MINNESOTA POLLUTION CONTROL AGENCY
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Remedial Design/Remedial Action (RD/RA) Work Plan Scenario A

Project Title: Former Fertilizer Plant and Maintenance Garage Site

1. Project Summary:

The Former Agricultural Chemical Plant site (the Site) was historically occupied by an agricultural chemical plant facility from 1960 to 1991, which included dry fertilizer storage, chemical storage, fertilizer blending/mixing, fuel storage, equipment/vehicle maintenance operations, and improper disposal of wastes. Since agricultural facility operations ceased, the Site has been partially investigated by the Site owner, which identified chlorinated ethenes (most notably trichloroethylene [TCE]) and agricultural chemicals (nitrogen, dicamba, metolachlor, metribuzin, pendimethalin, and triclopyr) in soil and groundwater above Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA)-regulated cleanup goals. Results from this Site owner-initiated investigation also indicated that migration of TCE in soil vapor off-Site may have occurred, including potential exposure to a pregnant person. A subsequent MPCA investigation identified TCE in both on- and off-Site groundwater and soil vapor, including several potential source areas.

It is our understanding that there is currently no viable responsible party for the Site and therefore, the MPCA and the MDA is investigating various impacts at the Site in support of implementing appropriate response actions to address potential risks to human health and the environment. It is our understanding that the site is going to be redeveloped into a golf course. At this time, the Site has not been fully investigated, and the nature and extent of the impacts are not fully defined, however, based upon the initial site assessment performed at the Site, various remedial actions are needed to address impacted soil vapor and drinking water wells in buildings located adjacent to the Site, and to address potential exposure to soil, groundwater and soil vapor impacts at the Site. As additional information is acquired for the Site, additional remedial actions may be required. As requested by the MPCA, Braun Intertec has prepared this work plan to perform remedial actions to address known issues related to potential areas of concern (AOCs) identified as "high risk" in our separate proposal/work plan prepared for r the proposed remedial investigation of the Site.

2. Statement of Problems, Opportunities, and Existing Conditions

Braun Intertec has prepared this Work Plan in response to the February 28, 2018 Request for Proposal (RFP) for the MPCA and the MDA. As detailed it the RFP, Scenario A for Category A includes preparing a Work Plan that addresses Remedial Design/Remedial Action activities. Braun Intertec has included the number of hours needed to complete the Remedial Design/Remedial Action work and appropriate personnel classifications from the RFP in the attached Example Scenario Spreadsheet.

Based on the number of potential source areas and viable pathways, it is assumed a risk-based approach will be taken to minimize risk and prioritize remedial activities, from high risk areas to low risk areas. While every effort has been made to identify what may be perceived to be as high risk, the MPCA and MDA will ultimately decide which pathways will be considered high risk,
and therefore, funded for remediation. For the purpose of this scenario we have assumed the following:

- Remediation efforts will initially focus on addressing risks related to off-site residences with known identified impacts above the applicable action levels (i.e. TCE HRLs, TCE 33x ISVs etc.), based upon the information provided in the RFP.
- Additional occupied structures may also require remediation/mitigation once the full remedial investigation has been completed.

- The need for on-site soil, groundwater and soil vapor remediation of specific contamination source areas will be determined based on the risks identified during completion of the remedial investigation. It is not practical to provide a detailed remediation design for on-site contamination with the existing data.

- Although the maintenance garage is currently vacant, it is likely to be used after the Site is redeveloped. We have included design of a sub-slab vapor mitigation system within our scope of work, but we realize that the MPCA may prefer to have the property owner or future developer perform this work, if possible.

Site History

The Site operated as an agricultural chemical plant from 1960 to 1991. During agricultural operations, Site operations included dry fertilizer storage, chemical storage, fertilizer blending/mixing, fuel storage, equipment/vehicle maintenance operations, and improper disposal of wastes. Available information for these operational areas, as well as additional notable areas, include:

- Dry fertilizer building: The fertilizer building had four access doors: the east and west ends of the building had large overhead doors; a small overhead door was located in the middle of the building on the north side; and a small service door was located on the south side. A pesticide mixer/blender was located inside the former fertilizer building on the west end. In 1999, the former dry fertilizer building was destroyed in a fire. During the fire, foam fire suppressant was applied to the blaze as part of an act of vandalism. No sampling for potential contaminants of concern (CoC) has been conducted for the former dry fertilizer building.

- Maintenance garage: Historical documentation indicates that the maintenance garage was used extensively for degreasing operations as part of washing and maintaining equipment and vehicles. Building records note that there were three additions to the building over the years, however these records, do not denote utility locations. Previous investigation results include collection of several samples for soil gas, groundwater, and soil. Soil gas results indicate TCE at concentrations greater than MPCA Commercial/Industrial 33x Intrusion Screening Value (ISV) of 230 micrograms per cubic meter (µg/m3) in building additions 1, 2, and 3, indicating a need for response actions. Groundwater results were also identified above Minnesota Department of Health (MDH) Health Risk Limit (HRL) for TCE (0.4 micrograms per liter [µg/L]), in numerous samples, ranging up to 500 µg/L. Previous investigation data for soil also shows soil concentrations greater than the MPCA Commercial/Industrial and Short-Term Construction Worker Soil Reference Value (SRV) for TCE (46 milligrams per kilogram [mg/kg]). Soil concentrations of TCE beneath the maintenance garage have ranged up to 120 mg/kg. No sampling results were available for additional CoCs, including petroleum constituents, pesticides (List 1 and List 2), fertilizers (nitrates, ammonia, and total Kjeldahl nitrogen [TKN]), metals, polychlorinated biphenyls, or additional volatile organic compounds (VOCs).

- Parking areas: Agricultural chemical equipment storage/parking areas were located on the north and south sides of the former dry fertilizer building. Limited sampling has been conducted in the former parking areas; however, previous results from the southern parking area had TCE results in groundwater ranging from 10 µg/L to 200 µg/L, well above the MDH HRL for TCE. In addition, the extent of TCE contamination was not fully defined. No sampling results were available for additional CoCs, including petroleum constituents, pesticides (List 1 and List 2), fertilizers (nitrates and TKN), or additional VOCs.

- Water supply areas: A water fill area was located outside the former fertilizer building at the west end. In 1997, a sample collected from the well by the MDA contained concentrations of nitrate (116 milligrams per liter [mg/L]), metolachlor (424 µg/L), and dicamba (283 µg/L), all of which are greater than applicable MDH HRLs. A groundwater sample collected from the well was also reported to have TCE at a concentration of 500 µg/L, which is well above the MDH HRL for TCE.

- Truck scale: The scale is located outside the west end of the dry fertilizer building and is surrounded on all sides by gravel. No sampling for potential CoCs has been conducted for the truck scale; however, one soil vapor sample was collected, with a reported TCE concentration of 200 µg/m3.

- Fuel storage areas: Records note the presence of a 500-gallon fuel oil aboveground storage tank (AST) used to heat the garage (diesel range organics [DRO]), and a 1,000-gallon gasoline UST (gasoline range organics [GRO]) used to fill large trucks, both installed in the 1960's. No soil, groundwater, or soil vapor sampling for potential CoCs has been conducted in the fuel storage areas and surrounding area.

- Stained/dumping areas: According to an interview of a former employee, a used parts degreasing agent was regularly poured onto the ground near the stream on Site. Discolored soils were reported to the north of the fertilizer building and garage during the last facility inspection. Due diligence efforts conducted during property transfer indicated these discolored soils were still present. No sampling for potential CoCs has been conducted for the reported dumping area; however, one groundwater sample appears to have been collected on the north side of the former maintenance garage, with a reported TCE concentration in groundwater above the HRL. Additional results or sampling locations for potential CoCs has not been conducted or provided.

- Off-Site Areas: Previous investigation for off-Site areas to the north and west of the Site has been completed for soil vapor and groundwater. Based on available information, sub-slab and soil vapor probe results have identified TCE on blocks 5 and 7. A sub-slab sample in a residence occupied by a pregnant woman is above the 33x Residential ISV for TCE; therefore, in accordance with the MPCA's Interim ISV Short Guidance dated February 13, 2017, expedited mitigation is necessary. The soil vapor probe result is indicative of potential vapor intrusion risk to neighboring structures. Groundwater sampling results indicate TCE concentrations greater than the HRL for several private wells, ranging from 5 µg/L to 20 µg/L. It should be noted that off-Site samples north of the stream were non-detect for TCE in both soil vapor and groundwater; however, additional compound results were not provided.

Since ceasing operations in 1991, the Site was purchased for redevelopment into a golf course.

Site Setting
The Site is situated east of and adjacent to a residential area, and a stream is located to the north of the Site (Figure 1). The Site topography has generally been noted as being mostly flat; however, the elevation dips downward toward the stream which runs east to west into the residential areas. Based on available information, the stream may be acting as a hydraulic barrier; however, additional sampling must be completed to confirm this observation.

Based on previous investigations, the Site geology was noted to generally consist of coarse grained sands to at least 30 feet below ground surface (bgs) with thin lenses of silt and clay. Shallow groundwater on Site was encountered at depths between 6 and 10 feet bgs during previous investigations, with groundwater samples collected at 15 feet bgs from investigation borings. Groundwater samples retrieved from off-Site domestic wells were collected at 30 feet bgs. The assumed groundwater flow direction is to the west. It should be noted that older portions of the town (situated closer to the Site) are on private well drinking water (blocks 3, 5, and 7), while newer portions of the town (farther west of the Site) are on community water from the local municipality (blocks 1, 2, 4, and 6).

Current Site Conditions
Current information on the Site suggest that existing conditions pose known and potential threats to human health and the environment. Based on available information, the current conditions for the Site, including notable existing conditions which affect contaminant migration and exposure pathways for current and future use, include:

- Dry fertilizer building: As a result of a fire, only the building slab remains, which has been observed as being cracked. During the fire, fire suppressant foam was applied, followed by building material removal shortly thereafter.

- Maintenance garage: A trench drain was observed within the maintenance garage leading to a 500-gallon UST of unknown age. There are no records of the tank having ever been removed or cleaned out, and it is assumed the tank leaked. The remainder of utility locations remain unknown. The concrete floor in this building is intact, and the building remains in good condition for future use.

- Parking areas: No additional information regarding the current condition of the parking areas has been provided or observed.

- Water supply areas: The shallow water supply well is still located in the water fill area and reported to be functional.

- Truck scale: The scale remains located outside the west end of the dry fertilizer building.

- Fuel storage areas: Both the gasoline UST and diesel AST remain on-site. Stained soils were apparent beneath the AST.

- Stained/dumping areas: No additional information regarding the former dumping and stained areas has been provided or observed.

Based on the reviewed/available information, multiple source areas and potential exposure pathways exist as a result of the Site use. Each of these pathways, some of which have yet to be investigated, may have multiple receptors as a result of contaminant migration. It has been reported that the surrounding community has expressed concern about risk to their health. To minimize on-going risk and perform response actions for completed exposure pathways, data gaps must be filled in order to holistically evaluate the Site and prioritize response actions.

While there are data gaps that exist that will need to be addressed in order to design a holistic approach to remedial actions for the Site and affected adjacent areas, there are exposure risks that have been identified that require immediate response. The first priority is to address the identified exposure pathways to the residential homes located to the west of the Site.

Additional remedial activities will most likely been needed in order to fully address the impacts at the site, however additional remedial investigations are required in order to define the extent of these additional remedial activities (i.e. soils removal, groundwater containment, additional sub-slab depressurization systems).

The following is a list of the opportunities for initial remedial actions at the Site to mitigate the identified risks from various exposure scenarios for the identified high rick receptors:

- Alternate water supply for three residences with detected TCE exceedances in private drinking water wells located in Blocks 7 and 5.
- Sealing of drinking water wells once alternative water has been provided.
- Sub-slab depressurization system in the residence with impacted sub-slab soil vapor.
- Sub-slab depressurization in portions of the existing maintenance garage, which is targeted for re-use.

In addition, we have included removal of stained soil around the 500-gallon AST and preparation of a Focused Feasibility Study to evaluate approaches for addressing VOC impacted soil and groundwater associated with the maintenance garage.

3. Goals, Objectives, Tasks, and Subtasks

Objective 1: Address Elevated TCE in Drinking Water
The three residences in Blocks 5 and 7 where elevated concentrations of TCE have been detected in drinking water wells should be supplied with an alternative water source as soon as practical. Bottled water should be supplied as soon as practical as a temporary measure; the most effective long-term alternative water supply would be to connect these residences to the existing municipal system. If extending the municipal system is not viable, or would take a significant amount of time to implement, then on-site water treatment should be provided for each affected residence.

Task A: Bottled Water Scenario
If the MPCA elects to provide affected residences with bottled water until the residences can be added to the municipal water supply, the tasks completed by Braun Intertec would be minimal as we assume that MPCA staff would coordinate this activity with the City and the property owner.

Subtask 1: Well Abandonment
After the residences are connected to the municipal supply, the existing drinking water wells at these residences should be abandoned in accordance with Minnesota Department of Health (MDH) requirements. The well abandonment work would be completed by a State contract driller. As part of this task, Braun Intertec will provide well abandonment specifications and bidding documents for the well abandonment work per the MPCA subcontractor manual. The specifications will be submitted to the MPCA for approval prior to bidding.

Once a State contract driller has been selected, Braun Intertec will coordinate mobilization with the well driller and the property owners, provide field oversight during well abandonment, and document that the three wells were properly abandoned and the site was restored appropriately. We assume that three private wells will be abandoned during one field mobilization under this scope of work.

Subtask 2: Reporting
Braun Intertec will provide a letter report that includes a summary of the well abandonment and copies of the well abandonment records.

Task B: Residential Water Treatment System Design and Installation (if municipal supply connection is not immediately feasible).

Subtask 1: Residential Water Treatment System Design and Contracting.
Braun Intertec will prepare specifications for furnishing and installing residential water treatment systems per the MPCA Contracting Manual. There are several technologies available for water treatment but the most cost-effective technology is using granular activated carbon for removal of TCE. The specifications will be submitted to the MPCA for approval prior to bidding. The MPCA could contract for the system installation directly or Braun Intertec could subcontract with a water treatment system installer under our work order. For the purpose of this work plan, we assume that Braun Intertec will retain a subcontractor to install the residential treatment systems and that the total installation cost of the three residential water treatment systems will cost between $5,000 and $10,000. Based on these assumptions, our budget for this subtask assumes that Braun Intertec will request bids from a minimum of two bidders. If possible, at least one bidder will be a Targeted Group/Economically Disadvantaged/Veteran-Owned (TG/ED/VO) Small Business. Once the bids have been received, Braun Intertec will review contractor bids with the MPCA to select the responsive low cost subcontractor before proceeding with the work.

Subtask 2: Residential Water Treatment System Installation Oversight and Confirmation Sampling
This subtask includes scheduling water treatment system installation with the residents and providing oversight during system installation. Our oversight will include one site visit per residence during system installation (for total of three site visits). Once the treatment systems have been installed and are operational, Braun Intertec will collect one water sample from each residence to confirm that the system is reducing contaminant concentrations below drinking water standards.

