3.0 EVALUATION OF ALTERNATIVES

Alternatives to the project are defined as functionally different ways of meeting the project need and achieving the project purpose. Assessment of alternatives should describe the process the proponent used to determine that the project is viable from a technical, economic and environmental perspective and should serve to validate that the preferred alternative is a reasonable approach (CEAA 2012).

As a component of the crown pillar stability assessment, a technical review was conducted by engineers and biologists to assess possible mitigation options for the full protection of underground workers, mine workings, and the aquatic environment. Three options were identified.

3.1 Option 1 - Do Nothing

In this scenario, underground mining would likely be suspended until the crown pillar failed. Lake water would flood the mine drawing down the Bernic Lake water level by 0.75 m resulting in a considerable loss of littoral zone fish habitat and significant impacts to the aquatic ecosystem throughout Bernic Lake. At a minimum, a dike would then be constructed in the lake in order to isolate the underground workings, dewater the mine, expose the lake bottom above the mine workings, and allow for the mine to be formally closed. A return to mining would be unlikely in this scenario.

3.2 Option 2 – In-Situ Reinforcement of the Crown Pillar

A number of stabilization options were considered. These options were assessed as either inappropriate or ineffective or both. All options would involve sending workers into an area identified as unsafe (under the fall of ground). Cabot considers this to be an unacceptable risk to employees and contractors. The roof elevation (~120 ft or 36.6 m) would be impossible to reach without an extensive backfilling operation. This would only provide a short-term solution and the crown pillar would continue to fail. In addition, the use of shotcrete (i.e., a concrete conveyed through a hose and projected at high velocity onto a surface) could hide crucial warning signs of ground degradation. Furthermore, the re-enforcement options, particularly backfilling, would require up to 36 months to complete which exceeds the anticipated time to failure.

3.3 Option 3 – Isolation of the Mine from the Lake

Isolation would be achieved through construction of a dike followed by the dewatering of the portion of Bernic Lake over the crown pillar. This option would eliminate the risk of flooding and reduce the load on the crown pillar, which in turn would slow or could even arrest the progress of failure. Depending on the alignment of the dike(s), this option could potentially be completed in nine to twelve months.

3.4 Preferred Approach

Isolation of the mine from the lake (Option 3) was identified as the most practical approach as it allowed the best opportunity to mitigate the environmental effects of a crown pillar failure on Bernic Lake, could be completed in the time frame needed, and would minimize risk to employees and contractors.

3.5 Dike Alignment Alternatives

Several dike alignments were developed by Cabot's consultant, Tetra Tech, who has expertise in mine engineering, geotechnical investigation, and environmental impact assessment (Figure 3.1). Important factors that were considered included the length of time to design and construct each dike option, the length of time to dewater the isolated portion of Bernic Lake (dewatering can only occur once the dike has been completed), and the extent and duration of effects to Bernic Lake.

3.5.1 *Option 3A – Arc Dike*

The arc dike would have the smallest footprint on the lake, require minimal water management and would maintain the natural drainage route of the lake water to Bernic Creek; however, the added weight of the dike structure and vibrations associated with construction could increase the rate of crown pillar degradation. Considering the significant safety concerns, this alignment was not explored past the conceptual stage.

3.5.2 *Option 3B – V - Dike*

The V-Dike consists of two structures with a combined length of approximately 950 m in length. The dikes would originate on the north and east shores and connect at an island southwest of the mine. This option presents the smallest reasonable footprint (~30 ha) and therefore environmental effects while maximizing safety considerations. This option also maintains the natural lake drainage and eliminates the need to construct a diversion channel or provide active water management (e.g., pumping). The timeline for construction, however, is estimated to be 18-24 months which presents a significant risk to mine workers and dike construction workers should the crown pillar fail before construction is complete.

3.5.3 Option 3C – Narrows Dike

Construction of the narrows dike involves the largest area of the lake (214 ha) and the greatest dewatering effort, but provides the most practical, safe and timely solution for mitigating the immediate risk of flooding of the mine. The timeline for construction of the narrows dike is approximately 9-12 months including dewatering.

