RECLAIM 8.0

USER MANUAL

MINING VERSION

Developed by:
Government of the Northwest Territories and
Crown-Indigenous Relations and Northern Affairs Canada

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This manual supports RECLAIM 8.0 for Closure and Reclamation Cost Estimates

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Definitions and Acronyms

TERM	DEFINITION
AACE	Association for the Advancement of Cost Engineering
AEMP	Aquatic Effects Monitoring Program
affected party(ies)	A party that is affected (or predicted to be affected) by a proposed or existing project, including an Indigenous government, an individual occupying land for traditional purposes, a private landowner, or a lease or interest holder (e.g., for a lodge).
Alberta Equipment Rental Guide	Alberta Roadbuilders and Heavy Construction Association (ARHCA) 2024 Equipment Rental Rates Guide
ARHCA	Alberta Roadbuilders and Heavy Construction Association[1]
Alberta Union Collective Agreement	Collective Agreement between PCL Builders Inc. Roadbuilding & Heavy Construction – Alberta and Construction Workers Union CLAC Local 63
The Blue Book 2024 BC	The Blue Book – 2024-2025 Equipment Rental Rate Guide BC Road Builders & Heavy Construction Association[2]
Boards	The Nunavut Water Board (NWB) and the Land and Water Boards of the Mackenzie Valley (LWB).
capital costs	Capital costs are recognized as fixed, one-time expenditures to bring a project to an operable/ final completed status. It includes the construction execution costs, and contrasts with operating/operational costs, which are the business operating costs, business overhead costs, equipment operating costs, etc. For RECLAIM, and in cost estimating practice, capital costs is used synonymously with DIRECT COSTS.
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada (formerly DIAND/INAC)
closure and reclamation	The process and activities that facilitate the return of areas affected by a project to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities.
closure cost estimate	An estimate of the cost to close and reclaim a project. Also referred to as environmental liability estimate.
contingency	An amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience.[3]. For RECLAIM, and most cost estimating projects, the determination of contingency percentage is a subjective and project-specific task that relies on the judgement of the estimator. The basis for that estimate typically correlates to the level of design (i.e., the more advanced the design, the fewer the project unknowns and cost uncertainties).
CPI	Consumer Price Index
CRP	Closure and Reclamation Plan.

[1] See https://www.arhca.ab.ca/
[2] See https://www.roadbuilders.bc.ca/blue-book/
[3] See AACE International Recommended Practice No. 10S-90 – Cost Engineering Terminology for Contingency

DIAND	Department of Indian Affairs and Northern Development (now CIRNAC)
direct costs	For mine reclamation projects, are those costs directly attributable to performing the work activities necessary for implementing the Closure and Reclamation Plan.
escalation	A provision in costs or prices for uncertain changes in technical, economic, and market conditions over time. Inflation (or deflation) is a component of escalation.[4]
engagement	The communication and outreach activities a proponent undertakes with affected parties prior to and during the operation of a project.
GNWT	Government of the Northwest Territories
GN	Government of Nunavut
ICM	Interim care and maintenance
INAC	Indigenous and Northern Affairs Canada/Indian and Northern Affairs Canada (now CIRNAC)
Indigenous government/ organization	An Aboriginal organization representing a First Nation (as defined in section 2 of the MVRMA), Métis or Inuit organization, the Tłı̨chǫ First Nation, the Tłı̨chǫ Government, or the Dél̨ı̨nę Got'ine Government.
indirect costs	The indirect costs in RECLAIM include those for planning and designing, and that administratively and logistically support the reclamation and closure work.
inflation	A persistent increase in the level of consumer prices, or a persistent decline in the purchasing power of money, caused by an increase in available currency and credit beyond the proportion of available goods and services.[5]
land use permit	A regulatory authorization required for an activity set out in sections 4 and 5 of the Mackenzie Valley Land Use Regulations; or a land use permit (type C) required by Tłı̨chǫ law for use in Tłı̨chǫ lands or by a Dél̨ı̨nę law for a use of Dél̨ı̨nę lands, respectively, for which a type A or type B land use permit is not required.
LWB	Land and Water Boards of the Mackenzie Valley
mob/demob	Mobilization/Demobilization
MVLWB	Mackenzie Valley Land and Water Board
NU	Nunavut
NWB	Nunavut Water Board
NWT	Northwest Territories
progressive reclamation	Closure and reclamation activities conducted during the operating phase of a project.
project definition	The scope of work/ all activities, for a given project (e.g. closure and reclamation project), that will be used to calculate its cost
proponent	Applicant for, or holder of, a water licence and/or land use permit.
QA/QC	Quality Assurance/Quality Control
RECLAIM cost model (or RECLAIM)	The preferred tool for calculating closure cost estimates for activities that require a water licence (including those that also require a land use permit).
reclamation	The process of returning a disturbed site to its natural state, or to a state which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
RIA	Regional Inuit Association (e.g. Kivalliq Inuit Association, Kitikmeot Inuit Association, and Qikiqtani Inuit Association)

[4] See AACE International Recommended Practice No. 10S-90 – Cost Engineering Terminology for Escalation

[5] See AACE International Recommended Practice No. 10S-90 – Cost Engineering Terminology for Inflation.

remediation	The removal, reduction, or neutralization of substances, wastes, or hazardous material from a site in order to prevent or minimize any adverse effects on the environment and public safety now or in the future.
security deposit	Funds held by the appropriate authority (e.g. GNWT, CIRNAC, or landowner) that can be used in the case of abandonment of a project to reclaim the site, or carry out any ongoing measures that may remain to be taken after the abandonment of the project.
SNP	Surveillance Network Program
water licence	An authorization required as per the Nunavut Water Regulations (NU land), Waters Regulations (NWT land outside of a federal area), and Mackenzie Valley Federal Areas Waters Regulations (federal area) for uses of water or deposits of waste into water.

