Via Email: lkerr@manitoulintransport.com

Manitoulin Group of Companies
2165 Brookside Blvd.
Winnipeg, Manitoba R2R 2Y3

December 2, 2022

Our File: 45629-199

Re: **Remedial Action Plan**

Date of Loss: October 28, 2022
Client: Manitoulin Group of Companies
Loss Location: Highway 391, 12 km north of Nelson House, MB
MB Env Incident: #ERT-22-0619
Collision: #22-01636

Dear Lindsay Kerr:

This letter is in reference to a requirement for action, as it pertains to the incident that occurred on October 28, 2022. The request for action requires the following: an initial plan, including timelines, for the response strategy for the impacted soil within the north ditch of Highway 391, located approximately 12 km north of Nelson House, MB. See attached figures for detailed site location.

Pario Engineering and Environmental Sciences (Pario) has been retained by Manitoulin Group of Companies (Manitoulin) to provide consulting services to assess and remediate the above noted site. This incident has been reported to Manitoba Department of Environment (MB Env) and can be referenced under Incident #ERT-22-0619. It was reported to Pario that on October 28, 2022 the driver for Manitoulin lost control of the tractor and trailer and drove into the north ditch of Highway 391. As a result of the incident, one of the tractors saddle tanks was damaged, releasing an estimated volume of 350 litres of diesel into the gravel surface area of the ditch.

The spill was covered by a tarp to protect the area prior to remediation. The estimated area of the spill is 4.5 metres (m) by 5.0 m. No culverts were noted to be nearby, and the closest watercourse is an unnamed watercourse (approximately 150 m east) that joins Kawaweyak Lake to an unnamed waterbody. As reported to Pario, diesel did not enter the watercourse.

Suggested Action to address impacts: To address the impacted soil, the remediation plan includes the use of a track mounted excavator to remove the upper soils for direct loading into a sealed end dump truck for transport to an approved waste facility.

Field screening will be conducted with a photo-ionization detector (PID). During collection of samples for field screening, additional soil samples will also be collected for confirmatory laboratory analyses, kept on ice in a cooler, to moderate temperature fluctuation, prior to delivery to the laboratory. Soil samples will be analyzed for Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and Petroleum Hydrocarbon (PHC) Fractions (F)1-4. Pending results from the laboratory, backfilling will take place using locally sourced and approved soils.

Based on information provided to Pario it is anticipated that the excavation my extend up to 1.0 m below ground surface and will be conducted within the highway ditch (excluding the embankment). The total estimated volume of soil to be excavated is 23 m^3 and will be transported to an approved waste facility. Sampling will be conducted in an approximately 3 m by 3 m grid pattern, with final sample number to be based on the final extents of the excavation. Based on the anticipated excavation dimensions, Pario will collect up to 13 soil samples (nine confirmatory samples, three background samples and one backfill characterization sample). Additional duplicate soil samples will be collected based on 10% of the total samples collected. The soil samples will be analyzed by Bureau Veritas Laboratory located in Winnipeg, MB.

Backfilling of the excavation will be completed by importing similar material from a local source, spread in 0.3 m lifts and track packed using the excavator on site to match pre-spill conditions. A follow up will be conducted in 2023 to observe any settling issues and address if required.

The following quality control / quality assurance (QC/QA) methods will be utilized during the program:

- Field operations were directed and supervised by qualified, competent environmental professionals.
- The heavy equipment and trucking contractors were selected based on confirmed qualifications, experience, equipment suitability, and quality.
- Soil sampling personnel donned new nitrile gloves before the collection and handling of each confirmatory soil sample.
- All sampling equipment was thoroughly decontaminated between sampling locations.
- All soil samples scheduled for analytical testing of PHC parameters were collected following zero-headspace protocols and were stored in ice-packed coolers until submitted to Bureau Veritas.
- A peer quality review process was implemented during data management, report preparation, and QC review of final report deliverables.

Quality control measures implemented as part of this Remediation Program also included reviewing Bureau Veritas QC / QA portion of analytical reports.

The anticipated start date for the work within this area is the week of January 2, 2022, pending vendor availability, ground disturbance procedures and landfill acceptance. The remedial excavation is expected to take up to two days to complete.

If you have any questions or concerns, please do not hesitate to contact the undersigned.

