Minto Mine Phase V/VI Expansion

Tailings Management Plan

Revision 01

June 2014

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1 Introduction

The objectives of the Phase V/VI Tailings Management Plan (TMP) are to summarize the quantities of mine waste (tailings and waste rock) that require management in tailings management facilities under the Phase V/VI mine plan, and to summarize how Minto Explorations Ltd. (Minto) proposes to manage these materials.

Phase V/VI mining consists of open pit mining from four separate pits as well as underground mining accessed by three portals. Ore released by Phase V/VI will be processed using the same milling infrastructure used in previous phases of mining, at a processing rate of 4200 tonnes per day (tpd).

This document is a summary of Minto's plan to manage both Phase V/VI tailings and NP:AP<3 waste rock produced from mining of the Phase V/VI open pits. As such, it refers to supporting engineering designs, as well as other plans for management of water, waste rock, and overburden where appropriate.

1.1 Table of Concordance

During the YESAB process no additional commitments were made. The relevant conditons in the Decision Document are addressed as follows:

Decision Document Condition	See section
Condition 1 – Main Pit Dump buttress	2.1
Condition 2 – in situ monitoring	Expec ted to be a condition of QML
Condition 3 – additional analysis	Main Dam preliminary design
Condition 4 – Main Dam saftety factors	Main Dam conceptual and preliminary designs
Condition 5 – quantitative risk assessment	Will be addressed in Main Dam Final design
Condition 6 – geotechnical investigations	Main Dam preliminary design
Condition 7 – sensitivity analysis	Main Dam preliminary design
Condition 8 – differential settlement	Main Dam preliminary design
Condition 9 – phreatic surface	Main Dam preliminary design
Condition 10 – inflow design flood	Main Dam preliminary design
Condition 11 – waste rock co-disposal	Expec ted to be a condition of QML
Condition 12 – FMEA	Will be addressed in Main Dam Final design

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2 Background and Overview

Minto Mine has been operating since 2007. The current project activities are collectively referred to as Phase IV and will transition into Phase V/VI upon receipt of appropriate authorizations. Because the Phase V/VI TMP builds on the site configuration that results from Phase IV operations, an overview of key Phase IV site components is provided here to establish context.

2.1 Key Phase IV Site Components for Management of Tailings

The Phase IV site components that relate to managing Phase V/VI tailings are shown on the plan of arrangement (Figure 2) and briefly described here.

- Mill
  - The mill is located on the north side of the Minto Creek valley east of Main Pit and west of the camp. The mill processes stockpiled and run-of-mine ore at a nominal rate of 4200 tonnes per day and produces slurry tailings that are discharged to Main Pit.
- Main Pit
  - Main Pit is centered in the Minto Creek valley west of the mill area, and was the first deposit mined at Minto Mine; mining ended there in April 2011. The Phase IV TMP has this pit filled with slurry tailings, the deposition of which began on November 1, 2012.
- Area 2 Pit
  - Area 2 Pit is located south of the mill area and southeast of Main Pit. As part of the Phase IV mine plan, the pit was mined in two stages, the first of which started in April 2011. The second stage (the last stage approved as part of Phase IV) pushed back the walls and deepened the pit; it was completed in Q1 2014. Underground mining of one of the Area 2 ore lenses, known as the M-Zone, via a portal in the base of the pit was commenced following completion of Area 2 Stage 2 open pit pit mining. Once underground mining via the M-Zone Portal is complete in Q4 2014, the Area 2 Stage 2 pit is scheduled to receive slurry tailings under the final stages of the Phase IV mine plan.
- South Wall Buttress (SWB)
  - The SWB is a rockfill structure that is designed to buttress the south wall of Main Pit and preserve its remaining volume for tailings and water storage purposes. Construction of the SWB began in May of 2011 and it has received rock from Area 2 Pit since that time. It is scheduled for completion to its design capacity during the period of open pit mining under Phase IV.

2.2 Overview of Phase V/VI Mine Plan

The components of the proposed Phase V/VI mine plan (Minto 2014a) that are relevant to tailings management are shown in Figure 1 and comprise:

- Area 2 Stage 3 Pit,
- Ridgetop North Pit,
- Main Pit Dump, and
- Main Dam.

Tailings production will transition from Phase IV to Phase V/VI when authorized. The nominal rate of mill throughput for Phase IV is 4200 tpd; this nominal processing rate will continue through Phase V/VI and will result in a seamless transition between project phases. The scheduled completion of Phase V/VI milling is Q3 2022.

Tailings will be discharged as slurry to the Main Pit, Area 2 Pit (both Stage 2 and Stage 3), and Ridgetop North Pit, and may be used for underground backfill in selected areas depending on the outcome of future underground mine engineering evaluations. Water stored in the pits will be reclaimed for use as process water, and will be transferred between pits to satisfy operational and storage requirements.

As described in the Phase V/VI waste rock and overburden management plan (WROMP), the great majority of waste rock generated in Phase V/VI will be released from the open pits, which are scheduled to be completed in 2017 (Minto 2014b). Waste rock with NP:AP<3 will be co-disposed with tailings in the Phase V/VI Tailings Management Facilities (TMFs), in locations that will be saturated post-closure. References to NP:AP< 3 waste rock in this TMP are descriptive only— the WROMP and references therein define this category of waste rock and discuss requirements for managing it.

The remainder of this document summarizes the plans to manage the tailings and NP:AP<3 waste rock that will be produced during Phase V/VI.

