



**Return Bids to:**

Natural Resources Canada

**Only bids submitted using CPC Connect service will be accepted.**

At least five (5) business days before the bid solicitation closing date, it is necessary for the Bidder to send an email requesting to open CPC Connect conversation to the following address:

<mailto:procurement-appvisionnement@NRCan-RNCan.gc.ca>

**Retourner Les Soumissions à:**

**Request for Proposal (RFP)  
Demande de proposition (DDP)**

**Proposal To: Natural Resources Canada**

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

**Proposition à: Ressources Naturelles Canada**

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

**Comments – Commentaires**

**Issuing Office – Bureau de distribution**

Finance and Procurement Management Branch  
Natural Resources Canada  
506 Burnside Road West  
Victoria, BC V8Z 1M5

<b>Title – Sujet</b> Tailings Sampling Program for Critical Minerals Potential in Canadian Mine Tailings	
<b>Solicitation No. – No de l’invitation</b> NRCan- 5000074745/A	<b>Date</b> 2023-09-14
<b>Requisition Reference No. - N° de la demande</b> 175989	
<b>Solicitation Closes – L’invitation prend fin at – à 02:00 PM EDT</b> on – le 2023-10-03	
<b>Address Enquiries to: - Adresse toutes questions à:</b>  <a href="mailto:Gerald.Baran@NRCan-RNCan.gc.ca">Gerald.Baran@NRCan-RNCan.gc.ca</a>	
<b>Telephone No. – No de telephone</b> 778-350-9373	
<b>Destination – of Goods and Services:</b> <b>Destination – des biens et services:</b>  See here-in	
<b>Security – Sécurité</b>  There are no security requirements associated with this requirement.	
<b>Vendor/Firm Name and Address</b> <b>Raison sociale et adresse du fournisseur/de l’entrepreneur</b>    <b>Telephone No.:- No. de téléphone:</b>  <b>Email – Courriel :</b>	
<b>Name and Title of person authorized to sign on behalf of Vendor/Firm (type or print)</b> <b>Nom et titre de la personne autorisée à signer au nom du fournisseur/de l’entrepreneur (taper ou écrire en caractères d’imprimerie)</b>    <hr/> <b>Signature</b> <span style="float:right"><b>Date</b></span>	



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The Articles contained in this document are mandatory in their entirety, unless otherwise indicated. Acceptance of these Articles, in their entirety, as they appear in this document, is a Mandatory requirement of this RFP.

**Suppliers submitting a proposal containing statements implying that their proposal is conditional on modification of these clauses or containing terms and conditions that purport to supersede these clauses or derogate from them will be considered non-responsive.**

Bidders with concerns regarding the provisions of the Bid Solicitation document (including the Resulting Contract Clauses) should raise such concerns in accordance with the Enquiries provision of this RFP.



## **REISSUE OF BID SOLICITATION**

This bid solicitation cancels and supersedes previous bid solicitation number NRCan-5000074745 dated June 15, 2023 with a closing of July 24, 2023 at 2pm EDT. A debriefing or feedback session will be provided upon request to bidders/offerors/suppliers who bid on the previous solicitation.



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## **PART 1 - GENERAL INFORMATION**

### **1.1 Introduction**

The bid solicitation is divided into seven parts plus attachments and annexes, as follows:

Part 1 General Information: provides a general description of the requirement;

Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation;

Part 3 Bid Preparation Instructions: provides Bidders with instructions on how to prepare their bid;

Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, and the basis of selection;

Part 5 Certifications and Additional Information: includes the certifications and additional information to be provided;

Part 6 Security, Financial and Other Requirements: includes specific requirements that must be addressed by Bidders; and

Part 7 Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract.

The Annexes include the Statement of Work, the Basis of Payment, the Federal Contractors Program for Employment Equity - Certification.

### **1.2 Summary**

**1.2.1** Natural Resources Canada (NRCan) by means of this RFP (Request for Proposal) is seeking services to carry out a tailings sampling program for sampling mine waste to support definition of the material as a resource consistent with NI 43-101 reporting; as well as to conduct characterization studies on critical minerals potential in Canadian mine tailings. It will support work undertaken by CanmetMINING on the B21 Critical Minerals in Canadian Mine Tailings (Mining Value from Waste) project.

The Work or a portion of the Work to be performed under the Contract will be on an "as and when requested basis" using a Task Authorization (TA).

The Contract will be in effect for one (1) year with one (1) additional (1) year option period.

**1.2.2** This bid solicitation allows bidders to use the CPC Connect service provided by Canada Post Corporation to transmit their bid electronically. Bidders must refer to Part 2 entitled Bidder Instructions, and Part 3 entitled Bid Preparation Instructions, of the bid solicitation, for further information.

### **1.3 Debriefings**

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days from receipt of the results of the bid solicitation process. The debriefing will be done in writing, by email.



## PART 2 - BIDDER INSTRUCTIONS

### 2.1 Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The [2003](#) (2023-06-08) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

- **In the complete text content (except Section 1 and 3) Delete:** Public Works and Government Services Canada” and **Insert:** “Natural Resources Canada.” **Delete:** “PWGSC” and **Insert:** “NRCan”
- **Section 2: Delete:** “Suppliers are required to” and **Insert:** “It is suggested that suppliers”
- **Subsection 1 of Section 8:**  
**Delete in its entirety:** Unless specified otherwise in the bid solicitation, bids may be submitted by facsimile. The only acceptable facsimile number for responses to bid solicitations issued by PWGSC headquarters is 819-997-9776 or, if applicable, the facsimile number identified in the bid solicitation. The facsimile number for responses to bid solicitations issued by PWGSC regional offices is identified in the bid solicitation
- **Subsection 2 of Section 8: Delete entirely**  
**Delete:** The only acceptable email address to use with CPC Connect for responses to bid solicitations issued by PWGSC headquarters is: [tps-gc.pareceptiondessomissions-apbidReceiving.pwgsc@tps-gc.pwgsc.gc.ca](mailto:tpsgc.pareceptiondessomissions-apbidReceiving.pwgsc@tps-gc.pwgsc.gc.ca), or, if applicable, the email address identified in the bid solicitation. : The only acceptable email address to use with CPC Connect for responses to bid solicitations issued by PWGSC headquarters is: [tps-gc.pareceptiondessomissions-apbidReceiving.pwgsc@tps-gc.pwgsc.gc.ca](mailto:tpsgc.pareceptiondessomissions-apbidReceiving.pwgsc@tps-gc.pwgsc.gc.ca), or, if applicable, the email address identified in the bid solicitation.  
**Insert:** The only acceptable email address to use with CPC Connect for responses to bid solicitation issued by NRCan is: <mailto:procurement-appvisionnement@NRCan-RNCan.gc.ca>  
**Subsection 2b of Section 8:**  
**Delete:** “six business days”  
**Insert:** “five business days”
- **Under Subsection 2 of Section 20:** Delete in its entirety

Subsection 5.4 of [2003](#), Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: 60 days  
Insert: 180 days

### 2.2 Submission of Bids

Bidders must submit all proposals electronically. Given the current constraints on NRCan’s networks, the electronic mail system has a limit of 1GB per single message received and a limit of 20GB per conversation. NRCan encourages bidders to submit all bids earlier than the closing time.



Bids must be submitted no later than the date and time indicated on page 1 of the bid solicitation.

**Only bids submitted using CPC Connect service will be accepted.**

At least five (5) business days before the bid solicitation closing date, it is necessary for the Bidder to send an email requesting to open CPC Connect conversation to the following address:

<mailto:procurement-apvisionnement@NRCan-RNCan.gc.ca>

**Note:** Bids will not be accepted if e-mailed directly to this address. This e-mail address is to be used to open CPC Connect conversation, as detailed in the Standard Instructions [2003 \(Subsection of Section 08\)](#), or to send bids through CPC Connect message if the bidder is using its own licensing agreement for CPC Connect.

**IMPORTANT:** It is requested that you write the bid solicitation number in "Subject" of the email:

NRCan-5000074745/A - Tailings Sampling Program for Critical Minerals Potential in Canadian Mine Tailings

NRCan will not assume responsibility for proposals directed to any other location.

The onus is on the Bidder to ensure that the bid is submitted correctly using CPC Connect service. Not complying with the instructions may result in NRCan's inability to ascertain reception date and/or to consider the bid prior to contract award. Therefore, NRCan reserves the right to reject any proposal not complying with these instructions.

Due to the nature of the bid solicitation, bids transmitted by email, mail or facsimile to NRCan will not be accepted.

### **2.3 Former Public Servant**

Contracts awarded to former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts awarded to FPSs, bidders must provide the information required below before contract award. If the answer to the questions and, as applicable the information required have not been received by the time the evaluation of bids is completed, Canada will inform the Bidder of a time frame within which to provide the information. Failure to comply with Canada's request and meet the requirement within the prescribed time frame will render the bid non-responsive.

#### Definitions

For the purposes of this clause, "former public servant" is any former member of a department as defined in the [Financial Administration Act](#), R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a) an individual;
- b) an individual who has incorporated;
- c) a partnership made of former public servants; or
- d) a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.





"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means a pension or annual allowance paid under the [Public Service Superannuation Act](#) (PSSA), R.S., 1985, c. P-36, and any increases paid pursuant to the [Supplementary Retirement Benefits Act](#), R.S., 1985, c. S-24 as it affects the PSSA. It does not include pensions payable pursuant to the [Canadian Forces Superannuation Act](#), R.S., 1985, c. C-17, the [Defence Services Pension Continuation Act](#), 1970, c. D-3, the [Royal Canadian Mounted Police Pension Continuation Act](#), 1970, c. R-10, and the [Royal Canadian Mounted Police Superannuation Act](#), R.S., 1985, c. R-11, the [Members of Parliament Retiring Allowances Act](#), R.S. 1985, c. M-5, and that portion of pension payable to the [Canada Pension Plan Act](#), R.S., 1985, c. C-8.

Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? Yes ( ) No ( )

If so, the Bidder must provide the following information, for all FPSs in receipt of a pension, as applicable:

- a) name of former public servant;
- b) date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with [Contracting Policy Notice: 2019-01](#) and the [Guidelines on the Proactive Disclosure of Contracts](#).

Work Force Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? Yes ( ) No ( )

If so, the Bidder must provide the following information:

- a) name of former public servant;
- b) conditions of the lump sum payment incentive;
- c) date of termination of employment;
- d) amount of lump sum payment;
- e) rate of pay on which lump sum payment is based;
- f) period of lump sum payment including start date, end date and number of weeks;
- g) number and amount (professional fees) of other contracts subject to the restrictions of a work force adjustment program.

## 2.4 Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority no later than five calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by Bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the question(s) or may request that the Bidder do so, so that the proprietary nature of the question(s) is eliminated and the



enquiry can be answered to all Bidders. Enquiries not submitted in a form that can be distributed to all Bidders may not be answered by Canada.

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Alberta.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the Bidders.

## 2.5 Applicable Laws

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Ontario.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the Bidders.

## 2.6 Improvement of Requirement During Solicitation Period

Should bidders consider that the specifications or Statement of Work contained in the bid solicitation could be improved technically or technologically, bidders are invited to make suggestions, in writing, to the Contracting Authority named in the bid solicitation. Bidders must clearly outline the suggested improvement as well as the reason for the suggestion. Suggestions that do not restrict the level of competition nor favour a particular bidder will be given consideration provided they are submitted to the Contracting Authority at least five days before the bid closing date. Canada will have the right to accept or reject any or all suggestions.

## 2.7 Bid Challenge and Recourse Mechanisms

- (a) Several mechanisms are available to potential suppliers to challenge aspects of the procurement process up to and including contract award.
- (b) Canada encourages suppliers to first bring their concerns to the attention of the Contracting Authority. Canada's [Buy and Sell](#) website, under the heading "[Bid Challenge and Recourse Mechanisms](#)" contains information on potential complaint bodies such as:
  - Office of the Procurement Ombudsman (OPO)
  - Canadian International Trade Tribunal (CITT)
- (c) Suppliers should note that there are **strict deadlines** for filing complaints, and the time periods vary depending on the complaint body in question. Suppliers should therefore act quickly when they want to challenge any aspect of the procurement process.



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## PART 3 - BID PREPARATION INSTRUCTIONS

### 3.1 Bid Preparation Instructions

- If the Bidder chooses to submit its bid electronically, Canada requests that the Bidder submits its bid in accordance with section 08 of the 2003 standard instructions. The CPC Connect system has a limit of 1GB per single message posted and a limit of 20GB per conversation.

Canada requests that the Bidder submits its bid in separately bound sections as follows:

- Section I: Technical Bid 1 electronic copy
- Section II: Financial Bid 1 electronic copy in a separate file and document
- Section III: Certifications 1 electronic copy

Prices must appear in the financial bid only. No prices must be indicated in any other section of the bid.

#### Section I: Technical Bid

In their technical bid, Bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will meet these requirements. Bidders should demonstrate their capability and describe their approach in a thorough, concise and clear manner for carrying out the work.

The technical bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that Bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, Bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

#### Section II: Financial Bid

3.1.1 Bidders must submit their financial bid in accordance with the Basis of Payment in Annex "B".

#### 3.1.2 Exchange Rate Fluctuation

C3011T (2013-11-06), Exchange Rate Fluctuation

#### Section III: Certifications

Bidders must submit the certifications and additional information required under Part 5.

## PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION

### 4.1 Evaluation Procedures

- (a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical evaluation criteria.
- (b) An evaluation team composed of representatives of Canada will evaluate the bids.

#### 4.1.1 Technical Evaluation

Mandatory evaluation criteria are included in Appendix "2" – Evaluation Criteria.



## 4.2 Basis of Selection

### 4.2.1 Highest Combined Rating of Technical Merit and Price

1. To be declared responsive, a bid must:
  - a. comply with all the requirements of the bid solicitation;
  - b. meet all mandatory criteria;
  - c. Obtain the required minimum of 41 points overall for the resource technical evaluation criteria. The rating is performed on a scale of 58 points.
2. Bids not meeting (a) or (b) or (c) will be declared non-responsive.
3. The selection will be based on the highest responsive combined rating of technical merit and price. The ratio will be 60 % for the technical merit and 40 % for the price.
4. To establish the technical merit score, the overall technical score for each responsive bid will be determined as follows: total number of points obtained / maximum number of points available multiplied by the ratio of 60 %.
5. To establish the pricing score, each responsive bid will be prorated against the lowest evaluated price and the ratio of 40%.
6. For each responsive bid, the technical merit score and the pricing score will be added to determine its combined rating.
7. Neither the responsive bid obtaining the highest technical score nor the one with the lowest evaluated price will necessarily be accepted. The responsive bid with the highest combined rating of technical merit and price will be recommended for award of a contract.



The table below illustrates an example where all three bids are responsive and the selection of the contractor is determined by a 60/40 ratio of technical merit and price, respectively. The total available points equal 135 and the lowest evaluated price is \$45,000 (45).

<b>Basis of Selection - Highest Combined Rating Technical Merit (60%) and Price (40%)</b>				
		<b>Bidder 1</b>	<b>Bidder 2</b>	<b>Bidder 3</b>
<b>Overall Technical Score</b>		115/135	89/135	92/135
<b>Bid Evaluated Price</b>		\$55,000.00	\$50,000.00	\$45,000.00
<b>Calculations</b>	<b>Technical Merit Score</b>	$115/135 \times 60 = 51.11$	$89/135 \times 60 = 39.56$	$92/135 \times 60 = 40.89$
	<b>Pricing Score</b>	$45/55 \times 40 = 32.73$	$45/50 \times 40 = 36.00$	$45/45 \times 40 = 40.00$
<b>Combined Rating</b>		83.84	75.56	80.89
<b>Overall Rating</b>		1st	3rd	2nd



## PART 5 – CERTIFICATIONS AND ADDITIONAL INFORMATION

Bidders must provide the required certifications and additional information to be awarded a contract.

The certifications provided by Bidders to Canada are subject to verification by Canada at all times. Unless specified otherwise, Canada will declare a bid non-responsive, or will declare a contractor in default if any certification made by the Bidder is found to be untrue, whether made knowingly or unknowingly, during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply and to cooperate with any request or requirement imposed by the Contracting Authority will render the bid non-responsive or constitute a default under the Contract.

### 5.1 Certifications Required with the Bid

Bidders must submit the following duly completed certifications as part of their bid.

#### 5.1.1 Integrity Provisions - Declaration of Convicted Offences

In accordance with the Integrity Provisions of the Standard Instructions, all bidders must provide with their bid, **if applicable**, the Integrity declaration form available on the [Forms for the Integrity Regime](http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html) website (<http://www.tpsgc-pwgsc.gc.ca/ci-if/declaration-eng.html>), to be given further consideration in the procurement process.

### 5.2 Certifications Precedent to Contract Award and Additional Information

The certifications and additional information listed below should be submitted with the bid but may be submitted afterwards. If any of these required certifications or additional information is not completed and submitted as requested, the Contracting Authority will inform the Bidder of a time frame within which to provide the information. Failure to provide the certifications or the additional information listed below within the time frame specified will render the bid non-responsive.

#### 5.2.1 Integrity Provisions – Required Documentation

In accordance with the section titled Information to be provided when bidding, contracting or entering into a real property agreement of the [Ineligibility and Suspension Policy](http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html) (<http://www.tpsgc-pwgsc.gc.ca/ci-if/politique-policy-eng.html>), the Bidder must provide the required documentation, as applicable, to be given further consideration in the procurement process.

- Bidders who are incorporated, including those bidding as a joint venture, must provide a complete list of names of all individuals who are currently directors of the Bidder or, in the case of a private company, the owners of the company.
- Bidders bidding as sole proprietorship, as well as those bidding as a joint venture, must provide the name of the owner(s).
- Bidders bidding as partnerships do not need to provide lists of names.  
Name of Bidder: \_\_\_\_\_

OR

Name of each member of the joint venture:



Member 1: \_\_\_\_\_  
 Member 2: \_\_\_\_\_  
 Member 3: \_\_\_\_\_  
 Member 4: \_\_\_\_\_

Identification of the administrators/owners:

SURNAME	NAME	TITLE

### 5.2.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "FCP Limited Eligibility to Bid" list available at the bottom of the page of the [Employment and Social Development Canada \(ESDC\) - Labour's](#) website.

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "FCP Limited Eligibility to Bid list at the time of contract award.

### 5.2.3 Additional Certifications Precedent to Contract Award

#### 5.2.3.1 Status and Availability of Resources

SACC Manual clause [A3005T](#) (2010-08-16) Status and Availability of Resources

#### 5.2.3.2 Education and Experience

SACC Manual clause [A3010T](#) (2010-08-16) Education and Experience



**5.2.3.3 Former Public servant**

<p><b>Former Public Servants</b> See the Article in Part 2 of the bid solicitation entitled Former Public Servant for a definition of "Former Public Servant".</p>	<p>Is the Bidder a FPS in receipt of a pension as defined in the bid solicitation?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, provide the information required by the Article in Part 2 entitled "Former Public Servant"</p>
	<p>Is the Bidder a FPS who received a lump sum payment under the terms of the Work Force Adjustment Directive?</p> <p>Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, provide the information required by the Article in Part 2 entitled "Former Public Servant"</p>

**SIGNATURE for CERTIFICATION**

The Contractor certifies having read and understood the information included in the present document and acknowledges receipt.

\_\_\_\_\_  
Name    Date

\_\_\_\_\_  
Signature of Authorized Representative





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## PART 6 – SECURITY, FINANCIAL AND OTHER REQUIREMENTS

### 6.1 Security Requirements

There are no security requirements associated with this requirement.

## PART 7 - RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

### 7.1 Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex "A" and the Contractor's technical bid dated \_\_\_\_\_. (to be completed at contract award)

#### 7.1.1 Optional Services

The Contractor grants to Canada the irrevocable option to extend the term of the Contract by up to one additional one year period(s) under the same conditions. The Contractor agrees that, during the extended period of the Contract, it will be paid in accordance with the applicable provisions as set out in the Basis of Payment .

The option may only be exercised by the Contracting Authority, and will be evidenced for administrative purposes only, through a contract amendment.

The Contracting Authority may exercise the option at any time before the expiry of the Contract by sending a written notice to the Contractor.

#### 7.1.2 Task Authorization

The Work or a portion of the Work to be performed under the Contract will be on an "as and when requested basis" using a Task Authorization (TA). The Work described in the TA must be in accordance with the scope of the Contract.

#### 7.1.3 Minimum Work Guarantee - All the Work - Task Authorizations

1. In this clause,

"Maximum Contract Value" means the amount specified in the "Limitation of Expenditure" clause set out in the Contract; and

"Minimum Contract Value" means 5% of the Maximum Contract Value.

2. Canada's obligation under the Contract is to request Work in the amount of the Minimum Contract Value or, at Canada's option, to pay the Contractor at the end of the Contract in accordance with paragraph 3. In consideration of such obligation, the Contractor agrees to stand in readiness throughout the Contract period to perform the Work described in the Contract. Canada's maximum liability for work performed under the Contract must not exceed the Maximum Contract Value, unless an increase is authorized in writing by the Contracting Authority.



3. In the event that Canada does not request work in the amount of the Minimum Contract Value during the period of the Contract, Canada must pay the Contractor the difference between the Minimum Contract Value and the total cost of the Work requested.
4. Canada will have no obligation to the Contractor under this clause if Canada terminates the Contract in whole or in part for default.

#### **7.1.4 Periodic Usage Reports - Contracts with Task Authorizations**

The Contractor must compile and maintain records on its provision of services to the federal government under authorized Task Authorizations issued under the Contract.

The Contractor must provide this data in accordance with the reporting requirements detailed below or in Annex "E". If some data is not available, the reason must be indicated. If services are not provided during a given period, the Contractor must still provide a "nil" report.

The data must be submitted on a quarterly basis to the Contracting Authority.

The quarterly periods are defined as follows:

1st quarter: April 1 to June 30;

2nd quarter: July 1 to September 30;

3rd quarter: October 1 to December 31; and

4th quarter: January 1 to March 31.

The data must be submitted to the Contracting Authority no later than 30 calendar days after the end of the reporting period.

#### **Reporting Requirement- Details**

A detailed and current record of all authorized tasks must be kept for each contract with a task authorization process. This record must contain:

##### **For each authorized task:**

- i. the authorized task number or task revision number(s);
- ii. a title or a brief description of each authorized task;
- iii. the total estimated cost specified in the authorized Task Authorization (TA) of each task, exclusive of Applicable Taxes;
- iv. the total amount, exclusive of Applicable Taxes, expended to date against each authorized task;
- v. the start and completion date for each authorized task; and



- vi. the active status of each authorized task, as applicable.

**For all authorized tasks:**

- i. the amount (exclusive of Applicable Taxes) specified in the contract (as last amended, as applicable) as Canada's total liability to the contractor for all authorized TAs; and
- ii. the total amount, exclusive of Applicable Taxes, expended to date against all authorized TAs.

**7.2 Standard Clauses and Conditions**

All clauses and conditions identified in the Contract by number, date and title are set out in the [Standard Acquisition Clauses and Conditions Manual](https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) (https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual) issued by Public Works and Government Services Canada.

**7.2.1 General Conditions**

[2035](#) (2022-12-01), General Conditions - Higher Complexity - Services, apply to and form part of the Contract. (Replace references to Public Works and Government Services Canada (PWGSC) with Natural Resources Canada (NRCan).

**7.3 Security Requirements**

There are no security requirements associated with this requirement.

**7.4 Term of Contracts**

**7.4.1 Period of the Contract**

The period of each contract is from date of contract award to \_\_\_\_\_ inclusive (to be provided at contract award).

**7.4.2 Option to Extend the Contract**

The Contractor grants to Canada the irrevocable option to extend the term of the Contract by up to one additional one year period under the same conditions. The Contractor agrees that, during the extended period of the Contract, it will be paid in accordance with the applicable provisions as set out in the Basis of Payment.

Canada may exercise this option at any time by sending a written notice to the Contractor before the expiry date of the Contract. The option may only be exercised by the Contracting Authority, and will be evidenced for administrative purposes only, through a contract amendment.

**7.5 Authorities**

**7.5.1 Contracting Authority**

The Contracting Authority for the Contract is:

Name: Gerald Baran  
Title: Procurement Specialist  
Organization: Natural Resources Canada  
Address: 505 Burnside Road West



Victoria, BC, V8Z 1M5  
Telephone: (778) 350-9373  
E-mail address: Gerald.Baran@NRCan-RNCan.gc.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

### 7.5.2 Project or Technical Authority (to be provided at contract award)

The Project Authority for the Contract is:

Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Organization: \_\_\_\_\_  
Address: \_\_\_\_\_

Telephone: \_\_\_\_ - \_\_\_\_ - \_\_\_\_  
Facsimile: \_\_\_\_ - \_\_\_\_ - \_\_\_\_  
E-mail address: \_\_\_\_\_

The Project Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Project Authority; however, the Project Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

### 7.5.3 Contractor's Representative (to be competed by the bidder)

Name:  
Title:  
Organization:  
Address:  
Telephone:  
E-mail address

## 7.6 Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a [Public Service Superannuation Act](#) (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with [Contracting Policy Notice: 2019-01](#) of the Treasury Board Secretariat of Canada.

## 7.7 Payment

### 7.7.1 Basis of Payment - Firm Lot Price - Task Authorizations

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price as specified in Annex B for a cost of \$\_\_



(insert the amount at contract award). Customs duties are included and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

#### **7.7.2 Limitation of Expenditure - Cumulative Total of all Task Authorizations**

1. Canada's total liability to the Contractor under the Contract for all authorized Task Authorizations (TAs), inclusive of any revisions, must not exceed the sum of \$ \_\_\_\_\_.  
Customs duties are included and Applicable Taxes are extra.
2. No increase in the total liability of Canada will be authorized or paid to the Contractor unless an increase has been approved, in writing, by the Contracting Authority.
3. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:
  - a. when it is 75 percent committed, or
  - b. four (4) months before the contract expiry date, or
  - c. as soon as the Contractor considers that the sum is inadequate for the completion of the Work required in all authorized TAs, inclusive of any revisions,  
whichever comes first.
4. If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority, a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

#### **7.7.2 Method of Payment**

##### **Milestone Payments**

Canada will make milestone payments in accordance with the Schedule of Milestones detailed in the Task Authorization and the payment provisions of the Contract if:

- a. an accurate and complete claim for payment, and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;
- b. all work associated with the milestone and as applicable any deliverable required has been completed and accepted by Canada.



