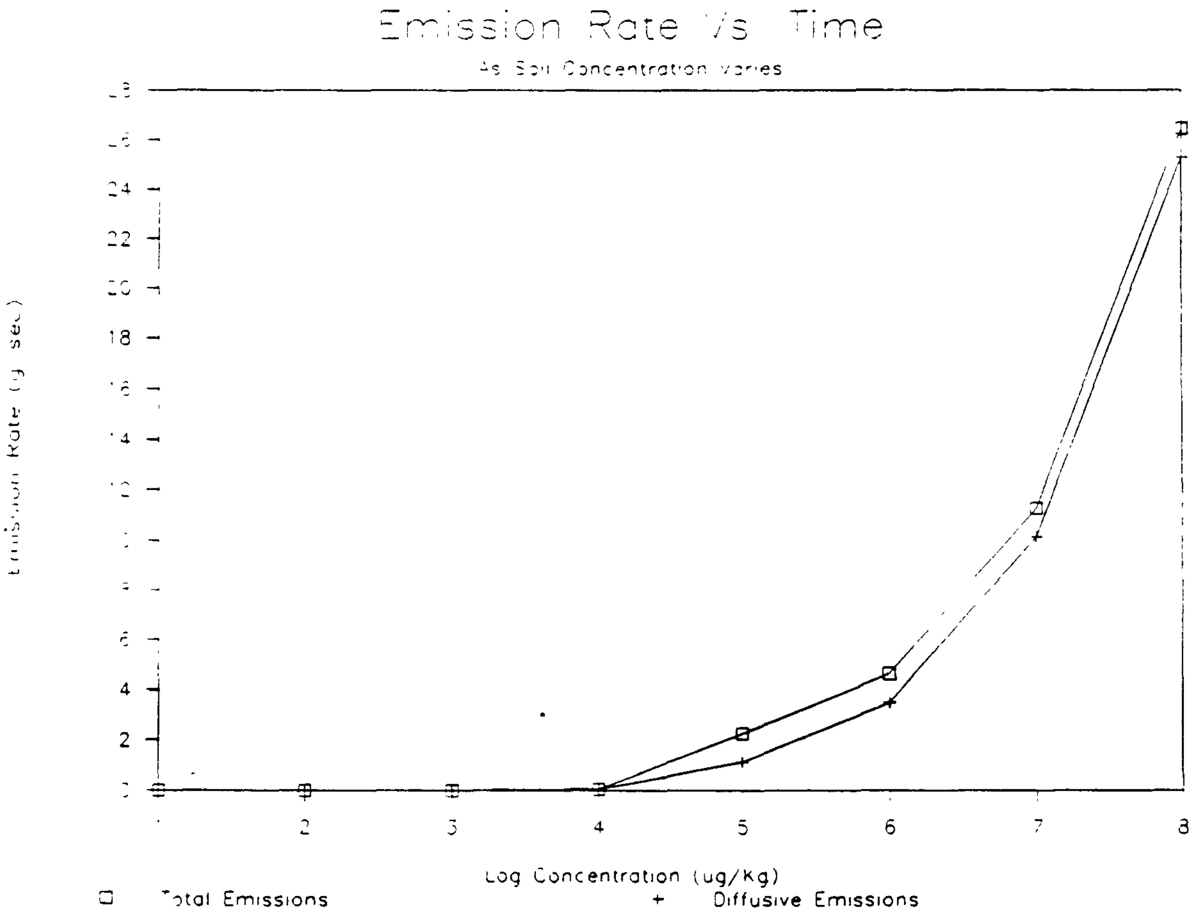

Figure A-3. Emission Rate vs. Time as Soil Concentration Increases.

Table A-6.

Effect of Molecular Weight (MW) + Vapor Pressure (P) on Emissions

Conc (ug/Kg)	Molecular Weight (g/g-mol)	Vapor Pressure (mm Hg)	Diffusive Emission Rate (g/sec)	Total Emission Rate ([illegible]/sec)
Alkanes				
butane	58.12	1820	4.52	6.40 *
pentane	72.15	513	4.52	6.40 *
hexane	86.18	150	4.52	6.40 *
heptane	100.2	46	4.05	5.55
octane	114.23	17	2.57	3.21
nonane	128.26	4.3	1.30	1.48
Aromatics				
benzene	78.12	95.2	5.18	7.06
ethylbenzene	106.16	10	1.87	2.21
o-xylene	106.2	7.0	1.54	1.78

* Pore space emissions equal the total mass of contaminant present divided by 3.

Table A-7

Comparison of Model Predictions to Field Data

Site	Run #	Compound	FIELD RESULTS		MODEL PREDICTIONS				PREDICTIONS FOR SIMPLE MODELS			
			Mass of Contam. Present (g)	Total Emissions (g)	Pore Space Emissions - EPS - (g)	Diffusive Emissions - Ei - (g)	Total Emissions (g)	Accuracy (%)	Pore Space Emissions -EPS- (g)	Diffusive Emissions - Ei - (g)	Total Emissions (g)	Accuracy (%)
A	1	Xylenes	855	24	49	182	231	863	7 4	62	69	189
	2	Xylenes[a]	12	37	4.0	20.3	24	-34	7 0	20	27	-27
	3	Xylenes[a]	140	82	47	203	249	204	83	203	285	248
A	1	Ethylbenzene	53	6.6	21	32	52	692	3.1	32	35	432
	2	Ethylbenzene[a]	1.2	8.4	0.4	4.2	4.6	-46	3.0	4.2	7.1	-15
	4	Ethylbenzene[a]	14	14	4.6	42	46	230	35	42	76	443
B	2	Xylenes[a]	0 13	7.2	4.3	20	24	236	5.8	2.0	7.8	8.3
	3	Xylenes[a]	2.7	2.2	0.9	9 2	10	357	5.8	9	15	581
	4	Xylenes[a]	3.7	2.3	1.2	11	12	421	5.8	11	17	621

Accuracy = (Model - Field)/Field x 100

[a] Pore space emissions equal total mass of contaminant present divided by 3.