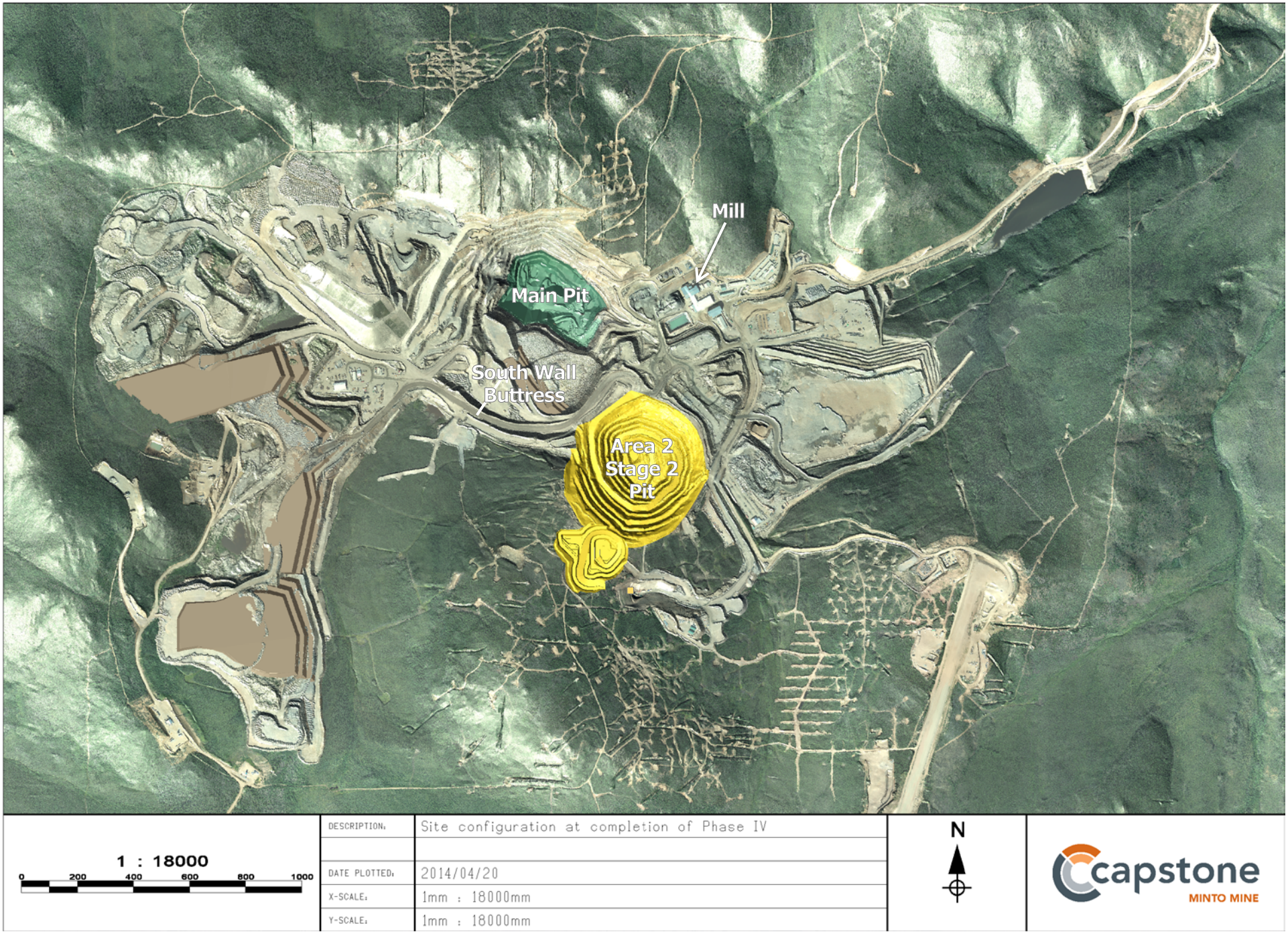

Figure 1: Key Minto Mine Phase IV site components.

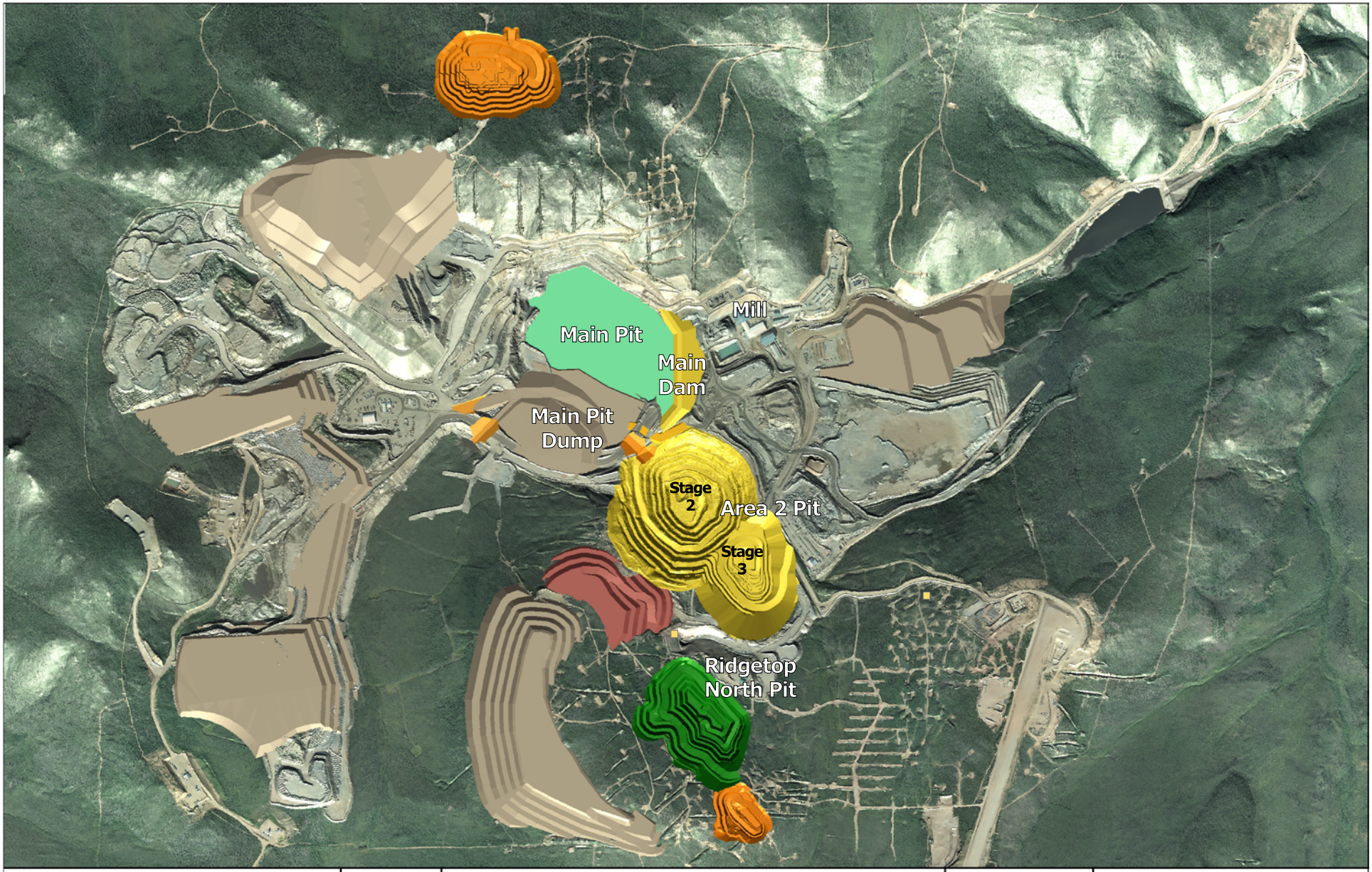

Figure 2: Key Minto Mine Phase V/VI site components.