Regards,

PARIO ENGINEERING &
ENVIRONMENTAL SCIENCES

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ra/dw/

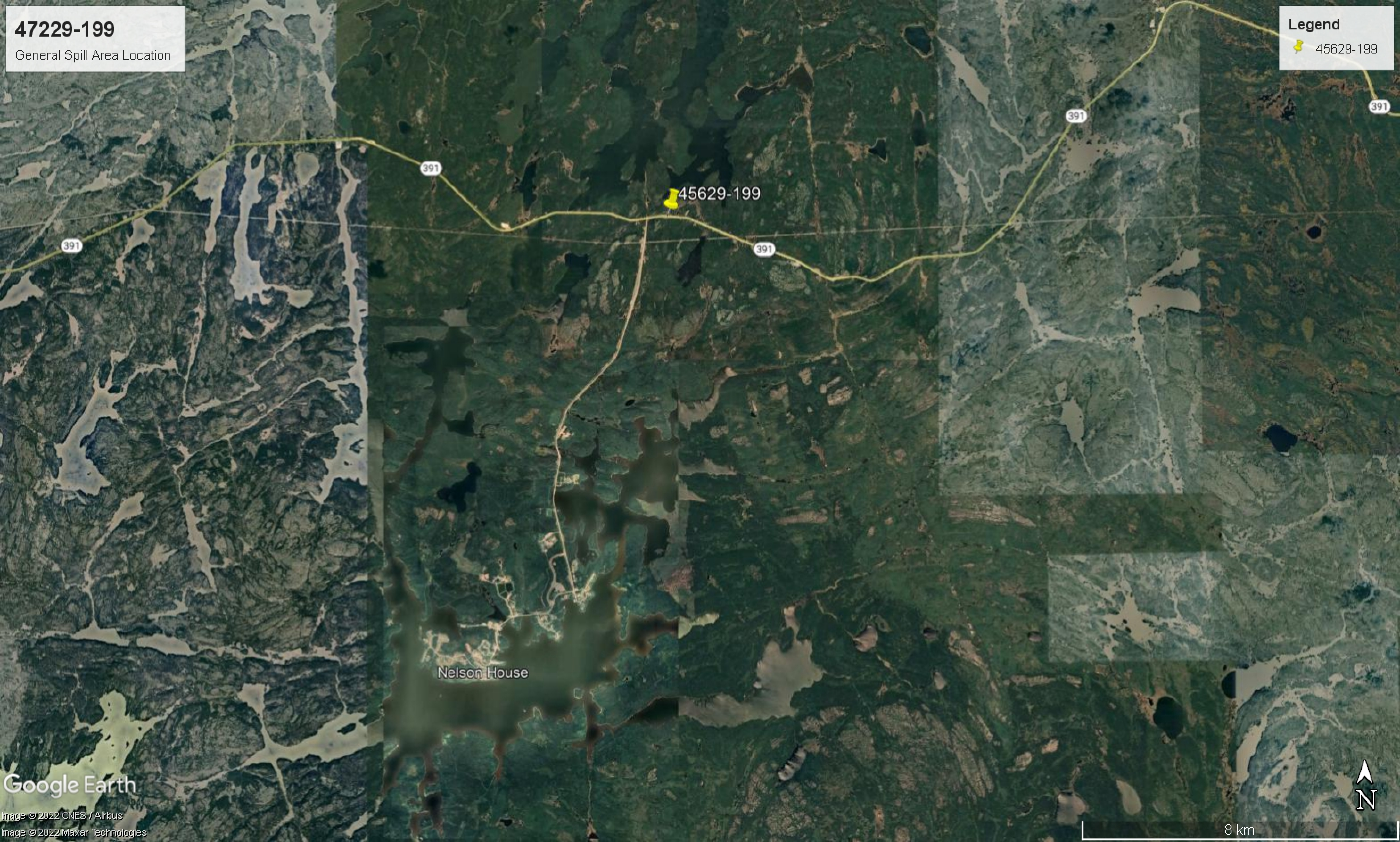
Attachments:
Site Location
Detailed Site Location
Proposed Excavation Details
Traffic Plan
Sampling Methodologies
Photos

Photo 1: Looking west across site showing incident prior to remediation.

Photo 2: Looking east across site showing potential impacted area covered by tarp.

SITE PHOTOGRAPHS

Manitoulin Group of Companies
2165 Brookside Blvd, Winnipeg, MB


47229-199
General Spill Area Location
Legend
45629-199
391
45629-199
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391
Nelson House
Google Earth
Image © 2022 CNES / Airbus
Image © 2022 Maxar Technologies
8 km
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47229-199
Detailed Spill Location
Legend
45629-199
45629-199
391
Provincial Rd 391
Provincial Rd 391
Google Earth
Image © 2022 Maxar Technologies
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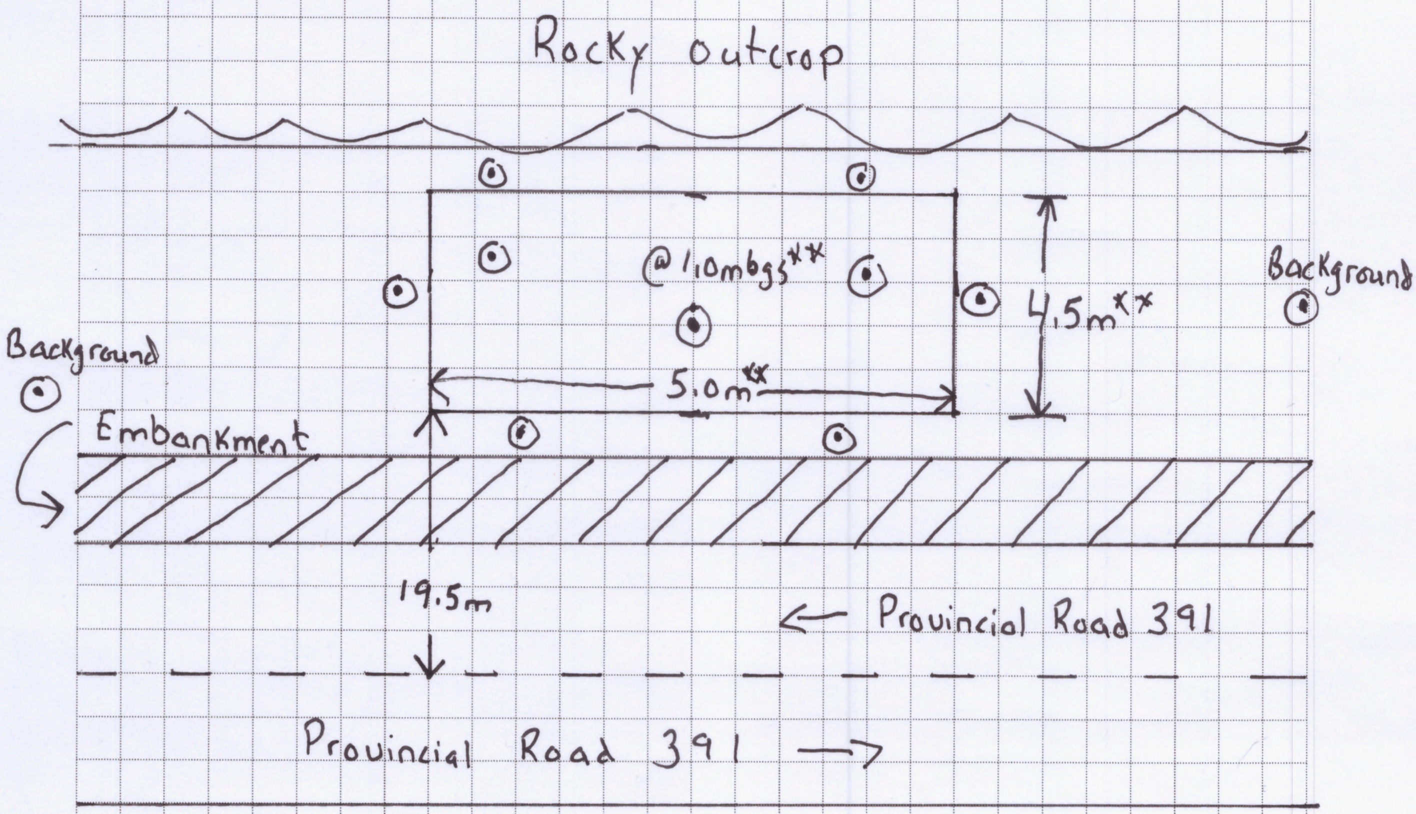
100 m

