Minto Mine

2014 Sediment and Erosion Control Plan

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Minto Mine

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1 Introduction

The Sediment and Erosion Control Plan (SECP) is a requirement of Quartz Mining Licence QML-0001 (QML), which requires "*a plan that describes methods and techniques for protecting undisturbed lands, minimizing mining footprints and reducing erosion of soils due to land disturbance and weathering by wind and water"* (Government of Yukon, 2011). This SECP is an update to the previous SECP, submitted in May 2011 and approved in October 2011, and provides an update to site conditions, as well as discussion regarding the proposed Phase V/VI expansion (currently in review with YESAB). The content of this SECP is derived from the *Plan Requirement Guidance for Quartz Mining Projects* (Government of Yukon, 2013). Changes from the previous SECP are outlined in Table 1-1.

The objective of the SECP is to minimize local site impacts from erosion and prevent sedimentation to the receiving environment of Minto Creek. Steep slopes are present on site, and those areas have the greatest potential for severe wind and water induced erosion. Where possible, source control will be the preferred method of sediment and erosion control, to minimize the initial mobilization of sediment. Generally, the intent is to establish intercepting ditches at the crest of steep and susceptible disturbed sites and to establish a vegetative mat on problem areas prior to the occurrence of erosion. In addition, where required, armoured channels or benching and coarse debris will be used to slow down water velocity, prevent rilling and moderate erosion.

Table 1-1: Summary of Changes to WPP from Previous Version

2011 Erosion and Sediment Control Plan	2014 Sediment and Erosion Control Plan
1.0 Introduction	1.0 Introduction Updated to include Phase V/VI infrastructure
2.0 Erosion and Sediment Control Plan Objectives	1.0 Introduction Moved to Section 1.0
3.0 Monitoring Strategies	2.0 Monitoring Strategies Updated to include Phase V/VI infrastructure
4.0 Erosion and Sediment Sources	3.0 Erosion and Sediment Sources Updated to include Phase V/VI infrastructure
5.0 Erosion and Sediment Control Best Management Practices	4.0 Erosion and Sediment Control Measures Updated to include Phase V/VI infrastructure
6.0 Conclusions and Recommendation	5.0 Conclusions

1.1 Project Description

Minto Explorations Ltd. (The Company), a wholly owned subsidiary of Capstone Mining Corporation (Capstone), owns and operates the Minto Project located 240 km (150 miles) northwest of Whitehorse, Yukon. The Minto Mine is a high-grade copper and gold mine with ongoing operations since October 2007. The Project area encompasses the Minto Creek Valley which collects and drains in to the Yukon

River (Figure 1-1). The Minto Mine is currently in Phase IV of operations, with an application for expansion to Phase V/VI submitted to YESAB for review and environmental assessment. An overview of major infrastructure at the Minto Mine and expansion in Phase V/VI is shown on Figure 1-2.

While source control of erosion and sediment will be the main method sedimentation prevention, the Minto Mine has two large control structures to prevent the release of sediment to the receiving environment. The two control structures are the, Minto Creek Detention Structure located slightly downstream of the Mill Valley Fill Extension (Figure 1-2) and the Water Storage Pond (large water body downstream of the Mill Valley Fill Extension in Figure 1-2). These two structures will ensure that as new infrastructure is constructed, potentially sediment-laden water will be collected and treated, if necessary, prior to discharge. A network of ditches conveys water from around the project site to the Minto Creek Detention Structure, which is pumped to the Main Pit for disposal. Water collected in the Water Storage Pond is generally diverted clean surface runoff and effluent from the water treatment plant. Any sediment collected in the Water Storage Pond will settle out prior to discharge to Minto Creek, and all water discharged to Minto Creek is required to meet Water Use Licence discharge limits.

1.2 SECP Objectives

The Minto Mine site has a unique set of properties and mixed terrain that will incorporate a host of best management practices for effective erosion and sediment control. There will be three main focuses of operation; sediment control during construction, site improvements and reclamation.

Sediment control during construction includes ditching, silt fencing and construction of temporary settling ponds to reduce the temporary loads of sediment associated with the movement of large volumes of material. These measures will be temporary during the construction period, and may be decommissioned once construction is complete.