3 Phase V/VI Storage Requirements

3.1 Tailings

From November 1, 2012, when dry-stacking operations ceased, through the completion of the Phase V/VI life-of-mine (LOM) plan, Minto will produce 13.3 Mt of tailings from 13.8 Mt of mill feed (assuming 96.7% mass pull to the tailings stream, with the balance reporting to concentrate). This tailings tonnage covers both the remainder of Phase IV and all of Phase V/VI. The two phases are considered together to facilitate integrated planning and to avoid having to account for processing of stockpiled Phase IV ore after Phase V/VI begins.

The dry density of deposited tailings is assumed to be 1.1 t/m^3 for planning purposes (SRK 2014); at this density, the 13.3 Mt of LOM tailings will require 12.1 Mm^3 of storage capacity.

3.2 NP:AP<3 Waste Rock

The Phase V/VI geochemical characterization report (SRK 2013a) and the WROMP (Minto 2014b) describe how NP:AP<3 waste rock was estimated and will be managed.

The total allowance for NP:AP<3 waste rock to be stored in the pits is 2.3 Mm^3. This includes material from Phase IV, some of which is already being stored beneath the final water level of Main Pit.

3.3 Water

Water storage requirements also need to be satisfied by the in-pit TMFs (specifically Main and Area 2 pits). The Phase V/VI water management plan (WMP) describes how the water storage requirements were determined (Minto 2014c); these requirements consist of a LOM accumulated water volume of 1.1 Mm^3 and a surge capacity of 1Mm^3. The LOM accumulated water volume estimate relies on a number of forward-looking assumptions which are described in the WMP and references therein.

3.4 Life-of-Mine In-pit TMF Storage Requirements

Table 1 summarizes the total storage requirements for the Phase V/VI Tailings Management Plan.

Table 1: Volume requirements for the Phase V/VI tailings management plan.

Material	Mass (Mt)	Dry Density (t/m^3)	Volume (Mm^3)
Phase IV + V/VI Tailings	13.3	1.1	12.1
NP:AP<3 Waste Rock (Phase IV + V/VI)			2.3
Accumulated Water (end of Phase V/VI)			1.1
Surge Capacity			0.975
		Total Storage Volume Required:	16.4

4 In-pit Tailings Management Facilities

4.1 Introduction

Planning for storage of Phase V/VI tailings and waste rock began with estimating the expected quantities of tailings and waste rock, and considering alternatives for storage to contain the required volumes. Alternatives were assessed against a suite of criteria that included foundation stability, drainage control, minimizing the need for re-contouring during closure, and developing landforms that would be appropriate for closure.

The outcomes of the evaluation process were summarized in a memorandum (SRK 2013b). The preferred alternative for tailings storage was to utilize the existing Phase IV and the future Phase V/VI open pits within the Minto Creek watershed for storage of Phase V/VI tailings and NP:AP<3 waste rock. Through subsequent planning, Minto has concluded that the optimal configuration will include:

- expansion of Main Pit tailings capacity beyond the Phase IV limits
- expanding the Phase IV plan for use of Area 2 Stage 2 Pit to include use of the future Area 2 Stage 3 Pit
- incorporating the future Ridgetop North Pit as a tailings management facility.

4.2 Storage Capacity

Each pit has a natural spill elevation – the lowest point on the pit rim – that limits its storage capacity for tailings and/or water. Therefore, Minto intends to increase the storage capacity of the Main Pit by constructing a dam on the east side of the existing pit; further details relating to the dam are described in Section 4.3.

Table 2 summarizes the storage capacities below the natural spill elevations of each of the Phase V/VI in-pit tailings management facilities (TMFs). Comparison with the Phase V/VI storage requirements (including surge capacity for seasonal water storage) in Table 1 with the available in-pit volumes in Table 2 shows that additional storage volume beyond the natural capacity of the existing and future pits is required. Therefore, Minto intends to increase the storage capacity of the Main Pit by constructing a dam on the east side of the existing pit; further details relating to the dam are described in Section 4.3.

Table 2: Natural storage capacities for Phase V/VI in-pit TMFs.

In-pit TMF	Approximate Spill Elevation (m above sea level)	Volume Below Spill Elevation (Mm^3)
Main Pit	791	4.7
Area 2 Pit (Stages 2+3)	799	7.7
Ridgetop North Pit	862	1.9
	Total volume below spill elevations	**14.3**

Plans for each of the three in-pit TMFs are described in the following sections.

4.3 Main Pit TMF

4.3.1 Capacity

The total storage capacity of Main Pit to its natural spill elevation is 4.7 Mm^3 (as noted in Table 2). As part of Phase V/VI, Minto will construct a dam across the low point of the east wall of Main Pit to increase its storage capacity to roughly 8 Mm^3. This will provide the storage capacity required for Phase V/VI tailings, NP:AP<3 waste rock and water (based on the figures in Table 1 and Table 2), as well as contingency for storage volume lost to ice entrainment.

4.3.2 Main Dam

Conceptual and Preliminary designs have been developed for the proposed dam (SRK 2013c, SRK 2014) which assumes construction using waste rock and overburden produced from mining at Minto. A low permeability core of a combination of geosynthetic liner and compacted fine-grained overburden will be encapsulated with rockfill; based on the preliminary design, the dam crest will have an elevation of 812 m and the dam will be designed such that the full supply level of the Main Pit TMF (MPTMF) is 809 m (the natural spill elevation of the Main Pit is roughly 791 m (Table 2)). A spillway with an inlet elevation of 809 m will be constructed south of the Main Dam to pass any water in excess of the MPTMF storage capacity to the Area 2 Pit, thereby protecting the Main Dam. Figure 3 provides an overview of the preliminary dam design.