APPENDIX B

PHYSICAL AND CHEMICAL CONSTANTS FOR SELECTED COMPOUNDS

APPENDIX B - PHYSICAL PROPERTY DATA

No.	Organic Compound	CAS NO.	Formula	Molecular Weight (g/g-mol)	Vapor Pressure (mm Hg)[1]	Diffusivity in Air (cm^2/sec)
1	Acetaldehyde	75-07-0	C2H4O	44.00	760	0.1240
2	Acetic acid	64-19-7	C2H4O2	60.06	15.41	1.1300
3	Acetic anhydride	108-24-7	C4H6O3	102.09	5.266	0.2350
4	Acetone	67-64-1	C3H6O	58.08	266	0.1240
5	Acetonitrile	75-05-8	C2H3N	41.06	90	0.1280
6	Acrolein	107-02-8	C3H4O	56.1	244.2	0.1050
7	Acrylic acid	79-10-7	C3H4O2	72.1	5.2	0.0908
8	Acrylonitrile	107-13-1	C3H3N	53.06	114	0.1220
9	Allyl alcohol	107-18-6	C3H6O	58.08	23.3	0.1140
10	Allyl chloride	107-05-1	C3H5CL	76.53	368	
11	Aniline	62-53-3	C6H7N	93.13	1	0.0700
12	Anthracene	120-12-7	C14H10	178.23	1.3E-06	
13	Benzaldehyde	100-52-7	C7H6O	106.12	1	
14	Benzene	71-43-2	C6H6	78.12	95.2	0.0932
15	Benzoic acid	65-85-0	C7H6O2	122.12	0.00704	
16	Benzyl alcohol	100-51-6	C7H8O	108.14	0.15	
17	Benzyl chloride	100-44-7	C6H5CH2Cl	126.6	1.21	0.0750
18	Bromoform	75-25-2	CHBr3	252.77	5.6	
19	1,3-Butadiene	106-99-0	C4H6	54.09	2100.00	0.2490
20	N-Butane	106-97-8	C4H10	58.12	1820	0.2490
21	2-Butanol	15892-23-6	C4H10O	74.12	10	
22	N-Butanol	71-36-3	C4H10O	74.12	6.5	
23	N-Butyl-Acetate	123-86-4	C6H12O2	116.16	15	
24	Tert-Butyl-Alcohol	75-65-0	C4H10O	74.12	0.17	
25	Carbon disulfide	75-15-0	CS2	76.13	366	0.1040
26	Carbon tetrachloride	56-23-5	CCL4	153.82	113	0.0632
27	Carbonyl sulfide	463-58-1	COS	60.1	–	
28	Catechol	120-80-9	C6H4(OH)2	110.1	–	
29	Chlorine	7782-50-5	Cl2	70.9	–	
30	Chlorobenzene	108-90-7	C6H5CL	112.56	11.8	0.0730
31	Chlorodifluoromethane	75-45-6	CHCLF2	86.47	–	
32	Chloroform	67-66-3	CHCL3	119.38	208	0.0888
33	Chloromethyl methyl ether	107-30-2	C2H5Cl0	80.51	–	
34	Chloropentafluoroethane	76-15-3	C2CLF5	154.47	–	
35	Chloroprene	126-99-8	CH2CHCH2Cl	76.53	273	0.1040
36	M-Cresol	108-39-4	C7H8O	108.14	0.08	0.0740
37	O-Cresol	95-48-7	C7H8O	108.14	0.24	0.0740
38	P-Cresol	106-44-5	C7H8O	108.14	0.11	0.0740
39	Cyanogen	460-19-5	C2N2	52.04	3980	
40	Cyclohexane	110-82-7	C6H12	84.16	100	0.0839
41	Cyclohexanol	108-93-0	C6H12O	100.16	1.22	0.2140
42	Cyclohexanone	108-94-1	C6H10O	98.14	4.8	0.0784
43	Cyclohexene	110-83-8	C6H1O	82.15	–	

Appendix B. (Continued)

No.	Organic Compound	CAS NO.	Formula	Molecular Weight (g/g-mol)	Vapor Pressure (mm Hg)	Diffusivity in Air (cm^2/sec)
44	Cyclopentane	287-92-3	C5H10	70.13	317.44	
45	Diazomethane	334-88-3	CH2N2	42.04	–	
46	Dibutyl-O-Phthalate	84-74-2	C16H22O4	278.35	1.00E-05	0.0439
47	O-Dichlorobenzene	95-50-1	C6H4CL2	147.00	1	0.0690
48	P-Dichlorobenzene	106-46-7	C6H4CL2	147.00	1.2	0.0690
49	Dichloroethylether	111-44-4	C4H8Cl2O	143.02	1.4	
50	Dichlorodifluoromethane	75-71-8	CCL2F2	120.91	4870	
51	1,1-Dichloroethane	75-34-3	C2H4CL2	98.96	234	0.0919
52	1,2-Dichloroethane	107-06-2	C2H4CL2	98.96	80	0.0907
53	1,1-Dichloroethylene	75-35-4	C2H2CL2	96.94	600	0.1040
54	cis-1,2-Dichloroethylene	156-59-2	C2H2CL2	96.94	208	
55	trans-1,2-Dichloroethylene	156-60-5	C2H2CL2	96.94	324	
56	Dichloromethane	75-09-2	CH2CL2	84.93	362	
57	Dichloromonofluoromethane	75-43-4	CHCL2F	102.92	1360	
58	1,2-Dichloropropane	78-87-5	C3H6CL2	112.99	42	
59	1,3-Dichloropropene	542-75-6	C3H4Cl2	110.98	43	
60	1,2-Dichloro-1,1,2,2-Tetrafluoroethane	76-14-2	C2CL2F4	170.92	–	
61	Diethanolamine	111-42-2	C4H11NO2	105.14	–	
62	Diethyl amine	109-89-7	C4H11N	73.14	350@35C	
63	N,N-Dimethylaniline	121-69-7	C8H11N	121.18	–	
64	Diethyl ether	60-29-7	C4H10O	74.12	440@20C	0.0782
65	Dimethylamine	124-40-3	C2H7N	45.08	563 @ 0C	
66	Dimethyl formamide	68-12-2	C3H7NO	73.09	4.0	0.0939
67	1,1-Dimethyl hydrazine	57-14-7	C2H8N2	60.10	157	0.1060
68	2,4-Dinitrophenol	51-28-5	C6H4N2O5	184.11	53.8	
69	1,4-Dioxane	123-91-1	C4H8O2	88.11	37	0.2290
70	Diphenyl	92-52-4	C12H10	154.21	–	
71	Epichlorohydrin	106-89-8	C3H5ClO	92.53	17	0.0860
72	1,2-Epoxybutane	106-88-7	C4H8O	72.0	–	
73	Ethanol	64-17-5	C2H6O	46.07	50	0.1230
74	Ethyl acetate	141-78-6	C4H8O2	88.11	100	
75	Ethyl acrylate	140-88-5	C5H8O2	100.12	40	0.0770
76	Ethyl amine	75-04-7	C2H7N	45.08	1057	
77	Ethylbenzene	100-41-4	C8H10	106.16	10	0.0750
78	Ethyl Bromide	74-96-4	C2H5Br	108.97	–	
79	Ethyl carbamate	51-79-6	C3H7NO2	89.09	10	
80	Ethyl Chloride	75-00-3	C2H5Cl	64.51	1200	0.2710
81	Ethylenediamine	107-15-3	C2H8N2	60.10	10.7	
82	Ethylene dibromide	106-93-4	C2H4Br	187.88	14	
83	Ethylene glycol	107-21-1	C2H6O2	62.07	0.13	0.1080
84	Ethylene imine	151-56-4	C2H5N	43.07	–	
85	Ethylene oxide	75-21-8	C2H4O	44.06	1250	0.1040