### 7.7.3 Time Verification

SACC Manual clause [C0711C](#) (2008-05-12) Time Verification

### 7.8 Invoicing Instructions

Invoices shall be submitted using **the following method**:

E-mail:

[Invoicing-Facturation@nrcan-rncan.gc.ca](mailto:Invoicing-Facturation@nrcan-rncan.gc.ca)

**Note:** Attach "PDF" file. No other formats will be accepted

Please do not submit invoices using more than one method as this will not expedite payment.

Invoices and all documents relating to a contract must be submitted on the Contractor's own form and shall bear the Contract number: \_\_\_\_\_ (TBD)

**Invoicing Instructions to suppliers:** <http://www.nrcan.gc.ca/procurement/3485>

### 7.9 Certifications and Additional Information

#### 7.9.1 Compliance

Unless specified otherwise, the continuous compliance with the certifications provided by the Contractor in its bid or precedent to contract award, and the ongoing cooperation in providing additional information are conditions of the Contract and failure to comply will constitute the Contractor in default. Certifications are subject to verification by Canada during the entire period of the Contract.

#### 7.10 Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in \_\_\_\_\_.

#### 7.11 Priority of Documents

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

- (a) the Articles of Agreement;
- (b) the general conditions [2035](#) (2022-05-12), General Conditions - Higher Complexity - Services;
- (c) Annex A, Statement of Work;
- (d) Annex B, Basis of Payment;
- (e) the signed Task Authorizations (including all of its annexes, if any)
- (f) the Contractor's bid dated \_\_\_\_\_, ([insert date of bid](#))

#### 7.12 Foreign Nationals (Canadian Contractor **OR** Foreign Contractor)

SACC Manual clause [A2000C](#) (2006-06-16) Foreign Nationals (Canadian Contractor)



OR

SACC Manual clause [A2001C](#) (2006-06-16) Foreign Nationals (Foreign Contractor)

### 7.13 Insurance

SACC Manual clause [G1005C](#) (2016-01-28) Insurance - No Specific Requirement

### 7.14 Dispute Resolution

The parties agree to maintain open and honest communication about the Work throughout and after the performance of the contract.

- (a) The parties agree to consult and co-operate with each other in the furtherance of the contract and promptly notify the other party or parties and attempt to resolve problems or differences that may arise.
- (b) If the parties cannot resolve a dispute through consultation and cooperation, the parties agree to consult a neutral third party offering alternative dispute resolution services to attempt to address the dispute.
- (c) Options of alternative dispute resolution services can be found on Canada's Buy and Sell website under the heading "[Dispute Resolution](#)".



## ANNEX “A”

### STATEMENT OF WORK:

#### SW1. TITLE

#### **Tailings Sampling Program for Critical Minerals Potential in Canadian Mine Tailings**

#### SUMMARY

Natural Resources Canada (NRCan) is seeking services to carry out a tailings sampling program for sampling mine waste to support definition of the material as a resource consistent with NI 43-101 reporting; as well as to conduct characterization studies on critical minerals potential in Canadian mine tailings. It will support work undertaken by CanmetMINING on the B21 Critical Minerals in Canadian Mine Tailings (Mining Value from Waste) project.

#### SW2. BACKGROUND

Under the Federal Budget 2021 funding for Critical Minerals Research and Development, there is focus on establishing Canadian value chains for critical minerals. These minerals are of vital importance to the green and clean technology-shift in the economy, high value technology products, and national defense. Developing reliable and robust supply chains for these minerals is important for the stability and growth of the Canadian economy.

Currently, programming within the Critical Minerals and Industry Support Division of Natural Resources Canada is inventorying the scale of critical minerals potential in mine waste/ mine tailings. This material represents at-surface deposits of partially processed critical mineral wealth unburdened by the economics of traditional mining and milling.

However, where economic valuation of traditional mineral resources is assessed **through Canadian Reporting Standards for Mineral Resources and Mineral Reserves** as outlined by the **Canadian Institute of Mining Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves**; and the **NI 43-101 Standards for Disclosure of Mineral Projects**; a standard for definition of mine waste as a resource has been lacking. In 2022, Natural Resources Canada facilitated a foundational study to develop a standardized protocol for sampling mine tailings to support the definition of the material as a resource consistent with NI 43-101 reporting; as well as to promote the consideration of secondary sources as defined mineral resources suitable for extraction, based on a mining circular economy model.

A Tailings Sampling Program will apply and test the methodologies and considerations proposed by this foundational study, by analyzing for critical mineral potential from secondary sources in Canadian mine tailings. One (1) historical and/or abandoned mine tailings site located in Nova Scotia with road access will be selected as a ‘use case site’ and strategically sampled as part of this program. This program aims to draw comparison between the methods of traditional mineral resource definition by NI 43-101 Standards of Disclosure for Mineral Projects, and to prove whether this reporting methodology can be applied practically to mineral resource definition of secondary sources. Finally, this program will also help inform other tailings characterization, remote sensing, and carbon capture utilization and storage research initiatives, currently underway at Natural Resources Canada.





### SW3. CONTEXT and OBJECTIVES

The key objectives of this project are to:

- Using the foundational guidelines and considerations for developing a tailings sampling program, as provided by NRCAN in the **Mining Value from Waste: Sampling Plan Development and Tailings Sampling Protocol** (NRCAN, 2022); Appendix 1, and in alignment with **NI 43-101 Standards of Disclosure for Mineral Projects**, plan and perform a tailings sampling program at one (1) use case tailings site from a Canadian historical and/or abandoned mine located in Nova Scotia with road access with the intent to ground truth proposed methodologies, perform a targeted sampling program, and provide an updated mineral resource estimate at the use case tailings site, as per NI 43-101, targeting at least one (1) of the Canadian critical minerals as set out by the **Government of Canada's List of Critical Minerals, 2021**.
- Help inform the development of best practices in the area of economic valuation of mine tailings and other waste streams, by establishing comparability of traditional methods of mineral resource definition as outlined by NI 43-101 Standards of Disclosure for Mineral Projects, to provide confidence in establishing NI 43-101 compliant and defined mineral resources from secondary sources in comparable application.

### SW4. Tasks, Deliverables, and Schedule

#### SW4.1 Tasks

Using one (1) Canadian historical and/or abandoned mine tailings site located in Nova Scotia with critical mineral\* potential as a secondary resource (\*Ni, Cu, Co, REE, Lithium or others, as outlined by the **Government of Canada's List of Critical Minerals, 2021**) as the use case tailings site, the Contractor will be performing the following requirements:

#### 1. Project Initiation:

- Introduce the consultant team (the 'Contractor') and the NRCAN team (the 'Project Authority')
- Confirm project objectives, deliverables, and timeline. Agreement on the method of communications and schedule of regularly project status update meetings, confirm data management and sharing structure, and review existing information at NRCAN.

#### 2. Tailings Sampling Program Plan, which shall include:

- Provide a plan for the collection of tailings sampling and analysis, (including proposed sampling locations, density, depth, proposed analytical methods) using traditional NI 43-101 reporting standards, and the **Mining Value from Waste: Sampling Plan Development and Tailings Sampling Protocol (NRCAN, 2022)** as guidelines in program planning (Appendix 1).
- Selection of the specific sample locations, and proposed number of samples, taking into consideration sampling density (with sampling grid designed both horizontally and vertically in the tailings storage area), sample size, and variability, during project planning for the use case tailings site. For proposal budgeting purposes, it can be assumed that the use case tailing site is approximately 600 meters x 300 meters in area, with an average depth of 4 to 8 meters. Sampling



will be required in both the horizontal and vertical space, for a proposed total of approximately 25 boreholes, and 150-200 samples taken at regularly spaced intervals.

- Collect and review of available data for literature, including any previously completed, publicly available and relevant technical reporting on site or subject matter, that is required which may contribute to use case analysis and project planning.
- Note that the Contractor is to be responsible for the costs and for arranging logistics for site visits and program execution, obtaining required site access permissions, and all permits required to carry out the sampling program.

**3. Tailings Sampling Program, Analysis, and Reporting**, which shall include:

- Execution of the Tailings Sampling Program Plan by conducting site visits to carry out tailings sampling at the use case tailings site, ensuring minimal disturbance to tailings sites;
- Sample collection at sites, while incorporating Quality Assurance and Quality Control into sampling by integrating appropriate sample blanks, duplicates, and certified reference materials, into the sampling program;
- Obtaining full and complete datasets for the samples collected: each sample must include spatial co-ordinates (Projection, North American Datum, Universal Transverse Mercator Zone, Easting, Northing, depth in storage facility), as well as consistent sample size and complete sample descriptions for characterization purposes;
- Ensuring appropriate methods are utilized to retain sample integrity during transport to a certified analytical laboratory for analysis;
- Ensuring a full and complete analytical dataset, as well as laboratory certificates and descriptions of laboratory analytical methods, are obtained and provided in both digital workbook and pdf formats.
- Selection of analytical tests, methods for sample analysis to be carried out, and selected laboratory\* of choice (\*must be ISO accredited, etc., with sampling methodologies etc. provided). The Contractor is to be responsible for the costs and logistics associated with sample analysis. For proposal budgeting purposes, it can be assumed that approximately 150-200 samples will need to be analyzed for major and minor elements using ICP-AES and/or ICP-MS.
- If timing and budgeting allows, several larger samples may be collected for further characterization.
- Sampling program, data interpretation, and technical reporting (in alignment with NI 43-101 Standards of Disclosure for Mineral Projects) are to be carried out by the Contractor.
- Remaining sample materials from the sampling program are to be collected and sent to CanmetMINING laboratory in Ottawa.



- All necessary permits, site access permissions, and insurance are to be obtained and completed by Contractor. Any liabilities (environmental, occupational health and safety, or otherwise) are the sole responsibility of the Contractor.
- Any additional sub-contracts and required licences, insurances, liabilities, permits, pertaining to sub-contracting (i.e. drilling) are the sole responsibility of the Contractor.

**4. Delivery of a Tailings Sampling Program final report, which shall include:**

- Summarize the outcomes and recommendations on next steps to the NRCan team through a virtual presentation. Key findings, supporting analysis, use case study, methodology, and references are to be included in a comprehensive technical report.
- A draft report, followed by a final report, outlining the tailings sampling program plan, methodology, work program, and results at the use case tailings site, as well as interpretation of results and recommendations for next steps and considerations shall be provided; reporting shall use NI 43-101 guidelines.
- Report drafts and final deliverables shall be provided in word document formatting; digital certificates shall be provided in excel and pdf formatting; maps and shape files of data may be requested for inclusion in final deliverables.
- A PowerPoint presentation summarizing the Tailings Sampling Program and Results shall be provided as a final deliverable along with the final report.

Tasks	Deliverables	Time Schedule (Approximate)
<b>Task#1: Project Initiation:</b>	As outlined in section SW4.1 of the Statement of Work.	Within 10 days of the signing of contract
<b>Task#2: Tailings Sampling Program Plan</b>	As outlined in section SW4.1 of the Statement of Work.	By October 30, 2023
<b>Task#3: Tailings Sampling Program, Analysis, and Reporting</b>	As outlined in section SW4.1 of the Statement of Work.	By January 30, 2024
<b>Task#4: Delivery of a Tailings Sampling Program final report</b>	As outlined in section SW4.1 of the Statement of Work.	By February 29, 2024

**SW4.2 Reporting Requirements**



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It is the responsibility of the Contractor to ensure that the Contract requirements are met and that deliverables are submitted on time; and are of an acceptable quality. It is the responsibility of the contractor to supply and ensure a Qualified Person (as defined by NI-43-101 Standards of Disclosure for Mineral Projects) approves all project planning, execution, interpretation, recommendations, drafts, and final deliverables to NRCAN. The Contractor shall provide progress updates to the Project Authority and/or delegates. Informal exchanges on the project and related topics are welcome and encouraged at any time during the life of this project.

#### **SW4.3 Method and Source of Acceptance**

All deliverables and services rendered under any contract are subject to inspection by the Project Authority. The Project Authority shall have the right to reject any deliverables that are not considered satisfactory in quality, content, or relevancy to defined objectives and tasks, or require their correction before payment will be authorized.

#### **SW4.4 Specifications and Standards**

The reports, and any related documents, shall be delivered in an electronic format compatible with Microsoft Word, Excel, and PowerPoint software (respectively). Portable Document Format (PDF) or other formats that cannot be manipulated will not be accepted.

The deliverables shall be prepared in either of Canada's official languages.

All deliverables resulting from this Contract are to be marked "© Copyright Company's Name, 2023 (2024): the Crown is licensed to copy, distribute, and use for any non-commercial purpose". All deliverables and data resulting from this Contract are owned by and the property of under the property of Natural Resources Canada.

