

Magino Gold Project

Schedule 2 Assessment of Alternatives for Mine Waste Management

November 2016





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SCHEDULE 2 ASSESSMENT OF ALTERNATIVES FOR MINE WASTE MANAGEMENT MAGINO GOLD PROJECT

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ACRONYMS

\$ dollar(s)% percent

°C degrees Celsius

μm micron

ABA acid-base accounting

AMSL above mean sea level

ARD acid rock drainage

ARD/ML acid rock drainage/metals leaching

ATD alternative tailings disposal
BAP best applicable practices
BAT best available technology

BCMEM British Columbia's Ministry of Energy and Mines

BFN Batchewana First Nation

CAD Canadian dollars
CIP carbon-in-pulp

EA Environmental Assessment

EBA Engineering Consultants, Ltd. FPB FPB Management Services, Inc.

ha hectare km kilometer

km² square kilometres

ktCaCO₃ kilotonnes calcium carbonate

LOM life of mine
m metre(s)
M million

Mm³ million cubic metres

MAA Multiple Accounts Analysis
MCFN Missanabie Cree First Nation

MEND Mine Environment Neutral Drainage

MERC Mushkegowuk Environmental Research Centre

MFN Michipicoten First Nation

ACRONYMS (CONTINUED)

mm millimetre(s)
Mt million tonnes

MMER Metal Mining Effluent Regulations

MNO Métis Nation of Ontario Consultation Committee

MPA maximum potential acidity

MRMF Mine Rock Management Facility

MV metavolcanics

NAG non-acid generating

NNP net neutralization potential NP neutralization potential

PAG potentially acid generating

Prodigy Prodigy Gold Inc.

RSA Regional Study Area

RSMIN Red Sky Métis Independent Nation

SLR Consulting (Canada) Ltd., SLR International Corporation

tCaCO₃/kt tonnes calcium carbonate per kilotonne

TIA Tailings Impoundment Area (refers to area for storage of tailings)

TK Traditional Knowledge

TMF Tailings Management Facility (refers to approach for tailings management)

tpd tonne(s) per day

TSD Technical Support Document
UTM Universal Transverse Mercator

WMU Wildlife Management Unit

1. INTRODUCTION

Prodigy Gold Inc. (Prodigy) is proposing to develop the Magino Mine in northern Ontario, Canada. This report has been prepared to support a regulatory amendment to Schedule 2 of the Metal Mining Effluent Regulations (MMER) under the Fisheries Act as the proposed mine waste management plans for disposal of tailings and mine rock at the project includes overprinting of natural waterbodies frequented by fish. This report has been prepared consistent with the Environment Canada's (2011) "Guidelines for the Assessment of Alternatives for Mine Waste Disposal" (i.e., Multiple Accounts Analysis [MAA] Guidelines).

1.1 BACKGROUND

This Technical Support Document (TSD) has been prepared by SLR International (SLR) as one in a series of reports intended to support the environmental assessment (EA) processes being undertaken in accordance with relevant Federal and Provincial EA legislation.

The full series of TSDs that are being prepared in support these EA processes include the following:

- Geotechnical and Geohydrologic Investigation
- Geochemical Assessment
- Surface Water Hydrology
- Hydrogeological Study and Groundwater Modelling
- Schedule 2 Assessment of Alternatives for Mine Waste Management (This TSD)
- TMF Conceptual Design Document
- Site Water Balance and Quality
- Visual Analysis
- Meteorology and Air Quality
- Climate Change
- Noise
- Vibration
- Light
- Human Health Risk
- Fish and Fish Habitat Baseline
- Surface Water and Sediment Quality
- Terrestrial Ecology
- Archaeology Report

- Closure Plan
- Environmental Management Systems

1.2 THE MAGINO PROJECT

The Magino site is located 195 kilometres (km) north of Sault Sainte Marie, Ontario, Canada. The site is in the Finan Township, approximately 40 km northeast of Wawa, Ontario, and 10 km southeast of Dubreuilville, Ontario. The location of the Magino Project is illustrated in **Map 1**.

Prodigy proposes to develop the Magino Gold Project on the site of a past producing underground mine as a brownfield project. The project area is within the Territorial District of Algoma, centered at UTM coordinates 689049E 53551422N (NAD 83 Zone 16U). The land, including subsurface rights, is owned by the Provincial Crown. Prodigy's wholly-owned (i.e., 100% Registered Ownership) land holdings forming the Magino property comprise 18 patented mining claims (mining and surface rights), 62 leased mining claims, and 17 unpatented mining claims with a combined area of 2,261 hectares (ha).

The project involves the mining of 550 million tonnes (Mt) of ore and mine rock using conventional open pit mining methods with gold extraction from the ore using a 35,000 tonne per day (tpd) carbon-in-pulp (CIP) mineral processing facility. The expected tonnages removed from the open pit include an expected 400 Mt of mine rock and up to 150 Mt of gold ore. After ore processing, an expected 150 Mt of tailings will be produced over a 12-year processing time-frame. Approximate quantities and properties for Magino waste streams are presented **Table 1-1**.

Table 1-1: Magino Project Expected Mine Waste Streams

| MATERIAL | TONNAGES (MT) | CHARACTERISTICS |
|--|------------------|--|
| Total material hauled from the open pit mine | 550 | |
| Mine rock produced | 400 - 430 | Over 99% NAG material NP/MPA ratio of 8.8 |
| Ore produced | 120 -150 | NAG |
| Tailings produced | 150 | NAG |

Definitions:

PAG: Potentially Acid Generating NAG: Non-Acid Generating NP: Neutralization Potential MPA: Maximum Potential Acidity

1.3 GEOCHEMICAL CHARACTERISTICS OF THE MINE ROCK ORE AND TAILINGS

The purpose of this section is to summarize the geochemical characterization of the ore and mine rock and to conclude that since the acid rock drainage (ARD) potential is low, this aspect is a low priority when evaluating deposition methods and site section. A description of the

geochemical assessment work completed to-date is presented in the Geochemical Assessment TSD.

Prodigy has developed a geologic block model showing the locations and configurations of the various lithologic units and combined with a preliminary mining and pit configuration plan has identified the lithologic compositions of ore and mine rock that will be mined from the pit.

EBA Engineering Consultants, Ltd. (EBA) performed initial geochemical characterization of the lithologic units (SLR, 2016). EBA reviewed available site data, including geological cross-sections, geologic models, and petrographic work from 2011, estimated volumes of mine rock, core logs, and a preliminary pit shell in order to develop a sampling and analysis program for acid rock drainage/metals leaching (ARD/ML) characterization. The EBA report presents a description of the geology and lithology of the bedrock in the mine pit area. Eleven (11) lithologic units have been delineated, with each subdivided into subunits.

Sample selection was completed with a focus on capturing the variability in each alteration type and zone, as well as the range of potential contaminant and sulphide content, in the dominant lithologies encountered on the property site. Samples were selected from core materials to ensure adequate representation of the variability within each lithologic unit.

EBA performed the static phase of the geochemical testing in accordance with the Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials, Mine Environment Neutral Drainage (MEND) Report 1.20.1 (MEND, 2009). The results of the static testing indicated that, overall, the ratio of Neutralization Potential to Maximum Potential Acidity (NP/MPA) was greater than 2.0 (ranging from 3.9 to 21) for all lithologic units except for Unit 5e (a massive sulfide). The ratio for Unit 5e is 0.5. The Net Neutralization Potential (NNP = NP-MPA) was greater than 20 tons CaCO₃ per 1,000 tons of rock (ranging from 20 to 250 t CaCO₃/kt rock) for all units except Unit 5e. The NNP for Unit 5e is -188 t CaCO₃/kt rock. The Unit 5e rock is a minor component (on the order of 0.5%) of the total rock to be mined from the proposed pit.

Based on these results, kinetic testing was not necessary according to the MEND procedures. Prodigy performed kinetic testing (i.e., humidity cell and field cell testing) to further characterize selected lithologic units that may be of particular interest (i.e., they represented a majority of the mine rock and/or ore, or elevated concentrations of sulfide were frequently observed). The kinetic testing was performed on Units 1, 2, 5c, 5e, 6 and 7. The kinetic testing was undertaken by SLR, and the results are presented in SLR (2016). The conclusions of this test work are summarized in the following sections.

1.3.1 MINE ROCK CHARACTERIZATION

Mine rock units tested as part of the geochemical analysis comprised Units 1, 2, 5c, 5e 6, 7, 9 and 11. For the mine rock, the static Acid-Base Accounting (ABA) work completed to-date includes 543 mine rock samples. In addition, nine (9) humidity tests and eight (8) on-going field cell tests have been performed on representative composite samples of each lithologic unit. The results indicate an overall Neutralizing Potential to Maximum Potential Acidity (NP/MPA) Ratio of 13.4.

The overall balance of acids and bases determined from the current pit configuration and block model is summarized in **Table 1-2**. The results in the test work indicate that co-disposal of the different types of mine rock in a single facility is not anticipated to produce acid leachate that could harm the environment. Only Unit 5e exhibits a potential for generation of acid drainage in the decades following its removal and disposal. Unit 5e is relatively small in terms of the total volume of material to be removed (i.e., on the order of 0.5% of the total mine rock).

The metals leaching results, as best indicated by the humidity cell and on-going field cell tests, indicate that copper was the only metal detected in leachate from the mine rock after it is initially placed in the mine rock management facility, but the concentration in leachate rate drops rapidly (within a year). Sulfate was also elevated in humidity cell and field cell effluent. Field cell testing will be continued, and runoff and leachate from the mine rock will be monitored during mine operations.

1.3.2 ORE & TAILINGS CHARACTERIZATION

The lithologic units included in the ARD testing program that characterize the ore are Units 1, 2, and 6. Since the tailings are milled and processed ore, these units also characterize the tailings. No acid leachate is expected to be generated by ore or the tailings based on the results of ARD testing.

Table 1-2: Summary of Overall ARD Potential for Mine Rock, Ore and Tailings

| MINE ROCK | | | | | | | | | |
|-----------|------------------|-------------------------------|-----|------------------|---------------|--------|--|--|--|
| Unit | Material | Average (tCaCO ₃ / | | Totals (ktCaCO₃) | | | | | |
| | Percent of Total | MPA | NP | MPA | NP | NNP | | | |
| MV | 57.0% | 12 | 122 | 2,887 | 29,353 | 26,466 | | | |
| 5C | 1.1% | 74 | 323 | 341 | 1,489 | 1148 | | | |
| 5E | 0.5% | 360 | 172 | 709 | 339 | -370 | | | |
| 6 | 34.0% | 3 | 63 | 435 | 9,141 | 8,706 | | | |
| 7 | 0.6% | 10 | 131 | 26 | 345 | 318 | | | |
| 9 | <0.1% | 7 | 27 | 3 | 11 | 8.5 | | | |
| 11 | 1.7% | 5 | 68 | 37 | 500 | 464 | | | |
| ОВ | 5.4% | 0 | 0 | 0 | 0 | 0 | | | |
| Totals | 100% | | | Overall NE | P/MPA: 13.4 | 36,740 | | | |
| iotais | 425 | M | t | Overallivi | / WII A. 13.4 | 30,740 | | | |

| TAILINGS AND ORE | | | | | | | | | |
|------------------|----------|--|-----|---|-------|-------|--|--|--|
| Unit | Material | Average for Unit (tCaCO ₃ /kt rock) | | Totals (ktCaCO₃) | | | | | |
| | Percent | MPA | NP | MPA | NP | NNP | | | |
| MV | 12.0% | 12 | 122 | 180 | 1,830 | 1,650 | | | |
| 6 | 86.0% | 3 | 63 | 322 | 6,760 | 6,438 | | | |
| Totals | 98.0% | | | Overall NF | 8,088 | | | | |
| 10tais | 125 | M | t | O C C C C C C C C C C C C C C C C C C C | 3,000 | | | | |

Abbreviations:

MPA = Maximum Potential Acidity
NP = Neutralization Potential
NNP = Net Neutralization Potential
MV = Metavolcanics; comprised of lithologic units 1 and 2 combined

2. METHODOLOGY

The Multiple Accounts Analysis (MAA) methodology as outlined in Environment Canada's "Guidelines for the Assessment of Alternatives for Mine Waste Disposal" (Environment Canada, 2011) was applied by Prodigy to establish the preferred method of tailings disposal and the disposal sites for the long-term disposal of mine rock and tailings that will be generated by its Magino Gold Project. The purpose of this assessment methodology is to objectively and rigorously assess each feasible alternative for the disposal of mine waste products. It entails seven steps:

- Step 1 involves determining which disposal technologies and disposal sites could be used for the storage of tailings and mine rock;
- Step 2 screens out any alternatives that have a fatal flaw, ensuring at least one alternative does not overprint natural waters frequented by fish;
- Step 3 involves characterizing the alternatives from environmental, technical, cost and socio-economic perspectives;
- Step 4 is the beginning of the MAA and includes setting up evaluation criteria (sub-accounts) and measurement criteria (indicators);
- Step 5 is the value-based process where each sub-account and indicator is weighted in importance, and assigned a value (scoring, weighting and quantitative analysis);
- Step 6 is a sensitivity analysis that recognizes that each stakeholder will not place the same importance on each impact; and
- Step 7 documents the results of the MAA.

Details of this methodology can be found on Environment Canada's website (http://ec.gc.ca/pollution/). A brief overview of this methodology follows.

2.1 IDENTIFICATION OF CANDIDATE ALTERNATIVES

The first step involves the development of a list of possible candidate sites for mine waste disposal (i.e., identification of alternatives), including Tailings Impoundment Areas (TIAs). The alternatives include different mine waste disposal technologies and disposal locations. However, it is appropriate for the Proponent to establish a basic set of threshold criteria to form the regional boundaries for selecting candidate alternatives. These threshold criteria should be as broad as possible and must be described and rationalized to ensure transparency. Typical examples cited by Environment Canada (2011) (i.e., Section 2.2 of the MAA Guidelines) include:

 Exclusion based on distance: There is sufficient precedent to suggest that at some point the distance between the mine/mill complex and the TIA becomes too great to ensure a positive economic outcome to the project. For any given project, this distance may be set.

- Exclusion based on presence of protected areas: There may be protected areas
 (e.g., nature reserves, sacred land) within the regional boundaries considered for
 candidate waste disposal alternatives. If it is known that a TIA in these areas would
 under no circumstances be allowed, these areas may be justifiably excluded from
 evaluation.
- Exclusions based on legal boundaries: Areas may be justifiably excluded from evaluation if legal boundaries would preclude mine waste disposal. These may include country borders or cadastral/land use/lease boundaries.
- Exclusion based on corporate policy: A project proponent may have specific corporate sustainability policies that would eliminate a candidate alternative from consideration. These may include a policy statement limiting consideration of alternatives that would require relocation of local inhabitants.

2.2 PRELIMINARY SCREENING

The process of pre-screening allows those alternatives that do not meet the minimum specifications listed in **Section 3.2** to be dismissed from the assessment process. By not meeting these threshold criteria, the alternative contains a fatal flaw that is so unfavorable or severe that eliminates the site as a potential candidate for mine waste disposal. Pre-screening criteria are formulated such that a "yes" or "no" response is possible. There must be no reasonable mitigation strategy that would convert a "yes" response into a "no" response.

2.3 ALTERNATIVES CHARACTERISATION

The remaining alternatives are characterized to:

- Ensure that each aspect of the alternative is properly considered; and
- Present sufficiently thorough information to allow direct comparison between alternatives, ensuring transparency of the alternative assessment process.

The MAA Guideline (Environment Canada, 2011) states that at least three alternatives should remain worthy of detailed assessment after completing the pre-screening process. At least one of these alternatives should not impact a waterbody frequented by fish, unless it can be demonstrated that this possibility does not reasonably exist based on site-specific circumstances.

2.4 LEDGER FORMAT

Evaluation criteria used in the MAA considers the material impact, such as benefit or loss, associated with each alternative. The multiple accounts ledger includes a three-level hierarchy comprised of accounts, sub-accounts, and indicators. Four (4) broad categories, or "accounts", are considered for the entire project life cycle, including:

Environmental;

- Technical;
- Project Economics; and
- Socio-Economics.

Each account is divided into evaluation criteria, or sub-accounts, that are used to evaluate the level of impact of the account. As stated in the MAA Guidelines (Environment Canada, 2011), sub-accounts should conform to the following criteria:

- Sub-accounts need to be impact driven;
- Sub-accounts must differentiate one alternative from another;
- Sub-accounts must be relevant to the account;
- Sub-accounts must be understandable, and unambiguously defined for clarity;
- Sub-accounts must not be redundant; and
- Sub-accounts should be judgmentally independent (i.e., one sub-account cannot depend on the value of another sub-account).

Sub-accounts measure impacts between alternatives and are often not easily quantified and ranked in a transparent manner. Measurement criteria (i.e., indicators) allow qualitative or quantitative measurement of the impact associated with each sub-account. For the purpose of the MAA, each indicator has a six-point scale that details how an alternative will be valued, with "6" being best and "1" being the worst.

Sub-accounts, indicators and scoring assigned to each of the four primary accounts are detailed in **Section 4** for each identified Tailings Impoundment Area (TIA).

2.5 VALUE-BASED DECISION PROCESS

2.5.1 SCORING

Each alternative is assigned a score with respect to each indicator ranging from one to six. A score of six is assigned when the alternative meets the best criteria on the qualitative value scale for the indicator, and a score of one is assigned when the alternative meets the worst criteria.

2.5.2 WEIGHTING

Magino Project personnel lead a team of experienced professionals consisting of engineers, geoscientists, geotechnical engineers and environmental specialists in determining the appropriate weighting of mine waste alternatives. A weighting was applied to each sub-account and indicator on a scale of one to six based on the relative importance of each sub-account and indicator. As per the MAA Guidelines (Environment Canada, 2011), a weight of two is considered twice as important as a weight of one, and a weight of four is twice as important as a

weight of two. By design of the scale, no sub-account or indicator can be valued more than six times more important than another sub-account or indicator.

2.5.2.1 Indicators and Sub-Accounts

The weight of indicators is comparable within each individual sub-account and cannot influence separate sub-accounts. In the event of only one indicator in a given sub-account, a weight of one is applied. Sub-account weights are only applicable within a given account and are not comparable across accounts.

2.5.2.2 Account

Environment Canada (2011), per Section 2.6.2 of the MAA Guidelines, suggests account weightings as follows:

- Environmental 6
- Technical 3
- Project Economics 1.5
- Socio-Economics 3

With regard to the Socio-Economics account, Aboriginal interests and considerations play a key role. The Base Case includes weighting the Environmental account twice as important as the Technical account and the Socio-Economics account, which in turn are weighted twice as important as the Project Economics (costs) account.

Additional scenarios are considered in order to evaluate the robustness of the analytical process and determine the degree to which various options are influenced by the choice of weighting:

- Case 2 weights all accounts equally;
- Case 3 weights the Environmental account twice as high as the Technical and Socio-Economics accounts while completely discounting cost considerations;
- Case 4 weights the Environmental and Technical accounts twice as high as the Project Economics and Socio-Economics accounts; and
- Case 5 puts twice as much weight on the Environmental and Socio-Economics accounts.

The sensitivity analyses presented in **Section 6** evaluates the results of these four additional scenarios against the Base Case for the TIAs.

2.5.3 QUANTITATIVE ANALYSIS

The MAA follows Environment Canada's methodology as outlined in Section 2.6.3 of the MAA Guidelines (Environment Canada, 2011):

For each indicator, the indicator value (S) of each alternative is listed in one column. The weighting factor (W) is listed in another column and the combined indicator merit score $(S \times W)$ is calculated as the product of these values.

Indicator merit scores can be directly compared across alternatives, and likewise, sub-account merit scores (\sum (S x W)) can be directly compared across alternatives. However, to allow comparison of these values against values for other sub-accounts, the score must be normalized to the same six-point scale used to score each indicator value. This is achieved by dividing the account merit score by the sum of the weightings ($\sum W$) to yield a sub-account merit rating (R_s =(\sum (SxW)/ $\sum W$)). This will again be a value between 1 and 6. This normalization is necessary to balance out different numbers of indicators and sub-accounts for each account. Without this normalization, the number of indicators associated with each sub-account, and the number of sub-accounts associated with each account, would have to be identical, otherwise the analysis will be skewed by accounts with more sub-accounts or indicators.

The results of these analyses are presented in **Section 5.2** for the TIAs.

3. TAILINGS MANAGEMENT ALTERNATIVE ASSESSMENT – PRE-SCREENING

The project boundaries are shown on **Map 2**. The surface area within the project boundaries amount to 2,261 ha. The open pit is located in the southeast portion of the property. No natural reserves or sacred lands exist within the project boundaries.

3.1 CONSIDERED TAILINGS DEPOSITION METHODS

Five (5) preliminary alternative tailings disposal (ATD) methods were identified, which include:

- ATD-#1 In-pit tailings disposal;
- ATD-#2 Dry stack tailings disposal;
- ATD #3 Surface paste tailings disposal;
- ATD #4 Thickened tailings disposal;
- ATD #5 Conventional tailings disposal; and
- ATD #6 Co-disposal of tailings and mine rock.