45629-199 Manitoulin Group Dec. 2/22 RAP Figure

*NTS
** Estimated Dimensions
⊙ = Sample Locations (Estimated)
Location: 55.887293° Lat
-98.812484° Long

N ↑



Manitoba Infrastructure and Transportation
TRAFFIC ENGINEERING

WORK ZONE TRAFFIC CONTROL MANUAL

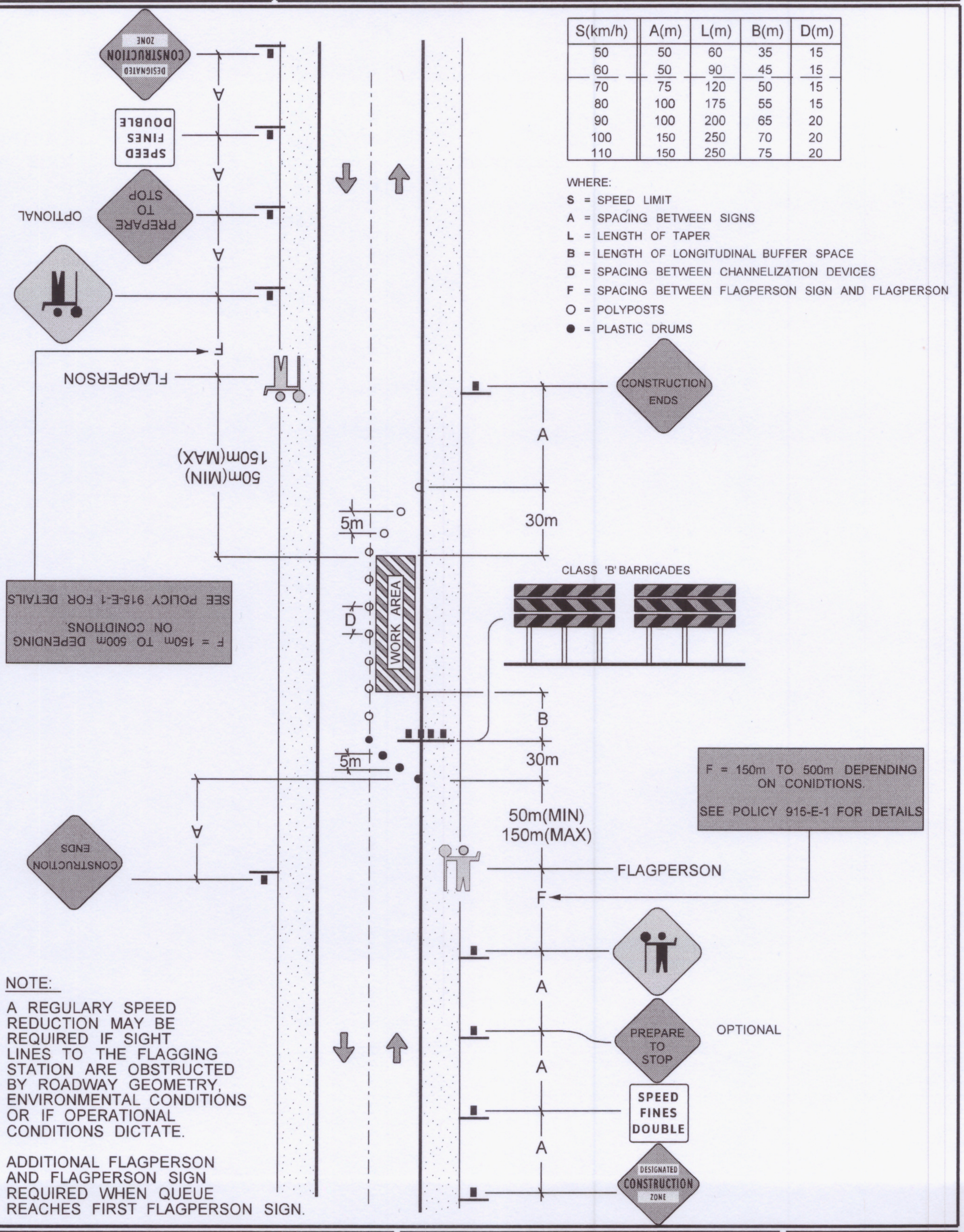
SINGLE LANE CLOSED

THIS LAYOUT APPLIES TO:
LONG DURATION (MORE THAN 4 HOURS)