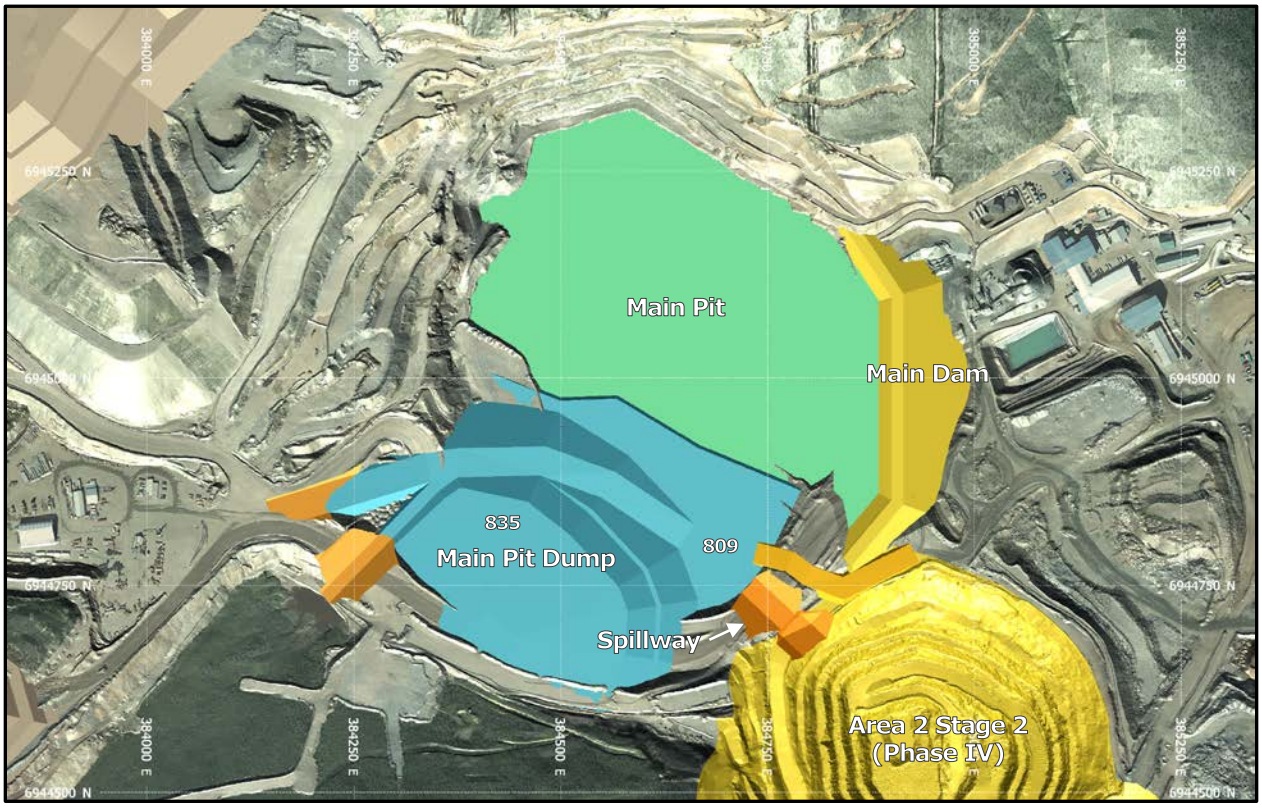

Figure 3: Overview of Main Pit showing conceptual location of Main Dam.

4.3.3 Management Considerations

The MPTMF will be operated such that a tailings beach is developed along the east side of the facility, minimizing the potential for seepage to the east. Storing NP:AP<3 waste rock within the MPTMF, completing the South Wall Buttress, and constructing the Main Pit Dump all require coordination with tailings placement to ensure optimal use of the MPTMF storage capacity. For all waste rock stored below the maximum operating limit of the MPTMF, water will fill the pore space as the adjacent tailings and water levels rise, and this volume of water needs to be taken into consideration during operational water management.

During closure, the final tailings surface will be shaped to convey local runoff and water from upgradient catchments across the reclaimed MPTMF and through an engineered spillway to Area 2 Pit. The final tailings surface will be covered with an appropriate soil cover and conveyance works will be sized and designed according to appropriate closure criteria (ACG 2014).

4.4 Area 2 Pit TMF (A2PTMF)

4.4.1 Capacity

The final Area 2 Pit TMF (A2PTMF) will consist of two intersecting pits separated by a saddle (Figure 4 and Figure 5). The larger and more northerly of the intersecting pits is a Phase IV development called Area 2 Stage 2 Pit (A2S2 Pit), while the smaller and more southerly pit will be a Phase V/VI development referred to as Area 2 Stage 3 Pit (A2S3 Pit).

A2S2 Pit is scheduled to receive tailings towards the end of Phase IV operations and into Phase V/VI operations. Prior to completion of A2S3 Pit, storage of tailings and water in A2S2 Pit is limited to that volume below the saddle elevation of 760 m (roughly 2.2 Mm^3) (Figure 6). After A2S3 Pit is complete (projected for Q2 2016), the entire volume of the combined A2S2 and A2S3 pits will be available for storage (Figure 6); the total storage capacity of the final Area 2 Pit below the natural spill elevation of 799 m will be approximately 7.7 Mm^3 (Table 2).

The storage curve for A2S2 Pit below the saddle elevation of 760 m is shown in Figure 7. The storage curve for A2S3 Pit is shown in Figure 8, with the volume stored in A2S2 Pit below 760 m subtracted from it. The total capacity of the A2PTMF is the sum of the two storage curves.

