Rehabilitation and Closure Plan

July 2018

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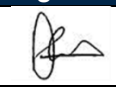
Approvals

OGC Designation	Name	Designation	Signature	Date
HSE Manager	Daniel Calderwood	Mr		June 2018

Revision History

Date	Revision No.	Issued for	By
2016	17	Annual Review for OGNZL	Part A - Kathy Mason, Part B – Malcolm Lane
2017	18	Annual Review for OGNZL	Part A – MB/RS, Part B Roll over
2018	19	Annual Review for OGNZL	Part A – MB, Part B

Contents

1 INTRODUCTION

1.1 Background

The conditions of Mining Licence 32-2388 (which have been incorporated into the Hauraki District Plan) and consents granted for the Martha Mine Extended Project require an annual review of a Rehabilitation and Closure Plan ("the Plan"). The conditions of consent for the Favona, Trio, Correnso and SUPA Underground Mines also require the preparation of a Rehabilitation Plan. This is the nineteenth version of the Plan to be prepared since Extended Project activities commenced in 1999.

The SUPA project began in January 2017 and is a small extension to mining within the Correnso Extensions Potential Project Area ("CEPPA"). The project is entirely underground without surface expression. The only closure related matter associated with SUPA is backfilling of the underground workings.

In addition to its mandatory rehabilitation and closure obligations, OGNZL carries out other activities at its own discretion. Part A of the Rehabilitation and Closure Plan identifies activities that OGNZL must complete to achieve closure (mandatory activities) and those that it retains the option of including if it chooses (discretionary activities).

New ownership has breathed new life into the project with a firm commitment to near mine and regional exploration. As foreshadowed last year, this has resulted in a reassessment of work priorities. In addition, as described in this report the North Wall slip has resulted in a reassessment of the work programme with respect to lake water quality.

1.2 Relevant Conditions

The requirements for rehabilitation and closure are specified in:

- the Hauraki District Plan
- consents and conditions relating to Storage 2 and the conveyor silt ponds,
- the Waikato Regional Council consents and conditions for the Martha Mine Extended Project,
- the Hauraki District Council land use consent and conditions for the Extended Project no 97/98 – 105
- The HDC land use consent for the relocation of the Cornish Pumphouse (No 85.030.009.PP),
- Condition 4 of Schedule 1 attached to Waikato Regional consents for the Favona Mine (refer consent number 109741, 109742, 109743, 109744, 109745, 109746),
- The Hauraki District Council land use consent and conditions 85.050.326.E for the Favona Underground Mine,
- The HDC land use consent for the relocation of the Grand Junction Refinery Building and Strongrooms,
- The HDC land use consent for the Trio Development Project, RC-15735
- Waikato Regional Council consents for the Trio Development Project (121416-121418, 121446, 121447),
- Hauraki District Council land use consent for the Trio Mine, RC-15774,
- Waikato Regional Council consents for the Trio Mine (121694-121697),
- Hauraki District Council land use consent for the Correnso Underground Mine, 202.2012
- Waikato Regional Council consents for the Trio Mine (124859 – 124864),
- Hauraki District Council land use consent for the Slevin Underground Project Area, 202.2016.00000544.001.

All of the relevant conditions are listed in **Appendix 1**. It should be noted that there are also consent conditions relating to the Rehabilitation Bond, post closure Trust (the Martha Trust) and Capitalisation Bond.

1.3 Report Content and Structure

In accordance with the consent conditions this report has been divided into two parts, Parts A and B. Part A summarises the rehabilitation activities that were carried out between 1 July 2017 to 30 June 2018, and outlines those rehabilitation activities that are planned for the coming year, i.e. 1 July 2018 to 30 June 2019. Part B outlines the rehabilitation and closure activities that would be needed should closure occur on 1 July 2018. Part B has been allowed to partially rollover this reporting period as no changes to the bond or closure costs are foreseen.

PART A

Contents

1 PART A ONGOING REHABILITATION OPERATIONS

1.1 Introduction

The Waikato Regional Council consent conditions for the Martha Mine Extended Project require that Part A shall:

- describe the programme of progressive rehabilitation (including revegetation) that is proposed for the Site for the following twelve months, should closure not be proposed during that period; and
- report on any such works undertaken during the previous year.

While the following sections have been written to fulfil the requirements of Part A, much of the following refers to activities that are not mandatory. **Mandatory** activities can be described as those activities that are required by the consents and the Mining Licence.

In addition to its **mandatory** requirements, OGNZL carries out other **discretionary** activities (i.e. activities that OGNZL may choose to complete during the remaining life of mine but are not part of its statutory obligations). They are described as either *Golden Legacy proje*cts or *Riparian and Biodiversity Projects*. Discretionary projects have no requirement for peer review, and there is no obligation for discretionary activities to be included in the costs derived for the bonds. Discretionary activities are those activities that go above and beyond the requirements of the conditions of consent. It is expected that discretionary activities described in this Plan will change from time to time as OGNZL, community and economic circumstances dictate.

The Golden Legacy concept involves the incorporation of the rehabilitation of the Martha Mine within an overall plan that includes adjacent areas such as the GNS Hazard Zones and other land owned by OGNZL. Several Golden Legacy projects arose from ideas presented in the 20/20 Vision document produced by Waihi Community Vision (WCV).

In addition to Golden Legacy projects, OGNZL also carries out activities that can be described as “Riparian and Biodiversity Projects”. These projects mostly pre-dated the WCV and have been carried out by OGNZL and its predecessor company for several years now.

From a practical perspective, there are areas of overlap between activities that are mandatory and discretionary. While OGNZL is not required to report on discretionary activities within this document, all the information is presented to allow all relevant parties to gain full knowledge of what is occurring and what is proposed.

1.2 Mandatory Requirements

1.2.1 Open Pit Area

1.2.1.1 Martha Mine Master Rehabilitation and Closure Concept Plan

Following the Barry Road Collapse and the subsequent identification of the hazard zones by GNS, it was considered that the previously planned lakeside park at Junction Road was no longer viable. The Company subsequently developed the currently approved Martha Mine Rehabilitation and Closure Concept Plan (Figure 1). This original Plan was developed in 2006 by a project team made up of OGNZL technical staff, Waikato University, Department of Conservation, WCV, Landscape Design Company, and tourism and marketing advisors.

The Rehabilitation and Closure Concept Plan is considered a "work in progress" and is subject to change and more detailed landscape planning. The Closure Concept Plan changed following the approval of the Martha East Layback. This year, changes have been made to show the North Wall following remediation and partial capping of the failed section. This updated plan is included as Figure 2.

The landscape plan for the pit currently includes a pontoon located on the west side of the open pit and a boat ramp on the southern side. OGNZL will be re-evaluating whether this is the best option in terms of providing lake access to the general public.

In addition to the closure plan, a landscape vision has also been developed. It is intended that rehabilitation will establish a self-sustaining ecosystem. After extensive consultation with stakeholders the following landscaping philosophy was adopted:

- Progressive removal of all exotic weed seed sources from the pit perimeter to reduce on-going long-term maintenance of pit walls.
- Provision of a new seed bank near the pit area i.e. around the pit rim, by revegetation of primarily native seedlings local to the area.
- Planting berms to achieve upwards and downwards growth without directly planting batters.
- Weed control, mulching and maintenance particularly in the first few years and reducing as plants become established and weed seed burden depletes.

Generally, the aim is to preserve views of the future lake from the surrounding pit rim walkways by using low grasses and groundcovers broken up in places with some small tree species e.g. manuka and pittosporum. This will also address the long-term issue of security for pedestrians using this walkway.

1.2.1.2 Screen Planting Plan

The conditions of the Hauraki District Council Land Use Consent No 97/98-105 and the varied Mining Licence 32-2388 require the preparation of a management plan for screen planting to mitigate the visual effects of the extended pit and the Grey Street noise bund. A Screen Planting Plan was originally prepared and subsequently approved by Hauraki District Council in October 1998, however it became outdated and was subsequently reviewed and approved by HDC in May 2007. The decision was made at the time to include the Screen Planting Plan within the Rehabilitation and Closure Plan because of the significant overlap between the two documents.

Mining Licence 32-2388 has been varied and approved. The screen planting conditions were substantially reworded on the basis that the Screen Planting Plan has served its purpose and is no longer required. With that in mind, a 2016 version of the Screen Planting Plan was prepared and this is expected to be the final revision of the document. In years to come, the vegetation maintenance programme will be included within the Rehabilitation and Closure Plan, and significant vegetation removal will require council approval.

A process exists at present whereby the OGNZL Senior Environmental Adviser – Operations contacts HDC's Strategic Planning Project Manager prior to the removal of large trees with a screening function. The two then visit the site, discuss the proposed plans for tree removal and agree on any need for mitigation, i.e. infill planting. This process is working well, and the intention is that this process will continue.

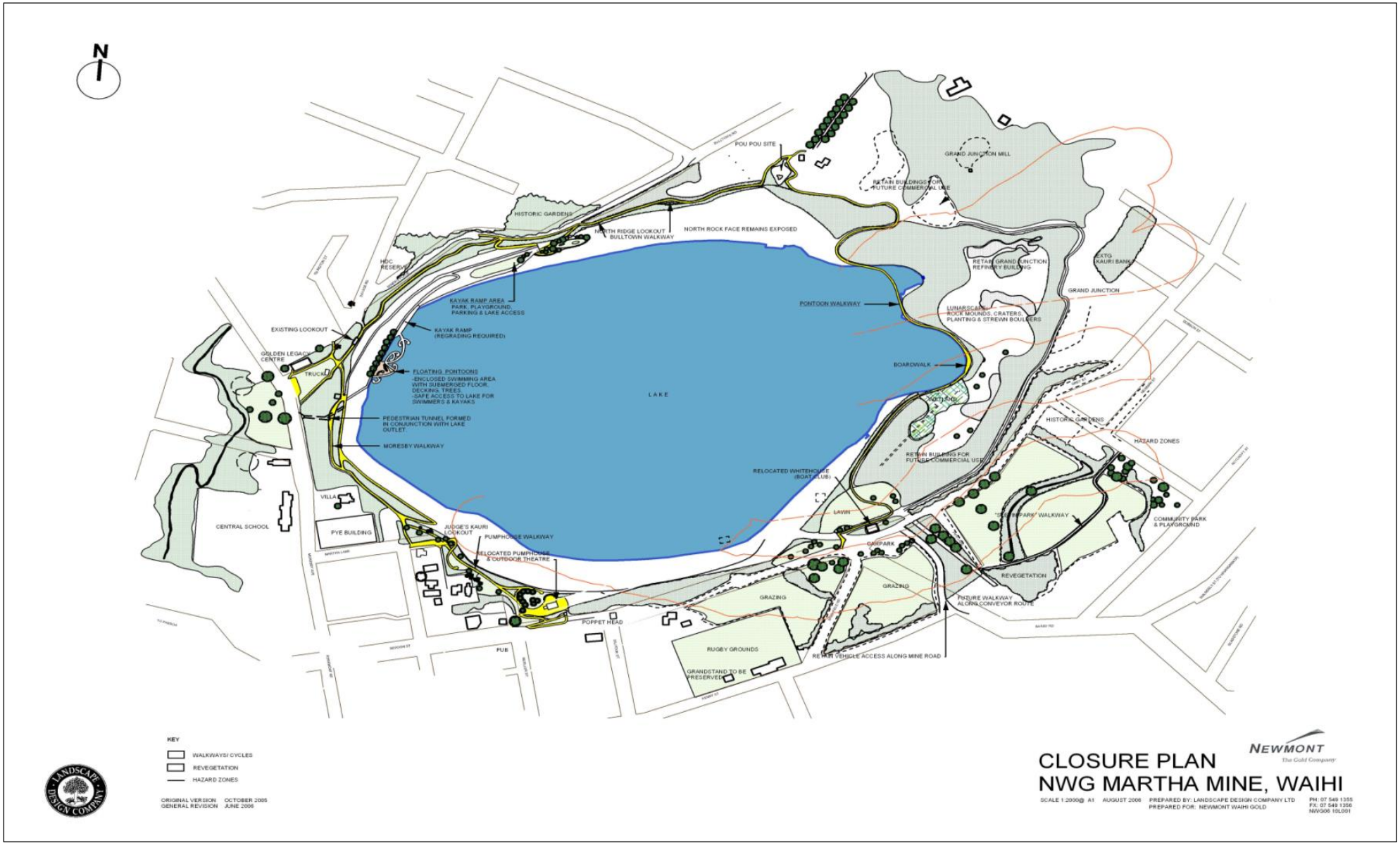


Figure 1- Newmont Waihi Gold Martha Pit Master Rehabilitation & Closure Concept Plan 2006

Figure 2 – Current Closure Concept Plan for Open Pit and Surrounds

1.2.1.3 Landscape Plans and Progress

Figure 3 shows the areas that have been rehabilitated around the open pit and pit-rim walkway, as well as some adjacent areas that could be described as “discretionary”. In 2012 this included plantings along the Mangatoetoe Stream west of the pit.

1.2.1.4 Pumphouse Relocation

The urban park developed around the relocated Cornish Pumphouse continues to be highly popular with visitors, and it has been used for community events held throughout the year.

Figure 4 shows the Pumphouse as a venue during the 2016 Beach Hop Waihi Warmup Party, and Figure 5 shows a team of OGNZL employees competing in the Drag Race.

1.2.1.5 Pit Rim Walkway

The walkway has been used for events like the Nugget Multisport, school fun runs and cross country events, and is included in the itinerary of the annual ECHO Walking Festival. It is used significantly by local walkers.

A section of the walkway was re-routed due to the North Wall Slip (Figure 6). As described in the Annual Work Programme 2017, OGNZL has planted trees and shrubs adjacent to the new section of the pit rim walkway with a number of plantings to the east of the pit.

Figure 3 – Rehabilitation of Open Pit and Surrounding Areas

Figure 4 – 2016 Beach Hop Warm-up Party

Figure 5 – Drag Race

Figure 6 – Rerouted Pit Rim Walkway

1.2.1.6 Grand Junction Refinery Building

The Grand Junction Refinery Building was relocated in March/April 2010 and subsequently refurbished in accordance with the Conservation Management Plan (refer Figure 7 and Figure 8). Landscaping work has largely been completed although ongoing minor and agreed improvements to the building and curtilage continue (i.e. in 2017 an historic ore wagon, refurbished by a local resident was placed on display beside the building).

Figure 7 - Landscape Plan for Grand Junction Refinery Building

Figure 8 – Relocated Grand Junction Refinery Building

1.2.1.7 Lake Water Quality

Background

Sampling of surface runoff above the proposed pit lake level has been refined and improved since it commenced in the late 1990's.

In 2007 a new monitoring programme was initiated for accurately assessing representative pit wall runoff. Runoff water quality for all the various rock types exposed in the open pit has been collected and this has provided more robust data than was previously available. The alteration map for the pit walls has been revised on an as required basis to provide a more accurate assessment of the geology affecting runoff water quality.

The pit wall runoff monitoring programme was focused entirely above the pit lake level (1104 mRL) as the water quality affecting the future pit lake will be determined from areas exposed to oxidation and weathering processes. No sample sites were selected below the pit lake level primarily because in the past it was unsafe working under the high walls. Furthermore, once inundated the sulphidic exposures below lake level will not materially influence lake water quality, and it is proposed to actively manage the water quality during initial lake filling. Runoff water quality from the monitoring programme has been used to represent specific alteration types and runoff below pit-lake level in the prediction model where the chemistry is similar (e.g. south wall PAF material).

The original intent was that monitoring of the runoff water quality would continue over time to assess changes both seasonally and over the longer term. AECOM considered the possibility that the PAF rock runoff may improve over time when deriving appropriate scenarios for assessment. Their conservative estimate assumed no improvement in PAF runoff, while the best estimate included some improvement (to a chemistry equivalent to the moderate PAF of the North Wall). The ability to continue monitoring the runoff water quality from the present locations has always been dependent upon the ability to safely access the sites to undertake the sampling.

The most recent URS report (2012) stated that unless mitigated, the pit lake water quality would degrade due to the acidity contribution from the sulphidic exposures above lake level. OGNZL is committed to ensuring that does not occur and that water discharge from the lake is of acceptable quality.

The current plan, as costed in the Rehabilitation Bond Report, is to run the river water used to supplement lake filling through a limestone channel as the lake is filled. Once the lake is filled, the water would be dosed with limestone using a limestone addition plant. The advice from AECOM was that the pit lake water quality would be acceptable in the long term if the North Wall was cut down to RL1120m, with the wall battered back allowing a capping layer to be constructed. Work on the remediation cut in the coming year will bring the wall height down closer to this level.

In 2017, in consideration of the lack of access to the North Wall and in a review of the data to date, no sites require on-going water quality run off sampling.

Proposed Work For 2018/19

At the time of writing five piezometers (P117 - P121) were being installed near the magazine ramp area on the North Wall (Figure 9). These are intended to assist monitoring water levels and the source of seepage on the upper east North Wall.

Figure 9 - Martha North Wall piezometers

No major work is planned for the coming reporting period other than drainage work or other maintenance as required.

