Quartz Exploration and Placer Financial Security Calculator

User Guide

May 2026

Acknowledgements

The Government of Yukon engaged EDI Environmental Dynamics Incorporated (EDI) to develop a tool to estimate financial security required for authorizations issued under the *Quartz Mining Land Use Regulations* and *Placer Mining Land Use Regulations.* This tool was intended to capture the potential liabilities associated with the exploration and placer mining in the Yukon and the costs to reclaim project features.

EDI developed an excel-based security calculator that is available for use on Yukon.ca/mining. This user guide provides supporting information on how to use that calculator and is adapted from work undertaken by EDI Environmental Dynamics Inc.

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1.0 INTRODUCTION

The *Quartz Mining Act* and *Placer Mining Act* gives the Chief of Mining Land Use and Chief of Placer Land Use the authority to determine if financial security is required for exploration and placer projects. The value of the security is based upon the costs of the abandonment of a project, restoration of the site of the project, and any measures required to be taken or continued if a project is abandoned.

More information on the process used to determine, collect, maintain, use and return security are available on Yukon.ca[1].

1.1 PURPOSE

The security calculator and user guide were created to:

- provide a fair, transparent, and consistent means of assessing reclamation liabilities for exploration and placer projects in Yukon;
- avoid financial risk and liability to the public/government by ensuring the assessed security represents the cost of reclamation to the Government;
- encourage dialogue between proponent and the department, with the aim of limiting unnecessary disturbance and prompting progressive reclamation; and
- promote transparency in bonding levels and methodology to Indigenous nations and the public.

Companies applying for authorization under the Quartz and Placer Acts are encouraged to review these tools to become familiar with the various elements required for reclamation. Providing detailed information on the proposed project and progressive reclamation activities will assist determination of the appropriate bond amount.

1.2 SCOPE

This security calculator applies to Class 1, 2, 3 and 4 quartz exploration projects and Class 1, 2 and 3 placer projects. The Government of Yukon will notify companies if security will be required for their operation.

Financial security for Class 4 placer projects is determined by the Yukon Water Board, though the Government of Yukon will use this calculator if security is requested by the board.

1.3 DEVIATION FROM CALCULATOR

When determining final financial security requirements for an authorization, the Government of Yukon may include additional costs to:

- account for inflation as the unit rates used in the calculator date back to 2018;
- include an increased contingency based upon the complexity of a project; and
- project specific considerations that are not captured within the standard calculator (e.g. historic disturbance, water treatment).

In addition to these items, the Government of Yukon may require that a third-party audit be conducted on financial security requirements if a site is particularly complex, includes features that require non-standard reclamation techniques, historic liabilities being assumed by a new operator, or other items that cannot be addressed using the standard calculator.

2.0 BREAKDOWN OF LINE ITEMS

A breakdown of line items, as provided by EDI to the Government of Yukon in 2019, is provided below to guide proponents on how to use the financial security calculator.

APPENDIX B. BREAKDOWN OF LINE ITEM ACTIVITIES

ESSENTIAL FIELDS

(1) PROJECT FEATURES & DIMENSIONS

Compiling data fields within this section is essential to calculating the cost of reclamation; these headings address project features and dimensions. Line items and open-input cells that are highlighted green must be populated to auto-compile other derived portions of the calculator.

1.1. TRAVEL/DISTANCES

a) To/From (Ground)

- Input one-way distance (km) to site from the nearest services station

b) To/From (Air/Heli)

- Input one-way distance (km) to site from the nearest services station

1.2. PROJECT FEATURES

a) Access Roads:

1- Input known 'New Cut' footprint
2- Input known 'Partial New Cut' footprint

b) Clearings:

1- Input known 'New Cut' footprint
2- Input known 'Partial New Cut' footprint

c) Project Components:

1- Input known 'New Cut' footprint
2- Input known 'Partial New Cut' footprint

Note: These items will auto-populate estimates within 2.2 General Reclamation Earthworks, 3 Personnel (Basic Disbursements).

1.3. RECLAMATION STANDARD/EXPECTATIONS

Not all project features will require the same reclamation effort. A key step in the Calculation Sheet involves determining the expected reclamation standard, referring to:

1. Decommission – Lite recontouring/roll back and installation of erosion control (if/where necessary)
2. Partial Reclamation – Partial recontouring/roll back and installation of erosion control, and
3. Full Reclamation – Comprehensive recontouring/roll back.

The user must input a ratio (/100%) of the reclamation standard for each project feature; these values will affect the cost of reclamation that is auto-compiled elsewhere in the Calculation Sheet. The standard of reclamation and subsequent scope of effort can then be adjusted based on reclamation requirements.