The first of the alternative disposal methods include deposition of tailings within an existing mined-out open pit, while the remainder of the disposal methods include surface deposition of tailings within an engineered facility. However, the last of the alternative disposal methods considered includes placement of tailings and mine rock together in a single facility (i.e., codisposal). The difference between dry stack, paste, thickened, and conventional tailings deposition relates to the amount of water contained in the tailings when sent to the disposal facility (i.e., slurry density). Co-disposal of tailings may consider tailings of effectively any slurry density. Each of these alternatives is summarized in the following sections.

3.1.1 IN-PIT TAILINGS DISPOSAL – ATD #1

Open pit disposal involves pumping tailings to an existing open pit capable of storing the tailings generated by the mill. Tailings can be transported (pumped transport of slurry, thickened or paste tailings, or truck or conveyor transport of filtered tailings) to a mined out open pit. Surface water management is relatively straightforward compared to on-land disposal alternatives, as water is contained within the boundaries of the mined-out pit. If the pit has already flooded as part of a planned closure scenario prior to use, tailings can be pumped (slurry) and discharged at depth in the open pit to reduce the effect on surface water in the open pit, as well as to limit destabilizing effects on the pit walls, which could occur by rapidly drawing down pit water levels.

3.1.2 DRY STACK TAILINGS DISPOSAL – ATD #2

Filtered or dry stack tailings are achieved by dewatering tailings materials to an unsaturated state, corresponding to approximately 80 to 85% solids by weight (defined as weight of solids

divided by weight of solids plus weight of water). Tailings are dewatered using vacuum or pressure filters, though screening methods may be considered where the fines content (fraction of material by weight finer than 75 microns) is relatively low (i.e., best for sandy material).

After dewatering, the tailings materials are transported by conveyor or truck to the disposal area where they are handled by earthmoving equipment. The need for containment structures (i.e., embankments) may be significantly reduced for dry stack tailings storage facilities compared to other tailings disposal methods.

3.1.3 SURFACE PASTE TAILINGS DISPOSAL – ATD #3

Paste tailings are generally defined as being comprised of 65 to 70% solids by weight material. Paste tailings are produced in specialised paste thickeners, or ultra-high-density thickeners, and have been dewatered to a point where they theoretically do not segregate when deposited and produce minimal bleed water. In spite of perceived pumping capabilities of paste tailings, a major challenge with paste tailings is flow velocity in the pipe. Positive displacement pumps are typically required over centrifugal pumps for transporting of paste tailings. Paste is best-suited for backfill in underground workings, where transport and placement is aided by gravity.

3.1.4 THICKENED TAILINGS DISPOSAL – ATD #4

Thickened tailings materials have been dewatered, or 'thickened', through the use of high-density or deep-cone thickeners, cyclones, or chemical modifications to a range of about 45 to 65% solids by weight. With many of the tailings thickening technologies, it takes what happens inefficiently in the tailings impoundment, and does it in the process circuit (i.e., water is released from the tailings and returned to process while the tailings are still in the process circuit). In these cases, and in order to obtain benefits of the technology in general terms, the tailings must remain non-segregating, meaning that the gradation of the material near the spigot is the same as that in the center of the pool. Thickened tailings produce smaller amounts of reclaim water than conventional tailings, and can form nominally steeper beach angles than conventional tailings, so slightly less space may be required for tailings disposal.

Alternatively, tailings thickening can be performed to classify the material, as is the case with the use of cyclones for sand dam construction. The cyclones use pressure to separate coarse tailings, termed underflow, from the fine tailings, termed overflow. Cycloning can be performed in a single cyclone (or single-stage), or in a series to achieve enhanced segregation of the coarse and fine materials.

With regard to containment of thickened tailings, modest retention structures are typically required (i.e., embankments or impoundments), and tailings are typically deposited using spigots from the perimeter or from a central thickened discharge. However, in some cases, the tailings can be self-supporting on low angle slopes, as is the case with cyclone sand dam construction.

3.1.5 CONVENTIONAL TAILINGS DISPOSAL – ATD #5

Conventional tailings are unthickened tailings slurry with a typical slurry density in the range of 30 to 40% solids by weight. Conventional tailings are pumped and piped to a tailings storage facility that employs containment dams, embankments or surface impoundments to retain the tailings, which are typically spigotted. Conventional tailings are characterized by low strength, high water content and exhibit relatively complex water management. Also, conventional tailings slurry typically segregates during deposition, with the tailings releasing significant amounts of water for recovery in reclaim water ponds.

3.1.6 CO-DISPOSAL OF TAILINGS AND MINE ROCK – ATD #6

Co-disposal is the mixing of fine-grained mine waste material (i.e., tailings) with coarse-grained mine waste material (i.e., mine rock) into a single waste storage facility. Mixing of the tailings with mine rock promotes filling of voids to maximise density of the material. Several different terminologies for co-disposal are considered based on the point at where mixing occurs, or how the independent waste streams are placed, as follows:

- Co-mingling: Co-mingling involves mixing and subsequent placement of tailings and mine rock together in a single waste storage facility. Tailings and coarse mine rock material are transported independently and mixed together, usually by mechanical means, within a waste storage facility, or combined into a single discharge stream when pumped or conveyed;
- Co-placement: Tailings and coarse mine rock materials are transported independently, but not mixed to form a single discharge stream. Examples of co-placement may include mine rock end-dumped into a tailings storage facility, or mine rock used to construct perimeter embankments for tailings storage; and
- **Co-deposition:** Similar to co-placement, but the waste streams are generally placed in independent layers allowing the deposited tailings to naturally enter the voids in the underlying mine rock layers.

For the purposes of the pre-screening assessment presented in **Section 3.2**, co-mingling of the tailings and mine rock is considered. However, co-placement of tailings and mine rock (e.g., use of mine rock for embankment construction) may be considered as a component to tailings disposal alternatives ATD #2 through ATD #5.

3.1.7 DISCUSSION

The standard approach for tailings disposal for the majority of mining operations in Northern Ontario and elsewhere in the world is a permanent surface impoundment, or Tailings Management Facility (TMF), confined as necessary with embankments to ensure containment. Tailings materials are often dewatered in conventional thickeners to a slurry density of up to about 55% solids by weight, or comprise conventional unthickened tailings with a slurry density of about 30 to 40% solids by weight, and are transported as a slurry to the TMF. Depending on the water content of the tailings delivered to the TMF, the typical approach in Northern Ontario

involves either conventional tailings management or thickened tailings management. A summary of the advantages and disadvantages of each tailings disposal method is presented in **Table 3-1**.

Table 3-1: Considered Tailings Disposal Methods - Advantages and Disadvantages

| DISPOSAL METHOD | ADVANTAGES | DISADVANTAGES |
|---|---|---|
| ATD #1 - In-Pit Tailings Disposal | Containment costs are substantially reduced Limited possibility of structural failure of the facility Attractive in the sense of putting material back from where it came Reduced disturbance footprint Likely close to process plant Reduced visual intrusion | Requires availability of a mined-out pit Ore body sterilization High tailings rate of rise resulting in large and long-term tailings consolidation Increased risk of groundwater contamination |
| ATD #2 – Dry Stack Tailings Disposal | Most efficient water conservation Low seepage losses from tailings stack Reduced disturbance footprint Minimal containment requirements (i.e., limited construction) Produces a stable tailings mass Increased potential for progressive reclamation More simple water management than other technologies | Higher capital costs than other technologies due in part to cost of filters Tailings must be conveyed or trucked to the TMF, potentially resulting in increased air quality impacts Increased power requirements Requires use of equipment for tailings placement/compaction Not a proven technology for sites with wet climates combined with high production rates Increased potential for dust management issues at the TMF Need to manage out-of-specification material |
| ATD #3 – Surface Paste Tailings Disposal | Less interstitial tailings water as compared to thickened and conventional tailings technologies Reduced seepage losses from the tailings Produces minimal seepage water (if any) when discharged Produces effectively a non-segregating tailings mass | Higher capital costs than other technologies due in part to cost of thickeners and pumps Higher operating costs than other technologies due to increased power requirements Need to manage out-of-specification material Not a proven technology at high production rates Limited use for surface disposal, with most successful applications involving paste backfill Berms and containment structures are typically still required |

| DISPOSAL METHOD | ADVANTAGES | DISADVANTAGES |
|--|---|---|
| ATD #4 – Thickened Tailings Disposal | Relatively low operating costs Less interstitial tailings water when compared to conventional tailings technology Tailings are less segregating than conventional tailings Proven technology at moderate to high production rates | Containment dams required Seepage issues depending on dam/impoundment type Considerable water to manage Increased cost over conventional tailings due to thickeners and pumping requirements Long term control and management is required, particularly if a water closure cover is employed |
| ATD #5 – Conventional Tailings Disposal | Lowest operating costs when compared with other technologies Proven technology at all ranges of tailings production | Least efficient water conservation Containment dams required Long term control and management is required, particularly if a water closure cover employed Seepage issues depending on dam/impoundment type Complex water management |
| ATD #6 – Co- Disposal of Tailings and Mine Rock | Strength and stability of co-mingled waste reduces consequences of static and dynamic loading of tailings alone Minimal containment requirements for comingled waste (i.e., limited construction) Combining the two waste streams increases the chemical stability reducing oxidation and the potential for acid mine drainage Potentially less complex water management than other considered tailings disposal technologies | Difficult to control the deposition strategy to optimise blending of the coarse and fine waste feeds Most economic where the two feeds can be pumped together or blended for in-pit storage (i.e., more challenging for surface disposal) A larger footprint area may be required to accommodate both waste streams |

3.2 PRE-SCREENING CRITERIA FOR ALTERNATIVE TAILINGS DISPOSAL METHODS

Section 2.3 of the MAA Guidelines (Environment Canada, 2011) identifies several legitimate pre-screening criteria, as follows:

- Would the TIA preclude future exploration or mining of a potential resource? A TIA located over an area where proven indicators of mineralization exist, or a reasonable indication of possible mineralization based on regional trends, may be one possible reason to exclude it from further consideration. Under this scenario, it may not be reasonable to conduct a lengthy exploration program to determine whether an economically viable resource exists in the area.
- Is any part of the mine waste disposal system unproven technology? If a specific disposal method relies on technology that has not been demonstrated to be effective in the context of the site under consideration, then it could justifiably be argued that the

alternative should be excluded from further consideration. It would not be reasonable to conduct lengthy fundamental or applied research to prove whether the technology may be successful.

- Will the TMF capacity be too small to store the proposed upper limit of tailings? Unless good rationale exists to have more than one TMF for any given project site (e.g., due to separation of tailings streams), it can justifiably be argued that a site that does not have sufficient capacity using reasonable, technically-viable containment strategies can be excluded from consideration.
- Will the TIA result in negative life of project economics? It is justifiable to exclude a
 TIA from further consideration if it would result in negative life-of-project total (overall)
 economics. When using project economics as pre-screening criteria, the mine waste
 disposal economics must be evaluated in consideration of the total project economics. It
 is conceivable that a more expensive mine waste disposal alternative could result in
 improved total project economics.

The criteria retained for pre-screening assessment of alternative mine waste disposal methods for the Magino Project builds on those suggested by the MAA Guidelines (Environment Canada, 2011), and include:

- Does the mine waste disposal system rely on proven technology? (Yes/No);
- Does the alternative have the capacity for a significant percentage of total tailings? (Yes/No);
- Is the alternative feasible with respect to project scheduling? (Yes/No); and
- Does the adoption/implementation of the disposal method result in negative life of the project economics? (Yes/No).

The results of the pre-screening assessment for the tailings disposal alternatives are presented in **Table 3-2**. Some of the factors that differentiate the use of the alternative tailings disposal (ATD) technologies include:

- Energy supply: Certain tailings disposal methods use more energy than other disposal
 methods, and thus require an expensive energy supply and greater overall carbon
 footprint. Specifically, dewatering and transport of filtered, thickened and paste tailings
 materials requires more energy than conventional tailings that uses only gravity.
 Similarly, certain types of co-disposal require more energy than conventional tailings,
 such as co-mingling that typically relies on dewatering of the tailings to a point (e.g., to a
 paste or filtered tailings) to facilitate mixing with the mine rock.
- **Climate:** Although certain tailings disposal methods have been implemented in wet or cold climates, their successful implementation may be aided by a dry climate.
- Production rates: Though they have been proposed for sites with moderate to high production rates, filtered and paste tailings disposal technologies remain unproven at certain production rates. However, thickened and conventional tailings disposal methodologies comprise proven technologies at mines with high production rates.

- Project economics: Prodigy must weigh carefully the trade-offs that come with using
 certain tailings disposal methods. For instance, reduced disposal area footprint and
 reduced water consumption, as is the case with filtered tailings, often come at the
 expense of higher up-front capital costs and operational costs, which is an expense that
 many mines cannot support.
- Operational predictability: Maintaining uniform deposition slopes on paste and certain types of thickened (e.g., cyclone sand dam) tailings disposal facilities has proven to be a challenge because of changes in ore characteristics, tailings gradations, and percent solids contained in the slurry. For filtered technology, coordination of the material handling, spreading and compaction with a high production rate are not simple tasks, combined with seasonally wet and/or cold weather. Also, filtered tailings and paste tailings technologies are more affected by upset conditions than other technologies, requiring contingencies for placement of "off-specification" material. Similar operational complexities to that of filtered and paste tailings can be expected for certain methods of co-disposal, particularly co-mingling.
- Topography: Some tailings disposal technologies are better-suited for flat topographies
 than others, though most tailings disposal technologies benefit from some natural
 topographic containment, which limits the need for paddock-style embankment
 construction. However, filtered tailings disposal or properly co-mingled tailings/mine rock
 disposal is possible in a variety of terrains, accounting for stability, operational and
 closure requirements.
- **Seismicity:** Concerns about dynamic stability of slopes constructed using tailings (e.g., filtered tailings or cyclone sand dams) may negate many of the perceived benefits, while engineered earthen or rock embankments designed to retain tailings slurry may be more robust in seismic situations (particularly when downstream construction is employed).
- Water: Filtered tailings technology significantly enhances water conservation, while
 paste tailings technology benefits similarly, albeit to a reduced degree. Water conserved
 by thickened tailings technologies are only marginally improved over conventional
 tailings disposal.

Of the various tailings disposal methods, thickened and conventional tailings deposition through the use of constructed surface impoundments remains the most common and typically least expensive of the ATDs. Other ATDs bring potential opportunities to conserve water, minimise space requirements, reduce environmental impacts, and improve closure conditions, but these opportunities must be analysed in detail before deciding on a specific method. While the industry has seen some success, the use of certain ATDs such as filtered tailings technology at high production rates remains unproven.

Table 3-2: Pre-Screening Summary for Alternative Tailings Disposal Methods for the Magino Project

| PRE-SCREENING CRITERIA | DATIONALE | | | ATD #2 DRY STACK | ATD #3 PASTE | ATD #4 THICKENED | ATD #5 CONVENTIONAL | ATD #6 CO-DISPOSAL ² |
|---|---|---|-----|---------------------|-----------------|---------------------|------------------------|------------------------------------|
| Does mine waste disposal system rely on proven technology? | If the ATD method relies on unproven technology at the Project site, then it can justifiably be argued that the alternative should be excluded from further consideration. | Is the technology proven in net-wet climates (i.e., precipitation exceeds evaporation) with moderately high tailings production rates (35,000 tpd)? | Yes | No | No | Yes | Yes | No |
| Does the alternative have the capacity for a significant percentage of total tailings? | If the ATD method cannot contain a significant portion of the tailings, it would not be the primary tailings impoundment method and another method would be required. | Is a single tailings disposal site feasible? | No | Yes | Yes | Yes | Yes | Yes |
| Is the alternative feasible with respect to Project scheduling? | If the ATD cannot accept tailings as required by the mine and milling production schedule, another tailings impoundment method will be required and the alternative should be removed from further consideration. | Can the disposal method be utilized from the onset of operation? | No | Yes | Yes | Yes | Yes | Yes |
| Does the adoption/implementation of the disposal method result in negative life of the Project economics? | It is justifiable to exclude a tailings disposal method from further consideration if its use would result in negative life of project total (overall) economics. | Is the disposal method anticipated to result in a significant increase in project cost (CAPEX & OPEX only)? | Yes | Yes | Yes | No | No | Yes |
| Sh | ould the ATD be carried forward to | the alternative assessment? | No | No | No | Yes | Yes | No |

Notes:

- 1. Blue shading denotes positive attributes for the considered alternative.
- 2. Responses to pre-screening criteria for ATD #6 assume co-mingling of the tailings and mine rock, while co-placement of tailings and mine rock (e.g., use of mine rock for embankment construction) may be considered as a component to alternatives ATD #2 through ATD #5.

3.2.1 IN-PIT TAILINGS DISPOSAL – ATD #1

Advantages of in-pit tailings storage include low tailings containment costs and low risk of tailings dam failure, as well as the tailings material is in effect returned to its original location. Disadvantages, however, include ore body sterilization, high tailings rate of rise, significant and lengthy rates of tailings consolidation, higher risks for groundwater contamination, as well as potentially increased difficulty in reclamation.

3.2.1.1 Considerations for the Magino Project

Current development plans for the Magino Project considers mining of the deposit within a 10-year time-frame and processing of the ore within a 10 to 12-year period. Unless additional resources are found, the pit will be depleted by Year 10 of operations. During mining, any tailings that are produced would have to be disposed of on the surface since the open pit will be actively mined. Also, as with any mine project, the pit has the potential to be expanded in the future based on project economics (e.g., reduced cut-off grade), whereby in-pit disposal could condemn future resources.

Up to approximately 30 Mt of ore is planned to be processed after the pit becomes available for use, which could conceivably be placed in the mined-out pit. Using this approach, up to 20% of the tailings generated during the life of mine could be disposed in-pit. The placement of tailings in the open pit after mining operations has ceased, and milling continues would have a limited effect on the selected on-land TMF footprint area as it would still be required to contain approximately 80% of the total tailings stream. However, a future in-pit tailings storage facility could enable the proponent to undertake early closure of the on-land facility while still operating the mill during the latter portions of the life of the project.

3.2.1.2 Pre-Screening Decision

The Magino Project site is a net-wet climate (i.e., precipitation exceeds evaporation) with an anticipated tailings production rate of 35,000 tpd. Based on these criteria, in-pit tailings disposal is considered a viable approach to tailings management, pending that an existing pit is available for use. However, an existing pit is not available for use at the forefront, and an out-of-pit disposal site is still required for the initial 10 years of operations, while it is more desirable to generate a single site for tailings disposal than rely on multiple storage locations. A reliance on more than one site for tailings storage would also have a significant negative effect on the life of project economics, requiring construction, operation and closure of two sites instead of one. Further, committing to in-pit disposal would limit the proponent's options to establish new mine plans toward the end of planned operations should economic conditions change, warranting additional mining or expansion of the resource. Therefore, this alternative is not considered feasible for the Magino Project and is eliminated from further consideration.

3.2.2 DRY STACK TAILINGS DISPOSAL – ATD #2

Since the Mount Polley tailings dam breach, which occurred in British Columbia in August 2014, a heightened interest in tailings dam safety has been realized, from the standpoint of the regulatory community, as well as the mine operators, design engineers, and the general public.

Shortly after the breach, British Columbia's Ministry of Energy and Mines (BCMEM) commissioned an expert engineering review panel to study the Mount Polley tailings dam breach (Morgenstern et al., 2015). The concluding remarks in this report state that the future of tailings management requires not only an improved adoption of best applicable practices (BAP), but also a migration to best available technology (BAT). They go on to say that "using filtered (or dry-stack) tailings technology is a prime candidate for Best Available Technology (BAT)" and recommended that "BAT should be actively encouraged for new tailings facilities and proposed mines." However, it is generally understood within the consulting and mining communities that dry stack tailings represent BAT only in specific locations, for specific mine plans, and under specific climatic conditions.

Projects that benefit most by the use of dry stack tailings technologies are typically characterized by one or more of the following attributes: (i) regions where water conservation is crucial; (ii) areas where high seismicity contraindicates some forms of cost-effective conventional tailings management (e.g., upstream-constructed embankments); (iii) topographic considerations that exclude conventional dam construction and/or viable tailings storage to dam material volume ratios; and (iv) the operating and/or closure liability of a conventional tailings impoundment is in excess of the incremental increase to develop a dry stack.

Although generally more expensive per tonne of tailings stored than conventional tailings disposal, filtering (or screening) costs can potentially be offset by improved storage efficiency and a smaller environmental footprint. The costs of moving tailings materials to the impoundment are higher than conventional slurry transport as trucks or conveyors are employed. Furthermore, an equipment fleet is typically required to spread and compact the material that is placed to form the structural shell zone.

As tailings are placed unsaturated, dry stack disposal facilities may be susceptible to oxidation. Although overall water losses are minor, provisions must still be made for the collection and management of seepage and surface water runoff.

Although dust generation is an issue for many dry stack tailings facilities, it can be managed by compaction of the materials, incorporating erosion protection on slopes, applying a tackifier, or covering the tailings surface by other means (e.g., progressive reclamation). Though more stable in seismically-active regions than certain other tailings disposal methods, site-specific testing and analyses are still required to characterise the dynamic performance and specific requirements for the dry stack facility.

Sites that exhibit seasonal or prolonged freezing weather conditions may be further challenged by dry stack technology, as frozen tailings cannot feasibly be placed and compacted. Along these lines, one thing that needs to be considered when designing a filtered tailings dry stack is where to place tailings that do not meet the project specifications with regard to water content (and or presence of ice). The general placement area may be designed to contain offspecification tailings for brief periods without need for a dedicated separate conventional tailings storage facility for upset conditions.