1.2.1.8 Pit Walls

Condition 37 of the Mining Licence states:

> *"The upper pit slopes shall be treated to ensure revegetation as soon as possible in the mining programme and in accordance with the current approved Rehabilitation and Closure Plan. Revegetation of the upper slopes will be carried out as far as practicable and may preserve some*

areas without vegetation to preserve and reflect the mining heritage of the town provided that the water quality of the Pit lake remains suitable for direct discharge to surface waters in accordance with resource consents held by the licensee from the Waikato Regional Council."

Current objectives for the pit walls are:

- Providing for public safety at closure.
- Improved pit wall runoff water quality, as a combination of all pit wall types above lake level where practicable.
- Self-sustaining groundcover wherever practicable, with minimal weed species.

Previously, several reports were supplied to the councils and peer reviewers including:

- Martha Pit Wall Risk Assessment – Lane Associates Ltd, 12 June 2014
- Martha Pit Wall Risk Assessment Update – Lane Associates Ltd, 20 October 2014
- Seiche Analysis – Pells Sullivan Meynink, 15 October 2014
- Eastern Pit Lake Park Public Safety Risk Assessment – Lane Associates Ltd, 16 March 2015
- Martha Pit Risk Summary Report – Lane Associates, 29 May 2015.

The Pit Wall risk assessment is in the process of being updated, and appears to confirm the results of the previous assessment. As a result of the failure on the North Wall, an additional geological domain has been identified and the North Wall is now split into North West and North East sections and are considered separately in the Pit Wall Risk Assessment.

1.2.1.9 Pit Wall Revegetation

Non-Acid Forming (NAF) Material

Progressive revegetation by hydroseeding has occurred on all the non-acid forming pit slopes above lake level. Hydroseeded areas are inspected annually for weeds and dieback.

Three native seed bed trials (50 m^2) of manuka were established using manuka slash in 2009. This was expanded in the following year to two field sized areas (top to bottom of the batter) of 30 x 15m. This technique has proven very successful and manuka has spread from these plots along the west wall. Other natives established have been pohutukawa trees (50) along the south cutback, and 80 (10 plots of 8 species) of various plants including native broom, flax, pittosporum, hebe, akeake, and toetoe. These are assessed for establishment success.

Weed control occurs biannually and includes spot spraying, hand-weeding and weed tree poisoning or removal on revegetated areas. This also includes the relocated topsoil stockpile on the north pit rim.

Potentially Acid Forming (PAF) Material

In 2008, OGNZL established a moss trial on PAF batters on the upper north and south walls within the open pit. The hydroseeders were sent samples of the PAF rock and they developed glue that would set and recreate a zone between the acidic zone and the moss. AECOM provided assistance in terms of advising lime addition rates. Two separate layers were applied to create the zone between the rock and the moss.

The glue was successful where the underlying material was competent rock. Some moss developed but only in areas where the pH was relatively high and there was competent rock beneath; no moss developed where the pH was less than about 4 and where the soil beneath it was eroding. The trial appeared to have been more successful on the North Wall than the South Wall. The north wall trial was subsequently destroyed with the East Wall cutback. Moss hydroseeding on the south wall was unsuccessful due to the low pH levels in the rock. Oxidised rock on the western pit wall had good moss cover. OGNZL does not anticipate repeating the moss trial; moss occurs naturally in the pit in suitable conditions and its viability can be interpreted from where it establishes.

1.2.2 Waste Rock Embankment

The overall original concept plan for the rehabilitation of the Waste Disposal Area (Figure 10) remains generally unchanged. Figure 11 provides a summary of rehabilitation completed at the Waste Disposal Area to date.

1.2.2.1 Embankment Rehabilitation

The waste rock embankment is rehabilitated to pasture and native vegetation. OGNZL generally plants areas of the waste rock embankment in native vegetation:

- if the embankment slope exceeds 20 to 25 degrees, and there is a risk of tracking by stock and damage to the land if the area is rehabilitated to pasture, or,
- if there are awkward areas that are difficult to farm, e.g. triangles of land adjacent to ramps, or,
- if there is an ecological benefit in planting selected areas.

The intention is to maximise the amount of pasture land available to the post-closure Trust while ensuring that native vegetation is planted in appropriate areas to ensure the long-term integrity of the capping layer, while achieving any biodiversity objectives.

In 2017, OGNZL planted approximately 700 trees and shrubs on the embankment in three triangles above collection pond S4.

Plantings to be undertaken in 2018 will be in-filling with a focus on maintenance of riparian and earlier embankment plantings (including fence maintenance, weed control on all land and release spraying of younger plantings).

The rehabilitated waste rock embankment is fenced into 1ha paddocks as areas become available. Figure 11 shows those areas of the embankment that have been rehabilitated up to the present. The 2017/18 construction season material was sourced from stockpiles (North, Central and East). 58,450m^3 was placed in the reporting period (Table 1).

Table 1: TSF1A Volume and Zone placement from stockpiles

Zone	Volume (m^3)	Comments
G+H	29,240	Areas 1,2,3
F	2,200	Areas 1,2,3
B	9,370	Areas 1 & 3
C1	11,725	Areas 1,2,3
C2	5,915	Areas 1,2,3
Grand total	**58,450**	

The plans for embankment rehabilitation during the coming year are described below. Of relevance is Condition 42 (A) of the Mining Licence (ML-32 2388) which was added as a variation to the Mining Licence in July 2011, and varied in 2014:

42A

a) *Prior to each increase in embankments and crest height of Tailings Storage Facility 1A above RL 166, as part of the Third Stage – Continued Waihi Operations within Annex A, the licensee shall provide to the Hauraki District and Waikato Regional Councils for their approval, a report detailing the height of the crest rise, the sequence of works proposed, and an anticipated timeline in which the physical works and revegetation of the embankments and crest will occur. The approved report shall form part of the Rehabilitation and Closure Plan required by 1(c) of this licence and shall incorporate the revegetation programme in 42A (c) below.*

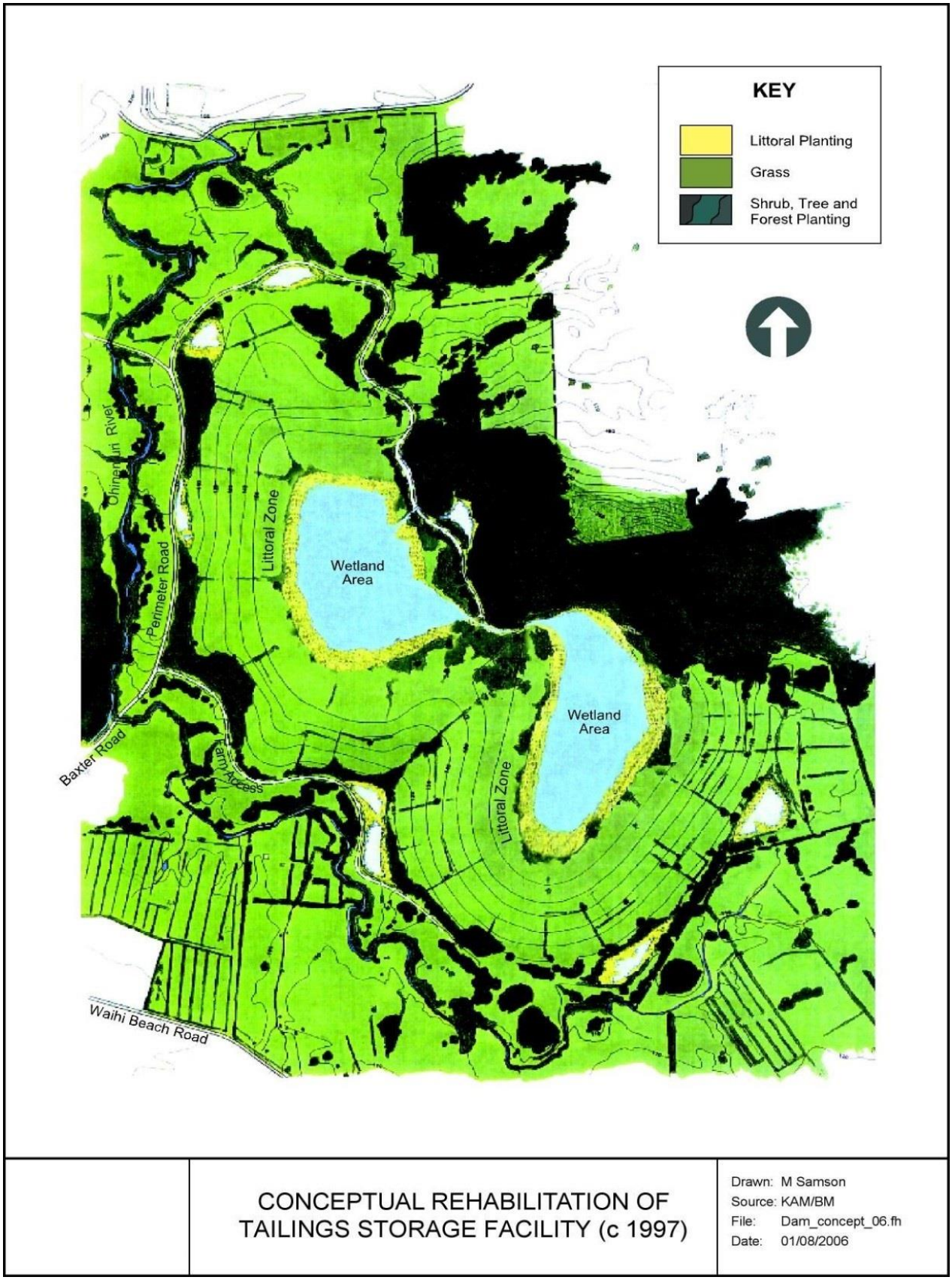


Figure 10 – Tailings Storage Facility Closure Concept Proposed in 1997

Figure 11 – Waste Disposal Area Rehabilitation and Bridge to Bridge Riparian Planting

b) The licensee shall have completed revegetation of the embankment slopes of Storage 1A to RL166 by 31 March 2015.

*c) Unless otherwise agreed in writing by Hauraki District Council and Waikato Regional Council, the licensee shall undertake the revegetation planting of the embankment slopes of Storage 1A such that after 31 March **2015**, all revegetation planting shall be staged relative to the annual lifts of the embankment crest, i.e. the lift undertaken in the previous season is to be revegetated while the current season's lift is being undertaken. Stockpile areas are excluded from the requirements of 42 (b) and (c).*

*d) If the programme in 42A **(b) or** (c) above is not achieved, the licensee shall forthwith provide a review to Hauraki District and Waikato Regional Councils detailing the reasons why this has occurred and measures proposed to address programme timing.*

With respect the 42A a) and c), the following is a summary of the proposed crest raises, the sequence of works proposed and an anticipated timeline in which the physical works and revegetation of the embankments and crest will occur:

TFS1A
Current Levels of TSF1A:

- The lowest point of the crest is in Zone B at 171.96 mRL.

Proposed Works 2017-2018:

As the remediation works have been completed the only activity to be undertaken over the next 12 months will be the carting of waste rock from the NAF stockpile to the underground portal for use as underground backfill.

1.2.2.2 Pasture Monitoring and Fertilizer Application

Assessment of the performance of the rehabilitated embankments is carried out annually by Dr Bob Stewart, Fertilizer and Lime Research Centre, Massey University. The objective of the assessment is to:

- Sample soils from the embankments to determine the fertiliser strategy for spring topdressing
- Inspect the embankment for pasture and soil condition.

The 2017 report forms **Appendix 2**. The pasture monitoring locations are shown in Figure 12 below.
The soil test data from the report indicated the following:

- The pH data for both TSF1A and TSF2 increased from that of 2015 as a result of liming in the previous year and is now at a satisfactory level across all sampling sites.
- Olsen-P levels are within the closure guideline of 25+/- 5 ug P ml^{-1} .
- Sulphate-S continues to decrease on TSF2 as expected, but the TSF1A data shows variability that may indicate some overland flow of surface water from earthmoving activities at the crest
- Mg is within guidelines on both TSF1A and TSF2 but K is slightly low on TSF1A. However, it has lifted to near the bottom of the target range. This suggests that the current fertiliser regime is adequately raising the K content of the soil and therefore does not need modification this year.

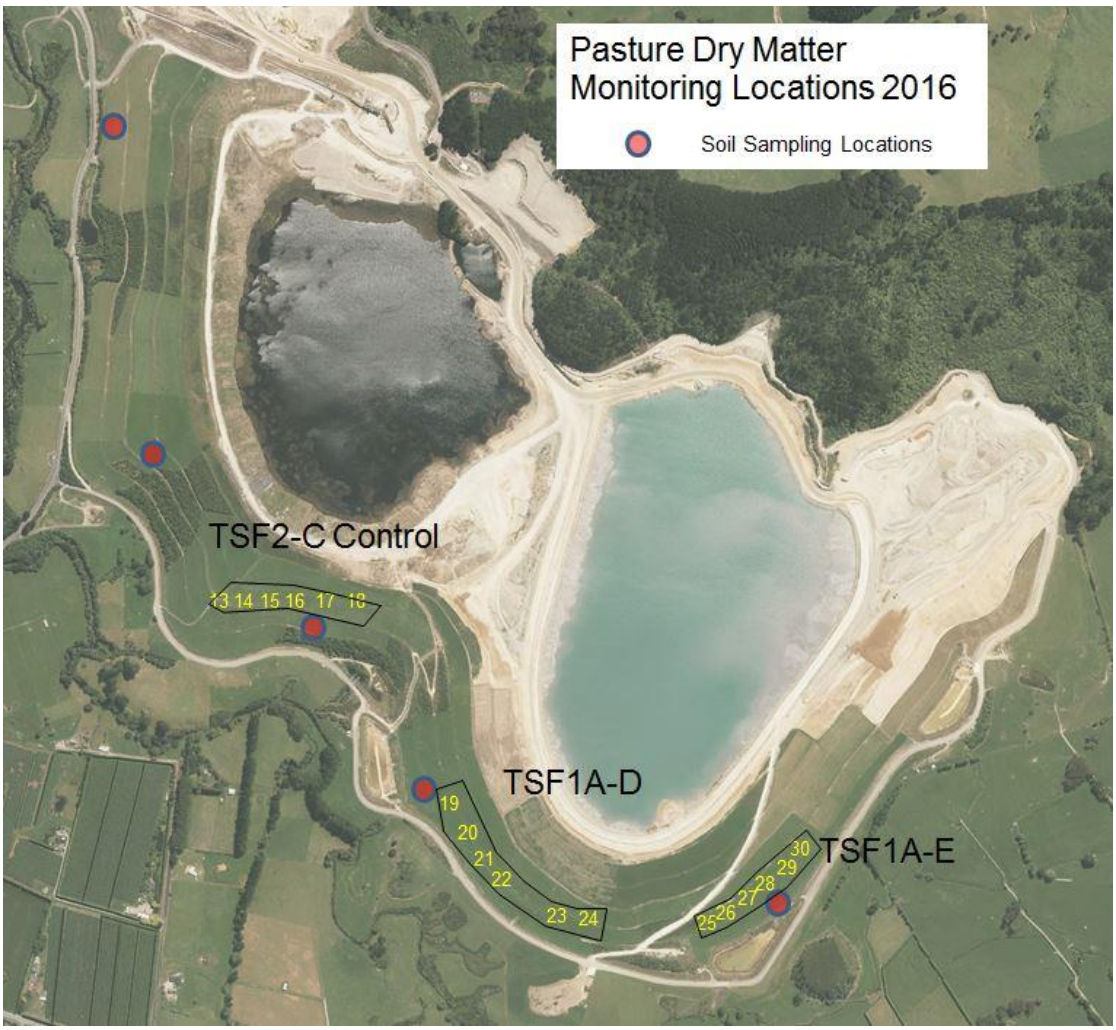


Figure 12 – Pasture Monitoring Locations

The report made three recommendations as follows:

1. For both TSF1A and TSF2 to continue with 400 kg/ha 30% potassic superphosphate or 200 kg/ha 30% potassic triple superphosphate. In either case, the 90 kg/ha N should be added separately.
2. Nitrogen (N) at 90 kg urea ha^{-1} (equates to 40 kg N ha-1) should continue to be applied in spring. These rates of N should be applied across both TSF1A and TSF2.
3. The fertiliser application history for the small paddock used for soil sampling (J) needs to be checked to see if this area has missed being top-dressed over 2014-2016.

Table 2 summarises the fertiliser that was applied during the reporting period.

Table 2 – Summary of Fertiliser Applied

When	Where	What	Rate kg/ha
Nov/Dec 2017	Storage 1A	Urea	90
Nov/Dec 2017	Storage 2	Urea	90
Nov/Dec 2017	Storage 2 (Area J)	Potassic Superphosphate	400
Nov/Dec 2017	Storage 2	Potassic Superphosphate	400
Nov/Dec 2017	Storage 1A	Potassic Superphosphate	400

1.2.2.3 Pasture and Vegetation Inspection

Pasture on TSF1A and TSF2 was described as in very good condition with no deficiencies. Pasture composition has a good legume/grass balance, within the closure guidelines of about 70:30 grass/clover mix, and ground cover is greater than 90%. Although there is some minor weed incursion in the pasture areas, largely broom, the gorse and ragwort noted in previous reports is under control.

Ground conditions were wet but soil damage was minimal, except for two recently grazed paddocks where there was evidence of moderate pugging. The Massey University report recommended that further thought be given to stand-off strategies prior to soil conditions reaching their plastic limit, i.e. in anticipation of significant rainfall.