Appendix B. (Continued)

No.	Organic Compound	CAS NO.	Formula	Molecular Weight (g/g-mol)	Vapor Pressure (mm Hg)[1]	Diffusivity in Air (cm^2/sec)
86	Formaldehyde	50-00-0	CH2O	30.03	3500	0.1780
87	Formic acid	64-18-6	CH2O2	46.03	42	0.0790
88	Furan	110-00-9	C4H4O	68.08	596	0.1040
89	Glycerol	56-81-5	C3H8O3	92.09	1.60E-04	
90	N-Heptane	142-82-5	C7H16	100.2	46	
91	N-Hexane	110-54-3	C6H14	86.18	150.3	0.2000
92	Hydrazine	302-01-2	H4N2	32.05	14.4	
93	Hydrochloric acid	7647-01-0	HCl	36.46	32,450	
94	Hydrogen cyanide	74-90-8	CHN	27.03	–	
95	Hydrogen sulfide	7783-06-4	H2S	34.08	15,200	0.1760
96	Isobutanol	78-83-1	C4H10O	74.12	10	0.0860
97	Isobutyl acetate	110-19-0	C6H12O2	116.16	–	
98	Isopropyl alcohol	67-63-0	C3H8O	60.1	42.8	0.0980
99	Isopropyl amine	75-31-0	C3H9N	59.11	460	
100	Isopropylbenzene	98-82-8	C9H12	120.19	10.9@40C	
101	Methanol	67-56-1	CH4O	32.04	114	0.1500
102	Methyl acetate	79-20-9	C3H6O2	74.08	235	0.1040
103	Methyl acrylate	96-33-3	C4H7O2	86.09	–	
104	Methyl amine	74-89-5	CH5N	31.06	770@ -6C	
105	Methyl bromide	74-83-9	CH3BR	94.94	–	
106	Methyl-tert-butyl-ether	1634-04-4	C5H12O	88.15	245	0.0806
107	Methyl chloride	74-87-3	CH3CL	50.49	3830	0.1260
108	Methylcyclohexane	108-87-2	C7H14	98.19	43	
109	Methyl-ethyl-ketone	78-93-3	C4H8O	72.11	100	0.0808
110	Methyl formate	107-31-3	C2H4O2	60.05	500	
111	Methyl hydrazine	60-34-4	CH6N2	46.07	49.6	
112	Methyl iodide	74-88-4	CH3I	141.94	91	
113	Methyl-Isobutyl-Ketone	108-10-1	C6H12O	100.16	19.31	
114	Methyl isocyanate	624-83-9	C2H3NO	57.05	348	
115	Methyl-Isopropyl-Ketone	563-80-4	C5H10O	86.13	15.7	0.0750
116	Methyl mercaptan	74-93-1	CH4S	48.1	–	
117	Methyl methacrylate	80-62-6	C5H8O2	100.10	39	0.0770
118	Methyl-N-Propyl-Ketone	107-87-9	C5H10O	86.13	–	
119	Alpha-Methyl-Styrene	98-83-9	C9H10	118.18	0.076	0.2640
120	Monoethanolamine	141-43-5	C2H7NO	61.08	–	
121	Morpholine	110-91-8	C4H9NO	87.12	10.08	
122	Naphthalene	91-20-3	C10H8	128.19	0.023	0.0590
123	2-Nitropropane	79-46-9	C3H7NO2	89.09	12.9	
124	N-Nitrosodimethylamine	62-75-9	C2H6N2O	74.08	–	
125	N-Nitrosomorpholine	59-89-2	C4H8N2O	116.11	–	
126	N-Nonane	111-84-2	C9H20	128.26	4.28	
127	N-Octane	111-65-9	C8H18	114.23	17	

Appendix B. (Continued)

No.	Organic Compound	CAS NO.	Formula	Molecular Weight (g/g-mol)	Vapor Pressure (mm Hg)[1]	Diffusivity in Air (cm^2/sec)
128	N-Pentane	109-66-0	C5H12	72.15	513	
129	Phenanthrene	85-01-8	C14H10	178.23	2.00E-04	
130	Phenol	108-95-2	C6H6O	94.11	0.0341	0.0820
131	Phosgene	75-44-5	CCl2O	98.92	1,394	0.1080
132	Phosphine	7803-51-2	H3P	34.00	2,000	
133	Phthalic anhydride	85-44-9	C8H4O3	148.11	0.0015	0.0710
134	Propane	74-98-6	C3H8	44.1	760	
135	1,2-Propanediol	57-55-6	C3H8O2	76.11	0.3	
136	1-Propanol	71-23-8	C3H8O	60.1	20.85	
137	beta-Propiolactone	57-57-8	C3H4O2	72.06	3.4	
138	Propionaldehyde	123-38-7	C3H6O	58.08	300	
139	Propionic acid	79-09-4	C3H6O2	74.08	10	
140	N-Propyl-Acetate	109-60-4	C5H10O2	102.12	35	
141	Propylene oxide	75-56-9	C3H6O	58.08	524.5	0.1040
142	1,2-Propylenimine	75-55-8	C3H7N	54.1	112	
143	Pyridine	110-86-1	C5H5N	79.1	20	0.0910
144	Quinone	106-51-4	C6H4O2	108.09	--	
145	Styrene	100-42-5	C8H8	104.15	7.3	0.0710
146	1,1,1,2-Tetrachloro-2,2-Difluoroethane	76-11-9	C2CL4F2	203.83	--	
147	1,1,2,2,-Tetrachloroethane	79-34-5	C2H2CL4	167.85	6.5	
148	Tetrachloroethylene	127-18-4	C2CL4	165.83	19	0.0720
149	Tetrahydrofuran	109-99-9	C4H8O	72.11	72.1	0.0980
150	Toluene	108-88-3	C7H8	92.14	30	0.0870
151	P-Toluidine	106-49-0	C7H9N	107.16	0.3	
152	1,1,1-Trichloroethane	71-55-6	C2H3CL3	133.41	123	0.0780
153	1,1,2-Trichloroethane	79-00-5	C2H3CL3	133.41	25	0.0792
154	Trichloroethylene	79-01-6	C2HCL3	131.4	75	0.0790
155	Trichlorofluoromethane	75-69-4	CCL3F	137.37	667	
156	1,2,3-Trichloropropane	96-18-4	C3H5CL3	147.43	3.1	
157	1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	C2CL3F3	187.38	300	
158	Triethylamine	121-44-8	C6H15N	101.19	400	
159	Trifluorobromomethane	75-63-8	CBRF3	148.91	--	
160	1,2,3-Trimethylbenzene	526-73-8	C9H12	120.19	--	
161	1,2,4-Trimethylbenzene	95-63-6	C9H12	120.19	--	
162	1,3,5-Trimethylbenzene	108-67-8	C9H12	120.19	1.86	
163	Vinyl Acetate	108-05-4	C4H6O2	86.09	115	0.0850
164	Vinyl bromide	593-60-2	C2H3Br	107.0	895	
165	Vinyl-Chloride	75-01-4	C2H3CL	62.5	2660	0.0900
166	M-Xylene	108-38-3	C8H10	106.2	8	0.0700
167	O-Xylene	95-47-6	C8H10	106.2	7	0.0870
168	P-Xylene	106-42-3	C8H10	106.2	9.5	