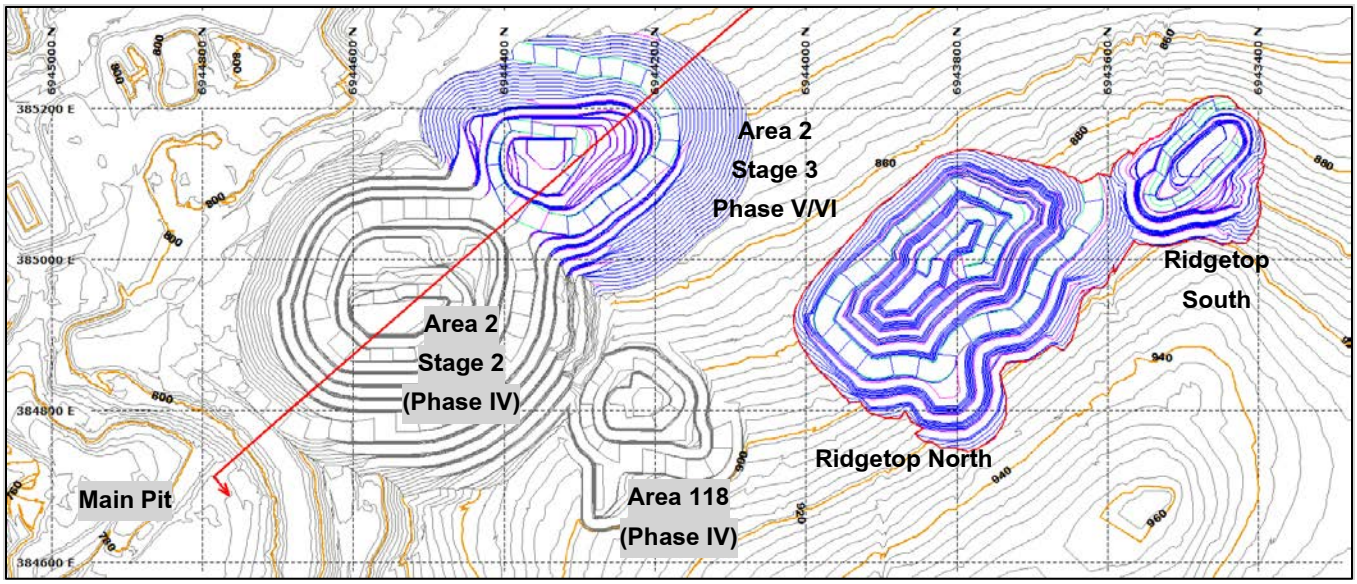

Figure 4: Overview of Phase V pits (excluding Minto North) showing section line for Figure 5 and Figure 6.

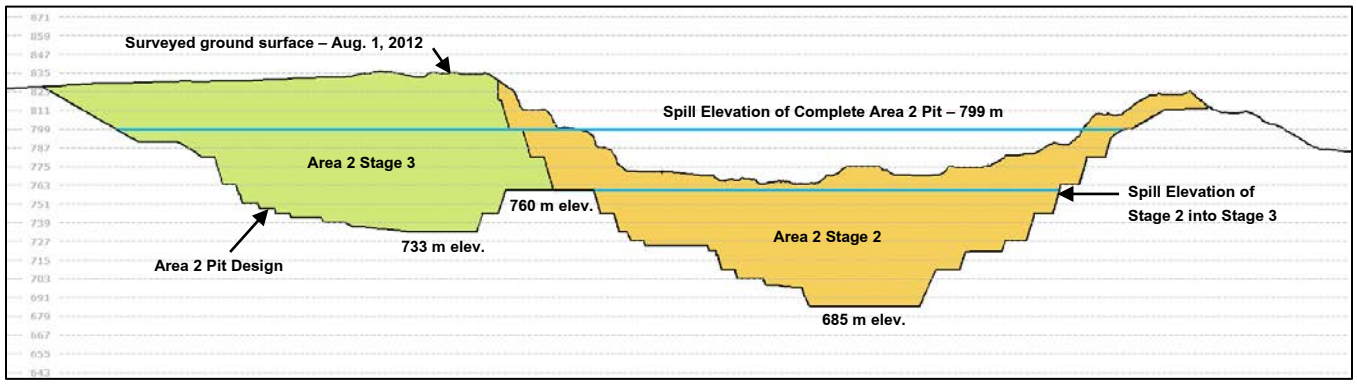

Figure 5: Section looking NW through Area 2 Pit showing staging and spill elevations.

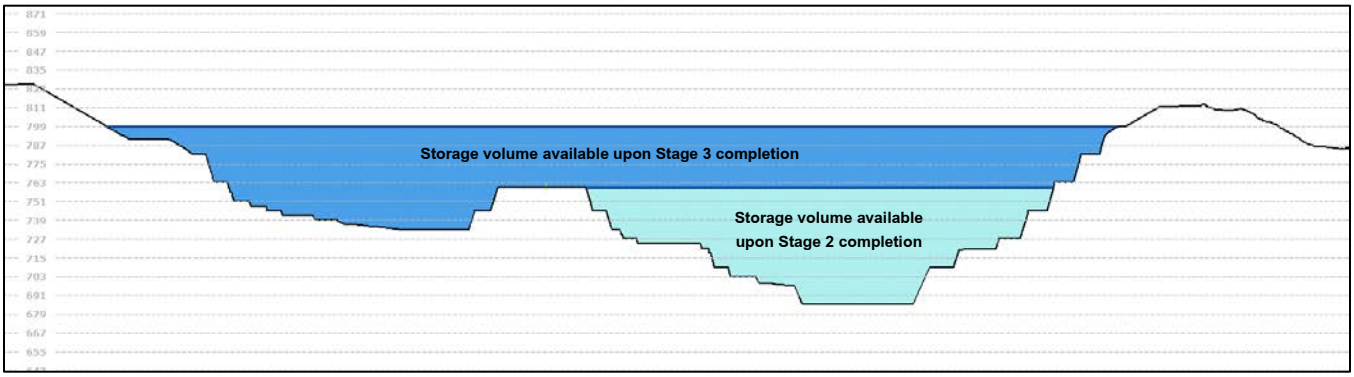

Figure 6: Section through Area 2 Pit showing storage volume made available with staged mining of Area 2.