While there is precedence in the mining industry for the use of dry stack tailings disposal technologies, a dry stack tailings storage facility at Magino would be without precedence considering the wet climatic conditions and the relatively high production rates. The characteristics of existing and proposed viable mining operations using dry stack tailings disposal are compared to the Magino Project in **Table 3-3**. The majority of current dry stack tailings operations are characterized by tailings production rates less than 10,000tpd, with a couple of operating facilities approaching 20,000 tpd. The technology is advancing such that some proposed projects are demonstrating viability for filtering tailings with production rates in the range of 70,000 tpd (i.e., Rosemont). However, projects proposing to filter tailings at production rates higher than about 10,000 tpd are characterized by arid environments. Dry stack tailings technology is viewed as a challenge for the Magino site as it falls outside of the perceived limits of existing and proposed dry stack facilities with relation to climate and proposed production rate, as illustrated in **Figure 3-1** (for mean annual precipitation) and **Figure 3-2** (for mean net precipitation).

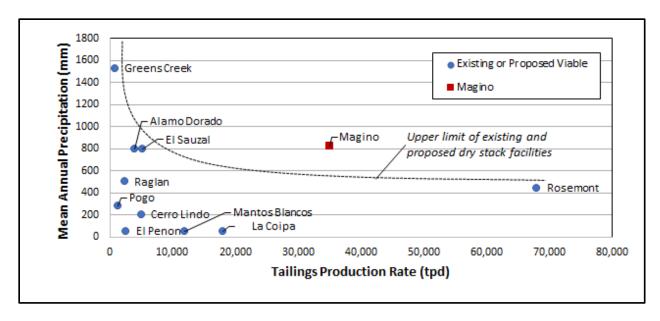


Figure 3-1: Existing and Proposed Dry Stack Facilities Compared to Magino Based on Mean Annual Precipitation and Tailings Production Rate

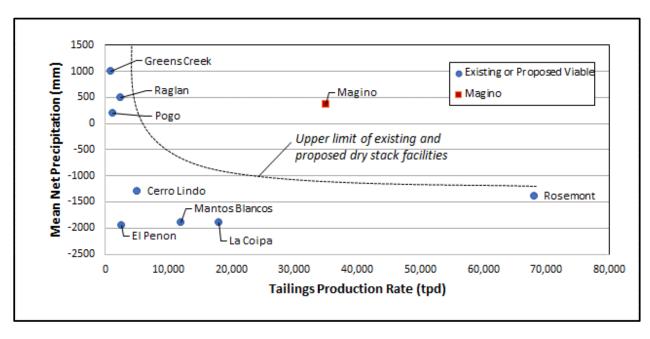


Figure 3-2: Existing and Proposed Dry Stack Facilities Compared to Magino Based on Mean Net Precipitation and Tailings Production Rate

Table 3-3: Dry Stack Tailings Case Studies Compared to the Magino Project

| SITE | RAGLAN | GREENS CREEK | POGO | MANTOS BLANCOS ¹ | LA COIPA | EL SAUZAL | EL PEÑON | CERRO LINDO | ALAMO DORADO | ROSEMONT (PROPOSED) | MAGINO (PROPOSED) |
|---|---|--|--|---|--|--|---|---|--|--|--|
| Tailings Production (tpd) | 2,400 | 800 | 1,250 | 12,000 | 18,000 | 5,300 | 2.600 | 5,000 | 4,000 | 68,000 | 35,000 |
| Tailings Technology | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Dry Stack | Thickened or Conventional |
| Reason for Tailings Technology Adoption | Site is permafrost, with technology selected to limit water in the TMF. Also, tailings solids are reactive. | Minimize footprint, remnant tailings not used for underground backfill, improve seismic stability. | Lack of a suitable conventional tailings site. | Conservation of water in arid environment and enhanced seismic stability. | Conservation of water in arid environment combined with cold climate and enhanced seismic stability. | Steep and rugged terrain near mill site selected for tailings placement. | Conservation of water in arid environment and enhanced seismic stability. | Conservation of water in arid environment and enhanced seismic stability. | Steep and rugged terrain near mill site selected for tailings placement. | Conservation of water in arid environment combined with enhanced regulatory acceptance | Challenged by dry stack technology due to climatic conditions and proposed tailings production rate |
| Equipment | Pressure Filters | Pressure Filters | Pressure Filters | Vibratory Screen Filter | Vacuum Filters | Vacuum Filters | Belt Filters | Belt Filters | Vacuum Filters | Pressure Filters | Conventional Slurry or Conventional Thickeners |
| Material Handling and Placement | Haul truck placement, spread by dozers and compacted | Haul truck, spread by dozer and roller compacted | Truck, co-disposal and with waste rock | Conveyor with mobile stacker (uncompacted) | Conveyor with mobile stacker (uncompacted) | Conveyed to stockpile, then hauled via truck to facility | Haul truck placement (uncompacted) | Haul truck placement, spread by dozers and compacted | Conveyed to stockpile, then hauled via truck to facility | Conveyor with mobile stacker | Slurry pipeline (gravity and pumping) |
| Solids Content at Tailings Disposal (%) | See below | See below | See below | 82-83% | 79-82% | See below | 82-83% | 87-88% | See below | See below | Proposed 55% by weight of solids |
| Moisture Content of Tailings at Disposal | Approx. optimum moisture content | Approx. optimum moisture content | Approx. optimum moisture content | See above | Approx. 2% above optimum moisture content | Approx. optimum moisture content | See above | See above | Approx. optimum moisture content | Within 3% (±) of the optimum moisture content | See above |
| Location | Canadian Arctic | Alaska, USA | Alaska, USA | Antofagasta Region, Chile | Atacama Region, Chile | State of Chihuahua, Mexico | Northern Chile | Province of Chincha, Peru | State of Sonora, Mexico | Arizona, USA | Northern Ontario |
| Mean Annual Temperature (°C) | -8°C | 5°C | -3°C | 16°C | Freezing year-round | 18°C | Note 3 | Note 3 | 26°C | 22°C | 3°C |
| Mean Annual Precipitation (mm) | 500 | 1,530 | 280 | <50 | <50 | 800 | <50 | 200 | 800 | 440 | 820 |
| Mean Annual Evaporation (mm) | Note 3 | 510 | Note 3 | >2,000 | >2,000 | 2,400 | >2,000 | 1,500 | Note 3 | 1,820 | 455 |

Notes:

1. The Mantos Blancos site disposes of the majority of their tailings in conventional tailings impoundments, while dry stacking is only used on the coarse-grained tailings (i.e., gruesos).

2. Data sources: (i) Lara & León (2011); (ii) AMEC (2008); and (iii) personal knowledge.

3. No data found for these parameters.

3.2.2.1 Consideration for the Magino Project

While dry stack tailings disposal technology at Magino may be considered technically feasible, it would be without precedence, as discussed above. Also, it would involve the following:

- High energy consumption for filtration equipment (additional greenhouse gas emissions);
- Operation of an additional equipment fleet (trucks and dozers) to transport, spread and compact tailings; to provide for access roads across the tailings; and for snow clearing (additional greenhouse gas emissions). Thus, a relatively large haulage and material handling fleet would be required to transport and compact the filtered tailings at the disposal site;
- A separate storage area would likely need to be provided for filtered tailings that cannot be placed during inclement weather or freezing conditions. This would be difficult to locate in the limited space available at the mine site;
- Dry stack tailings are more prone to wind and water erosion/dispersion;
- A water holding pond would be required for storage of impacted surface water runoff and management thereof, such as during spring runoff and other wet periods;
- A large filtration system would be required, or series of filters, considerably increasing
 the mechanical complexity of the tailings disposal option. Preliminary estimates indicate
 that over 22 large operating pressure filters would be required (in addition to another five
 units for stand-by to ensure system reliability). The capital and operating costs
 associated with such an extensive filtration plant are not considered feasible for the
 economic viability of the project; and
- The dry stack facility would involve compaction of tailings forming the outer shell to
 ensure structural stability. Since compaction issues could arise during freezing
 conditions, or during inclement weather (e.g., high snowfall or rainfall conditions), the
 failure risk, while low, would still be higher than slurry tailings deposition behind a rockfill
 embankment constructed during non-freezing conditions.

3.2.2.2 Pre-Screening Decision

The same general geographic locations would be considered for dry stack tailings disposal as for the other tailings disposal alternatives. As such, a single tailings disposal site is feasible, which could be utilized from the onset of operations. However, use of this disposal method is considered to offer limited environmental benefits over the other tailings disposal methods, while the in-plant water management methodology is considered more complex, as well as the concern with placement of off-specification material and/or material during inclement weather conditions. Furthermore, the added filtration and mobile equipment adds considerable capital and operating costs, which affects the economic viability of the project and increases overall greenhouse gas emissions resulting from the project. Finally, and most importantly for the Magino Project, implementation of this technology is well beyond any precedent with regard to

climatic conditions and tailings production rates. Therefore, this alternative is not considered feasible for the Magino Project and is eliminated from further consideration.

3.2.3 SURFACE PASTE TAILINGS DISPOSAL – ATD #3

Paste disposal has been successfully used as underground backfill for many years. Surface paste disposal, however, is relatively new and its application is limited, and expected to remain limited, to special circumstances. Surface paste tailings may be used at mines with low production rates with water and space constraints, as well as inexpensive energy. Due to the high percent solids of the paste and high viscosity, the paste flows follow the 'plug flow' concept (Watson, 2010). This requires the materials to have a minimum of 15% particles smaller than two micron (2 μ m) (Watson, 2010).

Producing and transporting paste is considered expensive due to the high capital and operating cost of paste thickeners and the need for positive displacement pumps. Typically, paste tailings are distributed in a surface facility in a similar manner to conventional tailings, using perimeter spigots. However, given the low water content, paste tailings form higher beach angles, requiring more careful consideration of embankment design (i.e., to accommodate the steeper beach angles). In some cases, paste tailings are spread using mechanical equipment, though challenged due to the low bearing capacity of the recently-placed paste tailings. Spreading of paste in a surface tailings disposal facility is a difficult operation since it requires mechanical equipment but cannot support any significant traffic loads.

Surface paste tailings are used at mines with low production rates with water and space constraints as well as inexpensive energy. Paste is best used to backfill underground workings. It is not recommended for moderate to high production mines or with coarse tailing materials.

3.2.3.1 Consideration for the Magino Project

The proposed processing rate for the Magino mill is 35,000 tpd. Paste technologies are used primarily for backfill of underground mines, and remain relatively unproven at mines with moderate to high production rates such as that proposed for the Magino Project. Further, as no underground mining is proposed to be associated with the Magino Project, the use of paste tailings technology is not considered desirable for the project.

3.2.3.2 Pre-Screening Decision

The same general geographic locations and footprint areas would be considered for a surface paste tailings disposal site as for the other tailings disposal alternatives, and the use of embankments for tailings containment are considered required. Paste is best used to backfill underground workings. The use of this disposal method is considered to offer limited environmental benefits over the other tailings disposal methods (i.e., the disturbance area remains the same), while the in-plant water management methodology is considered more complex. Furthermore, the added paste thickening and pumping equipment adds considerable capital and operating costs, which adversely impact the economic viability of the project. This technology is not recommended for moderate to high production mines or with coarse tailings materials. Finally, implementation of this technology is not considered viable at the proposed

tailings production rates, and provides limited advantage over thickened or conventional tailings disposal. Therefore, this alternative is not considered feasible for the Magino Project as it presents no environmental or economic advantages, and is eliminated from further consideration.

3.2.4 THICKENED TAILINGS DISPOSAL – ATD #4

As discussed in **Section 3.1.4**, thickened tailings technologies comprise several different approaches, with the use of thickeners to nominally decrease the water content of the tailings slurry considered more viable than the other approaches to thickened tailings (e.g., cyclones for sand dam construction) for the Magino Project. For instance, our experience with tailings dams constructed using cyclones for sand dam construction suggests that this is best employed for tailings storage within confined valleys with relatively short dam lengths. Given the site topography at Magino and the near project vicinity, development of a tailings dam requires effectively paddock-style construction, which would require significant volumes of cycloned sand materials. Also, cyclones can only be operated during non-freezing months, which would further challenge tailings operations given the large volume requirements.

With thickened tailings, thickeners are used in the process circuit to nominally decrease the water content of the tailings prior to pumping the thickened slurry to the TMF. The tailings are pumped to the TMF and spiggoted in a similar manner to a conventional system. Tailings thickeners are used to increase the slurry density at mines with various production rates, and have become a proven technology for most applications, including sites with moderate to high production rates. **Figure 3-3** provides a summary of the relative number of dewatered tailings facilities on a global scale through 2010, showing that thickened tailings technology is more commonly employed than the other methods. As a note, co-disposal as referenced in **Figure 3-3** refers to co-mingling where the fine tailings are dewatered (e.g., to a paste), and then mixed with the coarse mine rock materials.

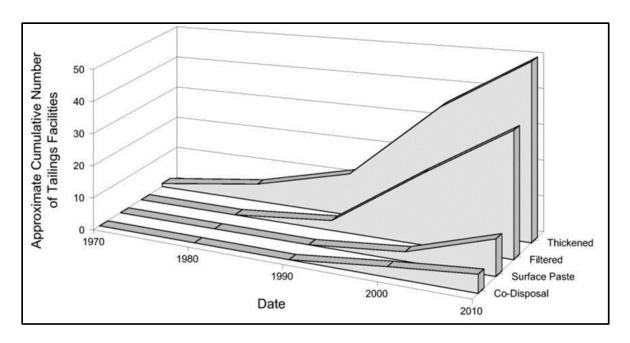


Figure 3-3: Trends in Dewatered Tailings Technology (Davies et al., 2010)

3.2.4.1 Consideration for the Magino Project

The proposed processing rate for the Magino Project is 35,000 tpd, which is well within the range of use for thickened tailings using thickeners in the mill. Given the wet environment, a nominal reduction in the amount of water contained in the tailings slurry is seen as a benefit for the project.

3.2.4.2 Pre-Screening Decision

Surface disposal of thickened tailings is anticipated to require effectively the same infrastructure as conventional tailings disposal for the Magino Project. The main benefit of using thickened tailings slurry over conventional tailings is the reduction in the amount of water contained in the tailings slurry being sent to the TMF. However, disadvantages to the approach include nominally increased costs and operating requirements for thickened tailings versus conventional tailings. Thickened tailings disposal for the Magino Project meets each of the pre-screening criteria, and is therefore carried forward in the MAA. During an August 23rd presentation to the Batchewana First Nation (BFN), some members expressed their preference for the thickened tailings disposal method.

3.2.5 CONVENTIONAL TAILINGS DISPOSAL – ATD #5

Conventional tailings disposal is widely used and remains one of the least expensive methods of disposal, recommended for use at any production rate. Selection of the embankment type, such as downstream, centerline, or upstream constructed embankments, must be based on the specific characteristics at each mine, including the tailings grind, climate, site seismicity, topographic constraints, and other factors. Where downstream embankment construction is

employed, in particular, these facilities are relatively simple to operate under varying weather conditions.

3.2.5.1 Consideration for the Magino Project

The proposed processing rate for the Magino Project is 35,000 tpd, which is well within the range of use for conventional tailings. Given the availability of suitable mine rock material for embankment construction at the site, development of the more significant embankments that would be required for storage of conventional tailings (and potentially thickened tailings) is not only achievable, but significantly reduces the amount of mine rock that would need to be managed in a separate mine rock management facility. The decreased costs and operating requirements for conventional tailings as compared to thickened tailings are seen as potential benefits.

3.2.5.2 Pre-Screening Decision

As discussed in the preceding sections, conventional tailings disposal has many of the same disadvantages as thickened tailings disposal. The main benefit to the use of thickened tailings over the use of conventional tailings is the removal of nominal amounts of water in the process circuit prior to delivery to the TMF. However, conventional tailings disposal remains a dependable and cost effective method for disposal of mine tailings. As such, conventional tailings disposal for the Magino Project meets each of the pre-screening criteria, and is therefore carried forward in the MAA.

3.2.6 CO-DISPOSAL OF TAILINGS AND MINE ROCK – ATD #6

As discussed in **Section 3.1.6**, the approach to co-disposal of tailings and mine rock that involves co-mingling was assessed through the pre-screening process, while co-placement of tailings and mine rock (e.g., use of mine rock for embankment construction, or dumping of mine rock into a mined-out pit alongside tailings) could be considered with any of the other tailings disposal alternatives.

3.2.6.1 Consideration for the Magino Project

When tailings are co-mingled, the tailings are typically dewatered to the point of a paste or filtered tailings prior to mixing with the mine rock. As such, the majority of the operational complexities discussed in the preceding sections for paste or filtered tailings would also apply for co-mingling as it relates to the Magino Project, particularly with respect to the proposed production rates and wet climatic conditions. An additional operational complexity is then introduced through the process of mixing the two waste streams together. Co-mingling technology is evolving and developing, with few mines having adopted the technology to-date, as illustrated in **Figure 3-3** (Davies et al., 2010).

3.2.6.2 Pre-Screening Decision

As discussed in the preceding sections, co-mingling of tailings with mine rock not only has many of the same operational complexities as paste or filtered tailings, but additional complexity is introduced via the mixing process. Paste thickening and filtering of the tailings are considered without precedent at the production rates proposed, and climatic conditions experienced, at the Magino site. Also, co-mingling of the two waste streams may result in the need for a larger facility, or multiple facilities, to contain the increased waste volume. Further, the increased equipment requirements (thickening, pumping and/or conveying, mixers, etc.) adds considerable capital and operating costs, which adversely impact the economic viability of the project. Therefore, co-mingling is not considered feasible for the Magino Project and is eliminated from further consideration.

3.2.7 ALTERNATIVE TAILINGS DISPOSAL METHODS – PRE-SCREENING SUMMARY

As discussed in the preceding sections, and as illustrated in **Table 3-2**, both thickened tailings disposal (ATD #4) and conventional tailings disposal (ATD #5) are considered viable options for the Magino Project, and are carried forward in the MAA.

3.3 INITIAL SITE SELECTION FACTORS

The open pit is located at the southeast corner of the Magino property, overlying a previously-developed underground mine. Important considerations for the identification of candidate sites include the following:

- Topographic containment: Good topographic confinement reduces the requirements
 for dams and minimizes the length and height of containment structures. Natural
 containment is preferred for long-term stability. The embankment fill to tailings storage
 capacity ratio is an important consideration where containment structures are required,
 with lower values indicating improved storage efficiency. Containment dams are typically
 the most significant proportion of total costs related to tailings storage when surface
 impoundments for conventional or thickened tailings slurry are used.
- Expandability: The volume of tailings and storage requirement for which this
 assessment is being completed is based on the anticipated mineral reserves. As a
 general preference, the TIA should have the potential for expansion should additional
 mineral reserves be proven and exploited.
- **Existing land use:** Considerations related to property ownership and rights, population and housing, recreation, transportation and service corridors, transmission line, easements and rights-of-way should be taken into consideration.
- Aboriginal traditional land use: Information about how recent and current traditional
 practices are carried out on the land potentially affected should be considered as part of
 the assessment process.

- **Proximity to process plant:** From an operational, maintenance and reliability perspective, shorter pipeline lengths are preferable thus reducing the potential adverse effects of accidents and malfunctions. The site should be easily accessible.
- Watersheds and drainage: Restraining activities to as few watersheds as possible is preferred. Locating a TIA in the upper reaches of a watershed(s) minimizes water management requirements, including the need for diversion works.
- Facility footprint: A smaller physical footprint is generally preferred as it has less direct environmental impacts, and also often translates to less runoff to manage and therefore lower operational costs and environmental risks.
- **Provide downstream buffering capacity:** Availability of additional surface area downstream of the disposal facility allows for easier collection of effluent, catchment of seepage, and the establishment of a collection/polishing pond and/or treatment facilities.

A total of ten (10) candidate sites have been identified for the pre-screening assessment. The locations of these alternative sites are presented on **Map 3**. **Table 3-4** provides a brief characterization of each candidate sites. An item of note regarding the candidate sites is that Site G is the only site contained within the property boundaries for the Magino Project.

The embankment quantities and available tailings storage capacity for each of the candidate sites was evaluated based on the following assumptions:

- Embankment geometry assumes 2.5H:1V (horizontal:vertical) upstream and downstream slopes, with 15 m crest width;
- A maximum embankment height of 100 m was assumed, though many of the sites were too confined to allow development of a 100 m high embankment without significant loss of tailings storage capacity;
- Embankment construction is assumed to comprise the downstream construction method, which provides for the most robust embankment volumes and enhanced safety requirements;
- Tailings storage capacity developed assuming 0% percent surface slopes on the tailings with 2 m freeboard, which is considered appropriate for this level of assessment (i.e., only used for preliminary facility sizing);
- Tailings capacities assume an in-place dry density of 1.4 tonnes per cubic meter (t/m³);
 and
- Rockfill assumed for embankment construction with a dry density of 2.0 t/m³.

Preliminary embankment grading was developed for each of the candidate sites. With the exception of Site G, which is within the Magino property boundary, available topography was provided with a 10-meter contour interval, which is considered suitable for development of preliminary screening-level layouts such as these.