[1] All vapor pressures are at 25°C unless otherwise indicated.

Attachment C
Assessment of Fugitive Emissions

May 18, 2009

RE: Minnesota Pollution Control Agency
WDE Landfill: Air Permitting Options
SEH No. MNPCA 107828 14.00

Ms. Jennifer Darrow
USEPA, Region V
77 West Jackson Blvd.
Chicago, IL 60604

Dear Ms. Darrow:

This letter provides additional information requested by EPA regarding the Waste Disposal Engineering Sanitary Landfill (WDE) in Andover, Minnesota, a closed landfill owned and operated by the Minnesota Pollution Control Agency (MPCA). Recent vapor sampling at vapor extraction well GW-43, located within the hazardous waste pit portion of the WDE Landfill, indicated high concentrations of several chlorinated compounds. This letter provides background information about the landfill, a proposed plan for treating the hazardous waste pit vapor, and the applicability of air permitting requirements for the site.

It is the MPCA's desire to conduct a remediation pilot study at the hazardous waste pit during the summer of 2009; therefore, expedient review of this letter and approval of the associated recommendations would be much appreciated.

Background Information

WDE is a closed landfill that accepted waste from 1971 to 1983. A hazardous waste pit area was permitted in 1971. Historic documents indicate that the pit cross-section consisted of a base layer of 18 inches of clay overlain by six inches of "bituminous liner" followed by six inches of crushed limestone. However, no record drawings of actual pit construction were identified in the file review. The waste pit is approximately 240 feet long, 90 feet wide, and 20 feet deep with the long axis oriented in a north-south direction. In 1974, the solid waste permit was modified and hazardous waste was no longer accepted. The facility accepted non-hazardous waste until closure in 1983.

In 1983 the WDE Landfill was designated as a Superfund site under the Comprehensive Environmental Response Compensation Act (CERCLA). Between 1984 and 1994 the responsible parties completed a remedial investigation and feasibility study, remedial design, and remedial action. Remedial action included a six foot landfill cover, passive landfill gas (LFG) venting, slurry wall around the waste pit, and a groundwater recovery system. The slurry wall was constructed around the perimeter of the waste pit to a depth of approximately 35 feet below ground surface. The slurry wall was reportedly keyed into a silt layer at depth. The groundwater recovery system installed at the site included six extraction wells located along the perimeter of the landfill near Coon Creek and one extraction well (EW-9) inside the waste pit slurry wall but outside the limits of the pit.

In 1995 the MPCA entered a Binding Agreement with the WDE Landfill Group. The WDE Landfill was removed from the Federal National Priorities List in June 1996 following entry into CLP and notice of compliance issuance. Further landfill responsibility reverted to the State of Minnesota.

An active LFG extraction and control system (enclosed flare) was installed at the landfill in 1998 which included 54 extraction wells. One extraction well (GW-43) was installed in the waste pit area. A geosynthetic clay liner (GCL) was also installed in areas of disturbance from the LFG extraction system installation to supplement the existing landfill cover system. In 2007, landfill gas engines were installed to generate electricity; however, the engines experienced mechanical issues and are not currently operating. An air permitting applicability assessment performed by Frederick Jenness of MPCA (based on an assessment by Earth Tech in 2006 for the engines and the WDE Landfill Flare Summary dated November 2003) showed that the flare and engines did not require a construction permit because potential emissions from this equipment were below State and Federal permitting thresholds.

Recent Activities and Emission Evaluation

SEH was retained by the MPCA to assess remedial options to more aggressively address soil and groundwater contamination associated with the hazardous waste pit area. One of the initial tasks performed by SEH included collection of a vapor sample from GW-43, which was analyzed for EPA Method TO-14. Due to high VOC concentrations measured from GW-43, SEH proposed to the MPCA to implement an emission evaluation associated with the LFG extraction system and GW-43. This effort included a review of historic operational data from GW-43 and additional vapor sample collection from GW-43 and the LFG extraction system.

Historic operation data at GW-43 suggested that this well was typically closed due to high oxygen levels. However, removal of a manhole located in the hazardous waste pit in 2007 resulted in decreased oxygen levels at GW-43 and the well was again opened. Subsequent gas extraction rates from GW-43 since 2007 were very low due to insufficient capabilities of the LFG extraction system. As part of the emission evaluation, vapor analytical samples were collected at the LFG extraction blower with GW-43 operating and closed, and directly from GW-43. Gas samples collected directly from GW-43 contained multiple quality control flags due to high concentrations exceeding the instrument calibration range; therefore, the results were estimated and not utilized to determine emission rates associated with the pit area Results of the sampling from the LFG extraction blower are provided in Table 1. As shown on Table 1, high concentrations of chlorinated compounds were present in the gas samples collected from the LFG extraction system while GW-43 was operating. GW-43 is currently shut off and isolated from the active LFG extraction system and flare.