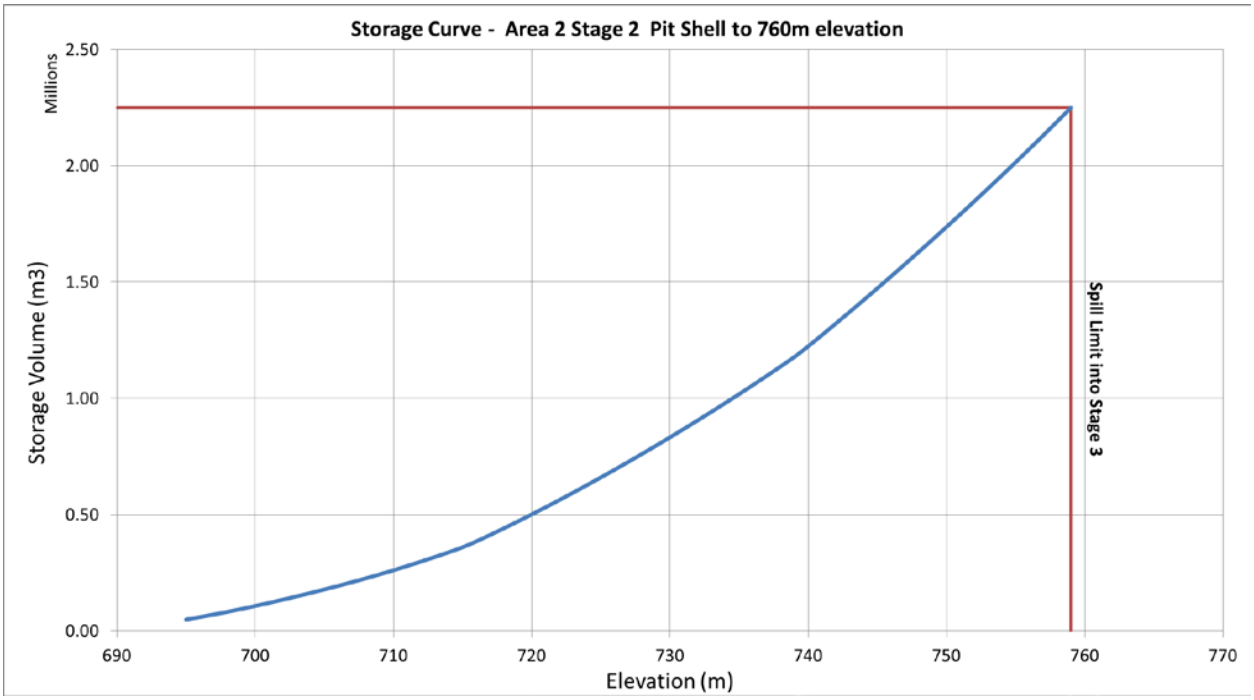

Figure 7: Storage curve for Area 2 Stage 2 (below 760 m elevation).

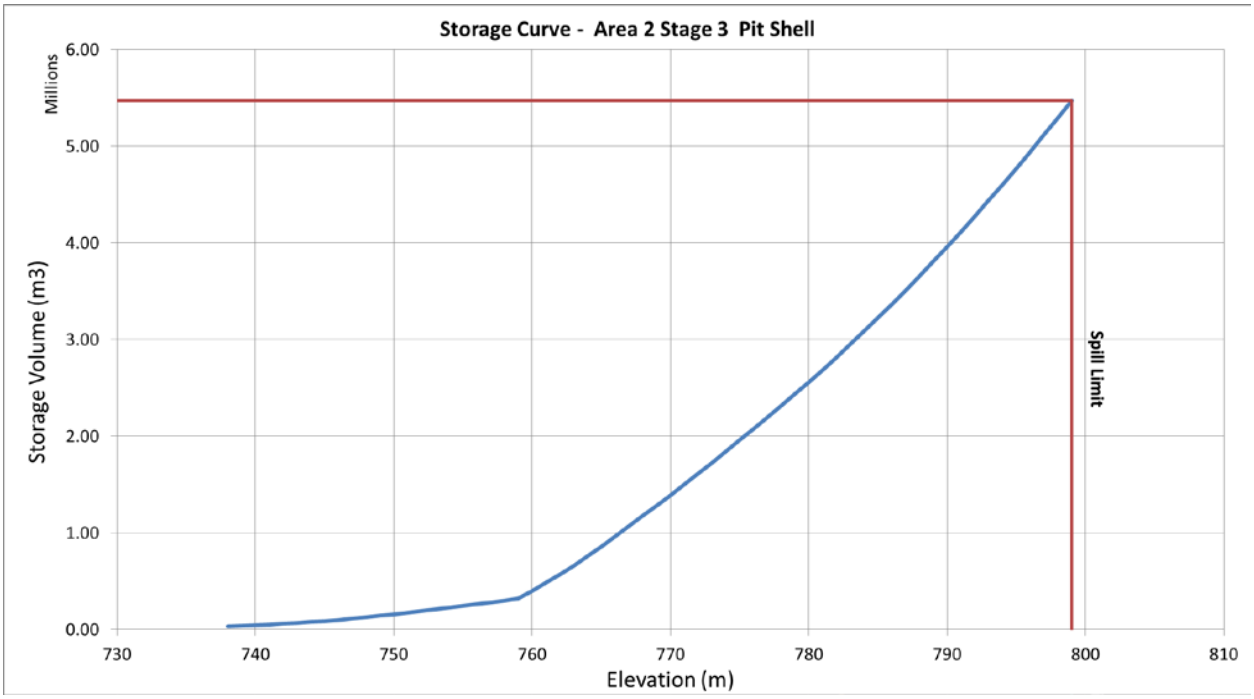

Figure 8: Storage curve for Area 2 Stage 3 (including Area 2 Stage 2 above 760 m elevation).

4.4.2 Management Considerations

At the end of Phase IV and the beginning of Phase V/VI, the A2PTMF will be used for storage of water, tailings, and NP:AP<3 waste rock. Once dam construction is under way, deposition will move back to the Main Pit TMF (MPTMF) and the function of A2PTMF will shift to being primarily a water management facility. In the final years of Phase V/VI operations, tailings will once again report to A2PTMF. These concepts are represented in the example Phase V/VI tailings deposition schedule that is discussed in Section 6. Excess water from both the Ridgetop North Pit TMF (RNPTMF) and MPTMF will be transferred to A2PTMF as required, and A2PTMF will be available to receive tailings when required.

The closure concepts for the A2PTMF are described in the Phase V/VI closure plan (ACG 2014); the following key aspects are summarized here for convenience. As the Minto site transitions into closure, the A2PTMF will receive water flows from:

- catchments above the pit;
- two major subcatchments of upper Minto Creek:
    - the south (W35a) subcatchment, which operationally will be routed to the Water Storage Pond;
    - the southwest (W15) subcatchment, which will report to the A2PTMF through the MPTMF.

Post-closure, A2PTMF will discharge to the reconstructed Minto Creek channel via an appropriately designed and constructed outlet. After Phase V/VI tailings discharge is complete, it is expected to take from 2 to 4 years for A2PTMF to fill to capacity and discharge. The actual time to capacity will depend on water management decisions during and immediately following Phase V/VI operations, and on precipitation and runoff experienced at site during that time.