Site improvements include upgrades to the current infrastructure and an evaluation of roadside ditches on the access road and haul roads in conjunction with slope stabilization on cut and fill slopes. In addition, permafrost crests overhanging cut slopes will have the trees bucked to prevent tearing of the vegetative mat as the melting soils undercut the bank.

Progressive reclamation and reclamation test plots on the Main Waste Dump and the Dry Stack Tailings Facility (Figure 1-2) will involve re-contouring and ditching along with the placement of a natural cover to prevent infiltration in to the waste rock. The test-plot program will evaluate potential cover and vegetation selection to minimize infiltration and maximize erosion control. More details are provided in the Decommissioning and Reclamation Plan (Minto Explorations Ltd., 2014).

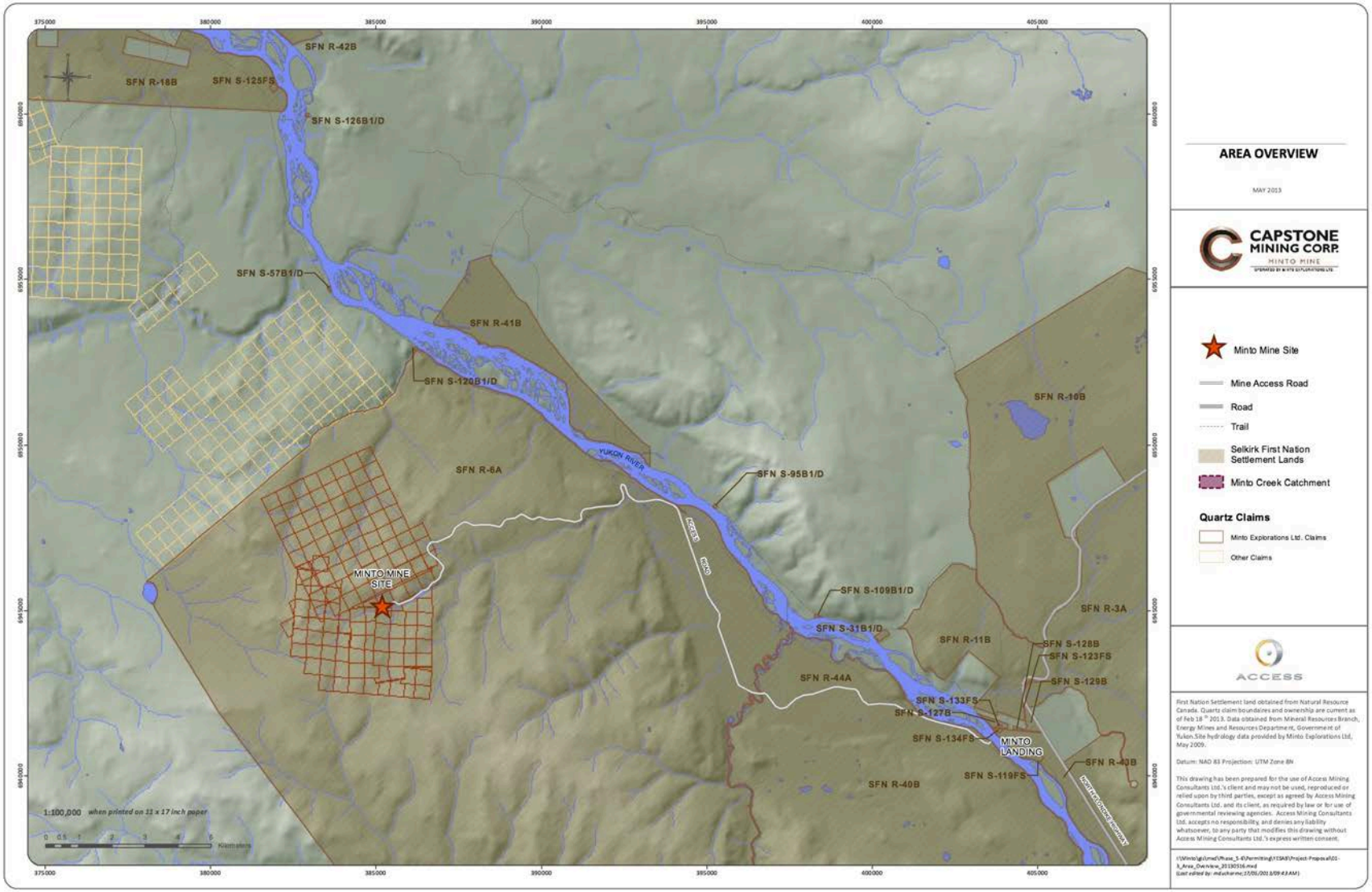

Figure 1-1: Minto Mine Area Overview

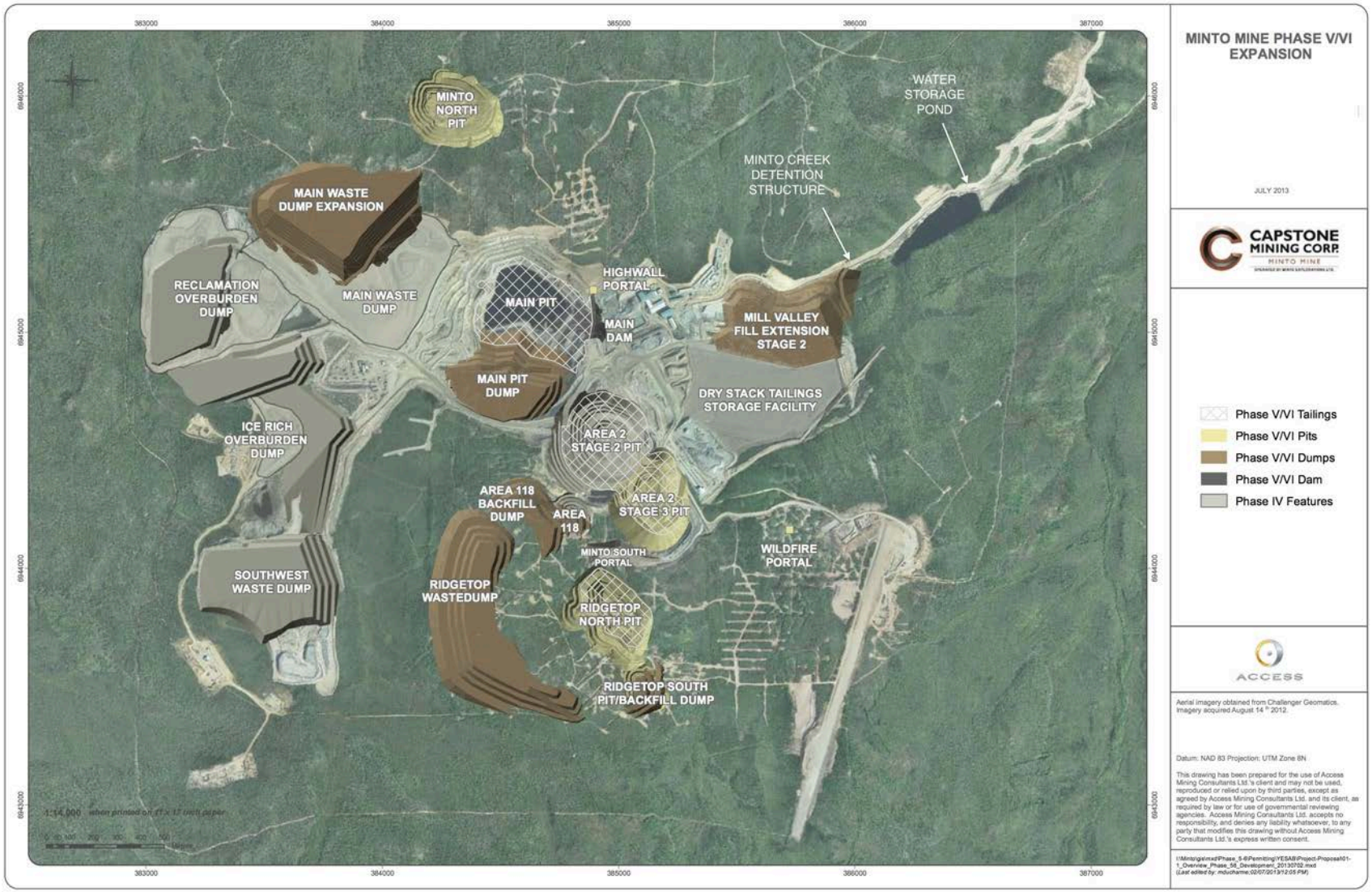

Figure 1-2: Minto Mine Area Overview – Existing and Phase V/VI Proposed Infrastructure

