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29 January 2026

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RE: Inuvialuit Water Board Water Licence N5L8-1848 Quality Assurance/Quality Control Plan – Unipkat I-22 Soil Remediation

The attached Quality Assurance/Quality Control Plan (QA/QC Plan) has been prepared by WSP Canada Inc. (WSP) on behalf of Shell Canada Limited (Shell) in accordance with the Annex 1, Part B sampling and analysis requirements in Water Licence N5L8-1848. The Licence, effective 14 November 2025, was issued to Shell for the remediation of the former Unipkat I-22 site approximately 115 kilometres northwest of Inuvik, Northwest Territories.

The QA/QC Plan outlines the actions to be taken by Shell, WSP and their subcontractors during the remediation project, including but not limited to the Annex 1 surveillance network monitoring program. Should you have any questions or comments, please do not hesitate to reach out to the undersigned or the WSP contacts listed in the attached document.

Sincerely,

Kyle Thompson
Sr. Program Manager, Legacy Soil & Groundwater Projects
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REPORT

Quality Assurance and Quality Control Plan

Former Unipkat I-22 Wellsite, Inuvialuit Settlement Region, Northwest Territories

Submitted to:

Shell Canada Limited

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Submitted by:

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1 Electronic Copy – Shell Canada Limited

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Acronyms and Abbreviations

AGAT	AGAT Laboratories
AST	aboveground storage tank
BTEX	benzene, toluene, ethylbenzene, xylenes
$CaCO_3$	calcium carbonate
CALA	Canadian Association for Laboratory Accreditation
CCME	Canadian Council of Ministers of the Environment
CoA	certificate of analysis
COC	chain-of-custody
CoC	contaminant of concern
CRM	certified reference material
CWS	Canada-Wide Standard
DM	Data Manager
DO	dissolved oxygen
EC	electrical conductivity
eCOC	electronic chain-of-custody
EDD	electronic data deliverable
EL	Environmental Lead
EPA	US Environmental Protection Agency
EQuIS	EQuIS Professional
ETC	enhanced thermal conduction
FEP	field execution plan
g	gram(s)
GCMS	gas chromatography-mass spectrometry
GeoVerra	Mackenzie Delta Geomatics Ltd.
GNWT	Government of Northwest Territories
HCl	hydrochloric acid
HNO_3	nitric acid
ISO	International Organization for Standardization
IWB	Inuvialuit Water Board
km	kilometre

m	metre
m^3	cubic metre
mbgs	metres below ground surface
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mL	millilitre
$NaHSO_4$	sodium bisulphate
n/a	not applicable
NGR	no guideline required
NWT	Northwest Territories
ORP	oxidation-reduction potential
PAH	polycyclic aromatic hydrocarbon
PC	Project Coordinator
PD	Project Director
PDF	portable data file
PHC	petroleum hydrocarbon
PM	Project Manager
QA	Quality Assurance
QC	Quality Control
RAP	remedial action plan
RDL	reportable detection limit
RPD	relative percent difference
Shell	Shell Canada Limited
SIR	sample inspection report
SM	Standard Method
SME	Subject Matter Expert
SQO	Soil Quality Objective
SS	Site Supervisor
SWI	specific work instruction
Taiga	Taiga Environmental Laboratory
TEP	task execution procedure

TPH	total petroleum hydrocarbons
TSS	total suspended solids
TTZ	target treatment zone
VOC	volatile organic compound
WSP	WSP Canada Inc.
°C	degrees Celsius
>	greater than
<	less than
≤	less than or equal to
µg/L	micrograms per litre
%	percent

1.0 PROJECT MANAGEMENT

1.1 Introduction

Annex 1 of Water Licence N5L8-1848 issued to Shell Canada Limited (Shell) by the Inuvialuit Water Board (IWB), effective 14 November 2025 (IWB 2025), establishes seven stations as part of a surveillance network in which water quality is to be monitored during remediation of the former Unipkat I-22 wellsite (the Site), in the Mackenzie River Delta, approximately 115 kilometres (km) northwest of Inuvik, Northwest Territories (NWT) (Figure A1, Appendix A). Part B of Annex 1 outlines the sampling and analysis requirements for the surveillance network, including that a Quality Assurance/Quality Control (QA/QC) Plan must be submitted and approved by an IWB-appointed Taiga Environmental Laboratory (Taiga) Analyst a minimum of 15 days prior to the onset of project activities. Project activities are assumed to include the remedial works as well as any activities executed prior to and thereafter in which site data are collected.

This QA/QC plan (Plan) details the organization, objectives, activities and QA/QC procedures associated with the site activities. Per the recommendation of the Canadian Council of Ministers of the Environment (CCME 2016a), this Plan has been developed in general accordance with US Environmental Protection Agency (EPA) guidance (2001, 2002, 2023).

1.2 Project Overview

Unipkat I-22 was a natural gas well initially drilled in 1972 and 1973 for exploratory purposes (IEG 2009). Historical site features included a drilling waste sump, camp sump, flare pit and an aboveground storage tank (AST) and drilling mud additives storage areas. Drilling at the Site was completed in March 1973, and a month later, the drilling waste sump was capped. After the initial cessation of site activities, the well was re-entered in February 1996 for re-abandonment and decommissioning.

In thawed conditions, from approximately May to late October every year, the Site is accessible by boat or barge on the Mackenzie River (and various tributaries) from Aklavik or Inuvik, NWT. In frozen conditions, weight- and speed-restricted travel is permitted on a portion of the annual Aklavik Ice Road between Inuvik and Aklavik, after which the Site is accessed by a 110 km private ice road.

Environmental field investigations were initiated at the Site in 1975 by the Disposal of Waste Fluids from Petroleum Exploration Drilling in the Canadian Arctic industry/government working group and then again in 2002 as part of Shell's internal Mackenzie Delta Historical Sumps program (IEG 2009). Stage 1 remediation was conducted at the Site in 2011 (IEG 2012). Soil with concentrations of petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), metals (barite-barium) and salinity parameters above applied guidelines was excavated to a maximum depth of 4.5 metres below ground surface (mbgs) from the camp sump, drilling waste sump and flare pit and transported to a temporary storage cell in Inuvik before being disposed of at the CCS Northern Rockies Landfill in Fort Nelson, British Columbia. The excavations were backfilled using materials sourced from point bar material on the southern side of the Arvoknar Channel.

Over the years, significant erosion has been observed, with the shoreline of Arvoknar Channel encroaching up to 65 metres (m) north into the Site, likely the result of annual freeze and thaw and natural stream channel movement typical of deltaic environments. The historical camp sump and flare pit have been inundated by the river channel as a result of riverbank erosion since the time of the historical remedial activities (see Figure A2). Review of historical data as part of the development of the remedial action plan (RAP, WSP 2025) approved under IWB Water Licence N5L8-1848 identified residual PHCs as well as barite-barium at concentrations above site-specific risk-based soil quality objectives (SQOs) in both the remaining drilling waste sump and adjacent historical storage area.

The extent of soil with concentrations of contaminants of concern (CoCs) greater than site-specific SQOs is presented in Figure A2 (Appendix A). The barite remediation will be initiated, per the RAP (WSP 2025), beginning in winter 2026, with the soil excavated and hauled to an approved disposal facility via ice road. Additional site work, including thermistor installation and additional geotechnical assessment for remedial design, will also be completed at that time.

The PHC remediation will be completed in winter 2026/2027. The soil will be excavated from the target treatment zone (TTZ) and treated via enhanced thermal conduction (ETC). This technology, patented by ICG Thermal Inc. of Calgary, Alberta, involves transfer of a heated airstream (approximately 300 to 450 degrees Celsius [°C]) to PHC-contaminated soil to volatilize and subsequently destroy CoCs. Treatment will occur in multiple soil cells constructed in a single area of the Site, with the heat supplied via a series of diesel burners.

Soil samples will be collected from the extents of each area excavated and analyzed for barite-barium and PHCs, as applicable. ETC-treated soil will be analyzed for PHCs to confirm compliance with SQOs, cooled and quenched as necessary to mitigate permafrost degradation and returned to the excavated footprint.

1.3 Project Organization

WSP Canada Inc. (WSP) is Prime Contractor for the site remediation and is as such responsible for all aspects of the work, including project management, on- and off-site construction management, and environmental data collection and management. Types of data to be generated during the project include:

- geotechnical data to assist in remedial design;
- soil quality data to confirm the effectiveness of the remedial action in meeting SQOs;
- water quality data to verify performance of the on-site water treatment plant in meeting discharge requirements; and
- survey data to document as-built conditions, including borehole and thermistor locations, construction site setup and the final extent of remedial action.

Key project personnel, responsible for the quality of the data collected, managed and reported during the remediation are identified in the sections that follow. Several of the positions are noted to be shared by multiple personnel, who will be working on site on a rotational basis (e.g., two weeks on site, two weeks off site). Should the listed personnel be unavailable due to unforeseen circumstances, additional project staff will be allocated to the necessary roles. All personnel will be trained for their roles and responsibilities, per WSP policy, and will be required to adhere to this QA/QC Plan.

1.3.1 IWB Executive Director

The IWB Executive Director, Mardy Semmler, is responsible for managing compliance with the terms and conditions of Water Licence N5L8-1848, as a means of ensuring effective water management practices during the remediation. Mardy is also responsible for review and approval of this QA/QC plan.

1.3.2 IWB-Appointed Inspectors

Lloyd Gruben, a water resource officer with the Government of Northwest Territories (GNWT), will be on site during the remediation to verify that the work proceeds in accordance with the terms and conditions of Water Licence N5L8-1848. Lloyd will report his findings to the IWB Executive Director.

1.3.3 Taiga Analyst

Taiga operates within the GNWT Department of Environment and Climate Change. A Taiga analyst will be appointed by the IWB to review this QA/QC and provide an approval recommendation to the IWB Executive Director.

1.3.4 Shell Project Manager

Kyle Thompson is Shell’s Project Manager (PM). He holds overall project execution responsibility, including sign-off on regulatory submissions/communication on behalf of Shell.

1.3.5 WSP Project Director

The WSP Project Director (PD) is Patrick Kalita. He has overall responsibility for meeting WSP’s project objectives on behalf of Shell.

1.3.6 WSP Project Manager

Joe Hyrich is the PM and is primarily responsible for management of the technical scope of work and permit compliance, in coordination with the Remediation Subject Matter Expert (SME) and Environmental Leads (ELs) in the field.

1.3.7 WSP Remediation SME

The remediation SME, Andrea Hachkowski, leads all technical aspects of the project (i.e., technical QC lead). She has the overall responsibility for achieving remedial endpoints (i.e., SQOs) in accordance with the RAP (WSP 2025) and meeting WSP quality standards.

1.3.8 WSP Project Coordinators

Project coordinators (PCs) for the project will include Ali Barron (office), Ibrahim Abboud (Site) and Elizabeth Lenkic (Site). Their role will be to coordinate internal reviews and assist in project management activities, as necessary.

1.3.9 WSP QA Manager

The QA Manager is Priyanka Patel. She has no direct involvement in day-to-day project activities; her main role is in the resolution of QA disputes, as necessary. Specific duties include (as necessary):

- directing QA reviews during various project phases;
- directing review of QA plans and procedures; and
- providing technical QA assistance to project staff.

1.3.10 WSP Site Supervisor

The WSP Site Supervisor (SS) will be a rotating role, filled by Lisa Switzer, Blair Haeser, and Navdeep Singh. The SS’s primary responsibility in implementing the project is coordinating and committing resources to meet project objectives and requirements, in terms of financial and scheduling metrics. The SS coordinates with the environmental lead (EL) to achieve the technical remedial objectives. Specifically, the SS will:

- achieve project objectives and develop a detailed work plan and schedule;
- establish project procedures to address specific project needs;
- acquire and apply corporate resources, as needed, to comply with the project budget and schedule;
- review and analyze task performance against planned schedule and budget;
- assess, identify and meet ongoing project or task staffing needs;
- coordinate Site and health, safety, security and environment orientations for project staff;
- train and oversee local staff;
- manage subcontractors;

- oversee operation of the on-site water treatment plant;
- work with IWB-appointed inspectors to comply with permit and licensing requirements; and
- monitor and direct on-site team members.

1.3.11 WSP Environmental Lead

The EL will also be a rotating role, shared by Marc Waddingham, Shane Fraser and others as appointed/needed (one EL on site at a time, with multiple field technicians and local hires). The EL is responsible for in-field technical execution of the project and meeting remedial objectives, per the RAP (WSP 2025) and permit documents. Specifically, the EL will:

- liaise with the SS to coordinate on-site activities;
- train and oversee WSP field technicians and local staff;
- ensure that technical field work is carried out in accordance with industry standards and approved standard operating procedures (task execution procedures [TEPs], field execution plans [FEPs] and specific work instructions [SWIs]);
- implement field QA/QC procedures;
- coordinate and execute baseline work, including monitoring well decommissioning;
- coordinate and execute air monitoring program during remediation;
- coordinate and execute collection of confirmatory soil samples in both the TTZ as well as from the treated soil stockpiles;
- coordinate and track sample shipments to the laboratory;
- liaise with the laboratory project manager, WSP Environmental PM, Data Quality Manager and Remediation SME to resolve analytical data quality issues;
- communicate with Remediation SME regarding to technical changes to the project, when the situation arises; for example, treatment deficiencies/compliance with SQOs and changes in the TTZ based on achievement of SQOs;
- work with IWB-appointed inspectors to comply with permit and licensing requirements; and
- review site reports (field notes, monitoring reports, etc.) prior to issuance to the WSP PM, PD and Remediation SME.

1.3.12 WSP Data Manager

The WSP Data Manager (DM) is Anita Colbert. She will be responsible for laboratory data tracking and overseeing data validation. Specific duties include:

- working with the ELs, as necessary, to schedule laboratory analyses;
- overseeing sample and data tracking from the point-of-field collection to entry into the project database;
- completing data validation and flag irregularities or non-compliances to the Remediation SME for decision-making; and
- overseeing production of data tables.

1.3.13 WSP Procurement Specialist

Manpreet Sidhu will be responsible for issuing all subcontracts needed to execute the project, including the analytical laboratory.

1.3.14 Analytical Subcontractor Project Manager

Laboratory analyses will be performed by AGAT Laboratories (AGAT) in Edmonton, Alberta. Mary-Grace Unera is the PM for AGAT. Mary-Grace will be responsible for coordinating and ensuring laboratory analyses are completed on the designated RUSH/100% turnaround time or other schedule specified by WSP; supervising in-house chain-of-custody (COC), accepting requirements as outlined herein, and overseeing laboratory data review and the preparation of certificates of analyses (CoAs). She will also initiate immediate communication with the WSP PM, Remediation SME and DM to provide information about transport issues and deficiencies at sample receipt (e.g., mislabelled sample containers, COC discrepancies, deficiencies in sample volumes, broken sample containers, etc.), or analytical issues such that decisions and/or corrective action can be taken (e.g., resampling).

1.3.15 AGAT QA Manager

AGAT’s QA managers will have the responsibility to:

- oversee laboratory QA procedures;
- oversee QA/QC documentation included in the CoAs;
- select and implement any necessary corrective actions;
- ensure adherence to applicable standard operating procedures and complying with this Plan; and
- approve final analytical reports.

Laboratory QA will be performed by the following staff:

- Operations Manager - Jarrod Roberts
- Organic Laboratory Manager – Laarni Hafso
- Inorganic Laboratory Manager – Shanna Mills
- Technical Reviewers – Melinda Guay, Quihong Dong

Depending on the analyses included in a particular shipment, multiple AGAT staff may authorize CoA transmittal to WSP.

The project teams and lines of reporting are displayed in Figure 1.

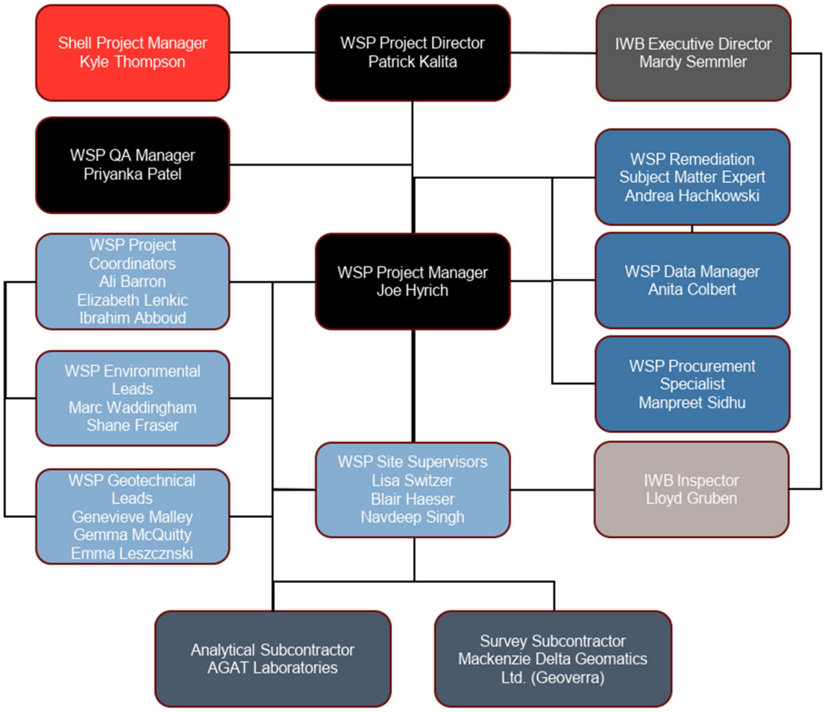

Figure 1: Project Quality Organizational Chart

1.4 Project Schedule

The estimated project schedule is summarized in Table 1, below.

Table 1: Proposed Site Work Schedule

Project Activity	Estimated Timeline
Engagement and consultation	Ongoing
Regulatory permitting application and approvals	April to December 2025 (completed pending potential amendments to scope)
2026 winter work planning	October to December 2025 (completed)
Ice road construction	January to February 2026 (in progress)
FEP, TEP, SWI Preparation and WSP Review	December 2025 to late-January 2026
FEP, TEP, SWI Shell Review	Late January to early February 2026
Geotechnical investigation, thermistor installation	February to March 2026
Soil barite remediation (off-site hauling and disposal – south excavation prioritized; north excavation will be completed if time allows)	March 2026
Demobilization	Mid-April 2026
Soil PHC remediation detailed design and planning	April to September 2026
Soil PHC remediation pre-mobilization of equipment (via barge)	September 2026
Ice road construction	December 2026

Project Activity	Estimated Timeline
Soil PHC remediation (and north barite excavation, as necessary)	January 2027 to April 2027
Demobilization	April 2027
Post-remedial monitoring and closure activities	July 2027 to licence closure

In February 2026, shortly after ice road construction, additional geotechnical investigation will be completed, including limited collection of soil samples for barium/barite analysis (for off-site disposal acceptability) and PHC analysis for ETC bench testing. Soil with barium/barite concentrations exceeding SQOs will be excavated from the designated area nearest Arvoknar Channel (Excavation A, Figure A2) and transported off site for disposal in March 2026. If time allows, the northern barite excavation (Excavation B) will also be completed, immediately thereafter. Otherwise, it will be completed in conjunction with the PHC remediation (Excavation C) in winter 2027. In conjunction with this work, thermistors will be installed to begin monitoring baseline ground temperatures and piles associated with historical infrastructure (drill rig, fuel storage) will be removed to facilitate the PHC remediation, scheduled for 2027.

1.5 Data Quality Objectives and Measurement Performance Criteria

1.5.1 Data Quality Objectives

The purpose of sampling various site media is to evaluate the effectiveness of the proposed remedial action in achieving SQOs and to confirm that the executed remedial action does not have a negative impact on the environment. Ultimately, laboratory analytical results will be used as a basis for the success of the project. However, it is also imperative that high-quality field data be collected. Table 2 summarizes the types of laboratory and field screening data to be obtained during the project.

Table 2: Project Analytical Data Types

Media	Field Screening Data[a]	Scheduled Laboratory Analyses
Soil	Soil vapour headspace concentrations	PHC Fraction F2, Type B Hydrocarbons, barite-barium
Surface water from stations 1848-1 to 1848-7, as specified in Annex 1B of Water Licence N5L8-1848[b]	Temperature, turbidity, pH, DO, ORP, EC	BTEX, acenaphthene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene, pyrene, benzo[a]anthracene, benzo[a]pyrene, TPH, nitrate, nitrite, pH, total lead, total mercury, TSS, hardness

Notes:

[a] Additional information regarding field screening and sampling is provided in the project FEPs.

[b] See Sections 1.7.2.2 and 2.1.2 for further information.

BTEX – benzene, toluene, ethylbenzene, xylenes

DO – dissolved oxygen

EC – electrical conductivity

ORP – oxidation-reduction potential

TPH – total petroleum hydrocarbons

TSS – total suspended solids

SQOs are discussed in Section 2.1.1. Maximum concentrations for surface water analytes are provided in Section 2.1.2. These maximum concentrations were specified by IWB in Water Licence N5L8-1848. Note that sample station 1848-1 is the water intake in Arvoknar Channel (for non-potable use during the project). Multiple samples may be collected from this location (in different seasons, as necessary, based on project duration) to evaluate baseline water quality. It is possible that concentrations of some analytes, notably TSS, may be naturally greater than the specified maximum concentrations to preserve water quality in Arvoknar Channel (i.e., the potential receiving body for discharge water from stations 1848-2 to 1848-7). If this is found to be the case, a variance request may be submitted to IWB to adjust the discharge criteria, consistent with natural water quality.

Sampling guidance, including collection of QC samples, has been developed to limit the probability of sampling and measurement errors. Mitigation of field errors will occur primarily through following WSP standard operating procedures. Sampling techniques and planned analytes are also discussed in detail in the FEPs developed for each field task. Throughout the project, QC samples will be analyzed to verify the accuracy and precision of the data against the laboratory's established control limits. Where results are outside of the control limits, they will be noted in the CoA and the reliability of the data will be assessed through WSP's data validation process. Laboratory data that are considered unreliable after validation will be assessed by the Remediation SME. Corrective action will be taken, as needed, to close data gaps.