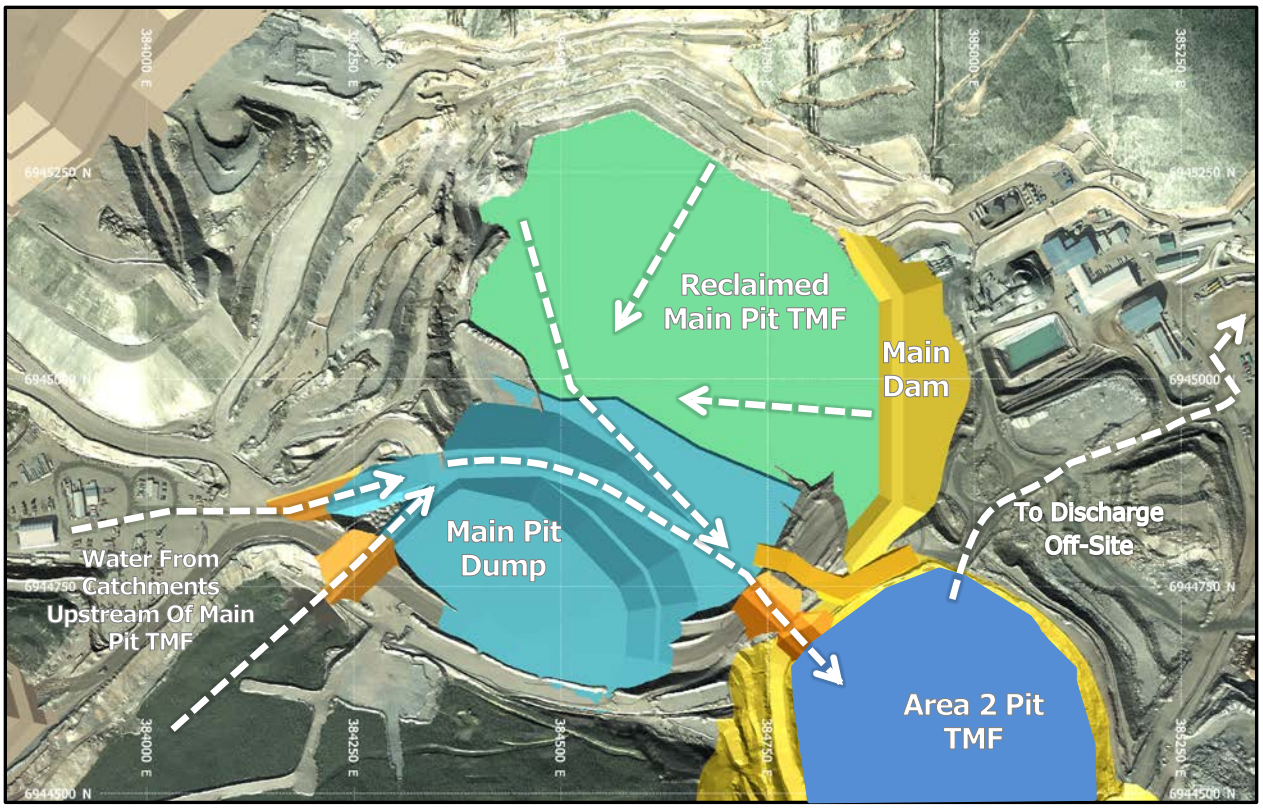

Figure 9: Conceptual post-closure water routing.

4.5 Ridgetop North Pit TMF (RNPTMF)

4.5.1 Capacity

Ridgetop North Pit (Figure 4) will be the final open pit mined as part of Phase V/VI, with mining scheduled to be completed during Q3 2017. The RNPTMF is projected to have a total storage volume of 1.9 Mm^3 (Table 2) below the natural spill elevation of 862 m. The storage curve for RNPTMF is shown in Figure 10. Because the final tailings surface will be at a shallow angle, tailings discharge will need to be carefully managed to ensure the available storage volume is used efficiently.

4.5.2 Management Considerations

The RNPTMF will receive only tailings slurry; no NP:AP<3 rock will be stored in this facility. During Phase V/VI operations, Minto anticipates pumping excess water from the RNPTMF to the adjacent A2PTMF for purposes of water management; there will be no surface discharge from the RNPTMF and no spillway.

After tailings placement is complete, an appropriate soil cover can be placed on the RNPTMF, contoured to control surface runoff and minimize or eliminate ponding- see the Phase V/VI closure plan (ACG 2014).

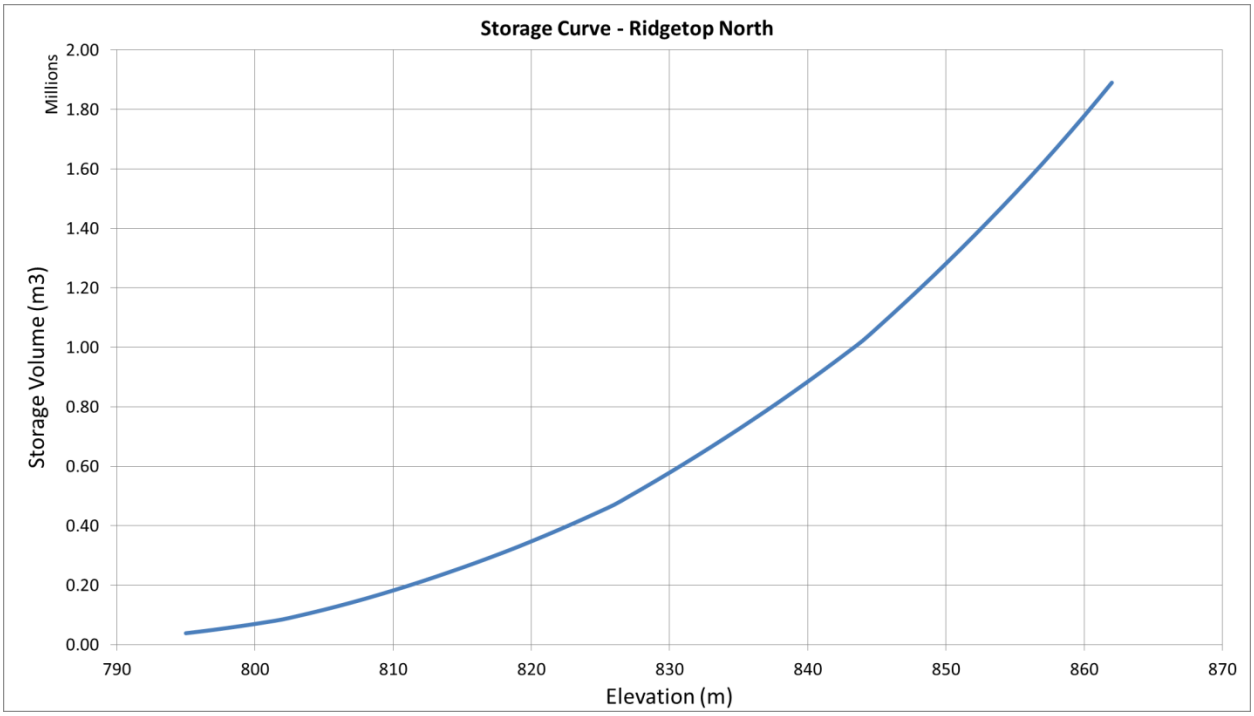

Figure 10: Storage curve for Ridgetop North.