2 Monitoring Strategies

Monitoring of surface structures and of the receiving environment for evidence of erosion and sediment accumulation is summarized in Table 2-1. Initial erosion can be visually inspected by searching for light surface material (litter or soil) movement, while sedimentation resulting from erosion can be found by searching for deposition of soil particles at the bottom of slopes and depressions. Rilling, gullying, pedestalling, unusual compaction, hoof shearing and trailing are also indicators of erosion problems.

Ditches will be examined during heavy runoff and the outlets of culverts and pipes visually inspected to ensure that roads and other permanent structures are not being compromised and sediment loads are not becoming excessive. Movement of the lighter and finer top soils before vegetation has taken root on reclaiming plots will be monitored closely and mitigation efforts employed to prevent compromising the seed and soil.

Table 2-1: Erosion and Sediment Monitoring Schedule

Activity	Location	Frequency
Visual inspections	Bottoms of slopes and depressions of large structures.	As needed following heavy rain events, and during freshet.
	Road routes: ditches and outlets of culverts and pipes.	As needed following heavy rain events, and during freshet.
Water quality monitoring for total suspended solids (TSS).[1.]	Water quality monitoring stations W2, W3, W50 and W17.	Weekly and during heavy runoff periods.
Physical inspection of surface facilities by a Yukon registered Engineer.[1.]	Water Storage Pond Dam, Mill Water Pond, all waste rock and overburden dumps, all water diversion and conveyance structures and the dry stack tailings storage facility.	After the spring thaw period in May/June of each year and again prior to the on-set of winter in September of each year.

1. Monitoring locations and frequency dictated by Water Use Licence QZ96-006 and Quartz Mining Licence QML-0001.

3 Erosion and Sediment Sources

There are numerous potential sources of erosion and sediment transport. The four key areas of concern at the Minto Mine include:

- Steep slopes present throughout the Mine site, and various other areas with high potential for wind and water induced erosion;

- Areas where permafrost has been exposed and the vegetative mat removed will expose previously covered frozen areas to ambient air temperatures and sunlight. The thawing process can create runoff and fluidized movement of soils and overburden;
- Heavy rainfall events and freshet runoff can create erosion and sedimentation in areas that did not have previously known erosion;
- Heavily trafficked areas and land disturbance caused by heavy equipment can be a continuous source of soil displacement and compaction. With compaction, infiltration is reduced and surface water has a greater potential for erosion. Proper planning prior to the commencement of heavy equipment and construction work can limit the disturbed footprint and mitigate erosion potential. During unusually heavy rain events oversaturated soils can exacerbate the problem.

4 Erosion and Sediment Control Measures

Multiple control methods outline in this section provide Minto Mine options that can be tailored to the type of erosion and sedimentation to be prevented or reduced. On site application of mitigation measures will be determined based on a variety of factors, and the most appropriate will be implemented.

4.1 Ditching

During heavy rainfall and thawing events, water movement on site can be significant. Strategically placed ditches and runoff collection structures can help direct water movement by reducing the total amount of water and reducing its interaction with erosion prone sites.

For example, cut and fill slopes created during road construction leave long runs of exposed soils that are prone to erosion. Creating an intercepting ditch above the cut slope will catch water and direct it to less erosion prone areas, thereby reducing runoff over sensitive regions.

Intercepting ditches around the mine site convey water to the Main Pit or the Minto Creek Detention Structure, which is subsequently pumped to the Main Pit for subsequent settling and water treatment.

Ditching should be used where long term infrastructure is predicted to shed precipitation that will require collection and possible treatment.

4.2 Sedimentation Ponds

Sedimentation ponds are typically temporary structures incorporated into base of a decline to collect runoff from areas of high sedimentation during construction. Water collected in the ponds can be allowed to settle and the water naturally overflow to the surrounding environment, or else pumped to other areas for further settling or, if necessary, treatment prior to discharge. The size of a sedimentation pond is dependant on the predicted flow rate and volume of sediment laden water to be collected.