TWO LANE ROAD - FLAGPERSON - VOLUME 500 - 1000 AADT

S(km/h)	A(m)	L(m)	B(m)	D(m)
50	50	60	35	15
60	50	90	45	15
70	75	120	50	15
80	100	175	55	15
90	100	200	65	20
100	150	250	70	20
110	150	250	75	20

WHERE:
S = SPEED LIMIT
A = SPACING BETWEEN SIGNS
L = LENGTH OF TAPER
B = LENGTH OF LONGITUDINAL BUFFER SPACE
D = SPACING BETWEEN CHANNELIZATION DEVICES
F = SPACING BETWEEN FLAGPERSON SIGN AND FLAGPERSON
○ = POLYPOSTS
● = PLASTIC DRUMS



NOTE:

A REGULARY SPEED REDUCTION MAY BE REQUIRED IF SIGHT LINES TO THE FLAGGING STATION ARE OBSTRUCTED BY ROADWAY GEOMETRY, ENVIRONMENTAL CONDITIONS OR IF OPERATIONAL CONDITIONS DICTATE.

ADDITIONAL FLAGPERSON AND FLAGPERSON SIGN REQUIRED WHEN QUEUE REACHES FIRST FLAGPERSON SIGN.

DATE OF ISSUE: 2015-05; REVISED:
http://www.gov.mb.ca/mit/contracts/workzone.html

APPROVED: Original Signed By Glenn Cuthbertson P. Eng.
DIRECTOR: TRAFFIC ENGINEERING BRANCH

TMP-915-20

STANDARD OPERATING PROCEDURE (SOP)

Soil Sample Collection

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1 INTRODUCTION

1.1 Objective

The objective of this SOP is to assist field staff in the collection of representative soil samples to accurately characterize site soil quality conditions. This information may help to document contaminant levels and if any risk to human health and the environment remains. Emphasis of this SOP will be for petroleum contaminated soil, as it is the bulk of the remedial work we do.

1.2 Documents

There are some references to Ontario, US EPA and ASTM documents. Much of what is in the Ontario documents is based on US EPA or CCME documents, which may also be the basis for guidance or regulatory documents in other Provinces or Territories. Please refer to the appropriate guidance or regulatory document that applies to the applicable jurisdiction.

1.3 Scope

Included in this discussion are procedures for obtaining representative samples, proper documentation of sampling activities and quality assurance/quality control (QA/QC) measures.

1.4 Method Summary

Soil samples may be recovered using a variety of methods and equipment. The select method is dependent on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Samples of near-surface soils may be easily obtained using a spade, stainless-steel spoon, trowel, or scoop. Sampling at greater depths may be performed using a hand auger; a power auger or drill rig; or, if a test pit is required, a backhoe.

All sampling devices should be:

1. Cleaned with phosphate free soap (usually Alconox™) and water.
2. Distilled water rinse
3. Final rinse using methanol.

It generally a good practise to wrap the cleaned equipment with clean aluminum foil until needed for use. Each sampler should be used for one sample only; however, dedicated tools may be impractical if there is a large number of soil samples required. In this case, samplers should be cleaned in the field using standard decontamination procedures as outlined the SOP for Equipment Cleaning.

2 SAMPLE PRESERVATION, CONTAINERS, HANDLING AND STORAGE

The chemical preservation of solids is not generally recommended, with the exception of samples collected for volatile organic analyses (as prescribed by the laboratory), which require field preservation in pre-filled methanol vials and syringe samplers supplied by the laboratory.

Refrigeration to below 10º C is necessary, if the samples are not submitted to the laboratory the same day as sampling. Storage and transportation on ice with temperatures lower than 10 C with minimal holding times is preferred to maximize sample integrity. Ice packs are not recommended, as they do not generally cool the sample bottles sufficiently and tend not to stay cool for long periods.

Sample jars should be provided by the laboratory, equipped with standard labels to be filled out during sample collection to reduce any potential labelling errors. All fields should be filled out with a non-smudging pen or permanent marker to avoid label issues. In some cases, it is good practice to also label the sample lid if there is a potential that the label may come off; however, most laboratories include labels that stay intact even when moisture is present.

3 POTENTIAL PROBLEMS AND EQUIPMENT

Potential problems with soil sampling include but not limited to:

- Cross-contamination.
- Improper sample collection.
- Inadequate sample volume.
- Lack of required preservation.
- Lack of proper refrigeration.
- Sample container breakage.
- Mislabelling.

Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and bottles, proper decontamination and proper sampling methodology. If dedicated sampling equipment use is not possible or practical, then proper decontamination of sampling equipment is necessary (see the Equipment Cleaning SOP). Improper sample collection is generally the result of the use of contaminated equipment; the disturbance of the matrix, resulting in compaction of the sample; and inadequate homogenization of the sample where required, resulting in variable, non-representative results. Specific advantages and disadvantages of the more common soil sampling equipment is presented in the table below:

Equipment	Use	Pros and Cons
Trowel, spoon or spatula	Soft surface soil	Relatively cheap and easily decontaminated. Not good for soils with stones and no finer materials. Loss of some volatile compounds is expected.