Table 3-4: Characteristics of Candidate Tailings Disposal Sites

| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | SITE A | SITE B | SITE C | SITE D | SITE E | SITE F | SITE G | SITE H | SITE I | SITE J |
|---------------|---|--|-----------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------------|
| | | Stream Length Affected | m | 1,700 | 500 | 0 | 1,500 | 1,840 | 3,800 | 4,000 | 700 | 2,170 | 3,100 |
| | Aquatic Habitat | Waterbody (lakes, ponds or wetlands) Impacted | no. | 0 | 0 | 0 | 2 | 5 | 2 | 2 | 1 | 0 | 0 |
| - | | Area of Waterbodies Impacted | ha | 0 | 0 | 0 | 0.5 | 25 | 4 | 8 | 9 | 0 | 0 |
| nment | Lhudrolo av / | Number of Additional Watersheds Affected | no. | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 3 |
| Environmental | Hydrology / Hydrogeology | Number of Stream Crossings by Tailings Pipeline and Road | no. | 2 | 1 | 3 | 3 | 3 | 2 | 0 | 1 | 1 | 2 |
| | Terrestrial Resources - General | Area Available for Tailings Storage | ha | 336 | 285 | 267 | 232 | 270 | 403 | 385 | 323 | 322 | 433 |
| | Terrestrial Resources - Air Quality / Noise | Straight-Line Distance from Project Boundary | km | 3.8 | 3.7 | 4.6 | 1.1 | 0.0 | 0.5 | Within | 3.8 | 0.3 | 5.0 |
| | | Tailings Storage | Mm ³ | 100 | 90 | 89 | 57 | 102 | 135 | 110 | 70 | 113 | 184 |
| | | Capacity (Note 2) | Mt | 140 | 126 | 125 | 80 | 143 | 189 | 154 | 98 | 158 | 258 |
| | Conventional or Thickened | Ability to Store LOM Tailings | Yes/No | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| Technical | Tailings Impoundment | Volume of Embankment Fill | Mm ³ | 132 | 108 | 90 | 94 | 88 | 83 | 75 | 72 | 84 | 114 |
| hr. | | (Note 3) | Mt | 264 | 216 | 180 | 188 | 176 | 166 | 150 | 144 | 168 | 228 |
| Тес | | Embankment Fill to Tailings Storage Volume | ratio | 1.3 | 1.2 | 1.0 | 1.6 | 0.9 | 0.6 | 0.7 | 1.0 | 0.7 | 0.6 |
| | Embankment | Height of Embankment | m | 90 | 90 | 80 | 80 | 80 | 80 | 80 | 100 | 80 | 90 (Note 1) |
| Notos | Operational Complexity | Access Pipeline and Road Length | km | 12.4 | 7.0 | 8.7 | 7.1 | 3.8 | 9.0 | 0.6 | 11.9 | 3.9 | 9.3 |

The embankment height for Site J can be reduced from 90 m as the current layout more than exceeds the required tailings storage capacity for the project; and
 Tailings storage capacity calculated assuming an in-place tailings dry density of 1.4 t/m³; and
 Embankment fill tonnage calculated assuming use of rockfill with an in-place dry density of 2.0 t/m³.

3.4 DESCRIPTION OF CANDIDATE SITES

Alternative locations were selected to lie within approximately a 10 km radius of the open pit in order to maintain a compact overall project footprint, and to reduce the length of pipelines for pumping, including reduction of associated risks.

As described in **Section 4**, the topography of the area shown in **Map 1** is relatively flat, ranging from about 385 meters (m) to 450 m above mean sea level (AMSL) and is characterized by low ridges and hills up to 50 m high, flanked by generally flat areas of glacial outwash, swamps, and numerous lakes and bogs. Within 25 km of the Magino Property, the highest point of elevation is 19.5 km southeast of Dubreuilville at 529 m AMSL. To the north, there exists a high ridge at 469 m AMSL along the road that connects Dubreuilville with Lochalsh. At approximately 19 km to the east, the highest point of elevation is at Manitou Mountain at 476 m AMSL.

Approximately 25 km to the northwest of the Magino Property, the highest point of elevation is 525 m AMSL. Much of this area is set within Wildlife Management Unit (WMU) 32 Eco region 3E. Ecoregion 3E is generally characterized as boreal forest underlain generally by granitic or gneissic bedrock. Soil in the western portion of the Ecoregion is generally poorly developed. Over the entire Ecoregion, mixed forest and coniferous forest comprise approximately 30% of the land area each (i.e., 60% total), while sparse forest comprises 11% and deciduous forest comprises 7%. Eight (8) percent of the Ecoregion has been cut over, and 7% is comprised of lakes and watercourses. The regional area at the mine site is dominated by early successional White Birch and Trembling Aspen. The western portion of WMU 32 is 4,375 square kilometres (km²) and is bounded by: the CP rail line to the north and east; Highway 101 and the Michipicoten River to the south; and Highway 17 and the old ACR rail line to the west. Based on the geological, topographical and biological features of the area, extending the radius would not provide a different range of candidate sites than those already described in **Table 3-4**.

With respect to Indigenous Interests and Socio-Economic considerations (non-Indigenous land uses), the following statements apply to the area containing the ten alternative candidate sites:

• Based on the Indigenous Traditional Knowledge (TK)/Traditional Land Use information that Prodigy has received at the time of writing from five different groups¹, the larger area is included in all or part of the traditional territories of the groups (First Nations and Métis) that have provided Prodigy with TK information (i.e., reports, maps). Both historic and current traditional uses are present in the area, including camp sites/cabins, trapping, hunting, fishing, plant gathering and cultural activities. The level of detail provided in the reports and maps provided by the groups is, in some cases, not specific to the locations of the ten candidate sites, or even the Magino Project site. Where this information is available for a candidate site from the reports Prodigy has, it has been summarized below, while respecting the confidentiality of the information in terms of specific mapped locations.

¹ TK information has been received from (in alphabetical order) Batchewana First Nation (BFN), Métis Nation of Ontario (MNO), Michipicoten First Nation (MFN), Missanabie Cree First Nation (MCFN), and the Red Sky Métis Independent Nation (RSMIN).

• In terms of non-Indigenous land uses in the area containing the ten candidate sites, Prodigy is in possession of more detailed information regarding the candidate sites located more closely to the Magino Project site (i.e., Sites D, E, G, and I). Outdoor recreational activities such as hunting, fishing, camping, and ATVing are common in the larger area. Mining and forestry activities also occur in the area. Each of the candidate sites are associated with licenced areas for trapping, bear management and baitfish harvesting, as indicated in the overviews provided below.

A brief overview of each candidate site as it relates to the Magino Project requirements is presented in the following sections.

3.4.1 CANDIDATE SITE A

3.4.1.1 Location & Accessibility

Candidate Site A is located approximately 3.8 km northeast of the Magino property boundary. An estimated 12.4 km access road would be required to accommodate pipeline routing from the proposed plant site, which would cross Richmont land holdings. The site comprises an area of approximately 336 ha.

3.4.1.2 Storage Capacity

The site topography is relatively flat, with no pronounced natural depressions. Though a hill is present in the southwest corner of the site that can be used to provide some limited natural containment, an embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 90 m provides containment for an estimated 140 Mt of tailings, which is less than the design criteria life of mine (LOM) storage requirement of 150 Mt. Though additional storage capacity may be achieved by nominally increasing the embankment height, the embankment fill to tailings storage ratio is estimated as 1.3. A ratio in excess of 1.0 signifies that more embankment fill is required to contain the tailings than the volume of tailings storage provided, indicating that the site provides inefficient tailings storage.

3.4.1.3 Land Use and Ownership

The surface and mineral rights within Site A are owned by a third party, and there are multiple pending mineral claims in the area. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available. Acquisition of Site A for development of a TMF would be difficult. Access to Site A crosses Richmont's active mine, located immediately east of the Magino site, which may be a limiting factor.

3.4.1.4 Environmental Considerations

Site A would overprint an estimated 1,700 m (linear) of stream bed and has the potential to extend impacts to three additional watersheds:

- The upper reaches of the Webb-Goudreau watershed (Lake Maskinonge drainage system);
- The upper reaches of the Willigar Lake watershed; and
- The Trout Lake and Lochalsh watershed.

Seepage, surface water runoff, and water quality control ponds would discharge into the upper reaches of these three watersheds. In addition, the tailings pipeline would follow the existing route 48 and come into the TMF north of Lake Maskinonge. Tailings and return water pipelines and associated access roads would require two stream crossings. Site A is located approximately 1 km northeast of Maskinonge Lake.

3.4.1.5 Socio-Economic Considerations

Site A is approximately 8 km west from Lochalsh and the surrounding area is considered a primary hunting area by residents of Dubreuilville and several Indigenous groups. Site A is located in proximity to ancestral traditional camps, current and historical camps and cabins identified by Missanabie Cree First Nation (MCFN) (Mushkegowuk Environmental Research Centre [MERC], 2014; Figure 1 Traditional Occupancy Values). Site A is within several kilometers of an identified "protection spot and gathering place" at Trout Lake (MERC, 2014; Figure 2: Protection Spot and Gathering Place Locations). During a recent presentation with MCFN, there was general agreement that Site A lies within the current land use area of MCFN. The Métis Nation of Ontario (MNO) consultation committee has identified a current and/or historic land route which extends through Site A (MNO, 2014; Figure 23: Land and Water Routes [Current and Historic]). The BFN have indicated a cabin/trapping area some distance south of Site A at Pine Lake (BFN, 2015; Map 4).

Site A includes parts of two licensed trapline areas (WA-047 and WA-046), part of a bear management area (WA32-002), and parts of two licensed baitfish areas (WA0071 and WA0072).

3.4.2 CANDIDATE SITE B

3.4.2.1 Location & Accessibility

Candidate Site B is located approximately 3.7 km northeast of the Magino property boundary, directly to the southeast of Site A. An estimated 7.0 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 285 ha. Site B is located in close proximity to the Edward Mine undertaking.

3.4.2.2 Storage Capacity

The site topography is relatively flat, with no pronounced natural depressions. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 90 m provides containment for an estimated 126 Mt of tailings, which is less than the design criteria LOM storage requirement of 150 Mt. Though additional storage capacity

may be achieved by nominally increasing the embankment height, the embankment fill to tailings storage ratio is estimated as 1.2, indicating that the site provides inefficient tailings storage.

3.4.2.3 Land Use and Ownership

The surface and mineral rights within Site B are owned by third parties (Richmont and Edwards Mines), and multiple pending mineral claims exist in the area. Sterilization of mineral resources within the area is unknown as drilling results are not available. Site B is approximately 8 km from Lochalsh and directly west of the Edwards Mine undertaking. Acquisition of Site B for development of a TMF is considered difficult. Access to Site B crosses Richmont's active mine, located immediately east of the Magino site, which maybe be a limiting factor.

3.4.2.4 Environmental Considerations

From an environmental standpoint, Site B would overprint an estimated 500 m (linear) of stream bed and has the potential to extend impacts to two additional watersheds:

- The upper reaches of the Webb-Goudreau watershed; and
- The Trout Lake watershed, which flows towards Lochalsh.

Both Maskinonge Lake (0.5 km from Site B) and Pine Lake (0.5 km from Site B) could receive seepage and runoff from the TMF. Tailings and return water pipelines and associated access roads would require one stream crossing along route 48.

3.4.2.5 Socio-Economic Considerations

Similar to Site A, Site B is used for recreational purposes by residents of Dubreuilville. Site B is located in proximity to ancestral traditional camps, current/historical camps and cabins identified by MCFN (MERC, 2014; Figure 1: Traditional Occupancy Values). Site B is within several kilometers of an identified "protection spot and gathering place" at Trout Lake (MERC, 2014; Figure 2: Protection Spot and Gathering Place Locations). During a recent presentation with MCFN, there was general agreement that Site B lies within the current land use area of MCFN. The BFN have indicated a cabin/trapping area some distance south of Site B (BFN, 2015; Map 4).

Site B includes parts of two licensed trapline areas (WA-047 and WA-046), part of a bear management area (WA32-002), and parts of two licensed baitfish areas (WA0071 and WA0072).

3.4.3 CANDIDATE SITE C

3.4.3.1 Location & Accessibility

Candidate Site C is located approximately 4.6 km southeast of the Magino property boundary. An estimated 8.7 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 267 ha.

3.4.3.2 Storage Capacity

The majority of the site topography is relatively flat, with a ridge in the central portion of the site area. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 80 m provides containment for an estimated 125 Mt of tailings, which is less than the design criteria LOM storage requirement of 150 Mt. Though additional storage capacity may be achieved by nominally increasing the embankment height, the embankment fill to tailings storage ratio is estimated as 1.0, indicating that the site provides relatively inefficient tailings storage.

3.4.3.3 Land Use & Ownership

The surface and mineral rights within Site C are owned by multiple third parties (Richmont, Grant Lake Forest Resources Ltd., Josephine Forest Resources Ltd., and Naveau Resources Forest Ltd.). There are multiple pending mineral claims in the area, mostly owned by Richmont. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available. Acquisition of Site C for development of a TMF is considered difficult.

3.4.3.4 Environmental Considerations

Site C is contained within the upper reaches of the Cawdron Lake watershed, which, has not been impacted by historical mining activities. In addition to impacts to the Webb-Goudreau watershed, which is the proposed location of the mine, locating the TMF on this site would extend the project impacted area to the Cawdron Lake watershed. Site C is not anticipated to overprint any stream bed. Tailings and return water pipelines and associated access roads would require three stream crossings.

3.4.3.5 Socio-Economic Considerations

Site C is characterized by mineral and forest land use. Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site C, though MCFN has indicated historical use sites to the east, near Cawdron Lake. As discussed above, acquisition of Site C for development of a TMF is considered difficult.

Site C includes parts of two licensed trapline areas (WA-057 and WA-058), part of a bear management area (WA32-011), and parts of two licensed baitfish areas (WA0072 and WA0079).

3.4.4 CANDIDATE SITE D

3.4.4.1 Location & Accessibility

Candidate Site D is located approximately 1.1 km southeast of the Magino property boundary. An estimated 7.1 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 232 ha.

3.4.4.2 Storage Capacity

The site topography is relatively flat, with no pronounced natural depressions. However, the site is narrow in order to limit impacts to adjacent waterbodies. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 80 m provides containment for only an estimated 80 Mt of tailings, which is approximately half of the design criteria LOM storage requirement of 150 Mt. The embankment fill to tailings storage ratio is estimated as 1.6, which is the highest value of the sites considered, indicating that the site provides the least efficient tailings storage of the considered sites.

3.4.4.3 Land Use & Ownership

The surface and mineral rights within Site D are owned by a third party, and there are multiple pending mineral claims in the area, mostly owned by Richmont. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available. Acquisition of Site D for development of a TMF is considered difficult.

3.4.4.4 Environmental Considerations

Site D is contained within the downstream portion of the Webb-Goudreau watershed. The site is located on a former iron ore mining site and was seriously impacted by those operations (i.e., abandoned mine workings; contaminated runoff from abandoned sites). The development of a TMF on Site D would not only require reclamation of abandoned mine workings, but could also condemn available future mineral resources as active mining claims exist on the site. In addition, Site D would overprint two waterbodies and is anticipated to overprint an estimated 1,500 m (linear) of stream bed. Tailings and return water pipelines and associated access roads would require three stream crossings.

3.4.4.5 Socio-Economic Considerations

Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site D, though MCFN has indicated historical use sites to the east, near Cawdron Lake. The MNO have identified the area in the vicinity of Site D as an area of Traditional Knowledge and cultural practices (MNO, 2014; Figure 22: Areas of Traditional Knowledge and Cultural Practices). As discussed above, acquisition of Site D for development of a TMF is considered difficult.

Site D includes part of a licensed trapline area (WA-056), parts of two bear management areas (WA32-002 and WA32-010), and part of a licensed baitfish area (WA0080).

3.4.5 CANDIDATE SITE E

3.4.5.1 Location & Accessibility

Candidate Site E is located immediately south of the Magino property boundary, and partially within the property boundary. An estimated 3.8 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 270 ha.

3.4.5.2 Storage Capacity

The site topography has moderate relief, with a hill in the northern portion of the site that limits storage capacity, and another hill in the southwest portion of the site that would be abutted by embankment. However, an embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 80 m provides containment for an estimated 143 Mt of tailings, which is less than the design criteria LOM storage requirement of 150 Mt. Though additional storage capacity may be achieved by nominally increasing the embankment height, the embankment fill to tailings storage ratio is estimated as 0.9. Though an improvement over Sites A through D, Site E also provides relatively inefficient tailings storage.

3.4.5.3 Land Use & Ownership

The surface and mineral rights within Site E are owned primarily by a third party, and there are multiple pending mineral claims in the area, mostly owned by Richmont. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available. Acquisition of Site E for development of a TMF is considered difficult.

3.4.5.4 Environmental Considerations

Like Site D, development of a TMF on Site E would not only require reclamation of abandoned mine workings and addressing other environmental impacts of previous iron ore mining, but could also condemn available future mineral resources. As such, Site E has effectively the same disadvantages as Site D.

Site E has the potential to impact the lower portion of the Webb-Goudreau watershed, and would overprint up to an estimated 1,840 m (linear) of stream bed as well as five waterbodies, including Teare Lake, which has been impacted by previous mining operations owned by Richmont. Tailings and return water pipelines and associated access roads would require three stream crossings.

3.4.5.5 Socio-Economic Considerations

Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site E; however, the MNO have identified the area containing Site E as an area of Traditional Knowledge and cultural practices (MNO, 2014; Figure 22: Areas of Traditional Knowledge and

Cultural Practices). As discussed above, acquisition of Site E for development of a TMF is considered difficult.

Site E includes part of a licensed trapline area (WA-056), part of a bear management area (WA32-010), and parts of two licensed baitfish areas (WA0080 and WA0071).

3.4.6 CANDIDATE SITE F

3.4.6.1 Location & Accessibility

Candidate Site F is located about 0.5 km southwest of the Magino property boundary. An estimated 9.0 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 403 ha. Access to this site would also require crossing of the Algoma Central Railway line, which is located immediately to the east of Site F. While passenger service on this line ceased in 2015, the line may still have other use and lobbyists are working to reopen passenger service, which is used to access various camps and lodges along the line.

3.4.6.2 Storage Capacity

The site topography is relatively gentle, with a natural depression near the center of the footprint area. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 80 m provides containment for an estimated 189 Mt of tailings, which is more than the design criteria LOM storage requirement of 150 Mt. Therefore, the embankment height can be reduced to balance with the LOM storage requirements. The embankment fill to tailings storage ratio is estimated as 0.6, which is a significant improvement over Sites A through E.

3.4.6.3 Land Use & Ownership

The surface and mineral rights within Site F are owned primarily by a third party. Site F is characterized by fewer mineral claims than other sites. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available.

3.4.6.4 Environmental Considerations

Site F would overprint up to an estimated 3,800 m (linear) of stream bed and has the potential to impact two watersheds:

- The Middleton watershed to the west; and
- The Summit Lake watershed, which is affected by proposed mining operations.

As such, this site would extent potential project effects into one additional watershed (i.e., Middleton). Tailings and return water pipelines and associated access roads would require two stream crossings. The TMF would overprint two waterbodies.

3.4.6.5 Socio-Economic Considerations

Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site F. One or more cottages/camps are present on Summit Lake, immediately adjacent to Site F. The small seasonal settlement at Goudreau, located immediately east of Site F, has 10 to 15 cabins. It is understood that 11 owners with 18 parcels of land are present in the Goudreau area. Based on land ownership considerations, acquisition of Site F for development of a TMF is considered difficult.

An outfitter (traplines and bear management areas in the vicinity) uses four of the cabins for his business. There are also two cabins/camps on Herman Lake to the near northeast of Site F, immediately west of the Magino site. Herman Lake is popular for pike, pickerel and whitefish fishing. Site F includes part of a licensed trapline area (WA-055), part of a bear management area (WA32-044), and part of a licensed baitfish area (WA0081).

3.4.7 CANDIDATE SITE G

3.4.7.1 Location & Accessibility

Candidate Site G is the only of the considered sites that is contained fully within the Magino property boundary. Given the close proximity to the proposed plant site, an estimated 0.6 km access road would be required to accommodate pipeline routing from the plant. The site comprises an area of approximately 385 ha.

3.4.7.2 Storage Capacity

The site topography provides natural confinement on the north due to the presence of a ridge, with gently sloping topography elsewhere. An embankment would be required for the majority of the TMF perimeter, though some natural confinement is provided on the north side of the facility. Development of an embankment with a height of approximately 80 m provides containment for an estimated 154 Mt of tailings, which is approximately equivalent to the design criteria LOM storage requirement of 150 Mt. The site provides the potential for vertical expansion of the embankments to provide additional tailings storage. The embankment fill to tailings storage ratio is estimated as 0.7, which is a significant improvement over Sites A through E, and similar to Site F.

3.4.7.3 Land Use & Ownership

The surface and mineral rights within Site G are owned by Prodigy. Sterilization of mineral resources within the area has been performed.

3.4.7.4 Environmental Considerations

Site G is contained within two watersheds:

• The upper section of the McVeigh Creek (Summit Lake) watershed, which also contains the proposed mine; and

The lower section of the Otto-Herman watershed.