Site-specific SQOs were calculated as part of RAP (WSP 2025) development. The calculations were based on an exposure assessment which identified the following operable exposure pathways and receptors.

Human Health

- Direct contact (ingestion/dermal absorption).

Ecological

- Wildlife and avifauna food and soil ingestion.

Other discharge limits and requirements have also been specified within Water Licence N5L8-1848.These will be discussed, along with the SQOs, in Section 2.

1.5.2 Measurement Criteria

Several checks have been built into the project, including QC standards, senior/SME review and management controls. The laboratory specifies QC standards to be applied to the data, and if not met, the data are suitably qualified. The analytical data and QC results are verified by the bench chemist and laboratory QA manager prior to release to WSP.

Documentation related to quality standards for the project will be drafted and reviewed internally by WSP staff with appropriate technical expertise. These documents will then be reviewed and approved by Shell.

During field activities, the ELs will supervise the work to verify that TEPs and FEPs are followed.

1.6 Training Requirements and Certifications

The team members listed in Section 1.3 were selected based on having the necessary experience and technical skillset to execute the project. AGAT will meet the project-specific requirements as approved by the IWB-appointed analyst.

1.7 Documentation

1.7.1 Field Sampling

The field team will maintain a daily record of general site conditions, significant events and observations, as well as data collected during sampling. A field record will be initiated at the start of field activities and maintained thereafter to record the findings of all sampling events. This will be supplemented by various field reports, including, but not limited to:

- surface water monitoring and sample collection log;

- equipment inspection log;
- field excavation wall (soil) log;
- field excavation base (soil) log;
- treated soil stockpile hand auger/test pit sample log;
- treated soil stockpile sampling figure;
- field excavation site plan;
- oxidizer air quality monitoring log;
- site perimeter air quality monitoring log; and
- thermistor download tracker.

All documents generated during field activities are controlled documents in the project SharePoint file and will be uploaded daily. Data collected digitally will be uploaded directly to the WSP databases by the PC daily, with portable data file (PDF) data backups saved in the SharePoint file. Data will not be deleted from tablets until confirmation of upload is received from the DM and PC.

1.7.2 Sample Identification

WSP has developed nomenclature that will be used to label each sample collected at the Site, including duplicates and blanks. Each sample label will consist of a site identifier, location identifier and sample number. The EL will maintain a listing of sample identifiers on a tracking log. Each WSP sample label will consist of two components:

1) Letter code corresponding to the sample medium/type/location. For example:
    a. EXA to EXC – confirmatory soil sample from Excavations A through C, per Figure A2.
    b. SP – confirmatory sample from treated soil stockpile.
    c. DW – discharge water samples, from the various sources specified in Section 1.7.2.2.
    d. TB – trip blank.
    e. FB – field blank.
    f. EB – equipment blank.
2) Sequential numbering.

Sample numbers will be reserved for the various media sampled and will not be repeated at a particular sampling location or medium. To minimize bias during laboratory analysis, duplicate samples will not be distinguished within the sample numbers and will be tracked via the sample tracking and data management systems. However, the site identifier and two letter media code will be applied.

1.7.2.1 Soil

The naming convention for soil samples will contain additional elements, as follows:

Excavations

- Each of Excavations A through C, shown in Figure A2, will be staked at the appropriate lateral sampling intervals, based on the area and in accordance with the Remedial Excavation and Confirmatory Soil

Sampling FEPs. The naming convention for soil samples collected from Excavations A through C will additionally indicate, for wall samples:

- which side wall the sample was collected from, in terms of direction (i.e., “NW”, “EW”, “WW”, “SW” for the north wall, east wall, west wall and south wall, respectively);
- the lateral station at which the wall sample was collected; and
- the sample depth.

The naming convention for side wall samples is depicted graphically in Figure 2.

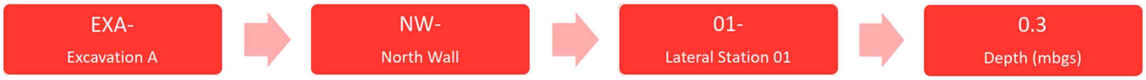

Figure 2: Excavation Wall Sample Nomenclature

Where a cutback is required based on laboratory analysis indicating a soil CoC concentration is greater than the specified SQO, a sample will be taken at the same station/depth as the original sample, but on the over-excavated wall. The sample number will remain the same, but be denoted with an alphabetical suffix, sequenced up “A”, “B”, “C”, depending on how many cutbacks are required. That is, the sample collected from the first cutback will be labelled with an “A” and submitted for analysis. If CoC concentrations in the sample from the first cutback remain above SQOs, the sample from the next cutback will be labelled with a “B”, and so on. This is presented in Figure 3.

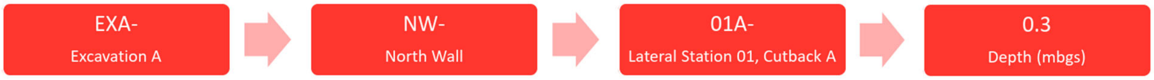

Figure 3: Excavation Wall Sample Nomenclature for Cutbacks

For the excavation base, soil samples will be collected at varying frequencies depending on the size of excavation, as detailed in the applicable FEP. Excavation base sample locations may not align with the established side wall stations, given that the prescribed base sampling frequency is related to an areal measurement, rather than a lateral perimeter measurement. As such, the naming convention for base samples has been simplified, per Figure 4.

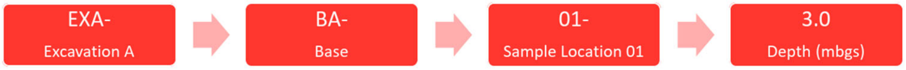

Figure 4: Excavation Base Sample Nomenclature

The naming convention for base cuts will be as outlined for sidewall cutbacks above. This is presented in Figure 5. Detailed field notes and drawings will be maintained showing measurements to base sample locations from nearby side wall sampling stations as well as from one base sample to another.

Figure 5: Excavation Base Cut Sample Nomenclature

Treated Soil Samples

ETC treatment may occur in either a stockpile (SP) configuration, or via enclosed TecZero unit. If using a stockpile configuration, multiple cells will be constructed parallel to one another, with two treatment areas, ‘A’ and ‘B’, situated across from one another in each cell. The nomenclature for confirmatory soil samples collected from treated soil stockpiles will be labelled with:

- fixed cell number, 01A/B through 03A/B, for example, for three treatment cells;
- overall stockpile treatment order;
- sample number, up to 16 per 300 cubic metre (m^3) stockpile (four from each of four quadrants); and
- sample depth (consistent with the positions of the heat transfer piping as well as the base of the pile).

Figure 6: Treated Soil Stockpile Sample Nomenclature

The overall treatment order pertains to the total number of stockpiles treated at the Site, rather than the sequential order of stockpiles treated in a particular cell (i.e., the first stockpile to finish treatment may be in Cell 1A and the next to finish may be in Cell 3B). This is consistent with the convention typically used by the ETC contractor.

Each TecZero cycle treats approximately 30 m^3 of soil. As such, multiple units may be used, labelled TZ1 through TZ8, for example. Upon completion of the treatment cycle, one soil sample will be collected from each unit for confirmation of compliance with SQOs. Like the ETC stockpiles, the samples will be labelled in order of completion rather than sequentially per treatment unit, for example:

- TZ1-01
- TZ2-02
- TZ3-03
- TZ1-04
- TZ4-05

Boreholes, Monitoring Wells, and Thermistors

The names of new boreholes drilled either before or after remediation will include the year completed in the sequential identifier (i.e., BH26-XX for a borehole drilled in 2026). Where a monitoring well or thermistor is constructed in a borehole, the “BH” prefix will be changed to either “MW” for monitoring well, or “T” for thermistor and the numbering sequence will continue in order according to the year of work. Soil sampling nomenclature for boreholes is provided below. This nomenclature will be used in identifying sample locations at the appropriate depths on the borehole logs generated during drilling.

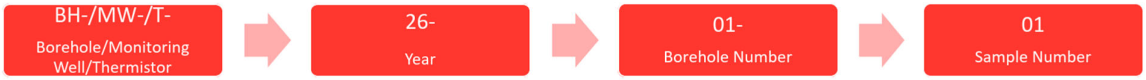

Figure 7: Borehole Soil Sampling Nomenclature

Sample intervals will be recorded on individual borehole logs.

1.7.2.2 *Surface Water and Discharge Water*

Annex 1B of Water Licence N5L8-1846 specifies eight sampling stations from which water samples must be collected and analyzed prior to release to the environment. These include:

- 1848-1 – water withdrawal from the point of intake in Arvoknar Channel;
- 1848-2 – discharge from soil treatment cell;
- 1848-3 – discharge from excavated area;
- 1848-4 – discharge from untreated soil storage area (i.e., untreated soil to be hauled off site to an approved treatment/disposal facility);
- 1848-5 – discharge from contaminated excavated soil staging area (i.e., stockpiled soil awaiting ETC treatment);
- 1848-6 – discharge from activated carbon water treatment system; and
- 1848-7 – discharge from standing water areas in topographic lows.

The station number will be included in each sample name. The samples from Arvoknar Channel will be labelled with the prefix “SW”, with the “DW” prefix applied to each of the other discharge samples. For example, the first sample collected from the Arvoknar Channel intake will be labelled “SW1848-1-01”. Naming conventions for surface water and discharge water are graphically depicted in Figures 8 and 9, respectively.

Figure 8: Surface Water Sample (from Arvoknar Channel) Nomenclature

For discharge samples from stations 1848-2 to 1848-7, as applicable, the following will be used.

Figure 9: Discharge Water Sample Nomenclature

1.7.2.3 *QC Samples*

Details on QC samples, including duplicates and blanks, are provided in Section 2.4.1. Figures 10 and 11 provide naming conventions for these samples.

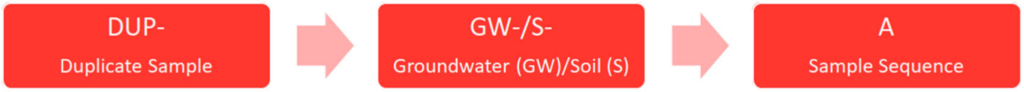

Figure 10: Blind Duplicate Nomenclature

Figure 11: Blank Sample Nomenclature

The naming convention for each QC sample includes specification of the media included in the sample, either soil or water (deionized from the laboratory). For blanks, the type (i.e., trip blank, field blank, equipment blank) will be specified, as shown.

1.7.3 Hard Copy Analytical Records

Hard copy analytical records will not be used for this project. Signed laboratory analytical reports will be supplied digitally to WSP in PDF.

1.7.4 Electronic Analytical Records

AGAT will transmit three comma-separated values (.csv) text files as the electronic data deliverables (EDDs) for each batch of samples submitted to the laboratory. These files include one for sample data, one for test batch data and one with QC data. The specifications for these files, compatible for direct upload into WSP's EQuIS Professional (EQuIS) project database, were provided to AGAT as part of their Master Services Agreement with WSP.

1.7.5 Project Record Maintenance and Storage

Project records will be stored and maintained in accordance with WSP's Global Records Management Policy, dated August 2022. Technical and project records, including but not limited to the following, will be maintained for a minimum of 10 years from the date of project/contract closure:

- drawings;
- intellectual property;
- photographs;
- project plans;
- project contracts, related correspondence and other supporting documents;
- project nomenclature and books;
- correspondence; and
- time sheets.

Additional detail is provided in Section 2.9. Each project team member is responsible for filing project information. Specific to filing collected field and laboratory analytical data, the following are the designated lines of responsibility:

- Communication and data from the laboratory – PC and DM
- Upload of field data – to be completed by field technicians/EL and verified by the PC (and DM for database entries)

Compliance with FEPs, TEPs and other instructional documents, including this Plan, will be verified by the PM and Remediation SME.

2.0 MEASUREMENT AND DATA ACQUISITION

This section of the Plan describes the procedures for data acquisition and management, in support of site remediation. It addresses the following:

- sampling process design;
- sampling methods;

- sample handling and COC;
- laboratory analytical methods;
- laboratory QC;
- field and laboratory instrument calibration;
- inspection and acceptance requirements for supplies and consumables;
- data acquisition;
- data management; and
- field and laboratory equipment testing, inspection and maintenance.

Soil and surface water samples will be collected for laboratory analysis as part of the project. Exact locations and numbers of samples will be based on field conditions during remediation.

2.1 Sampling Methods

2.1.1 Contaminants of Concern

CoCs at the Site are related to the historical aboveground storage and distribution of petroleum products. Releases from former fuel ASTs are the known primary source of PHC CoCs in site media. Barium was used as a drilling fluid additive. The CoCs in soil PHC Fraction F2, Type B Hydrocarbons and barium are discussed further below. Site-specific SQOs were calculated for the remediation based on relevant exposure pathways and receptors. These concentrations are presented in Table 3.

Table 3: Project SQOs

Parameter	Surface SQOs (≤0.5 mbgs, mg/kg)	Subsoil SQOs (>0.5 to 1.5 mbgs, mg/kg)	Subsoil SQOs (>1.5 to ≤3.0 mbgs, mg/kg)	Subsoil SQOs (>3.0 mbgs, mg/kg)
PHC Fraction F2	9,800		10,000[1]	
Type B Hydrocarbons	2,500	5,000	5,000	10,000[1]
Barium (True Total)	39,000		NGR	

Notes:

[1] management limit from CCME 2008

mg/kg – milligrams per kilogram

NGR – no guideline required based on the exposure assessment conducted in Section 4.5

> - greater than

≤ - less than or equal to

Table 4 presents the laboratory methods to be used for soil during the remedial works. Soil analytes (i.e., CoCs) are as specified in Table 3 (taken from the RAP). Analytes and laboratory methods for discharged water, as specified in the IWB Water Licence, are in Table 5 below.

Table 4: Soil Analytical Methods Summary

Analyte	Matrix	Laboratory Method
PHC Fraction F2	Soil	CCME PHC-CWS (Tier 1 Method) (CCME 2001)
Barium	Soil[a]	ASTM D4503-08 (ASTM 2008), EPA SW846-3050B (EPA 1996a), SM 3125 B (SM 2018a)

Notes:

[a] true total

CWS – Canada-Wide Standard

SM – standard method

Sampling will be completed in accordance with the FEPs.

2.1.2 Surface and Discharge Water Monitoring

Laboratory analyses to be performed on samples collected from the sampling points comprise the surveillance network specified in Section 1.7.2.2 and Annex 1B of Water Licence N5L8-1848 (IWB 2024). Table 5 provides the required analytes along with discharge limits. Note that water discharge is not anticipated for winter work in 2026. Water discharge may be required if the remediation work in 2027 extends into thawed conditions.

Table 5: Water Sampling and Analysis Requirements Stations 1848-2 to 1848-7

Analyte	Maximum Allowable Concentration (mg/L)[a]	Laboratory Method
Benzene	0.37	EPA 5021/8021B (EPA 2014a,b)
Toluene	0.002	
Ethylbenzene	0.090	
Xylenes	0.03	
Acenaphthene	0.0058	EPA 3510B/3511/8270E (EPA 1994, 2014c, 2018)
Anthracene	0.000012	
Fluoranthene	0.00004	
Fluorene	0.003	
Naphthalene	0.0011	
Phenanthrene	0.0004	
Pyrene	0.000025	
Benzo[a]anthracene	0.000018	
Benzo[a]pyrene	0.000015	
TPH	5	EPA 5030B/8260C (EPA 1996b, 2006)
pH	6 to 9	SM 4500-H+[b] (SM 2018b)
Nitrate (as nitrogen)	3.0	SM 4110 B (SM 2018c)
Nitrite (as nitrogen)	0.06	

Analyte	Maximum Allowable Concentration (mg/L)[a]	Laboratory Method
Total lead	Calculation[c]	SM 3030E/3125 (SM 2018d,a)
Hardness (as $CaCO_3$)	See note d	SM 2320B (SM 2018d)
Total mercury	0.000026	SM 3112B (SM 2018e)
TSS	15	SM 2540C/D (SM 2018f)

Notes:

[a] as per Part D, Item 24 of Water Licence N5L8-1848 (IWB 2025). A variance may be applied for, as indicated in Section 1.5.1, if concentrations are naturally greater in Arvoknar Channel than the specified maximum values in Table 5.

[b] completed using handheld meter. Holding time at laboratory is 15 minutes. As such, a measurement will be completed at the time of sample collection.

[c] hardness dependent:

- Hardness of 0 to ≤60 mg/L or unknown hardness, the maximum concentration equals 0.001 mg/L.
- Hardness >60 to ≤180 mg/L, calculate using the equation $e^{1.273(\ln[hardness])-4.705)}$ (in µg/L)
- Hardness >180 mg/L, the maximum concentration is 0.007 mg/L

[d] not specified in Water Licence N5L8-1848 but required for lead guideline calculation

$CaCO_3$ – calcium carbonate

mg/L – milligrams per litre

µg/L – micrograms per litre

Additional information on laboratory methods approved for AGAT's Edmonton laboratory under their Canadian Association for Laboratory Accreditation (CALA) scope can be found in Appendix B.

2.2 Sample Handling and Chain-of-Custody

2.2.1 Sample Preservation and Holding Times

Table 6 summarizes the requirements for sample containers, preservation and holding times for the analytical methods specified in Tables 3 and 4. Pre-cleaned sample containers will be certified by AGAT. Preservatives will be prepared using reagent-grade chemicals and added to the applicable sample containers prior to shipment to the Site. Following collection, samples will be stored on ice in coolers to a temperature below 10 °C for preservation. Ice needed for sample handing and shipment will be made on site using a potable water source.

Table 6: Sample Container, Preservation and Holding Times

Analysis	Sample Size/Container	Preservative	Holding Time
Soil			
PHC Fraction F2	Full (no headspace) 120 mL glass jar with Teflon-lined lid	None	14 days
Barium (True Total)	50 g soil in a plastic bag	None	6 months
Water			
BTEX	2 x 40 mL glass vials (no headspace)	$NaHSO_4$	14 days
PHC Fraction F2	2 x 100 mL amber glass bottles	$NaHSO_4$	14 days
PAHs (parameters per Table 5)	2 x 100 mL amber glass bottles	$NaHSO_4$	14 days
Routine Chemistry[a]	250 mL plastic bottle	None	72 hours to 28 days[c]
Total Lead	120 mL plastic bottle	HNO_3	6 months

Analysis	Sample Size/Container	Preservative	Holding Time
Total Mercury	100 mL amber glass bottle	HCl	6 months
TPH	2 x 40 mL amber glass vials (no headspace) 2 x 100 mL amber glass bottles	$NaHSO_4$ $NaHSO_4$	14 days
TSS	500 mL plastic bottle	None	7 days

Notes:

[a] Routine chemistry package includes pH, alkalinity, bicarbonate, carbonate, hydroxide, EC, fluoride, chloride, nitrite, nitrate, nitrate-nitrite, sulphate, calcium, magnesium, sodium, potassium, iron, manganese, total dissolved solids, sodium adsorption ratio, hardness and ion balance.

g – gram(s)

HCl – hydrochloric acid

HNO_3 – nitric acid

mL – millilitre

$NaHSO_4$ – sodium bisulphate

Additional information on sample glassware, preservatives and holding times is provided in Appendix C.

2.2.2 Sample Chain-of-Custody and Shipment

2.2.2.1 Sample Custody

Sample custody procedures will include the use of field logs, sample labels, custody seals and COC forms. For this project, an electronic COC (eCOC) form, provided by AGAT, will be used. Each person involved in sample handling will be trained in eCOC procedures prior to beginning work. The eCOC form must accompany samples during shipment from the field to the laboratory. However, if the eCOC cannot be printed, a pre-printed sample tracking sheet will be added to each cooler.

A sample is under custody when it meets the following criteria:

- It is under one’s possession.
- It is within one’s view, after being in one’s physical possession.
- It was in one’s physical possession and that person has restricted tampering.
- It is in a designated secure area.

The laboratory locations receiving samples from this project must comply with COC requirements as outlined in their own QA plan. Prior to sample shipment, the EL will email the populated eCOC to the AGAT PM, indicating that the sample shipment is ready. The AGAT PM will generate a sample log, ahead of receiving the samples at the lab to expedite sample allocation between laboratory units (i.e., organics laboratory versus inorganics laboratory) and sample integrity report (SIR) issuance once the samples are received. The shipping waybill and tracking information will also be transmitted to the AGAT PM and uploaded to the project SharePoint site.

2.2.2.2 Sample Shipment

Field QA, sample shipment and COC are key components of evaluating whether data collected at the Site may be used to make project decisions. Thus, it is imperative that all sample handling and COC be performed completely, accurately and consistently.

A completed eCOC form or tracking sheet will accompany all samples submitted to AGAT for analysis. The unique sample identifiers created using the naming conventions provided in Section 1.7.2 will be listed on the eCOC form. When transferring possession of the samples, the individuals relinquishing and receiving them will both sign, date and note the time of transfer on the COC.

WSP will package the samples for shipment from the Site with a signed COC or tracking sheet enclosed in each cooler. Samples will be cooled using ice cubes or blocks made on site, transported to Inuvik by ice road daily. The samples will then be shipped from Inuvik to AGAT’s Edmonton laboratory via Canadian North air cargo. Each sample will be wrapped in cushioning material (i.e., bubble wrap) and sealed in individual plastic bags to minimize the potential breakage/leakage during transport. The coolers or shipping containers will be closed and secured with perimeter strapping tape and with custody seals attached on two sides and covered with transparent tape. The eCOC number will also be noted on each custody seal, as well as an indication of shipment size (i.e., Cooler 1 of 4, 2 of 4, etc.). The waybill, indicating the originating address (i.e., Inuvik, NWT) will be attached to each container shipped.