Fugitive emissions associated with the gas from the non-hazardous waste portion of the landfill are calculated based on landfill gas generation rates calculated using the LandGEM model (based on waste in place and the age of the landfill) and sampled concentrations of various compounds in the landfill gas. A comparison of the landfill gas generation rates calculated by LandGEM for 2009 and the average observed flow at the flare during 2008 (162 cubic feet per minute, cfm) are provided in Table 2.

Using the LandGEM data and sampled concentrations at the blower that did not include the gas from the hazardous waste pit (from Table 1)[1], potential fugitive emissions of federal hazardous air pollutants (HAPs) are below major source thresholds for individual and total HAPs, as shown in Table 3. These calculations show that without the contribution from the hazardous waste pit, potential emissions are less than 10 ton/yr for individual HAP and 25 ton/yr for total HAPs.

[1] For those compounds listed in AP-42 Section 2.4, Municipal Waste Landfills, but not tested for, the AP-42 concentration was used.

A similar calculation can be made to determine HAP emissions with the gas from GW-43 included. Table 4 shows that fugitive HAP emissions are greater than major source thresholds when the gas from the hazardous waste area is included. These calculations show that potential emissions with the contribution from the hazardous waste pit exceed 10 ton/yr for federal HAPs methyl chloroform, methylene chloride, and trichloroethylene. Further, HCl emissions from the flare would be greater than 10 ton/yr if the gas from GW-43 was burned in the flare or engines (Table 5). If the facility is major source for HAPs, National Emission Standards for Hazardous Air Pollutants (NESHAP) would apply.

Using the difference between the two samples taken at the blower, one can estimate the VOC and HAP concentrations in the gas present in the hazardous waste area (Table 1).

Hazardous Waste Pit Emission Scenarios

If the gas from the hazardous waste pit is isolated and removed from the gas collection system and not burned in the flare or engines, HAP emissions associated with fugitive release of the gas from the hazardous waste pit only would depend on the flow rate of the gas into the atmosphere. A fugitive emission release of the hazardous waste pit would require gas to be actively extracted from the pit area since this area does not contain methane generating waste and is not pressure driven (other than minor effects associated with barometric pressure fluctuation). As shown in Table 6, the fugitive emissions from the hazardous waste pit would exceed 10 ton/yr of methyl chloroform only if the fugitive landfill gas flow rate from the pit area is 16 cfm or greater. The total fugitive landfill gas flow predicted by LandGEM for the entire facility is predicted to be 69 cfm. Since there is currently no active gas extraction or any other pressure driven gas flow from the hazardous waste pit, the fugitive gas flow from the pit area is likely well below 16 cfm.

The MPCA proposes to remove the chlorinated compounds from the hazardous waste pit using an active vapor extraction with an effluent treatment system. The method of treating the gas depends on the effectiveness of control. A pilot study is being planned to test the removal efficiency of cryogenic compression and condensation (C3) technology. If the C3 treatment system reduces the HAP concentrations in the gas to acceptable levels, then that system may remain in place. If the desired control is not achieved, then another study will be performed with another treatment method. This will continue until an acceptable treatment method is determined.

Hazardous Waste Pit Remediation Pilot Test and Air Compliance Options

The remainder of this discussion describes MPCA's proposed plan for treating the gas from the hazardous waste pit and offers permitting options for the remediation activities.

To limit emissions of HAPs, MPCA proposes the following changes:

1. Disconnect permanently the hazardous waste pit (GW-43) from the gas collection system.

2. Conduct a pilot study to determine the removal system that most effectively controls emissions from the hazardous waste pit.

3. Operate the system to control emissions to acceptable limits.

Each step in the proposed plan is discussed in detail below.

Step 1 - Disconnect the hazardous waste pit from the landfill gas collection system.

MPCA will disconnect GW-43 from the landfill gas collection system. The gas in the hazardous waste pit will be contained within the waste area. Since methane generating waste is not present in the pit area, it is not anticipated that vapors in the pit will be pressure driven. A minimum of 6 feet of earthen material, including two feet of clay are present above the pit area to minimize fugitive emissions associated with barometric pressure fluctuations.

Step 2 - Conduct a pilot study to determine the removal system that effectively controls emissions from the hazardous waste pit.
A pilot study will utilize a soil vapor extraction (SVE) system to collect and recover chlorinated and non-chlorinated compounds from GW-43 and other new wells in the pit area. The proposed system for the pilot study is a 100 cfm SVE with C3 treatment technology. This technology uses pressure change and condensers to recover the organic compounds (solvents). The recovered solvents will be collected for secondary treatment or recycling.

Gas extracted during the pilot study will be treated by the C3 system before being released into the atmosphere. The duration of the test is planned for up to six months. At the conclusion of the study, MPCA will determine whether the SVE and C3 system is adequate, or if another treatment option is needed. If another treatment method must be used, then an additional study will be performed.

Step 3 – Long-term operation of the treatment system to reduce concentrations to acceptable limits
Once a collection and treatment system is selected, the MPCA will operate the system to ensure that gas extracted from the hazardous waste pit is treated before being released to the atmosphere.

Permitting Options

Since emissions of the untreated landfill gas with GW-43 operating exceed 10 tons per year of an individual HAP, air construction and operation permits may be required for all or part of the landfill. However, if GW-43 is removed from the LFG extraction system, potential fugitive emissions of federal HAPs are below major source thresholds for individual and total HAPs. Listed below are proposed permitting options for the facility:

<u>Option 1</u> – Apply for an after-the-fact construction permit and operating permit for the *entire facility* prior to conducting the pilot study.

The permit would include fugitive emissions from the entire landfill (including the hazardous waste pit and nonhazardous waste area) and combustion equipment. The permit application would propose isolating the gas from the hazardous waste pit and controlling HAP emissions from the hazardous waste pit area using a treatment system. Since the facility is considered a major source of HAPs, either the NESHAP for Site Remediation or Federal Section 112(g), a case-by-case maximum achievable control technology (MACT) evaluation, would apply. Or, alternatively, federally enforceable permit emission limits could be proposed in the permit application to keep the facility below major source status for HAPs. A construction permit would be obtained prior to starting the pilot study for the SVE system.

An operating permit would be obtained when the long-term treatment option is determined. The operating permit would include monitoring requirements to ensure control of HAP emissions to below major source thresholds or to meet the case-by-case MACT requirements.