1.2.2.4 Pasture Maintenance

From time to time, work is undertaken to repair rehabilitated areas of the embankment. This work includes:

- Metaling of pugged soils around stock watering troughs and manholes,
- Additional drainage of wet area, and
- Drain cleaning of berms.

1.2.2.5 Earthworm Seeding

Although earthworm spread is occurring without intervention an opportunity was taken in May 2014 to enhance their activity (and run a primary school education programme) by seeding worm-laden sods across the embankment above collection ponds S4 and S5.

1.2.2.6 Tailings Capping of Storage 2

Tailings discharge into Storage 2 ceased on 15 July 2005. Since that time, water quality steadily improved and following the approval of Waikato Regional Council, the water has been discharged into tributary TB1. Monitoring of the pond water quality is carried out continuously with the use of automatic probes (pH, turbidity, EC and flow) installed in the decant pond. Pumping of the discharge is controlled by the SCADA programme setting trigger levels for the probes. Monthly samples are also taken from the pond as well as the stream that the pond discharges to.

During the summer of 2013-14, a further 1ha of ignimbrite capping was completed on the north-eastern side of Storage 2. The area was limed and geotextile applied prior to capping. During the summer of 2014-15, 0.29 ha of tailings capping was carried out on the south-east corner of the TSF2 tailings pond. Further capping of the TSF2 tailings was conducted early 2017. This reduced exposure of some north side tailings beach and allowed a greater freeboard buffer.

The Rehabilitation Bond makes an assumption as to the area of tailings that is required to be capped, but further work is required to confirm the optimal extent of the tailings capping.

1.2.2.7 Stockpiles and Silt/Collection Ponds

Stockpile inventories around the Tailings Storage Facilities are summarised in Engineering Geology's Annual Inspection Report.

During the coming year, OGNZL wishes to identify the options for the long term use of the various ponds around the site with a view to making a decision on which ponds should remain in the long term and which should be decommissioned.

1.2.2.8 Topsoil Stockpile Management

Topsoil for the purposes of embankment rehabilitation will not be utilized in 2018.

The topsoil will be used progressively as rehabilitation advances. Weed control will be carried out as necessary and any disturbed stockpiles temporarily seeded between rehabilitation work seasons.

1.2.2.9 Passive Underdrainage Treatment Trial

In November 2016, two small scale passive treatment systems to treat two of the discharges from the TSFs (TU at TSF1A and L10 at TSF2) were established under the guidance of the Centre for Mineral Environmental Research New Zealand (CMER). Passive treatment options employ either a reducing or oxidising strategy in the treatment of mine discharge. The first water samples were taken in mid-December 2016 and water samples are taken frequently. The trial is on-going.

1.2.2.10 Weed Control

OGNZL's Pest Management Plan was updated in 2015. The Pest Management Plan includes a section on Weed Identification and Management. Land management activities have focused on surveillance control of noxious weed species in sparser areas, and concerted programs on dense areas as resources allow.

On the rehabilitated embankment, thistle and ragwort spraying is carried out during the Spring and before Christmas. Gorse is sprayed as it appears and when actively growing.

In 2018, the Pest Management Plan is being incorporated into the Biodiversity Management Plan.

1.2.2.11 Other Work Planned for the Coming Year

OGNZL would like to:

- Start the process of looking at which underdrains could be direct discharged,
- Identify the best way of direct discharging from the very deep drains located in some of the sumps for Storage 2,

OGNZL will also be watching progress as the Waikato Regional Plan is reviewed with a view to introducing permitted activity rules where possible for ongoing closure works.

It is recognised that progress on this list of closure tasks will depend upon the resources available, the necessity to do other operational work in the coming year and any new plans arising from the results of exploration drilling activities.

1.2.3 Underground Mines

Development and production activities are ongoing in the Correnso and Daybreak orebodies and development has commenced in the Empire/Christina and SUPA orebodies (with production forecast in the coming year). Backfilling of Favona, Moonlight and Trio is complete. The Martha Drill Drives Project will see the development of two parallel exploration drives southwest from the edge of the SUPA consent area, with the likely breakthrough of a ventilation drive into the Martha Pit in the third quarter of 2018.

Progressive backfilling takes place within the mines where required. In the previous 12 months, the average month-end stope void remaining was approximately 1600m^3; under the current mining regime, this would be the typical stope void backfilling that would be required in the event of sudden closure.

Other areas in the Underground that would require backfilling upon the mine being closed are those areas of sustained vertical development. These include ventilation rises, ore and waste passes, and limited stacked development. As part of the mine being decommissioned, any portals would be backfilled to exclude access.

1.3 Discretionary Activities

1.3.1 Golden Legacy Projects

OGNZL worked with the Waihi community on a wide range of local (Golden Legacy) projects listed below. OGNZL will continue to be involved with them and assist with their concept development and will consider any community request for more direct input and assistance.

1.3.2 Martha Mine Master Rehabilitation and Closure Concept Plan

The Martha Mine Master Rehabilitation and Closure Concept Plan discussed in section 2.2.1.1 goes beyond the statutory requirements of closure because it also considers heritage feature protection and enhancement, sustainable land use and tourism opportunities. As OGNZL further develops its closure plans, any proposed changes will be reported in future Rehabilitation and Closure Plans.

1.3.3 Discovery Centre

OGNZL committed $1,000,000 to this project and the Discovery Centre opened on Seddon Street, across the road from the Cornish Pumphouse, on 26 September 2014. The Discovery Centre has several interactive facilities and tours of the mine are available. The Discovery Centre won Best Visitor Experience in the 2015 Service IQ New Zealand Museum Awards.

OGNZ continues to identify ways to assist in providing a positive visitor experience for tour buses visiting the mine to encourage further visits and the ongoing viability of the Discovery Centre.

1.3.4 Cultural Balance Plan

The Correnso consent conditions required a Cultural Balance Plan to be implemented. The company sought advice from local iwi, and in partnership with them has embarked on the process. This journey is led and driven by iwi and is proceeding according to their tikanga. The company conducts regular Cultural Awareness Training Programmes. All staff and contractors are required to attend this day-long course run by iwi.

1.3.5 Union Hill

The kilns, battery site, cyanide tanks and other foundations and historic workings at Union Hill show potential for public appreciation. A Tourism Development Study and Conservation Management Plan have been completed. OGNZL has also funded a management plan for Union Hill. Prior to that, OGNZL funded the Union Hill walkway. Weed control activities and general site maintenance have been ongoing and a progressive improvement programme is underway in conjunction with Waihi Heritage Vision, removing weed tree species and removing trees within fall-distance of key heritage artefacts.

1.3.6 Slevin Park

Slevin Park is the name given to the parcel of land in the Slevin Street area that was purchased by OGNZL following the collapse of land at Barry Road in 2001. It encircles the Eastern end of the hazard zones and is not affected by current mining activities. This area lies in close proximity to the Surface Facilities Area. This area of land has been fenced, areas planted or mown, with access roads and tracks provided. It includes closure of parts of Slevin, Newman and Grey Streets.

During 2009 a draft landscape plan that incorporated the WCV 'vision' and neighbours' and ex-residents' ideas was developed for the area. Parts of the area have been planted and this area is now an attractive addition to the Pit Rim walkway. The area is mown and maintained as necessary by OGNZL.

The future landscape of the proposed Slevin Park area could be a mix of native and exotic tree species including walkways and recreation areas and could possibly include lifestyle blocks with designated building sites. Any options would still have to take the hazard zones into consideration. OGNZL intends to prepare a divestment strategy that will cover areas of OGNZL owned land such as this, and further consideration will be given to what happens to this parcel of land at that time.

1.3.7 Riparian and Biodiversity Projects

1.3.7.1 Native planting

A riparian revegetation project on the Ohinemuri River between Golden Valley and Coronation (SH2) bridges, initiated by OGNZL in 1995, was completed in September 2005. The project has restored and enhanced the aquatic environment along the Ohinemuri River and its tributaries. It also provides potential links with the Golden Legacy Projects, e.g. for walkway development and by providing a corridor of native plants (Figure 11).

Fencing of riparian areas from stock has been completed and self-closing gates have been erected for public access and general up-keep. Significant areas of weed species were cleared (broom, gorse, blackberry, hawthorn etc.) to prepare sites for planting.

Most native plants are sourced from the Waihi ecological area. Hauora Nurseries is contracted by OGNZL to propagate seedlings and Kauri Gold is contracted to plant and maintain the sites. In the fifth year, plants have grown to a stage where little or no weed control is required on hill sites and the sites are essentially "self-sustaining". Riparian sites will always be prone to flood damage and weed invasion from upstream, but regular maintenance minimizes the issues.

The planting programme in 2013 initiated the progressive replacement of weed tree species in the pit screening areas with native species and the further development of the Favona North Swamp. For 2014, small gaps in the TSF2 embankment were planted out along with further enhancement of the pit screening and Favona Swamp. In 2015 further in-fill planting of Favona Swamp was carried out, along with enhancement areas around the pit. These areas continue to receive minor plantings and ongoing weed surveillance/control.

1.3.7.2 Kete Concept

The kete project involved a block-planting regime on the upper slopes of the waste rock embankments with specific species to create a 'kete weave' pattern. However, a review in 2014 found that flaws in the kete concept rendered the design unsustainable in the longer term:

- The full extent of the pattern would only be discernable from aircraft, not from the ground.
- The pattern is really a series of monocultures, and unnatural.
- Replacement planting would have to be with the same species, irrespective of their survivability.
- Native species naturally spreading into the pattern would have to be regarded as weeds.
- The pattern would commit OGNZL to the same rehabilitation process on the crest of TSF2, when other outcomes may be more desirable or cost-effective.

Planting of native species on the TSF embankments is now a more natural species-mix, retaining options for alternative revegetation techniques.

1.3.7.3 Kauri Bank

Kauri Bank was a project to re-establish lowland kauri on land administered by OGNZL such as around the perimeter of the pit, along walkways and along the Ohinemuri River and its tributaries. Kauri has been planted in groves as they may have once been before European colonization. To date, over five thousand trees have been planted. Most available areas have now been planted and this programme is now considered complete, although kauri will continue to be planted in accordance with the general mix of revegetation species.

1.3.7.4 Tailings Revegetation Trial

A vegetation trial was established over tailings at the southern end of TSF2 in 2011. The vegetation trial comprises five plots; three with zone H & topsoil with low and medium height native plants and one plot in grass cover; one with no soil cover but free draining ignimbrite and the other with plastic sheeting covering ignimbrite (refer Figure 13). This latter plot is to test the effect of an impermeable layer. The objective of the trial is to determine the effect of the soil covers with different vegetation types on the groundwater table near the ignimbrite/tailings contact. Four piezometers have been installed in each plot to monitor water levels. Additional objectives are to assess the success of the various types of plants established on the trial plot. The trial is expected to run for five years.

A number of the plants were tagged, photographed and measured in January 2012. In 2014, the plants were again measured for survival and growth. The 2014 Rehabilitation and Closure Plan included a report that summarised the piezometer data as well as the plant survival/growth data.

The report identified that the trial plot had been affected by potentially acid forming material. It also appears that plants require nitrogen fertilizer. Limestone was subsequently applied in accordance with a recommendation supplied by AECOM. The area was checked and reported on by Bob Stewart during his visit in July 2017. It was noted that liming of the area appears to have been successful in mitigating the effects of the PAF material. Continued monitoring of the area was recommended.

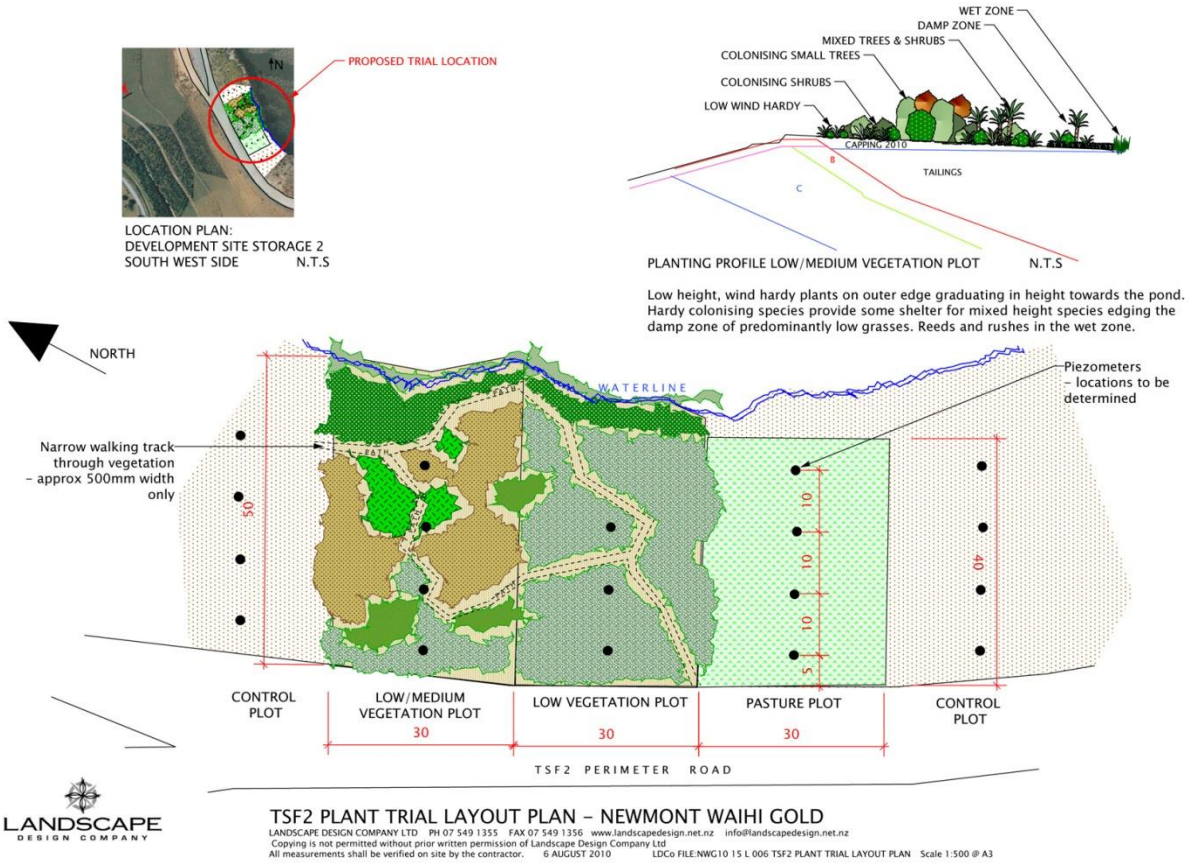


Figure 13 – Location and Trial Layout Plans for Tailings Revegetation Trial

1.3.7.5 Tailings Capping Manuka and Flax Revegetation Trials

OGNZL is continuing to trial flax and manuka slash laid directly on the ignimbrite capping that overlies the tailings as potential revegetation options for this area (refer Figure 14 and 15). Manuka establishment on the capped area is slower than on bare ground within the open pit (due to grass competition), however the flax plants have established well.

Figure 14 – Manuka Slash and Flax on Ignimbrite Capping

Figure 15 - Seedlings

1.3.7.6 Cycle Way

Western Bay of Plenty District Council (WBoPDC) has announced plans for a Hauraki Rail Trail extension between Waihi and Waihi Beach. The planned route is about 12.5 km long and is on a mixture of private and public land. The route is indicative only at this stage as WBoPDC meets with property owners to obtain formal agreements.

1.4 Closure Criteria

As described below, the Mining Licence and consent conditions provide the overall objective for closure and subsequent handover of the site to the Martha Trust.

Schedule 1 to the Waikato Regional Council consents for the Martha Mine Extended Project states the following in condition 9:

"Prior to commencement of construction of the tailings storage facility (Storage 1A), the consent holder shall prepare a concept plan ("the Plan") describing the proposed method of rehabilitation and closure of the Site. "The objective of this Plan shall be to ensure rehabilitation and closure of the Site in such a manner that in the long term the Site, and any structures on it, will remain stable; and any water discharging from the Site, and any groundwater under the Site, will be of a quality such that it will not adversely affect aquatic life, or other users of the water resource."

The Hauraki District Council Land Use Consent for the Martha Mine Extended Project (No 97/98 – 105) states the following in 3.31, condition 10 (refer complementary condition in WRC Schedule 1, condition 10.10):

"The Councils shall release the rehabilitation bond on the completion of closure of the site."

"Completion of closure of the site" means when the elements of the entire project have been demonstrated by the consent holder to the satisfaction of the Councils to have reached a stable, self-sustaining, rehabilitated state as defined by the approved Rehabilitation Plan."

In addition, the varied Mining Licence 32-2388 condition 36 states the following in condition 36:

> *"Mining, processing and waste disposal operations shall be carried out in such a manner as to ensure that the surface of the land suffers as little permanent damage as possible. The licence area is to be left in a clean and tidy condition after mining operations have ceased including removing from public view any used derelict equipment and machinery and the pit faces are to be left in a stable and safe condition."*

In summary, closure will be complete when OGNZL can demonstrate that the site has reached a stable, self-sustaining, rehabilitated state as defined in the approved Rehabilitation and Closure Plan, and the open pit walls are safe and stable. For this reason, OGNZL is in the process of incorporating closure completion criteria within the Rehabilitation and Closure Plan so that it is clear to all parties when closure has been achieved.