1 Introduction

Background

Mining, which includes all the phases of project development, plays an important role in the economy of Northern Canada. Unfortunately, there have been instances where mines were abandoned prior to full closure and reclamation. A consequence of this is that landowners (such as the Federal government) become responsible for a large portfolio of "contaminated" sites, most of which are managed by CIRNAC's Northern Contaminated Sites Program (NCSP). These sites range from relatively small advanced exploration properties to full scale former mines such as Giant (Northwest Territories), Faro (Yukon), and Jericho (Nunavut). With environmental liabilities totalling more than $10 billion, CIRNAC is responsible for closure and reclamation costs that are significantly greater than the security deposits that were posted by the private sector operators of the mines.

In response to these past events, the modern regulatory framework of Nunavut and the Northwest Territories was designed with the goal of ensuring that proponents close mines in an environmentally responsible way. As part of this framework, proponents are required to provide an acceptable form of security with the landowner (e.g., CIRNAC, Government of Northwest Territories, and/or Indigenous Associations) to cover closure costs in the event the proponent becomes insolvent. A key component of this process is the development of closure cost estimates that are based on the mine's Closure and Reclamation Plan (CRP). A proponent is required to develop a CRP and maintain a security deposit through the legally binding conditions set out in the regulatory authorizations issued to the proponent. Requirements of closure plans are jurisdictionally specific. Proponents are advised to seek guidance from the applicable land and water board / water board jurisdiction such as Mackenzie Valley Land and Water Board or Nunavut Water Board[6].

Within the modern regime, proponents are responsible for calculating closure cost estimates to ensure a third-party contractor can undertake the closure and reclamation of any abandoned sites. The closure cost estimate must include all direct and indirect costs that would be incurred from the time the site is abandoned, through interim care and maintenance and completion of closure activities. In addition to remedial works, closure cost estimates are to account for post-closure monitoring costs (for example, water quality monitoring, geotechnical inspections, etc.) and post-closure maintenance costs (for example, the costs of repairing eroded areas of a tailings cover that would be reasonably expected in the future).

RECLAIM has been developed on behalf of the GNWT and CIRNAC to assist the governments, the Boards, landowner (e.g., Indigenous Owned Land) and stakeholders (typically proponents) to estimate closure and reclamation costs (the "closure cost

[6] Mackenzie Valley Land and Water Board (https://mvlwb.com/resources/lwb-policies-and-guidelines) or Nunavut Water Board (https://www.nwb-oen.ca/).

estimate") at mines and advanced mineral explorations projects in the Northwest Territories (NWT) and Nunavut (NU). The model format is specifically designed to help these parties to better comprehend the multiple components of mine site closure cost estimates. These estimates are intended to cover environmental liabilities associated with authorized development projects in the NWT and NU. RECLAIM provides a transparent (nothing hidden) means of presenting the closure cost estimate. The RECLAIM Model is an LWB/GNWT/CIRNAC accepted means to develop a closure cost estimate for the purpose of estimating environmental liability. While the RECLAIM Model is a tool to develop closure cost estimates, establishing the security deposit amount[7] is jurisdiction specific and therefore not defined in the RECLAIM model.

Closure Cost Estimates

The closure costs are those to perform closure and reclamation activities, as defined in a mine's Closure and Reclamation Plan (the project definition). In order to develop a defensible closure cost estimate in RECLAIM, users should have sufficient expertise in mine closure and reclamation and related fields, and in the costing of large engineering projects.

This User Manual includes descriptions of:

- Considerations for closure cost estimates in northern settings (Section 2);
- How different parties may approach the cost estimate for a given site (Section 3). An understanding of the perspectives may help resolve differences in the estimates prepared;
- The RECLAIM Model and guidance on how to use it (Sections 4 and 5), which includes:
    - RECLAIM Model Worksheets (Section 4);
    - Using RECLAIM (Section 5).

2 Considerations for Northern Settings

To derive accurate closure cost estimates, it is imperative that the company have an approved Closure and Reclamation Plan which demonstrates a comprehensive understanding of closure and reclamation requirements, objectives, and the scope of work to achieve those objectives. The first step to using the model effectively is to prepare a comprehensive Closure and Reclamation Plan with sufficient detail to list and quantify the activities required.

[7] See Section 2.1 of *LWB/GNWT/CIRNAC Guidelines for Closure and Reclamation Cost Estimates for Mines* and the "Financial Security" sections of *A Mine Site Reclamation Policy for the Northwest Territories* and *Mine Site Reclamation Policy for Nunavut*, respectively.

Factors that should be recognized when developing a Closure and Reclamation Plan and liability cost estimate for a site in northern Canada are discussed below:

- Low unit costs typically apply to work that is conducted in large volumes using appropriate equipment. However, in northern Canada efforts to reduce mobilization costs to remote sites may result in some work being conducted with non-optimal equipment.
- Some activities are best conducted in summer, such as placement and compaction of soils, while others may require winter (i.e. frozen) conditions for trafficability reasons. As such, reclamation activities may need to be extended over several seasons at some northern sites.
- Productivity of people and equipment is reduced in winter conditions.
- Fuel costs can be high due to the cost of mobilizing fuel to site.

3 Proponent Operating Costs vs. Security Estimate

There are important differences in the types of cost estimates that may be prepared by a proponent or a regulator. These are described as follows:

3.1 Company Operating Costs – Internal Use

A proponent's estimate for internal use presents the costs the company expects to incur as part of the development project and is typically based on operating costs. The estimates may be derived to assess the viability of the mine or for corporate cash flow accounting. Typical factors which may affect this type of estimate are:

- Low unit costs are generally utilized as it is assumed that the work will be conducted under the direction of the mine manager utilizing existing staff and equipment.
- Equipment unit cost may exclude capital cost of the equipment as it may have been discounted to zero during operations.
- Equipment productivity may be assumed to be relatively high due to familiarity with working conditions on the site.
- Salvage and sale of equipment is typically included in a company's internal estimate to off-set costs.
- A low contingency may be applied based upon the assumption that the mine development and closure activities will proceed as planned without upsets or deviations.