<u>Option 2</u> – Obtain air permits <u>**after**</u> the pilot study.

When the gas in the hazardous waste pit is isolated from the gas collection system, emissions from the rest of the facility are below permitting thresholds. Therefore, an air construction and operating permit are required for the hazardous waste pit, but not the rest of the facility. Since the duration of the pilot study will be six months or less, the study may be considered a temporary source under federal rules and exempt from permitting requirements. After the pilot study determines the most effective treatment system, a construction permit application will be submitted. The permit application will include either a case-by-case MACT evaluation (if the facility does not limit emissions to below major source status for HAPs) or a federally enforceable emission limit to keep the facility minor for HAPs.

Recommendation

The MPCA is determined to reduce concentrations of chlorinated compounds in the hazardous waste area to acceptable levels. It is our opinion that the second permitting option presented above would be most applicable. With the hazardous waste pit removed from the active gas collection system, potential HAP emissions for the landfill are below major source thresholds. The pilot study is a short-term, temporary emission source with a duration of six months or less and is necessary to determine the best method to control HAP emissions. Federally-enforceable HAP emission permit limits or MACT requirements are difficult to determine until the control system is selected. Further, federally enforceable monitoring requirements ensuring that HAP emission limits are maintained cannot be determined until a specific control system is defined. Therefore, a permit is not required until after an acceptable control system is selected.

If the pilot study is exempt from permitting as a temporary source, MPCA will begin its pilot study and obtain an air permit for the treatment system that is ultimately selected. If EPA determines that a permit is required before the pilot study, then a permit application will soon be submitted.

It is the MPCA's desire to conduct the pilot study during the summer of 2009; therefore, expedient review and approval would be much appreciated. Please contact me at 920.452.6603 extension 3# if you have any questions or would like to discuss this project in more detail.

Sincerely,

SHORT ELLIOTT HENDRICKSON INC.

Raymond A. Ramos
Air Quality Professional

RAR/blk/BLK/TAH/MJB
Attachments
c: John Moeger, MPCA Project Team
Peter Tiffany, MPCA Project Team
Ingrid Verhagen, MPCA Team

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Table 1
WDE Landfill
Concentrations Measured at the Blower

Compound	Federal HAP	CAS No.	Molecular Weight (g/mol)	Sampled Concentration at Blower (ppmv) With GW-43 (2/19/09)	Sampled Concentration at Blower (ppmv) Without GW-43 (3/25/09)	Difference in Concentrations (ppmv)
1,1,1-Trichloroethane (methyl chloroform)	x	71-55-6	133.41	6,910	31	6,880
1,1,2,2-Tetrachloroethane	x	79-34-5	167.85	ND	ND	ND
1,1-Dichloroethane (ethylidene dichloride)	x	75-34-3	98.97	1,440	12	1,428
1,1-Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	13.0	ND	ND
1,2-Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	ND	-	ND
1,2-Dichloropropane (propylene dichloride)	x	78-87-5	112.99	ND	-	ND
2-Propanol (isopropyl alcohol)		67-63-0	60.11	ND	-	ND
Acetone		67-64-1	58.08	14	ND	ND
Acrylonitrile	x	107-13-1	53.06	ND	ND	ND
Bromodichloromethane		75-27-4	163.83	ND	-	ND
Carbon Disulfide	x	75-15-0	76.13	ND	-	ND
Carbon Tetrachloride	x	56-23-5	153.84	ND	-	ND
Chlorobenzene	x	108-90-7	112.56	ND	-	ND
Chloroethane (ethyl chloride)	x	75-00-3	64.52	34	30	4.2
Chloroform	x	67-66-3	119.39	ND	ND	ND
Chloromethane (methyl chloride)		74-87-3	50.49	ND	ND	ND
Dichlorobenzene		95-50-1	147	1.0	ND	ND
Dichlorodifluoromethane		75-71-8	120.91	11	ND	ND
Dichloromethane (methylene chloride)	x	75-09-2	84.94	3,430	27	3403
Ethanol		64-17-5	46.08	ND	-	ND
Ethylbenzene	x	100-41-4	106.16	63	101	-
Hexane	x	110-54-3	86.18	851	40	811
Hydrogen Sulfide		7783-06-4	34.08	-	10	-10
Methyl Ethyl Ketone (MEK)		78-93-3	72.11	46	ND	46
Methyl Isobutyl Ketone (MIBK)		108-10-1	100.16	ND	ND	ND
Perchloroethylene (Tetrachloroethylene)	x	127-18-4	165.83	61	23	38
t-1,2-dichloroethene		156-60-5	131.4	ND	ND	ND
Trichloroethylene (Trichloroethene)	x	79-01-6	131.4	1,670	-	1,670
Vinyl Chloride	x	75-01-4	62.5	30	50	0
Xylenes	x	1330-20-7	106.16	123	159	-

Table 2
WDE Landfill
Maximum Gas Generation Rate Estimation

	Landfill Gas Generation Rate				***Landfill Gas to Combustion Equipment***			***Landfill Gas Available for Fugitive Emissions***		
	cf/min	cf/yr	m3/yr	Capture Efficiency	cf/min	cf/yr	m3/yr	cf/min	cf/yr	m3/yr
Landgem (for 2009)	276.90	145,538,640	4,121,740	75%	207.68	109,153,980	3,091,305	69.23	36,384,660	1,030,435
Observed (2008)[1]	216.00	113,529,600	3,215,225	75%	162.00	85,147,200	2,411,419	54.00	28,382,400	803,806

1. Landfill gas generation rate and landfill gas available for fugitive emissions for the 'observed' data are based on measured flow to the flare (shown as landfill gas to combustion equipment) and a capture efficiency for the gas collection system of 75%.