### **SW5.0 OTHER TERMS AND CONDITIONS OF THE SoW**

#### **SW5.1 Contractor's Obligations**

Over the course of this Contract, the Contractor shall:

- Assign a Qualified Person ('Q.P'), with a minimum of ten (10) years experience related to the program field of study, to lead the Contractor's project team, and inform the planning, execution, analysis, and reporting of the program to the Project Authority;
- Present the proposed case tailings site sampling plan to NRCAN prior to commencement of program;
- Return all materials belonging to NRCAN upon completion of the Contract;
- Consult with any public and private sector experts, committees, and working groups (etc.) that are engaged in the subject matter;
- Participate in teleconferences, as needed and/or;

#### **SW5.2 NRCAN's Obligations**

- Approve the proposed plan and use case tailings site;
- Provide comments on draft reports within five (5) working days; and/or:
  - Provide assistance or support as required to advance the contract.

#### **SW5.4 Location of Work, Work Site, and Delivery Point**

The work is expected to be completed in the Contractor's place of business, and on specific tailings site selected for use case study. NRCAN will not reimburse the contractor for any travel expenses or disbursements.

#### **SW5.5 Insurance Requirements**

It is the sole responsibility of the Contractor to ensure appropriate insurance coverage for its own protection or to fulfill its obligations under the Contract, and to ensure compliance with required federal, provincial or municipal law. Any such insurance shall be provided and maintained by the Contractor at its own expense. Any insurance secured is to the benefit and protection of the Contractor and shall not be deemed to release or diminish its liability in any manner including as may be referenced elsewhere by the provisions of this Contract.

#### **SW5.6 Permitting, Site Access Permissions, and Liability Requirements**

It is the sole responsibility of the Contractor to seek and obtain any permits and site access permissions to carry out work on the use case tailings site. Any potential liabilities (environmental, occupational health and safety, or otherwise) are the sole responsibility of the Contractor.

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**ANNEX "B"**  
**BASIS OF PAYMENT**

(to be completed at contract award)

**Note:** Information from Appendix 2 will be used to generate the "Basis of Payment", at award.



**APPENDIX “2” - EVALUATION CRITERIA**

**1. Technical Criteria**

**1.1 Mandatory Evaluation Criteria**

- The Mandatory Criteria listed below will be evaluated on a simple met/not met basis. Proposals, which fail to meet the mandatory criteria, will be deemed non-responsive and will not be considered for point rated evaluation.
- The Bidder must provide documented substantiation that sufficiently supports claims of compliance with each criterion. Each criterion must be addressed separately. Canada reserves the right to request references from a bidder to conduct a reference check to verify the accuracy of the information provided.
- It is requested that supporting technical documentation, be provided with the bid at solicitation close and be cross-referenced on the Compliance Matrix for each criteria to outline where in the supporting technical documentation it demonstrates compliance. It is the Bidders responsibility to ensure that the submitted supporting technical documentation provides detail to prove that the technical proposal meet the requirements of the criteria.
- The substantiation of technical compliance **must not simply be a repetition of the requirement(s)** but must explain and demonstrate how the Bidder will meet the requirements and carry out the required Work. Simply stating that the Bidder or its proposed solution or product complies is not sufficient. Where Canada determines that the substantiation is not complete, the Bidder will be considered non-responsive and disqualified.
- If clarification regarding the supporting documentation is needed, the Contracting Authority will notify the Bidder that they must provide clarification within two (2) business days following notification. Failure to comply with the request of the Contracting Authority within that time period, will deem the bid non-responsive and the bid will be given no further consideration.
- Link to [NI 43-101 Standards](#)

**SAMPLE OF A COMPLETED COMPLIANCE MATRIX**

Criterion ID	MANDATORY CRITERIA	MET OR NOT MET (TO BE COMPLETED BY THE TECHNICAL EVALUATOR)	BIDDER SUBSTANTIATION / CROSS REFERENCE TO PROPOSAL
M1	The Bidder's proposed resource must have a minimum of ten (10) years of demonstrated	<input type="checkbox"/> Yes <input type="checkbox"/> No	Project 1 Company X – ABC Project January 2006 - August 2012 6 years, 8 months (80 months)  Project 2



Criterion ID	MANDATORY CRITERIA	MET OR NOT MET (TO BE COMPLETED BY THE TECHNICAL EVALUATOR)	BIDDER SUBSTANTIATION / CROSS REFERENCE TO PROPOSAL
	<p>experience as a Policy Analyst supporting Senior Officials.</p> <p>*Senior Official is defined as Director or above (public sector) or Director or above (private sector).</p>		<p>Company Y – ABC Project September 2012 - December 2014 2 years, 4 months (28 months)</p> <p>Project 3 Company Z – ABC Project March 2015 - December 2018 3 years, 10 months (46 months)</p> <p><b>TOTAL: 12 years, 8 months (154 months)</b></p>

**SAMPLE OF A PROJECT EXAMPLE**

- a) Project name and objectives;
- b) Project duration in terms of starting and ending dates (month/year);
- c) Description of the proposed responsibilities
- d) Description of result achieved and project outcome;
- e) The name and telephone number of the client contact who knows the Bidder's work and that can be reached during the evaluation period to validate the information provided



Criterion ID	Mandatory Criteria	MET OR NOT MET (TO BE COMPLETED BY THE TECHNICAL EVALUATOR)	DEMONSTRATED COMPLIANCE, CROSS REFERENCE TO RESUME AND PAGE NUMBER OR PROPOSAL AND/OR RESUME
<b>M1</b>	<p><b>Qualified Person ('Q.P') Primary Contact</b></p> <p>The Bidder MUST identify the Primary Contact responsible for coordinating the work on the proposed project team. The Primary Contact must be a current Qualified Person ('Q.P') as defined by NI 43-101 Standards of Disclosure for Mineral Projects and the Canadian Institute of Mining Metallurgy and Petroleum (CIM) Definition Standards for Mineral Resources and Mineral Reserves.</p> <p>Note: The Primary Contact will act from the time of the Contract Award to the submission and approval of final deliverables to the Project Authority.</p>	<input type="checkbox"/> Met <input type="checkbox"/> Not met	
<b>M2</b>	<p>The Primary Contact must have a minimum of (10) years of experience in the following categories:</p> <ol style="list-style-type: none"> <li>1. performing mining and /or mineral exploration program planning &amp; management</li> <li>2. NI 43-101 compliant technical reporting</li> </ol> <p>To demonstrate the experience, a curriculum vitae (CV) and Statements of Qualifications for</p>	<input type="checkbox"/> Met <input type="checkbox"/> Not met	





	the Primary Contact must be provided.		
<b>M3</b>	<p>The Bidder MUST identify at least one (1) team member with field experience related to Mining/Mineral Exploration Sampling and/or Tailings Sampling. The proposed team member must have completed a minimum of two (2) mining/mineral exploration or tailings sampling programs within the last ten (10) years from the date of bid solicitation closing.</p> <p>To demonstrate the experience, the Bidder must provide a curriculum vitae (CV) and Statements of Qualifications for the proposed team member(s) and indicate how the proposed team member(s) meets the criteria.</p> <p>Note: An individual resource can address both M1, M2, and M3.</p>	<input type="checkbox"/> Met <input type="checkbox"/> Not met	
<b>M4</b>	<p><b>Provide Demonstrated examples- Geochemical Sampling Program Planning, Analysis, and NI 43-101 Technical Reporting</b></p> <p>The Bidder MUST provide a minimum of two (2) project examples with the names and dates completed, in which they planned, executed, interpreted, and reported on a geochemical (ex. whole rock) and/or tailings sampling program, following NI 43-101 Standards of Disclosure for Mineral Projects, to define a mineral resource.</p> <p>*Projects completed within the last ten (10) years from the date of bid solicitation closing.</p>	<input type="checkbox"/> Met <input type="checkbox"/> Not met	
<b>M5</b>	<b>Work Plan</b>		



	<p>The bidder must submit a work plan that clearly demonstrates an approach that will lead to the successful completion of the project.</p>		
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**2.2 Rated Criteria Evaluation**

- Bidders are advised to address these criteria in the following order and in sufficient depth in their proposals to enable a thorough assessment. NRCan’s assessment will be based solely on the information contained within the proposal. NRCan may confirm information or seek clarification from bidders.
- Bidders are advised that only listing experience without providing any supporting data to describe responsibilities, duties and relevance to the criteria will not be considered demonstrated for the purpose of this evaluation.
- The Bidder should provide complete details as to where, when (month and year) and how (through which activities/ responsibilities) the stated qualifications/experience were obtained. Experience gained during formal education shall not be considered work experience. All criteria for work experience shall be obtained in a legitimate work environment as opposed to an educational setting. Co-op terms are considered work experience provided they are related to the required services.
- Bidders are also advised that the years(s) of experience listed for a project whose time frame overlaps that of another referenced project will only be counted once. For example: project one time frame is July 2001 to December 2001; project two-time frame is October 2001 to June 2002; the total years of experience for these two project references is one (1) year.
- Mixed number of years’ experience will be treated the same as exact number of years of experience. Example: A bidder with nine (9) years of experience would be awarded eighteen (18) points and a bidder with nine and a half (9.5) years of experience would also be awarded eighteen (18) points.
- If clarification regarding the supporting documentation is needed, the Contracting Authority will notify the Bidder that they must provide supporting documentation within two (2) business days following notification. Failure to comply with the request of the Contracting Authority within that time period, will deem the bid non-responsive and the bid will be given no further consideration.



Criterion	Point Rated Technical Criteria	Point Allocation	Maximum Points available	DEMONSTRATED COMPLIANCE, CROSS-REFERENCE TO RESUME AND PAGE NUMBER OR PROPOSAL
R1	<p>The Bidders should demonstrate the following corporate activities they have implemented to promote anti-racism and diversity within their organisation:</p> <ul style="list-style-type: none"> <li>a. The bidder has internally published policies or commitments on anti-racism and inclusiveness;</li> <li>b. The bidder has publicly available organisational commitments to a diverse workforce;</li> <li>c. The bidder's employees are mandated to take mandatory training on anti-racism</li> <li>d. The bidder's employees are mandated to take unconscious bias training;</li> <li>e. The bidder has developed internal staffing and/or recruitment strategy(ies) to increase representation of underrepresented groups in their workforce.</li> </ul> <p><b>NOTE:</b> Supporting documents. The bidder should provide details of the following activities.</p>	<p>Maximum 1 point for each activity.  <b>5 pts</b> = Bidder has demonstrated the existence of 5 out of 5 activities.  <b>4 pts</b> = Bidder has demonstrated at least the existence of 4 out of 5 activities.  <b>3 pts</b> = Bidder has demonstrated at least the existence of 3 out of 5 activities.  <b>2 pts</b> = Bidder has demonstrated at least 2 of the 5 activities.  <b>1 pt</b> = Bidder has demonstrated at least 1 of the 5 activities.  <b>0 pts</b> = the bidder does not address any of the activities.</p>	5	



	<p>For activities described in a. and b. (policy and commitments), the bidder should provide copies of policy or commitment documents including their effective date.</p> <p>For activities described in c. and d. (training), the bidder should provide the name of the course and the service provider; if developed internally, a copy of the course outline.</p> <p>For activities described in e. (staffing), the bidder should provide copies of job posting, or other staffing/recruitment documents demonstrating compliance with the rated criteria.</p>			
<b>R2</b>	<p><b>Bidder Proposed Q. P's Experience to Mineral Resource Definition by NI 43-101 Standards of Disclosure for Mineral Projects.</b></p> <p>The Bidder proposed Q.P. should have previous experience signing off on project(s) having undergone mineral resource definition by NI 43-101 Standards of Disclosure for Mineral Projects.</p> <p>To demonstrate, provide the name, date, and a brief description (i.e. 200 words or less) of two project examples.</p>	<p><b>5 points per project example for a total of 2 projects.</b> Breakdown of points for <u>each project example</u>, as follows:</p> <p><b>5 points</b> = Have signed off as Q.P for the project(s) undergoing mineral resources definition according to NI 43-101 Standards of Disclosure for Mineral Projects.</p> <p><b>2 points</b> = Have worked on the project(s) undergoing mineral resource definition, but no direct experience in being the signing Q.P. for an NI 43-101 project.</p> <p><b>0 points</b> = no experience with NI 43-101 Standards of Disclosure for Mineral Projects.</p>	<b>10</b>	
<b>R3</b>	<b>Work Plan</b>	Breakdown of points for the elements, as follows:	<b>28</b>	