3.5.4 Preferred Approach

Isolation of the mine from the lake (option 3) was identified as the most practical approach as it allowed the best opportunity to mitigate the environmental effects of a crown pillar failure on Bernic Lake, could be completed in the time frame needed, and would minimize risk to employees and contractors. A phased approach was determined as the best course of action. Phase I would involve the construction of a temporary dike at the narrows of Bernic Lake. This would allow the dewatering of the west basin of Bernic Lake and the alleviation of immediate risks to the mine. Phase II would involve geotechnical investigations at the permanent (to end of mine life) dike location, much closer to the mine, detailed design, and dike construction. Upon completion of the second dike, the west basin would be allowed to refill and then the temporary dike would be decommissioned, thus reducing the affected footprint from over 200 ha to less than 50 ha, as per conceptual alignment Figure 3.1. Except for the relatively small area enclosed by the permanent dike, Bernic Lake would be returned to its natural state and drainage route. It is expected that the temporary dike would be in place for a period of 2-4 years. The construction of two dikes within a short period creates considerable extra cost for Cabot; however, this approach provides an optimal solution in that it eliminates the immediate risk of flooding, minimizes the long-term footprint of the project, and upholds Cabot’s corporate commitment to being responsive, responsible and respected citizens in the communities in which the company operates.

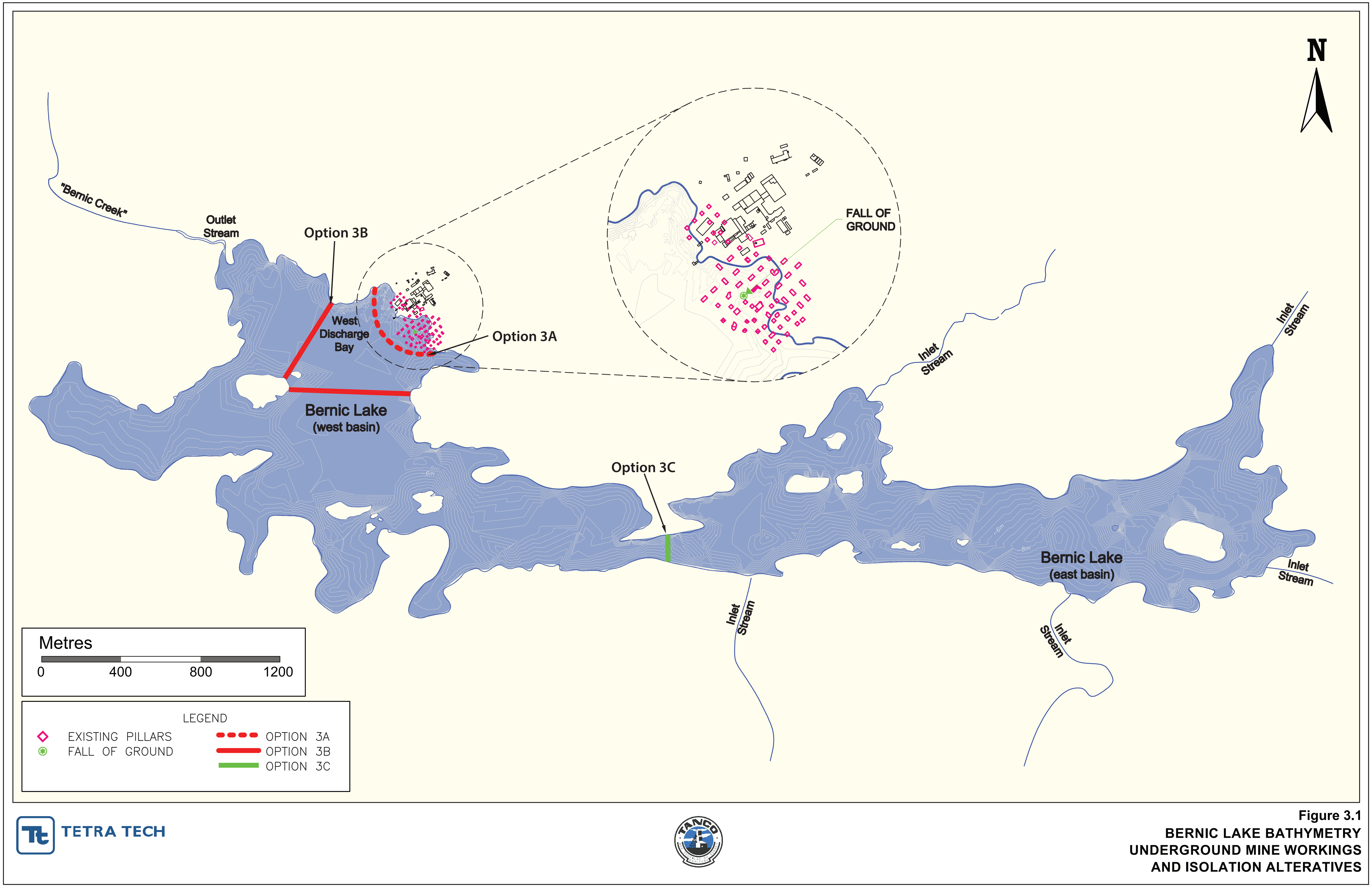

Figure 3.1
BERNIC LAKE BATHYMETRY
UNDERGROUND MINE WORKINGS
AND ISOLATION ALTERATIVES

3.6 Dewatering Options

Several options for dewatering were examined which took into consideration the available dewatering schedule, changes in water quality, and downstream effects.