All efforts will be made to ship the samples to the laboratory the same day they arrive in Inuvik from the Site. However, this may not always be possible due to site work schedule or weather, for example. In such cases, the samples may be unpacked in WSP’s Inuvik office and placed in a refrigerator, and repacked and resealed for shipment on the next available flight.

Commercial carriers are not required to sign off on the COC as long as the custody seals on the sample shipment container remain intact.

2.2.2.3 Sample Reception

Once the sample containers are in AGAT’s possession, both sample reception staff as well as the laboratory analyst, will inspect the shipping containers and samples, flagging the following in an SIR provided to WSP:

- broken or missing custody seals;
- container broken in transit;
- sample temperature greater than 10°C or frozen samples;
- missing COC (hard copy or electronic);
- Incomplete or incorrect information on COC.
- unclear or absent analytical requirements;
- missing or incorrect sample labels;
- hold time exceedances;
- broken, damaged or incorrect sample containers;
- incorrect preservation or headspace present in samples, as applicable;
- insufficient sample volume for requested analyses; and
- sediment particles larger than 1 centimetre in water container to be analyzed for organic CoCs.

AGAT reception personnel will break the cooler seals, sign the COC, transfer the samples into cool storage and log the above information for generation of the SIR. The SIR will be transmitted to the EL, PC and Remediation SME the day the samples are received and a decision will be made that day by the Remediation SME whether any re-sampling is required.

2.2.2.4 Field Documentation

Field documentation will be maintained electronically, using the activity forms outlined in Section 1.7.1. Where a physical logbook is maintained, it will be treated as a controlled document and subsequently part of the permanent project file. The field documents serve as the primary record of daily site conditions and activities; they are vital to communication between WSP, Shell, regulators and subcontractors. As such, it is important they be maintained.

2.3 Laboratory Analytical Methods and Quality Control

Samples will be analyzed in accordance with methodologies specified by CCME or other recognized standardization agencies, as noted in Tables 4 and 5 herein.

This section provides an overview of laboratory QA/QC methods. Reportable detection limits (RDLs) for the various analytes to be assessed at the Site are provided according to laboratory methods and are presented in Tables 7 and 8.

2.3.1 Soil

Table 7 presents the proposed RDLs for soil CoCs analyzed at the Site, along with the SQOs.

Table 7: Proposed Soil RDLs

Analyte	Surface SQOs (≤0.5 mbgs, mg/kg)	Subsoil SQOs (>0.5 to 1.5 mbgs, mg/kg)	Subsoil SQOs (>1.5 to ≤3.0 mbgs, mg/kg)	Subsoil SQO(>3.0 mbgs, mg/kg)	Proposed RDL (mg/kg)
PHC Fraction F2	9,800		10,000[1]		10
Type B Hydrocarbons	2,500	5,000	5,000	10,000	n/a
Barium (True Total)	39,000		NGR		400

Note:

n/a – not applicable; calculated value

All proposed RDLs are less than the accepted SQOs.

2.3.2 Groundwater (Post-Remediation)

Given that groundwater exposure pathways (consumption of potable groundwater, protection of freshwater aquatic life, wildlife watering) were deemed inoperable in the RAP (WSP 2025), analytes for post-remediation groundwater sampling have not been established, nor have Groundwater Quality Objectives. Plans for post-remedial groundwater monitoring, if necessary, will be communicated to IWB separately in 2026, along with details on QA/QC measures.

2.3.3 Discharged Water

Proposed RDLs for the IWB (2025)-specified sampling stations are listed in Table 8 below.

Table 8: RDLs for Licence-Specific Water Sampling Stations

Analyte	Maximum Allowable Concentration (mg/L)	RDLs (mg/L)
Benzene	0.37	0.0005
Toluene	0.002	0.0003
Ethylbenzene	0.090	0.0005

Analyte	Maximum Allowable Concentration (mg/L)	RDLs (mg/L)
Xylenes	0.03	0.0005
Acenaphthene	0.0058	0.00001
Anthracene	0.000012	0.00001
Fluoranthene	0.00004	0.00001
Fluorene	0.003	0.00001
Naphthalene	0.0011	0.00001
Phenanthrene	0.0004	0.00001
Pyrene	0.000025	0.00001
Benzo[a]anthracene	0.000018	0.00001
Benzo[a]pyrene	0.000015	0.00001
TPH	5	0.1
Hardness (as $CaCO_3$)	n/a	1
pH	6 to 9	n/a
Nitrate (as nitrogen)	3.0	0.5
Nitrite (as nitrogen)	0.06	0.05
Total lead	0.001 (See Table 4 notes)	0.0001
Total mercury	0.000026	0.000005
TSS	15	1

As shown, all proposed RDLs are less than the maximum allowable concentrations listed in Table 8.

2.4 Quality Control Procedures

2.4.1 Field

Field QC procedures for screening measurements will consist of:

- calibrating or verifying calibration (i.e., bump testing) of field instruments daily. As necessary, calibration may be done more frequently; and
- taking multiple screening measurements at a frequency of 10 percent (%) to verify reproducibility.

QC samples are per Table 9, below

Table 9: Field QC Sampling Requirements

QC Sample Type	Purpose	Sampling Frequency	Sample Composition[a]	Analytes
Blind duplicate	Monitoring precision of field sampling and analytical processes	One per every 10 samples collected per matrix	Same medium (soil or water) being sampled at the time	Same CoCs being investigated in the parent sample
Trip blank	Verify no VOC contamination of samples during shipment	One per cooler containing samples (soil and/or water) to be analysed for VOCs	Prepared by AGAT; certified clean sample vial filled with contaminant-free deionized water	BTEX
Field blank	Verify no VOC contamination of samples during collection	One per day per matrix or one per 20 samples collected per matrix, whichever is more frequent	Contaminant-free deionized water (for water samples) or silica sand (for soil samples), media and containers supplied by AGAT	BTEX
Equipment/rinsate blank	Assess adequacy of equipment decontamination procedures in the field	One per day per matrix or one per 20 samples collected per matrix, whichever is more frequent	Deionized water, supplied by AGAT, poured through or over decontaminated field sampling equipment prior to collecting field samples	Full suite of CoCs targeted by the field sampling undertaken at that time

Notes:

[a] Sample container and preservative information for each analysis are provided in Table 6.

VOC – volatile organic compound

2.4.2 Laboratory

Table 10 reproduces details from AGAT's QC guide, in terms of sample types, sampling frequencies and tolerances.

Table 10: AGAT QC Sample Standards

Sample Type	Sampling Frequency	Purpose	Acceptable Result
Calibration blank	Beginning of each day and after a spike or continuing calibration standard	Determining instrument background	<RDL
Method blank	Minimum of every 20 client samples	Contamination detection	<RDL
Calibration standard	At the beginning (and sometimes end) of a batch of samples	Accuracy	>0.990 correlation (or better), depending on analysis
Certified reference standard	Immediately after calibration, analyzed after every 20 client samples if used as a reference for the batch	Accuracy	+/- 30% recovery or better, depending on analysis
Method blank spike	Minimum of every 20 client samples	Accuracy check on preparation equipment	60 to 140% recovery or better, depending on analysis

Sample Type	Sampling Frequency	Purpose	Acceptable Result
Matrix spike	Minimum of every 20 client samples	Accuracy check for matrix interferences and sample heterogeneity	60 to 140% recovery or better, depending on analysis
Surrogate spikes	For organics, every sample, blank and spike	Accuracy of extraction and preparation techniques	50 to 140% recovery or better, depending on analysis
Replicates/duplicates	Minimum of every 20 client samples	Method precision	+/- 20% to +/- 50% RPD, depending on sample matrix
Matrix spike duplicates	Minimum of every 20 client samples	Method precision	+/- 20% to +/- 50% RPD, depending on sample matrix
Instrument duplicates	Every 20 samples, dependent on laboratory method	Instrument precision	+/- 30% RPD or better, depending on analysis

Notes:

RPD – relative percent difference

< - less than

Appendix D provides additional detail on AGAT's quality program.

2.5 Instrument/Equipment Testing, Inspection and Maintenance

Information on appropriate field equipment maintenance, testing and inspection procedures is provided in the project FEPs as well as the manufacturers' manuals. Laboratory equipment testing, inspection and maintenance to ensure generation of accurate and precise analytical data are completed in accordance with the schedule, procedures, criteria and documentation in AGAT's QA plan.

2.6 Instrument Calibration and Frequency

2.6.1 Field Instruments

Field instrumentation will be bump tested or calibrated daily, before the onset of field activities and in accordance with manufacturer instructions. If the field instrument cannot be adjusted to calibration, it will be taken out of service and replaced. For this reason, WSP will be mobilizing duplicates of each field instrument to be used on the project, as specified in the FEPs. If use of duplicate equipment is required, the initial field instrument will be shipped off site for repair and replaced to maintain redundancy.

2.6.2 Laboratory Equipment

The frequency of laboratory calibrations varies depending on the piece of equipment. For example, scales, refrigerators and pipettes are calibrated once a year but are subject to daily checks. In contrast, analytical instrumentation such as those used for gas chromatography-mass spectrometry (GCMS), inductively coupled plasma-mass spectrometry and inductively coupled plasma-optical emission spectrometry are calibrated anytime; for example, when maintenance work is completed, new standards are used, in instances where high analyte concentrations are detected in a sample, or when samples are composed of a complex matrix. For the GCMS instruments in the organics laboratory (i.e., the laboratory that runs hydrocarbon and VOC analyses), the daily calibration/verification check recoveries are analyzed for trends in the control charts and used as cues for additional calibration effort. These cues may be observed monthly or every few months. For equipment used for analysis of inorganic parameters (i.e., metals, nutrients/salinity parameters), daily calibrations are performed at minimum (sometimes several times a day, depending on usage).

2.7 Inspection and Acceptance of Supplies and Consumables

Project supplies and consumables for the project will be sourced from a variety of vendors. The supplies must meet a specified level of quality and arrive on time to the Site. WSP staff will conduct an inspection of all materials that arrive at the Site to verify they are fit for purpose. Supplies and materials on this project are acquired through purchase orders to the various vendors.

2.8 Data Acquisition

2.8.1 Planning

Section 1 of this document outlines the project and data quality objectives. The data needed to meet these objectives generally include, but are not limited to:

- site maps with sample locations/identifiers;
- CoC identification;
- SQO determination;
- laboratory method selection, including verification of detection limits;
- field parameter screening list; and
- Project schedule.

These details are provided both herein as well as in specific internal work instructions. Historical information, including analytical data, has been verified and included in the project database to maximize the accuracy and completeness of the overall site record.

2.8.2 Field Data Acquisition and Reporting

This component refers to the collection of field screening data, along with samples of the various media specified in this Plan. Field data are maintained in various dedicated records, as described herein. Sample data are tracked and recorded on the COCs completed and signed by the sampler and accompany the sample containers shipped to the laboratory. Copies of the COCs and field records will be saved in the project file and used to track data received from the laboratory and generate reports to the project team and Shell.

2.8.3 Laboratory Data Acquisition and Reporting

As part of data acquisition, the laboratory performs sample analyses and generates PDF analytical reports and associated EDDs. The laboratory QA manager verifies that the sample analyses reported in the generated deliverables match the requests made on the COCs and meet laboratory requirements for accuracy and precision, and also identifies data quality issues and provides qualifiers indicating limits to be placed on data use. The product of this activity is complete analytical information that is ready for validation by WSP’s DM prior to database entry.

2.8.4 Data Quality Validation, Data Entry and Reporting

WSP will be performing data validation for this project.

This will include review of:

- field QA/QC measures to verify that appropriate methodologies were followed;
- COC entries versus completed analyses;
- laboratory QC performance to confirm analytical results are within acceptance criteria;

- RDLs used in comparison with those specified in Tables 7, 8, and 9 herein; and
- field duplicate and blank results to confirm they were within alert limits.

Following data validation, the electronic data will be uploaded to the database and verified against the PDF file transmitted by the laboratory. The DM will qualify the analytical results, as necessary, and provide a statement on the reliability of the generated data.

2.9 Data Management

This section outlines the storage, handling, accessing and securing procedures for data collected during the project, using the existing electronic project (i.e., SharePoint) file and database. These existing repositories contain all data and information collected since WSP initiated data collection at the Site in 2022, as well as historical reports dating back to the early 2000s. Analytical data pre-dating WSP’s site involvement has been transposed, checked and uploaded to the project database.

The goals of data management for this project are to:

- establish procedures to manage, assess, document and transfer environmental and analytical data collected/generated in a controlled, functional and efficient manner;
- maintain a usable and accurate database that enables the internal data management team to process specific data requests from Project team members;
- easily transfer the database, or components of it, to other parties, as appropriate; and
- allow for easy archiving of data and information upon project closure.

Laboratory analytical data will be uploaded to the EQuIS database only after it is verified as meeting project data quality requirements. Each iteration of CoAs will be filed on the project SharePoint; however, only the final version will be used in project documentation (with version history and adjustments logged by AGAT on the CoA cover page).

2.9.1 Data Tracking and Management

2.9.1.1 Database

Field screening data, laboratory analytical results and the data validation information will be managed using the existing EQuIS database. Various technical and decision support modules are available for integration into EQuIS, including those related to chemistry, geology, data validation and electronic data capture (i.e., EQuIS Collect). The EQuIS database system is written in Microsoft VB.NET as a relational model in which different types of data are stored independently and linked through various search field. As such, it allows for users to generate a variety of reports to aid in data interpretation.

Although data reports can be downloaded by project team members with EQuIS login credentials, the master database is protected from all employees except those in the WSP data management technical group. This prevents database tampering, including accidental data deletion or addition of data that have not been checked and qualified by the DM. The master database is backed up weekly, at minimum.

2.9.1.2 Hard Copies

Most data generated during field activities will be recorded electronically, in Excel spreadsheets or via tablet, as stated in Section 1.7.1. However, it is likely that some field data may be recorded in logbooks; for example, during precipitation events or if the tablet is malfunctioning. In terms of laboratory data, the PDF of the signed CoA, complete with the COC forms, analytical bench sheets, instrumentation reports and chromatograms (as applicable), and QA/QC reports is considered equivalent to a hard copy. The Remediation SME (or designate) will request data downloads at least weekly to verify consistency between laboratory and field reports and the uploaded dataset. Where discrepancies are identified, the WSP DM (and AGAT PM) will be contacted to make corrections.

2.9.1.3 Data Input

Results of field screening, laboratory analysis, QA/QC checks and data validation qualifiers will be entered into the EQuIS database for storage, data validation and table generation during report development. The data will be transmitted by AGAT as an EDD and a PDF by email. AGAT will also upload the data directly into the database for validation by WSP via an automated process internal to EQuIS. Prior to running the validation tool, WSP will check the data uploaded by AGAT against the PDF CoA to confirm correctness. Field data will be checked against field logs.

The PDF CoAs will be stored, along with copies of the laboratory EDD, data validation report, scans of logbook entries and electronic field sheets, on the project SharePoint site. Field documents will be uploaded a minimum of once daily.

2.9.1.4 Data Presentation

EQuIS is fully integrated with ESRI geographic information system software and AutoCAD, as well as Bentley OpenGround geotechnical software. As such, in addition to laboratory and field screening data, the database will also store geospatial and geotechnical (i.e., soil log) data electronically recorded in pLog. Geospatial information will be collected by a surveying subcontractor, Mackenzie Delta Geomatics Ltd. (GeoVerra). Details on GeoVerra’s quality management processes are provided in Appendix E.

Depending on project needs, data presentation aided by EQuIS may include tabulated laboratory analytical and field screening data, tables and graphics showing statistical analyses, concentration isopleths and geologic cross-sections.

3.0 OVERSIGHT

3.1 Assessments and Response Actions

The EL is responsible for ensuring that the project FEPs and this Plan are adhered to throughout the remediation program. Daily checks will be completed to verify the following.

- Samples are being collected in an appropriate manner, per the FEP, including collection of QC samples at an appropriate frequency.
- Sample labels are filled out properly and accurately.
- COCs are filled out completely and accurately.
- Field logs are filled out completely and accurately.
- Generated documentation is being filed in the appropriate SharePoint location.
- Field reports are submitted to the appropriate WSP and Shell project team members.

The checks may be completed by the EL or may be assigned by the EL to another field team member. If reassigned, assessment, including surveillance, peer review and data quality assessment, may be undertaken. The results of the assessment will be communicated to the EL, who will be responsible for executing and documenting the corrective action.

3.2 Reporting

Status reports will be provided to Shell daily to provide, at minimum, site activities planned and completed, issues encountered as well as their resolution and planned work.

The laboratory will provide sample information reports as part of a sample receipt notification, as well as analytical status updates by email or phone, as specified in the laboratory scope of work/purchase order.

4.0 DATA VALIDATION AND RELIABILITY

4.1 Data Review, Validation and Evaluation

The data validation process is that which verifies that the data for the project were generated in accordance with QA/QC requirements. For laboratory analytical data, this requires evaluation of its accuracy and precision against analytical protocols. For clarity, precision is a measure of the laboratory's ability to replicate measurements from duplicate samples. Accuracy is a measure of how close a result is to the true, or expected, value based on percent recovery of standards and spikes. Precision and accuracy are independent metrics. Data can be inaccurate but precise, accurate and imprecise, both inaccurate and imprecise, or both accurate and precise.

During the data validation step, the WSP DM will note laboratory non-conformances or deficiencies impacting the precision and/or accuracy of the data and whether these occurrences have an overall effect on the reliability of using the data to make project decisions. Additionally, as a mitigation measure, the Remediation SME will review the CoAs as they come in and discuss laboratory-noted qualifiers, as needed, with the DM to ascertain re-sampling or re-analysis requirements and communicate them expeditiously. Note that AGAT's standard procedure is to hold samples for a minimum of 30 days, to allow for re-extraction or re-analysis if required. This period may be extended to up to a year by entering a long-term hold agreement.

Checks on precision and accuracy, completed by WSP, are provided in Sections 4.1.1 and 4.1.2.

4.1.1 Precision

Precision is evaluated by calculating RPD values between parent samples and duplicate samples, as follows:

$$\mathrm{RPD\%} = \frac{|\mathrm{S} - \mathrm{D}|}{\frac{1}{2}(\mathrm{S} + \mathrm{D})} \times 100$$

Where: RPD = relative percent difference

S = sample value

D = blind field duplicate or replicate value.

The laboratory calculates and reports RPDs based on internal sample duplicates. WSP similarly calculates RPD values based on detected CoC concentrations in blind field duplicate pairs. Exceedances of the QC acceptance or alert criteria are investigated with the laboratory and, if warranted, a corrective action report is requested from the laboratory. Laboratory QC acceptance criteria are per Table 10 and CCME (2016b). WSP's RPD acceptance criteria applied to analytical data from field duplicates is per CCME (2016a).

4.1.2 Accuracy

Accuracy is estimated by the laboratory using analytical data associated with known certified reference materials (CRMs) or matrix spikes. A CRM is a material that contains predetermined concentrations of the analyte(s) of interest in accordance with International Organization for Standardization (ISO) 17034 (2016). Spiking of CRMs into a sample matrix provides a measure of matrix effects on the accuracy of the analysis, as defined as the percent recovery of the spike. This is calculated through the following equation:

$$P = \left[\frac{SSR - SR}{SA}\right] \times 100$$

Where: P = percent recovery

SSR = spiked sample result

SR = native sample result

SA = spike concentration added to the sample

Exceedances of the QC acceptance or alert criteria (Table 10, CCME 2016b) are investigated with the laboratory and, if warranted, a corrective action report is requested from the laboratory.

4.1.3 Completeness

Completeness of a dataset is evaluated as follows:

$$Percent\ Complete = \frac{Valid\ Data\ Obtained}{Total\ Data\ Obtained} \times 100$$

The completeness goal is always 100%. Even if data are rejected, they still have value and use for the project.

4.1.4 Sensitivity

Sensitivity is addressed by the laboratory in establishing detection limits at levels that allow compliance with data quality objectives (i.e., allow meaningful comparison of data to SQOs). Meeting these detection limits requires consistent monitoring of instrument sensitivity during analysis.

4.2 Data Type

4.2.1 Screening Data

Field screening data for this project will include water quality parameters (e.g., DO, ORP, temperature, pH, turbidity, water levels) surface water/discharge water sampling, as well as measurement of organic vapours to monitor ambient conditions during soil treatment, or conditions of individual soil samples or monitoring wells.

The EL and Remediation SME will evaluate the field screening data both when the samples are collected as well as when laboratory data are received. Unusual readings will be noted in the appropriate field log/sheet (e.g., soil headspace vapour readings that do not correlate to odour or lack thereof, or laboratory analytical results), along with the rationale for it being considered unusual. The following additional information will also be recorded in the field (at minimum) to provide context to the EL and SME:

- instrument identifier;
- calibration or bump test record (standards used and results);
- dates and times of the calibration and field screening result; and
- field screening result.

Given that work will be completed in the winter, environmental field screening and soil logging will be completed in a warm environment to allow the soil to thaw. Headspace vapour concentrations will be measured in plastic bags half-filled with air after the soil has been thawed and subsequently broken apart to release VOCs. Ice content (i.e., for geotechnical purposes) will be logged using separate undisturbed soil cores in frozen conditions.

4.2.2 Definitive Data

Definitive data are those of measurable quality used to assess site CoCs and the effectiveness of the remedial action. A consistent level of rigour does not need to be maintained in the review of all definitive data received on the project. For example, CoC concentrations that are well below SQOs, or are non-detectable according to standard RDLs or well above SQOs don’t need to be as thoroughly reviewed as those closer in concentration to the remedial objectives. Additional consideration will be needed to evaluate data reliability for non-detectable concentrations when RDLs that are raised above the SQOs due to matrix or sampling interference, for example. This will involve either making decisions based on review of concentrations of the other analytes (e.g., whether they are non-detectable and standard RDLs were maintained), or when reliability is compromised, re-sampling.