(2) GENERAL RECLAMATION ACTIVITIES

2.1 MOBILIZATION/DEMOBILIZATION

This section addresses the estimated cost of transport to mobilize/demobilize reclamation equipment. Cost is based on median rates from the 2018 Third Party Equipment Rentals Guide (unless noted otherwise). Portions of this section heading are auto-populated from Section 1 Project Features & Dimensions. The following conditions and assumptions may apply:

a) Ground-Travel

- Input # Round-Trips
- Mob/demobilization applies to and should be accounted for each unit of equipment expected to be transported to/from site. For example: if one excavator, one dozer, and one rock truck are anticipated, then three lowbed trips to site are required:

  1- Lowbed – Input 1 (=Yes) or 0 (=No); Estimated at $220/h
  2- Pilot Car – Input 1 (=Yes) or 0 (=No); Estimated at $100/h
  3- Other Support Car – Input 1 (=Yes) or 0 (=No); Estimated at $100/h
  4- Specialized Transport – Requires project-specific cost-estimate; Input quoted value.

b) Heli-Travel

- Input # Round-Trips

  1- Heli-Transfers – Input 1 (=Yes) or 0 (=No); Estimated at $2100/h

c) Air Travel

- Input quoted value.

Note: Travel time should be based on distance from anticipated service community. Estimated travel time may require a lower rate of speed for off-highway travel. For example, 90 km/hr for highway travel, 60 km/hr for Forest Service Roads and 40 km/hr for access roads. Length of time can be adjusted based on known road conditions. Total time should also include effort to load/unload equipment (suggest adding 2 hrs per load). Depending on the duration of the project, machinery may remain on-site over many days/weeks. Lowbed operators may choose to drive to site to drop off the equipment, return empty and coordinated equipment recovery at a later time. This will affect the total number of round trips; assumptions should then be documented.

Pilot cars are required for oversized loads on public roads. A permit is required to move over-sized loads on public highway – this will likely require development of a Transportation Management Plan.

2.2 GENERAL RECLAMATION EARTHWORKS

Calculations in this section have been inferred based on details populated in Section 1 – Project Features and Dimensions (including project features and reclamation standards and expectations for these features), median rates from the 2018 Third Party Equipment Rentals Guide and cost rates/efforts (described both below and section 5- Supplemental Earthworks, Surface Preparation, Water Courses & Revegetation.

Surface Recontouring refers to necessary earthworks required to recontour disturbed landscapes to a condition that is safe/stable and consistent with predominant surface expression and drainage patterns.

- Assumes use of one (1) medium-sized dozer at $200/hr with a productivity of 300 m^3/hr which is (conservatively) up to 3.5 days (35 h) to address 1 ha at an average depth of 1m earthworks. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $7,000/ha.

Topsoil Placement & Final Surface Preparations refer to replacement/redistribution of topsoil stockpiled prior to development/construction; depending on project design and location of the stockpile, the material may or may not have to be transported, resulting in additional handling, equipment, time and cost.

- Assume use of one (1) medium-sized dozer or grader at $200/hr with a productivity of 300 m3/hr which is (conservatively) up to 1 day (24 h) to address 1 ha at a minimum depth of 0.1 m earthworks with finishing surface preparations. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $1,500/ha to 2,000/ha.

Section 1.3 Reclamation Standard/Expectation describes three general standards of reclamation: decommission, partial reclamation and full reclamation. The user can apply discretion when determining the level/standard of reclamation to be applied to project features, and thereby adjust cost/effort of reclamation to project circumstances. Here, the total (i.e., combined surface recontouring, topsoil placement and final surface preparations) cost/effort for full reclamation is $8,500/ha (this includes minor travel and surface preparations). It is assumed that surface recontouring, topsoil placement and final surface preparations can (and likely will) occur simultaneously. Therefore, both cost and logistical efficiencies have been applied to these reclamation activities. The cost/effort for partial reclamation and decommission was inferred as a matrix ratio, as follows:

	Full Reclamation	Partial Reclamation	Decommission (Lite Reclamation)
Effort (v. Full Reclamation)	1:1	1:2	1:10
Relative Cost	$8,500/ha	$4,250/ha	$850/ha

(3) PERSONNEL (BASIC DISBURSEMENTS)

Calculations in this section have been inferred based on details populated in section 1- Project Features and Dimensions and the time/effort to address the given standard of reclamation.