- For purposes of this Work Plan, it is assumed that MPCA will obtain access to the private residential properties for sampling.
- Upon approval of sampling, the homeowners will be contacted by Braun Intertec to schedule a sampling time and determine the best water sampling location. Since the purpose of this sample is to verify that the selected treatment system is reducing.
- TCE concentrations to meet drinking water standards, confirmation water samples will be collected downstream of the installed.
- Water Treatment System and upstream of any other water-altering device (i.e. water softener, pressure tank, or filtration system).

Once a suitable sample location is chosen, a purge of the water line will be performed by calculating the volume of water in the line and determining the water volume within the well (3 casing volumes). If well construction specifications are unknown, water quality stabilization parameters will be monitored until stabilized or 10 minutes of continuous purge has elapsed. Low-flow sampling will then be employed to fill sampling containers. For purposes of this Work Plan it is assumed that a 10-minute purge will be used for wells with no readily available construction information. The samples will be submitted to State Contract Laboratory for analysis of VOCs.

As part of this sub-task, Braun Intertec will prepare a letter report for each residence documenting the water treatment system design, installation and post-installation confirmation sampling results. Note that additional sampling and maintenance of the water treatment systems beyond installation and the initial post-installation confirmation sampling is beyond this scope of work.

Subtask 3: Well Abandonment
After water treatment systems are provided for the residences, the existing drinking water wells at these residences should be abandoned in accordance with Minnesota Department of Health (MDH) requirements. The well abandonment work would be completed by a State contract driller. As part of this task, Braun Intertec will provide well abandonment specifications and bidding documents for the well abandonment work per the MPCA subcontractor manual. The specifications will be submitted to the MPCA for approval prior to bidding.

Once a State contract driller has been selected, Braun Intertec will coordinate mobilization with the well driller and the property owners, provide field oversight during well abandonment, and document that the three wells were properly abandoned and the site was restored appropriately. We assume that three private wells will be abandoned during one field mobilization under this scope of work.

Objective 1 Timeline
If the MPCA elects to install residential water treatment systems (Task B), preparation of specifications will take approximately 2 weeks to complete. The bidding process will take 2-3 weeks, and system installation will take 1-2 weeks to coordinate and implement pending access to the residences.

Well abandonment can occur within 1-2 weeks after installation of the treatment system/access to bottled water or after connection to the municipal supply and selection of a State-approved drilling firm. The documentation reports will be prepared within 1-2 weeks after receiving the post-installation system installation confirmation sampling results from the laboratory, and after the well abandonment.

Objective 1 Deliverables
The deliverables for Task A include specifications for residential well abandonment and providing the MPCA with well abandonment records. The deliverables for Task B include specifications for the installation of treatment systems and well abandonment, bidding documents, three residential water treatment systems, a three residential treatment system installation reports that include descriptions the systems, installation and post-installation confirmation sampling results, well abandonment specifications and well abandonment records.

Objective 2: Mitigate Vapor Intrusion Risk to Home with Elevated Concentrations of TCE Detected in Soil Vapor

Task A: Sub-slab Depressurization System (SSDS) Design and Installation

Subtask 1: SSDS Design and Installation
As part of this task, Braun Intertec will prepare specifications to be used for bidding purposes under SSD State Contract S-1050. The technical specifications prepared for installation of the SSDS will meet the design criteria required in MPCA document c-rem3-06, "Diagnostic testing, installation and confirmation sampling for active vapor mitigation systems in single-family residential buildings".

It is our understanding that quote solicitation and SSDS installation contractor selection will be made by MPCA staff. In addition, we understand the MPCA will retain and pay the installation contractor directly. As part of this task, Braun Intertec will review contractor bids with the MPCA and provide recommendations for contractor selection.

Subtask 2: Installation Documentation, Confirmation Sampling and Reporting
Braun Intertec will conduct one site visit to oversee and document system installation at the property with elevated TCE concentrations in sub-slab soil vapor. Observations by Braun Intertec staff will be documented in field notes and photographs.
The MPCA selected SSDS installation contractor will follow the technical specifications prepared by Braun Intertec. All activities will be conducted in general accordance with the guidelines specified in MPCA document c-rem3-06, "Diagnostic testing, installation and confirmation sampling for active vapor mitigation systems in single-family residential buildings". Specifically, the selected contractor will perform pre-mitigation diagnostics, SSDS installation, and post-mitigation diagnostic testing at each targeted property, and will provide a property data submittal for each property.

Approximately 15 days following SSDS installation and diagnostic testing, Braun Intertec will return to the Site and conduct post-mitigation confirmation sampling at the property. Post-mitigation confirmation sampling will include collecting concurrent sub-slab, indoor air and ambient outside samples, and conducting follow-up pressure field extension (PFE) diagnostic testing. The post-mitigation confirmation sampling will be conducted after a one week (seven calendar days) equilibration period and completed within 30 days after active system installation. This proposal assumes 2 sub-slab samples, 1 indoor air sample, and 1 outdoor air sample will be collected and analyzed for VOCs using the TO-15 Method.

Confirmation Sub-slab Vapor Sample Collection Methods
The sub-slab vapor sampling pins will be installed in the basements of each of the residential houses targeted for sampling using hand equipment. Following installation, the newly installed sub-slab vapor points will be sampled.

The sub-slab vapor samples will be collected in accordance with MPCA Guidance Document 4-01a Vapor Intrusion Assessments Performed During Site Investigations and Guidance document Best Management Practices for Vapor Investigation and Building Mitigation Decisions dated October 2017 (October 2017 VI Guidance).

The vapor samples will be collected using a brass sub-slab vapor monitoring point from Vapor Pin™. A rotary hammer drill equipped with a 5/8-inch diameter hole will be used to drill through the slab and approximately 1-inch into the underlying soil. If permanent sub-slab vapor sampling pins are feasible, the hammer drill will be utilized to drill a 1½-inch diameter hole at least 1¾-inches into the slab to allow for flush installation of the vapor pins. The Vapor Pin™ will be driven into place in the slab using the vapor pin tools and a mallet. The installed vapor pin will then be allowed to equilibrate for at least 20 minutes after installation prior to sampling. After the pin has been allowed to equilibrate for at least 20 minutes, the Teflon cap will be removed for sample collection. Prior to collecting the soil vapor sample, Braun Intertec will complete a leak test and shut in test in accordance with Appendix B of the October 2017 VI Guidance. Once the leak test (water dam), and shut in test are completed successfully.

After the shut in test is completed successfully and prior to collecting the soil vapor sample, a minimum of three air volumes (the volume of the sample pin, pilot hole in the concrete and sample tubing) will be purged with a pump or graduated syringe. After purging an in-line particulate filter were be installed to prevent particulates and moisture from entering the evacuated sampling canister. The soil vapor sample will be collected by attaching the top end of the tubing to a sampling canister (summa canister under vacuum) instrumented with a vacuum gauge and a 200 ml/min flow regulator. After an adequate volume of air had been filled, the sampling canister valve will closed and final canister pressure and time required for sampling will be recorded on the chain-of-custody form and sample sheets.

Ambient Air Sampling Sample Collection Methods
One outdoor ambient air sample will be collected concurrently with the sub-slab soil vapor samples at each of the residential houses targeted for sampling. The ambient air samples will be placed in exterior areas on either side of the Site. The ambient air samples will be collected using laboratory-supplied negative pressure 6-liter summa canisters with 24-hour flow controllers. In addition, organic vapor readings will be measured with a PID in the vicinity of the sample locations.

The ambient air samples will be submitted analyzed for VOCs using United States Environmental Protection Agency (EPA) Method TO 15.

Indoor Air Sampling Sample Collection Methods
One indoor air sample will be collected at each of the residential houses targeted for sampling, concurrently with the sub-slab soil vapor samples. The indoor air samples will be collected from the basement of the property. The indoor air samples will be collected using laboratory-supplied negative pressure 6-liter summa canisters with 24-hour flow controllers. In addition, organic vapor readings will be measured with a PID in the vicinity of the sample locations.

The indoor air samples will be submitted and analyzed for VOCs using United States Environmental Protection Agency (EPA) Method TO 15.

After the results of the post-mitigation confirmation sampling are received from the analytical laboratory, Braun Intertec will preparation a Property Summary Report (MPCA document c-rem3-07) for the property. The Property Summary Report will follow the prescribed MPCA format and include all appropriate tables, figures (including the GIS templates figures), and appendices.

Objective 2 Timeline
Preparation of technical specifications will take approximately 1-2 weeks to complete. The bidding process will take 1-2 weeks, and system installation will take 1-2 weeks to coordinate and implement pending access to the residential home. Post-installation confirmation sampling will occur within 30 days of SSDS installation, with the final report completed 1-2 weeks after receiving analytical data from the post-construction confirmation sampling

Objective 2 Deliverables
The deliverables include technical specifications for installation of the SSDS, bidding documents, and one property summary report that includes description the SSDS, installation documentation, and the post-installation confirmation sampling results.

Objective 3: Mitigate Vapor Risk to the Future Occupants of the Existing Maintenance Garage (Optional)
We assume that since the maintenance garage is in good condition, this structure will remain on site for future re-use by the golf course. This objective includes design, installation oversight, and confirmation sampling for a sub-slab vapor mitigation system within our scope of work. However, we realize that the MPCA may prefer to have the property owner or future developer perform this work, if possible.

Based upon the figure provided, the Maintenance Garage is approximately 75,000 square feet in size.

Task A: Additional Sub-Slab Vapor Sampling to Define the Area Needing Mitigation
This task will be completed as part of the RI Work Plan included with this RFP.

Task B: Pre-diagnostic testing and vapor system specifications preparation
We assume that this task will be completed as part of the RI Work Plan included with this RFP.

Task C: System Installation Bid Preparation and selection
As part of this task, Braun Intertec will prepare specifications to be used for bidding purposes under the SSD State Contract S-1050. The technical specifications prepared for installation of the SSDS will meet the design criteria required in MPCA document c-rem3-06, "Diagnostic testing, installation and confirmation sampling for active vapor mitigation systems in single-family residential buildings".

Additional sub-slab vapor sampling proposed under Objective 3 of the *Remedial Investigation Work Plan (Scenario A)* included as Attachment A of this RFP, will define which portion of the building will require partial mitigation per MPCA guidance.

It is our understanding that quote solicitation and SSDS installation contractor selection will be made by MPCA staff. In addition, we understand the MPCA will be retaining the installation contractor directly. Braun Intertec will review the quotes obtained by the MPCA and provide recommendations for contractor selection.

Task D: Installation Documentation, Confirmation Sampling and Reporting
Installation of a sub-slab depressurization system will reduce the risk of vapor intrusion to future occupants by mitigating migration of impacted soil vapor into the building. Braun Intertec will coordinate with the selected SSDS installation contractor to schedule mitigation system installation.

Braun Intertec will conduct up to four site visits to oversee and document system installation at the Site with each visit consisting of two hour site visits during installation of the sub-slab depressurization system (SSDS). Observations by Braun Intertec staff will be documented in field notes and photographs.

The MPCA selected SSDS installation contractor will follow the technical specifications prepared by Braun Intertec. All activities will be conducted in general accordance with the guidelines specified in MPCA document c-rem3-06, "Diagnostic testing, installation and confirmation sampling for active vapor mitigation systems in single-family residential buildings". Specifically, the selected contractor will perform pre-mitigation diagnostics, SSDS installation, and post-mitigation diagnostic testing at each targeted property, and will provide a property data submittal for each property.

Following SSDS installation and diagnostic testing, Braun Intertec will conduct post-mitigation confirmation sampling at the property. Post-mitigation confirmation sampling will include collecting concurrent sub-slab, indoor air and ambient outside samples, and conducting follow-up pressure field extension (PFE) diagnostic testing. The post-mitigation confirmation sampling will be conducted after a one week (seven calendar days) equilibration period and completed within 30 days after active system installation.

It is assumed for this proposal that the post-mitigation confirmation sampling will be conducted in the first winter season after SSDS start-up. This proposal assumes three sub-slab samples, three indoor air samples, and one outdoor air sample analyzed for VOCs by Method TO-15.

Braun Intertec will prepare a field sketch map, a summary table of the sampling results, and a brief summary about the PFE measurements testing.

After the results of the post-mitigation confirmation sampling are received from the analytical laboratory, Braun Intertec will preparation a Property Summary Report (MPCA document c-rem3-07) for the property. The Property Summary Report will follow the prescribed MPCA format and include all appropriate tables, figures (including the GIS templates figures), and appendices.

Objective 3 Timeline
Preparation of bids and specifications will take approximately 1 week to complete. The bidding process will take 1-2 weeks, and then system installation will take 2-3 weeks pending access to maintenance building. The post confirmation sampling will occur within 30 days of system installation, with the final report completed 1-2 weeks after receiving the analytical data from the post confirmation sampling. The second round of seasonal sampling require 1-2 days of field work, and then 1-2 weeks to complete the final report once the data is received from the laboratory.

Objective 3 Deliverables
The deliverables include specifications for the installation of sub-slab depressurization system, bidding documents, sub-slab vapor system(s) installation, one property summary report that includes description of the system(s), installation and the post confirmation sampling results.

Objective 4: Focused Feasibility Study and Bench Scale Studies - Maintenance Garage.

Task A: Focused Feasibility Study
Objectives 1 through 3 address the known impacts at high risk AOCs, however, additional response actions may be required to address impacted environmental media associated with other AOCs. For example, existing soil and groundwater collected near the maintenance garage and the existence of impacted groundwater down-gradient from the Site are indications that there are soil source areas present that pose a continued risk to drinking water receptors as well as surface water and sediments associated with the stream that flows through the Site.

Although not proposed in the scope of the initial RI Work Plan, it is recognized that additional depth-stratified sampling for TCE in soil and groundwater below the Maintenance Garage will likely be needed as part of subsequent phases of the remedial investigation to confirm the lateral and vertical extent of impacts and total mass of TCE present. This work is not proposed at this time due to a lack of existing data related to the nature and extent of potential impacts related to PFCs and agricultural chemicals. Waiting until completion of the work proposed in the RI Work Plan will allow us to efficiently incorporate all potential COCs into the additional remedial investigation work that is needed in this area.

Following completion of additional remedial investigation activities below the Maintenance Garage, a focused feasibility study (FFS) will be performed to develop a cost-effective approach for addressing impacted soil and groundwater associated with the former Maintenance Garage. The FFS will identify, evaluate, and recommend selection of appropriate and cost effective remedial actions. The FFS will evaluate remedial approaches on the basis of effectiveness, implementability, and cost.

Based on existing available data and identified impacts, remedial actions that will be evaluated in the FFS include the following:

- Excavation and off-site disposal of shallow source soils.
- In-situ bioremediation.
- In-situ chemical oxidation.
- In-well air stripping.
- Zero valence iron (micro-particle injection).
- Groundwater extraction and treatment to provide hydraulic containment and to reduce the size of the groundwater plume.
- Construction of clean soil buffers to protect future users of the golf course.
- Administrative controls such as an environmental covenant for the Site and MDH well Advisory for the vicinity of the Site.

Bench scale studies may be appropriate for understanding the effectiveness, implementability, and cost of one or more potential remedial actions as discussed below.