Site G would overprint two wetlands and is anticipated to overprint an estimated 4,000 m (linear) of stream bed, mainly the upper reaches of McVeigh Creek, which is considered poor fish habitat. Tailings and return water pipelines and associated access roads would not require any stream crossings.

3.4.7.5 Socio-Economic Considerations

The land use proposed for Site G is mining. Because Site G is owned by Prodigy, the site is considered suitable for development of a TMF. A trail located north of Site G, between Herman Lake and Mountain Lake, is historically and currently used by MFN members (MFN, 2014; Sites A09a and C089). The MNO have identified locations immediately north and west of Site G (within the overall Project footprint) as sites of traditional ecological knowledge, and a larger area to the southeast of Site G as an area of traditional ecological knowledge and cultural practices (MNO, 2014; Figure 22: Areas of Traditional Knowledge and Cultural Practices). Traditional ecological knowledge includes such features as fish spawning locations, salt licks, and cyclical knowledge of animal populations.

Site G includes parts of two licensed trapline areas (WA-047 and WA-056), part of a bear management area (WA32-044), and part of a licensed baitfish area (WA0071).

3.4.8 CANDIDATE SITE H

3.4.8.1 Location & Accessibility

Candidate Site H is located about 3.8 km northwest of the Magino property boundary. An estimated 11.9 km access road would be required to accommodate pipeline routing from the proposed plant site. Access to this site would also require crossing of the Algoma Central Railway line, which is located between the Magino site and Site H. While passenger service on this line ceased in 2015, the line may still have other use and lobbyists are working to reopen passenger service, which is used to access various camps and lodges along the line. Located approximately 5 km south of Dubreuilville, Site H is the closest of the considered sites to the town. The site comprises an area of approximately 323 ha.

3.4.8.2 Storage Capacity

The site area contains several hills and ridges that significantly limit the available tailings storage capacity. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 100 m provides containment for only an estimated 98 Mt of tailings, which is considerably less than the design criteria LOM storage requirement of 150 Mt. The embankment fill to tailings storage ratio is estimated as 1.0, indicating that the site provides inefficient tailings storage.

3.4.8.3 Land Use & Ownership

With regard to land ownership, the surface and mineral rights within Site H are owned by a third party. Site H is characterized by fewer mineral claims than other sites. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available.

3.4.8.4 Environmental Considerations

Site H would overprint up to an estimated 700 m (linear) of stream bed and has the potential to extend impacts to two additional watersheds west of Dubreuilville:

- The Iris Lake watershed to the south; and
- The Magpie River watershed to the north.

Tailings and return water pipelines and associated access roads would require one stream crossing. The TMF would overprint one waterbody.

3.4.8.5 Socio-Economic Considerations

Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site H. Site H is in proximity to the Dubreuilville cemetery. One of Richmont Mine's camp accommodations (at Green Lake) is located to the northeast of Site H. It appears that the Dubreuilville sewage lagoons may be located just to the northeast of Site H, to the west of Lac Way/the start of the Goudreau Road. Based on land ownership considerations, acquisition of Site H for development of a TMF is considered difficult.

Site H includes part of a licensed trapline area (WA-048), parts of one or more bear management areas (WA-048), and part of a licensed baitfish area (WA0070).

3.4.9 CANDIDATE SITE I

3.4.9.1 Location & Accessibility

Candidate Site I is located 0.3 km north of the Magino property boundary. An estimated 3.9 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 322 ha.

3.4.9.2 Storage Capacity

The site topography is relatively flat, with a natural depression in the central portion, and a hill on the northeast corner of the site. The hill in the northeast portion of the site provides some natural confinement, with an embankment required for approximately 90 percent of the TMF perimeter. Development of an embankment with a height of approximately 80 m provides containment for an estimated 158 Mt of tailings, which is greater than the design criteria LOM tailings of 150 Mt. Vertical expansion of the area is possible to increase the storage capacity, but would have increased potential for impacting waterbodies that are currently being avoided.

The embankment fill to tailings storage ratio is estimated as 0.7, which is an improvement over Sites A through E and H, and similar to Sites F and G.

3.4.9.3 Land Use & Ownership

The surface and mineral rights within Site I are owned by a third party. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available.

3.4.9.4 Environmental Considerations

Site I would overprint up to an estimated 2,170 m (linear) of stream bed and has the potential to impact two watersheds:

- The middle reaches of the Dreany Lake watershed; and
- The upper reaches of the Otto-Herman watershed (i.e., Mountain Lake).

Tailings and return water pipelines and associated access roads would require one stream crossing. No lakes or identified wetlands would be impacted.

3.4.9.5 Socio-Economic Considerations

Site I is located adjacent to the Goudreau Road that is used to access the Magino site, which is travelled frequently by vehicles servicing the Richmont mine as well as recreational users (e.g. hunters and fishers). A trail currently and historically used by MFN members is located just south of Site I, between Herman and Mountain lakes. A large game (presumably moose) kill site was identified by MNO along the southern tip of Mountain Lake near the eastern boundary of Site I, and the area including Site I was identified by MNO as a large game harvesting area (MNO, 2014; Figure 18). Likely because of the road corridor, plant harvesting by MNO members also occurs near Site I (MNO, 2014; Figure 20: Plant Harvesting along the Roadways). Based on land ownership considerations, acquisition of Site I for development of a TMF is considered difficult.

Site I includes part of a licensed trapline area (WA-047), part of a bear management area (WA32-002), and part of a licensed baitfish area (WA0071). Mountain Lake, located immediately southeast of Site I, is a popular lake trout fishing location and has a boat launch. Dreany Lake, located just north, is also used locally for fishing.

3.4.10 CANDIDATE SITE J

3.4.10.1 Location & Accessibility

Candidate Site J is located 5.0 km east of the Magino property boundary. An estimated 9.3 km access road would be required to accommodate pipeline routing from the proposed plant site. The site comprises an area of approximately 433 ha.

3.4.10.2 Storage Capacity

The site topography is relatively flat, with no natural depressions. An embankment would be required for the entire TMF perimeter. Development of an embankment with a height of approximately 90 m provides containment for an estimated 258 Mt of tailings, which is approximately 70 percent greater the design criteria LOM tailings of 150 Mt. It is likely that the entire LOM tailings production can be contained with an embankment height less than 80 m, which is lower than the embankment heights for the other considered options. The embankment fill to tailings storage ratio is estimated as 0.6, which is similar to that of Sites F, G and I, and considered more favorable than the other sites.

3.4.10.3 Land Use & Ownership

The surface and mineral rights within Site J are owned by a third party. Part of the facility would overprint the Edward Mines workings. Sterilization of mineral resources within the area is unknown as drilling results for this area are not available.

3.4.10.4 Environmental Considerations

Site J would overprint up to an estimated 3,100 m (linear) of stream bed and has the potential to impact three watersheds:

- The upper reaches of the Webb-Goudreau watershed;
- The upper reaches of the Cawdron Lake watershed; and
- The Godin and Old Cabin Lakes watersheds.

Tailings and return water pipelines and associated access roads would require two stream crossings.

3.4.10.5 Socio-Economic Considerations

Based on the TK information provided to Prodigy, no specific Indigenous uses occur at Site J. Site J is located in proximity to ancestral traditional camps, and current /historical camps and cabins identified by MCFN near Pine and Tuff Lakes (MERC, 2014; Figure 1: Traditional Occupancy Values). Site J is within several kilometers of an identified "protection spot and gathering place" at Trout Lake (MERC, 2014; Figure 2: Protection Spot and Gathering Place Locations). During a recent presentation with MCFN, there was general agreement that Site J lies within the current land use area of MCFN. The BFN have indicated a cabin/ trapping area near Pine Lake, some distance west of Site J (BFN, 2015; Map 4). Based on land ownership considerations, acquisition of Site J for development of a TMF is considered difficult.

Site J includes part of a licensed trapline area (WA-046), part of one or more bear management areas (WA32-005), and part of a licensed baitfish area (WA0072). Site J overlays Road 48 and other smaller secondary roads/trails.

3.5 PRE-SCREENING OF CANDIDATE DISPOSAL SITES

The criteria retained for pre-screening assessment of alternative mine waste disposal locations (candidate sites) are:

- Is the mine waste disposal location within the cadastral boundaries of the Magino Project? (Yes/No);
- Will access to the area cause infringement on Aboriginal traditional land use activities? (Yes/No);
- Would the waste disposal location preclude future exploration or mining of potential resources? (Yes /No);
- Is the waste disposal location too small to store the proposed upper limit of tailings? (Yes/No);
- Does the waste disposal location provide efficient tailings storage capacity? (Yes/No);
- Is the waste disposal location reasonably close to the open pit and mill complex? (Yes/No); and
- Does the waste disposal location overprint waterbodies frequented by fish? (Yes/No).

The pre-screening assessment for location alternatives are presented in **Table 3-5**.

Based on the pre-screening assessment, candidate Sites A, B, D and H are rejected on the basis of:

- Site topography not conducive to the construction of an efficient tailings embankment structure, with an embankment fill to tailings storage ratio in excess of 1.0;
- Exclusion based on distance (Environment Canada, 2011; MAA Guidelines, Section 2.2)
 The distance of the access corridor from the proposed plant site is more than 5 km, which increases risks of accidents and malfunctions associated with longer tailings pipelines and water management strategies;
- Exclusion based on legal boundaries (Environment Canada, 2011; MAA Guidelines, Section 2.2) - Prodigy does not own the surface rights or the mineral rights for these sites; and
- These sites would extend potential impacts of the project to new watersheds otherwise unaffected by mining operations.

In addition to the above, candidate Site D is also rejected as the site is neither large enough to contain the design criteria life of mine tailings, nor is the site expandable; and it is an area that has been impacted by iron ore mining activities in the past, necessitating remediation. Candidate Sites A and B are also closer to Dubreuilville, relative to the other sites, considered prime hunting areas, and are more likely to impact the Trout Lake and Lochalsh watersheds. Furthermore, Richmont owns the minerals rights for both Sites B and D. Site H is also in proximity to the Richmont camp at Green Lake and the Dubreuilville cemetery.

Candidate Sites F and J are rejected on the basis of the following flaws:

- Exclusion based on distance (Environment Canada, 2011; MAA Guidelines, Section 2.2)
 The distance of the access corridor from the proposed plant site is more than 5 km, which increases risks of accidents and malfunctions associated with longer tailings pipelines and water management strategies;
- Exclusion based on legal boundaries (Environment Canada, 2011; MAA Guidelines, Section 2.2) – Prodigy does not own the surface rights or the mineral rights for these sites:
- Site J overprints the Edwards Mine, which is still active; and
- Site F is adjacent to the recreational settlement of Goudreau, and Summit Lake camps/cabins, which is considered undesirable.

One only of the candidate sites (Site G) meet all of the preliminary criteria, with three (3) additional sites maintained to be carried forward in the MAA assessment for more detailed evaluation, as follows:

- Candidate Site C Though this site is characterized by other undesirable features, as summarized in Table 3-5, this is the only site that does not overprint waterbodies frequented by fish. The MAA Guidelines (Environment Canada, 2011) require that at least one disposal site that does not overprint waterbodies frequented by fish is carried through the assessment;
- Candidate Site E This site offers suitable topography for construction of a TMF and is located less than 5 km from the proposed plant. However, this site has been extensively impacted by iron ore mining activities and would require extensive remediation efforts;
- Candidate Site G This is the only site that lies within the Magino property boundary and is therefore the closest disposal site to the proposed plant. The site topography is also conducive to development of a TMF; and
- Candidate Site I Like Site F, this site offers suitable topography for construction of a TMF and is located less than 5 km from the proposed plant. However, the mineral rights are owned by Richmont.

Table 3-5: Pre-Screening Assessment of Candidate Disposal Sites

| PRE-SCREENING CRITERIA | RATIONALE | SITE A | SITE B | SITE C | SITE D | SITE E | SITE F | SITE G | SITE H | SITE I | SITE J |
|---|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Is the mine waste disposal location within the | Surface and mineral rights owned by Prodigy | No | No | No | No | No | No | Yes | No | No | No |
| cadastral boundaries of the Magino Project? | Potential risk to Project schedule | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes |
| Will access to the area cause infringement on Aborigin | al traditional land use activities? | Note 2 | Note 2 | Note 4 | Note 4 | No | No | No | No | Note 5 | No |
| Would the waste disposal location preclude future expl | oration or mining of potential resources? | Note 3 | No | Note 3 | Note 3 | Note 3 |
| Is the waste disposal location too small to store the | Capable of storing 150 Mt of tailings | No | No | No | No | No | Yes | Yes | No | Yes | Yes |
| proposed upper limit of tailings? | Provide for Expandability | Yes | Yes | Yes | No | Yes | Yes | Yes | No | Yes | Yes |
| Does the waste disposal location provide efficient tailings storage capacity? | Embankment fill to tailings storage ratio less than 1.0 | No | No | No | No | Yes | Yes | Yes | No | Yes | Yes |
| Is the waste disposal location reasonably close to the | Site distance less than 3 km | No | No | No | Yes | Yes | Yes | Yes | No | Yes | No |
| open pit and mill complex? | Access corridor less than 5 km | No | No | No | No | Yes | No | Yes | No | Yes | No |
| Does the waste disposal location overprint | Impact waterbodies | No | No | No | Yes | Yes | Yes | Yes | Yes | No | No |
| waterbodies frequented by fish | Affect streams | Yes | Yes | No | Yes |
| Should the candidate site be carried forward in the | MAA? | No | No | Yes | No | Yes | No | Yes | No | Yes | No |

Notes:

- Blue shading denotes positive attributes for the considered sites.
- Sites A, B and J are located in relatively close proximity to First Nations Lands Missanabie Cree First Nation, with higher potential to infringe on Aboriginal traditional land use activities.
 It is unknown if these sites will preclude future exploration or mining of potential resources as mineral claims are present in the area.
 Sites D and E have been identified as areas of MNO Traditional Knowledge.

- 5. Site I is adjacent to Lacway/Goudreau road. The corridor is used for land use activity such as the collection of plants and residential and Aboriginal harvesting activities.

4. TAILINGS MANAGEMENT ALTERNATIVES ASSESSMENT – ALTERNATIVES CHARACTERIZATION

As discussed in **Section 3**, four candidate sites (Sites C, E, G and I) and two tailings disposal methods (conventional and thickened tailings) have been retained for more detailed evaluation.

With regard to the Magino Project, the primary difference considered between conventional and thickened tailings is the implementation of tailings thickeners at the plant to nominally increase the slurry density (i.e., decrease water content) prior to sending tailings to the TMF, which would have a moderate improvement to the water balance. However, whether conventional or thickened tailings are employed for the Magino Project, the general characteristics of the TMF are anticipated to be similar, with effectively identical embankment construction requirements, pipeline conveyances, and water management systems. The four (4) general alternatives considered in the following sections include:

- Alternative 1 Development of a Conventional or Thickened Tailings Management Facility (TMF) at Candidate Site C;
- Alternative 2 Development of a Conventional or Thickened TMF at Candidate Site E;
- Alternative 3 Development of a Conventional or Thickened TMF at Candidate Site G;
 and
- Alternative 4 Development of a Conventional or Thickened TMF at Candidate Site I.

This section describes the characterization criteria for the tailings management alternatives that will be used in the Multiple Accounts Analysis (MAA) described in **Section 2**. **Table 4-1** summarizes the characterization criteria for the tailings management alternatives with respect to applicable sub-accounts and indicators.

Table 4-1: TMF Alternatives Characterization

| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | SITE C | SITE E | SITE G | SITE I |
|---------------|--|---|------|---|---|--|---|
| | | Stream Length Affected | m | 0 | 1,840 | 4,000 | 2,170 |
| | Aquatic Habitat | Waterbody (lakes, ponds or wetlands) Impacted | no. | 0 | 5 (Teare Lake and smaller ponds) | 2 (Wetlands – no fish habitat) | 0 |
| | | Area of Waterbodies Impacted (excludes streams) | ha | 0 | 25 (Lake and ponds) | 8 (Wetlands) | 0 |
| | | Number of Additional Watersheds Affected | no. | 1 (Cawdron Lake) | 1 (Lower Webb-Goudreau) | 1 (Otto-Herman) | 1 (Mountain Lake/ Otto- Herman) |
| | Hydrology / Hydrogeology | Number of Stream Crossings by Tailings/ Reclaim Pipelines and Access Road | no. | 3 | 3 | 0 | 1 |
| | Water Quality | Availability of Downgradient Land for Additional Treatment, if required | | Capacity for moderate single polishing pond | Capacity for moderate single polishing pond | Capacity for multiple downstream ponds | Capacity for moderate single polishing pond |
| ental | water quality | Effluent Storage Capacity and Ability to Protect Downstream Aquatic Resources | | Storage for short duration | Storage for short duration | Any but most extreme event | Storage for short duration |
| Environmental | Terrestrial Resources - | Area Available for Tailings Storage | ha | 267 | 270 | 385 | 322 |
| Ē | General | Need for Additional Tailings Management Facility | | Yes | Yes | No | No |
| | | Straight-Line Distance from Project Boundary | km | 4.6 | 0.0 | Within | 0.3 |
| | Terrestrial Resources - Air Quality / Noise | Distance to Nearest Inhabited Community / Permanent Dwelling | km | 11.6 (Lochalsh) | 11.0 (Dubreuilville) | 10.5 (Dubreuilville) | 5.9 (Dubreuilville) |
| | | Distance to Nearest Cabin | km | 5.7 (Goudreau Lake north shore) | 2.6 (Goudreau Lake south shore) | 3.0 (Goudreau Lake north shore) | 2.2 (Trapper Cabin) |
| | | Area of Forest Impacted | ha | 305.4 | 312.0 | 357.6 | 345.5 |
| | Terrestrial Resources – Effects to Species | Area of Wetland Impacted | ha | 0 | 30.1 | 19.5 | 1.4 |

| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | SITE C | SITE E | SITE G | SITE I |
|----------------|------------------------|---|---------------------------|---|---|---|--|
| | | Tailings Storage Capacity (Note 1) | Mm ³ | 89 | 102 | 110 | 113 |
| | | Tallings Storage Capacity (Note 1) | Mt | 125 | 143 | 154 | 158 |
| | | Ability to Store LOM Tailings | Yes/No | No | No | Yes | Yes |
| | | Volume of Embankment Fill (Note 2) | Mm ³ | 90 | 88 | 75 | 84 |
| | | Volume of Embanding Fin (1volo 2) | Mt | 180 | 176 | 150 | 168 |
| | Design Considerations | Embankment Fill to Tailings Storage Volume | ratio | 1.0 | 0.9 | 0.7 | 0.7 |
| | | Lought of Designator Ditaking | m | 4,300 | 2,020 | 3,450 | 900 |
| | | Length of Perimeter Ditching | % of Embankment Length | 77% | 35% | 56% | 15% |
| | | Use of Natural Topography for Containment | % of Perimeter | 0% | 0% | 10% | 5% |
| | | Starter Dam Volume Required to Store 18.25Mm ³ of Tailings | Mm ³ | 14.1 | 10.8 | 8.6 | 9.3 |
| Technical | | Water Storage Capacity and Flexibility | | Storage for short duration | Storage for short duration | Any but most extreme event | Storage for short duration |
| T _e | | Reclaim Pond Position | | Adjacent to embankment (<200m) | Adjacent to embankment (<200m) | Nominally away from embankment (400-600m) | Mainly adjacent to embankment (200-400m) |
| | Embankment Safety | Length of Embankment | m | 5,550 | 5,750 | 6,150 | 5,880 |
| | Factors | Height of Embankment | m | 80 | 80 | 80 | 80 |
| | | Percentage of Alternative Contained by Embankments | % | 100 | 100 | 90 | 95 |
| | | TMF Water Management Operational Complexity | | Multiple components, moderately difficult | Moderately easy operation | Easy and simple operation | Moderately easy operation |
| | Operational Complexity | Access Pipeline and Road Length | km | 8.7 | 3.8 | 0.6 | 3.9 |
| | | Access to Reclaim Water | | Potential for seasonal/ occasional limitation for reclaim water | Potential for seasonal/ occasional limitation for reclaim water | Single pond with excess storage | Single pond with excess storage |

| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | SITE C | SITE E | SITE G | SITE I |
|-------------------|--|--|-----------------|--|--|-------------------------------------|--|
| | | Estimated TMF Construction Costs | \$CAD | \$775M | \$760M | \$652M | \$730M |
| | Capital Costs | Estimated Access Road Costs | \$CAD | \$2.8M | \$1.5M | \$0.8M | \$1.6M |
| | | Estimated Pipeline Costs | \$CAD | \$3.3M | \$2.1M | \$1.4M | \$2.2M |
| | On anoting Coata | Pumping Costs | m of head | 0 m | 0 m | 0 m | -20 m |
| S | Operating Costs | Pipeline Replacement Costs | \$CAD | \$3.3M | \$2.1M | \$1.4M | \$2.2M |
| Project Economics | | Cover (Overburden Cover, 1m assumed) | Mm ³ | 2.7 | 2.7 | 3.9 | 3.2 |
| ect Ec | Closure Costs | Inspections / Maintenance at Closure | | Annual | Annual | Annual | Annual |
| Proj | | Water Management at Closure / Post-closure | | None (passive water management) | None (passive water management) | None (passive water management) | None (passive water management) |
| | An eillean Coate | Land Acquisition Costs | \$CAD | Possibly unable to acquire | Possibly unable to acquire | Magino-owned (No cost) | Possibly unable to acqu |
| | Ancillary Costs | Habitat Offsetting Costs | \$CAD | \$0 | \$0.6M | <\$0.5M | <\$0.5M |
| | Opportunity Costs | Risk Arising from Schedule Delays | | Loss of investor confidence in the Project resulting in inability to raise funding | Loss of investor confidence in the Project resulting in inability to raise funding | None | Loss of investor confider in the Project resulting inability to raise fundin |
| | Aboriginal Land Use and Heritage Value | Traditional Land Use | | No impact | No impact | No impact | Impacts likely |
| 10 | | Loss of Biodiversity and Habitats | | Impacts likely | Negligible impact | Negligible impact | Negligible impact |
| Socio-Economics | Ecological / Cultural | Loss of Hunting Opportunity | | Negligible impact | Negligible impact | Negligible impact | Impacts likely |
| o-Ecol | Values | Loss of Agricultural Land | | No impact | No impact | No impact | No impact |
| Soci | | Affected Fishing Waterbodies | | No impact | Mitigation used – negligible impact | Mitigation used - negligible impact | No impact |
| | Operational Impacts and | Potential Impact on Nearby Residences | km | 5.7 | 2.6 | 3.0 | 2.2 |
| | Aesthetics | Visual Impact to Nearby Communities | km | 11.6 | 11.0 | 10.5 | 5.9 |

Notes:

^{1.} Tailings storage capacity assumes an in-place tailings dry density of 1.4 t/m³; and 2. Rockfill volumes assume a dry density of 2.0 t/m³ for rockfill.