Table 3
WDE Landfill
Fugitive Landfill Potential Emissions (without GW-43)

Annual Landfill Gas Available for Fugitive Emissions = **36,384,660** ft3/yr (Based on Landgem for 2009)

Compound	Federal HAP	CAS No.	Molecular Weight (g/mol)	Concentration (ppmv)	Concentration Based on (1) LFG Sample or (2) AP-42	Potential to Emit (ton/yr)
1,1,1-Trichloroethane (methyl chloroform)	x	71-55-6	133.41	30.50	(1)	0.1953
1,1,2,2-Tetrachloroethane	x	79-34-5	167.85	ND	(1)	ND
1,1-Dichloroethane (ethylidene dichloride)	x	75-34-3	98.97	12.40	(1)	0.0589
1,1-Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	ND	(1)	ND
1,2-Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	0.41	(2)	0.0019
1,2-Dichloropropane (propylene dichloride)	x	78-87-5	112.99	0.18	(2)	0.0010
2-Propanol (isopropyl alcohol)			60.11	50.1	(2)	0.14
Acetone			58.08	ND	(1)	ND
Acrylonitrile	x	107-13-1	53.06	ND	(1)	ND
Bromodichloromethane			163.83	3.13	(2)	0.025
Butane			58.12	5.03	(2)	0.0140
Carbon Disulfide	x	75-15-0	76.13	0.58	(2)	0.0021
Carbon Tetrachloride	x	56-23-5	153.84	0.004	(2)	0.00003
Carbonyl Sulfide	x	463-58-1	60.07	0.49	(2)	0.0014
Chlorobenzene	x	108-90-7	112.56	0.25	(2)	0.0014
Chlorodifluoromethane			86.47	1.3	(2)	0.0054
Chloroethane (ethyl chloride)	x	75-00-3	64.52	30.10	(1)	0.0932
Chloroform	x	67-66-3	119.39	ND	(1)	ND
Chloromethane (methyl chloride)		74-87-3	50.49	ND	(1)	ND
Dichlorobenzene		95-50-1	147	ND	(1)	ND
Dichlorodifluoromethane		75-71-8	120.91	ND	(1)	ND
Dichlorofluoromethane			102.92	2.62	(2)	0.0129
Dichloromethane (methylene chloride)	x	75-09-2	84.94	26.7	(1)	0.1089
Dimethyl sulfide (methyl sulfide)			62.13	7.82	(2)	0.0233
Ethane			30.07	889	(2)	1.2832
Ethanol			46.08	27.2	(2)	0.0602
Ethyl mercaptan (ethanethiol)			62.13	2.28	(2)	0.0068
Ethylbenzene	x	100-41-4	106.16	101.00	(1)	0.5147
Ethylene dibromide			187.88	0.001	(2)	0.0000
Fluorotrichloromethane		75-69-4	137.38	0.76	(2)	0.0050
Hexane	x	110-54-3	86.18	40	(1)	0.1663
Hydrogen Sulfide		7783-06-4	34.08	10	(1)	0.0164
Mercury	x	7439-97-6	200.61	2.92E-04	(2)	0.000003
Methyl Ethyl Ketone (MEK)		78-93-3	72.11	ND	(1)	ND
Methyl Isobutyl Ketone (MIBK)		108-10-1	100.16	ND	(1)	ND
Methyl mercaptan			48.11	2.49	(2)	0.0058
Pentane			72.15	3.29	(2)	0.0114
Perchloroethylene (Tetrachloroethylene)	x	127-18-4	165.83	22.90	(1)	0.1823
Propane			44.09	11.10	(2)	0.0235
t-1,2-dichloroethene			131.4	ND	(1)	ND
Trichloroethylene (Trichloroethene)	x	79-01-6	131.4	2.82	(2)	0.0178
Vinyl Chloride	x	75-01-4	62.5	50	(1)	0.151
Xylenes	x	1330-20-7	106.16	158.9	(1)	0.81

Uncontrolled

Maximum Individual HAP	0.81
Total HAPs	2.31

Table 4
WDE Landfill
Fugitive Landfill Potential Emissions (with GW-43)

Annual Landfill Gas Available for Fugitive Emissions = **36,384,660** ft3/yr (Based on Landgem for 2009)

Compound	Federal HAP	CAS No.	Molecular Weight (g/mol)	Concentration (ppmv)	Concentration Based on (1) AP-42 or (2) LFG Sample	Potential to Emit (ton/yr)
1,1,1-Trichloroethane (methyl chloroform)	x	71-55-6	133.41	6910.00	(1)	43
1,1,2,2-Tetrachloroethane	x	79-34-5	167.85	ND	(1)	-
1,1-Dichloroethane (ethylidene dichloride)	x	75-34-3	98.97	1,440	(1)	7
1,1-Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	13	(1)	0.059
1,2-Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	ND	(1)	-
1,2-Dichloropropane (propylene dichloride)	x	78-87-5	112.99	ND	(1)	-
2-Propanol (isopropyl alcohol)			60.11	ND	(1)	-
Acetone			58.08	13.5	(2)	0.04
Acrylonitrile	x	107-13-1	53.06	ND	(1)	-
Bromodichloromethane			163.83	ND	(1)	-
Butane			58.12	5.03	(1)	0.014
Carbon Disulfide	x	75-15-0	76.13	ND	(1)	-
Carbon Tetrachloride	x	56-23-5	153.84	ND	(1)	-
Carbonyl Sulfide	x	463-58-1	60.07	0.49	(2)	0.001
Chlorobenzene	x	108-90-7	112.56	ND	(1)	-
Chlorodifluoromethane			86.47	1.3	(2)	0.005
Chloroethane (ethyl chloride)	x	75-00-3	64.52	34.30	(1)	0.10
Chloroform	x	67-66-3	119.39	ND	(1)	-
Chloromethane (methyl chloride)		74-87-3	50.49	ND	(1)	-
Dichlorobenzene		95-50-1	147	0.956	(1)	0.01
Dichlorodifluoromethane		75-71-8	120.91	11.3	(1)	0.06
Dichlorofluoromethane			102.92	2.62	(2)	0.013
Dichloromethane (methylene chloride)	x	75-09-2	84.94	3,430	(1)	14
Dimethyl sulfide (methyl sulfide)			62.13	7.82	(2)	0.023
Ethane			30.07	889	(2)	1.261
Ethanol			46.08	ND	(1)	-
Ethyl mercaptan (ethanethiol)			62.13	2.28	(2)	0.007
Ethylbenzene	x	100-41-4	106.16	62.80	(1)	0.31
Ethylene dibromide			187.88	0.001	(2)	0.000009
Fluorotrichloromethane		75-69-4	137.38	0.76	(2)	0.0049
Hexane	x	110-54-3	86.18	851	(1)	3.46
Hydrogen Sulfide		7783-06-4	34.08	35.5	(2)	0.0571
Mercury	x	7439-97-6	200.61	2.92E-04	(2)	0.000003
Methyl Ethyl Ketone (MEK)		78-93-3	72.11	46.00	(1)	0.16
Methyl Isobutyl Ketone (MIBK)		108-10-1	100.16	ND	(1)	-
Methyl mercaptan			48.11	2.49	(2)	0.0057
Pentane			72.15	3.29	(2)	0.0112
Perchloroethylene (Tetrachloroethylene)	x	127-18-4	165.83	60.60	(1)	0.47
Propane			44.09	11.10	(2)	0.0231
t-1,2-dichloroethene			131.4	ND	(1)	-
Trichloroethylene (Trichloroethene)	x	79-01-6	131.4	1670	(1)	10.35
Vinyl Chloride	x	75-01-4	62.5	30	(1)	0.09
Xylenes	x	1330-20-7	106.16	123.0	(1)	0.62