4.3 Re-contouring and Surface Features

The accumulation of water and its movement over the soil surface can trigger soil particle movement. The impact is largely dependent on runoff velocity. Re-contouring methods can reduce this effect by shortening the length and decreasing the angle of the slope. Roughing up and loosening the surface area will impede water infiltration and improve its absorptive capacity. Creating undulations or troughs parallel to steep slopes will also reduce overland water movement velocity.

These types of improvements are beneficial for multiple reasons and incorporating these features can improve the effectiveness of other best management practices. With heavy equipment available they are easily planned and constructed.

Recontouring is appropriate for infrastructure that is no longer serving a structural purpose (i.e., during the reclamation phase of the mine), or, if conducted on retaining structures, only in accordance with appropriate engineered design.

4.4 Revegetation

Establishing a vegetative layer is critical to sites where there are exposed slopes and no further construction is planned. Once established, a vegetative layer eliminates the need for continual monitoring and maintenance by protecting the lighter, organic soil fractions from being displaced, retaining moisture, and preventing slope destabilization. Establishing permanent areas of vegetation, or the temporary seeding of hardy, fast growing species, can offer short or long term erosion control.

The choice of vegetation species will depend on many factors, such as availability, hardiness and emergence. Two important factors in choosing vegetation well suited specifically for erosion control are; those that provide roughness on the site surface, and have extensive rooting systems that will break up the top layer of soil. Both of these factors will improve water infiltration into the soil.

Seedbed preparations for vegetation establishment on steep slopes will have to be considered for those sites where it is determined to be a concern, and could include slope stabilization, stream course protection through the use of mats and mulch or organic matter application. Soil properties including organic matter content and nutrient level must also be addressed to promote successful re-vegetation.

Revegetation must be done with appropriate engineering consultation to ensure that the roots of seeded species will not adversely affect the structural properties of the surface to be revegetated. Following construction of mine infrastructure, revegetation can be immediately implemented on areas disturbed during construction, but which are no longer required for operations (e.g., overburden stockpiles, disturbed pits, along road routes and road ditches). Revegetation is more often conducted following closure of the mine, when no further disturbance is planned. Details of planned revegetation at the Minto Mine upon mine closure is described in the *Reclamation and Closure Plan* (Minto Explorations Ltd., 2014).

4.5 Silt Fencing

Installing silt fence as a sediment control method is a common method employed for level areas with diffuse erosion potential from sheeting on light soils. Silt fences are used to protect downslope areas and prevent further movement of the sediment as it is being transported. Settling of coarser material occurs as the runoff ponds upstream of the fence. Silt fencing is not appropriate for heavy flow areas and requires continuous maintenance.

4.6 Sheeting

Impermeable polyethylene sheets can offer immediate and temporary erosion control. Their use is suited for emergency responses or for short term protection in an area where the sheets will not be disturbed, because they are susceptible to tearing or movement by wind and heavy rainfall events. Also, they require inspection and maintenance until more permanent erosion measures can be implemented. However, properly installed and anchored, they can provide complete isolation of the erodible surfaces from the effects of wind and water erosion.

5 Conclusions

The Minto Mine Site has a unique set of properties and mixed terrain that will incorporate a host of best management practices for effective erosion and sediment control. This Sediment and Erosion Control Plan summarized sediment control structures in place at the Minto Mine, as well as control measures to be implemented should monitoring indicate the need. Monitoring for sedimentation to the downstream environment is conducted weekly, and discharge to the receiving environment is limited by a Water Use Licence. General sediment and erosion control methods will be applied during phased expansion and throughout operations and closure of the Minto Mine.

6 References

Government of Yukon. (2011, May 19). Quartz Mining License QML-0001.

Government of Yukon. (2013, August). *Plan Requirement Guidance for Quartz Mining Projects.* Retrieved from http://www.yukonwaterboard.ca/forms/quartz/Plan%20Requirement%20Guideline%20for%20Quartz%20Mining%20Projects%20-%20August%202013-kh.pdf

Minto Explorations Ltd. (2014). *Reclamation and Closure Plan.* Minto Mine.