3.2 Closure Cost Estimate

A closure cost estimate (i.e. an environmental liability cost estimate) is assumed to cover a third party's costs of closure and reclamation should the company become insolvent and abandon the site. Costs are therefore inherently higher than a proponent's operating cost estimate described in Section 3.1.

Typical factors which may affect this type of estimate are:

- Unit costs are based on third-party contractors conducting all of the work.
- Mobilization costs are included for every piece of equipment or machine required for the work (i.e. the RECLAIM Model does not assume that existing mine equipment is available and in good working condition, see Section 4.3.1).
- No allowance for salvage or sale of equipment.
- The closure costs are not reduced for progressive reclamation work until after the work has been completed and it is demonstrated that it meets the approved closure objectives.
- Includes a provision for interim site care and maintenance to address the period of time between the ceasing of operations and the commencement of closure work. The duration of Interim Care and Maintenance has demonstrably been found to be at least five years for projects that return to a public government; more if a final closure plan has not been approved and/or there are complex issues to address.
- A contingency is applied that reflects the maturity level and degree of uncertainty in the closure plan (i.e. address key areas of uncertainty in closure options until such time as the preferred option is demonstrated or verified during the life of the project).
- Salvage value is not recognized because of the problems associated with creditor's rights, sale of equipment, and uncertainty as to the actual value at the time of insolvency.
- The precautionary principle, which states that "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation[8]."

3.2.1 Progressive Reclamation

Closure cost estimates are prepared assuming that progressive reclamation is not conducted. Until this work is completed it is still an outstanding closure cost (i.e. an environmental liability) just like any reclamation which is put off until final closure of the project site. Therefore, closure cost estimates should cover the costs to complete this work as proposed.

If the company carries out progressive reclamation during operations as proposed, such as revegetation of disturbed areas during operations, then the closure cost estimate could be reduced by the associated costs for that component when the company demonstrates

[8] See Chapter 3 of Guide to understanding the Canadian Environmental Protection Act: chapter 3 - Canada.ca

that the closure activity has been successfully completed and closure objectives and criteria have been met. While the RECLAIM Model is a tool to develop closure cost estimates, the specifics for calculating work completed (i.e. progressive reclamation) for the purposes of reducing the closure cost estimate is jurisdiction specific and therefore not defined in the RECLAIM model.

4 RECLAIM 8.0

4.1 General Description

The RECLAIM Model is a tool developed in Microsoft Excel to aid in the calculation of costs associated with each activity required to meet the objectives of the site-specific Closure and Reclamation Plan. It provides line items for numerous types of reclamation activities which might be required at a given site. For each reclamation activity, the model presents the "quantity" of work multiplied by the appropriate "Unit Cost".

For example, a reclamation activity may involve using a dozer to contour overburden in a disturbed area. If the quantity of soil to be dozed is 500 m^3 and the unit cost is \$1.52/m^3, then the cost for that reclamation activity would be \$760. RECLAIM is designed to both assist the user in identifying each of the activities required by including a list of typical activities, as well as provides a range of unit costs.

RECLAIM lists many typical reclamation activities for each component. These default lists will likely cover the majority of reclamation activities required for decommissioning a given mine. The default lists do not attempt to include all possible reclamation activities as the spreadsheet would be too cumbersome. If a desired activity is missing from the default list the user may modify text within this area of the spreadsheet or insert rows within Microsoft Excel. If rows are inserted, it should be checked that these rows have been included in the total for the worksheet.

There are eleven reclamation costing worksheets used to compute the overall closure cost estimate. These include **direct costs** associated with the following mine components:

- Open pit
- Underground mine
- Tailings impoundment
- Rock pile
- Buildings and equipment
- Chemicals, hazardous materials, and contaminated soils
- Water management
- Water treatment

In addition to the reclamation activities, RECLAIM includes worksheets for estimating the closure costs for:

- Interim care and maintenance (including preparation of the Final Closure and Reclamation Plan)
- Post-closure monitoring and maintenance
- Mobilization and demobilization

Indirect cost factors such as engineering design, project management, health and safety monitoring & quality management, bonding/insurance, engagement and regulatory compliance, contingency and owner's representative are calculated as percentages of the direct costs in the Summary Worksheet.

4.2 Capital Costs

Capital costs are those directly attributable to the performance of the work and necessary for its completion. For mine reclamation projects, these are costs directly attributable to performing the work activities necessary for implementing the Closure and Reclamation Plan. Closure costs for each of the typical mine components are estimated in worksheets of the same name.

In the RECLAIM Model, capital costs are synonymous to 'direct costs'.

Most of the worksheets are self-explanatory based on the list of activities. However, the following worksheets are considered to warrant further description.

4.2.1 Chemicals, Hazardous Materials & Contaminated Soil

This worksheet is intended to itemize the costs for three aspects of this component of mine closure and reclamation:

- Inventory, collect, and contain chemicals, hazardous material and contaminated soil for treatment or transport.
- Physically gather materials from various locations around the mine site and secure for on-site treatment or for transport off-site.
- Off-site disposal fees at a certified facility.

It has been observed that even the best managed mines will have minor problems with hydrocarbon contamination associated with fuel handling and storage of waste oil, lubricants, coolants, and hydraulic fluid. In addition, many base-metal mines have soil contamination in the ore concentrate areas, especially if these are not protected from wind. It is common at older mines to encounter problems with asbestos and/or PCB's.).

Management of any of these materials must be addressed on an individual basis. This typically involves off-site disposal, though some hydrocarbon contaminated soil can be remediated on-site. Some mines produce a significant volume of hazardous waste, which may require a hazardous waste landfill to be developed on-site. This requires sophisticated design to ensure that the wastes remain encapsulated in the long-term.