5. TAILINGS MANAGEMENT ALTERNATIVE ASSESSMENT – MULTIPLE ACCOUNTS LEDGER

5.1 DETERMINATION OF SITE-SPECIFIC INDICATORS

Measurement criteria or indicators are required in order to allow for a qualitative or quantitative measurement of the impact associated with each sub-account. Indicators are expected to represent the most significant aspects of the project and the surrounding environment and are used to differentiate among the alternatives.

Environment Canada (2011) provides examples of criteria against which the alternatives may be evaluated, while indicating that not all criteria may be applicable to all projects. These criteria were taken as a starting point for discussions surrounding the Magino Project, which incorporates the following site-specific factors that are of relevance to the project:

- **Geochemistry of the Mine Waste** As discussed in **Section 1.3** of this report, the mine rock and ore/tailings are non-acid generating with NP/MPA ratios of 13.4 and 11.4, respectively. Therefore, geochemistry is not a concern.
- Species at Risk Discussions with the Ministry of Natural Resources and Forestry
 emphasizes the need to survey the area for species at risk and to take this information
 into consideration during the project development. Each of the candidate sites are
 located within the Regional Study Area (RSA), and baseline studies indicate that there
 are few species at risk present in the RSA.
- Discussions and Meetings with Aboriginal Groups This alternative assessment
 has included information, land use and traditional knowledge provided by the following
 Aboriginal communities:
 - o Hensel Design Group Inc. (November, 2015). Traditional Knowledge Assessment Related to the Magino Gold Project Prepared for Batchewana First Nation.
 - Mushkegowuk Environmental Research Centre (MERC). (2014). Missanabie Cree First Nation, Traditional Ecological Knowledge Preliminary Study, Magino Gold Project EIS.
 - Shared Value Solutions. (2014). Final Report on the Métis Nation of Ontario's Traditional Knowledge & Land Use Study and High Level Impact Assessment for the Magino Gold Project.
 - Hamilton. Dr. Scott. (2014). Traditional Land Use and Occupancy Study for Michipicoten First Nation Regarding Magino Mine Site.

The Red Sky Métis Independent Nation report provided to Prodigy did not contain any traditional knowledge information (Red Sky Métis Independent Nation™, 2014, Report for Prodigy Gold Incorporated – Magino Gold Project).

In addition to the above noted reports, a review of the disposal methodologies and tailings site locations was presented to BFN on August 23, 2016; the MCFN on September 10, 2016; and the MNO Consultation Committee on October 10, 2016.

- Water Management The Magino Project will have a surplus of water that must be
 carefully managed in order to minimize the potential effects of the discharge wastewater
 to the receiving environment. Water management for the project must integrate the open
 pit, the mill, the Mine Rock Management Facility (MRMF), and the TMF. This approach
 maximizes water reuse and minimizes use of fresh water from nearby waterbodies. It is
 important that the analysis considers an efficient and reliable water management
 approach.
- Local Socio-Economic Conditions Certain areas surrounding the Magino Project site are popular hunting or fishing grounds, development of which could affect such recreational activities. In some cases, cabins that provide seasonal lodging to support recreational activities are near to the project site. Mining is a part of the local economy, with past and present mine developments located near or at the site.
- **Project Economics** The economic viability of the Magino Project is sensitive to capital, operating, and closure costs.

With these factors taken into account, the list of sub-accounts and indicators presented previously in **Table 4-1** were developed to evaluate each of the four TMF alternatives. **Table 5-1** presents the rationale for the selection of the sub-accounts and indicators for the Magino Project.

Table 5-1: Rationale for Sub-Accounts and Indicators

| ACCOUNT | SUB-ACCOUNT | RATIONALE | INDICATOR | RATIONALE |
|---------------|-----------------------------|---|---|--|
| | | | Stream Length Affected | Minimizing the overall length of stream affected minimizes impacts to fish. |
| | Aquatic Habitat | Minimizing or avoiding aquatic resources minimizes disruption and potential effects to aquatic species. | Waterbodies (lakes, ponds or wetlands) Impacted | Fewer impacted waterbodies reduces the potential impacts to quantity and |
| | | | Area of Waterbodies Impacted | diversity of aquatic species. |
| | Hydrology / Hydrogoology | Surface runoff and groundwater are primary | Number of Additional Watersheds Affected | Restricting the footprint to the fewest number of watersheds is preferable as it facilitates management of runoff and seepage water. Also, fewer waterbodies are potentially impacted. |
| | Hydrology / Hydrogeology | pathways for environmental effects. | Number of Stream Crossings by Tailings/ Reclaim Pipelines and Access Road | Lower risks associated with breakage/ failure, accidents or malfunctions of pipelines with fewer stream crossings. |
| ıtal | Water Quality | Avoiding adverse effects on water quality is | Availability of downgradient land for additional treatment if required | Flexibility should be provided/ available for adaptive management for water structures/ practices. |
| Environmental | water Quality | important for the protection of the aquatic species. | Effluent storage capacity and ability to protect downstream aquatic resources | Larger available storage capacity improves the ability to cope with extreme weather events and operational upsets. |
| Env | Terrestrial Resources - | Minimizing overall footprint will minimize overall | Area Available for Tailings Storage | Smaller footprints have the potential for less environmental effect. |
| | General | environmental effects. | Need for Additional Tailings Management Facility | Sites that are too small to contain life of mine tailings would require two sites to be developed, extending project impacts. |
| | Terrestrial Resources - Air | Air quality is an important consideration for | Straight-Line Distance from Project Boundary | Potential for air quality and noise effects is greatly reduced with distance |
| | Quality / Noise | terrestrial species, vegetation and nearby communities. | Distance to Nearest Inhabited Property or Community | from the alternative site under consideration. |
| | Terrestrial Resources – | Species at risk are a particular focus of project | Area of Forest Impacted | Smaller area is preferred. Area is used as a proxy for habitat impacted and terrestrial wildlife potentially impacted. |
| | Effects to Species | environmental investigations. | Area of Wetland Impacted | Fewer wetlands impacted is preferred. Wetlands are used as a proxy to quantify impacts on amphibian species. |

| ACCOUNT | SUB-ACCOUNT | RATIONALE | INDICATOR | RATIONALE |
|-----------|-------------------------------|--|---|---|
| | | | Flexible Tailings Storage Capacity | Alternative must provide space for the construction of a TMF that will accommodate expected tailings production. Should additional mineral resources be identified through the life of the project, and the LOM extended, the TMF must provide flexibility for expansion. |
| | | | Ability to Store LOM Tailings | Alternative must provide space for the construction of a TMF that will accommodate expected tailings production, otherwise two sites are required. |
| | Design Considerations | Several important considerations contribute to the design and operational complexity of the TMF. A simpler, more flexible facility is preferred. | Volume of Embankment Fill | Used to identify sources of construction material and potential need for additional quarries to supply construction material. Smaller volumes are preferred. |
| | | | Embankment Fill to Tailings Storage Volume | The lower the ratio, the less dam construction is required to contain the tailings. This results in greater safety and lower construction costs. |
| | | | Length of Perimeter Ditching | Less ditching for management of runoff and seepage is preferred. |
| <u> </u> | | | Use of Natural Topography for Containment | Natural topography is more stable than a constructed embankment for containment. |
| Technical | | | Starter Dam Volume Required to Store 18.25Mm ³ of Tailings | Lower material quantities required for starter dam construction reduces the risks of impacts related to mine development scheduling, and decreases upfront capital costs. |
| | | | Water Storage Capacity and Flexibility | The ability to store excess water is required in order to cope with extreme events and operational upsets at the process plant. |
| | | | Pond position | Location of supernatant/ reclaim ponds away from embankments is preferred to reduce safety risks. |
| | Fash salam ant Option Fasters | Dam safety is of high importance for safety of | Length of Embankment | Smaller dams have reduced risks of failure and adverse effects in the event of failure. |
| | Embankment Safety Factors | personnel, neighboring communities, and protection of the receiving environment. | Height of Embankment | Lower dams have reduced risks of failure and adverse effects in the event of failure. |
| | | | Percentage of Alternative Contained by Embankments | The use of natural topography for containment reduces the need for dam construction, and hence reduces risks of dam failure. |
| | | | TMF Water Management Operational Complexity | Ease of water management is preferred. |
| | Operational Complexity | The more complicated a system is, the more difficult it is to operate and maintain, resulting in higher costs and greater risk of operational upsets (accidents and malfunctions). | Access Pipeline and Road Length | Greater distances require longer pipelines, which increases the risk of spills due to accidents and malfunctions, and increases the need for inspection and maintenance. |
| | | (accidents and manufictions). | Access to Reclaim Water | The ability to use reclaimed water for processing is preferred as it reduces the need of the Project for freshwater sources. |

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| ACCOUNT | SUB-ACCOUNT | RATIONALE | INDICATOR | RATIONALE |
|-------------------|--|---|--|--|
| | | Capital and sustaining capital costs to construct the | Estimated TMF Construction Costs | Overwhelmingly related to dam construction and dam volume. |
| | Capital Costs | TMF and other site infrastructure are a significant proportion of the overall project budget, and | Estimated Access Road Costs | Cost to realign/construct access road to TMF. Largely dictated by routing of pipelines. |
| | | minimizing of these costs is preferred. | Estimated Pipeline Costs | Cost to construct pipelines to and from the TMF to the plant site. |
| φ | Operating Costs | Ongoing costs for the operation of the TMF impact | Pumping Costs | Energy costs to pump tailings from mill to TMF and reclaim water from TMF to mill. |
| omic. | Operating Costs | overall project financial performance. | Pipeline Replacement Costs | Tailings delivery and water reclaim pipeline replacement cost, assuming pipes will require replacement at least once during life of mine. |
| Econd | | | Cover | Engineered cover systems are more expensive. However, revegetation/ rehabilitation of tailings surface is preferred. |
| Project Economics | Closure Costs | Closure costs impact overall project financial performance and increase the requirements for closure bonding. | Inspections / Maintenance at Closure | Alternatives that have lower requirements for ongoing inspection and maintenance are preferred and less costly, and generally result in lower closure costs. |
| | | | Water Management at Closure / Post-closure | Long-term water treatment (if required) increases closure costs. |
| | Ancillary Costs | Other ancillary costs also impact the overall project | Land Acquisition Costs | Estimated costs to acquire land not currently owned by Prodigy, if acquisition is possible. |
| | Andilary Costs | budget. | Habitat Offsetting Costs | Alternatives with no off-setting or low off-setting costs are preferred. |
| | Opportunity Costs | Delays in schedule are viewed as a loss in opportunity with regard to project economics. | Risk Arising from Schedule Delays | Whether or not land acquisition for the alternative under consideration may result in Project schedule delays. |
| | Aboriginal Land Use and Heritage Value | Aboriginal consultation is an important aspect of the Environmental Assessment Process. | Traditional Land Use | Alternatives which do not infringe on areas described as having traditional aboriginal uses are preferred. |
| | | | Loss of Biodiversity and Habitats | Alternatives with lower impacts on species are preferable. |
| nomics | Foological / Cultural Values | Minimizing or avoiding potential impacts to the way of life, culture and local communities are important | Loss of Hunting Opportunity | Hunting is an important cultural activity for the region. Alternatives that do not impact established hunting and fishing cabin/areas are preferred. |
| | Ecological / Cultural Values | to balance the need for regional economic development. | Loss of Agricultural Land | Agriculture may be a significant land use for some of the alternative sites. Avoidance of these areas is preferred. |
| Socio-Eco | | | Affected Fishing Waterbodies | Fishing is an important cultural activity for the region. Alternatives that do not impact established hunting and fishing cabin/areas are preferred. |
| | Operational Impacts and | Visual impacts can influence public perception of | Potential Impact on Nearby Residences | Areas with minimal human activities are preferred. |
| | Aesthetics | the Project. | Visual Impact to Nearby Communities | Greater distance from established communities is preferred. |

5.2 TMF ALTERNATIVES ASSESSMENT – VALUE-BASED DECISION PROCESS

A multiple accounts ledger was developed for the four (4) TMF alternatives retained after prescreening of the candidate sites. The scoring criteria for indicators (presented in **Table 5-1**) are provided in **Table 5-2**. Scoring of the retained alternatives (i.e., Sites C, E, G and I) with respect to these scoring criteria are shown in **Table 5-3**.

5.2.1 WEIGHTING FACTOR FOR SUB-ACCOUNTS AND INDICATORS

Per Environment Canada (2011), the account weightings are as follows:

- Environmental 6
- Technical 3
- Project Economics 1.5
- Socio-Economics 3

As per Section 2.6.2 of the MAA Guidelines (Environment Canada, 2011), the Magino Project team applied a weighting factor of 1 to 6 for each sub-account and indicator. These weighting factors are presented in **Table 5-4**.

5.2.2 RESULTS OF VALUE-BASED DECISION PROCESS

Table 5-5 through **Table 5-8** presents the results of the multiple account analysis for the individual indicators with regard to each of the sub-accounts and accounts (i.e., Environment, Technical, Project Economics and Socio-Economics). **Table 5-9** summarizes the multiple account analysis for each of the sub-accounts with regard to each of the accounts. The overall results of this analysis are summarized in **Table 5-10**.

Table 5-2: TMF Accounts, Sub-Accounts, Indicators and Scoring Criteria

| ACCOUNT | CUD ACCOUNT | INDICATOR | LINUT | | | SCOR | E | | |
|-----------|---|---|-------------------------------|---|---|---|--|--|---|
| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | 6 (BEST) | 5 | 4 | 3 | 2 | 1 (WORST) |
| | | Stream Length Affected | m | 0 | < 500 | <1000 | < 1500 | < 2000 | >2000 |
| | Aquatic Habitat | Number of Waterbodies (small lakes, ponds or wetlands) Impacted | no. | 0 | 1 | 2 | 3 | 4 | >5 |
| | | Area of Waterbodies Impacted | ha | 0 | <5 | <10 | <15 | <20 | >20 |
| | Hydrology / | Number of Additional Watersheds Affected | no. | 0 | 1 | 2 | 3 | 4 | 5 or more |
| | Hydrogeology | Number of Stream Crossings by Tailings/Reclaim Pipelines and Access Road | no. | 0 | 1 | 2 | 3 | 4 | 5 or more |
| tal | Water Quality | Availability of Downgradient Land for Additional Treatment, if required | qualitative | capacity for multiple downstream ponds | capacity for large single polishing pond | capacity for moderate single polishing pond | capacity for small single polishing pond | limited capacity for a single polishing pond | no capacity for downstream polishing pond |
| vironmen | Terrestrial Resources | Effluent Storage Capacity and Ability to Protect Downstream Aquatic Resources | Ability to store excess water | Any but most extreme event | 1 to 2-year return event | 1-year event | Must discharge prior to winter | Storage for short duration | Unable to store any excess water |
| ᇤ | | Area Required for Tailings Storage | ha | <200 | 200 to 300 | 300 to 400 | 400 to 500 | 500 to 1000 | > 1000 |
| | - General | Need for an Additional Tailings Management Facility | qualitative | No | N/A | N/A | N/A | N/A | Yes |
| | | Straight-line Distance from Project Boundary | km | Within Project boundaries | < 1 | < 2 | < 3 | < 5 | > 5 |
| | Terrestrial Resources - Air Quality / Noise | Distance to Nearest Inhabited Community / Permanent Dwelling | km | >10 | 5 to 10 | 5 to 3 | 3 to 1 | <1 | No Distance |
| | | Distance to Nearest Cabin | km | >10 | 5 to 10 | 5 to 3 | 3 to 1 | < 1 | No Distance |
| | Terrestrial - Effects | Area of Forest Impacted | ha | <200 | 200 to 300 | 300 to 400 | 400 to 500 | 500 to 1000 | >1000 |
| | Terrestrial - Effects on Species | Area of Wetlands Impacted | ha | 0 | < 1 | < 2 | < 3 | < 4 | >4 |
| | | Tailings Storage Capacity | Mt | > 150 | 130 to 150 two sites required | 110 to 130 two sites required | 90 to 110 multiple sites required | 70 to 90 multiple sites required | < 70 multiple sites required |
| Technical | Design Considerations | Ability to Store LOM Tailings | | Yes | N/A | N/A | N/A | N/A | No |
| Teck | | Volume of Rockfill Embankment | Mm ³ | < 40 | 40 to 60 | 60 to 80 | 80 to 100 | 100 to 120 | > 120 |
| | | Embankment Fill to Tailings Storage Volume | ratio | <0.40 | 0.40 to 0.55 | 0.55 to 0.70 | 0.70 to 0.85 | 0.85 to 1.0 | >1.0 |

| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | | | SCOR | RE | | |
|-----------|------------------------------|--|---|------------------------------------|--|---|--|---|--|
| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | 6 (BEST) | 5 | 4 | 3 | 2 | 1 (WORST) |
| | | Length of Perimeter Ditching | % of dam length | < 20% of dam length | 20% to 40% of dam length | 40% to 60% of dam length | 60% to 80% of dam length | 80% to 90% of dam length | 100% of dam length |
| | | Use of Natural Topography for Containment | % of perimeter | > 50% | 40% to 50% | 30% to 40% | 20% to 30% | 10% to 20% | <10% |
| | | Starter Dam Volume Required to Store 18.25 Mm ³ of Tailings | Mm ³ | <8 | 8 to 9 | 9 to 10 | 10 to 11 | 11 to 12 | >12 |
| | | Water Storage Capacity and Flexibility | Ability to store excess water | Any but most extreme event | 1 to 2-year return storm or snowmelt event | 1-year storm or snowmelt event | Must discharge prior to winter | Storage for short duration | Unable to store any excess water |
| | | Reclaim Pond Distance from Embankments | m | >1,000 | 800 to 1,000 | 600 to 800 | 400 to 600 | 200 to 400 | <200 |
| | Embankment Safety Factors | Overall Length of Embankment | m | <2,000 | 2,000 to 3,000 | 3,000 to 4,000 | 4,000 to 5,000 | 5,000 to 6,000 | >6,000 |
| | | Maximum Height of Embankment | m | < 60 m | 60 to 70 m | 70 to 80 m | 80 to 90 m | 90 to 100 m | > 100 m |
| | | Percentage of Alternative Contained by Embankment | % | <60% | 60 to 70% | 70 to 80% | 80 to 90% | 90 to 100% | 100% |
| | | TMF Water Management Operational Complexity | qualitative | Very easy; low complexity | Easy and simple operation | Moderately easy operation | Multiple components, moderately difficult | Multiple components, difficult | Multiple components, complex and difficult |
| | Operational Complexity | Access Pipeline and Road Length | km | < 1 km | 1 to 2 km | 2 to 3 km | 3 to 5 km | 5 to 10 km | > 10 km |
| | | Access to Reclaim Water | qualitative | Multiple ponds with excess storage | Single pond with excess storage | Potential for seasonal/occasional limitation for reclaim water | Seasonally limited access to reclaim water | Difficult to maintain pond with sufficient water to reclaim | No water reclaim possible |
| | | Estimated TMF Construction Costs | \$CAD | <\$500M | \$500-600M | \$600-700M | \$700-800M | \$800-900M | >\$900M |
| | Capital costs | Estimated Access Road Costs | \$CAD | <\$0.5M | \$0.5-1M | \$1-1.5M | \$1.5-2M | \$2-2.5M | >\$2.5M |
| SS | | Estimated Pipeline Costs | \$CAD | <\$0.5M | \$0.5-1M | \$1-1.5M | \$1.5-2M | \$2-2.5M | >\$2.5M |
| E | | Pumping Costs | m of head | < 500 | 500 to 1,000 | 1,000 to 1,500 | 1,500 to 2,000 | 2,000 to 2,500 | >2,500 |
| Econd | Operating costs | Pipeline Replacement Costs | \$CAD | <\$0.5M | \$0.5-1M | \$1-1.5M | \$1.5-2M | \$2-2.5M | >\$2.5M |
| Project I | Closure costs | Cover (Overburden Cover, 1m assumed) | Mm ³ (quantities of cover) | <2 | 2-2.5 | 2.5-3 | 3-3.5 | 3.5-4 | >4 |
| | | Inspections/ Maintenance at Closure | - | None required | Independent inspection/ maintenance required | Annual inspection / maintenance required | Semi-annual inspection / maintenance required | Quarterly inspection / maintenance required | Permanent active management required |

| ACCOUNT | Ancillary costs Opportunity costs Aboriginal Land Use and Heritage Value Ecological / Cultural Value | INDICATOR | UNIT | | | SCOR | RE | | |
|---------|---|--|-------|---|--|------------------------------------|------------------------------------|----------------------------|--|
| ACCOUNT | SUB-ACCOUNT | INDICATOR | UNIT | 6 (BEST) | 5 | 4 | 3 | 2 | 1 (WORST) |
| | | Water Management at Closure / Post-closure | - | No closure/ post- closure water management required | N/A | N/A | N/A | N/A | Active water management required |
| | Ancillary costs | Land Acquisition Costs | \$CAD | 0 | < \$1M | < \$2M | < \$3M | < \$4M | Possibly Unable to Acquire |
| | ,, | Habitat Offsetting Costs | \$CAD | 0 | <\$0.5M | \$0.5 to 1.0M | \$1.0 to 1.5M | \$1.5 to 2.0M | > \$2.0M |
| | Opportunity costs | Risk Arising from Schedule Delays | - | No schedule delays | Possible delays with no material risk to the Project | Potential delays of up to 3 months | Potential delays of up to 6 months | Potential delays of 1 year | Loss of investor confidence in the Project resulting in inability to raise funding |
| | | Traditional Land Use | - | No impact | N/A | N/A | N/A | N/A | Impacts likely |
| | | Loss of Biodiversity and Habitats | - | No impact | Negligible impact | N/A | N/A | N/A | Impacts likely |
| mics | Ecological / Cultural | Loss of Hunting Opportunity | - | No impact | Negligible impact | N/A | N/A | N/A | Impacts likely |
| conol | Value Los Aff Operational Impacts and Aesthetics Vis | Loss of Agricultural Land | - | No impact | Negligible impact | N/A | N/A | N/A | Impacts likely |
| cio-E | | Affected Fishing Waterbodies | - | No impact | Negligible impact | Limited impact | Moderate impact | N/A | Major impact |
| So | | Potential Impact on Nearby Residences | km | >10 | 5 to 10 | 5 to 3 | 3 to 1 | < 1 | No Distance |
| | | Visual Impact to Nearby Communities | km | >10 | 5 to 10 | 5 to 3 | 3 to 1 | < 1 | No Distance |