4.3 Validation and Verification Methods

The validation process assesses the effectiveness of field and laboratory QA/QC procedures in mitigating circumstances that may impact the usability of the data. Both laboratory performance and the effect of matrix and sampling interference are evaluated. Laboratory performance evaluation is a straightforward verification in compliance with analytical method requirements (i.e., either the laboratory performed the tests within the QC limits of the analytical method or they did not). To assess matrix and sampling effects, both the quantitative analytical results (i.e., from the parent and duplicate samples collected in the field) and the results of the laboratory precision and accuracy checks are evaluated, (i.e., against Table 10 criteria and/or CCME 2016a,b) and a determination is made on the reliability of the data for project decision-making.

Laboratory CoAs will each be accompanied by the supporting QC data, as outlined in Table 10. Before the CoA is released to WSP, the laboratory QA manager (or delegate) will review the performance QC data to confirm the completeness and accuracy of the sample and QC data and compliance with analytical method specifications, and report any data quality issues or potential limitations on data use.

As an independent quality check, WSP will obtain CRMs, spiked with a known quantity of a chemical (e.g., benzene), and manufactured in accordance with ISO standards. CRMs are typically accompanied by a certificate that includes concentrations of the specified chemical(s) and the associated uncertainty in the result and statement of metrological traceability. The CRMs will be submitted to up to three different laboratories, including AGAT, to evaluate the reliability of their instruments in reproducing the standard results. This will be done at least once during the remediation period.

4.4 Corrective Action

The corrective action process consists of the following steps:

- identifying problems;
- taking action to correct or eliminate the problem;
- monitoring the effectiveness of the corrective action;
- verifying that the problem has been corrected or eliminated; and
- documenting.

Potential corrective actions fall into two broad categories: analytical/equipment problems and non-compliance. Analytical and equipment issues may occur during sample collection, handling, preparation and analysis as well as during the QC review process. If the issue is analytical in nature, AGAT will contact WSP's EL, PC and Remediation SME. Communication of corrective actions, as well as their implementation, will be to the same WSP staff.

For non-compliance issues, a corrective action plan will be devised and implemented at the time of incidence and communicated to WSP. Any non-conformances with the laboratory QC procedures will be corrected and identified in the CoA. Non-conformances affecting data reliability will trigger replicate field sampling and laboratory analysis.

4.4.1 Sample Collection/Field Measurements

Project staff responsible for completing field screening measurements and sample collection must report all suspected technical or QA-related deficiencies to the EL, PC and Remediation SME, and log appropriately (i.e., on field screening sheets and/or separate field log book). If data quality is deficient to the point that project decisions are compromised, field corrective actions will be implemented and documented. No corrective action will be implemented without first communicating findings through the proper channels (i.e., to the EL, PC and SME). Example corrective actions for field measurement issues prior to work stoppage include, but are not limited to:

- repeating the measurement;
- considering effects of ambient conditions such as temperature and atmospheric pressure;
- checking battery life.
- recalibrating instruments;
- replacing instruments.

The EL is responsible for verifying that field data collected are fit for purpose and is responsible for control of, tracking and implementing any changes that need to be made at the Site to ensure quality data collection. As such, the ELs will conduct weekly field audits to verify field technician compliance with the FEPs and TEPs. Field corrective actions may be initiated by any project team member during any stage of the work, including during sample collection, sample packaging and shipment, and field recordkeeping. Corrective actions may range from amending field forms with correct information, providing additional training in field procedures or re-sampling, to name a few. If a need for corrective action is identified, the EL will summarize the problem, identify root causes and designate someone responsible for implementing the corrective action. The EL will verify that such action is taken and whether it is effective. The EL will follow up later, as necessary, to verify resolution of the problem.

4.4.2 Laboratory Analysis

Corrective action is required by the laboratory for equipment failures and non-compliances. Actions taken are dependent on both the analysis underway and the point in the analytical process in which the incident occurs. Incidents requiring corrective action may include, but are not limited to:

- QC data outside the tolerances for precision and accuracy;
- blanks containing contaminants at concentrations above acceptable limits;
- out of range RPDs;
- dilution requirements/unusual changes in detection limits; and
- deficiencies as identified by internal or external QA audits.

If QC data are found to be outside the acceptable ranges for precision and accuracy, AGAT's internal procedure is to re-extract and re-analyse the entire sample batch, depending on the reason for the failure. For any failures in performance tests or deficiencies identified via audit, a non-conformance investigation is initiated to determine the root cause and appropriate corrective actions. AGAT management communicates with their analysts daily such that the identified corrective actions can be initiated as soon as possible. The communication may be individual or in groups and re-training may occur depending on the scale of the issue. In the event of a failure that may cause significant delay to the receipt of laboratory data, extracts will be shipped to another AGAT location accredited for the requested analysis (e.g., from Edmonton to Calgary).

4.5 Reconciliation with Data Quality Objectives

The final step in data validation is the determination of data reliability once the final CoAs have been qualified as required. If the data are deemed of sufficient quality to support project objectives, the data will be released to the project team so that work may proceed. Further corrective action may be required for data deemed to be unreliable or unusable.

5.0 REFERENCES

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SM. 2018b. Method 4500-H+: pH value. January.

SM. 2018c. Method 4110B: Anions in Water by Ion Chromatography. January.

SM. 2018d. Method 3030: Preliminary Treatment of Samples.

SM 2018e: Method 2320: Alkalinity. January.

SM. 2018f. Method 3112: Metals by Cold-Vapor Atomic Absorption Spectrometry.

Signature Page

WSP Canada Inc.

2026-01-29

Joe Hyrich

Andrea Hachkowski, PEng
Project Director

Joseph Hyrich, BSc, MCPM
Senior Project Manager

AH/JH/dj

APPENDIX A

Figures

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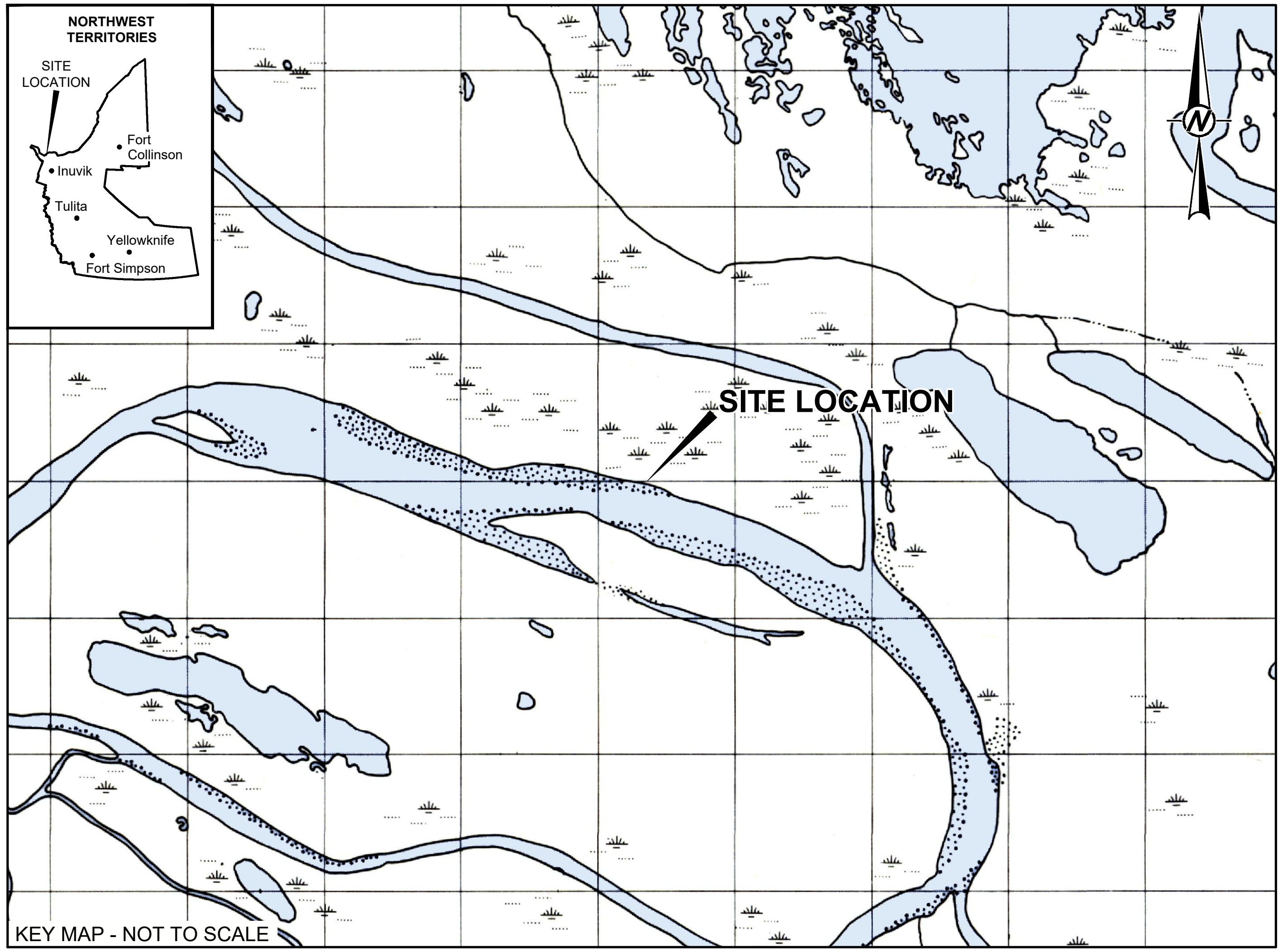

LEGEND

— — — 2024 SHORELINE

REFERENCE

IMAGE OBTAINED FROM GOOGLE EARTH © 2025 GOOGLE INC. USED WITH PERMISSION. GOOGLE AND GOOGLE LOGO ARE REGISTERED TRADEMARKS OF GOOGLE INC. IMAGERY DATE: 4 JUNE 2019. GOOGLE EARTH IMAGE IS NOT TO SCALE. DATUM: NAD83, PROJECTION: UTM ZONE 8.

TOPOGRAPHIC MAP 107C/04OBTAINED FROM Canmatrix. © 1958 THE ARMY SURVEY ESTABLISHMENT, R.C.E. PROJECTION: TRANSVERSE MERCATOR; DATUM: NAD27; COORDINATE SYSTEM: UTM ZONE 8. TOPOGRAPHIC MAP HAS BEEN SHIFTED FROM NAD27 TO NAD83 FOR MAPPING PURPOSES.

0 100 200
(APPROX.) METRES

CLIENT
SHELL CANADA LIMITED

CONSULTANT
wsp

YYYY-MM-DD	2026-01-09
DESIGNED	BVervoort
PREPARED	JKencana
REVIEWED	AHachkowski
APPROVED	JHyrich

PROJECT
SITE REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
SITE LOCATION PLAN

PROJECT NO.	PHASE-TASK	REV.	FIGURE
CA0059450.5095	2000-2606	0	A1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm
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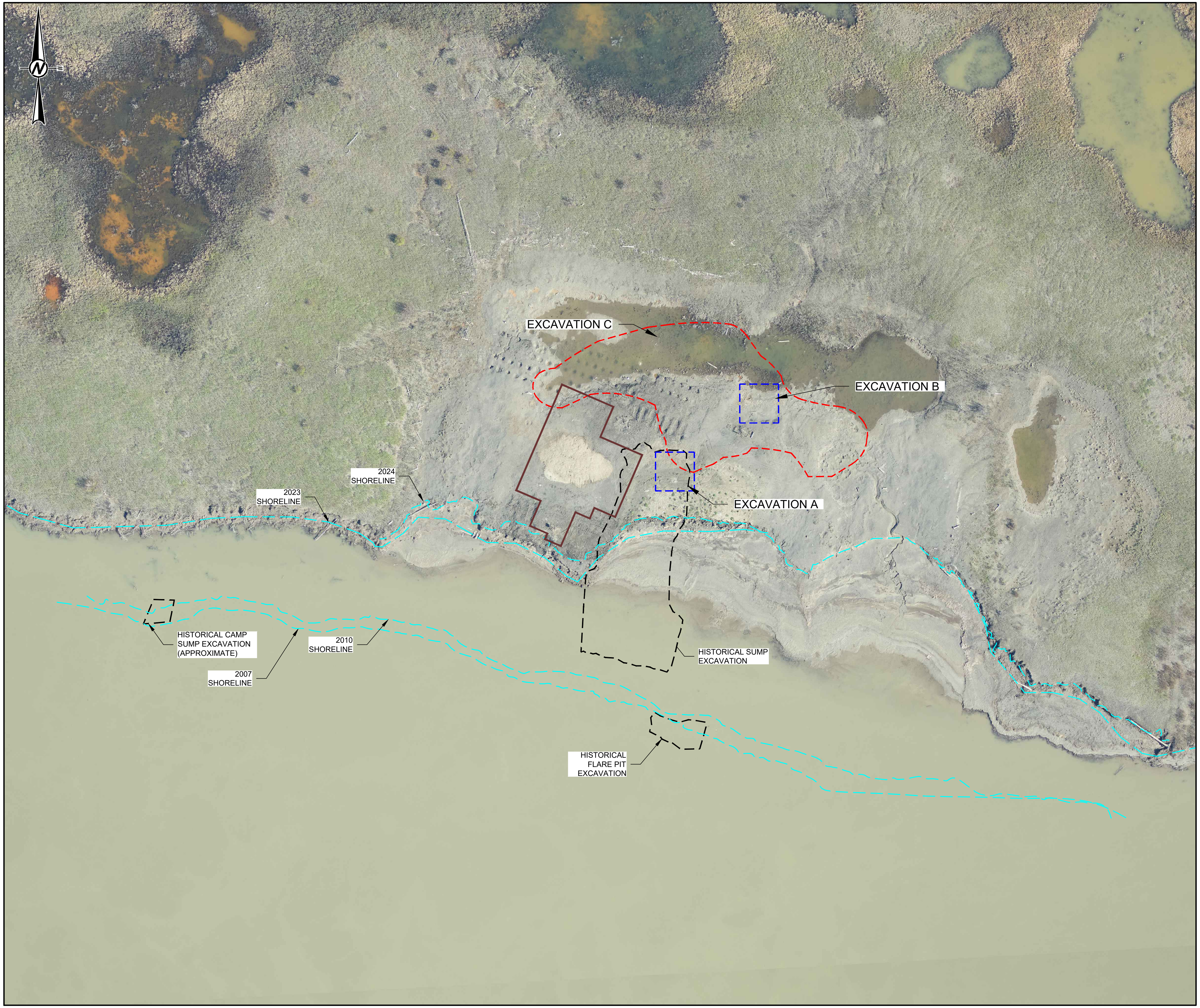

LEGEND

▬	AREA OF REMAINING WOOD PILES
– – –	SHORELINE
– – –	OVERALL EXCAVATION EXTENTS FOR SOIL WITH PHC CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 3.0 mbgs
– – –	OVERALL EXCAVATION EXTENTS FOR SOIL WITH BARITE-BARIUM CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 1.5 mbgs
– – –	HISTORICALLY REMEDIATED AREAS

LIST OF APPLICABLE ABBREVIATIONS

mbgs	METRES BELOW GROUND SURFACE
PHC	PETROLEUM HYDROCARBONS
SQO	SOIL QUALITY OBJECTIVE

NOTES

1. ALL LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON ACTUAL FIELD CONDITIONS.
2. GPS COORDINATES PROJECTION: TRANSVERSE MERCATOR; DATUM: UTM83; COORDINATE SYSTEM: UTM ZONE 8.

REFERENCE

ORIGINAL DRAWING OBTAINED FROM CHALLENGER GEOMATICS LTD.; DWG No.: 22-35141-002; SCALE: 1:1,250; DATE: SEPTEMBER 12, 2022.

ADDITIONAL INFORMATION OBTAINED FROM IEG CONSULTANTS LTD.; PROJECT No.: A04025A02; SCALE 1:750; DATE: SEPTEMBER 20, 2011.

0 25 50
1:1,000 METRES

CLIENT
SHELL CANADA LIMITED

PROJECT
SITE REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
REMEDIATION PLAN

CONSULTANT
wsp

YYYY-MM-DD	2026-01-08
DESIGNED	BVervoort
PREPARED	JKencana
REVIEWED	AHachkowski
APPROVED	JHyrich

PROJECT NO.	PHASE-TASK	REV.	FIGURE
CA0059450.5095	2000-2606	0	A2

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25 mm
0

APPENDIX B

AGAT CALA Scope of Accreditation

CALA Scope of Accreditation

Laboratory Name: AGAT Laboratories (Edmonton)

Client ID: 1003775

Parent Institution: AGAT Laboratories Ltd.

Address: 6310 Roper Road, Edmonton, Alberta, T6B 3P9

Contact: Sucheta Solanki

Email: solanki@agatlabs.com; orsini@agatlabs.com; jroberts@agatlabs.com; vhill@agatlabs.com

Phone: (780) 395-2531

Fax: (780) 468-2887

Standard: Conforms with requirements of ISO/IEC 17025:2017

Clients Served: All Interested Parties

Revised On: 11/11/2025

Valid To: 05/11/2028

001 - Anions

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: ION CHROMATOGRAPHY (IC)

Preparation Method: EXTRACTION

Lab Method ID(s): INOR-171-6002, INOR-171-6200

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4110 B	No	Yes	No
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER	No	Yes	No

Parameter

Chloride
Fluoride
Nitrate-N
Nitrite (NO2)
Sulphate

002 - Boron

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: ICP

Preparation Method: HOT WATER EXTRACTION

Lab Method ID(s): INOR-171-6005, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3120 B	No	Yes	No
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER	No	Yes	No

Parameter

Boron

004 - Conductivity

Field of Accreditation: Environmental

Matrix: Solids [Sediment, Soil]

Analytical Method: CONDUCTIVITY METER

Preparation Method:

Lab Method ID(s): INOR-171-6002, INOR-171-6208

Method Reference	Modified From	Analytical Method	Preparation Method
CURTIN, 2007 EC SOLUBLE IONS PG 161-171 SM 2510	No	Yes	No
MILLER, J.M.	No	Yes	No

Parameter

Conductivity (saturated paste)

005 - Extractable Barium

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: ICP/OES

Preparation Method: EXTRACTION

Lab Method ID(s): INOR-171-6007, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
ALBERTA ENVIRONMENT SOIL QUALITY GUIDELINES 6.2.2	Yes	Yes	No

Parameter

Barium (1M CaCl2)
Extractable Barium (0.1M CaCl2)

006 - Hexavalent Chromium

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: SPECTROPHOTOMETRIC

Preparation Method: EXTRACTION

Lab Method ID(s): INOR-171-6215

Method Reference	Modified From	Analytical Method	Preparation Method
SSSA PART 2 BY REISENAUER	Yes	Yes	No

Parameter

Hexavalent Chromium

008 - Metals

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: ICP/MS

Preparation Method: DIGESTION

Lab Method ID(s): INOR-171-6006, INOR-171-6202

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL SECTION C	Yes	Yes	No
EPA 3050B	Yes	Yes	No
SM 3125	Yes	Yes	No

Parameter

Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Strontium
Thallium
Thorium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

009 - Organic Carbon

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: CHEMICAL OXIDATION UV/VISIBLE

Preparation Method:

Lab Method ID(s): INOR-171-6216

Method Reference	Modified From	Analytical Method	Preparation Method
MSA PART 3 CH. 34	Yes	Yes	No

Parameter

Organic Carbon
Total Organic Carbon (TOC)

010 - Particle Size Analysis (PSA)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: HYDROMETER

Preparation Method:

Lab Method ID(s): INOR-171-6010

Method Reference	Modified From	Analytical Method	Preparation Method
JONES J. 2001 LAB GUIDE FOR CONDUCTING SOIL TEST & PLANT ANALYSIS	No	Yes	No

Parameter

Percent Clay

Parameter
Percent Sand
Percent Silt

011 - Particle Size Analysis (PSA)

Field of Accreditation: Environmental
Matrix: Solids [Soil]

Analytical Method: GRAVIMETRIC
Preparation Method: SIEVE

Lab Method ID(s): INOR-171-6009

Method Reference	Modified From	Analytical Method	Preparation Method
SHELDRICK, B.H. & WANG, C, �PARTICLE SIZE DISTRIBUTION IN SOIL� SAMPLING & METHODS OF ANALYSIS	Yes	Yes	No

Parameter
Particle Size (75um)

012 - Percent Saturation

Field of Accreditation: Environmental
Matrix: Solids [Soil]

Analytical Method: GRAVIMETRIC
Preparation Method: SATURATED PASTE

Lab Method ID(s): INOR-171-6000, INOR-171-6002, INOR-401-0120

Method Reference	Modified From	Analytical Method	Preparation Method
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER, 2ND EDITION	Yes	Yes	No

Parameter
Percent Saturation

014 - pH

Field of Accreditation: Environmental
Matrix: Solids [Sediment, Soil]

Analytical Method: ION SELECTIVE ELECTRODE (ISE)
Preparation Method:

Lab Method ID(s): INOR-171-6002, INOR-171-6205

Method Reference	Modified From	Analytical Method	Preparation Method
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER, 2ND EDITION	Yes	Yes	No

Parameter
pH (1:2) soil:$CaCl_2$

016 - Total Barium

Field of Accreditation: Environmental
Matrix: Solids [Soil]

Analytical Method: ICP
Preparation Method: FUSION

Lab Method ID(s): INOR-171-6008, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4503	Yes	Yes	No
SM 3120 B	Yes	Yes	No

Parameter
Total Barium

017 - Free Liquid

Field of Accreditation: Environmental
Matrix: Solids

Analytical Method: VISUAL
Preparation Method: PAINT FILTER

Lab Method ID(s): INOR-171-6012

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 9095	Yes	Yes	No

Parameter
Free Liquids

018 - Metals

Field of Accreditation: Environmental
Matrix: Solids

Analytical Method: ICP/OES
Preparation Method: LEACH

Lab Method ID(s): INOR-171-6011, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
IN-HOUSE	No	No	Yes