Uncontrolled

Maximum Individual HAP	43.49
Total HAPs	79.42

Table 5
HCl Emissions from Combustion Equipment

WDE Landfill
Potential Emission Calculations

Hydrogen Chloride Emissions - Fugitive and Combustion Sources

From AP-42, Section 2.4, Equation 9:
$C_{Cl} = \text{sum}(C_p * Cl_p)$
Where
C_{Cl} = Concentration of total chloride, ppmv as Cl^-
C_p = Concentration of each chlorinated compound, ppmv
Cl_p = Number of moles of Cl^- produced from the combustion of each chlorinated compound

Using Concentrations Measured at Blower

Compound	Molecular Weight (g/mol)	Concentration (Cp, ppmv)	Number of Chlorine Atoms per Molecule (Clp)	Cp*Clp	Controlled Mass Emissions of HCl (ton/yr)
1,1,1-Trichloroethane (methyl chloroform)		6,910	3	20,730	105.82
1,1-Dichloroethane (ethylidene dichloride)		1,440	2	2,880	14.70
1,1-Dichloroethene (vinylidene chloride)		13	2	26	0.13
Chloroethane (ethyl chloride)		34	1	34	0.18
Dichlorobenzene		1.0	2	2	0.01
Dichlorodifluoromethane		11	2	23	0.12
Methylene Chloride		3,430	2	6,860	35.02
Perchloroethylene (Tetrachloroethylene)		61	4	242	1.24
Trichloroethylene (Trichloroethene)		1,670	3	5,010	25.58
Vinyl Chloride		30	2	60	0.31
Total Chloride	35.45			35,867.2	**183.10**

Table 6
WDE Landfill
Hazardous Waste Pit Potential Emissions

Gas Flow	16	cfm (estimated)
	8409600	ft3/yr
Gas Temperature (assumed)	68	deg F
	20	deg C
Liters per mole of gas (at 68 deg F, 20 deg C)	24.04	liters per mole

Compound	Federal HAP	CAS No.	Molecular Weight (g/mol)	Concentration (ppmv)	Mass Emission Rate (lb/hr)	Mass Emission Rate (ton/yr)
1,1,1-Trichloroethane (methyl chloroform)	x	71-55-6	133.41	6880	2.28	10.01
1,1,2,2-Tetrachloroethane	x	79-34-5	167.85	ND	0	0
1,1-Dichloroethane (ethylidene dichloride)	x	75-34-3	98.97	1428	0.35	1.54
1,1-Dichloroethene (vinylidene chloride)	x	75-35-4	96.94	ND	ND	ND
1,2-Dichloroethane (ethylene dichloride)	x	107-06-2	98.96	ND	0	0
1,2-Dichloropropane (propylene dichloride)	x	78-87-5	112.99	ND	0	0
2-Propanol (isopropyl alcohol)			60.11	ND	0	0
Acetone			58.08	ND	0	0
Acrylonitrile	x	107-13-1	53.06	ND	0	0
Bromodichloromethane			163.83	ND	0	0
Butane			58.12	5.0	0.0007	0.0032
Carbon Disulfide	x	75-15-0	76.13	ND	0	0
Carbon Tetrachloride	x	56-23-5	153.84	ND	0	0
Carbonyl Sulfide	x	463-58-1	60.07	0.49	0.0001	0.0003
Chlorobenzene	x	108-90-7	112.56	ND	0	0
Chlorodifluoromethane			86.47	1.3	0.0003	0.0012
Chloroethane (ethyl chloride)	x	75-00-3	64.52	4	0.00067	0.0030
Chloroform	x	67-66-3	119.39	ND	0	0
Chloromethane (methyl chloride)		74-87-3	50.49	ND	0	0
Dichlorobenzene		95-50-1	147	ND	0	0
Dichlorodifluoromethane		75-71-8	120.91	ND	0.00000	0.0000
Dichlorofluoromethane			102.92	2.6	0.00067	0.0029
Dichloromethane (methylene chloride)	x	75-09-2	84.94	3403	0.72	3.15
Dimethyl sulfide (methyl sulfide)			62.13	7.8	0.001	0.005
Ethane			30.07	889	0.07	0.29
Ethanol			46.08	ND	0	0
Ethyl mercaptan (ethanethiol)			62.13	2.28	0.0004	0.0015
Ethylbenzene	x	100-41-4	106.16	101.00	0.03	0.12
Ethylene dibromide			187.88	0.0010	0.000000	0.000002
Fluorotrichloromethane		75-69-4	137.38	0.76	0.0003	0.0011
Hexane	x	110-54-3	86.18	811	0.174	0.76
Hydrogen Sulfide		7783-06-4	34.08	35.5	0.003	0.01
Mercury	x	7439-97-6	200.61	2.9.E-04	0.0000001	0.0000006
Methyl Ethyl Ketone (MEK)		78-93-3	72.11	46	0.0083	0.0362
Methyl Isobutyl Ketone (MIBK)		108-10-1	100.16	ND	0	0
Methyl mercaptan			48.11	2.49	0.0003	0.001
Pentane			72.15	3.29	0.001	0.003
Perchloroethylene (Tetrachloroethylene)	x	127-18-4	165.83	38	0.0156	0.068
Propane			44.09	11.10	0.001	0.005
t-1,2-dichloroethene			131.4	ND	0	0
Trichloroethylene (Trichloroethene)	x	79-01-6	131.4	1670	0.55	2.39
Vinyl Chloride	x	75-01-4	62.5	0	0	0
Xylenes	x	1330-20-7	106.16	0	0	0

Maximum Individual HAP	10.01
Total HAPs	18.04

Appendix T
Community Relations Plan Outline

Final

Community Relations Plan - Outline

Waste Disposal Engineering Closed Landfill

Andover, Minnesota

GHD | 1801 Old Highway 8 NW Suite 114 St. Paul Minnesota 55112 USA

11129194| Report No __ | April 10, 2018

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