OGNZL has developed a process for defining Closure Criteria based on a "narrative" or descriptive definition of "what" is the closure objective and "quantitative" or descriptive definition of "how" the objective is to be achieved. The quantitative method definition of each criterion may include numerical standards if appropriate for measurement and may not be required or appropriate for every closure element of the site.

Narrative:	Narrative criteria = closure objectives
Quantitative:	Quantitative = methodology to achieve the narrative criteria.

It should be noted that some closure criteria are still in the process of being developed. These are included in the sections to follow and will be progressed over the coming year.

1.4.1 Discharges to Surface Water

Closure completion criteria for discharges to surface water are already stated in the conditions of consent. Preliminary criteria are suggested as follows:

Narrative:

Discharges from the site, either alone or in combination, shall not cause a significant adverse environmental effect on the receiving surface water, including users of the resource and aquatic biota.

Quantitative:

The discharges, either separately or in combination, shall not cause the receiving water standards specified below to be breached (refer Consents Tables 1 and 2).

Table 1: Receiving Water Standards

Parameter	*Receiving Water Concentration*	
(g/m³ unless otherwise stated)	*Hardness 20 g/m³ $CaCO_3$*	*Hardness 100 g/m³ $CaCO_3$*
Temperature	*Less than 3°C increase*	*Less than 3°C increase*
pH	*6.5 to 9.0*	*6.5 to 9.0*
Suspended solids	*For upstream concentrations of less than or equal to 100 g/m3 the increase shall be no greater than 10 g/m3. For upstream concentrations of greater than 100 g/m3 the increase shall be no greater than 10%.*	*For upstream concentrations of less than or equal to 100 g/m3 the increase shall be no greater than 10 g/m3. For upstream concentrations of greater than 100 g/m3 the increase shall be no greater than 10%.*
Cyanide CN(wad)1	*0.093*	*0.093*
Iron	*1.0*	*1.0*
Manganese	*2.0*	*2.0*
Copper	*0.003*	*0.011*
Nickel	*0.04*	*0.160*
Zinc	*0.027*	*0.100*
Silver 1	*0.0002*	*0.0024*
Total ammonia	*Refer Table 2*	*Refer Table 2*
Antimony	*0.03*	*0.03*
Arsenic	*0.190*	*0.190*
Selenium	*0.005*	*0.005*
Mercury	*0.000012*	*0.000012*
Cadmium	*0.0003*	*0.001*
Chromium (VI)	*0.01*	*0.01*
Lead	*0.0004*	*.0025*

Notes:

(1) Site specific derived criteria using US EPA (1985) methodology.

(2) Monitoring of metals shall be based on the soluble test method, defined as the concentration of dissolved metals measured in that fraction which passes through a 0.45 um filter except for mercury (Hg) which shall be based on acid soluble concentrations determined on unfiltered samples.

(3) Current analytical procedures for mercury have a practical quantification limit (PQL) of 0.0005 ppm. This PQL is acceptable for the purposes of reporting mercury concentrations. The reporting 'limit' for mercury concentrations shall be reviewed annually by the consent holder and shall be adjusted in line with improvements in analytical technology.

(4) ~~Prior to 30 October 2007,~~ The selenium concentration in the receiving water shall remain below the trigger limits of 0.02 g/m3 ~~90%~~ 97% of the time on an annual basis, and ~~shall not exceed~~ 0.035 g/m3 in any single analysis, based on monitoring undertaken pursuant to condition 16 of consent 971318. ~~After 30 October 2007, selenium concentrations shall not exceed 0.005 g/m3, unless otherwise agreed with the Waikato Regional Council in writing.~~ In the event that these limits are exceeded, the consent holder shall inform the Waikato Regional Council as soon as practicable and prepare a report, to the satisfaction of the Council, to demonstrate that continued discharges at concentrations exceeding the trigger limits will have no more than minor effects on the Ohinemuri River. This report shall be provided to the Council within two months of the consent holder becoming aware of the trigger exceedence.

Table 2: Criteria for Total Ammonia

Chronic Criterion - g/m^3 as Ammonia							
Temp ^{0}C / pH	0	5	10	15	20	25	30
6.50	3.0	2.8	2.7	2.5	2.5	2.5	2.4
6.75	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.00	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.25	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.50	3.0	2.8	2.7	2.6	2.5	2.5	2.5
7.75	2.8	2.6	2.5	2.4	2.3	2.3	2.4
8.00	1.82	1.70	1.62	1.57	1.55	1.55	1.59
8.25	1.03	0.97	0.93	0.90	0.90	0.91	0.94
8.50	0.58	0.55	0.53	0.53	0.53	0.55	0.58
8.75	0.34	0.32	0.31	0.31	0.32	0.35	0.38
9.00	0.195	0.189	0.189	0.195	0.21	0.23	0.27

1.4.2 Pit Lake (Surface Water)

The consent conditions address both water quality and potential flooding issues as described below.

WRC consents 971287 to 971293 relate to pit lake formation and discharge. Condition 19 states that discharge from the pit lake shall not commence until the discharge, after reasonable mixing, can meet the receiving water criteria specified in Table 1 and the consent holder has received written approval from WRC for the discharge to commence.

Condition 18 states that prior to commencing discharge from Pit Lake the consent holder shall complete, to the satisfaction of Waikato Regional Council, a report that clearly details the likely incremental impact that this discharge will have on the flood routing capacity of the Mangatoetoe Stream. The consent holder shall then prepare a plan of works designed to mitigate the impacts of this discharge on any potentially affected properties or public utilities in the Mangatoetoe Stream catchment. Subject to the granting of any necessary consents, and at least six months prior to commencing discharge from the Pit Lake, the consent holder shall implement those measures to the satisfaction of the WRC.

Preliminary criteria are suggested as follows:

Narrative:

Lake Discharge shall not cause a significant adverse environmental effect on the Mangatoetoe Stream, including users of the resource and aquatic biota.

Lake water quality shall be suitable for recreational purposes.

Quantitative:

1. *The lake discharge shall not cause the receiving water standards specified in Tables 1 and 2 above to be breached.*

2. *Increases to the Mangatoetoe Stream flows resulting from the lake discharge shall not exceed;*

Yet to be determined.

1.4.3 Discharge of Seepage Drainage to Surface Water

The intent is to commence direct discharge of the seepage water when the water quality proves to be acceptable. This will require the approval of WRC (refer WRC consents 971303 and 971304, condition 8).

The intent long term is to discharge the underdrainage direct to the adjacent receiving water via drains that will allow the water to flow from the manholes to the receiving water. Storage 1A has been designed to readily accommodate this but there are several very deep manholes within Storage 2 and for this reason, some thought needs to be given to how the water can be direct discharged from them long term.

Preliminary criteria are suggested as follows:

Narrative:

The discharge of seepage shall not cause a significant adverse environmental effect on the Ohinemuri River or Ruahorehore Stream, including users of the resource and aquatic biota.

Quantitative:

Seepage discharges shall not cause the receiving water standards specified in Tables 1 and 2 above to be breached.

1.4.4 Discharge of Bypassed Seepage to Groundwater

The discharge of TSF bypass seepage to groundwater, subject to conditions, is authorized by WRC consent 971305 for Storage 1A and W1761 for Storage 2. Consent conditions clearly define the narrative closure criteria (refer consent 971305 condition 26 and 29 and W1761 condition 10 and 10A).

To meet the requirements of “stable” and “self-sustaining” OGNZL believes it is reasonable that the monitoring wells should demonstrate stable or improving trends in groundwater quality before closure and handover can occur.

The Company is currently collecting additional flow data to ground truth and refine its groundwater mass balance. The intention is that this work will be used to back-calculate trigger levels for groundwater quality. A similar process could possibly be used to develop closure criteria for groundwater.

Preliminary criteria are suggested as follows:

Narrative:

Discharges from the site, either alone or in combination, shall not cause a significant adverse environmental effect on the receiving groundwater and surface water, or on users of these resources, or, in the case of surface water, aquatic biota.

Seepage from the TSFs, in combination with all other discharges authorised from the Waste Disposal Area, shall not cause an adverse environmental effect on groundwater, or on users of this resource, outside the boundaries of Area D.

Quantitative:

Results from the groundwater monitoring wells shall demonstrate stable or improving trends in groundwater quality.

For surface water, the groundwater discharges, either separately or in combination with all other site discharges, shall not cause the receiving water standards specified in the consents to be breached.

1.4.5 Soils

The closure completion criteria for soils will focus on any potential contamination of soils due to modern mining related activities such as hydrocarbon and chemical spills and/or incorrect placement and treatment of PAF rock.

Preliminary criteria are suggested as follows:

Narrative:

To identify, and as relevant remove, treat and/or appropriately dispose contaminated soil around the site to achieve regulatory requirements relevant to the proposed future use of the land.

Quantitative:

Yet to be determined.

1.4.6 Embankment Pasture

The landscape philosophy for the TSF embankments is for a combination of pasture and native plantings. The methodology for rehabilitating the embankments is well established and the results have been successful.

The key management objectives for the pasture on the embankments are to:

- Ensure good pasture cover on the embankment;
- Prevent soil erosion and scouring by storm runoff, stock and vehicles;
- Prevent growth of tall tree species on pasture that may cause wind induced soil disturbance;
- Control invasive weeds; and
- Prevent stock damage to indigenous species.

Animal productivity, while important, is a secondary objective. High stock grazing rates may lead to pugging by cattle in wet weather, soil damage, increased erosion and weed invasion. In the worst case, if left unmanaged, this could compromise the integrity of the TSF capping layer. Where the embankment has been rehabilitated in pastoral vegetation the current aim is to achieve a level of pasture productivity that is similar to land of the same slope in the district, under pastoral land use.

To support this philosophy, pastoral knowledge through the dairy industry has been applied. An Olsen phosphate level of 25 parts per million (ppm) is considered an appropriate target level for productive dairy pasture on the volcanic ash soils of the region and will ensure growth of a vigorous sward, provided fertiliser maintenance requirements are met annually. Meeting this criterion will mean that the land meets one of the minimum requirements for dairy grazing at point of closure.

Bare soil is an indication of poor pasture management in an established pasture or poor seed germination/seed distribution in new pasture and can lead to excessive runoff and subsequent soil erosion. A stable sward should have less than 10% soil exposed over a minimum of two consecutive years.

District average production figures for land of similar slope to the embankment will need to be obtained from a registered agricultural consultant to assist with the criteria. No set yield figure can be provided, as seasonal variations need to be allowed for. Once this target has been met it should be demonstrated for consecutive years, indicating that the pasture has matured and productivity stabilised.

Setting a minimum level of earthworm population that existed on an undisturbed pasture prior to topsoil being removed from Storage 2 area will indicate a healthy biological state in the soil and significantly contribute to desirable physical and chemical properties in the soil.

Considerable experience with the embankment area that has already been rehabilitated indicates that the criteria listed below are collectively achievable within five years, using the proposed methods and knowledge described above.

Preliminary criteria are suggested as follows:

Narrative:

To provide a vegetative cover that will allow a sustainable land use similar to that which existed pre-mining while minimising erosion.

Quantitative:

1. *Phosphate levels determined by the Olsen Method should be a minimum of 25 + 5 ppm for two consecutive years after restoration.*
2. *Clover/grass compositional balance should be 20-30%/80-70%.*
3. *Exposed soil surfaces should be no greater than 10% of the rehabilitated area under grazing over two consecutive years.*
4. *Pasture production should equal the yearly district average for two consecutive years.*
5. *Earthworm population's average over 10 x 1 m^2 plots should be a minimum of 100 individuals per square metre.*

1.4.7 Embankment Native Plantings

Native shrubs and trees have been planted at various times on the embankment since 1990. The first plantings were in three locations on Storage 2 behind the West Silt Pond and S1 pond and one block in between from the 100 m to 110 m level.

The main concern with the establishment of indigenous vegetation on the embankment is the potential for deep tap roots to penetrate the zone G sealing layer. Any breach of the sealing layer, which is designed to prevent the ingress of oxygen to the unoxidised acid generating material beneath the cover, increases the potential for acid drainage to occur and to impact on discharge water quality.

Published reports (in Marden et.al. 2005[1]) indicate:

- that the majority of native plant roots are concentrated in the upper soil profile.
- The major vertical and obliquely inclined roots change abruptly and strike horizontally at a relatively shallow depth.
- The rooting depth of most New Zealand indigenous species rarely exceeded 2 m.

Based on this and the fact that the thickness of the cover materials (Zone G, H and topsoil) is approximately 2.1 m thick, it is unlikely that indigenous tree roots on the embankment will penetrate zone G. In addition, the compaction and low permeability of zone G will likely prevent root penetration.

A number of tall New Zealand indigenous species have been planted in the older plantings at the foot of the embankment. One species, totara, has self-sown with seeds introduced from mature trees growing along the Ohinemuri River between 200 and 500 metres away.

In 1990, OGNZL commissioned Landcare Research to carry out a study of the root depths of indigenous plants growing on the rehabilitated embankment area. The study concluded that mature tall tree species

[1] Marden M., Rowan C., and Phillips C.: Stabilising characteristics of New Zealand indigenous riparian colonising plants. Plant and Soil (2005) 278:95-105.

(i.e. greater than 20 m tall) are at greater risk of wind throw than shrub and small tree species[2]. The taller species therefore were not preferred on the embankment as at maturity any wind throw could create local disturbance of the cover materials with the possibility of exposing zone G to erosion. The overlying zone H provides protection for zone G; this condition must be maintained. It is also important to ensure that tree seedlings are not root bound when planted to reduce the likelihood of wind throw caused by spiralled roots.

In recent times, OGNZL has made the decision to remove cabbage trees from areas of the embankment where there is a risk that the tap root could damage the zone G cap.

Preliminary criteria are suggested as follows:

Narrative:

1. *To provide a sustainable vegetative cover that will minimise erosion,*
2. *To enhance both amenity and biodiversity at the Site by providing habitat and a food source for birdlife.*

It is noted that the second narrative criteria is not mandatory in terms of the consent conditions. It is a discretionary, providing an internal goal for WRC to aspire to.

Quantitative:

To have achieved 80% canopy closure as measured from aerial photographs based on a representative area[3] of the planting.

The expectation is that in the long term, maintenance will consist of an annual walkover to remove cabbage trees, invasive weeds and self-introduced deep rooting trees.

1.4.8 Pit Surrounds and Pit Walls

There are essentially two separate areas to be considered:

- The pit rim walkway and associated plantings, and,
- Vegetation on the upper pit slopes.

The aim of the pit rim walkway is to create an aesthetically pleasing area for the public to enjoy with minimal weed species that will preserve views of the current mine and the future lake from the surrounding pit rim walkways. The area incorporates the historic gardens to the North, exotic trees including fruit trees as a reminder of the previous inhabitants of the area, and a mixture of new exotic and native plantings, including a kauri grove and riparian planting adjacent to the Eastern Stream. The plantings have also had regard to the Screen Planting Plan, which is a requirement of Hauraki District Council Land Use Consent No 97/98-105 and the Mining Licence.

The pit rim walkway is now complete and has received positive feedback from the councils, the rehabilitation peer reviewer and the public. No further work is planned except for routine maintenance. No closure criteria are proposed for the pit rim walkway plantings on the basis that they have has been completed to the satisfaction of the councils and rehabilitation peer reviewer.

Revegetation of the upper pit slopes is covered by Mining Licence condition 37 which states:

"The upper pit slopes shall be treated to ensure revegetation as soon as possible in the mining programme and in accordance with the current approved Rehabilitation and Closure Plan. Revegetation of the upper slopes will be carried out as far as practicable and may preserve some areas without vegetation to preserve and reflect the mining heritage of the town provided that the water quality of the Pit Lake remains suitable for direct discharge to surface waters in accordance with resource consents held by the licensee from the Waikato Regional Council."

[2] Watson A, Phillips C, Simcock R.: Root depth Investigations of indigenous Plants: tailings dam Embankment- Martha Gold Mine, Waihi. Landcare Research Contract Report LC9798/90. April 1998).
[3] OGNZL is in the process of purchasing a drone within out a fish eye lens and this will allow software provided by Landcare Research to be used to assess whether the closure criteria have been met.

The pit walls above lake level on NAF material have been successfully hydroseeded with grasses and over time, other species have naturally colonised the area. Parts of the upper pit wall have been planted with a variety of indigenous species. This allows for the provision of a seed bank. The intention is to essentially let nature take its course while preventing noxious weeds and where necessary avoiding tall trees that could be susceptible to wind throw that could damage the pit slopes as well as blocking the pit lake outlet.

Some of the upper pit walls have been shotcreted and in those areas, planting is not an option. In other areas PAF material is exposed on the pit walls. No planting or hydroseeding is currently planned on the PAF pit slopes and these will essentially remain bare areas for the foreseeable future although some natural regeneration is less reactive areas will occur.

Narrative:

Compliance with the Biosecurity Act (1993), and the Waikato Regional Pest Management Plan.

Quantitative:

List of weed species to be removed is yet to be developed.