5 Water Management Considerations

Plans for water management at Minto during Phase V/VI operations are presented in the WMP (water management plan) (Minto 2014). The following elements of this tailings management plan represent important areas of overlap between the TMP and the WMP.

- The operational requirement for maintaining a surge capacity of 975,000 m^3 will be achieved over the life of Phase V/VI by reserving adequate volume in a combination of A2PTMF and MPTMF.
- Process water for milling operations will be drawn from water stored in A2PTMF and MPTMF.
- Water will be transferred from RNPTMF to A2PTMF as required, with the specific objective of managing excess water in RNPTMF and thereby avoiding the need for surface discharge from RNPTMF.

6 Deposition Schedule

Minto intends to use the three Phase V/VI tailings facilities as required to store tailings solids and NP:AP<3 rock, and to manage water; the precise deposition schedule will be subject to operational decisions based on water levels, achieved tailings density, and mill throughput.

The example deposition schedule shown in Figure 11 represents a scenario based on design values for mill throughput and tailings density, as well as projected pit completion dates. The schedule includes the transition from Phase IV operations, and can be summarized as follows:

- The schedule begins with deposition of tailings and NP:AP<3 rock to the MPTMF. When A2S2 mining is complete and the A2PTMF is available, deposition shifts to the new TMF. This keeps fill volumes down in

the MPTMF in advance of construction of the Main Dam. Tailings deposition in the Stage 2 portion of A2PTMF occurs while Minto North and A2S3 are mined.

- The Main Dam is completed using waste rock and overburden produced from mining; tailings deposition shifts back to the newly expanded MPTMF.
- Tailings are deposited into the RNPTMF once Ridgetop North Pit is complete; this allows the pit to be filled and may allow progressive reclamation of the RNPTMF prior to the end of Phase V/VI.
- When the RNPTMF is full, tailings deposition returns to the MPTMF and continues until it is at final design grade.
- Final tailings deposition reports to A2PTMF for the remainder of Phase V/VI operations.

In this example schedule, the A2PTMF is the mine's primary water management facility.

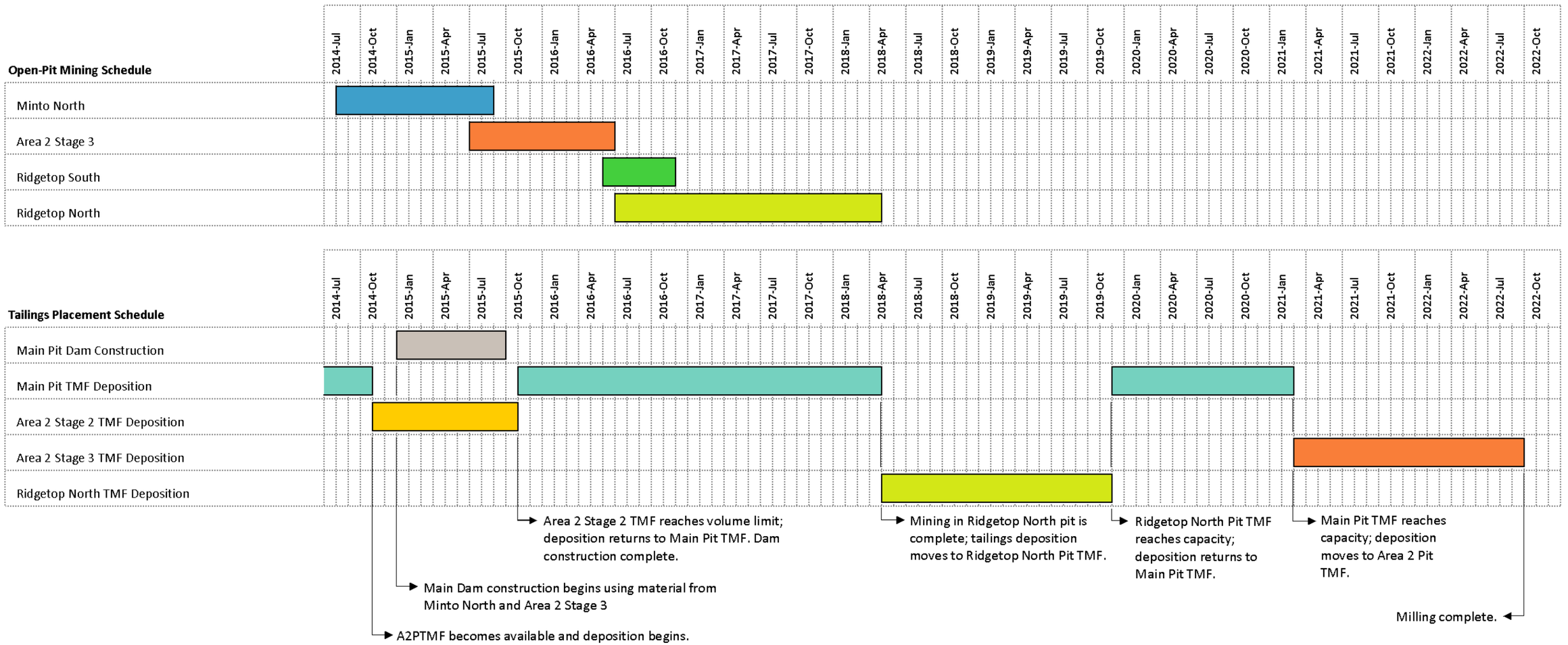

Figure 11: Example Phase V/VI tailings deposition schedule.

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