3.1 PROJECT AREA

This section is auto-populated based on Section 2.2 General Reclamation Earthworks. Here, the total (i.e., combined surface recontouring, topsoil placement and final surface preparations) cost/effort for full reclamation is 60h/ha or 5 days/ha (35 h/ha surface recontouring + 24 h/ha topsoil placement and final surface preparations). The time/effort for partial reclamation and decommission was inferred as a matrix ratio, as follows:

	Full Reclamation	Partial Reclamation	Decommission (Lite Reclamation)
Effort (v. Full Reclamation)	1:1	1:2	1:10
Relative Time/Effort	60 h/ha	30 h/ha	6 h
	5 days/ha	2.5 days/ha	0.5 days /ha

3.2 PERSONNEL DISBURSEMENTS

This section is auto-populated based on section 3.1 Project Area.

- Assumes # reclamation personnel days x $200/day for accommodations and subsistence.

Note: Personnel Disbursements can/will vary depending location and proponents. The rate of $200/day for accommodations and subsistence is a common industry standard. This value can be modified as/when required.

OPTIONAL FIELDS

(4) ASSET REMOVAL & SPECIFIC RECLAMATION FEATURES

4.1. GROUND-BASED ASSET & DEBRIS REMOVAL

This section addresses the estimated cost/effort to handle and remove remnant assets, scrap or debris left on-site. Legacy debris can be common in cases of abandonment or where the property has changed owners. Cost is based on median rates from the 2018 Third Party Equipment Rentals Guide (unless noted otherwise). The following conditions and assumptions may apply:

a) Equipment Removal

- Applicable to the time/effort to remove equipment such as excavators, crawler tractors, drill rigs, wash plants, conveyors, and crushers to be transported from the site to the nearest storage area (preferably at a secure location/compound) or delivered to scrap yards or auction centres depending on circumstances and condition of the equipment.
- Assume one (1) lowbed per piece of equipment to be removed; include total round-trip hours at $220/hr.

Note: Apply discretion. In the case of site abandonment, assume that proponents will likely mobilize newer and/or higher valued equipment off-site; older/legacy equipment are more likely to be left on-site. All assumptions should be documented.

b) Shipping Containers

- Applicable to the use of shipping containers to remove scrap or debris; containers can be loaded and transported using specialized trailer beds or flatbed trailers.
- Assume one (1) lowbed per shipping container; include total round-trip hours at $220/hr.

c) Scrap/Garbage Removal (Miscellaneous)

- Applicable to the use of a dump truck (8 m^3) at $150/hr to remove scrap or debris.
- Assume one (1) dumb truck x total number of loads necessary for waste disposal.

d) Camp (Tent/Camper Trailer)

- Applicable to wall tents and/or camper/trailer-style camps typically associated with small operations. Camp removal cost will be site-specific and dependant on type and size.
- Removal based on the use of a 1-ton truck to remove materials/trailer; if multiple camper trailers, the user should consider the time required to mobilize each trailer to a suitable destination.

Note: Condition of camps will determine whether the camp can/should be dismantled or disposed of as scrap.

e) Removal Crew

- Applicable to the necessity for a two-person team ($100/hr/team) to complete site clean-up, handle and remove debris and/or remnant equipment on-site.
- Consider total effort on-site in terms of 10 hr/day work days); for reference, assume 5 hr (½ day) to dismantle one (1) camp/feature.

f) Explosives Disposal

- Requires project-specific cost-estimate; enter quoted value.

Note: Permission/approval is likely required for disposal at a landfill.

g) Camp (Atco Trailer/Bunk House)

- Applicable to Atco trailer-style modular camp, and includes line items for dismantling, trucking, and pilot cars:

  1- Preparation for transport (per trailer) estimates two-person team (10 hr/day at $100/hr/team) to disconnect amenities and prepare the trailer for transport (e.g., blocking if required). Preparation time will be affected by trailer disposition.

  2- Assume one (1) lowbed per shipping container; Include total round-trip hours at $220/hr;

  3- Assume one (1) pilot car per trailer transport on public highways; include total round-trip hours at $100/hr.

h) Equipment Cleanup Activities

- Applicable to the use of heavy equipment for clean-up and removal of debris.

  1- Use of excavator at $250/hr.

  2- Use of dozer at $200/hr.

i) Disposal

- Applicable to disposal fees; the weight and associated fees for disposal may not be easily estimated at the project's permitting stage:

  1- General waste disposal tipping fee estimated at $200/ton; tipping fees will vary depending on landfill and location. Consider removal in terms of loads per 1-ton truck.

  2- Camper trailer disposal estimated at $460/trailer (2.3-ton trailer at $200/ton).

  3- Modular trailer disposal estimated at $4,800/trailer (24-ton trailer at $200/ton).