Task B: Bench Scale Study (not included in scope)
Additional field studies and bench scale studies may be performed to determine cost effective methods for reducing contamination at the Site. Full evaluation of in-situ bioremediation, chemical oxidation, and micro-particle zero valance iron injections may require additional field studies and bench test studies to determine if the technologies will be capable of degrading the CoCs below the Maintenance Garage to acceptable levels. Goals of a bench-scale study are described below for each of these three technologies.

- Anaerobic dechlorination occurs by sequential removal of chloride ions. For example, the chlorinated ethenes are transformed sequentially from PCE to TCE to the dichloroethene (DCE) isomers (cis-DCE or *trans-DCE)* to vinyl chloride (VC) to ethene. In this reaction, hydrogen serves as an electron donor and the chlorinated ethene molecule is the electron acceptor. Anaerobic reductive dechlorination of chlorinated hydrocarbons is

dependent on many environmental factors (e.g., anaerobic conditions, presence of fermentable substrates, and appropriate microbial populations). In-situ anaerobic dechlorination requires that specific subsurface geochemistry conditions and microbial conditions exists. Field studies will need to determine if the appropriate strains of bacteria are present, evaluate the substrate geochemistry including laboratory and field analysis of volatile organic compounds, sulfate, ferrous iron, methane/ethane/ethene, manganese, nitrate, specific conductance, total organic carbon (TOC), oxidation reduction potential (ORP), temperature, pH, and dissolved oxygen (DO). Reductive dechlorination degradation can be enhanced by introducing various fermentable compounds. The hydrogen needed to initiate the reaction is generated by fermentation of non-chlorinated organic substrates including naturally occurring organic carbon, accidental releases of anthropogenic carbon (fuel), or introduced substrates such as carbohydrates (sugars), alcohols, and low-molecular-weight fatty acids. Potential compounds include cheese whey, emulsified vegetable oil, molasses or others. A bench scale study for reductive dechlorination could provide information regarding the type of substrate that is most effective at enhancing biodegradation of CoCs, nutrient requirements (e.g., including carbon source, nitrogen, and phosphorous), determine if bioaugmentation is required, estimates of biodegradation rates and the types of daughter products generated by differing bioremediation approaches, and establish design parameters for full-scale bioremediation remedy.

- In situ chemical oxidation includes injecting chemical oxidants into the subsurface to reduce concentrations of COCs by destroying the chemicals in place via chemical oxidation reactions. Common oxidants that are utilized for this technology include Fenton's reagent, sodium permanganate, sodium persulfate, and ozone. Bench-scale treatability studies are useful for this technology to determine the most effective treatment chemistry for destruction of COCs and to estimate the dose of chemical required to achieve success.

- Zero valance iron additional studies are completed to determine whether the zero valance iron is capable of degrading the COCs, and whether a catalyst or other additives are required to increase effectiveness. Additional laboratory and field analysis should include chemical oxidation demand (COD), biological oxygen demand (BOD), soil oxidant demand (SOD), metals, major anions and cations, and total inorganic carbon (TIC).

The need for bench scale studies and scope of bench-scale studies cannot be defined based on existing information, so **Bench Scale Studies are not included in the scope of this Work Plan.** If performed in the future, results of bench scale studies will be combined with the results of the RI and used to refine the evaluation in the FFS.

Objective 4 Timeline
4-6 weeks will be needed to perform the evaluation and prepare a FFS report.

Objective 4 Deliverables
The deliverable includes a FFS report with recommendations for additional remedial actions to be completed at the Site.

Objective 5: Source Soil Removal
Potential source soils have been observed around the 500-gallon fuel oil AST (petroleum) and north of the fertilizer building and garage (unknown source). Potential source soil removal from these areas is described below.

Task A: Petroleum Stained Soils around the 500-Gallon Fuel oil AST
Petroleum saturated soils observed around the fuel oil tank (up to 200 cubic yards) will be removed in accordance with MPCA guidance document *Excavation of Petroleum-Contaminated Soil and Tank Removal Sampling c-prp3-01* dated March 2017 (March 2017 Petroleum Excavation Guidance).

Subtask 1: Plans and Specifications/Bidding Documents
Braun Intertec will prepare specifications for excavation and stockpiling of the petroleum impacted soils per the MPCA Contracting Manual. The specifications will be submitted to the MPCA for approval prior to bidding. We assume that Braun Intertec will retain a subcontractor to perform the excavation work and that the total installation cost of the work will cost between $5,000 and $10,000. Based on these assumptions, our budget for this subtask assumes that Braun Intertec will request bids from a minimum of two bidders. If possible, at least one bidder will be a Targeted Group/Economically Disadvantaged/Veteran-Owned (TG/ED/VO) Small Business. Once the bids have been received, Braun Intertec will review contractor bids with the MPCA to select the responsive low cost subcontractor before proceeding with the work.

Braun Intertec will prepare specifications and bidding documents for the soil boring in the petroleum stained soil area per the MPCA subcontractor manual. The specifications will be submitted to the MPCA and MDA for approval prior to bidding, as appropriate.

Subtask 2: Petroleum Impacted Soil Excavation and Stockpiling for Characterization
Braun Intertec will oversee the excavation of the petroleum impacted soils around the exiting fuel oil AST. Petroleum contaminated soils around the AST that meet the following criteria will be excavated:

- Soil headspace readings greater than 10 parts per million (ppm).
- Visual evidence of staining.
- Positive sheen test results.

If all of the soils that exceed the field screening criteria cannot be removed within 200 cubic yards, then a limited site investigation (LSI) will be performed in the vicinity of the AST under a separate scope of work.

If all impacted soils are removed by excavating no more than 200 cubic yards, sidewall and bottom excavation confirmation samples will be collected in accordance with the March 2017 Petroleum Excavation Guidance.

The excavated impacted soils will be stockpiled onsite and stockpile soil samples will be collected in accordance with the March 2017 Petroleum Excavation Guidance. The stockpiled petroleum-impacted soils may be land treated, composted, thermally treated, or disposed at a sanitary landfill in accordance with MPCA guidance. As the size of the stockpile is not know at this time, costs for sampling the stockpile for characterization are not included under this scope of work, however the number of stockpile samples for characterization will be in accordance with MPCA guidance as follows:

Cubic Yards of Soil in Stockpile	Number of Grab Samples
Less than 50	1
51-500	2
501-1,000	3
1,001-2,000	4
2,001-4,000	5
each additional 2,000	one additional sample

Soil samples will be submitted for the analysis as outlined in the MPCA Guidance documents *Soil Sample Collection and Analysis procedures c-prp4-04* dated March 2017, following the applicable analysis as listed for the gasoline UST, the fuel oil AST and for the "used oil" tank beneath the maintenance garage.

Subtask 3: Post-Excavation Boring
Since the site is primarily sandy, with a groundwater table less than 25 feet bgs, a post-excavation soil boring will be performed and soil and groundwater samples will be collected to evaluate if an LSI is necessary. Braun Intertec will contract a State Contract drilling firm to advance one boring to determine if a LSI is necessary. Soil and groundwater samples from the post-excavation soil boring will be collected in accordance with MPCA Guidance documents *Soil Sample Collection and Analysis procedures c-prp4-04* dated March 2017 and *Groundwater Sample Collection and Analysis Procedures | c-prp4-05* dated March 2017. Based on the results of the post-excavation soil boring sample analysis and the post excavation soil boring, the need for an LSI will be evaluated. An LSI is not included in this scope of work.

Task B: Discolored Soils to the North of the Fertilizer Building and Garage (not included in scope)
There are discolored soils located north of the former fertilizer building and the existing maintenance garage building. The exact cause of the discoloration is not known, however agricultural chemicals and PFC were used on-site and a former employee stated that used parts degreaser was regularly poured onto the ground near the stream (which is located north of the former fertilizer building and the existing maintenance garage). Additional investigation of this area will occur during the proposed RI, once the extent and magnitude of the impacts to the discolored soil are defined then an appropriate soil excavation and treatment can be implemented to address these soils in accordance with applicable MDA and MPCA guidance. **Removal of the discolored soils is not included in the scope of this Work Plan.**

Objective 5 Timeline
Bid specifications will be prepared in 2-3 week and the stained soils around the AST will be excavated for removal approximately 2-3 weeks following bid specification preparation pending excavator availability. The post-excavation boring will be completed within 1-2 days after completing the excavation. The confirmation sample and boring sampling results will require 1-2 weeks to receive from the analytical laboratory, and a final report can be created within 1-2 weeks of receiving the laboratory data.

Objective 5 Deliverables
The deliverables include bid specifications and is a report documenting the soil excavation (including the general excavation form), post-excavation soil boring advancement and sampling, stockpile soil sampling results.

Objective 6: Tank Removal/Abandonment
There are three unused petroleum storage tanks at the Site and we assume that these tanks will not be used by the potential future golf course. The unused tanks include a 500 gallon Fuel Oil AST, a 1,000 gallon gasoline UST, and a 500 gallon UST connected to the floor drain in the maintenance garage (suspected of having leaked). For the purposes of this Work Plan, Braun Intertec assumes that the 1,000 gallon gasoline tank and the AST will be removed and disposed off-site, and the 500 gallon UST beneath the maintenance garage floor will be abandoned in place.

Task A: Prepare Bid Specifications
Braun Intertec will prepare bid specifications for tank removal and disposal or abandonment in place (as appropriate) per the MPCA Contracting Manual. The specifications will be submitted to the MPCA for approval prior to bidding. For the purpose of this work plan, we assume that Braun Intertec will retain a subcontractor to remove the tanks and that the total construction costs for abandonment of all three tanks will cost between $10,001 and $50,000. Based on these assumptions, this budget for this subtask assumes that Braun Intertec will compete and submit the forms required per the purchasing manual, that the work will be advertised on the Department of Administration website, and that the solicitation will be sent to a minimum of three vendors. A minimum of one bidder will be a Targeted Group/Economically Disadvantaged/Veteran-Owned (TG/ED/VO) Small Business. We assume that no site walk will be required as part of the bidding process. Once the bids and required documents per the purchase manual have been received, Braun Intertec will review contractor bids with the MPCA to select the winning subcontractor before proceeding with the work.

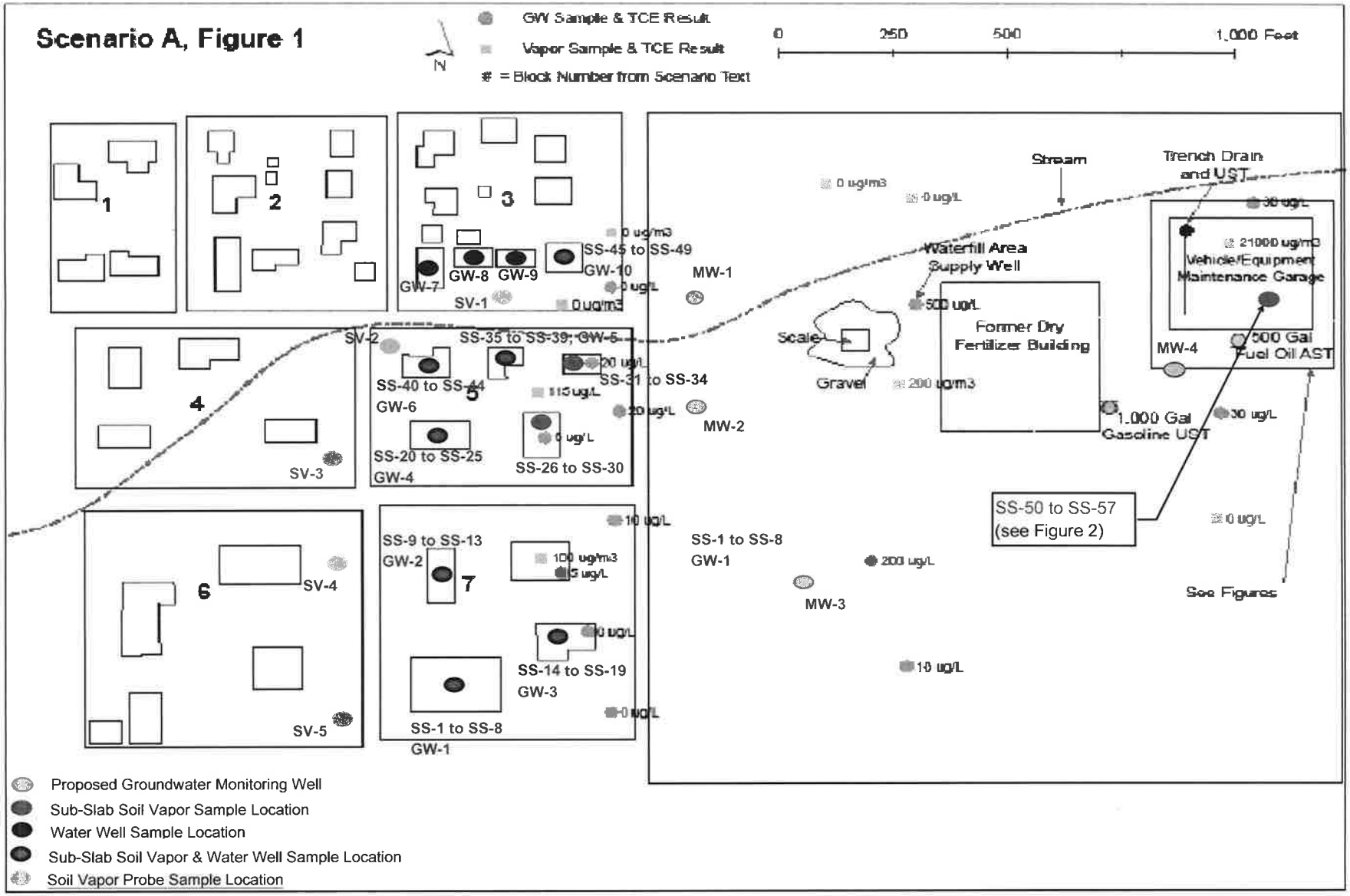
Task B: Tank Removal/Abandonment and Post-Excavation Sampling
Two tank removals and a tank abandonment will be performed by a MPCA certified contractor with oversight performed by Braun Intertec. After the tanks are removed, Braun Intertec will observe the tank basins for field indications of a release, if there are no field indications of a leak, and the tank appear to be in good condition, then Braun Intertec will collect soil samples from beneath the removed tank in accordance with MPCA guidance document *Site Assessment for Underground Storage Tanks with No Apparent Contamination* t-u2-11 Dated April 2012. For the 1,000 gallon gasoline UST, the two samples collect from beneath the tank. For the AST, one sample will be collected from 2 feet below the center of the removed AST. For the UST beneath the maintenance floor that is suspected of leaking, the contractor will cut two holes in the tank (after it is emptied and cleaned), and two soil samples will be collected from beneath each end of the UST.

For all tank locations, if there are system components present, samples will be collected from all transfer areas, beneath any leaking pipes or in areas of visible contamination. Samples will be collected from 2 feet below the loading rack, 2 feet below the leaking pipe sampling location, and/or in the most heavily stained area. If field indications are present that a leak from the tank has occurred, then the MPCA project manager will be called, and we assume that an LSI will be required. An LSI would be outside the scope of this Work Plan.