Equipment	Use	Pros and Cons
Spade or shovel	Medium soil, generally up to 0.3 metres in depth	Easy to decontaminate, can result in loss of some volatile compounds.
Coring device	Soft soils, generally up to 1 m in depth	Easy to use and can preserve soil core, but may be difficult to clean, unless disposable liners are used.
Split-spoon	Only limited by drill rig	Fairly common, preserves the soil core and reduces potential for volatile compound loss. Some methods also use acetate sleeves. Easy to decontaminate.
Hand auger	Soft soil, depth up to 1m	Easy to clean, but loss of volatile compounds is expected.
Continuous flight auger *(Not Recommended)*	Only limited by drill rig or operator (if portable auger is used)	Not recommended. The actual depth of sample is difficult to confirm. Soils from different depths can be mixed. Not easy to decontaminate because of the size of the augers. Loss of volatile compounds is expected.
Backhoe or excavator bucket	Good depth range, dependent on equipment used	Samples can be collected after visual assessment. More difficult to decontaminate due to size. Samples should be collected from face not in contact with the bucket. Loss of some volatile compounds is expected.

3.1 Sampling Support Equipment and Documentation List

Prior to conducting the work, the field staff should have:

- ☐ Personal protective equipment
- ☐ Sampling plan and sample location map
- ☐ Health and safety plan
- ☐ Sample bags for field screening
- ☐ Survey stakes or flags
- ☐ Cooler and ice
- ☐ Laboratory prepared sample containers, labels and chain of custody forms
- ☐ Sampling Equipment
- ☐ Field Forms
- ☐ Measuring tape(s) / wheel
- ☐ Field meters and calibrating gases
- ☐ Camera
- ☐ Equipment cleaning supplies
- ☐ Bubble wrap and Ziploc bags for sample jars

4 SAMPLE COLLECTION

The objective of representative sampling is to collect a sample or group of samples that adequately reflects site conditions.

4.1 Sampling Approaches

Some common sampling approaches are discussed in the subsections below.

4.1.1 Systematic Grid Sampling (i.e. Remedial Excavations)

Systematic grid sampling is likely the most common sampling approach for hydrocarbon remedial excavations. It involves the division of the area of concern into smaller sampling areas using a grid. This is generally the best approach when sampling from a remedial excavation, as it allows for field screening at select grids/intervals to determine the most suitable confirmatory samples to be collected for laboratory analyses. Samples are collected from the intersections of the grid lines, or "nodes" or in the centre. The origin and direction for placement of the grid should be selected by using an initial random point. The distance between nodes is dependent upon the size of the area of concern and the number of samples to be collected.

In general:

- Each sidewall of an excavation is divided up into 5 m grid sections.
- The excavation floor into 10 m grid sections.
- Samples from each grid are collected for field screening.
- The results of the field screening may be used to determine which samples should be collected for laboratory analyses.
- Generally, the "worst-case" field screening results are selected for laboratory analyses, assuming they are not all from the same general area. This approach generally provides relative confidence that if the laboratory analyses meets the clean-up standards, then the lower field screening results would also be expected to meet the clean-up standards.

As outlined in Ontario Regulation 153/04 (as amended), the **minimum** verification sampling frequency to be followed by Pario should be***:***

Table 4.1 – Minimum Sampling Frequency		
Excavation Floor Area (m^2)	**No. of Floor Samples to be Collected for Laboratory Analysis**	**No. of Wall Samples to be Collected for Laboratory Analysis**
<25	2	2
>25 - 50	2	3
>50 - 100	3	3
>100 - 250	3	5
>250 - 500	4	6
>500 - 750	4	7
>750 – 1000	5	8

Not intended to be used for excavations >4m in depth or >1000m²
Sidewall samples should not all be collected from the same wall

The additional comments or conditions are provided to guide sampling:

- These are minimum verification sampling numbers and does not include duplicate samples which are discussed below.
- Taking more than the minimum number of samples is good practice and provides more confidence.
- If there is a change in the soil type in sidewalls, then each layer should be sampled separately, increasing the overall minimum number of verification samples.
- If there is a more permeable seam or lens then this should be sampled separately.
- If the excavation is irregular in shape and has multiple areas, then each area is treated as separate and the minimum sample number should be applied to each separate area.

Confirmatory samples are collected from the fresh soil face following field screening to reduce any potential volatile compound loss, specifically for gasoline or other volatile compound contamination, unless directed otherwise by the Qualified Person (P.Geo., P.Eng.) overseeing the work.

If the suspected contaminant is heavier-end petroleum hydrocarbons such as lube oil, hydraulic oil, bunker C, transmission oil or mineral oil, that cannot be field screened with a PID, then visual staining, odour or sheen testing may need to be used to field screen samples for analyses. Where field screening is difficult, more verification samples may be warranted.

4.1.2 Judgmental Sampling

Judgmental sampling is based on the subjective selection of sampling locations relative to historical site information, on-site investigation (site walk-over), etc. There is no randomization associated with this sampling approach because samples are collected primarily at areas of suspected highest contaminant concentrations; therefore, any statistical calculations based on the sampling results would be unfairly biased.

4.1.3 Random Sampling

Random sampling involves the arbitrary collection of samples within a defined area. The arbitrary selection of sample locations requires each sample location to be chosen independently so that results in all locations within the area of concern have an equal chance of being selected. To facilitate statistical probabilities of contaminant concentration, the area of concern must be homogeneous with respect to the parameters being monitored. Thus, the higher the degree of heterogeneity, the less the random sampling approach will reflect site conditions

Other sampling methods are described in the Ontario Ministry of the Environment, Conservation and Parks (MECP) document entitled "Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario (December 1996).