	<p><b>The proposal will be evaluated based on the following 4 elements:</b></p> <p><b>1. <u>Tailings Sampling Program Plan:</u></b></p> <p>Provide a plan suitable for sampling a tailing site, including, approach and logistics, what samples will be analyzed and how/where, verification of results, analysis, and interpretation.</p> <p><b>2. <u>Mitigate Challenges:</u></b></p> <p>Discuss potential technical and logistical challenges that might be faced and possible mitigating solutions to achieve the research goal. Describe three (3) potential challenges and possible solution(s) with <u>brief descriptions to be provided.</u></p> <p><b>NOTE:</b> The work as outlined in the SOW is not often done in Canada, and the contractor will be relying on external groups (i.e., analytical lab) to complete the requirement, therefore there will be some challenges that the supplier will encounter.</p> <p><b>3. <u>Project Schedule:</u></b></p> <p>Clearly illustrate the level of effort and team member assigned for each task, schedule, and deliverable dates, and strategies for ensuring deliverables are met on time.</p>	<p><b>1. <u>Tailings Sampling Program Plan (14 points total):</u></b></p> <ul style="list-style-type: none"> <li>Presented with clarity a robust and suitable plan (<b>max 10 points</b>):</li> </ul> <p>10 points = Excellent; 8 points = Very Good; 6 points = Good; 4 points = Poor; 0 point = Unsatisfactory.</p> <ul style="list-style-type: none"> <li>Incorporated approaches that can ensure the quality of the research outcome (<b>max 4 points each</b>):</li> </ul> <p>4 points = Excellent. 3 points = Very Good; 2 points = Good; 1 point = Poor; 0 point = Unsatisfactory.</p> <p><b>2. <u>Mitigate Challenges (6 points total):</u></b></p> <ul style="list-style-type: none"> <li>Explained with clarity three (3) technical challenges that might be faced (<b>max 3 points</b>):</li> </ul> <p>3 points = 3 challenges. 2 points = 2 challenges. 1 point = 1 challenge 0 point = no challenge identified.</p> <ul style="list-style-type: none"> <li>Explained with clarity how the challenges could be mitigated (<b>max 3 points</b>):</li> </ul> <p>3 points = addressed all 3 challenges. 2 points = addressed 2 challenges.</p>		
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		<p>1 point = addressed 1 challenge. 0 point = no challenges have been addressed.</p> <p><b>3. <u>Project Schedule (8 points total):</u></b></p> <ul style="list-style-type: none"><li>Allocated a reasonable number of work hours, and identified the name of the team member assigned for completing each task <b>(max 4 points):</b></li></ul> <p>4 points = Excellent; 3 Points= Very Good; 2 Points = Good; 1 point = Poor; 0 point = Unsatisfactory.</p> <ul style="list-style-type: none"><li>Included a reasonable project schedule and deliverable dates <b>(max 2 points):</b></li></ul> <p>2 points = Excellent; 1.5 points = Very Good; 1 point = Good; 0.5 point = Poor; 0 point = Unsatisfactory.</p> <ul style="list-style-type: none"><li>Included strategies for meeting the deliverable time <b>(max 2 points):</b></li></ul> <p>2 points = Excellent; 1.5 Points = Very Good; 1 point = Good; 0.5 point = Poor; 0 point = Unsatisfactory.</p> <p><i>A key to the terms "Excellent, Very Good, Good, Poor, and Unsatisfactory" is depicted at the end of the Evaluation Grid.</i></p>		
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<p><b>R4</b></p>	<p><b>Practical Knowledge-Tailings Sampling</b></p> <p>The Bidder should demonstrate practical knowledge and familiarity with sampling from tailing sites of various characteristics, to ensure that the samples are obtained effectively, safely, that the sample's mineralogical integrity are retained and representative of each sample's location, and that the disturbance to the site is kept to minimal.</p> <p>To demonstrate these, the Bidder should provide a <u>brief description</u>. (200 words or less), supplemented with a photo, of:</p> <ol style="list-style-type: none"> <li>1. The type of equipment that is most suitable for a sampling of tailing site(s), and</li> <li>2. The best practice or measures that will be taken to ensure minimal site disturbance.</li> </ol>	<p>Breakdown of points for the elements, as follows:</p> <ol style="list-style-type: none"> <li>1. Presented with clarity the type of equipment that is most suitable for sampling tailing site(s) <b>(max 4 points)</b>: 4 points = Excellent; 3 Points = Very Good; 2 Points = Good; 1 point = Poor; 0 point = Unsatisfactory.</li> </ol> <p>Inclusion of photo of the suggested equipment <b>(max 2 points)</b>: 2 Points = included 0 points = not included</p> <ol style="list-style-type: none"> <li>2. Described the best practice or measures that will be taken to ensure minimal site disturbance <b>(max 4 points)</b>: 4 points = Excellent; 3 Points = Very Good; 2 Points = Good; 1 point = Poor; 0 point = Unsatisfactory.</li> </ol>	<p><b>10</b></p>	
<p><b>R5</b></p>	<p><b>Practical Knowledge-Chemical Analysis</b></p> <p>The Bidder should have practical knowledge of sample handling to ensure their integrity is retained and analyses are reliable. This includes knowledge of appropriate measures required in the shipment of the obtained samples to the analytical facility and familiarity with obtaining chemical analyses from an ISO-</p>	<p>Breakdown of points for the elements, as follows:</p> <ol style="list-style-type: none"> <li>1. Presented with clarity the quality assurance/quality control plan and transport plan for sample shipment <b>(max 3 points)</b>: 3 points = Excellent; 2 Points = Good; 1 point = Poor; 0 point = Unsatisfactory.</li> </ol>	<p><b>5</b></p>	



	<p>accredited analytical facility.</p> <p>To demonstrate these, the Bidder should provide a <u>brief description</u> (200 words or less) of:</p> <ol style="list-style-type: none"> <li>1. Their sample quality assurance/quality control plan and sample transport plan; and</li> <li>2. The considerations which need to be accounted for during transport from site to laboratory, in order to ensure sample integrity and proper chain of custody is maintained.</li> </ol>	<ol style="list-style-type: none"> <li>2. Described the considerations which need to be accounted for during transport from site to laboratory (<b>max 2 points</b>):</li> </ol> <p>2 points = Excellent; 1 point= Poor; 0 point = Unsatisfactory.</p>		
<b>Total points available:</b>			<b>58</b>	
<b>To be considered responsive, the minimum score is 41 points.</b>			<b>41</b>	

**Evaluation Grid Definitions:**

The Evaluation Grid definitions described below will be used to evaluate the Bidders' proposals based on each rated criterion.

Excellent	Rated criteria are covered in-depth and submitted information demonstrates a complete and deep understanding of all rated criteria elements.
Very Good	Submitted information clearly indicates a full understanding of all rated criteria elements.
Good	Submitted information clearly indicates a full understanding of most of the rated criteria, but not all.
Poor	Submitted information indicates some understanding of criteria outlined but do not demonstrate a full understanding of all rated criteria.
Unsatisfactory	Submitted information does not meet criteria.





**APPENDIX “3” - FINANCIAL BID PRESENTATION SHEET**

**Firm Price - Milestone Payments**

Bidder tendered all-inclusive firm price to perform the work is in Canadian funds, applicable taxes excluded. Any Travel and Living Expenses and other miscellaneous expenses must be included in the firm price.

***The bidder must complete the schedule below indicating the firm proposed amounts for each step according to the indicated percentages:***

Milestone #	Description of Milestone	Firm Price (Applicable Taxes Excluded)
1	(20% of the Total Cost) for the work following delivery and acceptance by the Project Authority of Task#1 and Task #2 as identified in the statement of work at Annex “A”	\$ _____
2	(50% of the Total Cost) for the work following delivery and acceptance by the Project Authority of Task #3 as identified in the statement of work at Annex “A”	\$ _____
3	(30% of the Total Cost) for the work following delivery and acceptance by the Project Authority of Task#4 as identified in the statement of work at Annex “A”	\$ _____
<b>Total Firm Price for Financial Proposal Evaluation:</b>		\$ _____



**APPENDIX "1" - MINING VALUE FROM WASTE: SAMPLING PLAN DEVELOPMENT AND TAILINGS  
SAMPLING PROTOCOL (NRCAN, 2022)**

**See Attached**



# Mining Value from Waste: Sampling Plan Development and Tailings Sampling Protocol

Prepared for:

**Natural Resources Canada**  
Critical Minerals & Industry Support Division

Attn:

Physical Scientist - Scientific Officer

September 30, 2022

Pinchin File: 302995

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Mining Value from Waste: Sampling Plan Development and Tailings Sampling

Natural Resources Canada

September 30, 2022

Pinchin File: 302995

FINAL DRAFT

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## 1.0 INTRODUCTION

The global transition to low-carbon technologies combined with an expanding digital and technological based economy is increasing the demand for critical minerals. This demand has created a unique opportunity for Canada to become a global leader in the production of critical minerals. To seize this opportunity, The Mining Value from Waste (MVfW) program, initiated in 2015, was endorsed by the Environment and Mines Ministers (EMMC) in 2018, and developed as a primary critical mineral research and development pillar at CanmetMINING, through Budget 2021 funding. The MVfW program aims to advance a circular approach to mine waste, by more fully utilizing the minerals in mine tailings, while simultaneously decreasing liabilities associated with long term storage at these sites. The initiative is coordinated by CanmetMINING and The Canadian Minerals and Metals Plan (CMMP) at Natural Resources Canada (NRCan). Canada's critical mineral list includes the following 31 critical minerals/mineral groups as being key to this transition: Aluminum, Antimony, Bismuth, Cesium, Chromium, Cobalt, Copper, Fluorspar, Gallium, Germanium, Graphite, Helium, Indium, Lithium, Magnesium, Nickel, Niobium, Platinum group metals, Potash, Rare earth elements (REEs), Scandium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Uranium, Vanadium, and Zinc. These minerals have been identified as being of high importance to ensure the future of Canada's economic security as well as providing sustainable and ethical minerals to Canada's partners.

Mine tailings provide an exciting opportunity to acquire critical minerals due to their ease of access, abundance, and their pre-milled partially processed nature. Pre-existing data from historic mine works may also increase the ease of mineral discovery in tailings. These characteristics could contribute to more cost-effective and rapid strategies for mineral production. Although this concept is attractive, there is not an established precedent to determine the economic viability of processing tailings for their mineral content. Furthermore, it is not clear if the current standards of disclosure for mineral projects set in NI 43-101 are sufficient or directly relatable for defining pre-existing mine tailings mineral potential. Also, not all the minerals listed in the Canada's critical mineral lists are well suited for potential extraction from tailings, either because they are relatively abundantly mined in Canada (i.e., nickel, uranium, potash), or because a mineral is not expected to be present in tailings (i.e., helium).

Reporting codes such as Canada's NI 43-01, the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC), and the Pan European Reporting Code (PERC) all provide structure and regulation for the reporting and disclosing of information on mineral projects; however, these documents do not provide any guidance or guidelines on modeling methods, sampling protocol, statistical parameters to report, or resource estimation protocol (Blannin et al., 2022). Current industry practices utilize guidelines and reporting requirements noted in supporting documents such as CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines, and Australian Guidelines



for the Estimation and Classification of Coal Reserves. These documents provide broad guidelines and cite resources that assist with methods for modeling and reserve estimation for many deposits, but may not be directly applicable for the evaluation of critical mineral extraction from tailings.

Pinchin was retained to study the prospect of tailings as a resource within Canada. The goals of this study are the following:

1. Determine best practices in economic valuation of mine tailings;
2. Define the sampling requirements to provide confidence in indicated and inferred resource estimation; and
3. Define barriers and other critical information in substantiating tailings as a mineral resource.

## 2.0 RESULTS OF LITERATURE REVIEW

The assessment of tailings for minerals/metals not evaluated during initial extraction is an ongoing topic of investigation that has gained the interest of researchers in Chile, the European Union, and now Canada (Arya et al., 2020; Suppes and Heuss-Aßbichler, 2021). Through case studies and meta-analysis, the reprocessing of the tailings has proven to be economically viable (Arya et al., 2020). A case study completed by Suppes and Heuss-Aßbichler (2021) found that in scenarios where historic tailings storage facilities (TSFs) were in need of environmental remediation, profitable mineral resources production alongside environmental remediation is possible; a win-win scenario.

NI 43-101 is an overarching instrument that has applicable legislation and policies for any mineral project and can be directly related to tailings mineral exploration. Existing best practice guidelines issued by the Canadian Institute of Mining for projects both in exploration and mineral resource/reserve definition phases are broad and contain applicable sampling and analytical protocol for tailings deposits. There is currently a lack of consensus on best practices in sampling for critical minerals found specifically in TSFs (Blannin et al., 2022). The existing best practice for conducting geological surveys and sampling protocols are open-ended and refer to textbooks and Collegiate Earth Science Departments (CIM Mineral Resource & Mineral Reserve Committee, 2018) where knowledge and research on the definition of tailings is limited.

Tailings deposits are generally heterogeneous and require extensive surface sampling for accurate and meaningful definition due to small scale and noncontinuous structures (Lottermoser, 2010; Pan et al., 2014; Nikonow et al., 2019). Tailings materials are deposited in tailings storage facilities by way of dry-stacking deposition, dewatered paste deposition, and most commonly by slurry deposition (Blannin et al., 2022). Slurry based tailings typically exhibit sedimentary-like deposition with particles sorted by grain size and density (Pan et al., 2014). Light and fine textured materials are comparatively deposited at



a greater distance from the point of influx than coarser materials (Pan et al., 2014; Blannin et al., 2022). Over a TSF lifetime, the spill point is often relocated creating different fan, cross cutting, and erosive structures within the TSF (Blannin et al., 2022). Furthermore, variability in mineral processing methods and ore characteristics (grade, mineral assemblage, texture) over a mine's lifetime increases the complexity of the tailing's structures and chemistry (Wilson et al., 2021; Blannin et al., 2022). These factors create conditions unique to each TSF, which justify the need for regularly spaced extensive sampling.