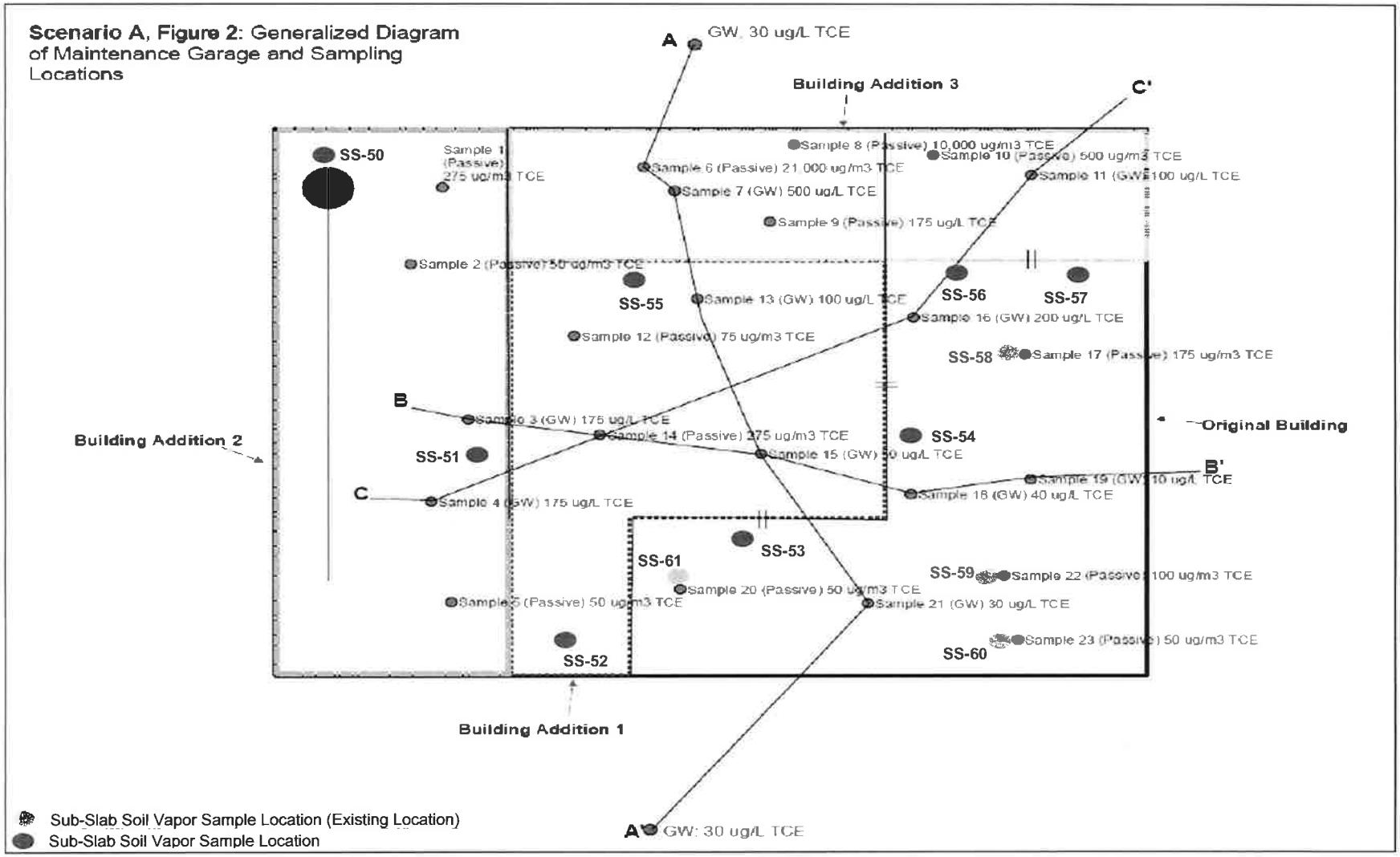
Soil samples will be submitted for the analysis as outlined in the MPCA Guidance documents *Soil Sample Collection and Analysis procedures c-prp4-04* dated March 2017, following the applicable analysis as listed for the gasoline UST, the fuel oil AST and for the "used oil" tank beneath the maintenance garage.

Objective 6 Timeline
The plans and specifications/Bidding documents can be prepared within 1-2 weeks for submittal to the MPCA Core Response Team to review. Work can begin within 2-3 weeks of the contractor being selected. Tank removal/abandonment is estimated to take 2-3 days to complete. Soil sample analysis will require 2 weeks. Tank abandonment reports will be completed 1-2 weeks after receiving laboratory data.

Objective 6 Deliverables
The deliverables include a report documenting tank removal/abandonment.


Scenario A, Figure 1
GW Sample & TCE Result
Vapor Sample & TCE Result
= Block Number from Scenario Text
N
0
250
500
1,000 Feet
1
2
3
4
5
6
7
SV-1
SV-2
SV-3
SV-4
SV-5
GW-7
GW-8
GW-9
GW-10
SS-45 to SS-49
SS-35 to SS-39; GW-5
SS-31 to SS-34
SS-40 to SS-44
GW-6
SS-20 to SS-25
GW-4
SS-26 to SS-30
SS-9 to SS-13
GW-2
SS-14 to SS-19
GW-3
SS-1 to SS-8
GW-1
MW-1
MW-2
MW-3
MW-4
Stream
Trench Drain and UST
Waterfill Area Supply Well
Scale
Gravel
Former Dry Fertilizer Building
1,000 Gal Gasoline UST
Vehicle/Equipment Maintenance Garage
500 Gal Fuel Oil AST
SS-50 to SS-57 (see Figure 2)
See Figures
Proposed Groundwater Monitoring Well
Sub-Slab Soil Vapor Sample Location
Water Well Sample Location
Sub-Slab Soil Vapor & Water Well Sample Location
Soil Vapor Probe Sample Location

Scenario A, Figure 2: Generalized Diagram of Maintenance Garage and Sampling Locations



MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Remedial Design/Remedial Action Scenario Spreadsheet

Project title: Former Agricultural Chemical Plant

	1. Personnel						2. Subcontracting		3. Equipment						Totals (Extended) (Personnel Hours Only)
Project Budget	Project Manager	Field Technician	GIS/CADD Specalist	QA/QC Officer	Scientist 1 or Engineer 1	Scientist 2 or Engineer 2	Laboratory	Drilling/ Other Contractor	Mileage	Sub-Slab Sampling Kit	PID (10.6 eV)	Micro Manometer	Water quality meter	GPS (sub-meter)	
Objective 1: Address Elevated TCE in Drinking Water															
Task A: Bottled Water Scenario															
Subtask 1: Well Abandonment (three wells)	4	10						Abandon 3 wells	60						14
Subtask 2: Reporting	4		1		4										9
Task B: Residential Water Treatment System Design and Installation (if municipal supply connection is not immediately feasible)															
Subtask 1: Residential Water Treatment System Design and Contracting	4				2	4		System Install							10
Subtask 2: Residential Water Treatment System Installation Oversight and Confirmation Sampling	4	16		3	8		3 water samples for VOCs		180				1		31
Subtask 3: Well Abandonment	4	10													14
Total for Objective 1 Hrs/Qty	**20**	**36**	**1**	**3**	**14**	**4**			**240**	**0**	**0**	**0**	**1**	**0**	**78**
Objective 2: Mitigate Vapor Intrusion Risk to Home with Elevated Concentrations of TCE Detected in Soil Vapor															
Task A: Sub-slab Depressurization System (SSDS) Design and Installation															
Subtask 1: SSDS Design and Installation.	3		2		4										9
Subtask 2: Installation Documentation, Confirmation Sampling and Reporting	4	8	1		8		TO-15, assumes 2 sub-slab, one indoor air, and one outdoor air	System Install	60	1	1	1			21
Total for Objective 2 Hrs/Qty	**7**	**8**	**3**	**0**	**12**	**0**			**60**	**1**	**1**	**1**	**0**	**0**	**30**
Objective 3: Mitigate Vapor Risk to the Future Occupants of the Existing Maintenance Equipment Garage															
Task A: Additional Sub-Slab Vapor Sampling to Define the Area Needing Mitigation **(Included in RI Costs)**															
Task B: Pre-diagnostic testing and vapor system specifications preparation **(Included in RI Costs)**															
Task C: System Installation Bid Preparation and Selection	4		3		8										15
Task D: Installation Documentation, Confirmation Sampling and Reporting	5	20	3		16		Assumes 3 sets of paired sub-slab, indoor air and ambient air.	System Install	60		1				44
Total for Objective 3 Hrs/Qty	**9**	**28**	**6**	**0**	**24**	**0**			**60**	**0**	**1**	**0**	**0**	**0**	**59**
Objective 4: Focused Feasibility Study and Bench Scale Studies - Maintenance Garage															
Task A: Focused Feasibility Study	20		6		20	50									96
Task B: Bench Scale Study **(Future task, costs not included)**															
Total for Objective 4 Hrs/Qty	**20**	**0**	**6**	**0**	**20**	**50**			**0**	**0**	**0**	**0**	**0**	**0**	**96**
Objective 5: Source Soil Removal															
Task A: Petroleum Stained Soils around the 500-Gallon Fuel Oil AST															
Subtask 1: Plans and Specifications/Bidding Documents	3				8										11
Subtask 2: Petroleum Impacted Soil Excavation and Stockpiling for Characterization	3	12							60		1			1	15
Subtask 3: Post Excavation Boring (includes reporting for Objective 5)	2	8	2		12				60		1			1	24
Task B: Discolored Soils to the North of the Fertilizer Building and Garage **(Future task, costs not included)**															
Total for Objective 5 Hrs/Qty	**8**	**20**	**2**	**0**	**20**	**0**			**120**	**0**	**2**	**0**	**0**	**2**	**50**
Objective 6: Tank Removal/Abandonment															
Task A: Prepare Rid Specifications	3		1		6										10
Task B: Tank Removal/Abandonment and Post-Excavation Sampling	3	12							60		1			1	15
Total for Objective 6 Hrs/Qty	**6**	**12**	**1**	**0**	**6**	**0**			**60**	**0**	**1**	**0**	**0**	**1**	**25**
Total Project Hours/Quantities	**70**	**96**	**19**	**3**	**96**	**54**			**540**	**1**	**5**	**1**	**1**	**3**	**338**

Assumptions:
Site is assumed to be in rural Minnesota 30 miles one way from our closest office.

MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155-4194

Remedial Investigation Work Plan (Scenario A)

Project Title: Former Agricultural Chemical Plant

1. Project Summary

The Former Agricultural Chemical Plant site (the Site) was historically occupied by an agricultural chemical plant facility from 1960 to 1991, which included dry fertilizer storage, chemical storage, fertilizer blending/mixing, fuel storage, equipment/vehicle maintenance operations, and improper disposal of wastes. Since agricultural facility operations ceased, the Site has been partially investigated by the Site owner, which identified chlorinated ethenes (most notably trichloroethylene [TCE]) and agricultural chemicals (nitrogen, dicamba, metolachlor, metribuzin, pendimethalin, and triclopyr) in soil and groundwater above Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Agriculture (MDA)-regulated cleanup goals. Results from the Site owner-initiated investigation also indicate that migration of TCE in soil vapor off-Site may have occurred, including potential exposure to a pregnant person. A subsequent MPCA investigation identified TCE in both on- and off-Site groundwater and soil vapor, including several potential source areas. Based on these investigation findings and lack of cooperation by the current Site owner, this Remedial Investigation (RI) Work Plan has been prepared to further investigate known and potential risks to human health and the environment as a result of historical Site use and releases, which in turn will be used for Remedial Design/Remedial Action (RD/RA) planning.

2. Statement of Problems, Opportunities, and Existing Conditions

Braun Intertec has prepared this RI Work Plan in response to the Request for Proposal (RFP) from the MPCA and MDA. As detailed in the RFP, Scenario A for Category A includes preparing a Work Plan for a Remedial Investigation to address known and potential contamination identified at the Site. As part of the RI Work Plan, contaminant pathways will be investigated to identify and evaluate those representing a high risk and support preparation of a RD/RA work plan to address complete high-risk exposure pathways. We have also included work to characterize and delineate suspected on-site source areas and to begin characterization of groundwater flow characteristics at the Site.

For the purposes of this RI Work Plan, Braun Intertec has made the following assumptions:

- Tasks that would typically be completed prior to preparing a RI Work Plan would include:
- Review of all available data to appropriately scope RI Work Plan activities. As this data has not been provided, based on available information a data gap analysis has been proposed to be completed along with receptor surveys.
- A Site walk with Braun Intertec, the MDA/MPCA, and person's familiar with the Site history and facility operations, to review the site use history to identify sampling areas including potential source areas and potential receptors.
- Based on the number of potential source areas and viable pathways, it is assumed a risk-based approach will be taken to minimize risk and prioritize investigation activities, from high risk areas to low risk areas. While every effort has been made to identify what may be perceived to be as high risk, the MPCA and MDA will ultimately decide which pathways will be considered high risk, and therefore, funded for investigation.
- Although the maintenance garage is currently vacant, it is likely to be used after the Site is redeveloped. We have included characterization of sub-slab soil vapor within our scope of work, but we realize that the MPCA may prefer to have the property owner or future developer perform this work, if possible.

- Although not proposed in the scope of this work plan, it is recognized that additional depth-stratified sampling for TCE in soil and groundwater below the Maintenance Garage will likely be needed to delineate the lateral and vertical extent of impacts and total mass of TCE present. This work is not proposed at this time due to a lack of existing data related to the nature and extent of potential impacts related to PFCs and agricultural chemicals. Waiting until completion of the work proposed in this Work Plan will allow us to efficiently incorporate all potential COCs into the additional remedial investigation work that is needed near the Maintenance Garage.

Site History

The Site operated as an agricultural chemical plant from 1960 to 1991. During agricultural operations, Site operations included dry fertilizer storage, chemical storage, fertilizer blending/mixing, fuel storage, equipment/vehicle maintenance operations, and improper disposal of wastes. Available information for these operational areas, as well as additional notable areas, include:

- Dry fertilizer building: The fertilizer building had four access doors: the east and west ends of the building had large overhead doors; a small overhead door was located in the middle of the building on the north side; and a small service door was located on the south side. A pesticide mixer/blender was located inside the former fertilizer building on the west end. In 1999, the former dry fertilizer building was destroyed in a fire. During the fire, foam fire suppressant was applied to the blaze as part of an act of vandalism. No sampling for potential contaminants of concern (CoC) has been conducted for the former dry fertilizer building.

- Maintenance garage: Historical documentation indicates that the maintenance garage was used extensively for degreasing operations as part of washing and maintaining equipment and vehicles. Building records note that there were three additions to the building over the years, however these records, do not denote utility locations. Previous investigation results include collection of several samples for soil gas, groundwater, and soil. Soil gas results indicate TCE at concentrations greater than MPCA Commercial/Industrial 33x Intrusion Screening Value (ISV) of 230 micrograms per cubic meter (µg/m3) in building additions 1, 2, and 3, indicating a need for response actions. Groundwater results were also identified above Minnesota Department of Health (MDH) Health Risk Limit (HRL) for TCE (0.4 micrograms per liter [µg/L]), in numerous samples, ranging up to 500 µg/L. Previous investigation data for soil also shows soil concentrations greater than the MPCA Commercial/Industrial and Short-Term Construction Worker Soil Reference Value (SRV) for TCE (46 milligrams per kilogram [mg/kg]). Soil concentrations of TCE beneath the maintenance garage have ranged up to 120 mg/kg. No sampling results were available for additional COCs, including petroleum constituents, pesticides (List 1 and List 2), fertilizers (nitrates, ammonia, and total Kjeldahl nitrogen [TKN]), metals, polychlorinated biphenyls, or additional volatile organic compounds (VOCs).