4.2.2 Buildings and Equipment

This worksheet outlines the demolition costs for buildings typically found at a mine site. It is assumed that inert debris (steel, concrete, wood, glass, plastic) will be disposed of on-site in an approved location such as a waste rock pile, landfill or other approved area specifically designated to accept these types of waste materials.

RECLAIM 8.0 uses the volume space of each building to estimate the demolition costs. For example, the total footprint area of a building multiplied by its height. Unit Costs are applied per m^3. Effort for disposal and burial of demolition waste are also included in this worksheet and needed to be included in the closure cost estimate.

Users should be aware that demolition cost estimates should include:

- Requirement for decontamination in advance of demolition to provide environmental protection. Where demolitions costs are expected to form a significant component of the closure cost estimate, users are encouraged to retain qualified persons to estimate costs.
- Health and safety workplace culture.
- Expectation for recycling, which then requires more careful Demolition.

Proponents are encouraged to discuss demolition activities and requirements with the landowner(s) prior to finalizing the demolition costs, especially if decontamination is required for remediation purposes.

4.2.3 Water Management (and Short-Term Water Treatment)

This worksheet provides a list of activities associated with water management; in essence the closure activities needed to collect, control, or restore surface or groundwater flows. Capital costs of water treatment systems are calculated within this worksheet, both for conventional active water treatment systems and passive water treatment systems.

As described below, there is a line included within this worksheet for short term water treatment calculated from the worksheet “Water Treatment”.

Alternatively, short term water treatment costs may be included within a component worksheet. For example, pit flooding activities such as batch treatment are listed within the worksheet “Open Pit”; costs of detoxifying a heap leach facility are listed within the “Rock Pile” worksheet; and treatment of tailings supernatant where reagents such as cyanide or ammonia are expected to decay to non-toxic levels in a specified period of time are included in the worksheet “Tailings”.

4.2.4 Water Treatment

Water treatment is generally considered for a site to be either short-term or long-term (for example more than 20 years[9]). Examples of short-term water treatment could include: water treatment required to draw down the supernatant in a tailings storage facility pond; treatment of a sediment pond with flocculent prior to release of water; or treatment of water expected to reach acceptable quality for direct discharge within 20 years.

Long term water treatment may be required for post-closure treatment of acid mine drainage or metal leaching. A more comprehensive list of what might be considered short-term versus long-term water treatment (i.e., post-closure) is described in Table 1. It is recognized that this definition of short-term versus long-term is somewhat arbitrary, and the user is encouraged to use the worksheets as best represents the expected situation and costs.

Given that water treatment may be considered short-term or long-term, the results of this worksheet do not appear directly within the summary sheet. Rather, the "Water Treatment" worksheet is used to calculate a cost that then feeds into either the "Water Management" worksheet when costs are for short-term water treatment or the "Post-closure Monitoring and Maintenance" worksheet when costs are for long-term water treatment.

[9] Based on professional judgment.

Table 1. Examples of What Would Typically be Considered Short-Term Versus Long-Term Water Management and Treatment

		Short Term	Long term (> 20 years)
Open Pit	flood pit - install/operate pumping system	x	
	construct diversion ditches	x	
	treat 1st filling	x	
	install pump/decant system	x	
	passive/biological treatment	x	
	overflow treatment		x
Rock Pile/Heap Leach Facility	construct diversion ditches	x	
	install groundwater collection system	x	
	install toe seepage collection system	x	
	collect and treat groundwater		x
	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
	operate and maintain passive treatment system		x
	detoxify heap leach pile (cyanide destruction)	x	
Tailings Storage Facility	construct diversion ditches	x	
	pump supernatant (to pit, U/G)	x	
	treat supernatant	x	
	install toe seepage collection system	x	
	collect and treat seepage (ARD/ML)		x
	install passive treatment system	x	
	operate and maintain passive treatment system		x
U/G Mine	accelerate flooding	x	
	install seepage collection system	x	
	install dewatering/pumping system	x	
	operate seepage/dewatering system (ARD/ML)		x
Water Management	refill lakes		x
	redirect creeks/streams	x	
	stabilize water management ponds	x	
	stabilize/close sediment ponds	x	
	fresh water supply - breach embankment	x	
	fresh water supply - remove piping system	x	
	construct water treatment plant	x	
	construct sludge pond	x	
	water control in reclamation quarry	x	
	operate/maintain water treatment plant		x

4.2.5 Interim Care and Maintenance

The Interim Care and Maintenance (ICM) worksheet captures the costs incurred during the period between the cessation of mining activities and when active remediation (a construction phase analogous to the implementation of closure activities) begins. The ICM activities include:

- Maintaining the overall physical and chemical stability of the site (on-site caretaker team carrying out site maintenance and water management as required)
- Finalizing the closure and reclamation plan
- Retaining a water licence for closure
- Conducting procurement activities to retain reclamation contractors

Care and maintenance costs should include personnel, camp, fuel, equipment and supplies. Water licence and land use permit requirements for environmental and geotechnical monitoring will have to be met during this period, and have been shown to be a significant driver in overall interim care and maintenance costs.

The scenario that typically forms the basis of the ICM costs is as follows:

- Operations have ceased with as much of the site facilities mothballed as possible. For example, the number of buildings that require usage and heat is reduced to the extent possible.
- Efforts have been made to minimize site presence with costs based on the minimum number of people on-site thought to be necessary to maintain site security and environmental compliance.
- The open pit or underground mine has been allowed to flood thus reducing (though likely not eliminating) the quantity of water to manage or treat.

The duration of Interim Care and Maintenance has demonstrably been found to be at least five years for projects that return to a public government.