1.4.9 TSF Safety and Stability

The embankments have been designed and constructed to ensure long term safety and stability. Monitoring and review of the design and construction performance has been ongoing since construction commenced. Details for assessing the stability of the embankments were presented as a part of the permitting process. Relevant stability design detail has been considered for development of the completion criteria.

Preliminary criteria are suggested as follows:

Narrative:

That the tailings storage facilities are structurally stable and that they will not cause adverse effects on the safety of users or downstream users, or on the environment.

Quantitative:

Quantitative criteria were developed by Engineering Geology Ltd and form **Appendix 3**. It should be noted that limits are included both for existing and yet to be installed settlement markers. The depths of fill will require confirming following installation and the deformation limits will need to be adjusted accordingly.

In addition to these quantitative criteria, there should be no visual indication of instability. Note that the Operations, Maintenance and Surveillance Manual[4] includes weekly and monthly visual checklists.

1.4.10 Pit Wall Safety and Stability

As previously discussed, the key for the pit slopes is to define in practice the meaning of “safe and stable” as stated in Mining Licence condition 36 as follows:

“… The licence area is to be left in a clean and tidy condition after mining operations have ceased including removing from public view any used derelict equipment and machinery and the pit faces are to be left in a stable and safe condition.”

OGNZL made a presentation on the meaning of “safe and stable” at the 2014 peer review meeting.

The Pit Wall Risk Assessment concludes that the post-closure lives risk associated with wall failure or rock fall is de minimis, while recommending some intervention to maintain acceptable levels of risk during lake filling when the likelihood of wall failure temporarily increases. The Pit Wall Risk Assessment also indicates that the pit walls will meet international guidelines and the socially accepted norm for tolerable life risk of 10^{-5} p.a during the closure and post closure periods. It is OGNZL’s view that this tolerable risk threshold should form the basis of the closure criteria for the pit walls.

[4] Operations, Maintenance and Surveillance Manual (Storage 1A and Storage 2), Newmont Waihi Gold 2013.

The current monitoring system for the open pit is extensive, as it should be while operations are continuing. The Pit Wall Risk Assessment indicates that radar monitoring will not be required, and can cease once operations are complete within the open pit. Accordingly, a review of the current monitoring programme is underway. The intention is to rationalise the monitoring programme so that it is more focussed on closure and the agreed definition of "stable and safe". Quantitative closure criteria are currently being developed.

Preliminary criteria are suggested as follows:

Narrative:

1. To ensure that the Mine Lake and its surrounds (the Site) provide a safe and sustainable recreational facility for the benefit of the Waihi community.

Quantitative:

a) A minimum acceptable risk threshold,

b) A set of movement criteria related to movement patterns, rates and magnitudes,

c) Minimum factors of safety under static and seismic conditions,

d) Controlled access in areas with a significant risk of subsidence collapse and major deformation risk.

e) Definition of the buffer zone.

Closure criteria will need to be developed and refined over time in response to events such as flooding and monitoring trends, therefore the costs of developing and refining these closure criteria have been allowed in the Rehabilitation Bond estimate.

1.4.11 Underground Workings

OGNZL carries out underground mining with the aim of ensuring the safety and health of employees during operations and the long-term safety and health of the community. Mining methods and practices employed at these operations focus on reducing the risks to public safety by backfilling of the workings in accordance with the relevant consent conditions. The backfilling is completed to the satisfaction of the relevant peer reviewer.

Development of completion criteria will continue as these projects are developed. Preliminary criteria are suggested as follows:

Narrative:

To ensure the long-term safety of people located above and adjacent to the underground workings, the ventilation and escape shafts.

Quantitative:

1. *Backfilling of the stope voids and stacked developments (including ventilation rises and ore/waste passes) where geotechnical conditions require backfilling to ensure long term stability.*
2. *Backfilling of 100m of the underground workings decline from the portal,*
3. *Backfilling of the shallow section of decline between Favona and Trio, (currently used to haul to and from Correnso)*
4. *Backfilling and capping of the ventilation and escape shafts.*
5. *Barricading the ventilation portal into the pit from MDDP and backfilling the first 50m of the ventilation drive from the pit.*

Appendix 1 – Consent Conditions

Appendix 1 - Consent Conditions

The relevant conditions are:

1. Varied Mining Licence 32-2388

3.1

Rehabilitation.

1c The licensee shall progressively implement Part A of the approved Rehabilitation and Closure Plan and shall implement Part B of the approved Rehabilitation and Closure Plan in the event of closure occurring. The appropriate Rehabilitation and Closure Plan is the plan approved pursuant to the conditions of the resource consents granted by the Waikato Regional Council for the extended project.

Fencing.

…

22c. On completion of mining operations any fences not required for safety purposes to be either removed or retained by mutual agreement between the relevant territorial authorities and the licensee.

Waste Rock Embankments and Tailings Ponds

…

32. Immediately following the completion of tailings deposition and until rehabilitation of the surface is complete the surface level of the tailings shall be measured at not less than two-monthly intervals to provide a record of settlement."

Rehabilitation

General

33. The licensee shall rehabilitate the whole licence area in accordance with the approved Rehabilitation and closure Plan referred to in condition 1c, and in accordance with the work programme specified in condition 2.

34. The licensee shall progressively strip and stockpile, as far as practical, topsoil from all areas to be used for construction and waste disposal in the process plant and waste disposal area. This stockpiled topsoil or topsoil stripped during the course of operations shall be used to produce the maximum rehabilitation benefit.

Mine Site

35. At all times mining shall be carried out in a manner which will ensure that environmental disturbance is kept to a minimum. All necessary steps shall be taken by the licensee to prevent unnecessary destruction of or damage to vegetation or property and to ensure the safety of the public and livestock.

36. Mining, processing and waste disposal operations shall be carried out in such a manner as to ensure that the surface of the land suffers as little permanent damage as possible. The

licence area is to be left in a clean and tidy condition after mining operations have ceased including removing from public view any used derelict equipment and machinery and the pit faces are to be left in a stable and safe condition.

37. *The upper pit slopes shall be treated to ensure revegetation as soon as possible in the mining programme and in accordance with the current approved Rehabilitation and Closure Plan. Revegetation of the upper slopes will be carried out as far as practicable and may preserve some areas without vegetation to preserve and reflect the mining heritage of the town provided that the water quality of the Pit lake remains suitable for direct discharge to surface waters in accordance with resource consents held by the licensee from the Waikato Regional Council.*

38. *Adequate drainage shall be provided on all access tracks and benches to prevent erosion of any adjacent land.*

Conveyor Route

39. *Upon completion of the project the land along the conveyor route shall be restored to its former condition unless the relevant territorial authority requires that it shall be left for use as a public walkway or other useful amenity provided that the cost of so doing does not exceed the cost of restoration to the former condition.*

Process Plant Site

40. *If, at or after the end of mining operations, the process plant or the wastewater treatment plant is dismantled, the area formerly occupied by and surrounding the dismantled plant shall be contoured, and as far as is reasonably practicable restored and in a manner that will protect water quality and avoid soil erosion.*

Tailings and Waste Disposal Site

41. *The licensee shall make good all final surfaces of the waste rock embankments, tailings storage areas, perimeter bund and any associated works in the waste and tailings disposal area at Baxter Road.*

42. *Rehabilitation of the final surface shall be progressive as areas of a practical working size become available and shall include the provision of a suitable rooting medium, contouring and drainage as required, to ensure the establishment and maintenance of a surface which will protect water quality and avoid soil erosion.*

42A

(a) *Prior to each increase in embankments and crest height of Tailings Storage Facility 1A above RL 166, as part of the Third Stage – Continued Waihi Operations within Annex A, the licensee shall provide to the Hauraki District and Waikato Regional Councils for their approval, a report detailing the height of the crest rise, the sequence of works proposed, and an anticipated timeline in which the physical works and revegetation of the embankments and crest will occur. The approved report shall form part of the Rehabilitation and Closure Plan required by 1(c) of this licence and shall incorporate the revegetation programme in 42A(c) below.*

(b) The licensee shall have completed revegetation of the embankment slopes of Storage 1A to RL166 by 31st March 2014.

(c) Unless otherwise agreed in writing by Hauraki District Council and Waikato Regional Council, the licensee shall undertake the revegetation planting of the embankment slopes of Storage 1A such that after 31st March 2014, all revegetation planting shall be staged relative to the annual lifts of the embankment crest, i.e. the lift undertaken in the previous season is to be revegetated while the current season's lift is being undertaken. Stockpile areas are excluded from the requirements of 42A(b) & (c).

(d) If the programme in 42A(c) above is not achieved, the licensee shall forthwith provide a review to Hauraki District and Waikato Regional Councils detailing the reasons why this has occurred and measures proposed to address programme timing.

Post Production

45. The maintenance of the Martha Hill Amenity Lake and Use Buildings shall be the responsibility of the company for the period of ten (10) years following the end of production operations or until the end of the licence period whichever is the sooner.

Annex A

The Open Pit

Rehabilitation

41. At the end of mining operations the dewatering pumps will be moved and the void created will refill with water (groundwater and stormwater). It is proposed to augment the filling of the pit by taking water from the Ohinemuri River. After a period of approximately five years a new lake will be created. This will be rehabilitated into a recreational area in accordance with the approved Rehabilitation and Closure Plan.

The Tailings and Waste Disposal Area

Rehabilitation

77. The waste and tailings disposal area will be rehabilitated in accordance with the approved Rehabilitation and Closure Plan to grass and native vegetation and wetlands (with permanent ponds). This will be achieved by staged revegetation of final slopes of the disposal area as soon as disposal operations allow. Stockpiled topsoil will be used to the maximum benefit in rehabilitation.

2. Martha Mine Extended Project - Waikato Regional Council Consents and Conditions

<u>9.0 Rehabilitation/closure Plan</u>

9.0 Prior to commencement of construction of the tailings storage facility (Storage 1A), the consent holder shall prepare a concept plan ("the Plan") describing the proposed method of rehabilitation and closure of the Site. The objective of this Plan shall be to ensure

rehabilitation and closure of the Site in such a manner that in the long term the Site, and any structures on it, will remain stable; and any water discharging from the Site, and any groundwater under the Site, will be of a quality such that it will not adversely affect aquatic life, or other users of the water resource.

9.1 The plan shall be in two parts:

- *Part A shall describe the programme of progressive rehabilitation (including revegetation) that is proposed for the Site for the following twelve months, should closure not be proposed during that period; and shall report on any such works undertaken during the previous year*

- *Part B shall:*

- *A) describe the proposed method of final rehabilitation and closure should closure occur within the following twelve months*

- *B) include an assessment of any residual risk that the Site would pose to the environment and the neighbouring community should closure occur within the following 12 months.*

- *C) include a programme for monitoring of the Site following closure, and list all maintenance works likely to be necessary at the closed Site for the foreseeable future.*

9.2 Review

The Plan shall be reviewed and updated annually and the concepts shall be described in more detail as appropriate.

The consent holder shall submit the Plan, and each annual review and update thereof, to the Panel for its review.

The consent holder shall then submit the peer reviewed Plan to the Waikato Regional Council for approval.

9.3 Implementation

The consent holder shall progressively implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

3. Martha Mine Extended Project - HDC Land Use Consent and Conditions (No 97/98 – 105)

3.23 Rehabilitation

…

(a) The consent holder shall rehabilitate all areas that have been subjected to mining operations as part of the Extended Project.

(b) Prior to the commencement of construction of the tailings storage facility (Storage 1A), the consent holder shall submit to the Council for approval detailed rehabilitation plans. These plans will be consistent with the relevant Annual Work Programme referred to in Condition 3.2 and the Rehabilitation/Closure Plan approved by the Peer Review Panel pursuant to Condition 8 of Schedule 1 to the Waikato Regional Council consents.

(c) The rehabilitation plans shall set out:

- *proposed recontouring of and rehabilitation of the noise bunds.*
- *Landscaping and details regarding facilities proposed for the recreational reserve at the eastern end of the new mine lake;*
- *Location of pedestrian access, tracks and viewing facilities around the extended pit perimeter;*
- *Planting and landscaping proposals for the remainder of the upper pit benches/batters and the immediate pit surrounds, that have not already been progressively rehabilitated;*
- *Ongoing rehabilitation measures proposed to pyritic rock areas;*
- *Safety fencing*
- *Maintenance proposals;*
- *With respect to Area D the areas to be grassed*
- *Details of the investigation and removal process for areas that may contain contaminated soils.*

(d) In considering these plans, Council shall take into account:

- *the degree of compliance with the concepts described in the relevant Annual Work Programme;*
- *their usefulness and practicability in terms of the Waihi community;*
- *on-going maintenance issues.*

HDC 3.31, condition 10 contains the following condition:

The Councils shall release the rehabilitation bond on the completion of closure of the site.

"Completion of closure of the site" means when the elements of the entire project have been demonstrated by the consent holder to the satisfaction of the Councils to have reached a stable, self-sustaining, rehabilitated state as defined by the approved Rehabilitation Plan."

4. Storage 2 Consents – Waikato Regional Council

Rehabilitation conditions are also specified in the existing consents for Storage 2.

The existing consents for Storage 2 state the following:

- W1761. "To discharge natural water containing waste onto the land and into the ground beneath storage 2 and the holding pond ….".

12. *The Grantee shall remove at the request of the Board mining equipment, buildings, pipes, silt traps and other structural works associated with the Water Right at the expiry, surrender or abandonment of the right provided that this condition shall not apply to the water treatment plant if the relevant territorial local authority consents to its remaining.*

Note that the condition above also applies to W1751 below. In addition, the following conditions apply:

W1751 "To dam unnamed water courses in order to construct a perimeter bund and access road around the north, west and south edges of the designated areas for storages 1 and 2 for waste and tailings disposal …."

1. *The rehabilitation plans and progressive rehabilitation of the site of the bund will be reviewed by a Peer Review Panel whose members will be appointed by the Grantee and approved by the Board. All costs related to the Peer Review Panel shall be borne by the Grantee.*

2. *The Grantee shall be responsible for ongoing maintenance of the rehabilitated area for the term of the right.*

Note that conditions 6 and 7 above, are also specified in W1749 "To dam unnamed water courses within the designated area for storage 2 in order to construct an impoundment structure for the containment of tailings from mining operations…"

5. Conveyor Silt Ponds – Waikato Regional Council

Condition 13 of W 1742 states the following:

"The Grantee shall rehabilitate and landscape the catchment and adjoining land surrounding the open pit site in accordance with the Rehabilitation and Closure Plan as specified in Schedule 1 of the Waikato Regional Council Consents for the Extended Martha Mine Project as granted in December 1998."

Condition 12 of W1743 states the following:

"The Grantee shall remove at the request of the Board mining equipment, buildings, pipes, silt traps and other structural works associated with this Water Right at the expiry, surrender or abandonment of the right provided that this condition shall not apply to the water treatment plant if the relevant territorial local authority consents to its remaining."

6. HDC Land use Consent 85.030.009.PP (Pumphouse Relocation)

8. Rehabilitation

"The consent holder shall rehabilitate all the areas subject of the earthworks upon completion of the works to a state as good as it was before the work commences. The rehabilitation works within Mining Licence 32-2388 shall be generally in conformity with the approved Rehabilitation and Closure Plan dated July 2001 – 2002 or any subsequent approved update".

7. Favona Underground Mine Consents – Hauraki District Council Land Use Consent 85.050.326.E

Rehabilitation

"29. The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the Favona Underground Mine. This Plan shall be submitted to the Council for written approval prior to the exercise of this consent. The Plan shall set out details on flooding of the mine, plugging of the decline, landscaping, rehabilitation of the polishing pond stockpile area, planting, fencing, and ongoing maintenance and may be the same Plan that is required as a condition of consents granted by the Waikato Regional Council (see note below). The Plant shall be consistent with and complement the Rehabilitation Plan prepared for the Martha consents.

30. The consent holder may amend the Plan at any time. No amendments shall be made to the Plan without the written approval of Council. Unless otherwise agreed in writing by the Council, the consent holder shall undertake the rehabilitation works in accordance with the most recent version of the approved Rehabilitation Plan."

(Note: Conditions 29 & 30 are complementary to Condition 4 of Schedule One – General Consents granted by the Waikato Regional Council)."

6. Favona Underground Mine Consents – Waikato Regional Council

Schedule 1 attached to resource consent numbers 109741, 109742, 109743, 109744, 109745 and 109746 states the following:

7. Rehabilitation Plan

"The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the Favona Underground Mine. This Plan shall be submitted to the Council for written approval prior to the exercise of this consent. The Plan shall set out details on flooding of the workings, plugging of the decline, landscaping, rehabilitation of the polishing pond stockpile area, planting, fencing, and ongoing maintenance and may be the same Plan that is required pursuant to condition 27 of the land-use consent granted by the Hauraki District Council. The Plan shall be in alignment with the Rehabilitation Plan prepared for the Martha consents.

The consent holder may amend the Plan at any time. No amendments shall be made to the Plan without the written approval of the Council. Unless otherwise agreed in writing by the Council, the consent holder shall undertake the rehabilitation works in accordance with the most recent version of the approved Rehabilitation Plan."

8. Screen Planting Conditions

The conditions of Hauraki District Council Land Use Consent No 97/98-105 and the varied Mining Licence 32-2388 require the preparation of a management plan for screen planting to mitigate the visual effects of the Extended Pit and the Grey Street noise bund.