- Parking areas: Agricultural chemical equipment storage/parking areas were located on the north and south sides of the former dry fertilizer building. Limited sampling has been conducted in the former parking areas; however, previous results from the southern parking area had TCE results in groundwater ranging from 10 µg/L to 200 µg/L, well above the MDH HRL for TCE. In addition, the extent of TCE contamination was not fully defined. No sampling results were available for additional COCs, including petroleum constituents, pesticides (List 1 and List 2), fertilizers (nitrates and TKN), or additional VOCs.

- Water supply areas: A water fill area was located outside the former fertilizer building at the west end. In 1997, a sample collected from the well by the MDA contained concentrations of nitrate (116 milligrams per liter [mg/L]), metolachlor (424 µg/L), and dicamba (283 µg/L), all of which are greater than applicable MDH HRLs. A groundwater sample collected from the well was also reported to have TCE at a concentration of 500 µg/L, which is well above the MDH HRL for TCE.

- Truck scale: The scale is located outside the west end of the dry fertilizer building and is surrounded on all sides by gravel. No sampling for potential COCs has been conducted for the truck scale; however, one soil vapor sample was collected, with a reported TCE concentration of 200 µg/m3.

- Fuel storage areas: Records note the presence of a 500-gallon fuel oil aboveground storage tank (AST) used to heat the garage (diesel range organics [DRO]), and a 1,000-gallon gasoline UST (gasoline range organics [GRO]) used to fill large trucks, both installed in the 1960's. No soil, groundwater, or soil vapor sampling for potential COCs has been conducted for the fuel storage area and surrounding area.

- Stained/dumping areas: According to an interview of a former employee, a used parts degreasing agent was regularly poured onto the ground near the stream on Site. Discolored soils were reported to the north of the fertilizer building and garage during the last facility inspection. Due diligence efforts conducted during property transfer indicated these discolored soils were still present. No sampling for potential COCs has been conducted for the reported dumping area; however, one groundwater sample appears to have been collected on the north side of the former maintenance garage, with a reported TCE concentration in groundwater above the HRL. Additional results or sampling locations for potential COCs has not been conducted or provided.

- Off-Site Areas: Previous investigation for off-Site areas to the north and west of the Site has been completed for soil vapor and groundwater. Based on available information, sub-slab and soil vapor probe results have identified TCE on blocks 5 and 7. A sub-slab sample in a residence occupied by a pregnant woman is above the 33x Residential ISV for TCE; therefore, in accordance with the MPCA's Interim ISV Short Guidance dated February 13, 2017, expedited mitigation is necessary The soil vapor probe result is also indicative of potential vapor intrusion risk to neighboring structures. Groundwater sampling results indicate TCE concentrations greater than the HRL for several private wells, ranging from 5 µg/L to 20 µg/L, including the home where a pregnant woman is known to reside. It should be noted that off-Site samples north of the stream were non-detect for TCE in both soil vapor and groundwater; however, additional compound results were not provided.

Since ceasing operations in 1991, the Site was purchased for redevelopment into a golf course.

Site Setting
The Site is situated east of and adjacent to a residential area, and a stream is located to the north of the Site (Figure 1). The Site topography has generally been noted as being mostly flat; however, the elevation dips downward toward the stream which runs east to west into the residential areas. Based on available information, the stream may be acting as a hydraulic barrier; however, additional sampling must be completed to confirm this observation.

Based on previous investigations, the Site geology was noted to generally consist of coarse grained sands to at least 30 feet below ground surface (bgs) with thin lenses of silt and clay. Shallow groundwater on Site was encountered at depths between 6 and 10 feet bgs during previous investigations, with groundwater samples collected at 15 feet bgs from investigation borings. Groundwater samples retrieved from off-Site domestic wells were collected at 30 feet bgs. The assumed groundwater flow direction is to the west. It should be noted that older portions of the town (situated closer to the Site) are on private well drinking water (blocks 3, 5, and 7), while newer portions of the town (farther west of the Site) are on community water from the local municipality (blocks 1, 2, 4, and 6).

Current Site Conditions
Current information on the Site suggest that existing conditions pose known and potential threats to human health and the environment. Based on available information, the current conditions for the Site, including notable existing conditions which affect contaminant migration and exposure pathways for current and future use, include:

- Dry fertilizer building: As a result of a fire, only the building slab remains, which has been observed as being cracked. During the fire, fire suppressant foam was applied, followed by building material removal shortly thereafter.

- Maintenance garage: A trench drain was observed within the maintenance garage leading to a 500-gallon UST of unknown age. There are no records of the tank having ever been removed or cleaned out, and it is assumed the tank leaked. The remainder of utility locations remain unknown. The concrete floor in this building is intact, and the building remains in good condition for future use.

- Parking areas: No additional information regarding the current condition of the parking areas has been provided or observed.

- Water supply areas: The shallow water supply well is still located in the water fill area and reported to be functional.

- Truck scale: The scale remains located outside the west end of the dry fertilizer building.

- Fuel storage areas: Both the gasoline UST and diesel AST remain on-site. Stained soils were apparent beneath the AST.

- Stained/dumping areas: No additional information regarding the former dumping and stained areas has been provided or observed.

Based on the reviewed/available information, multiple source areas and potential exposure pathways exist as a result of the Site use. Each of these pathways, some of which have yet to be investigated, may have multiple receptors as a result of contaminant migration. It has been reported that the surrounding community has expressed concern about risk to their health. To minimize on-going risk and perform response actions for completed exposure pathways, data gaps must be filled in order to holistically evaluate the Site and prioritize response actions.

The following table summarizes potential areas of concern (AOCs) identified at the Site. Each source area was ranked based on potential risk to receptors based on available information. The rankings (low, medium, and high) are intended to prioritize investigation in a phased approach based on identified exposure pathways and receptors, as well as take into account the potential for limited funding to be available. The COCs at the Site have been selected based on our review of the available information and the MDA/MPCA guidance documents.

The table also incorporates the rationale for investigating each AOC and applicable contaminant migration pathways.

Table A
AOCs, Associated COCs, Pathways, Risk Ranking and Rationale

AOC	COCs	Potential Media	Risk Level	Rationale
Northern Dumping & Staining Areas	VOCs GRO/DRO Pesticides	Soil	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to leach to groundwater, migrate to stream via runoff/infiltration
		Groundwater	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to migrate through groundwater and/or interact with surface water
Northern & Southern Parking Area	VOCs Pesticides/Herbicides Ammonia/Nitrates/TKN	Soil	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to leach to groundwater or migrate through soil vapor
		Groundwater	Low	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through groundwater and soil vapor
Former Dry Fertilizer Building	PAHs Pesticides/Herbicides Ammonia/Nitrates/TKN PFCs Metals	Soil	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to have leached COCs to groundwater and be present in soil based on Site use
		Groundwater	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through groundwater and/or soil vapor
Maintenance Garage	GRO/DRO VOCs Ammonia/Nitrates/TKN Metals Pesticides/Herbicides	Soil	Low	Potential source area(s) based on previous results and/or historical Site information; ability to have leached COCs to groundwater and be present in soil based on Site use
		Groundwater	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through groundwater
		Soil Vapor	Medium	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through soil vapor and/or utility corridors
500-gallon AST & 1,000-gallon UST	Petroleum	Soil	Low	Potential source area(s) based on previous results and/or historical Site information; ability to leach to groundwater or migrate through soil vapor
		Groundwater	Low	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through groundwater
		Soil Vapor	Low	Potential source area(s) based on previous results and/or historical Site information; ability to impact off-Site receptors through soil vapor and/or utility corridors
Water Fill/Scale/Water Supply Well Areas	GRO/DRO PFCs VOCs Ammonia/Nitrates/TKN Pesticides/Herbicides	Soil	Medium	Potential preferential pathway based on previous results and/or historical Site information; ability to impact off-Site receptors through migration to groundwater and/or soil vapor
		Groundwater	Medium	Potential preferential pathway based on previous results and/or historical Site information; ability to impact off-Site receptors through groundwater and/or soil vapor migration
Nearby Stream Channel	VOCs GRO/DRO PFCs	Sediment	Medium	Potential receptor based on previous results and/or historical Site information; ability to impact natural resources, impact stream users, and/or water intakes due to uptake and/or leaching
		Surface Water	Medium	Potential receptor based on previous results and/or historical Site information; ability to impact natural resources, impact stream users, and/or water intakes due to ingestion or contact
Residential Neighborhood	VOCs PFCs Pesticides/Herbicides Ammonia/Nitrates/TKN Petroleum	Soil Vapor	High	Potential receptors based on previous results and/or historical Site information; ability to be present within indoor spaces (inhalation)
		Groundwater	High	Potential receptors based on previous results and/or historical Site information; ability to be ingested or off-gas into soil vapor (inhalation)

Based on the reviewed/available information, opportunities for efficiency may exist across the MDA and MPCA Site Assessment Programs, as well as the MPCA Petroleum Remediation Program. Potential synergies may involve locating borings within preferential zones to allow for sample collection according to the individual program requirements. In addition, stratified samples may also be collected as required by the MDA and MPCA Petroleum Remediation programs. The ranking of AOCs also presents an opportunity to investigate highest priority pathways and potential receptors first (i.e. vapor intrusion and/or impacted domestic wells).

3. Goals, Objectives, Tasks, and Subtasks

Goal: To conduct a Remedial Investigation based on a tiered approach to evaluate Site conditions and assess risk to identified receptors, as well as collect additional information to resolve data gaps and evaluate and implement response actions.

Objective 1: **Complete a data gap analysis, receptor survey, and pre-investigation plans**

Task A: Data Gap Analysis
Due to the numerous potential exposure pathways and COCs, a data gap analysis is proposed to identify missing or inadequate information that would be required to more accurately characterize the Site as it relates to impacts on human health and the environment. During the data gap analysis, all previous reports will be reviewed, pertinent data obtained from available resources, and summarized to identify shortfalls. Ideally, the data gap analysis will allow for more focused and efficient data collection during the RI. For the purposes of this RI Work Plan, potential data gaps may include but are not limited to:

- Receptor-specific items (e.g. is the municipal water source from the stream and determining what stream classification/uses are applicable?).
- Besides TCE, are other COCs present in previous samples (i.e. petroleum).
- Available utility information, which may be obtained from municipal departments.
- A review of all COCs which may have been stored/used on Site and the disposition of the COCs (e.g. were COCs present on Site during the fire).
- The potential for byproducts/emerging contaminants to be present as a result of Site history (e.g. dioxins due to burned pesticides and perfluorinated chemicals (PFCs) due to fire foam suppressant).
- The status of Site redevelopment and planned use (e.g. has potentially contaminated soil been removed and utility corridor locations which may expose workers).
- Evaluating which pathways have not been evaluated to date (e.g. surface water).
- What additional information is required to evaluate remedial actions (e.g. soil porosity for soil vapor extraction).

As data gaps are identified or resolved, the preliminary risk rankings may be adjusted to account for information identified during the data gap analysis.

Task B: **Receptor Survey**
A receptor survey will be completed to identify potential receptors which may be exposed as a result of releases on Site. The receptor survey is generally a preliminary component completed for both the MPCA and MDA Site Assessment programs, as well as being required for petroleum tank Limited Site Investigations under the Petroleum Remediation Program. As part of this task, a receptor survey will be completed by identifying all pertinent receptors with potential or completed exposure pathways for soil, groundwater, soil vapor, surface water, sediment, and/or food chain. The survey will incorporate requirements from the individual programs as specified in MDA Guidance Document GD-9 (Attachment 2) and MPCA Guidance Document 4-02 (petroleum) and Risk-Based Site Evaluation Manual (non-petroleum). The receptor survey will be used to support creation of a Conceptual Site Model, which will be updated as additional information becomes available. The receptor survey may also be used to revise AOC priority ranking as necessary.

Braun Intertec will conduct a receptor survey in accordance with MPCA Guidance Document 4-02 Potential Receptor Survey and Risk Evaluation Procedures at Petroleum Release Sites. The receptor survey will identify water wells, potential vapor receptors and surface water bodies that may be at risk from the potential petroleum release related to the Site history. Results of the survey will be included in the investigation report.

Specifically, Braun Intertec will identify and map potential receptors starting with areas with known contamination. For the receptor survey, Braun Intertec will perform the following activities:

- Vapor Receptors: Potential receptors will be mapped within a 100-foot radius of the Site and/or known off-Site impacts.
- Water Well Survey: For potential water wells, Braun Intertec will conduct a walking survey of all properties within a 500-foot radius of the Site and known off-Site contamination areas, and contact the property owners regarding the presence of water wells, basements or sumps on their property. Braun Intertec will contact the City utility billing department to confirm which properties within the 500-ft radius are connected to the municipal water supply. Braun Intertec will search the Minnesota Geological Survey database for registered water wells within the one-mile radius and tabulate any well construction details for identified wells. Braun Intertec will contact City officials regarding any future water development plans in the area. The information obtained from the water well receptor survey along with the groundwater data from previous investigations will be used to evaluate the risk to potential water well receptors.
- Surface Water Receptor Survey: Braun Intertec will identify and map the potential surface water receptors within a 1/4-mile radius of the Site. In addition, the stream classification and user characteristics. If necessary, the Minnesota Department of Natural Resources and/or U.S. Fish & Wildlife Service will be contact to determine whether any threatened or endangered species are present which require special protections, or are known to be for consumption by humans.

Task C: Pre-Investigation Plans
Prepare a Sampling and Analysis Plan (SAP) incorporating results of the data gaps analysis and receptor survey, as well as a project-specific Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP).

Subtask 1: RI SAP Preparation
The RI SAP will detail the proposed sampling approach for the RI, including methods and procedures for soil, soil vapor, and/or groundwater sampling, as well as outline the project objectives, proposed sampling locations and rationale, data requirements, and schedule. The RI SAP will incorporate requirements from the individual programs as specified in MDA Guidance Document GD-9 and MPCA Guidance Document 4-01 (petroleum) and Risk-Based Site Evaluation Manual, including pathway-specific guidance documents (non-petroleum).

Subtask 2: QAPP Preparation
As is typically required for Site Assessment projects, a project QAPP will be prepared to identify data quality objectives and ensure data is usable in support of the project objectives.

Subtask 3: HASP Preparation
A Site-specific HASP will be prepared to identify potential Site hazards as they relate to the proposed RI. The HASP may be used to assist subcontractors with subcontractor-specific HASP generation for their associated tasks.

Objective 1 Timeline: 3-4 weeks

Objective 1 Deliverables: RI SAP with supporting QAPP and HASP

Objective 2: Complete a RI to Evaluate Receptor Risk

Task A: Evaluate Identified Receptors (High Risk Areas)
Task A will focus on evaluating potential exposure to identified receptors as summarized in the RI SAP. As included above in Table A, numerous potential source areas and/or migration pathways exist which may expose potential receptors to COCs. For the purposes of this Work Plan and as specified in the RFP, details regarding investigation of "high risk" AOCs are provided below and in Table B. Recommended investigation activities for the currently classified medium- and low-risk areas are provided under separate subtasks in order to confirm that the respective areas do not represent a higher risk than anticipated and to determine if corrective measures/response actions are warranted.