4.2.6 Post-Closure Activities

Post-closure monitoring and maintenance costs are estimated in the "Post-Closure" Worksheet. These should reflect the monitoring and maintenance plans and commitments identified in the Closure and Reclamation Plan, as well as the Post-Closure Monitoring and Maintenance Plan[10]. Common monitoring programs are the Surveillance Network Program (SNP), Aquatics Effects Monitoring Program (AEMP), groundwater, geotechnical, vegetation, and seepage. Other monitoring programs may be included to reflect the approved closure objectives for a particular project. If the trend for closure objectives is consistently being met, monitoring frequency is decreased at progressively fewer sampling points after closure.

[10] The LWBs' Standard Water Licence Conditions include Post-Closure Monitoring and Maintenance Plans, and it is typical for LWBs to require these for projects that require a water licence.

An important distinction regarding the calculated closure cost estimate for the post-closure monitoring and maintenance, is that it reflects the monitoring and maintenance commitments in the Closure and Reclamation Plan and not risk-based costs for potential future monitoring or maintenance events. If post-closure risk events are a concern for a closure component, the monitoring and maintenance plans should capture appropriate activities to be costed.

Post-closure maintenance is typically required for all mine sites with waste rock piles, tailings storage areas, etc. For example, spillways and diversions may require occasional clearing of debris and ice, rip rap may need to be repaired, covers over mine waste may require management of vegetation or repair of erosion.

Note that determination of future costs must include all parameters, including: site access, monitoring, labour, fuel, power and all reagents and supplies. The calculation of the Net Present Value of a future series of costs may be complicated as costs, and the frequency in which these costs are incurred, may change in future years (e.g. a reduced monitoring program with a declining frequency). In these cases, supporting worksheets and/or calculations may be required.

4.3 Indirect Costs as a Percentage of Direct Costs

Indirect costs are costs that are not directly attributable to the completion of an activity. They are typically allocated or spread across all activities on a predetermined basis (i.e., RECLAIM assigns a default percentage for the different indirect cost item).

The indirect costs in RECLAIM include those for planning and designing, and that administratively and logistically support the reclamation and closure work. They are calculated as specified percentages of the direct costs based on best professional judgement (i.e. the default indirect percentages in RECLAIM are based on best professional judgement).

4.3.1 Mobilization/Demobilization

Costs are estimated based on the assumption that a site has been abandoned after the owner becomes insolvent. Further, the assumption is made that the equipment and infrastructure has deteriorated to an advanced state of disrepair and has no material value (as has been the case for many abandoned sites in the north). Any equipment of value or that is salvageable is likely to be removed or sold to other local operators.

The closure costs will include mob/demob for equipment, supplies and workers to perform the ICM activities, active remediation (closure activities), and post closure monitoring and maintenance.

Especially in remote locations, careful consideration is given to the logistics and associated costs that are expected to contribute to high mobilization and demobilization costs.

Mobilization/Demobilization of Equipment and Supplies
It is assumed that a contractor would have to mobilize all equipment and infrastructure to the site in order to carry out the closure and reclamation work. Mobilization of fuel (including the costs of the fuel and of transporting the fuel) is assumed to be necessary for every site.

Many northern mine reclamation sites are not accessible by all-season road and require winter road or winter trail access, and/ or aircraft access, and/ or water access to mob/demob equipment and supplies. The Mobilization/Demobilization worksheet includes a "Winter Road for Mobilization" subsection with winter road construction and operation, limited winter use (winter trail), and winter road tariff as closure cost items. While the Unit Cost Table includes unit rates of mobilization for road access, sealift, and barging. Airlift mobilization is highly variable, dependant on size of equipment and materials, location and condition of airstrip, size of aircraft required, and therefore requires a user defined unit cost in the Unit Cost Table; "Other (e.g. airlift)" rate.

Some remote sites, especially in Nunavut, require mobilization by sealift to a designated port; and may then also require winter road access to the site.

Personnel Movement & Accommodation
In the case of remote sites, mobilization of workers at the beginning/end of each work rotation is included. Aircraft transport of personnel is often used for worker mob to the remote sites. Modifications to an existing camp or mobilization of a worker's camp may be required to allow for use by smaller numbers of support staff during closure and reclamation, or post-closure activities.

Ultimately, good knowledge of the mobilization and demobilization planned and actualized for the active mine operations is key in understanding the required post-mining access options and, therefore, provide more accurate reclamation costs.

4.3.2 Engineering Design

In preparing a closure cost estimate, it is typical to assume that there is an existing, CRP that can be converted to contract ready documents for closure activities. The CRP will exist in various stages of progressive design as the project advances through its lifecycle. It typically requires years to get a fully approved CRP, and applicants/licensees are encouraged to advance closure planning as early as possible.

In the RECLAIM Model, the engineering provision is for advancing the Closure and Reclamation Plan into a scope of work that can be provided to a contractor. Engineering

includes preparation of Issued For Construction (IFC) drawings and specifications for the closure and reclamation work. Additional engineering may be required while the work is being carried out to address any unexpected issues, and to provide quality assurance for the work.

Engineering costs will be scaled from 5% to 2% based on the phase of development. For example, Early (2-3%), Production (3-5%) and Post production (2-3%).

4.3.3 Project Management

Project management covers project oversight and contract administration, e.g., general project coordination, accounting and project control, general field oversight, change orders and as-built reports. Project management is assumed to be at least 8% of direct project costs.

4.3.4 Health and Safety & Quality Control

The inclusion of costs for workers health and safety program, and a quality management program are common in government contracting processes and as such are relevant to reclamation of mine sites. A provision of 1% of direct costs provides for preparation and administration of safety protocols, and the preparation and administration of the quality program.

4.3.5 Bonding/Insurance

Costs to secure performance and payment bonds and liability insurance are calculated as 3% of direct costs in RECLAIM.