Parameter
Antimony

Parameter
Arsenic
Barium
Beryllium
Boron
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Uranium
Vanadium
Zinc
Zirconium

019 - Oil and Grease

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: FTIR

Preparation Method: EXTRACTION

Lab Method ID(s): ORG-170-5200

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 1664	Yes	Yes	No
SM 5520 C	Yes	Yes	No

Parameter
Total Oil and Grease

021 - BTEX

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/MS

Preparation Method: LEACH

Lab Method ID(s): ORG-170-5100, ORG-170-5430, ORG-170-5440

Method Reference	Modified From	Analytical Method	Preparation Method
IN-HOUSE	No	No	Yes

Parameter
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Toluene

022 - Petroleum Hydrocarbons (PHC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID

Preparation Method: COLD SHAKE EXTRACTION

Lab Method ID(s): ORG-170-5120, ORG-170-5300

Method Reference	Modified From	Analytical Method	Preparation Method
CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD	No	Yes	No

Parameter
F2: C10-C16
F3: C16-C34
F4: C34-C50

023 - Petroleum Hydrocarbons (PHC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GRAVIMETRIC

Preparation Method: COLD SHAKE EXTRACTION

Lab Method ID(s): ORG-170-5120

Method Reference	Modified From	Analytical Method	Preparation Method
CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD	No	Yes	No

Parameter
F4: Gravimetric

024 - Petroleum Hydrocarbons (PHC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID-PURGE AND TRAP

Preparation Method:

Lab Method ID(s): ORG-170-5140, ORG-170-5430

Method Reference	Modified From	Analytical Method	Preparation Method
CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD	No	Yes	No

Parameter
F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

025 - Polycyclic Aromatic Hydrocarbons (PAH) and Alkylated Polycyclic Aromatic Hydrocarbons (PAH)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/MS

Preparation Method: EXTRACTION

Lab Method ID(s): ORG-170-5420

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 3540C	Yes	Yes	No
EPA 3570	Yes	Yes	No
EPA 8270E	Yes	Yes	No

Parameter
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Biphenyl (1,1-Biphenyl)
C1-Acenaphthenes
C1-Benz(a)anthracenes/Chrysenes
C1-Benzofluoranthenes/Benzopyrenes
C1-Biphenyls
C1-Dibenzothiophenes
C1-Fluoranthenes/Pyrenes
C1-Fluorenes
C1-Phenanthrenes/Anthracenes
C2-Benz(a)anthracenes/Chrysenes
C2-Benzofluoranthenes/Benzopyrenes
C2-Biphenyls
C2-Dibenzothiophenes
C2-Fluoranthenes/Pyrenes
C2-Fluorenes
C2-Naphthalenes
C2-Phenanthrenes/Anthracenes
C3-Dibenzothiophenes
C3-Fluoranthenes/Pyrenes
C3-Fluorenes
C3-Naphthalenes
C3-Phenanthrenes/Anthracenes
C4-Dibenzothiophenes
C4-Fluoranthenes/Pyrenes
C4-Naphthalenes
C4-Phenanthrenes/Anthracenes
Chrysene
Dibenzo(a,h)anthracene
Dibenzothiophene
Fluoranthene
Fluorene
Indeno(1,2,3 - cd)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
Quinoline
Retene

026 - Total Extractable Hydrocarbons (TEH)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID

Preparation Method: EXTRACTION

Lab Method ID(s): ORG-170-5120, ORG-170-5300

Method Reference	Modified From	Analytical Method	Preparation Method
AEC V92-G108	Yes	Yes	No
BC MOE LABORATORY MANUAL SECTION D	Yes	Yes	No

Parameter

Extractable Petroleum Hydrocarbons (EPH): C10-C19
Extractable Petroleum Hydrocarbons (EPH): C19-C32
SASK (C11-C22)
SASK (C23-C60)
Total Extractable Hydrocarbons (TEH): C10-C32
Total Extractable Hydrocarbons (TEH): C11-C30

027 - Volatile Organic Compounds (VOC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/MS-PURGE AND TRAP

Preparation Method: EXTRACTION

Lab Method ID(s): ORG-170-5170, ORG-170-5400

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5030C	No	Yes	No
EPA 8260D	No	Yes	No

Parameter

1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Hexanone (Methyl butyl ketone, MBK)
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane (Ethyl chloride)
Chloroethene (Vinyl chloride)
Chloroform
Chloromethane (Methyl chloride)
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dichloromethane
Ethylbenzene
Ethylene Dibromide
m,p-Xylene
Methyl ethyl ketone
Methyl isobutyl ketone (MIBK)
Methyl t-butyl ether
o-Xylene
Styrene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,2-Dichloroethylene (trans-1,2-Dichloroethene)
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane

028 - Volatile Organic Compounds (VOC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/MS-HEADSPACE

Preparation Method:

Lab Method ID(s): ORG-170-5160, ORG-170-5410

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021A	No	Yes	No
EPA 8260C	No	Yes	No

Parameter
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Hexanone (Methyl butyl ketone, MBK)
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane (Ethyl chloride)
Chloroethene (Vinyl chloride)
Chloroform
Chloromethane (Methyl chloride)
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dichloromethane
Ethylbenzene
Ethylene Dibromide
m,p-Xylene
Methyl ethyl ketone
Methyl isobutyl ketone (MIBK)
Methyl t-butyl ether
o-Xylene
Styrene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane

029 - Flashpoint

Field of Accreditation: Environmental
Matrix: Solids [Ash, Soil]

Analytical Method: PENSKY-MARTENS CLOSED CUP
Preparation Method:

Lab Method ID(s): ORG-170-5210

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D93	Yes	Yes	No

Parameter
Flashpoint

030 - Alkalinity

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: TITRIMETRIC
Preparation Method:

Lab Method ID(s): INOR-171-6205

Method Reference	Modified From	Analytical Method	Preparation Method
SM 2320 B	Yes	Yes	No

Parameter
Alkalinity (pH 4.5)

031 - Ammonia

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: COLORIMETRIC
Preparation Method:

Lab Method ID(s): INOR-171-6211

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500-NH3 G	Yes	Yes	No

Parameter
Ammonia

032 - Anions

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: ION CHROMATOGRAPHY (IC)
Preparation Method:

Lab Method ID(s): INOR-171-6200

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4110 B	Yes	Yes	No

Parameter
Bromide
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

034 - Chemical Oxygen Demand (COD)

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: SPECTROPHOTOMETRIC
Preparation Method:

Lab Method ID(s): INOR-171-6210

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 410.4	Yes	Yes	No

Parameter
COD

035 - Conductivity

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: ION SELECTIVE ELECTRODE (ISE)
Preparation Method:

Lab Method ID(s): INOR-171-6205

Method Reference	Modified From	Analytical Method	Preparation Method
SM 2510 B	Yes	Yes	No

Parameter
Conductivity (25˚C)

037 - Dissolved Metals

Field of Accreditation: Environmental
Matrix: Water

Analytical Method: ICP/OES
Preparation Method:

Lab Method ID(s): INOR-171-6100, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3120 B	Yes	Yes	No

Parameter
Aluminum
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Nickel
Phosphorus
Potassium
Silicon

Parameter
Sodium
Strontium
Sulphur (Sulfur)
Titanium
Tungsten
Zinc
Zirconium

038 - Dissolved Metals

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: ICP/MS

Preparation Method:

Lab Method ID(s): INOR-171-6100, INOR-171-6202

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3125	Yes	Yes	No

Parameter
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Molybdenum
Nickel
Phosphorus
Selenium
Silver
Strontium
Tellurium
Thallium
Thorium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc

039 - Mercury

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: COLD VAPOUR ATOMIC ABSORPTION (CVAA)

Preparation Method:

Lab Method ID(s): INOR-171-6204

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3112 B	Yes	Yes	No

Parameter
Mercury

040 - pH

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: PH METER

Preparation Method:

Lab Method ID(s): INOR-171-6205

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500-H+	Yes	Yes	No

Parameter
pH

042 - Solids

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GRAVIMETRIC **Preparation Method**:

Lab Method ID(s): INOR-171-6102, INOR-171-6104

Method Reference	Modified From	Analytical Method	Preparation Method
SM 2540 C	No	Yes	No
SM 2540 D	No	Yes	No

Parameter
Total Dissolved Solids
Total Suspended Solids

043 - Total Metals

Field of Accreditation: Environmental **Matrix**: Water

Analytical Method: ICP/OES **Preparation Method**: DIGESTION

Lab Method ID(s): INOR-171-6100, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3120 B	Yes	Yes	No

Parameter
Aluminum
Barium
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Potassium
Silicon
Silver
Sodium
Strontium
Sulphur (Sulfur)
Tin
Tungsten
Uranium
Vanadium
Zinc
Zirconium

044 - Total Metals

Field of Accreditation: Environmental **Matrix**: Water

Analytical Method: ICP/MS **Preparation Method**: DIGESTION

Lab Method ID(s): INOR-171-6100, INOR-171-6202

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3030 E	Yes	Yes	No
SM 3125	Yes	Yes	No

Parameter
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Boron
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium

Parameter
Manganese
Mercury
Molybdenum
Nickel
Phosphorus
Selenium
Silver
Strontium
Thallium
Thorium
Tin
Titanium
Tungsten
Uranium
Vanadium
Zinc
Zirconium

045 - Turbidity

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: NEPHELOMETRIC

Preparation Method:

Lab Method ID(s): NOR-171-6101

Method Reference	Modified From	Analytical Method	Preparation Method
SM 2130 B	No	Yes	No

Parameter
Turbidity

046 - Oil and Grease

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: FTIR

Preparation Method: EXTRACTION

Lab Method ID(s): RG-170-5200

Method Reference	Modified From	Analytical Method	Preparation Method
SM 5520 C	Yes	Yes	No

Parameter
Total Oil and Grease

048 - Polycyclic Aromatic Hydrocarbons (PAH) and Alkylated Polycyclic Aromatic Hydrocarbons (PAH)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/MS

Preparation Method: EXTRACTION

Lab Method ID(s): RG-170-5421

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 3510B	Yes	Yes	No
EPA 3511	Yes	Yes	No
EPA 8270E	Yes	Yes	No

Parameter
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Biphenyl (1,1-Biphenyl)
C1-Acenaphthenes
C1-Benz(a)anthracenes/Chrysenes
C1-Benzofluoranthenes/Benzopyrenes
C1-Biphenyls
C1-Dibenzothiophenes
C1-Fluoranthenes/Pyrenes
C1-Fluorenes
C1-Phenanthrenes/Anthracenes

Parameter

C2-Benz(a)anthracenes/Chrysenes
C2-Benzofluoranthenes/Benzopyrenes
C2-Biphenyls
C2-Dibenzothiophenes
C2-Fluoranthenes/Pyrenes
C2-Fluorenes
C2-Naphthalenes
C2-Phenanthrenes/Anthracenes
C3-Benz(a)anthracenes/Chrysenes
C3-Dibenzothiophenes
C3-Naphthalenes
C3-Phenanthrenes/Anthracenes
C4-Benzanthracenes/Chrysenes
C4-Dibenzothiophenes
C4-Naphthalenes
C4-Phenanthrenes/Anthracenes
Chrysene
Dibenzo(a,h)anthracene
Dibenzothiophene
Fluoranthene
Fluorene
Indeno(1,2,3 - cd)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
Quinoline
Retene

049 - Total Extractable Hydrocarbons (TEH)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID

Preparation Method: EXTRACTION

Lab Method ID(s): ORG-170-5120, ORG-170-5300

Method Reference	Modified From	Analytical Method	Preparation Method
AEC V92-M2	Yes	Yes	No
BC MOE LABORATORY MANUAL SECTION D	Yes	Yes	No
EPA 3510	Yes	Yes	No

Parameter

Extractable Petroleum Hydrocarbons (EPH): C10-C19
Extractable Petroleum Hydrocarbons (EPH): C19-C32
F2: C10-C16
Hydrocarbons: C11-C30
SASK (C11-C22)
SASK (C23-C60)
Total Extractable Hydrocarbons (TEH): C10-C32

050 - Total Petroleum Hydrocarbons (TPH)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID-PURGE AND TRAP

Preparation Method:

Lab Method ID(s): ORG-170-5140, ORG-170-5430

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 8260D	No	Yes	No
EPA 5030C	No	Yes	No

Parameter

F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

051 - Volatile Organic Compounds (VOC)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/MS-PURGE AND TRAP

Preparation Method:

Lab Method ID(s): ORG-170-5170, ORG-170-5400

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5030C	No	Yes	No
EPA 8260D	No	Yes	No

Parameter
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,2,4-Trichlorobenzene
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Hexanone (Methyl butyl ketone, MBK)
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chlorodibromomethane
Chloroethane (Ethyl chloride)
Chloroform
Chloromethane (Methyl chloride)
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dibromochloromethane
Dichloromethane
Ethylbenzene
Ethylene Dibromide
m,p-Xylene
Methyl ethyl ketone
Methyl isobutyl ketone (MIBK)
Methyl t-butyl ether
Methyl tert-butyl ether (MTBE)
o-Xylene
Styrene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane
Vinyl chloride

052 - Volatile Organic Compounds (VOC)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/MS-HEADSPACE

Preparation Method:

Lab Method ID(s): ORG-170-5160, ORG-170-5410

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021A	No	Yes	No
EPA 8260D	No	Yes	No

Parameter
1,1,1,2-Tetrachloroethane
1,1,1-Trichloroethane
1,1,2-Trichloroethane
1,1-Dichloroethane
1,1-Dichloroethylene
1,2,4-Trichlorobenzene
1,2-Dibromomethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloropropane
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-Hexanone (Methyl butyl ketone, MBK)
Acetone (2-Propanone)
Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride

Parameter
Chlorobenzene
Chlorodibromomethane
Chloroethane (Ethyl chloride)
Chloroform
Chloromethane (Methyl chloride)
cis-1,2-Dichloroethylene
cis-1,3-Dichloropropene
Dichloromethane
Ethylbenzene
Ethylene Dibromide
m,p-Xylene
Methyl ethyl ketone
Methyl isobutyl ketone (MIBK)
Methyl t-butyl ether
o-Xylene
Styrene
Tetrachloroethylene
Toluene
trans-1,2-Dichloroethylene
trans-1,3-Dichloropropene
Trichloroethylene
Trichlorofluoromethane
Vinyl chloride

053 - Microtox

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: BIOLUMINESCENCE

Preparation Method:

Lab Method ID(s): TOX-171-7100

Method Reference	Modified From	Analytical Method	Preparation Method
EPS 1/RM/24	No	Yes	No

Parameter
Microtox IC50 (15 min)

056 - Cations

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: ICP/OES

Preparation Method: SATURATED PASTE

Lab Method ID(s): INOR-171-6002, INOR-171-6201

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3120 B	Yes	Yes	No
SOIL SAMPLING & METHODS OF ANALYSIS CHAPTER 15	Yes	Yes	No

Parameter
Boron
Calcium
Magnesium
Potassium
Sodium
Sulphur (Sulfur)

057 - Chloride

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: COLORIMETRIC

Preparation Method:

Lab Method ID(s): INOR-171-6002, INOR-171-6212

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500-CL- E	Yes	Yes	No

Parameter
Chloride

058 - pH

Field of Accreditation: Environmental

Matrix: Solids [Sediment, Soil]

Analytical Method: PH METER

Preparation Method:

Lab Method ID(s): INOR-171-6207

Method Reference	Modified From	Analytical Method	Preparation Method
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER, 2ND EDITION	Yes	Yes	No

Parameter
pH (1:1) soil:water
pH (1:2) soil:CaCl2
pH (1:2) soil:water
pH (saturated paste)

059 - Petroleum Hydrocarbons (PHC)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID-HEADSPACE

Preparation Method:

Lab Method ID(s): ORG-170-5110, ORG-170-5440

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL SECTION D	No	Yes	No
EPA 5021A	No	Yes	No
EPA 8260D	No	Yes	No

Parameter
F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

060 - Flashpoint

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: PENSKY-MARTENS CLOSED CUP

Preparation Method:

Lab Method ID(s): HC-320-22000

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D93	Yes	Yes	No

Parameter
Flashpoint

061 - Elemental Sulphur

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: X-RAY FLUORESCENCE (XRF)

Preparation Method:

Lab Method ID(s): HC-320-22001

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4294	No	Yes	No

Parameter
Elemental Sulphur (Elemental Sulfur)

062 - Viscosity

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: VISCOMETER

Preparation Method:

Lab Method ID(s): HC-320-22002

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D7042	No	Yes	No

Parameter
Dynamic Viscosity
Kinematic Viscosity

063 - Pour Point

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: POUR POINT ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22003

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D5853	No	Yes	No
ASTM D97	No	Yes	No

Parameter
Pour Point

064 - Cloud Point

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: CLOUD POINT ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22004

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D2500	No	Yes	No

Parameter
Cloud Point

065 - Density and API

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: DIGITAL DENSITY ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22005

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4052	Yes	Yes	No
ASTM D5002	Yes	Yes	No

Parameter
API Gravity
Density

066 - Colour

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: VISUAL EXAMINATION

Preparation Method:

Lab Method ID(s): HC-320-22006

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D1500	No	Yes	No

Parameter
Colour

067 - Micro Carbon Residue

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: MICRO METHOD

Preparation Method:

Lab Method ID(s): HC-320-22007

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4530	No	Yes	No

Parameter
Micro Carbon Residue

068 - Salt

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: ELECTROMETRIC

Preparation Method:

Lab Method ID(s): HC-320-22008

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D3230	No	Yes	No

Parameter
Salt Content

069 - Sediment

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: MEMBRANE FILTRATION

Preparation Method:

Lab Method ID(s): HC-320-22009

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4807	Yes	Yes	No

Parameter
Total Solids (TS)

070 - Basic Sediment and Water (BSW)

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: CENTRIFUGE

Preparation Method:

Lab Method ID(s): HC-320-22010

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4007	Yes	Yes	No

Parameter
Sediment
Water

071 - Atmospheric Distillation

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: THERMOMETER

Preparation Method: DISTILLATION

Lab Method ID(s): HC-320-22011

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D86	No	Yes	No

Parameter
Atmospheric Distillation

072 - Total Acid Number

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: POTENTIOMETRIC TITRATION

Preparation Method:

Lab Method ID(s): HC-320-22012

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D664	Yes	Yes	No

Parameter
Total Acid Number

073 - True Vapour Pressure

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: VAPOUR PRESSURE ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22013

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D6377	No	Yes	No

Parameter
Vapour Pressure

074 - Simulated Distillation

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: GAS CHROMATOGRAPHY

Preparation Method:

Lab Method ID(s): HC-320-22014

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D7169	Yes	Yes	No

Parameter
Crude oil-Boiling Point Fractions

075 - Volatile Organic Phosphorus

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: ICP/OES

Preparation Method:

Lab Method ID(s): HC-320-22015

Method Reference	Modified From	Analytical Method	Preparation Method
CCQTA	No	Yes	No

Parameter
Phosphorus in crude oil 250 degrees C cut

076 - Metals

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: ICP/OES

Preparation Method:

Lab Method ID(s): HC-320-22017

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D5708 A	No	Yes	No

Parameter
Aluminum
Barium
Boron
Cadmium

Parameter
Calcium
Chromium
Copper
Iron
Lead
Magnesium
Manganese
Molybdenum
Nickel
Phosphorus
Silicon
Silver
Sodium
Tin
Titanium
Vanadium
Zinc

078 - Sulphur Compounds

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: GC/SCD

Preparation Method:

Lab Method ID(s): HC-320-22019

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM 5504	Yes	Yes	No
ASTM D5623	Yes	Yes	No

Parameter
Butyl mercaptan (1-Butanethiol)
Carbon sulfide
Cobalt Sulfide
Diethyl disulfide
Dimethyl disulfide
Ethyl mercaptan (Ethanethiol)
Ethyl methyl sulfide
Ethyl sulfide (Diethyl sulfide)
Hydrogen Sulfide (H2S)
Isobutyl mercaptan (2-Methyl-1-propanethiol)
Isopropyl mercaptan (2-Propanethiol)
Methyl mercaptan (Methanethiol)
Methyl sulfide
Propyl mercaptan (1-Propanethiol)
sec-Butyl mercaptan (2-Butanethiol)
tert-Butyl mercaptan (2-Methyl-2-propanethiol)
tert-Butyl methyl mercaptan
Thiophene

079 - Total Mercury

Petroleum Lab

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: ATOMIC ABSORPTION SPECTROSCOPY (AAS)-THERMAL DECOMPOSITION

Preparation Method:

Lab Method ID(s): HC-320-22021

Method Reference	Modified From	Analytical Method	Preparation Method
UOP 938	Yes	Yes	No

Parameter
Total Mercury

081 - Total Extractable Hydrocarbons (TEH)

Mobile Lab

Field of Accreditation: Environmental

Matrix: Solids

Analytical Method: GC/FID

Preparation Method: EXTRACTION

Lab Method ID(s): MO-0300

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL	No	Yes	No
CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD	No	Yes	No

Parameter
Extractable Petroleum Hydrocarbons (EPH): C10-C19
Extractable Petroleum Hydrocarbons (EPH): C19-C32
F2: C10-C16

Parameter
F3: C16-C34
F4: C34-C50
Total Extractable Hydrocarbons (TEH): C10-C32

082 - Total Petroleum Hydrocarbons (TPH)

Mobile Lab

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID-HEADSPACE

Preparation Method:

Lab Method ID(s): MO-0500

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL	No	Yes	No
CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD	No	Yes	No