4.2. FUEL/HYDROCARBON REMOVAL

This section addresses the estimated cost/effort to handle and remove common fuels and other hydrocarbons. Cost is based on median rates from the 2018 Third Party Equipment Rentals Guide (unless noted otherwise). The following conditions and assumptions may apply:

a) Fuel Drum/Tidy Tank/Lubricant Storage

- Applicable to the removal of fuel drums and other portable fuel containers.
- Assume the use of one (1) 5-ton truck at $100/hr; include total round-trip hours to/from site to a disposal facility, and travel limitations on public highways as described in 2.1.
- Assume ten (10) drums or similarly sized fuel containers per 5-ton truck. For reference, the volume of a 45-gallon drum is approximately 205 litres.

b) Large Fuel Tank Storage

- Applicable to the removal of large-sized steel tanks >900 L.
- Assume one (1) transport truck/trailer per large tank at $220/h; include total round-trip hours to/from site to a disposal facility, and travel limitations on public highways (as described in (1-a)

c) Soil Remediation

- Requirement may not be easily estimated at the project's permitting stage. It is recommended that a project-specific cost-estimate be solicited.

4.3. RECLAMATION OF GROUND-BASED EXPLORATION ACTIVITIES

This section addresses the estimated cost/effort to reclaim exploration features. Cost is based on median rates from the 2018 Third Party Equipment Rentals Guide (unless noted otherwise) and/or determined in consultation with relevant service providers. The following conditions and assumptions may apply:

a) Drill Site Reclamation

- Reclamation of drill site/pads for ground-based activities ($/ha) includes backfilling sumps, removal of debris, landscape recontouring, topsoil replacement, and revegetation.
- Cost of reclamation is $1,500/ha based on estimates from MEMPR (2003); a minimum $500 fee should be applied for smaller sites.
- Disturbance footprint can be populated as total area (ha) if known or inferred using dimensions (width x length); the total disturbance area should be estimated when considering multiple drill sites.

b) Large Gravel Pads

- Removal and reclamation of large gravel pads is based on volume (m^3) and includes basic earthworks (no revegetation). Reclamation area inferred using dimensions (width x length x depth); the total combined disturbance footprint should be considered when considering multiple gravel pads.

- Assume one (1) medium sized excavator at $250/hr with a production rate of 150 m^3/hr; also assume one (1) off-road dump truck (17 m^3 load capacity) at $300/hr with a production rate of two (2) loads per hour; a minimum $500 fee should be applied for smaller sites.

c) Trench

- Reclamation of trenches is based on volume (m^3) and includes basic earthworks (no revegetation). Reclamation area inferred using dimensions (width x length x depth); the total combined disturbance footprint should be considered when considering multiple trenches.

- Assume one (1) medium-sized excavator at $250/hr with a production rate of 150 m^3/hr and finishing; A minimum $500 fee should be applied for smaller sites.

d) Sealing Exploration Drill Holes (# Holes)

- Average/estimated cost solicited from service provider at $4,000/hole.

Note: Ground-water monitoring may be necessary depending on applicable regulatory requirements.

e) Sealing Exploration Drill Holes (Total Depth of Holes)

- Average/estimated cost solicited from service provider at $25/m.

Note: Ground-water monitoring may be necessary depending on applicable regulatory requirements.

f) Sealing Openings/Adits

- Requirement may not be easily estimated at the project's permitting stage. It is recommended that a project-specific cost-estimate be solicited.

g) Waste Dumps

- Requirement may not be easily estimated at the project's permitting stage – especially if there is potential for acid and metalliferous drainage. It is recommended that a project-specific cost-estimate be solicited.

4.4. RECLAMATION OF HELICOPTER-BASED EXPLORATION ACTIVITIES

This section addresses the estimated cost/effort to reclaim helicopter-based exploration activities. Estimates were solicited in consultation with helicopter service provider. Base rates can/should be refined depending on location. The following conditions and assumptions may apply:

a) Helicopter Staging

- For helicopter-based programs, a safe staging area is required for materials and crew. Helicopter costs for exploration activities are separated into two line-items: (1) distance to staging area and (2) distance from staging area to site.

- Assume use of one (1) Astar helicopter at $2,100/hr (all inclusive); average cruising speed is 212 km/h; an additional $10/km applied for each km >212 km.

    1- Determine one-way distance from nearest helicopter base to staging area (km).

    2- Determine one-way distance from staging area to site (km); total round-trip km's will be calculated (internally) and applied to subsequent fields.

b) Crew Staging

- Assume cost of crew staging and subsistence.

    1- Determine round-trip vehicle mileage from nearest service location to staging area or to helicopter base (km).

    2- Determine total meals and accommodation (inclusive) for hotel/trailer camp ($200/day per person); account for two-person crew.