4.1.4 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, spoons, shovels, and scoops. The surface material can be removed to the required depth with this equipment; stainless-steel or plastic scoops can then be used to collect the sample. This method can be used in most soil types but is limited to sampling near-surface areas.

Soil samples are collected using the following procedure:

1. Carefully remove the top layer of soil to the desired sample depth with the precleaned sampling equipment.
2. Using a precleaned, stainless-steel scoop, spoon, trowel, or plastic spoon, remove and discard the thin layer of soil from the area that came into contact with the shovel.
3. Transfer the sample into an appropriate container using a stainless-steel or plastic lab spoon or equivalent. If composite samples are to be collected, place the soil sample in a clean stainless-steel bowl and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Place the soil samples into labeled containers. Composite

samples are not to be used for contamination that is expected to have volatile organic compounds;

4. Volatile organic compound samples (i.e. for BTEX and F1 hydrocarbons) must be collected using a syringe or plunge type sample device and placed directly into a lab supplied vial with methanol preservative, being careful not to lose any methanol as this may bias results;
5. Ensure that a sufficient sample size has been collected for the desired analysis, as specified in the Sampling Plan; and
6. Decontaminate equipment between samples.

QA/QC samples should be collected as specified, according to the Work Plan, but as a minimum should consist of:

- One field duplicate (soil and/or water) for every 10 samples.
- One trip blank for every groundwater submission (when VOCs or BTEX are part of the analyses).
- One field blank every groundwater event (when VOCs or BTEX are part of the analyses) per sampling event.

4.1.5 Sampling at Depth with a Split-Spoon (Barrel) Sampler

The procedure for split-spoon sampling describes the extraction of undisturbed soil cores of 18 or 24 inches in length using a split-spoon sampler provided by the driller or a 48-inch core barrel with an acetate sampling sleeve. A series of consecutive cores may be sampled to give a complete soil column, or an auger may be used to drill down to the desired depth for sampling. The split-spoon is then driven to the desired sampling depth through the bottom of the augured hole and the core extraction, or in the case of a continuous sampler, driven from and to the desired depth.

A split-spoon sampling device may be used to collect information such as soil density, while a continuous sampler using a Geoprobe will not. All work should be performed in accordance with American Society for Testing and Materials (ASTM) D 1586-84, Penetration Test and Split Barrel Sampling of Soils.

The borehole logs will be used to record the length of the tube used to penetrate the material being sampled and the number of blows required to obtain this depth (in 6” intervals). Samples should be collected from the opened sampler immediately, placed in sample jars provided by the laboratory, and preserve or place the sample on ice. Follow proper decontamination procedures and deliver samples to the laboratory for analysis.

4.1.6 Test Pit/Trench Excavation

These relatively large excavations are used to remove sections of soils when detailed examination of soil characteristics (horizontal, structure, color, etc.) is required. This method also causes more surface disturbance and potentially damage to lawns or paved areas.

- Prior to any excavations with a backhoe, it is important to confirm that all sampling locations are clear of utility lines and poles (subsurface as well as above surface) by retaining a clearance contractor.
- Using the backhoe, a trench is dug to approximately 3 feet in width and approximately 1 foot below the cleared sampling depth. Place removed or excavated soils on plastic sheets, if necessary.
- Trenches greater than 4 feet deep should be sampled using the excavator and not entered by staff, unless the excavation is sloped or protected by a shoring system, as required by Occupational Health and Safety Act.
- A shovel is used to remove a 1 to 2-inch layer of soil from the vertical face of the pit where sampling is to be done, or from a fresh face of soil collected by the excavator bucket. Care should be taken to acquire a representative sample of the desired depth and not cave material.

In general, the material excavated should be placed back in the ground in a similar manner to that excavated. As a minimum, the soil should be bucket compacted as it is replaced to reduce potential settlement and mounded at the surface. In high traffic areas it may require proper compaction to avoid settlement.

4.1.7 Soil Stockpiles

Refer to section 36 of Schedule E of the Ontario Regulation or as required in other provinces.

Where soil excavated from, or under, the property and is stockpiled for possible potential reuse, the soil must be sampled and analyzed as follows, before it is reused:

- Samples of the soil from each stockpile to be reused must be collected and analyzed so as to characterize the contaminants (or lack thereof) present in the excavated soil;
- Samples must be selected for analyses and contaminants chosen for analyses on the basis of all available information obtained regarding the released material;
- Sampling locations must be chosen and uniformly distributed and representative of sampling collection throughout the stockpile;
- Samples must not be collected from the surface of a stockpile; and,
- Samples of soil from stockpiles must be collected and analyzed by an accredited laboratory, at or above the applicable minimum frequencies set out in Table 2 of Schedule E of the Regulation (see below).

Excerpt from Schedule E: Table 2 - Minimum Stockpile Sampling Frequency

Table 4.2 - Minimum Stockpile Sampling Frequency

Sample Frequency	Field Screening Samples	Samples for Laboratory Analysis
Less then $50m^3$	A minimum of 5 samples	A minimum of 1 sample
>$50m^3$ to $150m^3$	A minimum of 15 samples	A minimum of 3 samples
>$150m^3$ to $500m^3$	A minimum of 30 samples	A minimum of 5 samples
>$500m^3$ to $1500m^3$	A minimum of 50 samples	A minimum of 10 samples
>$1500m^3$	A minimum of 75 samples	A minimum of 15 samples

4.1.8 Imported Fill (Soil Imported to a Phase 2 Property)

The selection of parameters for analyses should be consistent with the material released, to support the imported fill is considered "clean". Importing fill from non-licensed pits or quarries is not recommended, as the source and potential contaminants of concern from the generating site may not be known. Special considerations for fill import should be discussed with the QP, prior to it being required.