Parameter
F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

083 - BTEX

Mobile Lab

Field of Accreditation: Environmental

Matrix: Solids

Analytical Method: GC/PID-HEADSPACE

Preparation Method:

Lab Method ID(s): MO-0500

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021	Yes	Yes	No
EPA 8021B	Yes	Yes	No

Parameter
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Styrene
Toluene

084 - Total Purgeable Hydrocarbons (TPH)

Mobile Lab

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID-HEADSPACE

Preparation Method:

Lab Method ID(s): MO-0500

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL	Yes	Yes	No

Parameter
F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

085 - Total Extractable Hydrocarbons (TEH)

Mobile Lab

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID

Preparation Method: EXTRACTION

Lab Method ID(s): MO-0300

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL	Yes	Yes	No

Parameter
Extractable Petroleum Hydrocarbons (EPH): C10-C19
Extractable Petroleum Hydrocarbons (EPH): C19-C32
F2: C10-C16
F3: C16-C34
F4: C34-C50
Total Extractable Hydrocarbons (TEH): C10-C32

086 - BTEX

Mobile Lab

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/PID-HEADSPACE

Preparation Method:

Lab Method ID(s): MO-0500

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021	Yes	Yes	Yes

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 8021B	Yes	Yes	No
BC MOE LABORATORY MANUAL SECTION D	No	Yes	No

Parameter

Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Styrene
Toluene

091 - Alcohols

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/FID

Preparation Method:

Lab Method ID(s): ORG-170-5442

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021	Yes	Yes	No
EPA 8015C	Yes	Yes	No

Parameter

1-Butanol (n-Butanol)
1-Propanol (Propanol)
2-Butanol (sec-Butanol)
2-Methyl-1-propanol (Isobutanol)
2-Propanol (Isopropyl alcohol)
Ethanol
Methanol
Pentanol
tert-Butanol (2-Methyl-2-propanol)

094 - Alcohols

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID

Preparation Method:

Lab Method ID(s): ORG-170-5442

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 5021	Yes	Yes	No
EPA 8015C	Yes	Yes	No

Parameter

1-Butanol (n-Butanol)
1-Propanol (Propanol)
2-Butanol (sec-Butanol)
2-Methyl-1-propanol (Isobutanol)
2-Propanol (Isopropyl alcohol)
Ethanol
Methanol
Pentanol
tert-Butanol (2-Methyl-2-propanol)

097 - Hexavalent Chromium

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: SPECTROPHOTOMETRIC

Preparation Method:

Lab Method ID(s): INOR-171-6219

Method Reference	Modified From	Analytical Method	Preparation Method
SM 3500-CR B	Yes	Yes	No

Parameter

Hexavalent Chromium

099 - Reid Vapor Pressure

Petroleum Lab

Field of Accreditation: Petroleum

Matrix: Fuel

Analytical Method: VAPOUR PRESSURE ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22026

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D323	No	Yes	No

Parameter

Reid Vapor Pressure

100 - Vapor Pressure

Field of Accreditation: Petroleum

Matrix: Fuel

Analytical Method: VAPOUR PRESSURE ANALYZER

Preparation Method:

Lab Method ID(s): HC-320-22025

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4953	No	Yes	No
ASTM D5191	No	Yes	No

Parameter
Dry Vapor Pressure

101 - Sediment

Field of Accreditation: Petroleum

Matrix: Oil

Analytical Method: GRAVIMETRIC

Preparation Method: EXTRACTION

Lab Method ID(s): HC-320-22027

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D473	Yes	Yes	No

Parameter
Sediment

103 - Bulk Density

Field of Accreditation: Environmental

Matrix: Solids [Bulk, Soil]

Analytical Method: GRAVIMETRIC

Preparation Method:

Lab Method ID(s): INOR-171-6004

Method Reference	Modified From	Analytical Method	Preparation Method
BLAKE, G.R., MSA BULK DENSITY, 1986	No	Yes	No

Parameter
Bulk Density

104 - Specific Gravity

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: MUD BALANCE

Preparation Method:

Lab Method ID(s): INOR-171-6003

Method Reference	Modified From	Analytical Method	Preparation Method
PROCEDURE FOR USING BAROID MUD BALANCE	No	Yes	No

Parameter
Specific Gravity

105 - Moisture

Field of Accreditation: Environmental

Matrix: Solids

Analytical Method: GRAVIMETRIC

Preparation Method:

Lab Method ID(s): LAB-175-4002

Method Reference	Modified From	Analytical Method	Preparation Method
SOIL SAMPLING & METHODS OF ANALYSIS, CARTER 2008	No	Yes	No

Parameter
Percent Moisture

106 - Sulphide

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: COLORIMETRIC

Preparation Method:

Lab Method ID(s): INOR-171-6222

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500-S2-	No	Yes	No

Parameter
Sulphide

107 - Atterberg Plasticity Index

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: LIQUID LIMIT DEVICE

Preparation Method:

Lab Method ID(s): INOR-171-6218

Method Reference	Modified From	Analytical Method	Preparation Method
D4318 STANDARD TEST METHOD FOR LIQUID PLASTICITY INDEX OF SOILS METHOD B	Yes	Yes	No

Parameter
Liquid Limit
Plastic Limit
Plasticity Index

108 - Ammonia Nitrogen

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: COLORIMETRIC

Preparation Method:

Lab Method ID(s): INOR-171-6211

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500-NH3 G	Yes	Yes	No

Parameter
Ammonia-N

109 - Total Purgeable Hydrocarbons (TPH)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/FID-HEADSPACE

Preparation Method:

Lab Method ID(s): ORG-170-5110, ORG-170-5440

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL SECTION D	No	Yes	No
EPA 5021A	No	Yes	No
EPA 8260	No	Yes	No

Parameter
F1: C6-C10
Total Purgable Hydrocarbons (TPgH): (C5-C10)
VH: C6-C10

110 - Polycyclic Aromatic Hydrocarbons (PAH)

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: GC/MS

Preparation Method: EXTRACTION

Lab Method ID(s): MO-0200

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 3510B	Yes	Yes	No
EPA 3511	Yes	Yes	No
EPA 8270E	Yes	Yes	No

Parameter
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3 - cd)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
Quinoline

111 - Polycyclic Aromatic Hydrocarbons (PAH)

Field of Accreditation: Environmental

Matrix: Solids [Soil]

Analytical Method: GC/MS

Preparation Method: EXTRACTION

Lab Method ID(s): MO-0210

Method Reference	Modified From	Analytical Method	Preparation Method
EPA 3540C	Yes	Yes	Yes
EPA 8270	Yes	Yes	Yes
EPA 3570	Yes	Yes	Yes

Parameter
1-Methylnaphthalene
2-Methylnaphthalene
Acenaphthene
Acenaphthylene
Acridine
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(e)pyrene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3 - cd)pyrene
Naphthalene
Perylene
Phenanthrene
Pyrene
Quinoline

112 - Organic Chloride Content

Field of Accreditation: Environmental

Matrix: Oil

Analytical Method: COULOMETRIC TITRATION

Preparation Method: COMBUSTION

Lab Method ID(s): HC-320-22030

Method Reference	Modified From	Analytical Method	Preparation Method
ASTM D4929 B	Yes	Yes	No

Parameter
Organic Chloride Content

114 - pH

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: PH METER

Preparation Method:

Lab Method ID(s): INOR-171-6207

Method Reference	Modified From	Analytical Method	Preparation Method
SM 4500 H+	No	Yes	No

Parameter
pH

115 - Conductivity

Field of Accreditation: Environmental

Matrix: Water

Analytical Method: CONDUCTIVITY METER

Preparation Method:

Lab Method ID(s): INOR-171-6208

Method Reference	Modified From	Analytical Method	Preparation Method
SM 2510 B	No	Yes	No

Parameter
Conductivity

116 - Metals

Field of Accreditation: Environmental

Matrix: Solids

Analytical Method: ICP/OES

Preparation Method: ACID DIGESTION

Lab Method ID(s): INOR-171-6201, INOR-171-6006

Method Reference	Modified From	Analytical Method	Preparation Method
BC MOE LABORATORY MANUAL SECTION C	No	Yes	No
BC MOE LABORATORY MANUAL, SALM	No	No	Yes

Parameter
Aluminum
Boron
Calcium
Iron
Magnesium
Manganese
Phosphorus
Potassium
Silicon
Sodium
Strontium
Sulphur (Sulfur)

Multisite Laboratory

This laboratory operates from more than one location within a city or region, however, is considered one accreditable unit. This scope of accreditation includes testing carried out at the following additional locations identified in the scope above. Where the appendix does not list a location, testing is carried out in the main laboratory.

Mobile Lab	6310 Roper Road Edmonton, AB T6B 3P9
Petroleum Lab	8207 Roper Road Edmonton, AB T6E 6S4

† "OSDWA" indicates the appendix is used for the analysis of Ontario drinking water samples, which is subject to the rules and related regulations under the Ontario "Safe Drinking Water Act" (2002).

The list of tests and measurement capabilities for which a laboratory is accredited can change at any time due to circumstances such as scope extensions, voluntary withdrawal of tests by the laboratory and suspension. Scopes are published by the CALA via the Internet at https://directory.cala.ca/ (https://directory.cala.ca/)

Canadian Association for Laboratory Accreditation Inc.

Certificate of Accreditation

AGAT Laboratories (Edmonton)
AGAT Laboratories Ltd.
6310 Roper Road
Edmonton, Alberta

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Accreditation No.: 1003775
Issued On: 12/9/2024
Accreditation Date: 10/19/2011
Expiry Date: 6/9/2027

K McKinley
President and CEO

This certificate is the property of the Canadian Association for Laboratory Accreditation Inc. and must be returned on request; reproduction must follow policy in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.cala.ca.

APPENDIX C

AGAT Sampling Guide

Alberta

AGAT Laboratories

Sample Procedures & Requirements

ORGANIC - WATER

PARAMETER	CONTAINER[3]	HOLDING TIME	MINIMUM AMOUNT	PRESERVATIVE
BTEX/F1	AG, NH	14 days	2 x 40 mL	$NaHSO_4$
F2-F4	AG	14 days	2 x 100 mL	$NaHSO_4$
BTEX/VPH/VH	AG, NH	14 days	2 x 40 mL	$NaHSO_4$
EPH/LEPH/HEPH/PAH	AG	14 days	2 x 100 mL	$NaHSO_4$
Alcohol	AG, NH	14 days	2 x 40 mL	NA
Amine Scan	AG	7 days	2 x 40 mL	NA
Chlorophenolics	AG	14 days	250 mL	$NaHSO_4$
EOX	AG, NH	14 days	250 mL	HNO_3
Glycol	AG	14 days	2 x 40 mL	$NaHSO_4$
Glyphosate	PB	14 days	125 mL	$Na_2S_2O_3$
Oil & Grease by IR	AG	28 days	2 x 250 mL	H_2SO_4
PAH	AG	14 days	2 x 100 mL	$NaHSO_4$
PCB	AG	Unlimited	2 x 250 mL	NA
Sterilant	AG	14 days	250 mL	$NaHSO_4$
Sulfolane	AG	7 days	2 x 40 mL	$NaHSO_4$
VOC	AG, NH	14 days	2 x 40 mL	$NaHSO_4$

INORGANIC - WATER

PARAMETER	CONTAINER	HOLDING TIME	MINIMUM AMOUNT	PRESERVATIVE
Detailed Salinity / Routine Chemistry	PB	See Individual	250 mL	NA
Metals - Dissolved	PB	6 months	60 mL	[1]HNO_3
Metals - Total	PB	6 months	120 mL	[1]HNO_3
Ammonia	PB	28 days	120 mL	H_2SO_4
Anions - Bromate, Chlorate, Chlorite	PB	28 days	60 mL	EDA
Alkalinity	PB	14 days	60 mL	NA
Biochemical Oxygen Demand	PB	48 hours (AB) 72 hours (BC)	1000 mL	NA
Carbon , Total or Dissolved Organic	PB	28 days	120 mL	[1]H_2SO_4
Carbon , Total or Dissolved Inorganic	PB	28 days	60 mL	NA
Chemical Oxygen Demand	PB	28 days	120 mL	H_2SO_4
Chlorine, Total Residual	AG, NH	ASAP - 15 minutes	500 mL	NA
Chromium, Hexavalent	PB	28 days	60 mL	[4]Buffer
Conductivity	PB	28 days	60 mL	NA
Cyanide, Free	PB, OP	14 days	60 mL	NaOH
Cyanide, Total	PB, OP	14 days	60 mL	NaOH
Mercury	AG	28 days	2 x 40 mL	[1]HCl
Mercury – Low Level	AG	28 days	100 mL	[1]HCl
Microbiology	Sanitized PB	30 hours	2 x 120 mL	$Na_2S_2O_3$
Microtox	CG, NH	72 hours	500 mL	NA
Nitrate, Nitrite	PB	72 hours	60 mL	NA
Nitrogen, Total Kjeldahl	PB	28 days	120 mL	H_2SO_4
Oxygen, Dissolved	Winkler Bottle	ASAP - 15 minutes	300 mL	[2]See notes
pH	PB	ASAP - 15 minutes	120 mL	NA
Phenol, Total (4aap)	AG	28 days	100 mL	H_2SO_4
Phosphate, Ortho	PB	72 hours	60 mL	Filter 0.45 µm
Phosphorous, Total	PB	28 days	120 mL	HNO_3
Phosphorous, Total - Low Level	PB	28 days	120 mL	H_2SO_4
Silica, Reactive	PB	28 days	60 mL	Filter 0.45 µm
Solids (TSS, TDS, TS)	PB	7 days	500 mL	NA
Sulphide	PB, NH	14 days (AB) 7 days (BC)	60 mL	NaOH+ZnAc
Turbidity	PB	72 hours	120 mL	NA

ORGANIC - SOIL

PARAMETER	CONTAINER[3]	HOLDING TIME	MINIMUM AMOUNT
BTEX/F1	MeOH / CG, NH	40 days	2 X 5 g in 40 mL + 25 g
F2-F4	CG	14 days	25 g
BTEXS/VPH/VH	MeOH / CG, NH	40 days	2 X 5 g in 40 mL + 25 g
EPH/LEPH/HEPH/PAH	CG	14 days	25 g
Alcohol	CG, NH	14 days	25 g
Amine	CG	14 days	100 g
Chlorophenolics	CG	14 days	25 g
EOX	CG, NH	14 days	25 g
Glycol	CG	14 days	25 g
Glyphosate	CG	14 days	25 g
Oil & Grease by IR	CG	28 days	25 g
PAH	CG	14 days	25 g
PCB	CG	Unlimited	25 g
Semi-Volatiles	CG	14 days	25 g
Sterilant	CG or P.BAG	14 days	50 g
Sulfolane	CG	14 days	50 g
Sulphur, Elemental	CG or P.BAG	30 days	50 g
TCLP BTEX/Flashpoint	CG, NH	14 days	125 g
VOC	MeOH / CG, NH	40 days	2 X 5 g in 40 mL + 25 g

INORGANIC - SOIL

PARAMETER	CONTAINER	HOLDING TIME	MINIMUM AMOUNT
Detailed Salinity	P. BAG	30 days	500 g
Metals	P. BAG	6 months	50 g
Boron, Hot Water Soluble	P. BAG	6 months	50 g
Carbon, Total Organic	P. BAG	28 days	100 g
Chloride	P. BAG	30 days	200 g
Chromium, Hexavalent	CG or P. BAG	30 days	50 g
Conductivity	P. BAG	30 days	200 g
Mercury	P. BAG	28 days	50 g
Microtox	CG, NH	72 hours	200 g
Moisture	CG, NH	14 days	50 g
Nitrogen, Total	P. BAG	28 days	200 g
Particle Size by Sieve or Texture	P. BAG	30 days	200 g
pH	P. BAG	30 days (AB) 365 days (BC)	200 g
Sulphur, Elemental	CG or P.BAG	30 days	50 g

NOTES:

1 - Filter (0.45 µm) and THEN preserve for *dissolved* or fill preserved bottle for total
2 - Add $MnSO_4$ and alkaline iodine azide
3 - Teflon Lined (TL) required and No Headspace (NH) recommended for all organic containers
4 - 1N NaOH/Ammonium Buffer

Please contact your laboratory for more detailed sampling instructions or to notify of incoming RUSH samples.

Container Codes

AG - Amber Glass CG - Clear Glass MeOH - Methanol NH - No Headspace OP - Opaque P.Bag - Plastic Bag PB - Plastic Bottle

RUSH CHARGES AND TIMES		EXAMPLE CALCULATIONS	
TURN-AROUND TIME	SURCHARGE	RECEIVABLE INFORMATION	RESULTS DELIVERABLE DUE BY
< 24 Hours	200%	Monday before 9:00 AM	Tuesday by 9:00 AM
Next Business Day	100%	Monday before 3:00 PM	Tuesday by 8:00 PM
Two Business Day	50%	Monday before 3:00 PM	Wednesday by 8:00 PM
Three Business Day	25%	Monday before 3:00 PM	Thursday by 8:00 PM
5 - 7 Business Days (Regular)	0%	Monday before 3:00 PM	Wednesday of the following week by 8:00 PM

8/11/2021

Environmental Division

AGAT Laboratories

Tips for Packing Your Sample Cooler

Here are 8 cooler packing tips to help you protect your samples from damage and maintain sample temperatures within the regulatory required range of 10º Celsius or below.

1. **Natural ice is the best choice** for keeping samples cold.
2. **Ice should take up at least three quarters of the space in your cooler.**
   ****When in doubt, use more ice; this is more cost-effective than resampling.*
3. **Never use dry ice** when packing your cooler! Not only is it a safety hazard, it will freeze your samples solid, compromising sample integrity and possibly shattering your containers.
4. **Seal each container tightly or in water-tight plastic bags** (preferably bubble bags) to prevent water from getting onto the sample and degrading the label.
5. **Use bubble bags or bubble wrap!** They are the ideal packing material for glass containers, and the trapped air provides additional insulation to help keep samples cold and offer a cushioning effect.
6. **Isolate each sample container** with non-absorbent packing material. Glass containers in direct contact with one another are almost certain to break. Do not stack glass containers or lay them on their sides.
7. **Pre-chill the sample,** if above ambient temperature when collected, place in an ice bath for a few minutes before packing. This saves your cooler ice from having to both lower the sample temperature as well as keep it cold.
8. **Use an AGAT cooler;** these are chosen and provided due to their insulation specifications.

***Reference the "Sample Integrity" document for further tips on how to avoid flags when sampling.*

APPENDIX D

AGAT Quality Program Summary

AGAT Laboratories

Understanding Quality

About AGAT Laboratories

AGAT Laboratories is a highly specialized Canadian company providing analytical solutions worldwide. As Canada's national privately-owned laboratory network, AGAT Laboratories is renowned for providing accurate, timely and defensible solutions to complex analytical requests with a constant focus on ensuring "Service Beyond Analysis" to its national and international clients since 1979. With coast-to-coast locations, AGAT Laboratories is comprised of 12 scientific divisions that service a wide spectrum of industries, namely, Environmental Chemistry, Mining Geochemistry, Petroleum Testing, Oil Sands Analysis, Rock Properties, Reservoir Characterization, Lubricant Testing, Air Quality Monitoring, Forensic Chemistry, Ultra-Trace and Toxicology, Food Testing, and Agricultural Analysis.

For more information, please visit **www.agatlabs.com**, follow us on **LinkedIn**, **Twitter** and **Instagram**, and subscribe to our **YouTube channel**.

AGAT Laboratories

Understanding Quality

AGAT Laboratories employs quality assurance professionals whose mandate is the continuous improvement of our organization. Our Quality Assurance Division monitors the operations of the company and ensures compliance with the best-documented practices. This division employs a Quality Assurance System to ensure precision, accuracy and reliability in all of our services. These best practices are documented and consistent with industry-regulated standards. In addition, we conduct regular quality control checks on all instrumentation and our personnel regularly evaluate all methodologies and procedures for the continuous improvement of our services. Quality control data is delivered to our clients for review in the form of a Certificate of Analysis as well as a Quality Assurance Report.

We don't view analytical determinations from a factory perspective; we view *quality as the responsibility of the entire organization*.

AGAT Laboratories is accredited or approved for specific analyses by the following:

- The Canadian Association for Laboratory Accreditation (CALA)
- The Standards Council of Canada (SCC)
- Centre d'expertise en analyse environnementale du Québec (CEAEQ)
- The NELAC Institute (TNI)
- The British Standards Institution (BSI)

AGAT Laboratories is accredited for specific tests as stated on the applicable scope of accreditation to the following:

- ISO /IEC 17025:2017 - General Requirements for the Competence of Testing and Calibration Laboratories

AGAT Laboratories is certified to the following:

- ISO 9001:2015 - Quality Management System

AGAT Laboratories' Quality Assurance personnel operate as a team across Canada and are collectively responsible for ensuring the highest degree of data scrutiny possible. Our Quality Assurance Division operates separately from all of our other operations. They report directly to our Chief Executive Officer and have no compensation directly or indirectly tied to laboratory production, financial or otherwise. This allows the division to operate in an unbiased manner for the benefit and improvement of all operations.

Quality Control: Accuracy vs. Precision

Understanding the difference between accuracy and precision is an important concept in quality control.

Precision: Is a measure of how well replicate measurements reproduce and can be calculated from laboratory duplicate samples.

VS

Accuracy: Is a measure of how near a result is to the true value (sometimes called the expected value) and is often expressed as percent recovery. Method accuracy is determined from the analysis of standards and spikes.

Method precision and accuracy are not the same factors. An analyst's data can be precise without being accurate, accurate without being precise, inaccurate and imprecise, or both accurate and precise.

The following bull's eye examples are often used when explaining the difference between accuracy and precision.

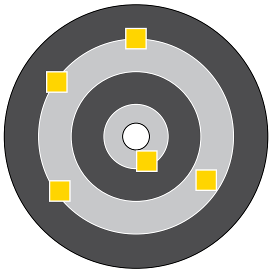


Figure 1.