The AOCs identified in Task A as "high risk" have been assigned the highest priority based on the available information, which suggests that exposure via the identified pathways is already occurring or is imminent. Table B summarizes the pathways considered to be high risk, additional details on potential COCs associated with the AOC, and the proposed number of borings and sample locations to evaluate the pathway.

Table B
High Risk AOCs, Potential COCs, Pathways, and Investigation Information

AOC	Potential COCs	Potential Media	# Borings / Sample Locations	Sampling Intervals
Residential Occupants	VOCs PFCs Pesticides/Herbicides Ammonia/Nitrates/TKN Petroleum	Soil Vapor	5 probes 49 sub-slab locations during the first seasonal event and 20 locations (assumed) during the second seasonal event.	5 feet bgs (soil gas probe) Based on square footage (see Table 1)
		Groundwater	10 locations (existing private wells)	Not Applicable

Subtask 1: Soil Vapor Sampling
Soil vapor sampling will consist of both sub-slab soil vapor sampling using Vapor Pins™ and soil vapor sampling in exterior spaces using soil vapor probes. Forty-nine sub-slab (SS-1 through SS-49) and five soil vapor probe (SV-1 through SV-5) sample locations are proposed to investigate the extent of soil vapor contamination in the adjacent neighborhood, which is known to be at least partially residential. However, based on results from the sampling proposed herein, subsequent additional sub-slab or soil vapor probes sample locations may be necessary to fully define the vapor intrusion AOC. Sub-slab sampling locations are being proposed for structures adjacent to previous sample locations with detections above applicable ISVs or contaminated groundwater, while soil vapor probes are proposed as step out locations from sub-slab sample locations.

Prior to performing any ground intrusive sampling, a utility locate request will be filed with the Minnesota Gopher State One Call system to mark and clear public underground utilities. In addition, due to the need to sample on private property, a private locate will be performed to minimize the potential for utility strikes outside of public right-of-way.

For sub-slab sampling, it is assumed that sub-slab samples will be collected from the lowest level of nine structures to complete definition of the vapor intrusion AOC. This RI Work Plan assumes that the installation and sampling activities will require up to three separate mobilizations due to potential access and coordination difficulties. The sub-slab vapor samples will be collected in general accordance with MPCA Guidance Document 4-01a *Vapor Intrusion Assessments Performed During Site Investigations*. The soil vapor samples will be collected using a brass sub-slab vapor monitoring point (Vapor Pin™). Prior to installing the Vapor Pin™, the work area will be observed for evidence of sub-slab utilities and/or obstructions. A rotary hammer drill equipped with a 5/8-inch diameter hole will be used to drill through the slab and approximately 1-inch into the underlying soil in the lowest level of the structure. The hammer drill will be utilized to drill a 1½-inch diameter hole at least 1¾-inches into the slab to allow for flush installation of the vapor pins for completion of subsequent sampling events (i.e. heating/non-heating events). The Vapor Pin™ will be driven into place in the slab using the vapor pin tools and a mallet. A Teflon cap will be placed onto the sample barb at the top of the vapor pin to prevent interaction of the sub-slab air with air from the interior of the building. The installed Vapor Pin™ will then be allowed to equilibrate for at least 20 minutes after installation prior to sampling. During this time, sample location and building-specific information, including any potential vapor sources, will be recorded on a *Vapor Intrusion Building Survey Form* (MPCA document 3-01a).

After the pin has been allowed to equilibrate for at least 20 minutes, the Teflon cap will be removed for sample collection. A photoionization detector (PID) reading will be obtained prior to installing the sampling train and performing a water dam leak test and sampling train shut-in test. Upon completion of the leak tests, a minimum of three purge volumes (the volume of the sample pin, pilot hole in the concrete and sampling train) will be purged with a pump or graduated syringe. The soil vapor sample will then be collected by opening the sampling canister (summa canister under vacuum) affixed with a vacuum gauge and a 200 milliliter per minute (ml/m) flow regulator. After an adequate volume of air has been obtained, the sampling canister valve will be closed and final canister pressure and time required for sampling will be recorded on the chain-of-custody form and sample sheets. After sample collection, the Teflon cap will be replaced and a stainless-steel cover will be placed over the Vapor Pin™.

Three outdoor air samples (for each day of sampling) will also be collected concurrently with the sub-slab vapor sampling as quality assurance samples. The outdoor air samples will be obtained as time-weighted samples over a 24-hour period using certified-clean canisters provided by the laboratory. A flow controller will be affixed to the canister

prior to sampling to ensure proper sample collection.

The following additional information regarding the sampling conditions and methodologies will be documented and reported along with the sampling results during indoor air sampling:

- A sketch of the lowest level floor of the structure showing the sampling location and noteworthy features observed especially potential vapor entry locations.
- Pertinent observations during sampling such as odors or field instrument readings, and ventilation conditions (e.g., heating system active and windows closed).
- The following actions will be taken to document conditions during the planned outdoor air sampling:
  - An outdoor plot sketch will be drawn that includes the building site, area streets, outdoor air sample location, location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), and compass orientation (north).
  - Weather conditions (e.g., precipitation, indoor and outdoor temperature, and barometric pressure) and ventilation conditions (e.g., heating system active and windows closed) will be recorded.
  - Any pertinent observations such as odors, field instrument readings, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) will be recorded.

Should results indicate vapor concentrations below applicable 33x ISVs, follow-up sampling will be performed in the subsequent season. For the purposes of this proposal, it is assumed that 20 second sampling event samples will be required.

For results greater than applicable 33x ISVs, an evaluation will be made on whether to perform a pre-mitigation diagnostic test on the entire structure, or perform additional focused sampling for partial mitigation. In these instances, the MPCA Project Manager will be contacted regarding a recommended approach. After a decision has been made, a Change Order for the selected approach will be submitted.

A State Drilling Contractor will install up to five temporary soil vapor probes to an approximate depth of 5 feet bgs (assuming no basements in nearby structures with groundwater at 6 feet bgs) using direct-push drilling technologies. Soil vapor probe locations have been pre-selected based on historical information; however, modifications may be made dependent upon field observations and utility locate information (see Figure 1).
The proposed soil vapor probe locations are intended to fully define the vapor intrusion AOC.

Soil vapor probes will be installed by pushing a disposable sampling point to the desired depth with minimal soil disturbance and sealing the annular space with hydrated bentonite. Prior to sample collection, a Braun Intertec field technician will screen soil vapor samples with a PID. The field technician will then collect a soil vapor sample from each sampling point with a summa canister affixed with a 200 ml/m flow controller and dedicated tubing.
The probes will then be sealed/abandoned in accordance with MDH regulations. All soil vapor probe locations will then be recorded using a portable GPS unit.

All samples will be submitted under chain-of-custody and analyzed for VOCs by a State Contract Laboratory using U.S. Environmental Protection Agency (EPA) Method TO-15 on a standard turnaround time (Table 2).

Our cost estimate assumes that vapor investigation will be completed over a five-day period, with drilling activities being completion in one mobilization however, due to the difficulties in coordinating with 12 different property owners' schedules, additional time and/or mobilizations may be required. In the event additional time/mobilizations are required, the MPCA Project Manager will be notified regarding a change order. A 2-person crew will perform all Task A activities within the allotted timeframe with one 150-mile mobilization.

Subtask 2: Domestic Well Water Sampling
Sampling of domestic wells will occur for 10 existing well locations on Blocks 3, 5, and 7 to assess groundwater quality (see Figure 1 and Table 1). Results from the domestic well sampling will be used to eliminate the contaminated groundwater pathway or be used for determining appropriate remedial actions. Depending on the results of the water well receptor survey, additional samples may be necessary should potential receptors be identified outside those outlined in Table 1.
To initiate domestic well sampling, Braun Intertec will assist the MPCA/MDA with creating a letter that MPCA will mail or leave during neighborhood canvassing. The letter will include information for scheduling sampling of the well, as well as asking for well construction information, if known. For purposes of this RI Work Plan, it is assumed that MPCA

will obtain access to the private residential properties for sampling. Upon approval of sampling, the homeowners will be contacted by Braun Intertec to schedule a sampling time and determine the best water sampling location. Braun Intertec will collect a sample from an exterior faucet, if possible. If there is no exterior faucet located outside a specific home, Braun Intertec will coordinate entry to the home with the homeowner and will collect a sample from an interior faucet upstream of any water-altering device (i.e. water softener, pressure tank, or filtration system).

Once a suitable sample location is chosen, a purge of the water line will be performed by calculating the volume of water in the line and determining the water volume within the well (3 casing volumes). If well construction specifications are unknown, water quality stabilization parameters will be monitored until stabilized or 10 minutes of continuous purge has elapsed. Low-flow sampling will then be employed to fill sampling containers. For purposes of this RI Work Plan it is assumed that a 10-minute purge will be used for wells with no readily available construction information.

To more efficiently characterize the off-Site boundaries of COCs, domestic wells will be sampled for analytes which are overseen by all three regulatory programs. Domestic wells will be sampled and analyzed by a subcontracted State Contract Laboratory with MDA approval to perform the selected agricultural chemical analyses for contaminants specific to each regulatory agency as follows:

MPCA Site Assessment Program:
VOCs by EPA Method 8260
PFCs by EPA Method 537

MDA Site Assessment Program:
MDA List 1 & List 2 Pesticides by EPA Method 8270
Nitrates as nitrogen by EPA Method 300
TKN by EPA Method 351.2,

MPCA Petroleum Remediation Program:
GRO & DRO by modified Wisconsin method

Quality control/quality assurance (QA/QC) samples, including a trip blank, duplicate sample, and extra-volume laboratory spike sample, will also be collected as part of sampling activities and submitted for analytical testing as specified in Table 2. Samples submitted for laboratory analysis (including QA/QC samples) will be transported from the Site to the laboratory in a cooler on ice and delivered under chain-of-custody protocol. All sampling containers, preservation methods, hold times and QA/QC samples will follow requirements outlined in the approved Site-specific QAPP prepared for the RI. All sampling containers will be supplied by the subcontracted laboratory. Samples will be submitted on a standard turn around and laboratory results will be available within 2 weeks of sample submittal.

Our cost estimate assumes that water sample collection will be completed in a 1-day timeframe during other investigation activities; however, due to the difficulties in coordinating with 10 different property owners' schedules, additional time and/or mobilizations may be required. In the event additional time/mobilizations are required, the MPCA Project Manager will be notified. Upon sample completion, Braun Intertec will deliver the samples under chain-of-custody to the subcontracted laboratory for analysis.

Task B: Investigation of Medium and Low Risk AOCs
Medium risk AOCs are considered viable exposure pathways; however, based on limitations for imminent/substantial risk to receptors, are not considered high-risk, while low risk AOCs are viable pathways, but CoC toxicity or pathways may not be as toxic. A list of potential COCs for each AOC is presented in Table A. It should be noted that response actions taken on Site will be largely dependent upon data collected as part of investigation for medium and low risk AOCs.

Subtask 1: Soil/Groundwater Investigations
Additional sampling to investigate medium and low risk AOCs may involve several types of sampling, including: surface and subsurface soil collection, additional groundwater delineation on-Site and off-Site, and stream and sediment sampling adjacent and downgradient of the Site. Based on MDA and Petroleum Remediation Program requirements, in addition to grab samples obtained from borings exhibiting visual or olfactory indications of contamination, strategic interval sampling will be required for select areas (notably tank locations and pesticide/fertilizer use areas).

Based on the Site layout, several opportunities for sampling efficiency/consolidation are available. For instance,

Limited Site Investigation of the gasoline UST may be combined with investigation of the eastern access door for the former dry fertilizer building. In addition, sampling the existing water supply well for additional parameters, such as PFCs or dioxins, may be useful in determining whether these COCs are present on Site and whether additional investigation is warranted.

It should be noted that investigation of medium and low risk AOCs will be required to redevelop the Site into a golf course. Considerations with respect to the proposed redevelopment are likely to include potential leaching ability of existing soils, determining an appropriate engineered cap over soils, identifying potential utility corridors, and delineation of any hazardous waste.

As discussed above, there are efficiencies that can be gained by taken a holistic approach to the investigation of the low and medium risk AOCs. There are several AOCs that will require additional investigations based upon contaminant type. Below is a table which identifies onsite AOCs that will require initial assessment to determine if a release has occurred. These areas may require an iterative investigation approach to fully delineate the impacts.

Table C below identifies the AOC, the rationale for sampling in that area, the assumed media that will be sampled and the assumed COCs.

Note: the exact number of borings required and the boring locations for each risk area will be determined after an initial site visit has been performed. For the purpose of this initial work plan, Braun Intertec is assuming that one soil boring will be advanced in each AOC identified below, except for the former fertilizer building and agricultural equipment parking and storage areas where two borings (or boring clusters when composite samples are collected) will be advanced. Additional assessment work will most likely be needed to fully delineate the extent of impacts identified during implementation of this initial work plan. This additional assessment work is outside of the scope of this initial work plan.

Table C
On-Site AOC Investigation Information

AOC	Feature	Rationale	Media	Depths sampled	COCs
Former Dry Fertilizer Building	Cracked Pad	Fertilizers and other ag chemical storage and mixing activities and cracked floor	Soil/ Groundwater	0-0.5 C 2-2.5 C 4.5-5 D Plus Every two ft. until the Water table D*.	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
Former Dry Fertilizer Building	Cracked Pad	Fire suppression and fire suppression chemicals could have penetrated through cracks to underlying soils.	Soil/ Groundwater	0-0.5 4.5-5 Water table	PAHs PFCs Metals

Former Dry Fertilizer Building	Load in/Load out areas	Two large overhead doors, one small overhead, and one service door (4 sample areas total)	Soil	0-0.5 C 2-2.5 C 4.5-5 D	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
Northern & Southern Parking Area	Agricultural equipment parking and storage	Potential track off or spills from equipment	Soil	0-0.5 C 2-2.5 C 4.5-5 D	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
Water Fill/Scale/Water Supply Well Areas	Water Fill area	Chemical mixing, filling of chemical dispersion equipment	Soil/ Groundwater	0-0.5 C 2-2.5 C 4.5-5 D Plus Every two feet until the Water table D*	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
Water Fill/Scale/Water Supply Well Areas	Scale pits	Track off, spills	Soil/ Groundwater	0-0.5 C 2-2.5 C 4.5-5 D Plus Every two feet until the Water table D*	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
Former Dry Fertilizer Building	Run off from fire	Fire extinguish run off from the Ag chemical building, plus PFCs form fire suppression chemicals	Soil	Ag Chemicals : 0-0.5 C 2-2.5 C 4.5-5 D Non –Ag Chemicals: 0-0.5 and Indications of impacts	Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN PAHs PFCs Metals
Northern Dumping & Staining Areas	Discolored Soils	Discolored soils, potentially related to dumping of spent solvents, however the source of the staining is unknown	Soil	0-0.5 and Indications of impacts	VOCs Metals PAHs DRO GRO TCLP for disposal characterization

Maintenance Garage	500 Gallon Trench Waste UST	Waste tank connect to floor drain, reported to have leaked	Soil/ Groundwater	Base of tank, Water Table And/or Indications of impacts	PAHs VOCs Metals DRO GRO Pesticides/Herbicides (MDA Lists 1 & 2) Ammonia/Nitrate-Nitrogen/TKN
500-gallon AST & 1,000-gallon UST	1,000 Gallon UST, 500 Gallon AST**	---	---	---	---

C = Composite Samples
D = Discrete Sample
D* = Per MDA guidance, these samples will be held under chain of custody procedures and analyzed per MDA staff approval.
** = The existing 500 gallon fuel oil AST and 1,000 gallon gasoline UST will be abandoned under the Remedial Design/Remedial Action Activities Work Plan included as Attachment A of this RFP. The investigation required for these tanks will be evaluated after the tanks are removed.