3.6.1 *Option 1 – Dewater directly to the Bird River*

Option 1a – This option involved dewatering the entire west basin directly to the Bird River over the winter of 2013 to 2014. The winter surface ice would minimize the re-suspension of sediments by wave action although TSS would be expected to increase towards the end. The instantaneous pumping rate, 2.5 m^3/s, would double the normal winter flow in Bird River but would be well within the normal spring freshet peek flow of 15 m^3/s. This option was rejected as there would be no attenuation of nutrients and TSS in the latter stages of dewatering.

Option 1b – This option would also involve direct dewatering to the Bird River at a lower rate until August 2014. The winter surface ice would minimize the re-suspension of sediments by wave during the winter months but there would be no mitigation during the open-water months. The total TSS loading would be expected to be higher than Option 1a. The instantaneous pumping rate of 0.7 m^3/s would have little incremental effect on the normal seasonal flow in the Bird River. This option was rejected as there would be no attenuation of nutrients and the total TSS loading would be higher than Option 1a.

3.6.2 *Option 2 – Surge/settling pond and filtration*

This option would involve the construction of a surge/settling pond and a filtration plant. A settling pond would be constructed between Bernic Lake and the Bird River. The purpose of the pond would be to provide primary settling to reduce TSS while a filtration plant would complete the TSS reduction and reduce the nutrient load. The discharge rate of 0.7 m^3/s would have little incremental effect on the normal seasonal flow in the Bird River. This option was rejected as the dewatering rate would necessitate a large settling pond and would result in correspondingly large land disturbances for the pond and sourcing the construction materials. In addition, the construction of a large settling pond and the procurement of a filtration plant land capable of treating 0.7 m^3/s would be cost prohibitive.

3.6.3 *Option 3 – Discharge to the Shatford Lake watershed*

This option would involve developing a discharge pathway to a Shatford Lake tributary and/or using the Shatford Lake watershed as a treatment system. Access from TANCO to Shatford Lake would be required to install the pipeline and discharge diffuser. Water would be discharged into an intermittent channel which would then report to Shatford Lake and onto the Bird River. This option was rejected as Shatford Lake would essentially be converted to a settling pond and it is unlikely federal approval would be granted.

3.6.4 Option 4 – Discharge to a Treatment Wetland

This option would involve the discharge of water to a natural wetland that would be augmented as necessary to improve the the performance in reducing nutrients and TSS. The Bernic Creek wetlands would be isolated with temporary upstream and downstream containment dikes to increase capacity and residence time. A channel would be excavated to adjacent wetlands to the west which increase the overall capacity and effectiveness of the treatment wetlands by fivefold. Water would be discharged into the Bernic Creek wetlands at a rate of 0.7 m^3/s, which would then pass through 5.4 km of wetlands before discharging into the Bird River. The dewatering period would extend from December 2013 to August 2014.

3.6.5 Preferred Approach

The use of treatment wetlands was selected as the preferred option as it has the greatest potential to reduce nutrient and TSS loading to the downstream environment. Further study is ongoing.

3.7 Water Management Options

Water accumulation in the west and east basins of Bernic Lake will require ongoing management during the period in which the west basin has been dewatered. Any water accumulating in the west basin would likely have elevated TSS therefore it was determined that the water would be pumped to the treatment wetlands. Several options were assessed for managing east basin water.

3.7.1 Option 1 – Allow Excess Water to Spill into the West Basin

This option would allow excess water from the east basin passively spill into the west basin which would then be discharged to the treatment wetlands. This option was rejected as it would unnecessarily cause nutrient and TSS loading in the treatment wetlands.

3.7.2 Option 2 – Discharge Directly to the Bird River

This option would involve an extension of the process plant make-up water line to the Bird River at the TANCO road crossing. Excess water would be periodically pumped directly to the Bird River. This option was rejected as it would require additional kilometres of pipeline and provide no attenuation of nutrients.

3.7.3 *Option 3 – Discharge to the Treatment Wetlands*

This option would involve an extension of the process plant make-up water line to the treatment wetlands. This was selected as the preferred option as the treatment wetlands would provide nutrient reduction.