    3- Determine total meals and accommodation (inclusive) for tent camp ($50/day per person); account for two-person crew.

c) Helipad Removal

- Assume 2-person crew at $1000/day per crew (10 hr/day x 2 personnel x $50/hr/person):

    1- Apply ½ day for two-person crew to disassemble one (1) helipad ($500/site)

    2- Apply 3-4 h to cache timbers ($350/site); Apply 1-2 h to burn small debris ($100/site)

d) Drill pads

- Assume 2-person crew at $1000/day per crew (10 hr/day x 2 personnel x $50/hr/person)

    1- Apply ½ day for two-person crew to disassemble small structures (min. $500/site)

    2- Apply 1 day for two-person crew to disassemble large structures (min. $500/site)

    3- Apply cost from (4.3-d) Sealing exploration hole (min. $4,000/hole)

    4- Apply 3-4 h to cache timbers for small structures ($350/site)

    5- Apply 7-10 h to cache timbers for large structures ($850/site)

    6- Apply 1-2 h to burn small debris ($100/site)

    7- Apply 3-4 h for removal of non-wooden debris ($350/site)

e) Fuel Barrels

- Assume time/distance to remove fuel barrels from site to off-site location; volumes described in (4.2-a) Fuel/Hydrocarbon Removal:

    1- Full barrels – Consider 2 barrels per load ($1,750/barrel).

    2- Empty barrels – Consider 10 barrels per load ($350/barrel).

f) Camp Disassembly/Removal

- Assume 2-person crew at $1000/day per crew (10 hr/day x 2 personnel x $50/hr/person) to remove exploration camps on-site (includes disassembly, removal of non-wood parts, and burning of wooden debris).

    1- Apply 2-3 h per tent pad ($250/pad).

    2- Apply ½ day to disassemble structures ($500/structure).

    3- Apply ½ day to dispose of buildings and associated debris ($500/structure).

(5) SUPPLEMENTAL EARTHWORKS & RECLAMATION ACTIVITIES

5.1. GENERAL RECLAMATION EARTHWORKS

This section addresses the estimated cost/effort for reclamation earthworks that apply similarly to advance exploration hard rock (quartz) mining and placer mining activities and/or features. Cost is based on median rates from the 2018 Third Party Equipment Rentals Guide (unless noted otherwise) and/or determined in consultation with relevant service provider. The following conditions and assumptions may apply:

a) Surface Recontouring

- Applicable to necessary earthworks required to recontour disturbed landscapes to a condition that is safe/stable and consistent with predominant surface expression and drainage patterns.
- Assume use of one (1) medium-sized dozer at $200/hr with a productivity of 300 m^3/hr which is (conservatively) up to 3.5 days (35 h) to address 1 ha at an average depth of 1m earthworks.
- Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $7,000/ha.

b) Topsoil Placement

- Applicable to replacement/redistribution of topsoil stockpiled prior to development/construction; depending on project design and location of the stockpile, the material may or may not have to be transported, resulting in additional handling, equipment, time and cost.
- Assume use of one (1) medium-sized dozer at $200/hr with a productivity of 300 m3/hr which is (conservatively) up to 1 day (24 h) to address 1 ha at a minimum depth of 0.1 m earthworks with finishing surface preparations. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $2,000/ha.

Note: Includes minor travel and finishing surface recontouring.

5.2. SURFACE PREPARATION

a) Dozer-Ripper (Subsoil Decompaction)

- Applicable to subsoil decompaction and ripping to facilitate water infiltration and root proliferation.
- Assume use of one (1) medium-sized dozer at $200/hr equipped with a standard ripper or para-tilling attachment at $50/hr with a combined production capacity of 0.607 ha/hr. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $400/ha.

b) Tractor (Harrowing/Surface Preparation)

- Applicable to harrowing in preparation for seeding and typically applied along relatively flat terrain with smooth surfaces.
- Assume use of one (1) medium sized tractor at $150/hr equipped with a standard harrowing attachment at $50/hr with a combined production capacity of 0.607 ha/hr. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $320/ha.

Note. This approach is not likely to be used on exploration project or projects in remote locations with steep and/or variable terrain.

c) Excavator (Rough and Loose Surface Preparation)

- Applicable to "rough and loose" surface treatment to provide erosion control (in the absence of vegetation cover) and facilitate creation of microsites for seed establishment and cover development.
- Assume use of one (1) medium-sized excavator at $250/hr with a production capacity of 0.25 ha/hr. Disturbance footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $800/ha.

5.3. SUPPLEMENTAL TOPSOIL

- Applicable to the import of supplemental topsoil for capping surfaces. Topsoil sources may vary; distance to soil provider should be taken into consideration.

Note: If topsoil is stripped and stockpiled appropriately (i.e., taking into consideration soil handling and conservation best management practices), there should not be a need for the addition of supplemental topsoil. In the case of poor topsoil management or legacy soil handling practices, supplemental topsoil may be required to improve reclamation success.