Specifically the screen planting conditions are as follows:

"3.14 Screen Planting

(a) Prior to the exercising of the consent, the consent holder shall prepare and submit to the Council for approval a plan and schedule indicating planting proposals to mitigate the visual effects of extending the open pit. This plan and schedule will include:

- *An outline of the type and approximate number of plants to be used;*
- *Details of the trees and plants to be relocated as a result of mining activities and the position that those trees and plants will be relocated;*
- *A planting plan on a suitable scale agreed with Council;*
- *A schedule of implementation;*
- *A programme for the progressive removal of invasive exotic trees, plants and seedling (e.g. wattle and pine) in order that the intended mix of native and exotic plants becomes the dominant species.*

Within twelve months of granting this consent, the consent holder shall commence implementing the planting schedule.

(b) The noise bunds at Grey Street and to the west of the pit shall be hydroseeded and planted in accordance with the plan referred to in (a) above immediately following completion of construction of the bunds."

Mining Licence condition 25 is similar to the aforementioned condition.

In addition Mining Licence condition 6 states the following under the heading "Construction Operations".

"Vegetation outside of the area 5 metres from the final pit perimeter as shown in Annex A to the licence boundary shall be protected and retained to the maximum extent practicable and where necessary, particularly opposite the top of Martha Street and Savage Road, shall be supplemented to minimise the visual impact of the project."

9. Grand Junction Refinery and Strong Rooms Relocation Consent

10. A landscaping plan be prepared and approved by HDC's Planning and Environmental Services Manager within 6 months of relocating the Refinery and Strong room/s. The landscaping plan shall facilitate public viewing from the Pit-Rim walkway and accommodate future public access to the building. Maintenance of the landscaped area shall be the responsibility of the consent holder.

17. That the Martha Mine Rehabilitation Plan (MMRP) shall be updated to take account of the CMP requirement, as part of the 2010 Annual Review Programme, and that the CMP, once completed, be incorporated by reference into the MMRP.

10. Trio Development Project HDC Land Use Consent RC-15735

3. The land use activities permitted under this consent for all activities relating to the Trio Development Project within the Trio Project Area as described in the application documents, being the construction and use of an exploration access incline and decline and

associated underground workings and facilities, include, but are not limited to, the following activities:

…

- Rehabilitation activities, including backfilling with waste rock and flooding with treated water and water from the Ohinemuri River.

20. The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the construction and use of the workings associated with the Trio Development Project. This plan shall be submitted to the Waikato Regional Council and Hauraki District Council (the "Councils") for written approval within 2 months to the exercise of this consent. The Plan shall set out details on flooding the underground workings, backfilling the vent shaft and access decline, and removal of surface infrastructure and planting of surface areas affected. As a minimum the Plan shall provide for the backfilling of the initial 200m length of the access decline tunnel from the current Favona access tunnel. The consent holder may amend the Plan at any time. No amendments shall be made to the Plan without the written approval of the Councils. Unless otherwise agreed in writing by the Councils, the consent holder shall undertake the rehabilitation works in accordance with the approved Rehabilitation Plan.

The Plan shall be consistent with and complement the Rehabilitation Plan required by the conditions of consent for the Martha and Favona mines.

11. Trio Development Project WRC Consents (121416-121418, 121446, 121447).

Schedule 1, Condition 4:

The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the construction and use of the workings associated with the Trio Development Project. This plan shall be submitted to the Waikato Regional Council and the Hauraki District Council (the "Councils") for written approval within 2 months of the exercise of this consent. The Plan shall set out details on flooding the underground workings, backfilling the vent shaft and access decline, and removal of surface infrastructure. The consent holder may amend the Plan at any time. No amendments shall be made to the Plan without the written approval of the Councils. Unless otherwise agreed in writing by the Councils, the consent holder shall undertake the rehabilitation works in accordance with the approved Rehabilitation Plan.

12. Trio Mine HDC Land Use Consent.

24. The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the construction and use of the workings associated with the Trio Underground Mine Project. This Plan shall be submitted to the Waikato Regional Council and Hauraki District Council for written approval prior to the exercise of this consent.

24.1 The Plan shall be in two parts:

Part A shall describe the programme of progressive rehabilitation (including re-vegetation and backfilling) that is proposed for the site for the following twelve months, should closure

not be proposed during that period; and shall report on any such works undertaken during the previous year.

Part B shall:

- describe the proposed method of rehabilitation and closure should closure occur within the following 12 months;
- include an assessment of an residual risk that the site would pose to the environment and the neighbouring community should closure occur within the following 12 months; and
- include a programme for monitoring of the site following closure, and list all maintenance works likely to be necessary at the closed site for the foreseeable future.

24.2 Review

The Plan shall be reviewed and updated annually and the concepts shall be described in more detail as appropriate.

The consent holder shall submit the Plan, and each annual review and update thereof, to the Peer Review Panel (as required by the Martha Extended Project) for its review.

The consent holder shall then submit the peer reviewed Plan to the Hauraki District Council and Waikato Regional Council for approval.

24.3 Implementation

The consent holder shall implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

24.4 Rehabilitation Plans associated with the Martha Extended Project and Favona Mines

The rehabilitation Plan may also include any other information that the consent holder wishes, and may be combined with the Rehabilitation Plan(s) associated with the Martha open pit and Favona underground mines.

13. Trio Mine WRC Consents (121694-121697)

Schedule 1, condition 4:

4. The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the construction and use of the workings associated with the Trio Underground Mine Project. This Plan shall be submitted to the Waikato Regional Council and Hauraki District Council for written approval prior to the exercise of this consent.

4.1 The Plan shall be in two parts:

Part A shall describe the programme of progressive rehabilitation (including re-vegetation and backfilling) that is proposed for the site for the following twelve months, should closure not be proposed during that period; and shall report on any such works undertaken during the previous year.

Part B shall:

- describe the proposed method of rehabilitation and closure should closure occur within the following 12 months;
- include an assessment of an residual risk that the site would pose to the environment and the neighbouring community should closure occur within the following 12 months; and,
- include a programme for monitoring of the site following closure, and list all maintenance works likely to be necessary at the closed site for the foreseeable future.

4.2 Review

The Plan shall be reviewed and updated annually and the concepts shall be described in more detail as appropriate.

The consent holder shall submit the Plan, and each annual review and update thereof, to the Peer Review Panel (as required by the Martha Extended Project) for its review.

The consent holder shall then submit the peer reviewed Plan to the Hauraki District Council and Waikato Regional Council for approval.

4.3 Implementation

The consent holder shall implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

4.4 Rehabilitation Plans associated with the Martha Extended Project and Favona Mines

The Rehabilitation Plan may also include any other information that the consent holder wishes, and may be combined with the Rehabilitation Plan(s) associated with the Martha open pit and Favona underground mines.

14. Correnso Mine HDC Consent

4. Rehabilitation Plan

The consent holder shall prepare a Rehabilitation Plan covering all areas that may be affected by the construction and use of the workings associated with the underground mining within Area L of the Golden Link Project Area. This plan shall be submitted to the Waikato Regional Council and the Hauraki District Councils (the “Councils”) for written approval prior to the exercise of this consent. The Plan shall set out details on backfilling and flooding the underground workings, backfilling the vent shaft and access decline, and removal of surface infrastructure. The consent holder may amend the Plan at any time. No amendments shall be made to the Plan without the written approval of the Councils.

Unless otherwise agreed in writing by the Councils, the consent holder shall undertake the rehabilitation works in accordance with the approved Rehabilitation Plan.

15. Correnso Mine WRC Consents 124859-124864

73 The consent holder shall prepare a Rehabilitation Plan (Plan) covering all areas that may be affected by the construction and use of workings associated with the Correnso Underground Mine. This plan shall be submitted to Waikato Regional Council and Hauraki District Council for written approval prior to the commencement of the Correnso Underground Mine.

a) The Plan shall be in two parts:

i) Part A shall describe the programme of progressive rehabilitation (including revegetation and backfilling) that is proposed for the site(s) for the following twelve months, should closure not be proposed during that period; and shall report on any such works undertaken during the previous year.

b) Part B shall:

i) Describe the proposed method of rehabilitation and closure should closure occur within the following 12 months;
ii) Include an assessment of any residual risk that the site(s) would pose to the environment and the neighbouring community should closure occur within the following 12 months, and
iii) Include a programme for monitoring of the site(s) following closure, and list all maintenance works likely to be necessary at the closed site(s) for the foreseeable future.

c) The consent holder shall implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

16. Slevin Underground Project Area (SUPA) HDC Consent 202.2016.00000544.001

36 The consent holder shall prepare a Rehabilitation Plan (Plan) covering all areas that may be affected by the construction and use of workings associated with the Slevin Underground Mine. This plan shall be submitted to Waikato Regional Council and Hauraki District Council for written approval prior to the commencement of the Slevin Underground Mine.

a) The Plan shall be in two parts:

i) Part A shall describe the programme of progressive rehabilitation (including revegetation and backfilling) that is proposed for the site(s) for the following twelve months, should closure not be proposed during that period; and shall report on any such works undertaken during the previous year.

b) Part B shall:

iv) Describe the proposed method of rehabilitation and closure should closure occur within the following 12 months;

v) Include an assessment of any residual risk that the site(s) would pose to the environment and the neighbouring community should closure occur within the following 12 months, and

vi) Include a programme for monitoring of the site(s) following closure, and list all maintenance works likely to be necessary at the closed site(s) for the foreseeable future.

c) The consent holder shall implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

17. Martha Drill Drive Project (MDDP) HDC Consent 202.2017.00000664.001

28 The consent holder shall prepare a Rehabilitation Plan (Plan) covering all areas that may be affected by the construction and use of workings associated with the MDDP. This plan shall be submitted to Waikato Regional Council and Hauraki District Council for written approval prior to the commencement of the MDDP.

a) The Plan shall be in two parts:

i) Part A shall describe the programme of progressive rehabilitation (including backfilling) that is proposed for the site(s) for the following twelve months, should closure not be proposed during that period and shall report on any such works undertaken during the previous year.

b) Part B shall:

i) Describe the proposed method of rehabilitation and closure should closure occur within the following 12 months;

ii) Include an assessment of any residual risk that the site(s) would pose to the environment and the neighbouring community should closure occur within the following 12 months; and

iii) Include a programme for monitoring of the site(s) following closure, and list all maintenance works likely to be necessary at the closed site(s) for the foreseeable future.

c) The consent holder shall implement Part A of the approved Plan and shall implement Part B of the approved Plan in the event of closure occurring.

29 The Plan shall be reviewed and updated annually and the concepts shall be described in more detail as appropriate.

30 The consent holder shall submit the Plan, and each annual review and update thereof, to the Peer Review Panel (as required by the Martha Extended Project HDC Consent No. 97/98-105) for its review.

31 The consent holder shall then submit the peer reviewed Plan to Hauraki District Council and Waikato Regional Council for approval.

32 The Rehabilitation Plan may also include any other information that the consent holder wishes, and may be combined with the Rehabilitation Plan(s) associated with the Martha open pit and underground mines of Favona, Trio, CEPPA and SUPA.

Appendix 2 – Massey Fertilizer Report

FERTILIZER & LIME RESEARCH CENTRE

Massey University

REPORT TO R. SQUIRE ON VISIT TO WAIHI

13th July 2017

PURPOSE OF VISIT AND REPORT

- Soil sampling on the rehabilitated embankments on TSF1 and TSF2 for the 2017 spring fertiliser recommendations
- Inspect the embankment for pasture and soil condition, together with any other plant growth issues.

Pasture Growth

There is now a single set of cages on TSF2 that are used as a control for assessing pasture production on TSF1. Data presented includes actual Dry Matter (DM) figures as well as % performance of TSF1 relative to TSF2 (Control).

The mean annual DM production for the 2016 period from TSF2 is **8212** kg ha^{-1} yr^{-1} compared to the mean for 2015 of **8672** kg ha^{-1} yr^{-1}. Growth on TFS1 is **8066** kg ha^{-1} yr^{-1} compared with **8603** kg ha^{-1} yr^{-1} for 2015 (Figure 1). For 2016 the productivity from the younger TSF1A-E rehabilitation is **85 %** of TSF2, while the older TSF1A-D rehabilitation is **111%** of TSF2. The growth from TSF1A-E is discussed further later in this report. The average production on TSF1 is **98%** of TSF2. The overall level of productivity from both rehabilitation areas continues to be more than satisfactory for a dry stock farming operation on this slope and in the climate of this area. For comparison, adjusted for slope (80% for 12°) The

TSF1 and TSF2 mean predicted flat land equivalent DM productivity is **10,265** kg ha^{-1} yr^{-1} and **10,083** kg ha^{-1} yr^{-1} respectively.

The disparity between productivity from the two TSF1 sets of cage data was recently flagged in correspondence between Russell Squires, Craig Ross and me. I reviewed the cage data for 2016 for all data (Control and TSF1), comparing summer and winter growth and noting that the aspect for all cages is from SW to SE. In summer 2016 both TSF1 sites performed better than the Control, whereas in winter, both performed worse that the Control (by 20%), with TSF1A-E showing the lowest productivity.

I also reviewed the data from January to April 2017, which showed TSF1 considerably outperforming the Control in January but underperforming thereafter. Based on the summer/winter data from 2016, both January and February (and possibly March) should have shown better growth on TSF1 than the Control. Inspection of the Waikato regional Council rainfall database for the Queens Head station in Waihi shows that the rainfall for January was 27.5 mm, February 112 mm, March 420 mm and April 290 mm, which, apart from January, appears to be well above average rainfall. Note that some of the rainfall figures are estimated from graphs but should be within 5 mm of the actual amount.

My view is that the pasture growth differential is a result of soil moisture differences with TSF1A-E being a wetter site with poorer soil drainage limiting grass growth. There is no evidence in the measured soil fertility data to suggest any nutrient deficiencies, although N is not measured and it would be reasonable to assume some loss of N through mineralisation when the soil is waterlogged. However, no yellowing of pasture to indicate a significant N deficiency was noted during the inspection carried out in July 2017.

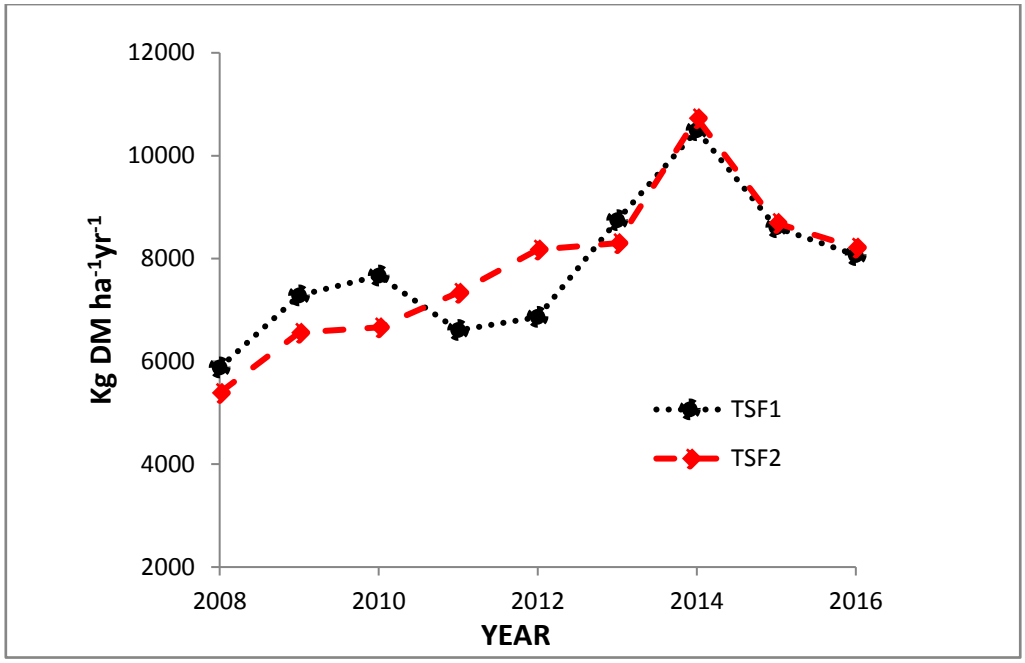


Figure 1: *Pasture growth data for 2008 – 2017. There is no statistically significant difference between the annual yields from TSF1 and TSF2. The variation from year to year largely reflects climate differences.*

SOIL TESTS

The following soil test ranges are suitable targets for the rehabilitation soils (consistent with the rehabilitation guidelines);

pH	5.8-6.0
Olsen-P	20-30
Soil Test K	7-10
Sulphate-S	10-12
Soil Test Mg	8-10

Table 1 summarises soil test data from 2009 to 2015. The pH data for both TSF1 and TSF2 has decreased slightly from that of 2016 (Table 1), when pH spiked after liming in 2014-2015, but the pH remains at a satisfactory level across all sampling sites. Olsen-P levels are also within the closure guidelines of 25$\pm$ 5 µg P ml^{-1}, except for the western area sampling site (J)

Table 1: Nutrient levels 2009-2017. The lead figure is the average and figures in brackets the range of values obtained. * one unlimed and one limed site (2014 pH data, no mean calculated).