Figure 1 ▪ Inaccurate and Imprecise

This is a random pattern, both inaccurate and imprecise. Results are not clustered together and are not near the bull's eye.

Analysis: The same sample was analyzed five times and the analyst did not achieve correct results (inaccurate) as no two results were the same (imprecise).

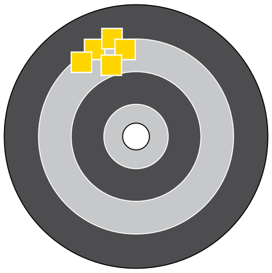


Figure 2.

Figure 2 ▪ Precise but Inaccurate

This is a precise pattern, but inaccurate. The results are clustered together but do not hit the intended mark (the expected result).

Analysis: A sample was analyzed five times. The analyst achieved results that were all close to each other (precise), however, they were not close to the actual result (inaccurate).

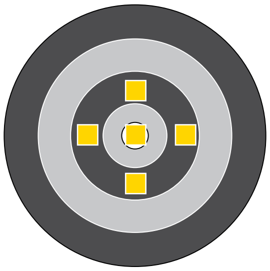


Figure 3.

Figure 3 ▪ Accurate but Imprecise

This is an accurate pattern, but imprecise. The results are not clustered but their "average" position is the centre of the bull's eye.

Analysis: For the sample analyzed five times, the average of the five results was the expected result (accurate) but the results are not close to one another (imprecise).

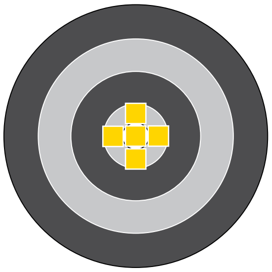


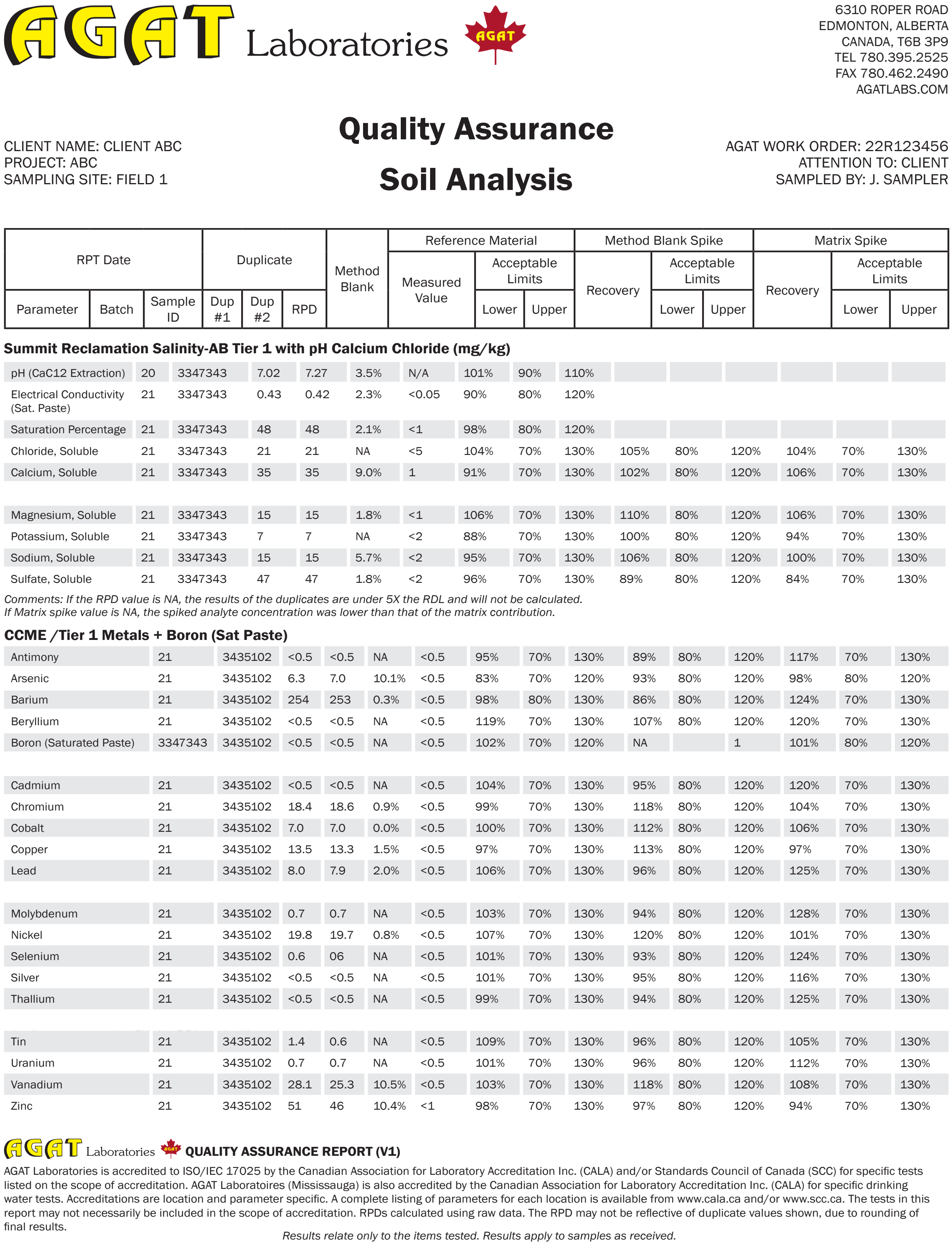
Figure 4.

Figure 4 ▪ Precise and Accurate

This pattern is both precise and accurate. The results are tightly clustered and their average position is the centre of the bull's eye.

Analysis: For a sample analyzed five times, the analyst consistently achieved the expected value.

Generally speaking, quality control samples that are analyzed in the laboratory alongside client samples are designed to measure precision and accuracy with the ultimate goal of developing each analytical process to the point where "Figure 4: Precise and Accurate" becomes the norm.



AGAT Laboratories

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EDMONTON, ALBERTA
CANADA, T6B 3P9
TEL 780.395.2525
FAX 780.462.2490
AGATLABS.COM

CLIENT NAME: CLIENT ABC
PROJECT: ABC
SAMPLING SITE: FIELD 1

Quality Assurance

Soil Analysis

AGAT WORK ORDER: 22R123456
ATTENTION TO: CLIENT
SAMPLED BY: J. SAMPLER

RPT Date			Duplicate			Method Blank	Reference Material			Method Blank Spike			Matrix Spike		
							Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
Parameter	Batch	Sample ID	Dup #1	Dup #2	RPD			Lower	Upper		Lower	Upper		Lower	Upper

Summit Reclamation Salinity-AB Tier 1 with pH Calcium Chloride (mg/kg)

pH (CaC12 Extraction)	20	3347343	7.02	7.27	3.5%	N/A	101%	90%	110%						
Electrical Conductivity (Sat. Paste)	21	3347343	0.43	0.42	2.3%	<0.05	90%	80%	120%						
Saturation Percentage	21	3347343	48	48	2.1%	<1	98%	80%	120%						
Chloride, Soluble	21	3347343	21	21	NA	<5	104%	70%	130%	105%	80%	120%	104%	70%	130%
Calcium, Soluble	21	3347343	35	35	9.0%	1	91%	70%	130%	102%	80%	120%	106%	70%	130%
Magnesium, Soluble	21	3347343	15	15	1.8%	<1	106%	70%	130%	110%	80%	120%	106%	70%	130%
Potassium, Soluble	21	3347343	7	7	NA	<2	88%	70%	130%	100%	80%	120%	94%	70%	130%
Sodium, Soluble	21	3347343	15	15	5.7%	<2	95%	70%	130%	106%	80%	120%	100%	70%	130%
Sulfate, Soluble	21	3347343	47	47	1.8%	<2	96%	70%	130%	89%	80%	120%	84%	70%	130%

Comments: If the RPD value is NA, the results of the duplicates are under 5X the RDL and will not be calculated.
If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.

CCME /Tier 1 Metals + Boron (Sat Paste)

Antimony	21	3435102	<0.5	<0.5	NA	<0.5	95%	70%	130%	89%	80%	120%	117%	70%	130%
Arsenic	21	3435102	6.3	7.0	10.1%	<0.5	83%	70%	120%	93%	80%	120%	98%	80%	120%
Barium	21	3435102	254	253	0.3%	<0.5	98%	80%	130%	86%	80%	120%	124%	70%	130%
Beryllium	21	3435102	<0.5	<0.5	NA	<0.5	119%	70%	130%	107%	80%	120%	120%	70%	130%
Boron (Saturated Paste)	3347343	3435102	<0.5	<0.5	NA	<0.5	102%	70%	120%	NA		1	101%	80%	120%
Cadmium	21	3435102	<0.5	<0.5	NA	<0.5	104%	70%	130%	95%	80%	120%	120%	70%	130%
Chromium	21	3435102	18.4	18.6	0.9%	<0.5	99%	70%	130%	118%	80%	120%	104%	70%	130%
Cobalt	21	3435102	7.0	7.0	0.0%	<0.5	100%	70%	130%	112%	80%	120%	106%	70%	130%
Copper	21	3435102	13.5	13.3	1.5%	<0.5	97%	70%	130%	113%	80%	120%	97%	70%	130%
Lead	21	3435102	8.0	7.9	2.0%	<0.5	106%	70%	130%	96%	80%	120%	125%	70%	130%
Molybdenum	21	3435102	0.7	0.7	NA	<0.5	103%	70%	130%	94%	80%	120%	128%	70%	130%
Nickel	21	3435102	19.8	19.7	0.8%	<0.5	107%	70%	130%	120%	80%	120%	101%	70%	130%
Selenium	21	3435102	0.6	06	NA	<0.5	101%	70%	130%	93%	80%	120%	124%	70%	130%
Silver	21	3435102	<0.5	<0.5	NA	<0.5	101%	70%	130%	95%	80%	120%	116%	70%	130%
Thallium	21	3435102	<0.5	<0.5	NA	<0.5	99%	70%	130%	94%	80%	120%	125%	70%	130%
Tin	21	3435102	1.4	0.6	NA	<0.5	109%	70%	130%	96%	80%	120%	105%	70%	130%
Uranium	21	3435102	0.7	0.7	NA	<0.5	101%	70%	130%	96%	80%	120%	112%	70%	130%
Vanadium	21	3435102	28.1	25.3	10.5%	<0.5	103%	70%	130%	118%	80%	120%	108%	70%	130%
Zinc	21	3435102	51	46	10.4%	<1	98%	70%	130%	97%	80%	120%	94%	70%	130%

AGAT Laboratories **QUALITY ASSURANCE REPORT (V1)**

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratoires (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation. RPDs calculated using raw data. The RPD may not be reflective of duplicate values shown, due to rounding of final results.

Results relate only to the items tested. Results apply to samples as received.

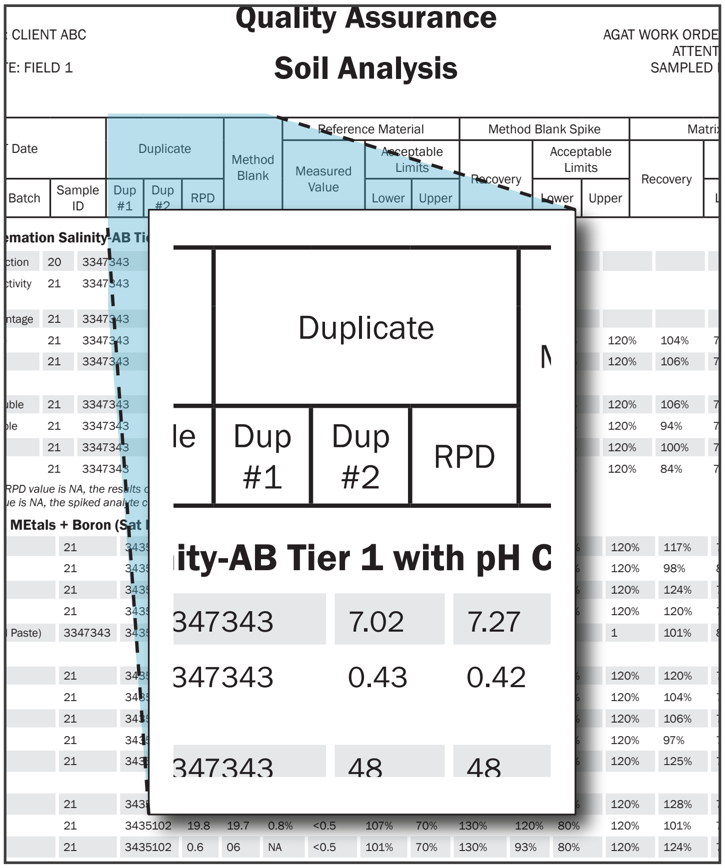
Figure 5.
AGAT Laboratories' Quality Assurance Report.

Quality Control Samples

Accuracy and precision are estimated in an analytical process through the use of quality control samples. Quality control samples come from both the laboratory and the field. Laboratory quality control sample results are reported in the AGAT Laboratories' Quality Assurance Reports, which are delivered alongside the Certificate of Analysis. The following is an explanation of each of these laboratory samples, their origin and purpose

Duplicates

Under the Duplicates heading in the AGAT Laboratories' Quality Assurance Report, there exists three columns, Duplicate 1, Duplicate 2 and RPD (Relative Percent Difference). Duplicates are a measurement of analytical precision and can mean more than one thing. It is important to understand the difference between the versions of these samples.



Quality Assurance

Soil Analysis

CLIENT ABC

FIELD 1

AGAT WORK ORDE

ATTENT

SAMPLED

	Duplicate		
le	Dup #1	Dup #2	RPD

ity-AB Tier 1 with pH C

347343	7.02	7.27
347343	0.43	0.42
347343	48	48

Figure 6.
Duplicate data on Quality Assurance Report.

Laboratory duplicates are two aliquots taken from the same sample container and then processed through the entire analytical procedure separately. Measured results are used to compare the analytical precision of the entire analytical process including sample preparation, digestion, extraction and instrumental measurement.

Matrix Spike Duplicates

These are used to determine method precision. These samples involve taking two aliquots from a client sample and adding known amounts of the contaminants of interest to both aliquots, then processing them through the entire analytical procedure separately. Although similar to laboratory duplicates, in this method, precision can be measured on analytes even in situations where the sample itself might have been a "non-detect" for the compounds of interest.

Instrument Duplicates

Where two aliquots are taken from the same extract or digest and then analyzed by the same instrument at the same time. Results from these duplicates indicate instrumental precision, however, they do not provide information relative to the entire analytical process. In all analytical procedures, we measure and report laboratory duplicates, but never instrumental duplicates. This allows us a true and accurate picture of the entire analytical process, not just of the instrumental precision.

Split Sample

A sample which has been thoroughly blended and split between two containers. These samples can then be sent to one laboratory, or sometimes to two separate labs. Split samples are intended to measure the precision of sampling and analytical procedures, however the thoroughness of the blending process can often be the determining factor in the precision of the two data points.

Co-located Samples

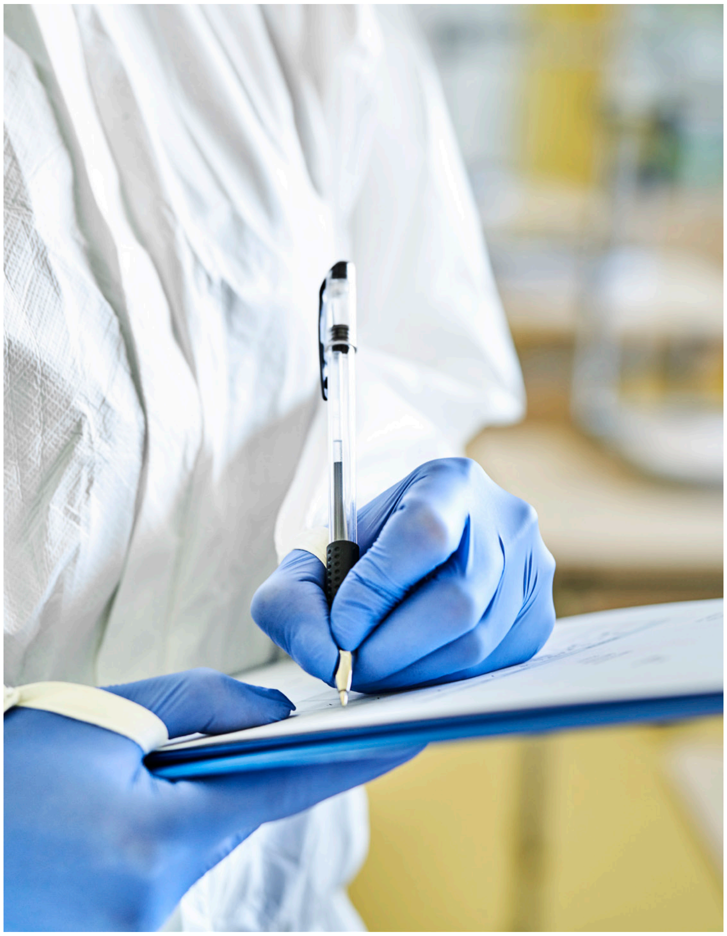
Samples taken in the same location but not blended. Due to the extreme variability of environmental samples over short spatial differences, especially soils, it is difficult to use co-located soil samples to assess laboratory precision. They can however be useful in measuring sample precision or the variability of the matrix.

The Relative Percent Difference (RPD)

The numerical value of comparing duplicate values to one another. This is calculated by taking the difference of the two measurements, dividing it by the average of both measurements, and then multiplying it by 100 per cent. RPD is a direct indicator of quality control when comparing repeated measurements that are expected to have similar values.

Certified Reference Material

Certified Reference Material (CRM) is purchased material that contains predetermined concentrations of the analyte or analytes of interest. CRMs are manufactured by companies accredited to the current version of the ISO 17034 standard. They are typically samples of either water or soil where the “right answer” for analysis is known to demonstrate the accuracy of a specific method. CRMs can be used to calibrate instruments by preparing a series of dilutions from the standard. Reference standards (RM) are similar to CRMs, but are purchased from a different supplier, not accredited to ISO 17034, where certified reference materials are not available. A second source CRM is used to ensure that the calibration standard is correct and is measured before and after a batch of client samples. On our Quality Assurance Report, the “measured value” for the CRM is expressed as a percentage recovery of the certified value after the client samples have been measured.

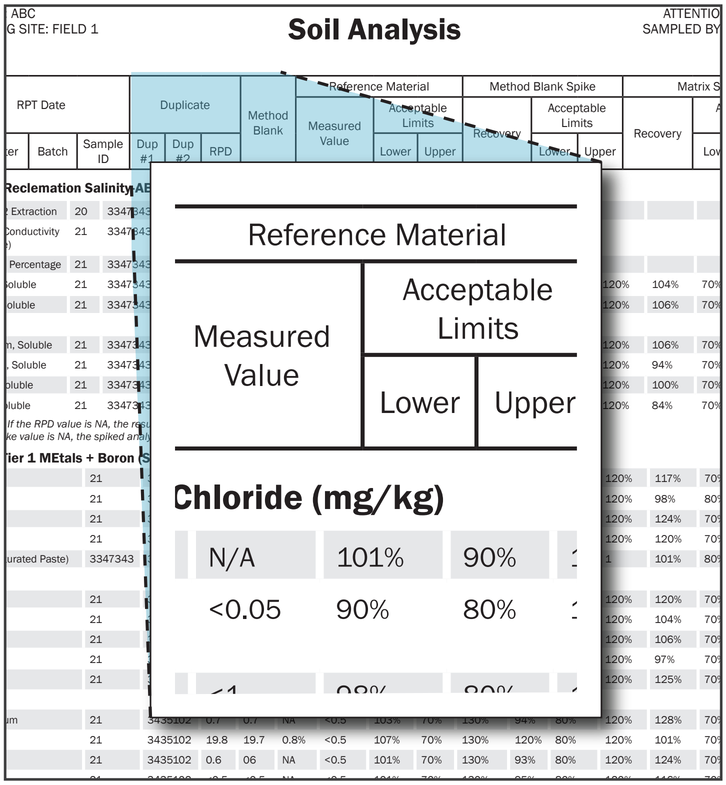


Spikes

There are two types of spikes that are routinely analyzed by AGAT Laboratories - Matrix Spikes and Method Blank Spikes. Both are used to measure the accuracy of the analytical method, and the effect a particular sample matrix has on the accuracy of that measurement.

Matrix Spike

Is prepared by adding a known amount of the target analyte(s) to a volumetric aliquot of the client sample. By spiking the sample matrix, our laboratory analysts can demonstrate whether a chosen method is fit for purpose to measure the adjacent samples, that are of a similar matrix. The percentage recovery of the matrix spike will indicate the accuracy of the analytical method and provide a measure of any potential matrix interferences or heterogeneity issues.