1- Topsoil Volume: Apply rate of $15/$m^3$ for small topsoil volumes.

2- Topsoil Area: Apply inferred rate of $30,000/ha for large topsoil volumes based on average cost for distribution of 0.3 m topsoil per hectare.

3- Travel: Depending on the estimated topsoil volume, assume use of one (1) dump truck (17m^3) at $200/hr; include total round-trip from source provider to site. It is recommended that a project-specific quote be solicited for transportation of larger volumes of topsoil.

5.4. STREAM CROSSING & STREAM RESTORATION

Reclamation costs are sourced from the Northern Interior Forest Region Detailed Engineered Cost Estimate Procedures (2016). The Best Management Practices for Works Affecting Water in Yukon (YG-Water Board 2011) was consulted for necessary in-stream activities. The following conditions and assumptions may apply:

a) Bridges (Removal & Transport)

- Costs are categorized by bridge size. Reclamation time/effort includes removal of bridge structures and transportation to a nearby/near-site storage area. If travel >20 km, mob/demob and removal costs should be included, as referred in (2-1) Equipment Removal.

    1- Width 6-9m: $2,500 x # bridges

    2- Width 9m-12m: $2,750 x # bridges

    3- Width 12m-15m: $3,500 x # bridges

    4- Width 15m-18m: $6,000 x # bridges

    5- Width 18m-21m: $7,500 x # bridges

    6- Width 21m-24m: $8,500 x # bridges

b) Stream Culvert Removal

- Applicable to stream culvert removal and site reclamation; includes site isolation, excavation of the road surface, reconstruction of the streambed (using clean gravel/cobble materials) and installation of appropriate erosion control measures.

    1- Non-Fish Bearing Stream: $5,000 x # culverts (quoted)

    2- Fish Bearing Stream: $10,000 x # culverts (quoted)

Note: Fish bearing streams will likely also require environmental permitting, an environmental management plan, fish salvage, and associated professional fees; refer to (9-c) Stream Restoration for details. These additional costs should be solicited on a project-specific basis.

c) Stream Restoration

- Applicable to stream channel restoration that may be required depending on the disturbance; reclamation activities include relevant permitting, fish salvage (personnel and equipment), site isolation, environmental monitoring, riparian planting, and erosion and sediment control.

- Inclusive cost based on known time/effort for past restoration projects (EDI Internal) at $1,000/m linear length of stream channel (width <6 m) to be restored.

- Cost is based on linear metre of stream channel and is intended for small to mid-sized streams (channel width <6 m). It is recommended that a project-specific quote be solicited for stream restoration.

5.5. REVEGETATION – SEEDING

After reclamation earthworks and surface recontouring, exposed soils should be seeded as soon as practicable to help stabilize surface soils – unless the areas are reasonably expected to recover through natural regeneration. The seed mixture should be consistent with the desired land use. Locally sourced native species are preferred; but short-lived or annual cover crop species can be used to facilitate a preliminary cover conducive to erosion and sediment control. For reference, the Yukon Mine Site Reclamation and Closure Policy (YG-EMR 2006), the Yukon Revegetation Manual (YG-EMR-2013b), and the Soil Rehabilitation Guidebook (MOF 1997) provides relevant resources and revegetation techniques.

Reclamation costs were sourced from goods and service providers; however, seed source availability and unit/rate values are likely to vary depending on location and time of year. Productivity rates (hand-broadcasting, ATV mount and aerial dispersal) from NEIPC (2010) are provided. The following conditions and assumptions may apply:

a) Hand Broadcast Seeding & Fertilization

- Applicable to hand-cast or handheld cyclone seeder and fertilizer dispersal; commonly used and beneficial for localized features having steep and/or uneven surfaces. The combined cost is for simultaneous seed and fertilizer application

    1- Seed: Calculation includes materials cost at $25/kg and application cost for one (1) person to hand-broadcast at $40/hr production rate of 1 ha/day during a 10 hr/day (quoted).

    2- Fertilizer: Calculation includes materials cost at $300/kg and application cost for one (1) person to hand-broadcast at $40/hr production rate of 1 ha/day during a 10 hr/day (quoted).

b) ATV Broadcast Seeding & Fertilization

- Applicable to broadcast cyclone seeder and fertilizer dispersal mounted to an ATV; commonly used and beneficial for large areas or linear disturbances. The combined cost is for simultaneous seed and fertilizer application.

    1- Seed: Calculation includes materials cost at $25/kg and application cost for one (1) person to broadcast at $40/hr production rate of 5 ha/day during a 10 hr/day (quoted).