Table 5-3: Scoring of the Alternative Sites

| ACCOUNT | SUB ACCOUNT | INDICATOR | | ALTE | RNATIVE | |
|---------------|--|---|--------|--------|---------|--------|
| ACCOUNT | SUB-ACCOUNT | INDICATOR | SITE C | SITE E | SITE G | SITE I |
| | | Stream Length Affected | 6 | 2 | 1 | 1 |
| | Aquatic Habitat | Number of Waterbodies (small lakes, ponds or wetlands) Impacted | 6 | 1 | 4 | 6 |
| | | Area of Waterbodies Impacted | 6 | 1 | 4 | 6 |
| | | Number of Additional Watersheds Affected | 5 | 5 | 5 | 5 |
| | Hydrology / Hydrogeology | Number of Stream Crossings by Tailings/Reclaim Pipelines and Access Road | 3 | 3 | 6 | 5 |
| ıtal | Water Quality | Availability of Downgradient Land for Additional Treatment, if required | 4 | 4 | 6 | 4 |
| Environmental | Water Quality | Effluent Storage Capacity and Ability to Protect Downstream Aquatic Resources | 2 | 2 | 6 | 2 |
| Envir | Terrestrial Resources - General | Area Required for Tailings Storage | 5 | 5 | 4 | 4 |
| ш | | Need for an Additional Tailings Management Facility | 1 | 1 | 6 | 6 |
| | | Straight-line Distance from Project Boundary | 2 | 5 | 6 | 5 |
| | Terrestrial Resources - Air Quality / Noise | Distance to Nearest Inhabited Community / Permanent Dwelling | 6 | 6 | 6 | 5 |
| | | Distance to Nearest Cabin | 5 | 3 | 4 | 3 |
| | | Area of Forest Impacted | 4 | 4 | 4 | 4 |
| | Terrestrial - Effects on Species | Area of Wetlands Impacted | 6 | 1 | 1 | 4 |
| | | Tailings Storage Capacity | 4 | 5 | 6 | 6 |
| - | | Ability to Store LOM Tailings | 1 | 1 | 6 | 6 |
| Technical | Design Considerations | Volume of Rockfill Embankment | 3 | 3 | 4 | 3 |
| H | | Embankment Fill to Tailings Storage Volume | 1 | 2 | 4 | 4 |
| | | Length of Perimeter Ditching | 3 | 5 | 4 | 6 |
| | | Use of Natural Topography for Containment | 1 | 1 | 2 | 1 |

| ACCOUNT | SUB-ACCOUNT | INDICATOR | ALTERNATIVE | | | |
|-------------------|---------------------------|--|-------------|--------|--------|--------|
| | | | SITE C | SITE E | SITE G | SITE I |
| | | Starter Dam Volume Required to Store 18.25 Mm ³ of Tailings | 1 | 3 | 5 | 4 |
| | | Water Storage Capacity and Flexibility | 2 | 2 | 6 | 2 |
| | Embankment Safety Factors | Reclaim Pond Distance from Embankments | 1 | 1 | 3 | 2 |
| | | Overall Length of Embankment | 2 | 2 | 1 | 2 |
| | | Maximum Height of Embankment | 4 | 4 | 4 | 4 |
| | | Percentage of Alternative Contained by Embankment | 1 | 1 | 3 | 2 |
| | Operational Complexity | TMF Water Management Operational Complexity | 3 | 4 | 5 | 4 |
| | | Access Pipeline and Road Length | 2 | 3 | 6 | 3 |
| | | Access to Reclaim Water | 4 | 4 | 5 | 5 |
| Project Economics | Capital Costs | Estimated TMF Construction Costs | 3 | 3 | 4 | 3 |
| | | Estimated Access Road Costs | 1 | 3 | 5 | 3 |
| | | Estimated Pipeline Costs | 1 | 2 | 4 | 2 |
| | Operating Costs | Pumping Costs | 6 | 6 | 6 | 6 |
| | | Pipeline Replacement Costs | 1 | 2 | 4 | 2 |
| | Closure Costs | Cover (Overburden Cover, 1m assumed) | 4 | 4 | 2 | 3 |
| Proj | | Inspections/ Maintenance at Closure | 4 | 4 | 4 | 4 |
| | | Water Management at Closure / Post-closure | 6 | 6 | 6 | 6 |
| | Ancillary Costs | Land Acquisition Costs | 1 | 1 | 6 | 1 |
| | | Habitat Offsetting Costs | 6 | 4 | 5 | 5 |

| ACCOUNT | SUB-ACCOUNT | INDICATOR | | ALTE | RNATIVE | |
|-----------------|--|---------------------------------------|--------|--------|---------|--------|
| ACCOUNT | 30B-ACCOUNT | INDICATOR | SITE C | SITE E | SITE G | SITE I |
| | Opportunity Costs | Risk Arising from Schedule Delays | 1 | 1 | 6 | 1 |
| | Aboriginal Land Use and Heritage Value | Traditional Land Use | 6 | 6 | 6 | 1 |
| s; | | Loss of Biodiversity and Habitats | 1 | 5 | 5 | 5 |
| Socio-Economics | Ecological / Cultural Value | Loss of Hunting Opportunity | 5 | 5 | 5 | 1 |
| o-Eco | | Loss of Agricultural Land | 6 | 6 | 6 | 6 |
| Socic | | Affected Fishing Waterbodies | 6 | 5 | 5 | 6 |
| | Operational Impacts and | Potential Impact on Nearby Residences | 5 | 3 | 4 | 3 |
| | Aesthetics | Visual Impact to Nearby Communities | 6 | 6 | 6 | 5 |

Table 5-4: Weighting of Sub-Accounts and Indicators

| ACCOUNT | WEIGHT | SUB-ACCOUNT | WEIGHT | INDICATOR | WEIGHT |
|---------------|-----------------------------|---|---|---|--------|
| | | | | Stream Length Affected | 5 |
| | | Aquatic Habitat | 5 | Number of Waterbodies (small lakes, ponds or wetlands) Impacted | 4 |
| | | | | Area of Waterbodies Impacted | 4 |
| | | Hydrology / | | Number of Additional Watersheds Affected | 4 |
| | Hydrology / Hydrogeology | | 3 | Number of Stream Crossings by Tailings/Reclaim Pipelines and Access Road | 2 |
| ental | | Water Quality | 4 | Availability of Downgradient Land for Additional Treatment, if required | 3 |
| Environmental | 6 | Water Quality 6 | 4 | Effluent Storage Capacity and Ability to Protect Downstream Aquatic Resources | 3 |
| Ē | | Terrestrial Resources - | _ | Area Required for Tailings Storage | 2 |
| | General | 3 | Need for an Additional Tailings Management Facility | 6 | |
| | | | | Straight-line Distance from Project Boundary | 2 |
| | | Terrestrial Resources - Air Quality / Noise | 2 | Distance to Nearest Inhabited Community | 2 |
| | | 7 | | Distance to Nearest Cabin | 2 |
| | | Terrestrial - Effects on | 2 | Area of Forest Impacted | 2 |
| | | Species | 2 | Area of Wetlands Impacted | 2 |
| | | | | Flexible Tailings Storage Capacity | 4 |
| | | | | Ability to Store LOM Tailings | 6 |
| <u>_</u> | | | | Volume of Rockfill Embankment | 1 |
| Jica | | | _ | Embankment Fill to Tailings Storage Volume | 4 |
| echi | Technical 8 | Design Considerations | 5 | Length of Perimeter Ditching | 1 |
| - | | | | Use of Natural Topography for Containment | 4 |
| | | | | Starter Dam Volume Required to Store 18.25 Mm ³ of Tailings | 2 |
| | | | | Water Storage Capacity and Flexibility | 4 |

| ACCOUNT | WEIGHT | SUB-ACCOUNT | WEIGHT | INDICATOR | WEIGHT |
|---|-----------------|--|----------------------------|---|--------|
| | | | | Reclaim Pond Distance from Embankments | 1 |
| | | Embankment Safety | | Overall Length of Embankment | 5 |
| | | Factors | 6 | Maximum Height of Embankment | 6 |
| | | | | Percentage of Alternative Contained by Embankment | 5 |
| | | | | TMF Water Management Operational Complexity | 3 |
| | | Operational Complexity | 5 | Access Pipeline and Road Length | 2 |
| | | | | Access to Reclaim Water | 6 |
| | | | | Estimated TMF Construction Costs | 6 |
| | | Capital Costs | 5 | Estimated Access Road Costs | 3 |
| | | | | Estimated Pipeline Costs | 3 |
| ics | | Operating Coats | 4 | Pumping Costs | 2 |
| non | Operating Costs | 4 | Pipeline Replacement Costs | 2 | |
| Project Economics | 1.5 | | 2 | Cover (Overburden Cover, 1m assumed) | 3 |
| ect | | Closure Costs | | Inspections/ Maintenance at Closure | 4 |
| Proj | | | | Water Management at Closure / Post-closure | 2 |
| | | An alliana Canta | 4 | Land Acquisition Costs | 1 |
| | | Ancillary Costs | 1 | Habitat Offsetting Costs | 1 |
| | | Opportunity Costs | 3 | Risk Arising from Schedule Delays | 3 |
| | | Aboriginal Land Use and Heritage Value | 5 | Traditional Land Use | 1 |
| nic | | | | Loss of Biodiversity and Habitats | 1 |
| onor | | Ecological / Cultural | 2 | Loss of Hunting Opportunity | 1 |
| Ēco | 3 | Value | 3 | Loss of Agricultural Land | 1 |
| ocio | Socio-Economic | | | Affected Fishing Waterbodies | 1 |
| , so the second | | Operational Impacts | 2 | Potential Impact on Nearby Residences | 2 |
| | | and Aesthetics | 2 | Visual Impact to Nearby Communities | 2 |

Table 5-5: TIA Environment Account Indicator Analysis

| SUB-ACCOUNT | INDICATOR | WEIGHT | SIT | EC | SITI | ΕE | SITI | E G | SIT | ΕI |
|----------------------------|---|--------------|--------|-------|--------|-------|--------|-------|--------|-------|
| SUB-ACCOUNT | INDICATOR | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| | Stream Length Affected | 5 | 6 | 30 | 2 | 10 | 1 | 5 | 1 | 5 |
| Aquatic Habitat | Number of Waterbodies (small lakes, ponds or wetlands) Impacted | 4 | 6 | 24 | 1 | 4 | 4 | 16 | 6 | 24 |
| | Area of Waterbodies Impacted | 4 | 6 | 24 | 1 | 4 | 4 | 16 | 6 | 24 |
| | Sub-Account | Merit Score | 7 | 8 | 18 | 3 | 3 | 7 | 5 | 3 |
| | Sub-Account I | Merit Rating | 6.0 | 00 | 1.3 | 38 | 2.8 | 35 | 4.0 |)8 |
| Hydrology / | Number of Watersheds Affected | 4 | 5 | 20 | 5 | 20 | 5 | 20 | 5 | 20 |
| Hydrogeology | Number of Stream Crossings by Tailings/Reclaim Pipelines and Access Road | 2 | 3 | 6 | 3 | 6 | 6 | 12 | 5 | 10 |
| | Sub-Account | Merit Score | 2 | 6 | 20 | 3 | 3 | 2 | 30 | Ö |
| | Sub-Account I | Merit Rating | 4.3 | 33 | 4.3 | 33 | 5.3 | 33 | 5.0 | 00 |
| Water Quality | Availability of Downgradient Land for Additional Treatment, if required | 3 | 4 | 12 | 4 | 12 | 6 | 18 | 4 | 12 |
| Water Quality | Effluent Storage Capacity and Ability to Protect Downstream Aquatic Resources | 3 | 2 | 6 | 2 | 6 | 6 | 18 | 2 | 6 |
| | Sub-Account | Merit Score | 1 | 8 | 18 | 3 | 3 | 6 | 18 | 3 |
| | Sub-Account I | Merit Rating | 3.00 | | 3.00 | | 6.00 | | 3.00 | |
| Terrestrial Resources - | Area Required for Tailings Storage | 2 | 5 | 10 | 5 | 10 | 4 | 8 | 4 | 8 |
| General | Need for an Additional Tailings Management Facility | 6 | 1 | 6 | 1 | 6 | 6 | 36 | 6 | 36 |
| | Sub-Account | Merit Score | 1 | 6 | 16 | 3 | 4 | 4 | 4 | 4 |
| | Sub-Account I | Merit Rating | 2.0 | 00 | 2.0 | 00 | 5.5 | 50 | 5.5 | 50 |
| Terrestrial | Straight-line Distance from Project Boundary | 2 | 2 | 4 | 5 | 10 | 6 | 12 | 5 | 10 |
| Resources - Air | Distance to Nearest Inhabited Community | 2 | 6 | 12 | 6 | 12 | 6 | 12 | 5 | 10 |
| Quality / Noise | Distance to Nearest Cabin | 2 | 5 | 10 | 3 | 6 | 4 | 8 | 3 | 6 |
| | Sub-Account | Merit Score | 2 | | 28 | | 3: | | 20 | |
| | Sub-Account I | Merit Rating | 4.3 | | 4.6 | | 5.3 | | 4.3 | |
| Terrestrial - Effects | Area of Forest Impacted | 2 | 4 | 8 | 4 | 8 | 4 | 8 | 4 | 8 |
| on Species | Area of Wetlands Impacted | 2 | 6 | 12 | 1 | 2 | 1 | 2 | 4 | 8 |
| | Sub-Account | | 2 | | 10 | | 10 | | 10 | |
| | Sub-Account I | Merit Rating | 5.0 | 00 | 2.5 | 00 | 2.5 | 50 | 4.0 | 00 |

Table 5-6: TIA Technical Account Indicator Analysis

| SUB-ACCOUNT | INDICATOR | WEIGHT | SIT | E C | SIT | EE | SITE | G | SIT | El |
|--------------------------|--|--------------|--------|-------|--------|-------|--------|-------|--------|-----------|
| SUB-ACCOUNT | INDICATOR | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| | Tailings Storage Capacity | 4 | 4 | 16 | 5 | 20 | 6 | 24 | 6 | 24 |
| | Ability to Store LOM Tailings | 6 | 1 | 6 | 1 | 6 | 6 | 36 | 6 | 36 |
| | Volume of Rockfill Embankment | 1 | 3 | 3 | 3 | 3 | 4 | 4 | 3 | 3 |
| | Embankment Fill to Tailings Storage Volume | 4 | 1 | 4 | 2 | 8 | 4 | 16 | 4 | 16 |
| Design Considerations | Length of Perimeter Ditching | 1 | 3 | 3 | 5 | 5 | 4 | 4 | 6 | 6 |
| Considerations | Use of Natural Topography for Containment | 4 | 1 | 4 | 1 | 4 | 2 | 8 | 1 | 4 |
| | Starter Dam Volume Required to Store 18.25 Mm ³ of Tailings | 2 | 1 | 2 | 3 | 6 | 5 | 10 | 4 | 8 |
| | Water Storage Capacity and Flexibility | 4 | 2 | 8 | 2 | 8 | 6 | 24 | 2 | 8 |
| | Sub-Account | Merit Score | 46 | | 60 | | 126 | | 10 | 5 |
| | Sub-Account N | lerit Rating | 1. | 77 | 2.3 | 31 | 4.8 | 5 | 4.0 | 4 |
| | Reclaim Pond Distance from Embankments | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 2 |
| Embankment Safety | Overall Length of Embankment | 5 | 2 | 10 | 2 | 10 | 1 | 5 | 2 | 10 |
| Factors | Maximum Height of Embankment | 6 | 4 | 24 | 4 | 24 | 4 | 24 | 4 | 24 |
| | Percentage of Alternative Contained by Embankment | 5 | 1 | 5 | 1 | 5 | 3 | 15 | 2 | 10 |
| | Sub-Account | Merit Score | 4 | 0 | 4 | | 47 | | 40 | |
| | Sub-Account N | lerit Rating | 2.3 | 35 | 2.3 | 35 | 2.7 | 6 | 2.7 | <u>'1</u> |
| Operational | TMF Water Management Operational Complexity | 3 | 3 | 9 | 4 | 12 | 5 | 15 | 4 | 12 |
| Complexity | Access Pipeline and Road Length | 2 | 2 | 4 | 3 | 6 | 6 | 12 | 3 | 6 |
| | Access to Reclaim Water | 6 | 4 | 24 | 4 | 24 | 5 | 30 | 5 | 30 |
| | Sub-Account | Merit Score | _ | 7 | 4: | 2 | 57 | | 48 | |
| | Sub-Account N | lerit Rating | 3.3 | 36 | 3.8 | 32 | 5.1 | 8 | 4.3 | 6 |

Table 5-7: TIA Project Economics Account Indicator Analysis

| CUD ACCOUNT | INDICATOR | WEIGHT | SI | ГЕ С | SITI | EE | SITI | E G | SIT | ΕI |
|-------------------|--|---------------|-----------|-------|--------|-------|----------------|-------|--------|-------|
| SUB-ACCOUNT | INDICATOR | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| | Estimated TMF Construction Costs | 6 | 3 | 18 | 3 | 18 | 4 | 24 | 3 | 18 |
| Capital Costs | Estimated Access Road Costs | 3 | 1 | 3 | 3 | 9 | 5 | 15 | 3 | 9 |
| | Estimated Pipeline Costs | 3 | 1 | 3 | 2 | 6 | 4 | 12 | 2 | 6 |
| | Sub-Accoun | t Merit Score | | 24 | 33 | 3 | 5 ⁻ | 1 | 3 | 3 |
| | Sub-Account | Merit Rating | 2 | .00 | 2.7 | 75 | 4.2 | 25 | 2. | 75 |
| Operating Costs | Pumping Costs | 2 | 6 | 12 | 6 | 12 | 6 | 12 | 6 | 12 |
| Operating Costs | Pipeline Replacement Costs | 2 | 1 | 2 | 2 | 4 | 4 | 8 | 2 | 4 |
| | Sub-Accoun | t Merit Score | 14 | | 16 | | 20 | | 16 | |
| | Sub-Account | Merit Rating | 3.50 4.00 | | 5.00 | | 4.00 | | | |
| | Cover (Overburden Cover, 1m assumed) | 3 | 4 | 12 | 4 | 12 | 2 | 6 | 3 | 9 |
| Closure Costs | Inspections/ Maintenance at Closure | 4 | 4 | 16 | 4 | 16 | 4 | 16 | 4 | 16 |
| | Water Management at Closure / Post-closure | 2 | 6 | 12 | 6 | 12 | 6 | 12 | 6 | 12 |
| | Sub-Accoun | t Merit Score | | 40 | 40 | | 34 | | 37 | |
| | Sub-Account | Merit Rating | 4 | .44 | 4.44 | | 3.7 | '8 | 4. | 11 |
| Ancillary Costs | Land Acquisition Costs | 1 | 1 | 1 | 1 | 1 | 6 | 6 | 1 | 1 |
| Ancinal y Costs | Habitat Offsetting Costs | 1 | 6 | 6 | 4 | 4 | 5 | 5 | 5 | 5 |
| | Sub-Accoun | t Merit Score | | 7 | 5 | | 1. | | 6 | |
| | Sub-Account | Merit Rating | 3 | .50 | 2.5 | 50 | 5.5 | | 3.0 | 00 |
| Opportunity Costs | Risk Arising from Schedule Delays | 3 | 1 | 3 | 1 | 3 | 6 | 18 | 1 | 3 |
| | Sub-Accoun | t Merit Score | | 3 | 3 | | 18 | 3 | 3 | |
| | Sub-Account | Merit Rating | 1 | .00 | 1.0 | 00 | 6.0 | 00 | 1.0 | 00 |