For the determination and modeling of economically viable regions of TSFs, specific sample density and statistical modeling will vary on a case-by-case basis. Through intensive study, which accounted for the variation in sample density, sample scheme, and statistical analysis, it was observed that a relatively low density, regularly spaced grid was sufficient to classify inferred, indicated, and measured resources of TSFs (Blannin et al., 2022). Geostatistical sequential Gaussian Simulation Methodology (USGSim) has been determined to be an applicable method of analysis (Blannin et al., 2022). 3D modeling may also provide an in-depth definition of geochemical features, aiding resource amount determination and delineation (Pan et al., 2014).

Defining tailings as a resource is an underdeveloped area of study and presents a viable opportunity. As such, establishing recommendations, policies, and risks associated with working with tailings is necessary for safe, reliable, and cost-effective mineral acquisition.

### 3.0 CHALLENGES WITH SAMPLING

#### 3.1 Safety Concerns

All exploratory sampling programs aiming to assess and delineate a mineral resource are subject to safety concerns. Based on the nature of TSFs, additional safety concerns must be considered. The most notable of these is the stability of the tailings for access and sampling. When at or near saturation, disturbed tailings may undergo liquefaction and become unstable for access. Vibration from a running engine, small drilling equipment, or even walking across areas that appear solid may cause liquefaction, a significant hazard. Some types of tailings may also form a crust or hardpan at the surface or within the capillary zone which makes the tailings appear solid. If the crust or hardpan is broken through, the underlying tailings may have a significantly higher moisture content and be far less able to support loads. Encountering liquefaction conditions may lead to loss of equipment or life. The proponent should ensure that staff accessing the tailings are aware of potential physical risks and proceed with caution. A geotechnical engineer should assess ground stability and develop a health and safety plan before people or equipment are used to access a TSF.



There are also potential chemical hazard exposures by way of dermal (contact with skin), ingestion, and inhalation pathways from materials composing the TSF. Potential exposure to chemical hazards relates to the constituents of the tailings/tailings facility and may include radioactive parameters, metals, or low pH (acidic) conditions related to the oxidation of the tailings. Chemical hazards may be generated from the tailings because of liberation through tailings oxidation processes (acid mine/rock drainage) or under pH neutral conditions. The hazard may be present in the runoff, ponded water, and tailings. Additionally, fine tailings material can be mobilized as fugitive dust and be re-deposited on equipment or inhaled.

The proponent should evaluate the potential chemical hazards relating to the TSF and implement appropriate measures to eliminate potential exposure pathways.

### 3.2 Material Heterogeneity – Understanding the Tailings ‘Deposit’

Categorizing and understanding tailings as a technogenic type deposit (Duczmal-Czernikiewicz et al., 2021) aids in understanding that success in economic retrieval relies heavily on data driven understanding of internal structures and chemical gradients. Therefore, comprehension of mechanisms of deposition unique to primary host rock mineralogy/chemistry, mine milling, tailings engineering, and evolution are essential for successful economic extraction.

Knowledge of the mineral series that contains the metal/mineral of interest is of primary concern. In many cases that evaluated the economic viability of recovering minerals from a TSF, the primary metals/minerals of interest match the associated minerals extracted at the mine when in operation. Examples of such metals/minerals are Cu, Au, Pb, and Zn (Muir et al., 2005; Barago et al., 2021; Duczmal-Czernikiewicz et al., 2021). Several of the minerals from Canada’s critical mineral list, such as Al, Cr, Co, Ni, PGEs, Sn, W, U, and Zn, were the primary focus of mining operations, and therefore will be present in tailings at some concentration. Other critical metals/minerals which were bound in minerals that were not of primary interest to the mine may or may not be present in the TSF due to the selective disposal of “waste” minerals into waste stockpiles throughout the process of crushing, screening, and flotation (Duczmal-Czernikiewicz et al., 2021).

Understanding what mineral(s) hold the commodity of interest is also vital for understanding depositional characteristics and trends. Principles of sedimentology teach us that denser/coarser particles drop out of solution in higher energy areas than less dense/finer particles and that round particles are more likely to roll along a substrate than angular particles. Tailings deposits are no different, with coarser particles settling closer to the spill point and finer particles settling more distal and laterally (Wennberg et al., 2008). Typically, the slope of tailings beach profile decreases in inclination further out from the spill point, with slopes averaging 0.5° (Wennberg et al., 2008). Slopes proximal to discharge points can become as steep as 10°, at which point slumping may occur (Dillon et al., 2004); however, fine fraction





settling works to level out these steep inclines (Wennberg et al., 2008). Additionally, different methods of discharge such as multi-point (spigot), subaqueous, and subaerial deposition, can alter the degree of sorting and slope of deposits (Dillon et al., 2004; Wennberg et al., 2008). Understanding if the targeted metal/mineral to be reprocessed is concentrated in the coarse and dense depositional area close to the spill point or if it is a part of the light and fine fraction is vital for success in economic delineation.

Another major influence on the tailings deposit is the evolution of the TSF. During a typical active life span of a TSF, not only will the spill points have been relocated, but engineering and earthworks may take place to maintain tailings structural integrity. Usually, tailings dams are eventually raised as mine production and lifespan increases (Vanden Berghe et al, 2011; Bhanbhro, 2014). Spill point locations during early development of a TSF may be buried by the construction of berms to maintain necessary bank stability and TSF volume (Figure 1). If the coarse heavy fraction contains the metal/metal of interest, upstream and centerline type dam construction methods will create "false bottoms" that control the geometries of the deposit. Knowing the method and history of TSF construction creates a stronger foundation of deposit comprehension, which will aid in developing more appropriate sampling programs.

### 3.3 Accessing Remote Sites

Similar to other sampling programs and exploratory drilling, the TSF may be situated at a remote location. However, in comparison to exploration or new mine development an advantage that a TSF may have is that the area has seen historical (or possibly ongoing) mining work, and there may be access and infrastructure that remains. The proponent should develop appropriate health and safety plans for accessing and working on remote TSFs. Methods of access to the TSF may pose a significant limiting factor to the types of equipment that can be mobilized to the TSF, and therefore may be a significant consideration in the type of sampling approach. Drill rig access to very remote TSFs may be impractical, affecting the ability to access samples at depth.

### 3.4 Analytical Methodology Considerations

Based on Pinchin's discussions with analytical laboratories and extraction process designers, materials within TSFs do not pose concerns for laboratory analysis or in developing material-specific extraction processes. However, since the list of critical minerals includes minerals of varying properties, the mineralogy of the tailings body may have been derived from a variety of ore types, processed by various means, and even deposited by different methods. As such, prior to designing the sampling program, the proponent should discuss the minerals of interest, required detection limits, and the general mineralogy of the tailings with the assay laboratory or extraction process designer to provide clarification on the volumes of sample required and sample handling or preservation requirements.



### 3.5 Ownership and Liability

The proponent must ensure that appropriate agreements for TSF site access and sampling have been obtained with the Site owner. At the sampling stage, it is expected that there would be a limited concern for environmental liability, as such aspects should also be initially reviewed and continually revisited if the project advances as the sampling program and site disturbance expands.

Historic tailings facilities may have been constructed to design guidelines that do not conform to current regulations or best practices. A geotechnical assessment of the containment system should be completed to ensure that the integrity of the facility is not adversely impacted when accessing or conducting the sampling program (e.g., drilling), as the proponent may be liable for any resulting environmental damage.

The full assignment of liability to the proponent poses a roadblock to the Mining Value from Waste (MVfW) initiative as bonding and liability can be burdensome, or even worse, can be unknown and unlimited (Kirkham, 2021). At TSF sites that are orphaned/abandoned, some level of shared risk and opportunity should be considered. Solutions may entail a trilateral partnership between the federal government, provincial/territorial government, and the proponent to share the risks within an equitable framework (Kirkham, 2021).

### 4.0 PERMITTING AND APPROVALS

A report completed for NRCan in March 2021 by Kirkham Geosystems Ltd. summarized the Federal, Provincial, and Territorial Regulatory, Legislative, and Policy Landscape and Issues pertaining to MVfW. This report concluded that existing legislative and regulatory frameworks currently accommodate the concept of MVfW, although streamlining may be necessary. At the provincial and territorial levels, the same legislative and regulatory frameworks that apply to all mineral projects are also applicable to tailings, waste mining, and re-processing projects (Kirkham, 2021). As there are differences in local legislation, the proponent is directed to review requirements applicable to the assessed TSF. Initial phases of sampling/assessment may have limited permitting and approval requirements, but as the project advances considerable permitting aspects will be encountered similar to mining or mineral extraction projects.

### 5.0 RESOURCE ESTIMATE REPORTING

For disclosure of TSF resource estimation, report writing should follow NI 43-101 closely. Areas that should be given particular attention are Sections 2.3, 2.4, and 3, which reference mineral resource and mineral reserve estimates reporting disclosures. Guidelines set forth by NI 43-101 are broad enough so that tailings resource estimation is allowed, but since applying this to tailings is a new concept, some unique factors must be considered.



Section 2.3 of NI43-101 states “(1) An issuer must not disclose (a) the quantity, grade, or metal or mineral content of a deposit that has not been categorized as an inferred mineral resource, an indicated mineral resource, a measured mineral resource, a probable mineral reserve, or a proven mineral reserve rules and policies indicates that reporting of resource estimation must only report on indicated, inferred, measured, or proven mineral reserves.” The heterogeneous and non-continuous nature of tailings requires high confidence in reserve modeling to classify reserves as indicated, measured, etc. A detailed and tightly delineated understanding of the tailings deposit found through appropriate sampling configurations (see Section 6.2) and statistical modelling (see Section 7.1) are of paramount importance and require finer resolutions than typical mineral deposits.

Section 2.4 of NI43-101 states “an issuer may disclose a historical estimate, using the original terminology, if the disclosure:

- a) identifies the source and date of the historical estimate, including any existing technical report;
- b) comments on the relevance and reliability of the historical estimate;
- c) to the extent known, provides the key assumptions, parameters, and methods used to prepare the historical estimate;
- d) states whether the historical estimate uses categories other than the ones set out in sections 1.2 and 1.3 and, if so, includes an explanation of the differences;
- e) includes any more recent estimates or data available to the issuer;
- f) comments on what work needs to be done to upgrade or verify the historical estimate as current mineral resources or mineral reserves; and
- g) states with equal prominence that:
  - (i) a qualified person has not done sufficient work to classify the historical estimate as current mineral resources or mineral reserves; and
  - (ii) the issuer is not treating the historical estimate as current mineral resources or mineral reserves.”

It is likely that historic documentation on mill processing/recovery of target minerals, tailings chemistry, and water monitoring in relation to tailings exists and may be of value. This data may prove useful in the estimation of inferred mineral resources on a TSF, though additional sampling would be required to verify historical data within the TSF and to define the deposit as an indicated/inferred resource.



Section 3.4 (c) of NI43-101 states *"If an issuer discloses in writing mineral resources or mineral reserves on a property material to the issuer, the issuer must include in the written disclosure the key assumptions, parameters, and methods used to estimate the mineral resources and mineral reserves"*. A major assumption that is made, in particular with Rare Earth Elements (REEs), is the value of the critical mineral being extracted. REE pricing is opaque and fluctuates heavily due to the current consortium among producers. Metal price assumptions are the same regardless of waste or primary resources, though given the initiative at NRCan that places importance on critical minerals, it is likely that evaluation of tailings sites for REEs will be conducted. A second key assumption is that the sampling density performed is sufficient to delineate small sedimentary-like structures which may heavily control critical mineral concentration variations. A third key assumption made in defining a deposit as an indicated/inferred resource is in statistical modeling, where spatial continuity of structures are assumed between sampling points. However, this assumption can be mitigated and tested with more intricate forms of statistical analysis (see Section 7.1).

## 6.0 SAMPLING PROTOCOL FOR TAILINGS

### 6.1 Quality Assurance and Quality Control

Section 3.3 (c) of NI43-101 states *"If an issuer discloses in writing exploration information about a mineral project on a property material to the issuer, the issuer must include in the written disclosure a summary of... the quality assurance program and quality control measures applied during the execution of the work being reported on."* A quality assurance and quality control (QAQC) program should include duplicate samples, blank samples, and appropriate certified reference materials samples. Though there are no standards for QAQC sample density, typical QAQC samples represent 5-10% of the samples submitted for assay. Sample preparation should be conducted in a manner where no bias is given to samples selected for analysis to ensure sampling that is representative of the deposit. Appropriate methods of analysis should be selected at the discretion of the Qualified Person (QP) and will be dependent on the commodity of interest.

### 6.2 Sampling Density and Configuration

Before a sampling program is conducted, it is best practice to have knowledge of the depositional method such as historic discharge locations, dam topography, milled ore grades over mine life, and expected grain size of the target mineral (coarse vs. fines). In most cases, documentation of historical mine operations will provide some valuable information to develop sample targets. Should mine documentation be absent or insufficient, geophysical surveys may be a useful tool. There is no current methodology that exists to accurately characterize a TSF's interior structures. Electrical resistivity tomography has been shown to highlight areas of low resistivity in tailings, indicating the presence of metals (i.e., Fe, Cu, Zn,



Cd, As, and Sb) (Yurkevich et al., 2017) and seismic refraction has shown some ability to delineate topsoil emplaced during reclamation, zone of saturation, and bedrock/dam topology (Vanhala et al., 2005); however, these non-invasive methods can not accurately differentiate coarse and fine material.