    2- Fertilizer: Calculation includes materials cost at $300/kg and application cost for one (1) person to broadcast at $40/hr production rate of 5 ha/day during a 10 hr/day (quoted).

c) Aerial Broadcast Seeding & Fertilization

- Applicable to dispersal via aerial seeding and fertilization (e.g., airplane, helicopter or drone); beneficial for large areas in remote access locations. The combined cost is for simultaneous seed and fertilizer application.

    1- Seed: Calculation includes materials cost at $25/kg and application cost for helicopter at $2,100/hr production rate of 1 ha/hr (inferred).

    2- Fertilizer: Calculation includes materials cost at $300/kg and application cost for helicopter at $2,100/hr production rate of 1 ha/hr (inferred).

Note: Additional aircraft fees may apply. Request quote as part of additional 'stand-by' heli-based activities.

5.6. REVEGETATION – PLANTING

In addition to seeding, planting may be required to re-establish vegetation as per the desired end-land use and performance requirements. Here, planting refers to the use of rooted tube-stock to integrate trees, shrubs or forbs into the reclaimed landscape. Species should be sourced locally and selected in consultation with qualified vegetation/forestry specialists. For reference, the Yukon Mine Site Reclamation and Closure Policy (YG-EMR 2006), the Yukon Revegetation Manual (YG-EMR-2013b), and the Soil Rehabilitation Guidebook (MOF 1997) provides relevant resources and revegetation techniques.

Reclamation costs were sourced from goods and service providers; however, tube-stock source availability and unit/rate values are likely to vary depending on location and time-of-year. Productivity rates are from NEIPC (2010). The following conditions and assumptions may apply:

a) Seedlings & Tube-Stock Planting

- Assume a material cost of $0.5 x # seedlings and planting cost of $1 x # seedlings at an application rate of 1,500 units per ha

b) Fertilizer (Tea-Bag Dispersal)

- Assume a material cost of $0.07 x # tea-bags and installation cost of $0.2 x # tea-bags at an application rate of 1,500 units per ha

Note: Fertilizer application may only be necessary for nutrient poor sites.

5.7. ADDITIONAL REVEGETATION ACTIVITIES

Additional time and/or cost intensive revegetation activities may be required (beside seeding and planting) where landscape features must be stabilized as soon as possible – namely hydroseeding and live-staking.

- Hydroseeding refers to the process spraying a slurry of seed, mulch and tackifier onto exposed surfaces. The slurry provides conditions that facilitate rapid germination, insulation from environmental conditions, and protection from erosion. Hydroseeding is typically used to stabilize steep slopes with exposed soils. Hydroseeding involves a greater seed application rate compared to broadcast seeding methods (NEIPC 2010).

- Bioengineering refers to the used of live plant cuttings to establish vegetation, typically with the intent of stabilizing stream banks and restoring riparian function. Many methods, material, and construction characteristics can be used depending on the project requirements. Bioengineering has site-specific applications, such stabilizing drainages or riparian areas. Live-staking of deciduous species (willow, cottonwood) is effective for stabilizing surfaces and slopes, and areas with high soil moisture content.

Cost will vary depending on general location (i.e., distance to nearest service centre), landscape and terrain, remoteness and accessibility of site, project footprint, and seed source and applicable materials. The following conditions and assumptions may apply:

a) Hydroseeding

- Assume an inclusive cost for all services where disturbance/revegetation footprint can be populated as total hectares (if known) or inferred using dimensions (width x length) at $20,000/ha (quoted).

Note: Cost may range from $0.5/m^2 standard agronomic seed mixtures (e.g., commercial or highway revegetation) to $4.00/m^2 for specialty composition. An application rate of $2.00/m^2 (equivalent to $20,000/ha) has been inferred for use of common native seed. It is recommended that a project-specific quote be solicited for hydroseeding services.

b) Bioengineering (Live Staking)

- Assume a combined cost for cutting/preparing and then planting live stakes based on one (1) person at $40/hr at a distribution rate of 10,000 stems per hectare (or 1 stem per m^2) (Hollis and Leech 1999); productivity is approximately 50 stems/hr for cutting/preparation and 100 stems/hr for planting. Dimensions of the disturbance/revegetation footprint can be populated as total area in m^2 (if known) or inferred using dimensions (width x length) at $1/m^2 to $1.15/m^2 (quoted and inferred).