TSF2	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	**2017**
pH	5.9 (5.7-6.0)	5.8 (5.6-6.0)	5.8 (5.6-5.9)	5.8 (5.5 – 6.0)	6.0, 5.5*	5.9 (5.6-6.1)	6.1 (5.7-6.4)	**6.0 (5.7-6.2)**
Olsen P (μgP/ml)	43 (24-54)	33.6 (22-39)	34 (19-49)	31 (17 – 38)	27 (17-38)	26 (18-46)	30 (23-32)	**21 (15-30)**
S (μgS/g)	83 (12-161)	34 (21-60)	28 (10-53)	63 (25 – 76)	63 (25–88)	49 (35-77)	76 (52-118)	**52.7 (22-89)**
K (MAF Quicktest)	10 (7-12)	5 (3-7)	6 (5-6)	6 (5 – 7)	6 (5-7)	7 (5-8)	7 (6-8)	**7 (6-8)**
Mg (MAF Quicktest)	26 (20 – 28)	20 (15 – 24)	15 (11 – 21)	12 (11 – 14)	12 (11-14)	12 (10-17)	18 (10-21)	**13.7 (10-19)**
TSF1								
pH	5.8	6.2 (5.8-6.4)	5.7 (5.7-5.8)	5.7 (5.7)	5.7 (5.7)	5.9 (5.9-6)	6.0 (5.9-6.1)	**5.9 (5.8-6.0)**
Olsen P (μgP/ml)	33	23.1	41.5 (33-50)	28 (25 – 31)	28 (25-31)	37 (17-45)	20 (15 – 26)	**26 (22-30)**
S (μgS/g)	252	180 (165-195)	159 (64-254)	188 (168 – 209)	188 (168-209)	155 (101-209)	146 (120-273)	**155 (72-238)**
K (MAF Quicktest)	7	5 (5)	5 (4-6)	5 (5)	5 (4-6)	5 (4-6)	4 (3-4)	**6 (6-6)**
Mg (MAF Quicktest)	23 (one site)	25 (22 - 27)	25 (22 – 29)	18 (12 - 23)	11 (8-15)	16 (10-22)	13 (11-15)	**18 (14-22)**

which is outside the range. It has been consistently low so, as was suggested in my previous report, it should be checked to see if this small paddock has been missed during fertiliser application.

Sulphate S remains at around 155 μg/gS on TSF1, after showing an expected drop through to 2012. The variable levels measured since may relate to overland flow from the embankment up slope from the rehabilitated areas during high rainfall events and if this drainage is controlled the SO_4-S levels should start to decrease again. However, even the resulting increased levels of SO_4-S are too low to be of concern for pasture growth but may require monitoring of Copper levels in stock. The TSF2 SO_4-S data shows a continuing decrease towards a more normal soil level after a minor spike in 2016. Mg is within or above guidelines for pasture on both TSF1 and TSF-2. K is still slightly low on TSF1, but has lifted over 2016-2017 to near the bottom of the target range (MAF-QuickTest 7-10). This suggests that the current fertiliser regime is adequately raising the K content of the soil and therefore does not need modification this year.

Fertiliser Requirements for TSF1 and TSF2

Since Average Olsen P remains within the target range of 20 - 30 and MAF Quicktest K values are at moderate levels (Table 1), maintenance applications of potassic-P fertiliser should be continued at the same rate as previous years across both TSF1 and TSF2 of 400 kg/ha 30% potassic superphosphate or 200 kg/ha 30% potassic triple superphosphate..

Nitrogen (N) at 90 kg urea ha^{-1} (equates to 40 kg N ha^{-1}) should continue to be applied in spring. These rates of N should be applied across both TSF1 and TSF2 separately from the superphosphate.

Pasture and Vegetation Inspection

Pasture on TSF1 and TSF2 is in reasonable condition and meets the closure guidelines of > 90% ground cover and 7030 grass/clover mix. There was no evidence of any nitrogen deficiency observed during the 13 July inspection. Weed incursion appears to be well controlled. Ground conditions were again wet during the July inspection but soil damage is minimal, except for two recently grazed paddocks where there is evidence of moderate pugging. The practise of removing stock prior to significant rainfall events should continue to be emphasised to farm staff. I note that there has been no new rehabilitation since the time of my previous report in 2016.

RECOMMENDATIONS

1. For both TSF1 and TSF2, apply 400 kg/ha 30% potassic superphosphate or 200 kg/ha 30% triple superphosphate in spring.

2. N should be applied separately across all rehabilitation areas on TSF1 and TSF2 at 90 kg urea/ha (40 kgN/ha) in spring.

3. The fertiliser application history for the small paddock used for soil sampling (J) needs to be checked to see if this area has missed being topdressed over 2014-2016.

R B Stewart CPAg
25 August 2017

Appendix 3 – EGL Closure Criteria

Engineering Geology Ltd
CONSULTING GEOTECHNICAL, GEOLOGICAL AND EARTHQUAKE ENGINEERS

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Ref: 6165

22 November 2017

NEWMONT WAIHI GOLD
TAILINGS STORAGE FACILITIES
CLOSURE CRITERIA

1.0 INTRODUCTION

Newmont Waihi Gold require criteria to be developed that must be satisfied before official closure of the tailings storage facilities (Storage 1A and Storage 2). In broad terms the criteria are to ensure that the tailings storage facilities are structurally stable and that they will not cause adverse effects on the safety of users and downstream users, or on the environment.

Engineering Geology Ltd has developed closure criteria based on measured and/or calculated parameters. They are summarised below in the following sections.

2.0 STABILITY

The criteria for stability are based on industry accepted standards for dams. They are summarised below:

Based on measured pore pressures and best estimates of soil strengths the following criteria should be achieved:

a. Static Factor of Safety (FoS) ≥ 1.5
b. Seismic OBE (permanent displacements less than 20mm)
MDE (permanent displacements less than 0.5m)

3.0 DEFORMATION

Criteria are provided for both total deformation and rate of deformation.

3.1. Total Deformation

The total deformation criteria are based on typical post-construction embankment shoulder settlements at 10 years after end of construction published in Fell *et al.* (2005). They report settlements of generally less than 0.5% to 0.7% of the depths of fill, at 10 years after construction, are observed for well and reasonably to well compacted rockfills and compacted earthfills. We recommend values of 0.75% and 0.5% for Storage 2 and Storage 1A respectively. Higher values are appropriate for Storage 2 as the embankment fill consists of more weathered mine waste than in Storage 1A. Total horizontal movements have been taken equal to approximately two thirds of vertical movement.

The proposed total deformation criteria are summarised in Table 1.

TABLE 1. Proposed Closure Deformation Criteria

TSF	TOTAL SETTLEMENT (%H)	TOTAL HORIZONTAL MOVEMENT (%H)
Storage 2	0.75	0.5
Storage 1A	0.5	0.35

Note: H= total depth of fill plus depth of natural soil where it may exist beneath the embankment.

Limits for horizontal and vertical deformations for individual settlement markers, based on the criteria in Table 1, are provided in Tables 2 and 3 for Storage 2 and Storage 1A respectively. Some of the settlement markers have not yet been installed. The depth of fill will need to be confirmed following installation of the markers and the deformation limits revised accordingly.

3.2. Rate of Deformation

At closure settlements are expected to be very small and review of monitoring to date generally indicates this to be the case. However, closure criteria also need to take into consideration the inherent error in the measurements and the frequency of survey (annually). The level of accuracy of survey measurements is about +/-10mm for vertical measurements and +/- 20mm for horizontal movements. There is a higher degree of error associated with the horizontal measurements compared to vertical and this needs to be reflected in the closure criteria. To account for the inherent error in survey measurements we propose that the rate of movement criteria be based on the average change in measurements over a period of 5 years. This will help smooth out any errors that could otherwise affect results if a shorter period of time was considered.

The recommend criteria are:

a. the average rate of settlement and horizontal movement should be less than 5mm/year over a period of 5 years before closure
b. the last measurement should be within the limits of accuracy of measurement (i.e. +/-10mm vertically or +/-20mm for horizontal deformations) from the expected average value based on measurements from the previous 5 years of monitoring.

3.3. Assessment of Compliance

Assessment of compliance with the proposed criteria is not difficult now that all the data are in an excel spreadsheet. When evaluating the deformation data any sudden large changes in movement outside the normal behaviour should be checked. Sometimes they can be due to survey error or disturbance of the settlement marker. If there is any doubt the settlement marker should be re-surveyed.

4.0 PIEZOMETERS

Piezometers are installed in the embankments and foundations. Closure criteria for piezometers depend on where the piezometers are located. Criteria for piezometers located

in the downstream shoulder and foundations are governed by consideration of stability. Criteria for piezometers located in the upstream shoulder (Zone B) are based on control of seepage from the tailings. The recommended criteria are summarised below:

a. Downstream shoulder: ru<0.35 (governed by static stability)
b. Base of embankment: ru<0.4 (governed by seismic stability)
c. Upstream shoulder: ru<0.5 (to avoid excessive seepage)

Where ru = $\frac{\text{Pore water Pressure (kPa)}}{\text{Vertical Overburden Pressure (kPa)}}$

In addition piezometers must demonstrate a steady response for at least 2 years with annual seasonal fluctuations of less than 1m, unless located in the foundations or base of the embankment where a greater seasonal fluctuation can be expected.

5.0 REHABILITATION

With time the stored tailings consolidate and gain in strength. Ultimately it may be possible to reclassify the tailings storage facilities so they are no longer considered dams. Criteria to enable the TSF's to be declassified as dams are yet to be developed.

Prepared by
ENGINEERING GEOLOGY LTD

Trevor Matuschka, CPEng, Category A Recognised Engineer

Encl: Tables 2 and 3

Table 2. Storage 2 Settlement Marker Deformation Criteria for Closure

Section	Bench	Fill Depth (m)	Soil Depth (m)	Total (m)	Total Permissible Deformation	
					Horizontal (mm)	Vertical (mm)
B	110	7.2	2.3	9.5	47.5	71.25
	120	19.8	2.3	22.1	110.5	165.75
	130	28.0	2.3	30.3	151.5	227.25
	142	37.6	2.3	39.9	199.5	299.25
	156	48.8	2.3	51.1	255.5	383.25
C	110	9.8	2.5	12.3	61.5	92.25
	120	18.0	2.5	20.5	102.5	153.75
	130	28.6	0.5	29.1	145.5	218.25
	142	40.9	0.5	41.4	207	310.5
	156	52.0	0.5	52.5	262.5	393.75
C	110	9.5	2.3	11.8	59	88.5
	120	17.5	2.3	19.8	99	148.5
	130	26.9	2.3	29.2	146	219
	142	41.4	0.5	41.9	209.5	314.25
	156	52.4	0.5	52.9	264.5	396.75
E	110	8.0	2	10	50	75
	120	17.5	0.5	18	90	135
	130	25.5	0.5	26	130	195
	142	37.7	0.5	38.2	191	286.5
	156	46.1	3	49.1	245.5	368.25
F	110	12.6	1	13.6	68	102
	120	19.4	2	21.4	107	160.5
	130	20.2	2.5	22.7	113.5	170.25
	142	29.1	2.5	31.6	158	237
	156	40.9	2.5	43.4	217	325.5
Y	110	8.1	2.5	10.6	53	79.5
	120	14.2	2.5	16.7	83.5	125.25
	130	20.1	2.5	22.6	113	169.5
	142	29.7	2.5	32.2	161	241.5
	156	42.9	2.5	45.4	227	340.5
Z	110	12.5	2.5	15	75	112.5
	120	18.2	2.5	20.7	103.5	155.25
	130	28.5	2.5	31	155	232.5
	142	41.5	2.5	44	220	330
	156	50.9	2.5	53.4	267	400.5

TABLE 3. Storage 1A Settlement Marker Deformation Criteria for Closure

Section	Bench	Fill Depth (m)	Soil Depth (m)	Total (m)	Total Permissible Deformation	
					Horizontal (mm)	Vertical (mm)
G	120	10.3	0	10.3	36.05	51.5
	130	17.8	2	19.8	69.3	99
	140	27.0	2.5	29.5	103.25	147.5
	152	40.3	2.5	42.8	149.8	214
	165	52.2	2.5	54.7	191.45	273.5
	177.25	62.4	2.5	64.9	227.15	324.5
H	110	12.3	0	12.3	43.05	61.5
	120	20.1	0	20.1	70.35	100.5
	130	29.0	0	29	101.5	145
	140	38.1	0	38.1	133.35	190.5
	152	49.3	0	49.3	172.55	246.5
	165	61.3	0	61.3	214.55	306.5
	177.25	72.6	0	72.6	254.1	363
I	120	14.2	0	14.2	49.7	71
	130	23.0	0	23	80.5	115
	140	30.2	1.5	31.7	110.95	158.5
	152	38.5	1.5	40	140	200
	165	50.3	1.5	51.8	181.3	259
	177.25	59.0	1.5	60.5	211.75	302.5
J	120	11.2	0	11.2	39.2	56
	130	16.8	2.5	19.3	67.55	96.5
	140	25.4	2.5	27.9	97.65	139.5
	152	34.0	2.5	36.5	127.75	182.5
	165	42.2	2.5	44.7	156.45	223.5
	177.25	50.4	2.5	52.9	185.15	264.5
K	120	11.9	0.0	11.9	41.65	59.5
	130	18.4	1.0	19.4	67.9	97
	140	25.1	1.0	26.1	91.35	130.5
	152	30.2	2.0	32.2	112.7	161
	165	36.4	2.0	38.4	134.4	192
	177.25	43.2	2.0	45.2	158.2	226
L	130	5.9	0.0	5.9	20.65	29.5
	140	12.8	1.0	13.8	48.3	69
	152	19.5	1.0	20.5	71.75	102.5
	165	22.9	1.0	23.9	83.65	119.5
	177.25	33.4	1.0	34.4	120.4	172
M	130	16.1	0.0	16.1	56.35	80.5
	140	23.1	1.0	24.1	84.35	120.5
	152	33.6	1.0	34.6	121.1	173
	165	44.7	1.0	45.7	159.95	228.5
	177.25	56.9	1.0	57.9	202.65	289.5

2018-19 Rehabilitation and Closure Plan

05 July 2018

Part B:

Approvals

OGC Designation	Name	Designation	Signature	Date

Revision History

Date	Revision No.	Issued for	By

Title:

Report Objective:

Scope of Work:

Limitations:

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1 INTRODUCTION

The following sections address the requirements of Part B of the annually updated Rehabilitation and Closure Plan (Plan) required by condition 9.2 of Schedule 1 of the resource consents for the Extended Martha Mine project. In short, Part B assumes cessation of mining by 30 June 2019, and describes:

- The work required to rehabilitate and achieve closure criteria for all the areas disturbed by mining;
- The ongoing post-closure maintenance and monitoring tasks; and
- As assessment of the residual risk associated with the rehabilitated site

In meeting the Part B Plan requirements of the conditions of the resource consents condition 9.2, Part B also addresses the requirements of condition 3.23 of the project's land use consent.

The works outlined in Part B of the Plan are subject to peer review (condition 9.3 of Schedule 1). In previous years, Part B has presented both the description of the works and the estimated cost of undertaking them. The cost estimates establish the appropriate Rehabilitation and Capitalisation Bond quanta. Under the conditions of consent the bond quanta are not subject to peer review. This year, the bond estimates are presented in separate reports.

2 STARTING ASSUMPTIONS

2.1 Date of Cessation of Mining

The Plan covers the period to 30 June 2019, which sets the assumed date for cessation of mining.

2.2 Closure Period

Completion of closure of the site is that point in time when the elements of the entire project have been demonstrated by OceanaGold[1] to have reached a stable, self-sustaining, rehabilitated state to the satisfaction of the Council. This is a point in time defined as "Closure" and is deemed to be reached when:

- the pit slopes are shown to be in a stable and safe condition;
- any water discharging from the site, and any groundwater under the site, achieves a quality that it will not adversely affect aquatic life, or other users of the water resource;
- any structures on the site are stable;
- all revegetation required for the extended project is complete, and monitoring demonstrates it to be self-sustaining; and
- all modern underground stopes infilled.

The minimum time to complete closure of the site after cessation of mining is determined by conditions 20(b) and (c) of discharge permit 971293, which provides for discharge from the pit lake into the Mangatoetoe Stream. Condition 20(b) states:

"… *The consent holder shall monitor the effect of Pit Lake discharge on the Mangatoetoe Stream for a minimum period of five years after the lake first overflows*. …"

Condition 20(c) states:

[1] Reference to "OceanaGold" includes the current and previous operators of the Waihi gold mines.

"*The consent holder shall, in consultation with the Waikato Regional Council, develop and undertake a monitoring programme during lake filling and for a period of up to 5 years after filling for the purpose of locating any springs that may be reactivated or result from connections from Pit Lake*."

Estimates of the time to fill the lake indicate a duration of seven years, and conditions 20(b) and (c) stipulate another five years to monitor the lake overflow. For the purposes of this report, an additional year is added to provide for removal of plant and equipment, to complete a range of technical studies, reports, plans and manuals, and the initial work for drafting and letting the closure works contract (or contracts). The resulting closure period duration of 13 years is assumed.

In practice, Closure will be achieved in many areas well within that timeframe.