The sampling requirements are as follows:

- At least one soil sample must be analyzed for each 160 cubic metres (m^3) of soil for the first 5,000 m^3 to be assessed at each source from which soil is being brought to the phase two property; and,
- At least one soil sample must be analyzed for each additional 300 m^3 of soil imported to the site.

4.1.9 Source Soil Sampling

A sample of the contaminated source soil is collected for laboratory analyses to determine and document the contaminants expected to be present at the source. For petroleum hydrocarbons the source sample will provide the laboratory chromatograph pattern of the contaminant released. This information will be used to assist in determining if other sample detections in the confirmatory soil samples may be present that are possibly related or unrelated to the loss. In some cases, several source samples may need to be collected if different impacts may have been lost in several areas of the site (i.e. diesel fuel lost at point of impact and motor oil lost at resting place of the vehicle). Where possible, collect samples that are believed to be highly impacted to confirm that the source exceeds the remediation criteria and to provide a clear chromatograph.

4.1.10 Background Samples

Background or "clean" samples are collected from an area upgradient from the contamination area and representative of the typical conditions. These samples provide a standard for comparison of onsite contaminant concentration levels and should only be collected if the material is deemed representative of the soil left on completion of the excavation. It is recommended that a minimum of two samples be collected in areas not influenced by the release and at depths representative of the excavation (i.e. shallow excavation, collect shallow background samples). Deeper excavations would likely require several background samples, including a sample at depth so a more direct comparison of the shallow and deeper sample results can be completed. It is recommended the background samples be submitted on hold at the laboratory (unless a pre-existing source of contamination is expected, then submit for analyses), and only run if some unusual detections in the confirmatory samples are identified and cannot be easily distinguished as unrelated to the loss (i.e. chromatograph pattern from the confirmatory samples identified something unusual and we need to determine if the background also has this characteristic). Hold times need to be considered with this approach, generally to be lab prepared and analysed within 14 days for volatiles. In

Ontario, comparison to the Ministry of the Environment, Conservation and Parks Table 1 Full Depth Background Site Condition Standards should suffice in confirming the limits of the excavation meet "typical" background concentrations without the need for analyses on background samples.

4.2 Sample Preparation

Representative sample collection includes sample quantity, volume, preservation, and holding time. Sample preparation refers to all aspects of sample handling after collection. How a sample is prepared can affect its representativeness. For example, homogenizing can result in a loss of volatile compounds and is inappropriate when volatile contaminants are the concern.

4.2.1 Sample Quantity and Volume

The volume and number of samples necessary for site characterization will vary according to the budget, project schedule, and sampling approach.

4.2.2 Sample Preservation and Holding Time

Sample preservation and holding times for the key sampling parameters are noted below, but should be confirmed by the laboratory:

Table 4.3 – Typical Sample Hold Times and Volume

	Holding Time		Minimum Volume	
Parameter	**Soil**	**Water**	**Soil**	**Water**
VOCs (including BTEX and F1)	14 Days	14 days	40ml methanol preserved vial	3 - 40ml vials, no headspace
PHCs (F2 to F4)	14 Days	40 days	120 ml	2 - 500 ml amber bottle
Semi Volatile Compounds PAHs	60 Days	14 days	120 ml	2 – 1 litre amber bottles
PCBs	Indefinite	14 days	120 ml	2 - 500 ml amber bottle
Metals	180 days	60 days	250 ml	120 ml plastic

Some sampling holding times and jar requirements are usually listed on the back of the laboratory chain of custody.

4.2.3 Removing Extraneous Material

When sampling, an effort should be made to discard materials in a sample that are not relevant for site or sample characterization (e.g., asphalt, glass, rocks, and leaves), because the presence of such materials may introduce an error in analytical procedures.

4.2.4 Homogenizing Samples

Homogenizing is the mixing of a sample to provide a uniform distribution of the contaminants. Proper homogenization is intended to provide samples are representative of the total soil sample collected. All samples to be composited or split should be homogenized after all aliquots have been combined. Do not homogenize samples for volatile organic compound or light-end (BTEX and F1 fraction) hydrocarbon analysis.

4.2.5 Compositing Samples

Compositing is the process of physically combining and homogenizing several individual soil aliquots of the same volume or weight. Compositing samples provides an average concentration of contaminants over a certain number of sampling points. As mentioned, samples for volatile organic compounds (specifically VOCs and/or BTEX/F1 hydrocarbons) should not be composited due to volatile compound loss.

4.2.6 Splitting Samples

Splitting samples is performed when multiple portions of the same samples are required to be analyzed separately. Fill the sample containers simultaneously with an alternate volume of the sample so each jar has similar material within each.

4.3 Post-Sampling

4.3.1 Field

Decontaminate all equipment according to the applicable Equipment Cleaning SOP.

4.3.2 Office

Organize field and logging notes and transfer the appropriate forms to the electronic file folder.

4.4 Sampling Documentation

4.4.1 Sample Labelling (Proposed for Discussion)

The following sample identifications are recommended for simplicity and consistency in Pario reporting. While deviations or additions to the labelling may be necessary, such as adding reference to "D" for duplicate or adding depths or dates, adhering to the general standard reference protocol is recommended.