(6) ENVIRONMENTAL MONITORING & RECLAMATION PLANNING

6.1. RECLAMATION PLANNING & ASSESSMENT

Environmental and geotechnical monitoring may be required depending on project features to document site conditions (e.g., stability, performance and/or required follow-up action). Reclamation monitoring is beneficial as a mechanism for adaptive management in support of the proponent's narrative for environmental stewardship in fulfilment of permit conditions and requirements. Cost will vary depending on general location (i.e., distance to nearest service center), project features and circumstances and other factors. The following conditions and assumptions may apply:

a) Vegetation Monitoring

- Assume a minimum cost for one (1) site visit by a qualified vegetation specialist at $1,500/day with $100/day/unit equipment disbursement, equivalent to $1,600/day (quoted); populate equivalent number of field days and anticipated number of repeat site visits (e.g., Year-1, Year-3 and Year-5 is equivalent to 3 site visits)

b) Geotechnical and/or Ground-Water Monitoring

- Assume a minimum cost for one (1) site visit by a qualified geotechnical or ground-water specialist at $1,500/day with $100/day/unit equipment disbursement, equivalent to $1,600/day (quoted); populate equivalent number of field days and anticipated number of repeat site visits (e.g., Year-1, Year-3 and Year-5 is equivalent to 3 site visits)

c) Water Quality/ARD Monitoring

- Assume a minimum cost for one (1) site visit by a qualified geotechnical or ground-water specialist at $1,500/day with $500/day/unit lab sampling/equipment disbursement, equivalent to $2,000/day (quoted); populate equivalent number of field days and anticipated number of repeat site visits (e.g., Year-1, Year-3 and Year-5 is equivalent to 3 site visits).

Note: Material and travel costs not included for all fields (above). Service(s) may require multiple site visits. Day rate for a professionally affiliated specialist may be higher than quoted here.

6.2. RECLAMATION PLANNING & ASSESSMENT

Environmental and geotechnical planning may be required to address project features and site-specific circumstances. Cost will vary depending on general location (i.e., distance to nearest service center), project features and circumstances and other factors. The following conditions and assumptions may apply:

a) Reclamation Plan

- Assume a minimum all-inclusive cost for one (1) reclamation plan at $7,500/unit.

b) Geotechnical Assessment

- Assume a minimum all-inclusive cost for one (1) geotechnical assessment at $7,500/unit (where applicable).

c) Soil Remediation Investigation

- Assume a minimum all-inclusive for one (1) soil remediation investigation at $15,000/unit (if known spills and contamination).

d) Ground-Water Investigation

- Assume a minimum all-inclusive cost for one (1) ground-water investigation at $30,000/unit based on minimum of three (3) investigation holes ($10,000/hole) to determine ground-water interactions (where applicable).

e) Hazardous Materials Assessment

- Assume a minimum all-inclusive cost for one (1) reclamation plan at $5,000/unit to assess materials left on site and identify potential areas of contamination (where applicable).

Note: Material and travel costs not included for all fields (above). Service(s) may require multiple site visits.

6.3. MISCELLANEOUS – PROJECT LOGISTICS

Miscellaneous aspects of project implementation and logistics may not be entirely captured by all line items (#1-6 and subsections therein). The following are applicable at the discretion of the user.

a) Additional Accommodation & Subsistence

- Assume minimum of $200/day/person x all personnel for accommodations and subsistence.

b) Additional Vehicle Mileage

- Assume total round-trip distance (km) to cover fuel and vehicle travel expenses to/from the site to the nearest service location at $1.05/km.

c) Additional Travel – Helicopter Access/Support

- Assume total round-trip time (hr) to cover travel expenses to/from the site to the nearest staging area or helicopter base at $2,100/hr.

d) Additional Travel – Airplane

- Assume total round-trip distance (km) to cover travel expenses to/from the site to the nearest service location at $550/km or $1,100/hr.

SUMMARY SHEET

(7) COST ADJUSTMENTS

Populating all the essential line items (#1-3) and any of the optional ones (#4-6) will auto-compile final calculations summarized in the Summary Sheet. At this time, cost adjustments can be applied to the grand subtotal value to account for project management and/or uncertainty.

7.1. PROJECT MANAGEMENT

A project manager or management team will be required to coordinate all aspects of the reclamation project, including administering contracts, supervising contractors, and ensuring that all tasks are completed as intended. The level of project management is often commensurate to the size and scale of the project (i.e., based on the number of components and reclamation line items). In the absence of project specific quoted cost, project management services are estimated as a percent share of the total values for reclamation activities. The following are applicable at the discretion of the user:

- Assume 10% project management services fee to administer the reclamation project; enter '1' in the data cell (if applicable) to implement/auto-populate fee.

7.2. UNCERTAINTY

At the discretion of the user, an uncertainty factor can be included to the total estimated reclamation cost to account for remoteness, risk or other unforeseen costs. Where applicable:

- Assume 15% uncertainty fee; enter '1' in the data cell (if applicable) to implement/auto-populate fee