4.3.6 Engagement and Regulatory Compliance

Engagement and consultation are required components of the regulatory process for applicants and holders of land use permits and water licences. For example, in the NWT, the LWB have developed an engagement and consultation policy and engagement guidelines for applicants and holders of water licences and land use permits[11]. The Policy describes expectation for communication and outreach with affected parties (including the LWB and Crown) from the initial project planning and pre-application (of permits and licences) stages through the life of the project. Engagement Record(s) and an Engagement Plan(s) are required submissions of the policy and guidelines.

Engagement activities should also consider risk communication in order to restore confidence in the mine site area so that closure objectives related to cultural use can be met. For example, these activities may include campaigns over various media (social media, radio, etc.), development of visual and graphical tools, risk communication specialists, and costs of developing risk communication plans.

[11] Further information can be found on the LWB website.

Regulatory compliance costs may include but are not limited to: transfer or renewal of authorizations e.g. submission of application, participation in technical sessions and public hearings); preparing required submissions (e.g. annual reports required by the water licence, responses to information requests); reporting (e.g. monitoring reports, reclamation completion reports); and responding to reviewer comments during public reviews.

Engagement and regulatory compliance costs during the closure planning, active closure, and post-closure phases should be included in the estimate. A provision of 3% of direct costs provides for the engagement process.

4.3.7 Contingency

A contingency is added to cover both the uncertainty in the costing estimate (i.e., variability in quantity of work, unit costs and required scope of activities) and the possibility that some aspects of the closure and reclamation activities may be more difficult to perform (design developments and changes within the scope, and variations in market and environmental condition). Contingency usually excludes[12]:

- Major scope changes;
- Extraordinary events such as major strikes and natural disasters;
- Management reserves; and
- Escalation and currency effects.

The determination of the contingency percentage is a subjective and project-specific task that relies on the judgement of the estimator. There is commonly considerable debate between proponents and regulators about the most appropriate contingency percentage. Table 2 provides some guidance.

[12] See AACE International Recommended Practice No. 10S-90 – Cost Engineering Terminology for Contingency

Table 2. Guidelines for Contingency Percentage

Estimate Type	Description	Typical CRP Phase	Contingency
Pre-feasibility, conceptual or trade-off study	Very basic engineering only and costs based upon typical unit costs (typical level of detail in Closure and Reclamation Plans)	Initial CRP/ Interim CRP (ICRP)	25 %
Feasibility or advanced conceptual	Engineering may be 10% complete and costs based upon typical unit costs	ICRP/ FCRP with substantive-level engineering design	20 %
Preliminary or budget level	Little detailed engineering and costs based upon verbal quotes	Final CRP with substantive design complete	15 %
Definitive or construction drawing phase	Engineering mostly complete, some written quotes	Final CRP with detailed design complete	10 %
Detailed or Project Control	Based upon detailed engineering "take-offs" and written quotes	Final CRP with IFT engineering complete	5 %

For mining, most Closure and Reclamation Plans and associated closure cost estimates are at the "feasibility or advanced conceptual" level until nearing the end of operations. This is due to lack of detailed engineering and uncertainty in the quantities of work. During the life of the mine, reclamation research, operational experience (possibly from other mines), data from environmental monitoring programs, and engagement with affected parties may reduce uncertainty.

A low contingency would be indicative of a comprehensive database of site specific parameters, detailed engineering, and proven closure and reclamation measures. Proven measures are those that have been shown to be effective in conditions similar to those at the mine, and the effort and cost associated with that work is well understood.

To the extent possible, if there are major areas of uncertainty in a Closure and Reclamation Plan, these should be addressed in the appropriate mine component spreadsheet (e.g. thicker cover, different slope, liner, quarry, etc.). In some cases, it may be appropriate to consider a different level of contingency for different components of the closure cost estimate.

In RECLAIM 8.0, contingencies are applied to the direct costs.

4.3.8 Owner's Representative

According to Treasury Board policy, Directive on the Management of Projects and Programmes, government projects are required to be effectively planned, implemented,

monitored and controlled, and closed to enable the realization of the expected benefits and results for Canadians[13].

These costs are calculated as 5% to 3% of direct costs in RECLAIM. The % scale is meant to correlate to the phase of mining (e.g., exploration, construction, production, closure activities and post closure monitoring).

4.4 Segregation of Costs into Land or Water Related Costs

The RECLAIM model calculates closure costs in their entirety. However, for each activity, the user can assign a percentage of each cost to either be included as a land related cost or as a water related cost. This is to assist landowners and/or proponents to segregate the closure cost estimate into land or water related costs as applicable for specific authorities/jurisdictions. Examples of each are as follows:

- An activity such as a building demolitions would be 100% land liability;
- Treating supernatant prior to discharge would be 100% water liability;
- Placing a soil cover over a rock pile could be say 50% land liability in promoting revegetation, and 50% water liability in reducing seepage loading.

4.5 Unit Cost Table

After having developed a comprehensive Closure and Reclamation Plan from which the reclamation activities have been scoped and quantified, the selection of Unit Costs to apply to each of these activities is required to derive a security estimate.

The Unit Cost table contains a list of many of the common reclamation activities that may be carried out at a particular mine site and the associated Unit Costs for each activity. The rates are based in Q2 2024[14], and the source references for development of the unit rates include:

- Published data sources:
  - Alberta General Construction Sectors Collective Agreement (for crafts)
  - RS means online data released Q2 2024 for location in Yellowknife, Northern Territory Canada
  - Richardson Cost Online Data for Construction Estimate, July 2024 Edition
  - Construction Labour Relations Alberta
  - Equipment Rental Rate Guide – 2024-2025 Blue Book – BC Road Builders and Heavy Construction Association
  - 2024 Equipment Rental Rates Guide and Member Roasters – Alberta Roadbuilders and Heavy Construction Association
  - Quebec Rental rates for Heavy Machinery 2024

[13] See https://www.tbs-sct.canada.ca/pol/doc-eng.aspx?id=32594

[14] The second quarter of 2024, April 1 to June 30

- First Principle Cost Estimating
    - Atkins Realis civil unit rate tool
- Third-party reference costs
    - Atkins Réalis recent awarded contractor for non-union indirect labour: site manager, supervisor, security/fist aid, administrative staff, registered engineer, environmental technologist
    - Atkins Réalis historical data
    - Web searches
    - Budgetary quote for HDPE pipes

For each activity in the Unit Cost Table, there is a brief description of the activity and a one to four-character acronym, called the cost code, for that activity. Additional activities, with user-defined cost codes and unit costs, may be added to the unit cost table.