- Source and/or TCLP – source sample
- BG-1 – background sample one
- BH1 – borehole one (BH1-1 with the additional 1 denoting the first sample collected vertically)
- MW1 – monitoring well one
- TP1 – test pit sample one (TP1-1 with the additional 1 denoting the first sample collected vertically, TP1-2 etc.)
- AS-1 – assessment sample one
- N-1 – north wall sample one
- W-2 – west wall sample two
- S-3 – south wall sample three
- E-4 – east wall sample four
- F-5 – floor sample five

- SW-UP – Surface water sample collected upgradient of the loss (SW-Down for downgradient etc.)

For samples collected at various depths on the walls of a completed excavation can have a letter added to denote the vertical profile sampling (i.e. N-1A collected near surface on north wall, N-1B, second sample collected vertically beneath N-1A etc.). Sample dates, depths, field screening results, observations can be recorded on the applicable field excavation log.

4.4.2 Soil Sample Label

The soil sample label is filled out prior to collecting the sample and should contain the following:

1. Site name or identification.
2. Sample location and identifier.
3. Date samples were collected in a day, month, year format (e.g., 03 Jan 88 for January 3, 1988).
4. Time of sample collection, using 24-hour clock in the hours:minutes format.
5. Sample depth interval.
6. Analysis required.
7. Sampling personnel.

All labelling information should be filled out in its' entirety prior to submission to the lab.

4.4.3 Logbook

A bound field notebook or standard Pario field form (i.e. excavation or borehole log form) will be maintained by field personnel to record daily activities, including sample collection and tracking information. A separate entry will be made for each sample collected. These entries should include information from the sample label and a complete physical description of the soil sample, including texture, color (including notation of soil mottling), consistency, moisture content, cementation, and structure. Specific field forms should be used, dependent on the sampling required.

4.4.4 Chain-of-Custody

Use the chain-of-custody form to document the types and numbers of soil samples collected and logged. All applicable fields must be populated.

4.5 Sampling Design

- A Sampling Plan should be implemented before any sampling operation is attempted, with attention paid to contaminant type and potential concentration variations.
- The sampling plan shall be discussed with a Qualified Person (P.Geo. or P.Eng.), prior to conducting to ensure the objectives of the sampling plan are met.
- Any of the sampling methods described here should allow a representative soil sample to be obtained, if the Sampling Plan is properly designed.

- Consideration must also be given to the collection of a sample representative of all horizons present in the soil. Selection of the proper sampler will facilitate this procedure.
- A stringent QA Project Plan should be outlined before any sampling operation is attempted. This should include, but not be limited to, properly cleaned samplers and sample containers, appropriate sample collection procedures, chain-of-custody procedures, and QA/QC samples.

5 DATA VALIDATION

5.1 Quality Assurance/Quality Control Samples

QA/QC samples are used to identify error due to sampling and/or analytical methodologies and chain-of-custody procedures.

5.1.1 Field Duplicates (Replicates)

Field duplicates are collected from one location and treated as separate samples throughout the sample handling and analytical processes. These samples are used to assess total error for critical samples with contaminant concentrations near the action level. **Generally, duplicates or replicates for soil should be collected for every 10 samples as a minimum.** Duplicates help validate data in the event the file may go to subrogation or potential litigation.

5.1.2 Rinsate (Equipment) Blanks

Rinsate blanks are collected by pouring analyte-free water (i.e., laboratory de-ionized water) on decontaminated sampling equipment to test for residual contamination. These samples are used to assess potential cross-contamination due to improper decontamination procedures. These should be used when significant sampling and equipment cleaning is conducted.

5.1.3 Performance Evaluation Samples

Performance evaluation samples are generally prepared by a third party, using a quantity of analyte(s) known to the preparer but unknown to the laboratory. The percentage of analyte(s) identified in the sample is used to evaluate laboratory procedural error.

5.1.4 Matrix Spike/Matrix Spike Duplicates (MS/MSDs)

MS/MSD samples are spiked in the laboratory with a known quantity of analyte(s) to confirm percent recoveries. They are primarily used to check sample matrix interferences.

5.1.5 Field Blanks

Field blanks are prepared in the field with certified clean sand, soil, or water. These samples are used to evaluate contamination error associated with sampling methodology and laboratory procedures. Generally, for water sampling and utilize a contaminate free water.

5.1.6 Trip Blanks

Trip blanks are prepared prior to going into the field using certified clean sand, soil, or water. These samples are used to assess error associated with sampling methodology and analytical procedures for volatile organic compounds. One trip blank per groundwater sampling event is recommended for analyses to confirm no cross-contamination was introduced during transport to the laboratory.

6 HEALTH AND SAFETY

Use appropriate safe work practices for the type of contaminant expected (or determined from previous sampling efforts. Refer to the Pario Health and Safety Plan, or site-specific Health and Safety Plan for more details.

7 REFERENCES

United States Environmental Protection Agency (EPA – Revised 2014) Operating Procedure – Soil Sampling – SESDPROC-300-R3.

United States Environmental Protection Agency (EPA – 2002) Guidance on Choosing a Sampling Design for Environmental Data Collection - For Use in Developing a Quality Assurance Project Plan - EPA QA/G-5S.

Ontario Regulation 153/04: Records of Site Condition – Part XV.1 of the Act, under the Environmental Protection Act, R.S.O. 1990, c. E19, Part IX SCS, Sections 34 to 43.1 (O.Reg. 153/04).

Guidance on Sampling and Analytical Methods for Use at Contaminated Sites in Ontario, December 1996.