The sampling configuration design will be based on whether the coarse material or the fine material contains the metal/mineral of interest. In either case, delineation of coarse material slopes and slumps from fine material dropped from suspension will mark boundaries for areas of interest. Should coarse material be of interest, sampling programs should make focus sampling near the tailings dam through all stages of construction, as some construction techniques act to conceal older spill points with the addition of new dam embankments (Figure 1).

Since TSF are heterogeneous both in the vertical and horizontal axis, extensive sampling should be conducted to categorize zones of economic interest throughout the deposit. Blannin et al., (2022), supplied many different surface sampling configurations and spacing, providing insight on viable options for tailings sampling. Best data were made when the horizontal spacing between samples was 13 to 15 m apart (Blannin et al., 2022), and were more accurate when samples were evenly collected in grid spacing (Pan et al., 2014; Sädbom and Bäckström, 2018; Blannin et al., 2022). It should be noted that statistical analysis and modeling have indicated that sampling in 40 m intervals can be sufficient for reaching inferred/indicated resource classifications. Where high sample densities are not feasible, it is suggested that regular grid spacing produces better and more powerful results than random and nested sample point configurations (Blannin et al., 2022). Where tailings spill point history is known, greater sampling densities may be advantageous (13 to 15 m) if the commodity of interest is held in the tailings coarse fraction. This will delineate "sedimentary" structures, as these structures may have control on overall chemistry representing the grade of ore that was milled or periods of inefficiency in metal refining (Blannin et al., 2022).

In the vertical dimension, equal grid sample spacing should be considered and collected continuously and evenly through the decided interval. This method produces representative and unbiased results. Where structures exist, different sediment textures and minerals are defined, sample interval splitting along the structure may be advantageous. Drilling depth will be dependent on if the metal/mineral of interest is concentrated in the fine or coarse fractions. If the coarse fraction is desired, sampling to the depth of the impoundment in all drill locations is advantageous to define the lateral and distal extent that the coarse-grained fan structures extend. If the fine fraction is to be targeted, sample holes should be drilled starting from the interior of the TSF, with each successive hole being advanced toward the dam. The process of constructing vertical additions to a dam has the potential to create a sawtooth-like structure, with noncontinuous lenses of alternating coarse and fine material that dips at the slope of the spill point



depositional fans (Figure 2) (Pan et al., 2017). By migrating toward the dam, these lenses can be defined, and drilling can cease once lenses are no longer detected and only coarse material remains.

Sampling should occur to the full depth of the TSF impoundment where possible, unless on rare occasions where tailings are underlain by synthetic geo-textile membranes or clay liners. Great caution should be taken to not drill to a depth that will puncture geo-synthetic or clay liners as this could pose a significant environmental impact. Therefore, knowledge of the TSF depth and design should exist before any drilling is undertaken to determine an appropriate sampling depth.

### 6.3 Methodology for Sample Collection

Tailings sampling methods exist in two general categories, hand and drill rig operated. An excellent summary of a variety of sampling methods was presented in the National Uranium Tailings Program Uranium Tailings Sampling Manual produced by Energy, Mines, and Resources Canada in 1985 (EMRC 1985).

Hand-operated techniques include surface grab samples, hand augers (Photograph 1), hand piston samplers (Photograph 1), thin-walled tube samplers, and gravity core samplers (Photograph 2) (EMRC, 1985; Frew 2014; Sädbom and Bäckström, 2018). Some drill rig operated techniques include split-spoon samplers, Shelby tube samplers (Photograph 4), and long thin-walled tube samplers (EMRC, 1985; Frew, 2014). Additionally, in TSFs where the material is unconsolidated and semi-fluidized some unique sampling methods exist such as cyre piston samplers and wireline fluid samplers (Canadian Oilsands Innovation Alliance (COSIA), 2015). All techniques have their advantages and disadvantages, as outlined in Table 1, therefore best drilling methodology will be specific to the site and goals of the project (EMRC, 1985).

Table 1. - Sampling Methods for Tailings

Technique (Reference Author)	Application	Pros	Cons
Hand Auger: (EMRC, 1985; Frew 2014, Sädbom and Bäckström, 2018)	Preliminary on or near surface sampling. Characterization of samples on site.	Cost effective. Fast paced. Hand operated. Can sample up to 5m in depth.	Not viable if tailings surface is covered (soil, cobbles, overburden, water). Samples are highly disturbed (structures destroyed) and spatially inaccurate.
Hand Piston Sampler (EMRC, 1985)	Shallow depth sampling. Characterization of samples on site.	Cost effective. Fast paced. Hand operated.	Limited to shallow depth surface sampling. Short sample length limited to operator strength.



Technique (Reference Author)	Application	Pros	Cons
		Preserves sediment structure.	Samples cannot be examined in the field if lodged in sample tube.
Gravity Samplers: Mackereth Corer, Russian' Peat Corer (EMRC, 1985; Frew 2014)	Surface sampling of submerged surface.	Viable where tailings facility has flooded. Ease of use in deep water.	Limited to sampling the surface. Limited by hydrostatic pressure at pond bottom and power of air compressor.
Split-Spoon Sampler (EMRC, 1985) (Photograph 3)	Capable of at-depth sampling. Sample characterization possible on site.	Sedimentary structures can be somewhat preserved.	Samples must be encased in inert sleeve (commonly acetate plastic) if chemical analysis is to be done to prevent oxidation/contamination. Samples are relatively disturbed.
Shelby Tube Sampler (EMRC, 1985)	Capable of at-depth sampling.	Samples are undisturbed and chance of contamination is low.	Ground must be absent of cobbles and large clastic material. Samples are short in length and difficult to examine in the field.
Piston Corer (EMRC, 1985; Frew 2014) (Photograph 6)	Can be used in lacustrine and water submerged environments.	Similar to Shelby tube technique, but pistons prevent entry of tailings until desired sample depth is reached. Target specific horizons.	Ground must be absent of cobbles and large clastic material. Samples are short in length and difficult to examine in the field.
Long Thin-Walled Tube Sampler (EMRC, 1985)	A single, up to 10m long continuous sample.	Best preservation of sedimentary structures. Sample splitting can be done after examination to delineate horizons.	Sample preserved in tube and cannot be examined on site. Long length of the sample makes sample transport difficult.
Cyre Piston Sampler (COSIA, 2015)	Typically used to collect fluid fine tailings and soft captured fines.	Samples collection in soft unconsolidated tailings deposits. Target selected sample depths.	In more fluid samples, structure is highly disturbed. Difficult to examine sample in the field.
Wireline Fluid Sampler (COSIA., 2015)	Used for sampling more fluid-like material.	Collect fluidized tailings samples.	Limited to fluid samples, not core, therefore tailings structures are not preserved.

Sampling methodology will vary based on project objectives and the existing TSF conditions. If limited to the evaluation of surface features, hand augers traditionally used for soil sampling programs may be sufficient. Sampling directly from surface should be avoided as the surface may contain various contaminants from aeolian or anthropogenic sources and may be oxidized (Sädbom and Bäckström,



2018). If the TSF has been remediated and covered with soil and vegetation, surface sampling traditional augers or other hand-driven samplers may not be viable.

In the event surface sampling is not feasible or where more in-depth 3D modeling is desired, soft sediment drilling techniques can be conducted. In literature, several techniques have been used. A method sometimes used is boring down and stopping at selected intervals and sampling the material. This method however is not recommended as there is a higher likelihood of sample contamination, and this technique does not allow for the continuous sampling methodology. Another method sometimes used is the direct push. Direct push drills are hydraulically powered and use dynamic percussion to force small diameter tubes fitted with plastic liners into the subsurface. This method, and methods similar, can be more valuable as they allow for continuous sampling and preserve tailings structures which can be logged for further deposit definition.

## 7.0 BEST PRACTICES IN ECONOMIC VALUATION OF MINING TAILINGS

### 7.1 Statistical Analysis

Reporting codes such as Canada's NI 43-101, JORC, and PERC all provide structure and regulation for the reporting and disclosing of information on mineral projects. These documents do not provide guidance or guidelines on the modeling methods or statistical parameters to classify a deposit as a mineral reserve or resource (Blannin et al., 2022). Reporting guidelines and requirements are noted in supporting documents such as CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines, and Australian Guidelines for the Estimation and Classification of Coal Reserves. These guidelines have incorporated the evolution of statistical modeling and variations within deposit forms, to allow modeling to conform to unique deposits. As such, the method of statistical analysis used to characterize a deposit is at the discretion of the QP. If an expert in statistical analysis is consulted for the method of analysis, this must be disclosed as per section 3.2 of NI 43-101 *"If an issuer discloses in writing scientific or technical information about a mineral project on a property material to the issuer, the issuer must include in the written disclosure (a) a statement whether a qualified person has verified the data disclosed, including sampling, analytical, and test data underlying the information or opinions contained in the written disclosure."*

The QP should consider a diverse approach with appropriate methods to quantify data, and effectively interpret the statistical and physical/chemical variables to develop a deposit model that is accurate. Variables that may control grade in TFSs include the following: average grain size, bed vertical thickness, distance from discharge point, depth, oxidation levels, pH; and categorical variables such as type of discharge point and mineral assemblage, and any correlations they have with each other and with the commodity of interest. Primary evaluation can be done using univariate, bivariate, and/or multivariate





statistical methods to discern if the tested variable influences metal/mineral commodity. Further graphical representations such as regression analysis and variogram plots may also aid in characterising the trend of correlations. Determining these relationships can help provide insight onto areas of interest for additional sampling.

Beyond determining variable correlations, measuring spatial continuity is essential for resource definition. Typically, traditional deposit resource estimation uses geostatistical techniques, and more commonly geometric modeling (Blannin et al., 2022). Geometric modeling typically implements inverse distance weighted methods of interpretation; however, this method is limited as it does not account for the spatial discontinuity that is characteristic of heterogeneous TSFs (Blannin et al., 2022). Geostatistical modelling and classification methods such as sequential Gaussian Simulation Methodology (USGSim) have been used to quantify and incorporate risks associated with spatial discontinuity, such as uncertainties of grade estimates, tonnage, and kriging variance (Owusu and Dagdelen, 2019; Blannin et al., 2022). USGSim methodology has proven the ability to classify tailings as indicated/inferred resources (Blannin et al., 2022), and the procedural methodology can be observed in Manchuk and Deutsch (2012). Conversely, Pan et al. (2017) utilized a 3-D geometric with inverse distance weighing model, though their model was not subject to block validations nor quantification of indicated/inferred resources, it did have success in highlighting areas of greater target metal concentrations. Though geostatistical methods of modelling offer greater accountability for spatial discontinuity, geometric modelling using inverse distance weighing may be sufficient in defining indicated and inferred classifications where sample density is high enough to intersect tailings scale structures (13 to 15 m).

There is not a consensus among researchers or governing agencies on an acceptable confidence level or error for meeting measured, indicated, or inferred classifications (Blannin et al., 2022). In fact, determining a standard metric to measure error and confidence level is a point of contention amongst experts, with different recommendations for time periods of measurements (quarterly, annually), and appropriate scale (mine block, mining unit, or deposit as a whole) to use (Noppé, 2014; Blannin et al., 2022). The reality is no single method or metric is sufficient to cover all deposits due to scale, geometry, and mine life variations (Noppé, 2014). Since a TSF contains two zones of deposition (coarse and fine), it would be acceptable to scale deposit estimations based on the entirety of the TSF, except where multiple impoundments exist or where clear textural and chemical differences are observed and rationalized by historic data. When considering tailings, it is reasonable to assert that a high confidence level is necessary purely due to heterogeneity and has been recommended to be based on tonnage and to exceed a 90% confidence level (Blannin et al., 2022) with acceptable error being no more than  $\pm 20\%$ ,  $\pm 30\%$ , and  $\pm 50\%$  for measured, indicated, and inferred classifications respectively (Wellmer, 1983).



## 7.2 Unique Considerations for the Valuation of Mine Tailings

CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines section 6.12.1 has outlined 12 key factors which contribute to cut-off grades for economic production. Primary factors that contribute to economic valuation include long-term commodity prices or contracted pricing, exchange rates, mineral processing, mineral recovery, extraction, and royalty costs. Additional considerations include deposit location, scale, grade, grade continuity, mining method, environmental and social consideration, and waste disposal costs. There is not yet an industry standard to determine the value of a deposit.

A method cited in CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines is to determine the financial break-even point of cut-off grades. A break-even cut-off grade is defined as the lowest grade/mineral value of materials that can be mined and processed at an operating profit incorporating all known costs. Determining this cut-off grade is based on the consideration of several different input costs which vary considerably between open pit and underground mines. Since TSFs are located on the surface, they are most comparable to open pit mining costs. However, mining of tailings has several distinct factors that would act to lower cut-off grades as outlined in CIM Estimation of Mineral Resources & Mineral Reserves Best Practice Guidelines Table 7-1. The fact that tailings exist on the surface drastically lowers extraction costs. Tailings have also been milled, which reduces costs associated with processing. Another cost-effective attribute to tailings is access, as there is the potential of re-purposing pre-existing infrastructure. Ultimately, the most dominant factor in determining if a mine will be economic or not is commodity price and commodity price projections.