Acronyms have been developed to reflect the activity it is intended to apply to. For example, if a reclamation activity such as covering a waste rock pile for re-vegetation involves the excavation of soil which is readily excavated, hauled a short distance and dumped, then the cost code SB1L would be appropriate. This acronym translates roughly as Soil, Bulk, 1 (for short haul), low. If the excavation involved careful or controlled work, such as in ditch or spillway construction, then the SC1L cost code for Soil, Controlled, 1 (for short haul), low may be more appropriate.

For each Unit Cost, a range is provided from low (L) to high (H), which is intended to capture the variability in level of effort that may be required. For the example provided above, SB1L, the suffix L in the acronym indicates that the cost for this particular activity is believed to be at the lower end of the range for soil movement. Factors such as an uphill haul, difficult excavation due to density, frozen zones or excessive boulders would require the use of the high cost suffix, H. In this way the selection of the cost code allows others to understand the assumptions of the estimator for the scope of work and intended effort. Users are encouraged to document the assumptions used to select the appropriate Unit Cost.

To provide better transparency to the RECLAIM Model on the breakdown of Unit Costs and their references, the following are appended to this manual:

- Basis of Unit Rates Development
- RECLAIM v.8.0 Price Sources, Basis and References

The price sources, basis and references are intended to allow review and consistent updates of the unit rates in future versions of the costing model.

4.5.1 Escalation

Construction escalation refers to the increase in costs (e.g. labour, equipment, materials) for a project over time. Inflation (the increase of the cost of living over time) is a

component of escalation; as are uncertain changes in technical, other economic, and market conditions.

The RECLAIM v.8.0 Unit Costs are presented as Canadian dollars in Q2 2024. The Unit Costs can be escalated in the RECLAIM model to reflect a project in a future-current year, e.g. a closure cost estimate calculated in 2027 will have 3 years of increased Unit Costs compared to 2024. A data entry cell, below the "Year for Rate Escalation", in the Unit Cost worksheet allows the user to enter the current year to calculate an escalation rate from 2024. The rate is automatically calculated based on the Canadian Consumer Price Index (CPI) for the "Select Location", either Nunavut or NWT[15].

CPI is commonly used as the cost index for calculating the rate of inflation. The RECLAIM Model uses this as the rate of escalation for the Unit Costs (labour, equipment, materials and reclamation activities). Although different cost indices exist for construction projects, including additional ones within the Statistics Canada web portal[16] (e.g. Building construction price indexes, Construction Buildings Materials Price Index) and the Engineering News-Record Cost indices[17] (Construction, Building Cost, Material Price, Skilled Labour, Common Labour), they are not accurately representative of mine reclamation projects, and census data not necessarily updated annually or publicly or appropriate for Northern Canada. The use of CPI/inflation as escalation provides a reliable metric for calculating the increase of costs for the near-term future (e.g. 3-5 years). For a more accurate determination of the increase of costs at a future time, it is recommended that the Unit Cost be updated/redeveloped. This would capture unexpected economic events, e.g. global supply chain shortage post pandemic. The Basis of Unit Rates Development will allow a consistent framework for the future updates of the Unit Costs.

4.6 Specified Costs and Estimator

In some cases, rather than selecting a Unit Cost from the Unit Cost Table provided in RECLAIM, it may be appropriate to derive a project specific Unit Cost. If a proponent is proposing a Specified Unit Cost, it should provide sufficient detail and rationale to allow others to review and assess the adequacy of these "specified" costs. All supporting calculations and documentation should be provided.

When using a specified cost, the unit cost can be inserted in the Unit Cost Table. Where these specified costs are to be in used in calculations, the suffix "S" would be used instead of "L" or "H". The specified cost can be simply inserted directly into the applicable worksheet in the Unit Cost Column.

[15] See Statistics Canada CPI

[16] See https://www150.statcan.gc.ca/n1/en/type/data?subject_levels=18#tables

[17] The Engineering News-Record is a reputable reference for Construction Cost Indexes in North America; however, those cost are based on cities in the United States and are not necessarily reflective of prices changes in Northern Canada.

Specified costs are typically derived from one of the following three methods, which are further described below:

- Quotes from qualified 3rd party contractors,
- Information provided by equipment suppliers, or
- First principle cost estimating.

Quotes From Contractors

It is important to be very clear in obtaining costs from qualified contractors. The contractor's cost should include direct cost, fuel (consumption and mobilization unless mobilization is included elsewhere), tires, maintenance, support equipment, and an operator's hourly rate. Ideally, the contractor should have knowledge of local conditions and how they may vary with seasons. The more information the contractor has regarding the scope of work and conditions, the more reliable the cost estimate to carry out the work will be.

Equipment Suppliers

Unit Cost data can be obtained from equipment suppliers. However, caution is warranted as a supplier is likely to provide only peak or optimal performance data. In all cases, adjustments will be required to reflect local cost factors such as labour rate and availability, or specific job site factors which affect productivity (cycle-times) such as weather and daylight hours.

First Principle Cost Estimating

First principle cost estimating means evaluating equipment productivity in terms of hourly production divided by hourly cost of operation. Productivity evaluation is a series of adjustments or corrections to the peak or optimal productivity rate for a given piece of equipment. For example, adjustment factors for an excavator would involve difficultly in digging (type and hardness of material), job geometry (side-hill or full bench), finish condition (ditch versus quarry operation), operator skill (fair, good, excellent), working time per hour and other appropriate site factors. The "Estimator" worksheet provides examples for productivity adjustments based on the Caterpillar Performance Handbook Edition 42. Another source of unit cost data is the RS Means Heavy Construction Costs.