All samples collected for non- agricultural analyses (VOCS, metals, PFCs, and PAHs) will be discreet samples. Additional analyses (PCBs, SVOCs, zinc, copper), etc. may be recommended as additional information concerning site activities and chemical products stored on site becomes available. These analyses are not included in the scope of work for this subtask. QA/QC samples will be collected in accordance with the project QAPP.

Sampling for Agricultural COCs
Prior to investigation in areas sampled for agricultural COCs, Braun Intertec will perform a preliminary Site visit with MDA staff to confirm proposed sampling area/boring locations and related sample collection and laboratory analysis requirements.

For soil borings advanced in agricultural chemical AOCs, sampling will consists of at least one surface composite sample, one subsurface composite sample and one subsurface discrete sample. Composite samples will consist of 4 evenly-spaced sub-samples from an area roughly 15 feet in diameter. Surface composite samples will be taken from 0 to 6 inches below any surficial gravel. Subsurface composites will be collected from a depth of 2 to 2.5 feet below ground surface (bgs).

One discrete "grab" sample will be collected from a depth of 4.5 to 5 feet bgs, and will be collected from the boring near the center of the risk area or close to the probable source in each surface composite area.

Borings completed through concrete will be through cracks whenever possible and will be patched and sealed upon completion of sampling.

Dedicated sampling equipment will be used for each sample to reduce the risk of cross-contamination. All drilling and hand auger equipment will be decontaminated between sampling in accordance with MDA Soil Sampling Guidance (Guidance Document 11). All agricultural chemical samples collected during the field investigation which were not initially submitted for analysis will be held frozen for future possible analysis based on review of the initial results and discussions with MDA staff.

Given the shallow groundwater conditions at the Site (less than 10 feet bgs), at least one of the borings in each risk area will be advanced to the water table to collect a groundwater sample for agricultural chemical analysis.

Groundwater sampling in agricultural risk areas will include the collection of water from a temporary screened PVC well using a check valve and dedicated polyethylene tubing. All water sampling will be completed in a manner consistent with MDA Ground Water Sampling Guidance (Guidance Document 12).

Task C: Permanent Groundwater Monitoring Wells
To define groundwater flow direction at the Site, four permanent groundwater wells will be installed. These monitoring wells will be screened to intersect the shallow water table to evaluate groundwater flow direction in the surficial acquirer. The results of the RI described in this work plan may identify additional impacts to groundwater in the surficial aquifer and, therefore, additional permanent monitoring wells in the surficial aquifer may be necessary in the future. In addition, deeper monitoring wells will be needed in the future to assess the nature and extent of TCE migration in deeper aquifers.

Subtask 1: Well Installation Plans and Specifications/Bidding Documents
As part of this task, Braun Intertec will provide monitoring well installing specifications and bidding documents for the well installation work per the MPCA subcontractor manual. The specifications will be submitted to the MPCA and MDA for approval prior to bidding, as appropriate.

Subtask 2: Well Installation
The permanent monitoring wells will be placed with one well located along the eastern (assumed upgradient) portion of Site, and two wells placed on the western portion of the Site, down-gradient of the suspected onsite source areas. Additionally one well will be placed on the north of the stream east of the fertilizer building in order to evaluate whether the onsite stream is acting as a hydrogeological barrier. The locations of the proposed monitoring wells are shown on Figure 1.

Water level gauges (staff head gauge or similar) will be installed in two locations within the stream (upgradient and downgradient of the former fertilizer building) to evaluate groundwater and surface water interactions at the site.

Braun Intertec will provide oversight during well construction. After the permanent monitoring well have been installed Braun Intertec will properly develop the wells. After the wells are properly developed and have been allowed to equilibrate completely, Braun Intertec will collect one round of groundwater elevation data.
Sampling of the newly installed wells will occur under a separate work plan once the shallow groundwater COCs have been determined through sampling and analysis of groundwater samples from the planned temporary wells.

Task D: Geophysical Survey
In addition to a private utility locate, a geophysical survey of the Site is proposed to identify underground utilities which may act as preferential pathways or sources of releases of COCs (e.g. sewers). Ground-penetrating radar (GPR) or electromagnetic (EM) methods would be applied in all areas. For the purposes of this RI Work Plan, it is assumed that GPR will achieve the stated objective. GPR will also be used to determine the presence/absence of additional underground features, such as buried materials or tanks. To complete the geophysical survey, bids will be solicited by potential subcontractors in accordance with the State of Minnesota Purchasing Manual. Upon receipt of the required number of bids, the MPCA Project Manager will be sent a bid tabulation sheet for selection of the contractor.

Task E: Domestic and Supply Well Information
As impacts to domestic wells and the Site supply well have already been identified, additional information regarding well construction is necessary to appropriately scope potential response actions (i.e. well abandonment). A well survey will be completed concurrently with domestic well sampling (Task A, Subtask 1), which will identify well specifications such as depth, diameter, casing material, pump status, and disconnects that may be required. Should information not be easily attainable, well sounding or logging may be employed.
Well sounding or logging is not included in this proposal.

Task F: RI Report
Braun Intertec will complete a comprehensive report of RI assessment activities. The report will include a description of field methods and procedures, discussion of RI results, and include information applicable to completing a RD/RA and/or feasibility study. Supporting data to be included within the RI Report will include a site location map on a USGS topographic map, a site map showing pertinent features including utilities, well and vapor receptor survey maps (including MPCA vapor intrusion templates), groundwater elevation contour maps, sample location maps, at least two geologic cross sections, a table of sample location geographic coordinates, tables with PID results and soil and groundwater analytical results, tables of groundwater elevation data, a table of water supply wells, a photographic log, copies of all laboratory reports, soil boring and monitoring well logs,
and water supply well logs.

Objective 2 Timeline: Based on the tasks as part of Objective 2, it is anticipated that RI activities will be completed within 6 to 8 weeks of authorization to proceed, with the timeline highly dependent upon Site and individual property access or time of year (for existing soil vapor sample second round sampling only). A draft RI Report submitted approximately 10 to 12 weeks after authorization to proceed.

Objective 2 Deliverables: RI Report including supporting documentation. Raw data will also be submitted in MPCAs/MDAs requested format for database format.

Objective 3 - RD/RA Data Collection
Additional sampling and data collection activities for use in a RD/RA for the Site are summarized below

Task A: Sub-Slab Vapor Evaluation in Support of Mitigation
This Task includes additional sub-slab vapor sampling and completing pre-diagnostic testing to support design of a vapor mitigation approach for the Maintenance Garage. As noted above, as the building is currently vacant, this work may be completed at a later date, or may be completed by the golf course owner. For the purpose of this proposal we have assumed that the MPCA will request that Braun Intertec perform this work under this Work Plan.

Sub Task 1: Additional Sub-Slab Soil Vapor Sampling
Additional sub-slab sampling will be completed within the maintenance garage to fully define the vapor intrusion AOC. For the purposes of this RI Work Plan, it is assumed that Vapor Pins™ installed during the previous round of sampling are still present and in usable condition and that additional sub-slab sampling will occur during completion of Task A.

Ten sub-slab samples were previously collected within the structure; however, based on the square footage of the building (estimated to be 75,000 square feet), 8 additional sub-slab samples are required to fully define and identify partial mitigation areas (SS-50 to SS-57). Two additional Vapor Pins™ will be installed in both building addition 1 and 2, while four additional sample locations will be placed within the original building (see Figure 2 and Table 2). All Vapor Pins™ will be installed and sampled in a similar manner as off-Site sub-slab sampling (Task A, Subtask 1). In addition, one outdoor air sample will be collected as previously described.

Based on the results from the previous investigation, mitigation of the original building may not be required; therefore, a second round of sampling is proposed to verify COCs are not greater than 33x Commercial/Industrial ISVs. For the second seasonal event (heating or non-heating), the four previously existing sub-slab monitoring points (SS-58 to SS-61), as well as the four additional sample locations (SS-53, SS-54, SS-56 and SS-57) will be resampled (minimum 30 days between events). For the purposes of this RI Work Plan, it is assumed that the second sampling event will not be conducted in the same heating/non-heating season as the original round.
All Vapor Pins™ will be sampled in a similar manner as off-Site sub-slab sampling (Task A, Subtask 1).

Subtask 2: Follow up Seasonal Sampling to Confirm the VI AOC Boundaries
This subtask includes performing a second round of sub-slab sampling in the portions of the building outside the VI AOC to confirm the VI AOC boundaries. As the exact size of the VI AOC is not know at this time, the exact number of samples required cannot be defined in this scope of work. However, once the additional sampling in Task A above is competed and the VI AOC is defined, a work plan for the second round of sampling (performed in the opposite season as the entail round of sub-slab data) will be prepared and submitted to the MPCA for approval.

Subtask 3: Pre-mitigation Diagnostic Testing
Concurrently with soil vapor sampling activities described in Subtask 1, pre-mitigation diagnostic assessments will be performed for two structures: building additions 1, 2, and 3 of the maintenance garage, and the northeastern structure of Block 7 (previous sub-slab result greater than 33x Residential ISVs.

Braun Intertec will perform diagnostic testing at both structures to evaluate sub-slab pressure fields and identify vapor mitigation system design criteria. As part of diagnostic testing, the following activities will be completed:

- A private locate and Site walk will be performed prior to selecting appropriate testing locations and identify any subgrade features which may affect testing and/or future system installation.

- It is assumed at least four suction pit test locations will be needed to complete the diagnostic testing within each of the four identified areas. At each test location, approximately 4-inch diameter holes will be cored through the concrete floor slab to monitor vacuum at various locations and distances within the building (approximately 1 per 250 square feet). Different fans sizes will then be used to generate vacuum beneath the floor slab, and several ¼-inch-diamater holes will be drilled into the floor slab around each test location to measure the sub slab vacuum at different distances from the test locations. The results will then be used to determine system design and select an adequately sized fan(s) to maintain vacuum under the building.

- Results will be compiled on a Pre-Mitigation Diagnostic Checklist for each area (MPCA Guidance Document 3-06a).

- Pressure differentials will be monitored throughout the testing, with a goal of maintaining 3 to 5 pascals, depending on the season.

Objective 3 Timeline: It is anticipated that RD/RA data collection activities will be completed within 2 to 4 weeks of authorization to proceed.

Objective 3 Deliverables: A letter report that defines the AOC for vapor mitigation in the Maintenance Garage, which includes soil vapor sampling and vacuum field extension data.

Objective 4: Assist MPCA and MDA with Public Outreach Support

Task A: Assist with public outreach
Based on concerns previously expressed by area residents, a provisional task has been included within this RI Work Plan to assist MPCA and MDA perform public outreach. While the needs of outreach are generally unknown, it is assumed that public outreach assistance may be required with respect to converting individual property owners to other potable water sources, as well as entering residences for sub-slab vapor sampling and/or providing additional support for conveying risks should results indicate a potential risk.

Objective 4 Timeline: As needed

Objective 4 Deliverables: Property summary reports or other deliverables, as requested.

Table 1
Sample Locations, Matrices and Rationale - Off Site Receptors
Scenario A

Sample ID		Sample Matrix	Location	Rationale
SV-1		Soil Vapor	ROW, Block 3	Screen/evaluate soil vapor beyond known area 100' buffer
SV-2		Soil Vapor	ROW, Block 5	Screen/evaluate soil vapor beyond known area 100' buffer
SV-3		Soil Vapor	ROW, Block 4	Screen/evaluate soil vapor beyond known area 100' buffer
SV-4		Soil Vapor	ROW, Block 6	Screen/evaluate soil vapor beyond known area 100' buffer
SV-5		Soil Vapor	ROW, Block 6	Screen/evaluate soil vapor beyond known area 100' buffer
SS-1 to SS-8		Soil Vapor	Block 7, SW structure	Assess sub-slab conditions for structure adjacent to known plume
SS-9 to SS-13		Soil Vapor	Block 7, NW structure	Assess sub-slab conditions for structure adjacent to known plume
SS-14 to SS-19		Soil Vapor	Block 7, SE structure	Assess sub-slab conditions for structure adjacent to known plume
SS-20 to SS-25		Soil Vapor	Block 5, SW structure	Assess sub-slab conditions for structure adjacent to known plume
SS-26 to SS-30		Soil Vapor	Block 5, SE structure	Assess sub-slab conditions for structure with known impacted well
SS-31 to SS-34		Soil Vapor	Block 5, NE structure	Assess sub-slab conditions for structure with known impacted well
SS-35 to SS-39		Soil Vapor	Block 5, middle structure	Assess sub-slab conditions for structure adjacent to known plume
SS-40 to SS-44		Soil Vapor	Block 5, NW structure	Assess sub-slab conditions for structure adjacent to known plume
SS-45 to SS-49		Soil Vapor	Block 3, SE structure	Verify no vapor risk is present across from known plume area
SS-50 to SS-57		Soil Vapor	Maintenance Garage	Complete density sampling within building additions for targeted partial mitigation of sub-slab vapors
SS-58 to SS-61		Soil Vapor	Maintenance Garage	Complete density sampling and 2nd round for original building clearance (samples 17, 20, 22, and 23)
GW-1		Groundwater	Block 7, SW structure	Assess groundwater conditions adjacent to known plume
GW-2		Groundwater	Block 7, NW structure	Assess groundwater conditions adjacent to known plume
GW-3		Groundwater	Block 7, SE structure	Verify no impacts to well, including additional analyses
GW-4		Groundwater	Block 5, SW structure	Assess groundwater conditions adjacent to known plume
GW-5		Groundwater	Block 5, middle structure	Assess groundwater conditions adjacent to known plume
GW-6		Groundwater	Block 5, NW structure	Assess groundwater conditions adjacent to known plume
GW-7		Groundwater	Block 3, SW structure	Verify no impacts to well, including additional analyses
GW-8		Groundwater	Block 3, left-mid structure	Verify no impacts to well, including additional analyses
GW-9		Groundwater	Block 3, right-mid structure	Verify no impacts to well, including additional analyses
GW-10		Groundwater	Block 3, SE structure	Verify no impacts to well, including additional analyses
QA/QC*	TB-X	Trip Blank (GW)	Not Applicable	QA/QC, 1 per cooler (trip blank)
	GW-X	Field Duplicate	Same as original/native sample	QA/QC, 1 per 20 samples per matrix (field duplicate)
	Same as Original	MS/MSD	Same as original/native sample	QA/QC, 1 per 20 samples per matrix (MS/MSD extra volume)