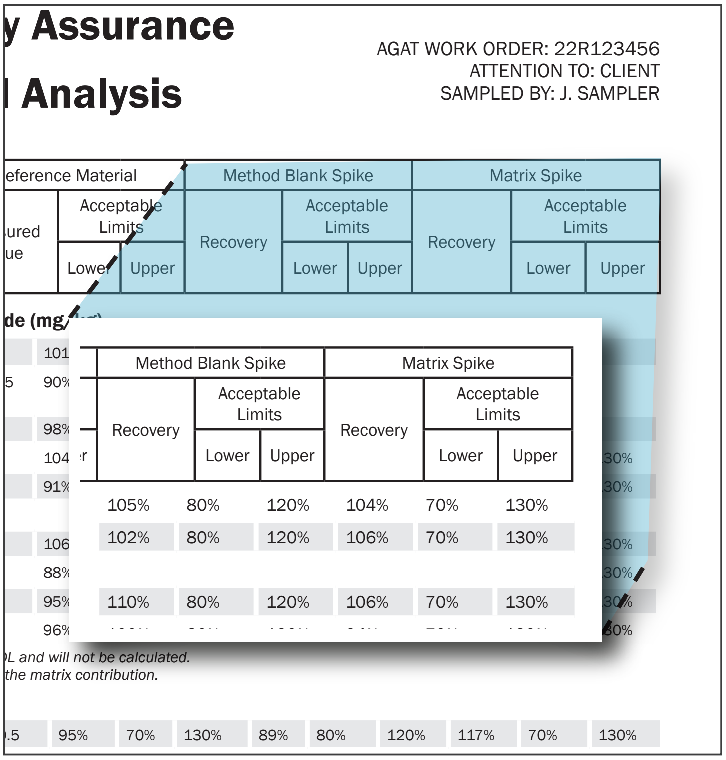

ABC
G SITE: FIELD 1

Soil Analysis

ATTENTIO
SAMPLED BY

Reference Material		
Measured Value	Acceptable Limits	
	Lower	Upper
Chloride (mg/kg)		
N/A	101%	90%
<0.05	90%	80%

Figure 7.
Reference material data on Quality Assurance Report.


y Assurance
l Analysis

AGAT WORK ORDER: 22R123456
ATTENTION TO: CLIENT
SAMPLED BY: J. SAMPLER

Method Blank Spike			Matrix Spike		
Recovery	Acceptable Limits		Recovery	Acceptable Limits	
	Lower	Upper		Lower	Upper
105%	80%	120%	104%	70%	130%
102%	80%	120%	106%	70%	130%
110%	80%	120%	106%	70%	130%

L and will not be calculated.
the matrix contribution.

Figure 8.
Spike data on Quality Assurance Report.

Method Blank Spike

Is constructed by simply adding a known quantity of the analyte of interest to an aliquot of reagent water or clean soil free of analytes being tested for. The method blank spike acts as a measure of the accuracy of the equipment and analyst technique, as well as a check on the preparation of the matrix spike.

Surrogate Samples

The Environmental Protection Agency defines a Surrogate Spike as: “A pure substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them to establish that the analytical method has been performed properly.”

Surrogate spikes are very important when analyzing organic environmental analytes. In particular, in determining how completely the analyte of interest was partitioned from the original water or soil sample. In the case of extractable compounds, this is into the solvent phase, and for the case of Volatile Organic Compounds, it is into the vapour phase.

In many cases, these compounds could be deuterated versions of the target compounds. These surrogates are identical to the parent compound; however, the hydrogen atoms on the original compound are replaced with deuterium atoms. In this way, the surrogate such as Toluene-d8 behaves in the same manner as the parent compound, yet is distinguishable from the parent by the analytical instrumentation.

Putting It All Together

Focus and importance are usually centred on individual components of quality control procedures that are followed in the laboratory. Of equal importance however, is reviewing how all of these procedures fit together. To understand this fact, one must first understand how a laboratory defines a "batch" of samples.

How many client samples are analyzed before, between and after quality assurance samples are utilized to verify the validity of the produced data?

A typical scenario is depicted in Table 1 below. Note: there are numerous analytical parameters that each have their own quality control requirements. Table 1 is a summary of the typical batch criteria.

Table 1.

Sample Type	Order	Sample Type	Order
Calibration Standard 1	1	Client Sample 3	12
Calibration 2	2	Client Sample 4	13
Calibration 3	3	Client Sample 5	14
Calibration 4	4	Client Sample 6	15
Method Blank	5	Client Sample 7	16
Certified Reference Material	6	Client Sample 8	17
Method Blank Spike	7	Client Sample 9	18
Client Sample 1	8	Client Sample 10	19
Client Sample 1 Duplicate	9	Client Sample 10 Duplicate	20
Client Sample 1 Matrix Spike	10	Client Sample 10 Spike	21
Client Sample 2	11	Certified Reference Material	22

** As illustrated in the table, the analysis of ten client samples actually involves the measurement of up to 22 samples.*

If the first quality control samples adhere to the criteria, then the client samples undergo analysis. If the last quality control samples do not pass the specified criteria, client sample results are deemed "non-conforming" and the process starts again from the beginning, after the cause of the original failure has been determined.

Before client sample results are released to the client, both sets of quality control samples must pass all relevant tests and adhere to the criteria.

The quality control results that appear on your Quality Assurance Certificate are the results of the quality control samples analyzed after your samples. Any indication of irregularities will halt the laboratory analysis until such time that corrective measures can be taken and samples can be re-analyzed.

As Stated in AGAT Laboratories' Quality Policy:

"We, AGAT Laboratories, strive to meet our clients' turn-around time and service requirements while upholding the principle that the quality of the data is paramount."

AGAT Laboratories will not compromise the quality of data simply to meet an internal turnaround time target. Our employees are free from the possibility of disciplinary actions resulting from any slowdown in production as related to a quality issue. AGAT Laboratories' employees are encouraged to raise any quality-related issues that they may identify without concern of reprisal or slowed production. All AGAT Laboratory staff sign off annually on AGAT's Ethics and Compliance Policy and Data Integrity and Impartiality Compliance Policy.

Quality Control Reference Guide

The following table represents typical acceptable ranges for the quality control samples previously described.

Please note: These ranges are guidelines and may not represent specific jurisdictional requirements. Please contact AGAT Laboratories' Quality Assurance Division for more information.

AGAT Laboratories has provided this overview to assist you in your interpretation of the quality control data that is provided in your reports.

If you are interested in our in-house quality seminar, please **visit our website** for more information or contact us at **info@agatlabs.com**.

Table 2.

Quality Control Sample	Frequency of Use	Purpose	Acceptable Result
Calibration Blank	At the beginning of the day and after a spike or continuing calibration standard.	Used to determine instrument background.	<RDL
Method Blank	Every 20 client samples, minimum.	Contamination	<RDL
Calibration Standard	At the beginning and sometimes at the end of a batch of samples.	Accuracy	>0.990 correlation (or better) depending on the analysis.
Certified Reference Standard	Run immediately after calibration. Analyzed after every 20 client samples if used as the Reference for the batch.	Accuracy	+/-30% recover (or better) depending on the analysis.
Method Blank Spike	Every 20 client samples, minimum.	Accuracy, check on prep equipment.	60-140% recovery (or better) depending on the analysis.
Matrix Spike	Every 20 client samples, minimum.	Accuracy, matrix interferences and sample heterogeneity.	60-140% recovery (or better) depending on the analysis.
Surrogate Spikes	Organics - every sample, blank and spike.	Accuracy of extraction and prep techniques.	50-140% recovery (or better) depending on the analysis.
Replicates / Duplicates	Every 20 client samples, minimum.	Precision of the method.	+/-20% to +/-50% RPD depending on the sample matrix.
Matrix Spike Duplicates	Every 20 samples, for some methods.	Precision of the method.	+/-20% to +/-50% RPD depending on the sample matrix.
Instrument Duplicates	Every 20 samples, for some methods.	Precision of the instrumental determination.	+/-30% RPD (or better), depending on the analysis.

APPENDIX E

GeoVerra Project Quality Plan

Quality in GeoVerra

Rev #	Date <YYYY-MMM-DD>	Rev. Status	Reviewer (s)	Approver/Owner
1	2022-May-17	IFU	VP, Operational Excellence	National Quality Manager

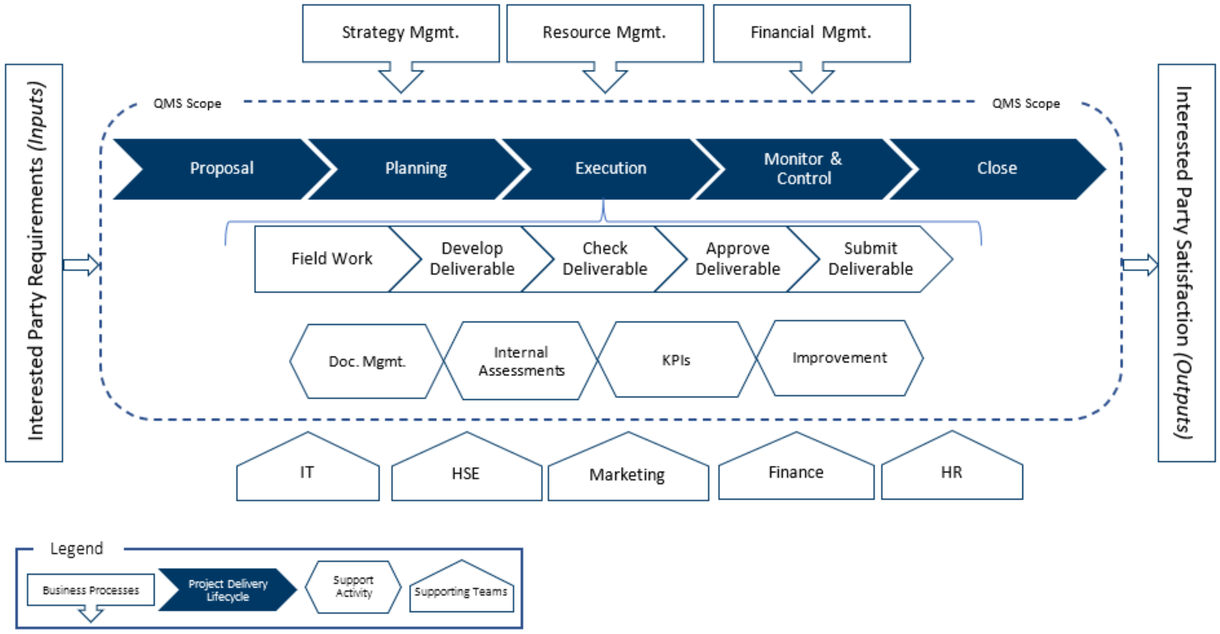


Figure 1: GeoVerra Quality System Framework

In GeoVerra, accuracy is critical to our business.

To meet client driven quality requirements, GeoVerra strictly follows all statutes, regulations, by-laws, and practice guidelines for the surveying profession.

Our employees are professionals, trained in their respective roles. Our processes include checking and verification every step of the way. Our project managers rigorously supervise their projects and are involved throughout the process to answer questions, provide advice, and direct the scope of work.

GeoVerra strives to provide high-quality survey services in the safest, timeliest, and most cost-effective manner to achieve client satisfaction. Committed to continual improvement, GeoVerra encourages all employees to identify and implement process and/or service improvements to ensure the company is performing at optimum quality, reliability, service, and efficiency.

In GeoVerra we continually review and update our ISO-aligned quality system. Its critical components include:

- Quality policy
- Quality control processes
- Document management
- Change management process procedure
- Nonconformance handling, and corrective & improvement actions processes
- Internal assessment processes

We thank you for your business and are committed to your satisfaction.

Quality Control Procedure

Rev #	Date <YYYY-MMM-DD>	Rev. Status	Reviewer (s)	Approver/Owner
0	2022-May-06	IFU	Regional VPs	National Quality Manager

1. Purpose and Scope

1.1. Purpose

This document describes quality control activities for geomatics work in GeoVerra

1.2. Scope

This document applies to all projects within GeoVerra.

2. Instructions

Quality and accuracy are critical to our business, and as such our processes include checking and verification every step of the way.

2.1. Specific Quality Control Activities

Process Step	Quality Control Activities
Requirements Review	• Project requirements are reviewed by the GeoVerra Project Manager and communicated to the project team
Field Data Collection	• Equipment is calibrated and validated regularly • Critical field activities are guided by work instructions that were developed based on best practices, subject matter expert input and client feedback • Redundancy checks are performed in the field
Office Data Processing	• Office personnel review all field returns for completeness and accuracy
Calculations	• All calculations are independently verified
Deliverable Creation	• All deliverables are reviewed and checked by a second person • Checklists exist to assist in creation and review of many of our deliverable types
Final Review Before Submission	• Project managers review deliverables against project requirements before delivery to the client

3. Records

The following records are to be kept when adhering to this work instruction:

Record	Storage Location
Evidence of checking and validation activities	Project folders

4. Referenced Documents

The following documents/templates are referenced within this document:

Document Name	Storage Location
NA	

5. Change Log

Date (YYYY-MMM-DD)	Revision	Description of Change
2022-May-06	0	No change to revision. Updated document to current template. Changed document owner.
2020-Jul-03	0	Initial release.

Project Quality Plan (PQP)

Project Details			
Project #:		Project Name:	Unipkat Remediation
GV Project Manager:	Ramon Pina	PQP Approval Date:	
Client:	WSP	PQP Rev:	
Project Scope:	Survey Support for Enviro remediation		

In keeping with GeoVerra's Project Playbook, the GeoVerra project manager (PM) will supervise project activities and monitor project progress to provide confidence of effective delivery of quality, schedule, and cost, throughout the project.

Project Quality Plan

PQP Section	Section Description
Scope	This quality plan is applicable to the Unipkat Enviro Remediation project. It is applicable to the processes used to produce the deliverables necessary to meet the contractual obligations of this project.
Quality Objective	To provide deliverable(s) meeting all code, regulation, and industry standards. To meet all established timelines and approved budget.
Responsibilities	The PM has overall responsibility for the successful completion of the project, including conformity to all applicable GeoVerra policies, procedures, instructions, etc., as well as meeting the objectives outlined above. Responsibilities of team members involved in the planning, executing, controlling, and monitoring the progress of the activities covered by this plan are outlined in various documents, including but not limited to organizational charts and work instructions. Team members access work instructions, templates, checklists, etc., via GeoVerra's intranet (GV Huddle).
Documentation	Project deliverables will be created in accordance with GeoVerra's quality management system (QMS). Project documents will be organized, stored, and revision controlled. Project folders will be established in adherence to GeoVerra's Project Standard Folder Structure. There are no special document control requirements. Project data and records will be maintained in accordance with the Data & Record Retention Policy.
Records	Identifiable and retrievable records will be maintained to provide evidence of activities affecting quality. Project records will be organized, stored, and accessible to applicable stakeholders in accordance with GeoVerra's Project Folder Structure.

PQP Section	Section Description
	Records will be retained per contractual requirements or as required by jurisdictional or governing professional association requirements, whichever is the longest and in accordance with the Data & Record Retention Policy.
Resources	Securing of resources is completed in the "planning" phases, as outlined within GeoVerra's Project Playbook (see PMO Zone on GV Huddle). Working with GeoVerra leadership, the PM will provide adequate resources, including, but not limited to people, equipment, and data. The PM will obtain, or confirm that, all required preliminary inputs (such as search data or client input data) prior to starting associated work.
Requirements Review / Project Inputs	The PM will review all relative documents (e.g., contract, work authorization, proposal) to enable a clear understanding of the scope, change process, billing instructions, etc. This is in keeping with GeoVerra's Project Playbook (see PMO Zone on GV Huddle).
Communication	GeoVerra encourages open communication internally as well as between GeoVerra and WSP Canada. When practical, face-to-face, telephone, or video communication is encouraged. As needed, these conversations will be followed by an email summarizing relevant points made in the conversation. Emails containing relevant project information (such as related to decisions, approvals, etc.) will be maintained as project records with the project file folders. The PM will hold internal project meetings as need it to maintain effective project team communication. The agenda may vary depending on the project needs and will be chaired by the PM, or delegate. Meetings between GeoVerra and WSP Canada will be held as per client request. Meeting minutes (or similar) will be created and stored within the project's file folders. In the event GeoVerra receives a formal complaint from WSP Canada the issue is to be brought to the PM's attention as soon as possible. If appropriate, the PM will contact WSP Canda to seek clarity, obtain additional information and/or develop an action plan. The PM will escalate the client complaint as needed within GeoVerra's leadership team and to the National Quality Manager.
Purchasing	N/A
Product and Service Provision	GeoVerra will use team members that are competent, trained, experienced, and (if required by applicable law or practical industry practices) licensed in and for the performance of their duties. GeoVerra will perform the contracted services under controlled conditions. These conditions include: • The availability of deliverable input information o Deliverable input information received from WSP Canada is stored according to GeoVerra's standard filing system. These files are easily recognizable by their file name and easily retrievable. o Any changes to the input information will be subject to GeoVerra's Management of Change Procedure, as well as WSP Canada's procedure, as applicable. Records are maintained of these changes, as required.

PQP Section	Section Description	
	o Confidentiality of all project-related information is an understood function at GeoVerra. This principle is reinforced by the GeoVerra PM. • The availability of work instructions o GeoVerra team members have access to various work instructions, checklists, forms, templates, etc. via GeoVerra's intranet (GV Huddle). o All documented instructions etc. are written in such a way as to recognize a level of competence associated with the functions performing the activities. o Team members are required to adhere to all requirements outlined in these documents as well as any client-specific requirements. The GeoVerra PM will confirm any client-specific requirements are communicated to the project team. o At the beginning of the project, work instructions, etc. are reviewed for suitability by PM. Specific quality control requirements for this project are outlined below.	
	Quality Control Requirement	Application On This Project
	Field Data Collection • Equipment is calibrated and validated regularly. • Equipment is visually checked daily by the field crew prior to start of survey. • Critical field activities are guided by work instructions that were developed based on best practices, subject matter expert input and client feedback. • Redundancy checks are performed in the field.	• GeoVerra Equipment Calibration Program • Conventional Equipment Calibration Work Instruction • Field Notes Instruction • GeoVerra Feature Code List • Data Processing Checklist.
	Office Data Processing • Office personnel review all field returns for completeness and accuracy.	• Field Data Processing Instruction • Data Processing Checklist
	Calculations • All calculations are independently verified.	• Quality Control Calculations Spreadsheet Work Instruction • QC Calculations Spreadsheet
	Deliverable Development • All deliverables are reviewed and checked by a second person. • Checklists exist to assist in creation and review of many deliverable types.	

PQP Section	Section Description
	Final Review Prior to Submission • PM or Project Coordinator reviews deliverables against project requirements before delivery to the client. • All the data that is submitted to the client as final, will be storage in the job folder to keep a record.
Identification and Traceability	Deliverables submitted to WSP Canada by GeoVerra will be traceable using revisions.
Customer Property	GeoVerra will exercise care with WSP Canada's property while it is being used, or under GeoVerra's control. Client property can include the following: • Drawings, specifications, databases, 3D models and other input information GeoVerra identifies, verifies, protects and safeguards WSP Canada's property provided for project use. This is done via storage on GeoVerra's network and by using GeoVerra's standard filing structure. If any WSP Canada property is lost, damaged, or otherwise found to be unsuitable for use, it will be reported to WSP Canada. A record of the incident is stored in the project folder, along with supporting documentation (if any) and WSP Canada's response or requests. GeoVerra will shred sensitive hardcopy client documentation when no longer current or required. Sensitive or proprietary hardcopy client information will not be discarded into recycle bins, unless previously shredded. Handling of confidential documents will be in accordance with the Manage Project Documents process outlined in GeoVerra's Project Playbook (see PMO Zone on GV Huddle). GeoVerra will contact WSP Canada whenever questions or issues arise regarding WSP Canada supplied documentation. If necessary, a meeting can be requested by either GeoVerra or WSP Canada.
Storage & Handling (Preservation of Outputs)	Conformity of deliverables is preserved during internal processing and delivery to WSP Canada through effective management of documentation, records, and electronic virus protection. This preservation includes the following: • Identification – utilizing either WSP's naming and/or numbering standard, as required • Handling – recognizable cover sheets accompany internal reviews and transmittals, as needed, use of effective network and software protection • Storage and protection of documentation, records, confidential information, and other intellectual property through implementation of effective network storage and security measures. Deliverables will be issued to WSP Canada per WSP's transmittal and project close-out requirements.
Nonconforming Products	Client dissatisfaction will be handled on a case-by-case basis. Client deliverables will not be submitted with known deficiencies.

PQP Section	Section Description
	GeoVerra team members are required to identify and report project deliverables or processes that do not conform to requirements. GeoVerra will use the Control of Non-conformances Procedure to address the identified non-conformance. Should WSP Canada initiate a nonconformance (NCR) against GeoVerra, WSP Canada will advise GeoVerra's PM. The GeoVerra PM will engage the National Quality Manager within twenty-four (24) hours of being notified. GeoVerra will respond to the NCR via WSP Canada's form (if provided) or via GeoVerra's Quality Issue Form and submit a suitable response within the timeline provided by WSP Canada. GeoVerra will maintain records of the NCR response, along with evidence to demonstrate completion of the identified action plan. All nonconformances initiated by WSP Canada will require WSP Canada's approval to close the nonconformance.
Monitoring & Measurement	The PM will monitor and report project performance and manage change per GeoVerra's Project Playbook (see PMO Zone on GV Huddle). Project progress will be monitored via the project schedule as required. • To monitor progress, the PM will watch the stage assignments and status and connect with teams. • To monitor quality, the PM will perform reviews on deliverables and confirm that checklists have been used throughout the process. • To monitor financials, the PM will review adherence to budget and confirm invoices are submitted and paid in a timely manner. Client satisfaction is an ongoing, continuous activity within GeoVerra. Clients are encouraged to provide feedback (both positive and constructive) to GeoVerra. Regular project meetings (formal or informal) are one way to present, review and respond to any client feedback. If necessary, GeoVerra's Corrective & Improvement Actions Procedure will be used to implement corrective actions.
Inspection & Testing Equipment	Equipment is calibrated and validated regularly, in keeping with GeoVerra's Equipment Calibration Program. The Director, Equipment and Asset Management maintains appropriate records are maintained.
Audit	The National Quality Manager will coordinate any project audit requested by WSP Canada subject to appropriate change management procedures. Any internal project audits will be conducted in keeping with GeoVerra's Internal Audit Procedure. A copy of the final audit report will be provided to GeoVerra's PM and filed within the project file folders. Identified audit findings (nonconformances and/or opportunities for improvement) will be addressed in adherence to GeoVerra's Control of Non-conformances Procedure and/or Corrective & Improvement Actions Procedure. In addition to formal project audits, this project and project team members are subject to inclusion in the GeoVerra's internal audit program.

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