4.7 Summary Sheet

The summary sheet presents the subtotals of capital and indirect costs to derive the total closure cost estimate.

The RECLAIM model calculates closure costs in their entirety. However, for each activity, the user can assign a percentage of each cost to either be included as a land related cost or as a water related cost. It is within the summary sheet that the percentage of indirect costs that are to be assigned to "land liability" and "water liability" are calculated for determining the appropriate security when required for the jurisdiction, i.e., NWT. These

percentages correspond directly to the percentage of direct costs that make up the total direct costs. The RECLAIM Model applies these direct cost percentages to indirect costs. For example, if direct costs are calculated as being 20% land and 80% water, then the same percentages are applied to indirect costs.

5 Using RECLAIM v.8.0

Upon opening RECLAIM 8.0, depending on the user's computer security settings, the user may receive a SECURITY WARNING "macros have been disabled". Select the "Enable this content" within the options menu. A pop-up box will request the Project Name. Typically, this is the mine name, which will be inserted at the top right of each worksheet. The program will then initialize, which should only take a few seconds.

The program opens to the instructions sheet, which is an overview description of the program and details of program limitations. There are some requirements that must be met for the program to work. The following instructions should be reviewed prior to modifying the worksheets:

- The names of the worksheets must not be changed.
- Certain cells have defined names, which must not be changed. Where the cell is named, the name will appear in the name box.
- The first line of data for any component worksheet starts on line 4. Do not change the first line of a component worksheet.
- Cell A1 of the component sheet must always contain the "count" of that component for the duplicate function to work.
- The user can add lines to component activities and the unit cost table. However, the user should check that the new unit cost does not fall outside the named ranges. You can check the size of the named range by selecting the name from the drop-down box at the top left of the sheet. For example, in Version 7.0 the unit costs range is to line 172 of the unit cost worksheet.
- A component will only be printed if its sub-total is greater than zero. In addition, a component and the summary sheet cannot be printed if there is an error. Printing has been set to print 1 page per worksheet.

5.1 Completing Worksheets

Complete each of the individual worksheets by selecting the type of activity required, estimating the quantity (e.g., volume, area, length etc.) in column E and assigning an appropriate unit cost code in column F.

Activity items can be added to component worksheets, either by changing the activity/material description in column B, adding the activity where the line item is purposely left as "other" or inserting a line and copying the content from an adjacent line.

As described in Section 4.4, activities are typically assigned a percentage as "land liability" which will be used to set land security and the remaining percentage as "water liability" which will be used to set water security.

5.2 Menu Descriptions

Functions specific to the Reclaim Model program are displayed in the tab “Add Ins” on the Excel menu bar. If this menu tab is not displayed, the functions are also found within the sheet titled “Tools”. A summary of the functions is provided in the Instructions worksheet and are described below:

Clear
This function deletes all input data, deletes any duplicated elements and blanks out the project name.

Another function within this menu is to hide or display segregation columns within the worksheets that ascribe the costs to either ‘water’ or ‘land’ liability.

Note the Clear function does not affect the Unit Cost Table.

Duplicate
This function duplicates components of the project. For example, if there is more than one Open Pit, complete the activities and quantities for one Open Pit then use duplicate to add a second Open Pit. Quantities for the new Open Pit are erased, but the Activities and Cost Codes are carried over from the original Open Pit. The new Open Pit subtotal is added to the Summary page. The duplicate function can be applied for the following worksheets: open pit, underground mine, tailings impoundment, rock piles, buildings and infrastructure, and estimator.

Unit Costs
By selecting the show/hide function within Unit Costs a window of Unit Costs is displayed to the right of the open worksheet to allow the user to view the table of Unit Costs for ease of reference. The Unit Cost table has a filter in the 'UNITS' column. You can select to only see a particular unit (e.g. km) or multiple units (km and m^3) or all units.

By selecting the inflate function, Unit Costs can be increased by a percentage to account for inflation from the date the Unit Costs were last updated (RECLAIM v.8.0 was updated in Q2 2024).

6 References

Association for the Advancement of Cost Engineering International (AACE), (2019). AACE International Recommended Practice 10S-90, *Cost Engineering Terminology*. https://web.aacei.org/docs/default-source/rps/10s-90.pdf

Department of Indian Affairs and Northern Development (DIAND), (2002a). *Mine Site Reclamation Policy for the Northwest Territories.* https://www.gov.nt.ca/ecc/sites/ecc/files/resources/mine_site_reclamation_policy_-_nwt.pdf

Department of Indian Affairs and Northern Development (DIAND), (2002b). *Mine Site Reclamation Policy for Nunavut.* https://www.rcaanc-cirnac.gc.ca/eng/1100100036042/1547658056831

Land and Water Boards of the Mackenzie Valley (LWB), (2023). *Engagement and Consultation Policy.* https://mvlwb.com/media/1835/download?inline

Land and Water Boards of the Mackenzie Valley (LWB), (2018). *Engagement Guidelines for Applicants and Holders of Water Licences and Land Use Permits.* https://mvlwb.com/media/814/download?inline

LWB/AANDC, (2013). *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories Mines.* https://mvlwb.com/media/873/download?inline

LWB/GNWT/CIRNAC, (2022). *Guidelines for Closure and Reclamation Cost Estimates for Mines.* https://mvlwb.com/sites/default/files/2022-01/LWB%20GNWT%20CIRNAC%20Guidelines%20for%20Closure%20and%20Reclamation%20Cost%20Estimates%20for%20Mines%20-%20FINAL%20-%20Jan%2019_22.pdf