Table 5-8: TIA Socio-Economics Account Indicator Analysis

| SUB-ACCOUNT | INDICATOR | WEIGHT | SIT | ГЕ С | SITE E | | SITE | E G | SIT | ΕI |
|--|---------------------------------------|--------------|--------|-------|--------|-------|--------|-------|--------|-------|
| SUB-ACCOUNT | INDICATOR | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| Aboriginal Land Use and Heritage Value | Traditional Land Use | 1 | 6 | 6 | 6 | 6 | 6 | 6 | 1 | 1 |
| | Sub-Account | Merit Score | | 6 | 6 | | 6 | | 1 | |
| | Sub-Account I | Merit Rating | 6 | .00 | 6.0 | 00 | 6.0 | 00 | 1.0 | 00 |
| | Loss of Biodiversity and Habitats | 1 | 1 | 1 | 5 | 5 | 5 | 5 | 5 | 5 |
| Ecological / Cultural | Loss of Hunting Opportunity | 1 | 5 | 5 | 5 | 5 | 5 | 5 | 1 | 1 |
| Value | Loss of Agricultural Land | 1 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| | Affected Fishing Waterbodies | 1 | 6 | 6 | 5 | 5 | 5 | 5 | 6 | 6 |
| | Sub-Account | Merit Score | • | 18 21 | | 1 | 21 | | 18 | |
| | Sub-Account l | Merit Rating | 4 | .50 | 5.2 | 25 | 5.2 | 25 | 4.5 | 50 |
| Operational Impacts | Potential Impact on Nearby Residences | 2 | 5 | 10 | 3 | 6 | 4 | 8 | 3 | 6 |
| and Aesthetics | Visual Impact to Nearby Communities | 2 | 6 | 12 | 6 | 12 | 6 | 12 | 5 | 10 |
| | Sub-Account | Merit Score | 22 | | 18 | | 20 | | 16 | |
| _ | Sub-Account l | Merit Rating | 5 | .50 | 4.5 | 50 | 5.0 | 00 | 4.0 | 00 |

Table 5-9: TIA Sub-Account Analysis

| ACCOUNT | CUD ACCOUNT | WEIGHT | SITI | E C | SIT | EE | SIT | EG | SIT | ΈΙ |
|----------------------|---|-----------------------------|--------|------------|--------|-------|--------|-------|--------|-------|
| ACCOUNT | SUB-ACCOUNT | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| | Aquatic Habitat | 5 | 6.00 | 30.00 | 1.38 | 6.92 | 2.85 | 14.23 | 4.08 | 20.38 |
| | Hydrology / Hydrogeology | 3 | 4.33 | 13.00 | 4.33 | 13.00 | 5.33 | 16.00 | 5.00 | 15.00 |
| | Water Quality | 4 | 3.00 | 12.00 | 3.00 | 12.00 | 6.00 | 24.00 | 3.00 | 12.00 |
| Environment | Terrestrial Resources - General | 3 | 2.00 | 6.00 | 2.00 | 6.00 | 5.50 | 16.50 | 5.50 | 16.50 |
| Environment | Terrestrial Resources - Air Quality / Noise | 2 | 4.33 | 8.67 | 4.67 | 9.33 | 5.33 | 10.67 | 4.33 | 8.67 |
| | Terrestrial - Effects on Species | 2 | 5.00 | 10.00 | 2.50 | 5.00 | 2.50 | 5.00 | 4.00 | 8.00 |
| | | Account Merit Score | 79. | 67 | 52. | 26 | 86. | .40 | 80. | .55 |
| | | Account Merit Rating | 4.1 | 19 | 2.7 | 75 | 4.9 | 55 | 4.2 | 24 |
| | Design Considerations | 5 | 1.77 | 8.85 | 2.31 | 11.54 | 4.85 | 24.23 | 4.04 | 20.19 |
| Technical | Embankment Safety Factors | 6 | 2.35 | 14.12 | 2.35 | 14.12 | 2.76 | 16.59 | 2.71 | 16.24 |
| | Operational Complexity | 5 | 3.36 | 16.82 | 3.82 | 19.09 | 5.18 | 25.91 | 4.36 | 21.82 |
| | | Account Merit Score | 39. | 78 | 49. | 75 | 71. | .73 | 66. | .25 |
| | | Account Merit Rating | 2.4 | 19 | 3. | 11 | 4.4 | 48 | 4. | 14 |
| | Capital Costs | 5 | 2.00 | 10.00 | 2.75 | 13.75 | 4.25 | 21.25 | 2.75 | 13.75 |
| | Operating Costs | 4 | 3.50 | 14.00 | 4.00 | 16.00 | 5.00 | 20.00 | 4.00 | 16.00 |
| | Closure Costs | 2 | 4.44 | 8.89 | 4.44 | 8.89 | 3.78 | 7.56 | 4.11 | 8.22 |
| Project Economics | Ancillary Costs | 1 | 3.50 | 3.50 | 2.50 | 2.50 | 5.50 | 5.50 | 3.00 | 3.00 |
| Leonomics | Opportunity Costs | 3 | 1.00 | 3.00 | 1.00 | 3.00 | 6.00 | 18.00 | 1.00 | 3.00 |
| | | Account Merit Score | 39. | 39 | 44. | 14 | 72. | .31 | 43. | .97 |
| | | Account Merit Rating | 2.6 | 33 | 2.9 | 94 | 4.8 | 82 | 2.9 | 93 |
| | Aboriginal Land Use and Heritage Value | 5 | 6.00 | 30.00 | 6.00 | 30.00 | 6.00 | 30.00 | 1.00 | 5.00 |
| | Ecological / Cultural Value | 3 | 4.50 | 13.50 | 5.25 | 15.75 | 5.25 | 15.75 | 4.50 | 13.50 |
| Socio-Economic | Operational Impacts and Aesthetics | 2 | 5.50 | 11.00 | 4.50 | 9.00 | 5.00 | 10.00 | 4.00 | 8.00 |
| | | Account Merit Score | 54. | 50 | 54. | 75 | 55. | .75 | 26. | 50 |
| | | Account Merit Rating | 5.4 | 1 5 | 5.4 | 48 | 5.5 | 58 | 2.0 | 65 |

Table 5-10: TIA Account Analysis (Base Case)

| ACCOUNT | WEIGHT | SITE C | | SITE E | | SITE G | | SITE I | |
|-------------------|---------------------|--------|-------|--------|-------|--------|-------|--------|-------|
| ACCOUNT | WEIGHT | RATING | SCORE | RATING | SCORE | RATING | SCORE | RATING | SCORE |
| Environment | 6 | 4.2 | 25.2 | 2.8 | 16.5 | 4.5 | 27.3 | 4.2 | 25.4 |
| Technical | 3 | 2.5 | 7.5 | 3.1 | 9.3 | 4.5 | 13.4 | 4.1 | 12.4 |
| Project Economics | 1.5 | 2.6 | 3.9 | 2.9 | 4.4 | 4.8 | 7.2 | 2.9 | 4.4 |
| Socio-Economic | 3 | 5.5 | 16.4 | 5.5 | 16.4 | 5.6 | 16.7 | 2.7 | 8.0 |
| Alte | native Merit Score | 52. | .9 | 46. | 7 | 64. | 7 | 50. | 2 |
| Alter | native Merit Rating | 3.9 | 9 | 3.5 | 5 | 4.8 | 3 | 3.7 | 7 |

5.3 RANKING OF ALTERNATIVES

5.3.1 ENVIRONMENT

Site G was the highest-ranked alternative location with regard to environmental considerations, with favorable scores arising from the proximity to the proposed mine (i.e., within the property boundaries) as it relates to limited impacts to additional watersheds away from the mine and no stream crossings. Also, Site G provides for easier water management given the proximity to the mine, combined with the ability for construction of downgradient ponds. Site C also ranked high with regard to the Environmental account, with favorable scores arising from the lack of impact to waters frequented by fish and no impact to wetlands.

5.3.2 TECHNICAL

Site G was the highest-ranked alternative location with regard to technical considerations, receiving the highest scores for design considerations and operational complexity. These scores were most influenced by the close proximity to the proposed processing plant, a favorable embankment fill to tailings storage ratio, the lowest requirement for starter dam construction materials, the greatest amount of natural containment, and ease of maintaining the pond away from the dam embankment.

5.3.3 PROJECT ECONOMICS

This account is heavily influenced by capital required for embankment construction. Other costs are typically less by an order of magnitude or more, and do not have a significant influence on the outcome. Site G ranked the highest of the alternatives in this account, benefitting largely from the greater amount of natural containment and therefore lower direct costs for embankment construction. Though not assessed in this evaluation, use of mine rock from the pit for embankment construction would further separate Site G from the other sites on the basis of cost given the short haulage distances. In addition, land acquisition costs are not a contributing factor as the site is located on land wholly-owned by Prodigy.

5.3.4 SOCIO-ECONOMIC

Sites C, E and G ranked similarly with regard to the Socio-Economic account. Site I ranked the lowest of the considered sites due primarily to perceived impacts to traditional land use, and loss of hunting opportunities.

6. TAILINGS MANAGEMENT FACILITY ALTERNATIVE ASSESSMENT – SENSITIVITY ANALYSIS

A sensitivity analysis was carried out to evaluate the sensitivity of the account weightings on selection of the preferred TMF alternative. Four sensitivity analysis scenarios were given consideration, in addition to the Base Case presented in **Section 5**:

- Case 1: Base Case;
- Case 2: All accounts weighted equally;
- Case 3: Environment account weighted twice as important as technical and socioeconomic accounts, cost account has no weight;
- Case 4: Environment and technical accounts weighted twice as important as socioeconomic and cost accounts; and
- Case 5: Environment and socio-economic accounts weighted twice as important as technical and cost accounts.

The scenarios presented are believed to offer a reasonable diversity of considerations for those factors that should most heavily influence selection of the TMF alternative. An unlimited number of additional scenarios for sensitivity analysis could be proposed by adjusting the weightings for individual indicators and sub-accounts. The results of the sensitivity analysis are presented in **Table 6-1**.

Table 6-1: TIA Assessment Sensitivity Analysis

| SCENARIO | SCENARIO DESCRIPTION | SITE C | SITE E | SITE G | SITE I |
|----------|--|--------|--------|--------|--------|
| Case 1 | Base Case | 3.9 | 3.5 | 4.8 | 3.7 |
| Case 2 | All accounts weighted equally | 3.7 | 3.6 | 4.9 | 3.5 |
| Case 3 | Environment account weighted twice as important as technical and socio-economic accounts, cost account has no weight | 4.1 | 3.5 | 4.8 | 3.8 |
| Case 4 | Environment and technical accounts weighted twice as important as socio-economic and cost accounts | 3.6 | 3.4 | 4.7 | 3.7 |
| Case 5 | Environment and socio-economic accounts weighted twice as important as technical and cost accounts | 4.1 | 3.8 | 4.9 | 3.5 |

Site G rises as the preferred alternative with respect to each of the various scenarios evaluated. Therefore, based on the results of the sensitivity analysis, the weightings and ratings chosen, and the site selection process, Prodigy concludes that Site G is the preferred site for development of a TMF, and that the process for selection of the site is robust. Also, with regard to type of tailings management, Prodigy considers either conventional or thickened tailings to provide similar benefits to the project.

7. MINE ROCK AND OVERBURDEN ASSESSMENT

This section discusses selection of the mine rock and overburden storage locations for the Magino Project.

7.1 MINE ROCK MANAGEMENT FACILITY (MRMF)

As discussed in **Section 1.2**, up to 430 Mt of mine rock will be generated by the Magino Project. The mine rock is anticipated to be of sufficient quality for use as a borrow source for site construction, particularly for use as TMF embankment fill, as well as other site construction needs including grading fills, road construction, pads for laydown areas, and foundations for site infrastructure.

Construction of the TMF embankment on Site G is expected to require a minimum of 75 Mm³, or an estimated 150 Mt, of mine rock for embankment fill. Additional construction requirements for the site are anticipated to require up to 50 Mt of additional mine rock. Hence, the remaining need for mine rock disposal is only on the order of up to 230 Mt.

Assuming that the starter embankment for the TMF is constructed to contain approximately 18 months of mine production at 35,000 tpd, construction of the TMF starter embankment is estimated to require 8.6 Mm³ of mine rock, or approximately 17.2 Mt of mine rock, which is nominally greater than the estimated initial pre-strip tonnage of 12.4 Mt, as illustrated in **Figure 7-1**. It is anticipated that the mine production schedule can be modified such that additional mine rock can be mined during initial site construction to meet the requirements for the starter embankment and other site construction. Also, by developing the pit as a source for borrow, the need for other potential on-site or off-site borrow sources may be reduced or eliminated.

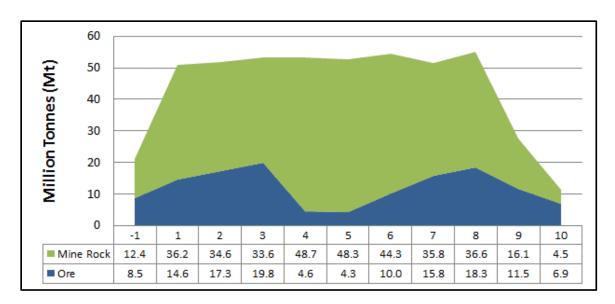


Figure 7-1: Estimated Mine Production Schedule (550 Mt at 35,000 tpd Production Rate)

The prime consideration for the location of the Mine Rock Management Facility (MRMF) is the haulage distance from the open pit. In addition to the mine rock used for TMF embankment fill and other site construction, Prodigy intends to build its MRMF on the perimeter of the proposed TMF Site G, along the northeast, east, and southeast perimeter of the TMF, as shown on **Map 4**. Additional benefits to this approach include:

- Locating the MRMF entirely within Prodigy's property;
- The MRMF does not overprint waterbodies additional to those overprinted by the selected TMF (i.e., no additional loss of fish habitat);
- The MRMF will remain within the footprint of the project disturbed areas;
- Enhanced stability of the TMF embankment provided by additional buttressing with mine rock above and beyond that needed to achieve stability requirements;
- Haulage distances from the mine pit are limited to the extent feasible (i.e., less than 3 km); and
- Locating the MRMF in this area will enable Prodigy to capture the majority of runoff from the MRMF and channel it via gravity to the same Water Quality Management Pond that will be used for capture of the TMF seepage and surface runoff water (i.e., limiting complexity of the site water management systems).

Therefore, by placing the remaining mine rock (i.e., that not used for TMF or other site construction) in close proximity to the proposed mill and TMF, the need to evaluate alternative off-site locations for the MRMF is eliminated.

7.2 OVERBURDEN STOCKPILES

Development of the open pit is anticipated to result in the excavation of approximately 23 Mt of overburden during the life of the mine operation. Subgrade excavation performed for the TMF embankment to facilitate construction on a stable foundation is anticipated to require a minimum of another 2 Mt of topsoil and/or overburden excavation over the course of TMF development. While the topsoil and a portion of the overburden will be segregated and stockpiled for future reclamation use, much of the overburden will be used for construction purposes, including backfill of topographic low areas within the project site.

The following areas, illustrated on **Map 4**, have been retained for stockpiling of overburden/topsoil on the Magino Project site:

- Northwest Fill Area & Overburden/Soil Stockpile Located on the northwest side of the proposed TMF adjacent to the Water Quality Control Pond (i.e., Lake 7).
 Development of this stockpile will fill in the northeast portion of Lake 7; and
- Southwest Fill Area & Overburden/Soil Stockpile Located on the southwest side of
 the proposed TMF. Development of this stockpile will fill in a portion of McVeigh Creek
 west of Spring Lake, which will be redeveloped to the south as a clean surface water
 diversion.

These stockpile areas will not overprint waterbodies frequented by fish, and the retained locations facilitate management of surface water runoff from the stockpiles.

8. WATERBODIES OVERPRINTED BY PROJECT INFRASTRUCTURE

Map 5 presents the expected physical footprint of the Project on the Magino property, while Map 6 highlights the waterbodies that will be overprinted by the Project components. **Table 8-1** lists the waterbodies that will be overprinted by the Project components.

Table 8-1: Waterbodies Overprinted by Project Components

| WATERBODY | MINE INFRASTRUCTURE AFFECTING WATERBODY |
|---------------|--|
| Waterbody 1 | Overprinted by construction of the TMF/MRMF, with portion filled for plant infrastructure. |
| Waterbody 2 | Overprinted by construction of the TMF/MRMF. |
| Waterbody 3 | Overprinted by construction of the TMF/MRMF. |
| Waterbody 4 | Overprinted by construction of the TMF/MRMF. |
| Waterbody 5 | Overprinted by construction of the TMF/MRMF. |
| McVeigh Creek | Portion of McVeigh Creek north of bypass road is filled with mine rock and overburden. Diversion channel constructed south of the bypass road to join Spring Lake outflow to McVeigh Creek. As the upper reach of McVeigh Creek is not considered valuable fish habitat, the diversion channel will be constructed as a fish habitat compensation project. |
| Waterbody 10 | Diversion channel will be constructed (fish habitat compensation) to improve outflows from this wetland and enhance fish habitat. The diversion will also reduce hydrostatic pressure on the open pit. |
| Webb Lake | Drained and backfilled due to proximity to open pit. |
| Lovell Lake | Drained and backfilled, then overprinted by construction of the MRMF. |
| Waterbody 6 | Outflow is rerouted towards Otto Lake. |
| Waterbody 7 | Converted to Water Quality Control Pond for site runoff. |

Baseline characterizations of these waterbodies are presented in the following TSDs:

- Surface Water Hydrology TSD;
- Fish and Fish Habitat TSD; and
- Surface Water and Sediment Quality TSD.

Summaries of baseline conditions are provided in Chapter 4 of the EIS (Section 4.3.4 for fish habitat and Sections 4.2.8 to 4.2.10 for hydrology, water and sediment quality). An overview of the proposed fish habitat compensation plan as required under the Fisheries Act is presented in Section 7.4.1 of the EIS. The detailed compensation plan will be submitted once the EIS review is completed and the Project proceeds to the next stage of development.

9. CONCLUSIONS

Using the MAA methodology and the account weights prescribed by Environment Canada for the Environmental, Technical, Project Economics, and Socio-Economic factors, the preferred alternative for tailings management at the Magino Project is the use of conventional or thickened slurry technology, with storage in a surface impoundment located within Prodigy's existing property, west of the open pit and plant site. This site, herein termed Site G, allows for ease of integration into the overall site-wide water management plan, provides beneficial topography for long-term development and closure of a TMF, as well as providing favorable design and safety factors.

Because the mine rock is not acid generating, it is anticipated that the mine rock can be used as a borrow source for site construction, which limits the need for development of other on-site or off-site borrow sources. A significant portion of the mine rock (i.e., approximately 50%) is required for construction of the TMF embankment and other site fills during the life of mining operations. As such, storage of only about 200 Mt of mine rock is required, with the prime consideration for location of the Mine Rock Management Facility (MRMF) being haulage distance from the open pit. Accordingly, Prodigy intends to build its MRMF on the perimeter of the proposed TMF Site G, along the northeast, east, and southeast perimeters. Key benefits to this approach include enhanced stability of the TMF embankment and integration of the MRMF into the site-wide water management system. By using mine rock for site construction and placing the remainder of the material in close proximity to the proposed mill and TMF, the need to evaluate alternative off-site locations for the MRMF was eliminated.

Development of the open pit and subgrade excavation performed for TMF embankment construction will generate topsoil and overburden materials. While the topsoil and a portion of the overburden will be segregated and stockpiled for future reclamation use, much of the overburden will be used for construction purposes, including backfill of topographic low areas within the project site.

Map 4 shows the proposed site plan for the Magino Project, including the preferred options for tailings, mine rock and overburden storage, as well as their interaction with key components of the site such as watercourses and site infrastructure.

10. CLOSING

This MAA has been completed using the best knowledge available at the time, including experience of personnel at this and other projects, environmental considerations, and technical factors. SLR International Corporation (SLR) and FPB Management Services Inc. (FPB) appreciate the opportunity to provide Prodigy with technical support on the Magino Project.

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MAPS