Notes: *Locations not shown on Figure 1
QA/QC = Quality Assurance/Quality Control
X = Sequential number
ROW = right-of-way

Table 2
Proposed Analyses – Off-site Receptors
Scenario A

Sample ID	Laboratory Analysis									Quality Control Samples		
	TO-15	VOCs	PFCs	List 1 Ag Chem	List 2 Ag Chem	Nitrates	TKN	GRO	DRO	Duplicate/ Replicate	Trip Blank	MS/MSD
SV-1	X	-	-	-	-	-	-	-	-	-	-	-
SV-2	X	-	-	-	-	-	-	-	-	-	-	-
SV-3	X	-	-	-	-	-	-	-	-	-	-	-
SV-4	X	-	-	-	-	-	-	-	-	-	-	-
SV-5	X	-	-	-	-	-	-	-	-	-	-	-
SS-1 to SS-8	X	-	-	-	-	-	-	-	-	-	-	-
SS-9 to SS-13	X	-	-	-	-	-	-	-	-	-	-	-
SS-14 to SS-19	X	-	-	-	-	-	-	-	-	-	-	-
SS-20 to SS-25	X	-	-	-	-	-	-	-	-	-	-	-
SS-26 to SS-30	X	-	-	-	-	-	-	-	-	-	-	-
SS-31 to SS-34	X	-	-	-	-	-	-	-	-	-	-	-
SS-35 to SS-39	X	-	-	-	-	-	-	-	-	-	-	-
SS-40 to SS-44	X	-	-	-	-	-	-	-	-	-	-	-
SS-45 to SS-49	X	-	-	-	-	-	-	-	-	-	-	-
SS-50 to SS-57	X	-	-	-	-	-	-	-	-	-	-	-
SS-58 to SS-61	X	-	-	-	-	-	-	-	-	-	-	-
GW-1	-	X	-	-	-	-	-	-	-	-	X	-
GW-2	-	X	X	X	X	X	X	X	X	X	-	-
GW-3	-	X	X	X	X	X	X	X	X	-	-	-
GW-4	-	X	X	X	X	X	X	X	X	-	-	-
GW-5	-	X	X	X	X	X	X	X	X	-	-	X
GW-6	-	X	-	-	-	-	-	-	-	-	-	-
GW-7	-	X	-	-	-	-	-	-	-	-	-	-
GW-8	-	X	-	-	-	-	-	-	-	-	-	-
GW-9	-	X	-	-	-	-	-	-	-	-	-	-
GW-10	-	X	X	X	X	X	X	X	X	-	-	-

Notes:
VOCs Volatile Organic Compounds by EPA Method 8260
PFCs Perfluorinated Chemicals by EPA Method 537
List 1 & 2 MDA agricultural compounds by modified EPA Method 8270
Nitrates Nitrate as nitrogen by EPA Method 300 or similar
TKN Total Kjeldahl Nitrogen by EPA Method 351.2
GRO Gasoline range organics by modified Wisconsin method
DRO Diesel range organics by modified Wisconsin method

Figure 1
Proposed Sample Locations – Adjacent Neighborhood
High Risk Areas of Concern Only
Scenario A

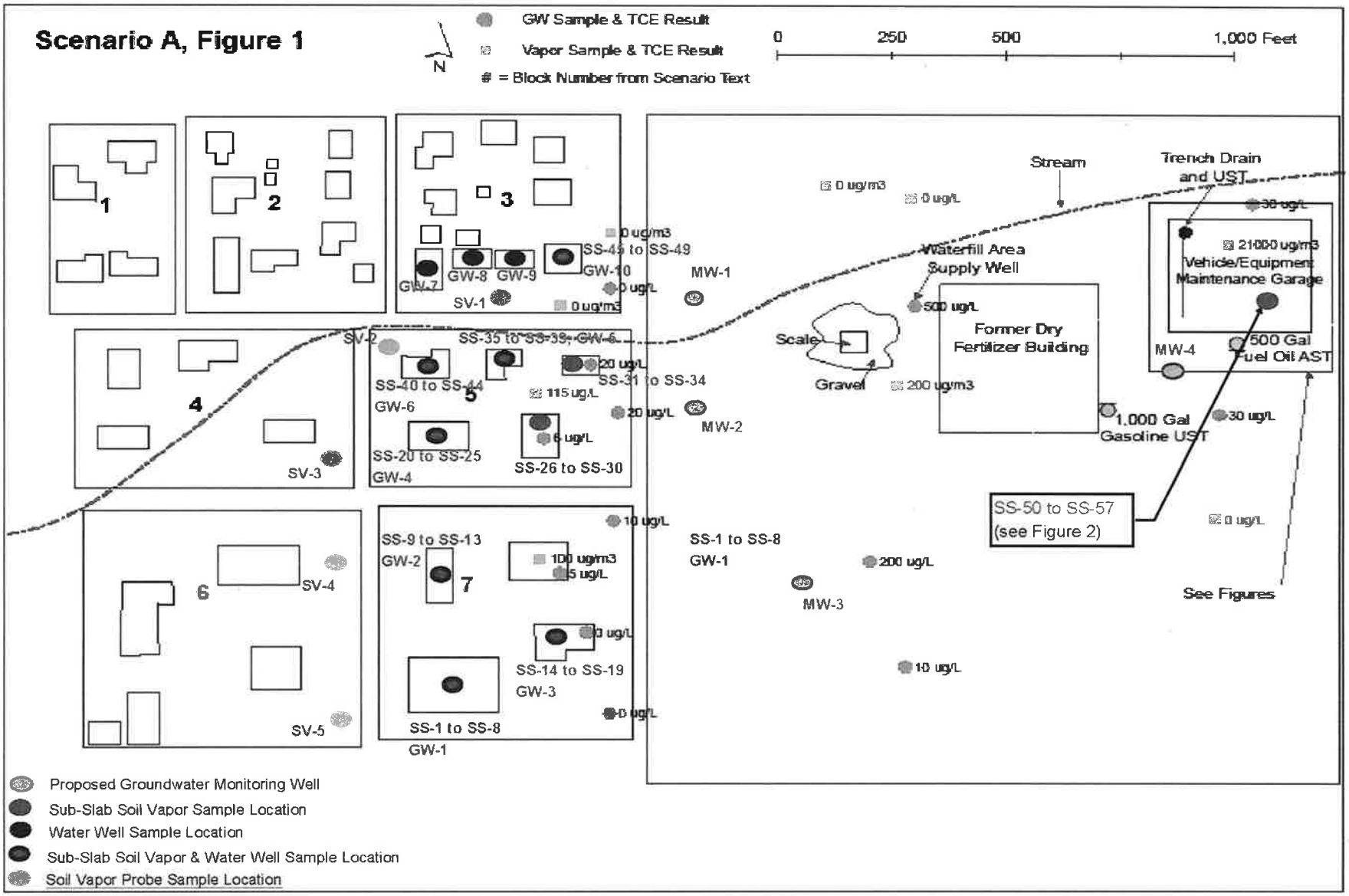
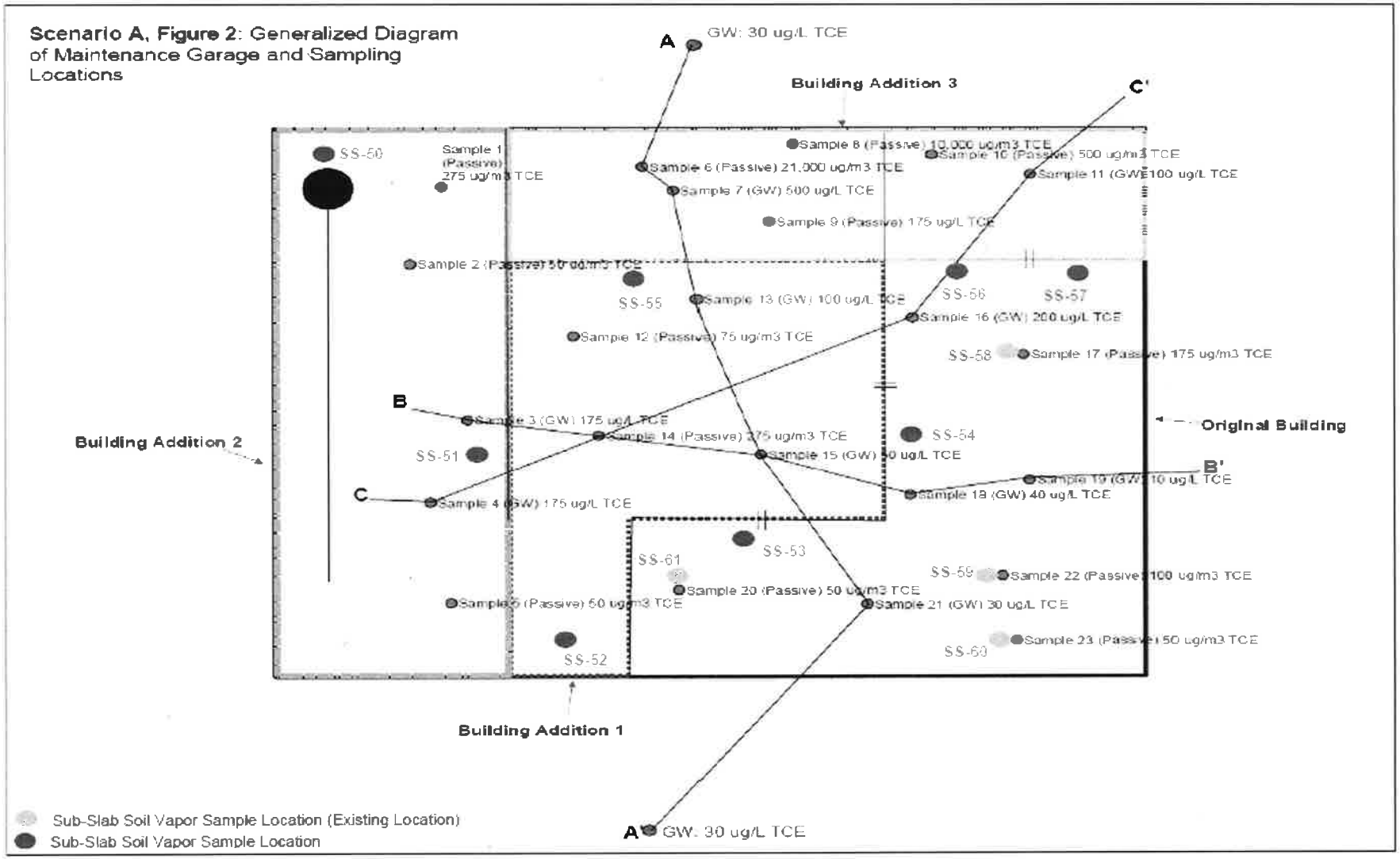


Figure 2
Proposed Sample Locations – Maintenance Garage
High Risk Areas of Concern Only
Scenario A



MINNESOTA POLLUTION CONTROL AGENCY
520 Lafayette Road North
St. Paul, MN 55155 4194

Remedial Investigation Scenario Spreadsheet (Scenario A)

Project title: Former Agricultural Chemical Plant

	1. Personnel						2. Subcontracting		3. Equipment										Totals (Extended) (Personnel Hours Only)
Project Budget	Project Manager	Field Technician	GIS/CADD Specialist	QA/QC Officer	Scientist 1 or Engineer 1	Scientist 2 or Engineer 2	Laboratory	Drilling	Mileage	Sub-Slab Sampling Point	Sub-Slab Sampling Kit	PID (10.6 eV)	Micro Manometer	Submersible pump	Water quality meter	Water Level Indicator	GPR	GPS (sub-meter)	Coring Machine	
Objective 1: Complete a data gap analysis, receptor survey, and pre-investigation plans																				
Task A: Data Gap Analysis	3			2	10	10														25
Task B: Receptor Survey	3		2			16			60											21
Task C: Pre--Investigation Plans																				0
Subtask 1: SAP	2		2	2	10	20														36
Subtask 2: QAPP	2			4		4														10
Subtask 3: HASP					1	1														2
Total for Objective 1 Hrs/Qty	**10**	**0**	**4**	**8**	**21**	**51**			**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**94**
Objective 2: Complete a RI to Evaluate Receptor Risk and in Support of a RD/RA																				
Task A: Evaluate Identified Receptors - High-Risk AOCs																				
Subtask 1: Soil Vapor Sampling - Including acquiring drilling quotes	10	62			55		77 TO-15 (69 Sub-Slab & 5 subsurface soil vapor, 3 ambient); 3 certified cans (ambient air);	5 Vapor Probes + Private Locate	300	49	49	5						1		127
Subtask 2: Domestic Well Water Sampling (10 wells)	5	20			5		12 VOCs (GW); 6 PFCs, List 1, List 2, Nitrates, TKN, GRO, DRO (GW)		60						2					30
Task B: Investigation of Medium and Low Risk AOCs																				
Subtask 1: Soil/Groundwater Investigations (Assumes 13 sampling locations, 11 of which will consist of multiple borings in a 15 foot radius to create composite samples), includes 5 temp wells, one initial site walk to select boring locations, and acquiring drilling quotes	8	30			2			46 total borings, 5 temp wells + Private Locate	120			3		3	3	3		1	1	40
Task C : Permanent Groundwater wells																				
Subtask 1: Well Installation Plans and Specifications/Bidding Documents					6															6
Subtask 2: Well Installation (Assumes 4 permanent wells and two surface water gauges will be installed and developed, one round of ground water elevation data)	4	30			4			4 permanent wells, 2 stream gauges	60			2		1	1	2				38
Task D: Geophysical Survey	2	20	2						60								2	2		24
Task E: Domestic and Supply Well Information		5							20											5
Task F: RI Report	16		8	4	8	24														60
Total for Objective 2 Hrs/Qty	**45**	**167**	**10**	**4**	**80**	**24**			**620**	**49**	**49**	**10**	**0**	**4**	**6**	**5**	**2**	**4**	**1**	**330**
Objective 3: RD/RA Data Collection																				
Task A: Sub-Slab Vapor Evaluation in Support of Mitigation																				
Subtask 1: Additional Sub-Slab Soil Vapor Sampling (initial round plus workplan for second round)	3	16			8		18 TO-15 (16 Sub-Slab & 2 outdoor)		20	8	16	2								27
Subtask 2: Follow up Seasonal Sampling To confirm the VI AOC Boundaries (cost no included as dependent on result of subtask 1)																				
Subtask 3: Pre-mitigation Diagnostic Testing	4	40			40				20			4	4						4	84
Total for Objective 3 Hrs/Qty	**7**	**56**	**0**	**0**	**48**	**0**			**40**	**8**	**16**	**6**	**4**	**0**	**0**	**0**	**0**	**0**	**4**	**111**
Objective 4: Assist MPCA and MDA with Public Outreach Support																				
Task A: Assist with public outreach	10		2						60											12
Total for Objective 4 Hrs/Qty	**10**	**0**	**2**	**0**	**0**	**0**			**60**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**
Total Project Hours/Quantities	**72**	**225**	**16**	**12**	**147**	**75**			**780**	**57**	**65**	**16**	**4**	**4**	**6**	**5**	**2**	**4**	**5**	**547**

Assumptions:
Site is assumed to be in rural Minnesota 30 miles one way from our closest office.