A cost liability associated with TSF valorization would be the handling of tailings material. Tailings material is fine grained, often rich in metals, and commonly water saturated; all characteristics that make them reactive and an environmental threat (Duczmal-Czernikiewicz et al., 2021). Tailings dams are constructed to remove any interaction between an eco-system and tailings material. The process of resource extraction from a TSF poses a potential risk to their integrity. The possibility of dam breaching while extracting tailings in the vicinity of a tailings dam is a risk that needs to be very carefully assessed. Some tailings in the vicinity of dams may need to be left in place to maintain dam stability, and this loss of resource will affect the project value. Geotechnical studies of tailings material stability will be mandatory to define a "no dig zone" to maintain dam integrity and may impact the volume of the deposit. Dam stabilization requirement concurrent with excavation will also increase the cost of production, and waste produced from re-working a TFS may require the development of a second TSF for the placement of the processed tailings.



Another variable worthy of consideration is water management. For example, a flooded TSF may be required to be drained to allow machinery access for excavation. Additionally, monitoring and de-watering of the TSF may be needed to maintain bank stability and safe access to the deposit. Water held in a TSF may: be acidic, be rich in suspended particulates, contain toxic concentrations of metals, or even contain radioactive materials (Liu et al., 2015). For safe discharge of de-watered tailings water, remediation infrastructure may be required to be developed to meet water quality standards, such as settling ponds and treatment plants, which will affect the cost of extraction and ultimately resource valuation. Moreover, existing TSF water management systems such as spill points and treatment plants will need to be evaluated for how dewatering and excavation may affect their capacity to function. Changes to water management pertaining to the TSF may also result in broader changes to water management for the entire site and thereby result in additional engineering costs and/or updates to any existing closure or monitoring plans.

## 8.0 BARRIERS IN SUBSTANTIATING TAILINGS AS A RESOURCE

One barrier to substantiating a TSF as a resource or reserve is the degree of heterogeneity present in tailings. The largest influence in forming economic pockets in tailings is the discharge point location and the sedimentary structures it forms. These structures can be non-continuous and irregularly spaced, increasing the likelihood of over or underestimating the resource. Increased sample density and available information on tailings and milling history could mitigate this issue along with a supplemental sampling program.

Another barrier for proving economic value of a TSF is a lack of comparable examples in both literature and existing projects. With limited references, potential for sub-par sampling and inadequate statistical analysis and modeling increases.

A major consideration for the evaluation of tailings as a resource is the beneficial environmental impact it can have. An important distinction between resource extraction from traditional mining and from a TSF is that mineral extraction from a TSF has environmental and economic value. This is not considered in a typical economic evaluation. If environmental health values were considered into economic feasibility calculations, more "value" could be found in these types of projects. Particularly where historic tailings dams need urgent intervention to reduce negative environmental impacts such as acid rock drainage.

A review of federal, provincial, and territorial regulatory, legislative, and policy landscape and Issues with respect to mining value from waste completed for NRCan by Kirkham in 2021 concluded that existing legislative and regulatory frameworks currently accommodate the concept of mining value from waste, although streamlining may be necessary. Kirkham identified full assignment of liability to the proponent as a roadblock as bonding and liability are burdensome and may be unknown and unlimited. They also



reported, some level of shared risk and opportunity should be considered at historic or abandoned mine sites.

### 9.0 NEXT STEPS

It is anticipated that this Tailings Sampling Protocol will evolve and benefit with feedback from application to real world case studies. Only through the implementation of various sampling methodologies and the incorporation of aspects such as permitting, and approvals can the actual resource estimation be assessed, and sampling strategies critically evaluated.

Potential field sites should be selected to account for variability in TSFs. Consideration should be given to mining and milling of different primary ores from alternative depositional environments such as Volcanic Massive Sulphide (VMS) deposits, or placer deposits. Furthermore, tailings that have been deposited by different methods and are of differing stage of reclamation should be evaluated. Ideally, a field site that has abundant information on the ore type, milling methodology, and milling history, as well as the depositional history of the tailings should be selected as this would allow greater resolution in designing the sampling program. Table 2 below lists several of the minerals listed in the Canada Critical Mineral list with information on example areas of deposit and potential field sites. Please note this list is based solely on publicly available material.

**Table 2. Preliminary Considerations for Field Site Selection**

Critical Mineral(s)	Common Deposit Type	Geographic Occurrences	Example Sites
Platinum Mineral Group (PGM)	VMS	Sudbury, ON; Thompson MB, Voisey's Bay, NL	Vale; Voiseys Bay, NL
Rare Earth Elements (REE)	Oil Sands	Fort McMurray, AB	Suncor; Firebag Mine, Fort McMurry
Lithium, Tin & Tantalum	Pegmatite ores, Boron/Borates	Val-d'Or, QP	North American Lithium; Quebec Lithium mine, Val-d'Or, QP
Copper	Porphyry, VMS	British Columbia; Sudbury ON	Teck; Highland Valley Mine, South Central BC
Zinc	SEDEX, VMS	Flin Flon, MN; Timmins ON	Hudbay Mineral Inc; 777 Mine, Flin Flon, MN



Critical Mineral(s)	Common Deposit Type	Geographic Occurrences	Example Sites
Selenium & Tellurium	VMS	Sudbury, ON; Snow Lake District, MB; Jewel Lake area, BC	Whistle and Frood Mines Sudbury, ON; Gaspé Copper Mine PQ
Vanadium	Magnetite Iron Ore Deposits	Labrador Trough Region, NL	Iron Ore Company of Canada NL
Scandium	Cobalt Deposits	Cobalt, ON	Cart Lake Tailings
Antimony	Pegmatites, Lithium Deposits, Silver Deposits	Cranbrook, BC	Silvana mine, Sandon, BC West Gore mine, NS
Uranium	Unconformity Related Uranium Deposit	Athabasca Basin, SK	Cameco; Cigar Lake Project, McClean Lake, SK
Graphite	Vein type, Crystalline flake type	North-Eastern ON, South-Western PQ	Northern Graphite Corp; Bisset Creek, ON

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Mining Value from Waste: Sampling Plan Development and Tailings Sampling

Natural Resources Canada

September 30, 2022

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FINAL DRAFT

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Template: Master Report for Remedial Excavation, EDR, July 14, 2019





**APPENDIX A**  
**Photos of Drilling Methods**  
**(5 Pages)**



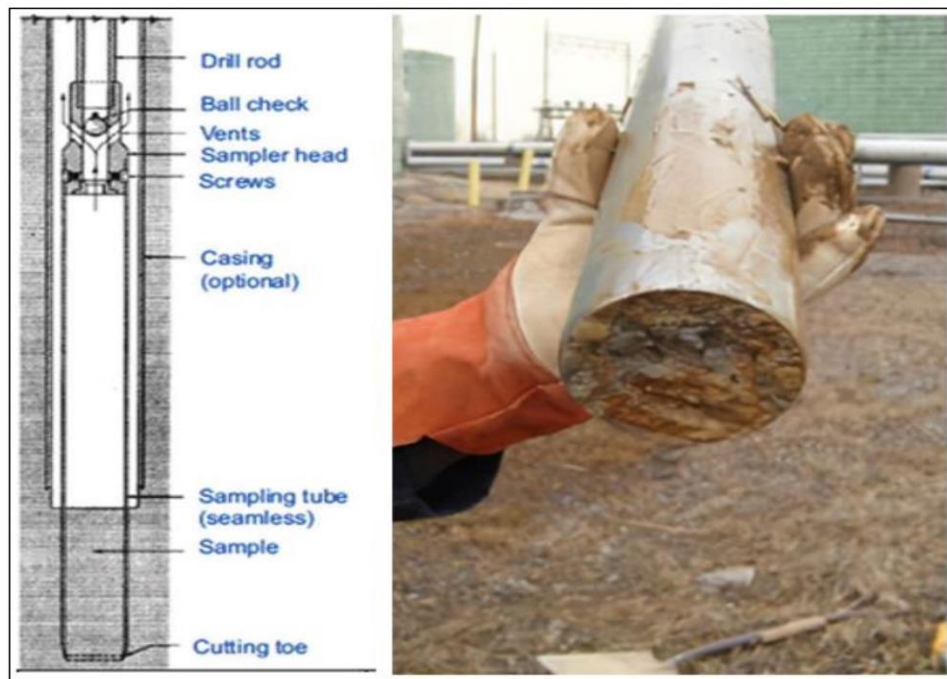
Photograph 1. Left: hand piston sampler. Right: Hand auger sampler.



Photograph 2. Left: Submersible Mackereth Corer. Right: Submersible Russian peat corer.



Photograph 3. Drill mounted split spoon sampler.



Photograph 4. Left: Diagram of Shelby tube sample collection process. Right: Sample Retrieved by Shelby tube.



Photograph 5. Piston corer sample.



**APPENDIX B**  
**Figures of Tailings Structures**  
**(2 Pages)**

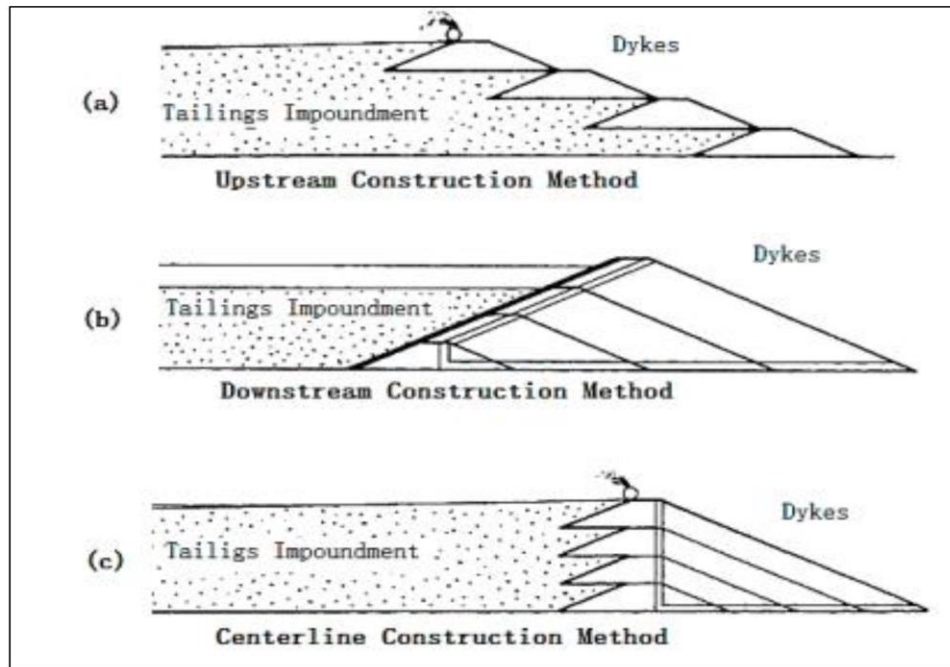


Figure 1. Methods of Tailings Dam construction (Bhanbhro, 2014).



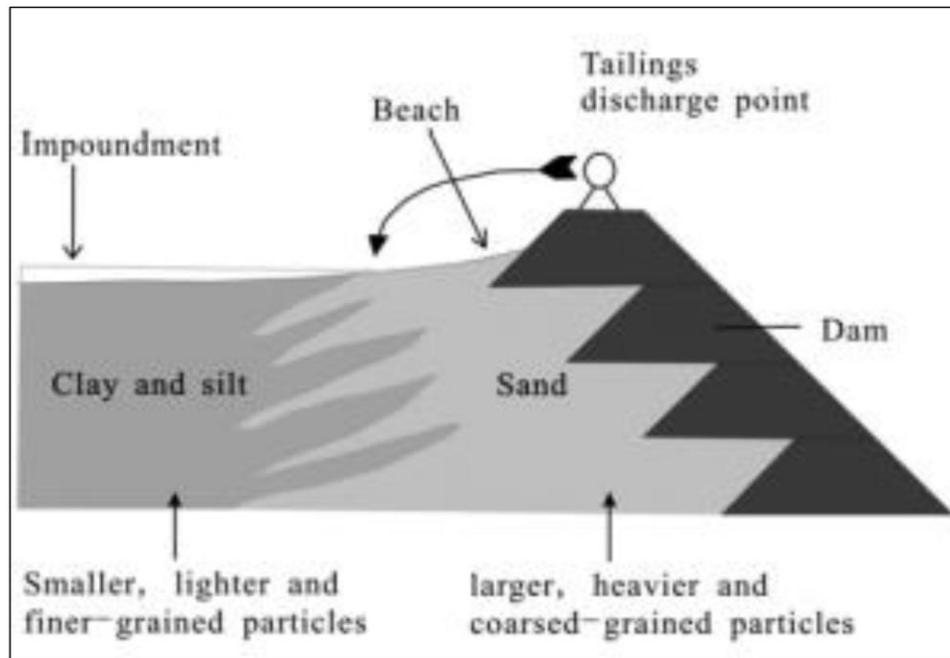


Figure 2. Example depositional environment in the tailings pond (Pan et al., 2017)