2.3 Timing

Some activities are more significant than others in terms of timing. In particular the following is assumed;

- the bulk of the demolition, dismantling and salvaging of plant including buildings, fuel storage, explosives magazines, crushers, conveyors, vehicle wash bays, and stores would take place early in the process, i.e. Years one and two;
- items such as pumps, pipework, refuge chambers, and fans would be retrieved from underground as soon as possible to allow backfilling to be completed prior to the commencement of flooding of the open pit;
- rehabilitation of exposed PAF at the embankment at the waste disposal area could commence immediately;
- prompt rehabilitation of PAF areas would allow collection pond water to be direct discharged;
- capping of the tailings surface of Storage 1A following lowering of the water within the impoundment to allow the tailings to dry over the first summer[2], capping expected to take one to two years to complete, i.e. Years 2 and 3;
- water treatment would be required until the water quality improved sufficiently to allow direct discharge, particularly for the Storage 1A tailings pond (three years). The assumption for TSF1A decant and process water is 6 months of cyanide treatment followed by 2.5 years of metals treatment, and for three years of metals reduction treatment for other sources; and
- lake filling would commence one year after mining ceases, and would take approximately seven years.

2.4 Current Mine Status

The scope of works to rehabilitate the Waihi gold mines covers all of the consented projects and assumes the following status for each.

2.4.1 Martha Mine

Mining within the Martha pit ended in April 2015 following a rock fall from the north east pit wall that compromised the north wall ramp access. In April 2016, another, larger (approximately 2 million tonnes) failure occurred in the same location. At the time of reporting, a consent application to reopen and mine the pit has been submitted.

2.4.2 Martha Mine East Layback

[2] OceanaGold is in the process of reducing the volume of water in the TSF1A impoundment, which will result in stronger tailings near the embankment and hence the opportunity to start this work earlier. For this review, the potential to start capping earlier than previously assumed is ignored.

The Martha East Layback project ended with the access restriction created by the April 2015 rock fall. The submitted Martha Project consent would eventually see resumption of the Eastern Wall, however timing is unknown.

2.4.3 Martha Exploration Project

There is no plan to start this project, and with the mining licence due to expire at about the end of the period covered by this Plan, the project's consents have effectively lapsed.

2.4.4 Favona and Trio Mines

Mining at the Favona and Trio underground mines is complete, although it is planned to mine deeper within Trio with some production mining scheduled for 2019.

Favona and Trio infrastructure (declines and Trio vent shaft) continue in operation to service Correnso.

2.4.5 Correnso Project

Correnso will continue to be mined throughout the period covered by this Plan.

2.4.6 SUPA Project

SUPA will continue to be mined throughout the period covered by this Plan.

2.4.7 MDDP

The Martha Development Drive Project will continue to be mined throughout the period covered by this Plan.

2.5 Rehabilitation Areas

Progressive rehabilitation takes place during the life of the mine. Areas that have been or will be rehabilitated within the coming year are not included in the areas for rehabilitation following sudden closure.

The areas assumed for rehabilitation and included in this Plan are summarised in Table 1.

Table 1: Rehabilitation Areas

Mine Element	Area (ha)
Martha pit surface facilities area	6.30
Conveyor corridor	1.34
Mill, water treatment plant, polishing pond stockpile etc.	18.12
Waste disposal area (WDA)	
1A Embankments	7.72
Load-out area and workshop	3.25
Conveyor area	5.12
Eastern haul road	1.32
Tailings storage facility 1A capping	11.24
Tailings storage facility 2 capping	2.00
WDA stockpiles - topsoil	3.98
WDA stockpiles - other	34.62
Total:	95.01

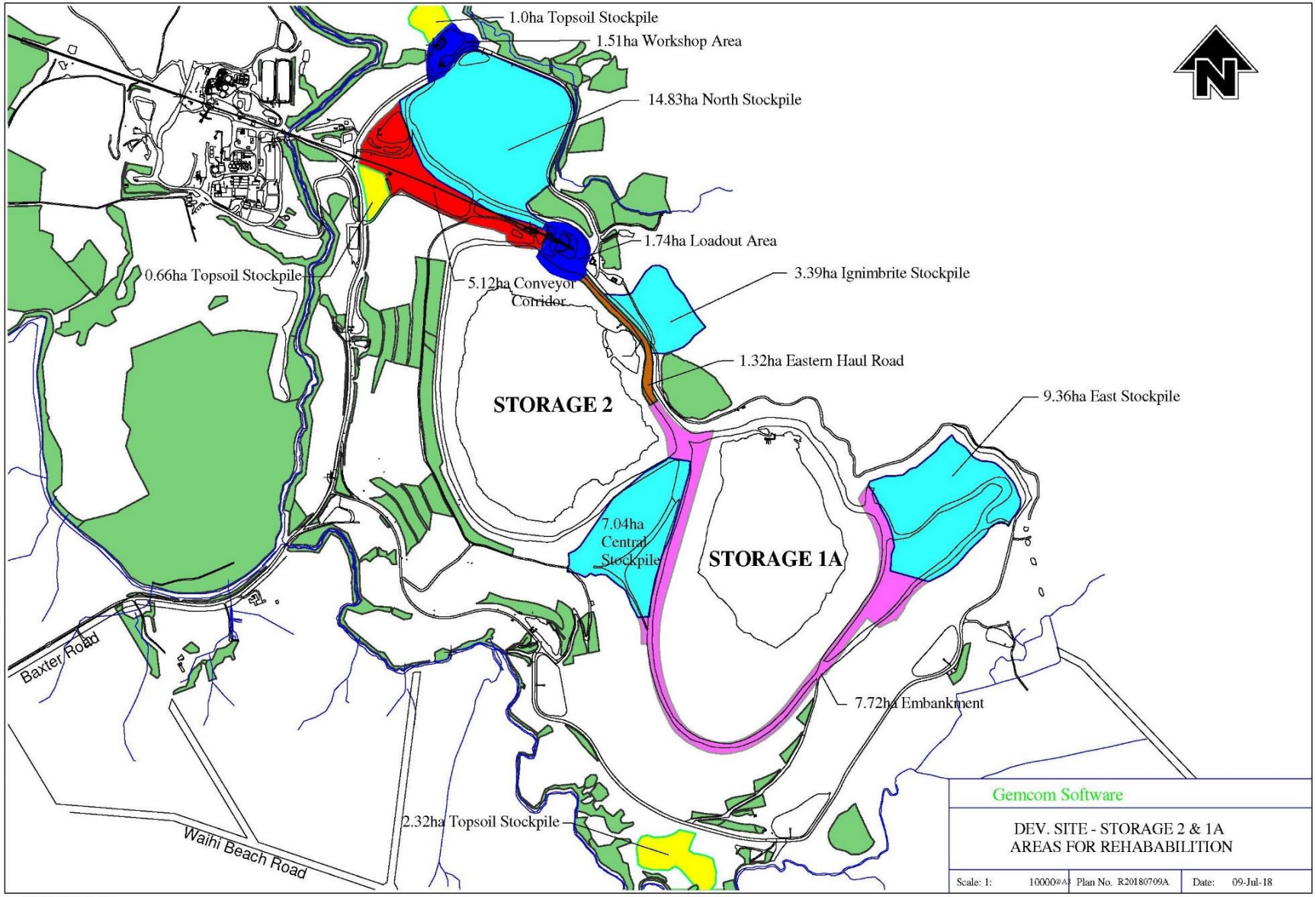


Figure 1: WDA Rehabilitation Areas 2017-18

3 MARTHA MINE

3.1 Closure

3.1.1 Overview

The conceptual closure plan for the open pit prepared in 2008 and shown in Error! Reference source not found. remains unchanged. All waste rock or ore has been moved from the surface facilities area and with no mining planned, no further use of the area is proposed before 30 June 2019.

Without safe access, the pumping and any other equipment currently within the pit is assumed to be abandoned.

3.1.2 Pit Wall Stabilisation Works

3.1.2.1 Pit Wall Hazard Identification and Scaling

At the completion of mining, a Hazard Management Plan would be written to identify areas around the lake edge that may be prone to softening, and to identify areas that need to be scaled and rocks removed.

3.1.2.2 Riprap for Lake

The riprap around the lake edge is complete, other than that section that was lost with the north east wall failure. This lost section will be reinstated during the failure remediation works.

3.1.3 Pit Lake and Park

3.1.3.1 Lake Level Studies and Grand Junction B/Western Adit

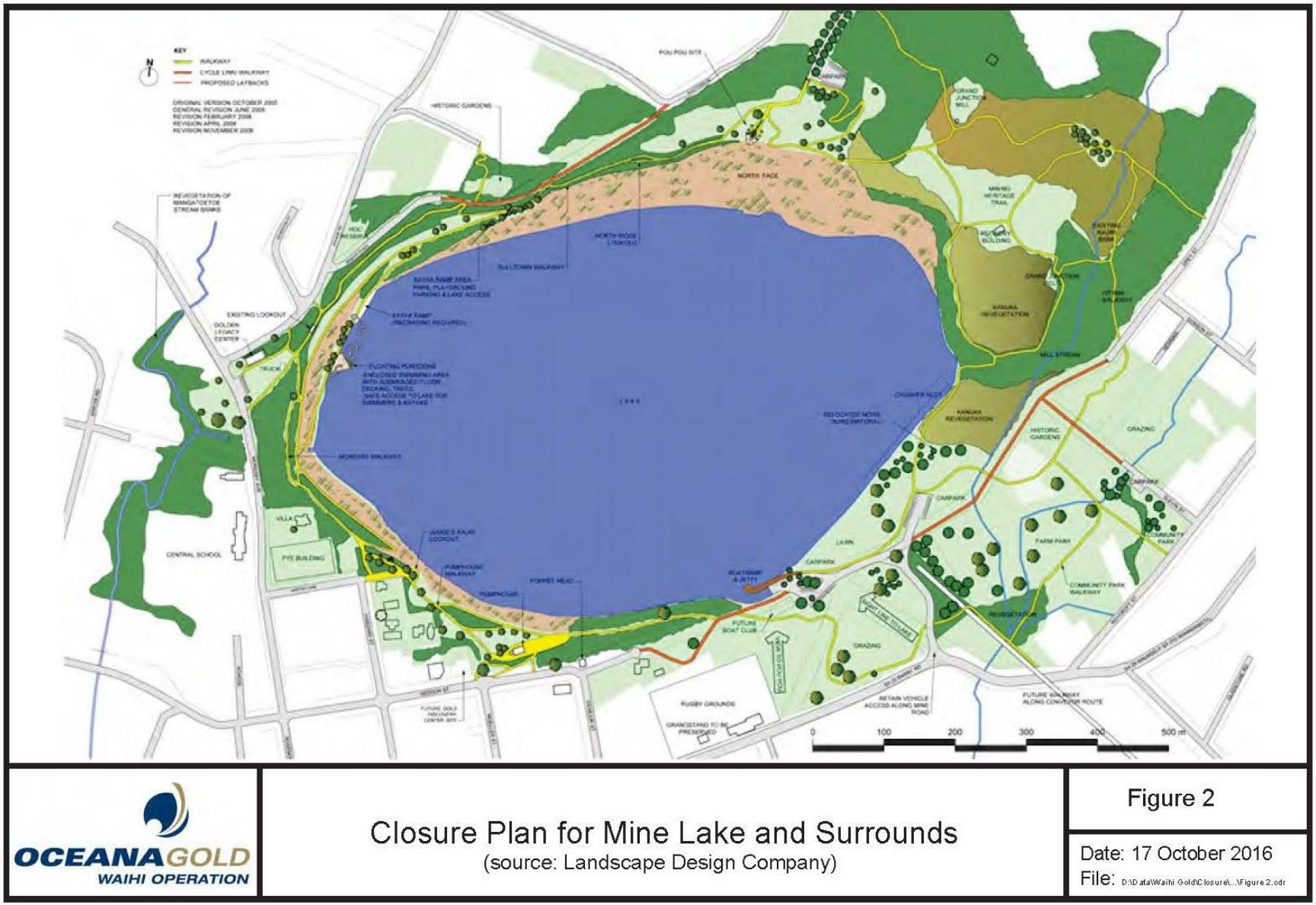
On the basis of technical work carried out for the Extended Project, it was determined that the lake level should be conservatively set at RL1104 (mine datum). The level was set relative to the adjacent Mangatoetoe Stream, and historic mine workings at the western end of the pit were taken into account. In this regard the lowest known potential exit point was described as the former warm spring which flowed from an adit at RL 1106 (mine datum).

It is assumed that Grand Junction B shaft will require capping given that it is located in the vicinity of the lake outlet.

3.1.3.2 Drainage Tunnel and Outlet Channel

OceanaGold's predecessor commissioned URS (now AECOM) to complete an outlet design review for the Martha pit lake, and this was completed in February 2011[3]. The report updates investigations carried out in late-1996. The recommended outlet is a 1.8m diameter pipe approximately 150m long, which discharges to the Mangatoetoe Stream.

[3] URS New Zealand Ltd., Martha Mine Pit Lake Outlet Design Review. February 2011.



OCEANAGOLD WAIHI OPERATION

Closure Plan for Mine Lake and Surrounds
(source: Landscape Design Company)

Figure 2

Date: 17 October 2016
File: D:\Data\Waihi Gold\Closure\...\Figure 2.cdr

Figure 2: Closure Plan for Mine Lake and Surrounds

3.1.3.3 Lake Filling

It was previously assumed that the existing mine dewatering booster pumps would be used to pump water from the Ohinemuri River to fill the lake. With access into the pit now restricted it may not be possible to recover those pumps, but there are a range of other pumps and pipework currently in use underground or at the process plant that would become available upon cessation of mining.

3.1.3.4 Lime Addition to Lake

For sudden closure, the assumption is that limestone is added to the lake during and beyond filling to maintain lake water pH.

The remodelled predictions for lake water quality undertaken by AECOM in 2009 identified a need to add alkalinity to the lake to ensure robust water quality at lake filling. The predictions suggested that alkalinity should be added to the river water as it is discharged to the lake, to provide 60 g/m^3 of $CaCO_3$. AECOM has advised that up to 1,320t[4] of alkalinity as calcium carbonate should be added to the total river water volume with this likely to be undertaken by lining an open channel, along which the river water flows, with limestone. Assuming 50% efficiency in alkalinity production from limestone, a mass of 2,640 t of limestone comprising clean 25-50 mm chip would be required in the open channel over the filling period.

To maximise the alkalinity input to the lake during filling, and based on advice from AECOM, OceanaGold proposed installing limestone in channels or swales along the length of the haul road. This proposal was described in previous versions of the Plan, but is now possible only at the upper end of the north wall ramp. Limestone addition will also be possible on the benches of the remediated north east wall, during and after this work is complete. OceanaGold is currently awaiting advice on these replacement alkalinity addition options.

Once full, the lake is assumed to require an ongoing addition of limestone at an annual rate of 30t of alkalinity (as $CaCO_3$) to maintain lake water pH in the long term. With approximately 50% dosing efficiency for limestone, this amounts to 60t limestone annually. The type of limestone used would be fine lime supplied in bulk form to a lime silo from where a prescribed quantity would be added to a batch mixing tank via a screw feeder. The lime would be dosed at a set rate into a known flow rate of water and discharged onto the surface of the lake via a floating diffuser arrangement.

A reassessment of changes to the long-term lake water quality predictions resulting from the north east wall failure is planned, i.e. to determine whether the remediated wall contains less or more sulphides and whether those sulphides are more or less reactive.

3.1.4 Surface Facilities Area

3.1.4.1 NAG Testing Programme

At closure, it is expected that a testing programme would be carried out at the Surface Facilities Area (SFA) to identify PAF rock, including PAF sheeting that would need to be removed.

It is assumed that scraping 200mm of residual PAF material from an area of 2ha will be required, with this material pushed into the base of the crusher slot, or possibly into the pit.

3.1.4.2 Filling Crusher Slot and Recontouring SFA

It is assumed that the crusher slot would be filled at closure. The slot requires 83,000m^3 of material to fill, and the ramp area adjacent to it requires 7,000m^3.

[4] Based on estimates for Ohinemuri River volume in lake. URS, 14 December 2011.

3.1.4.3 Revegetation

The SFA, which totals around 6.3ha, will be covered in 0.5m of subsoil and laid with 100m of topsoil and grassed.

3.1.5 Noise Bund

Material from the Grey Street noise bund will be used to provide the subsoil and topsoil required to rehabilitate the SFA. The bund contains 120,300m^3 of suitable NAF material, compared with a minimum of about 30,000m^3 required for SFA rehabilitation. The excess could either be disposed of at the pit, or used to address any potential shortfall of subsoil and topsoil at the waste disposal area.

3.1.6 Lakeside Amenities

3.1.6.1 Historic Structures

Works associated with the relocation of the Pumphouse and Grand Junction Refinery Building are complete. Eight pillars of the Powerhouse Foundations removed during the Grand Junction Refinery building shift will be reinstated.

3.1.6.2 Pit Rim Walkway

The pit rim walkway and rehabilitation of the areas around the pit are complete, although adding or forming approximately 500m of walkway in the Grand Junction area and surrounds is provided for.

3.1.6.3 Amenities Block/Services (South Side of Lake)

The Whitehouse Building, which sits outside the high and medium hazard zones, could be used as a lakeside amenities block.

3.1.6.4 South Wall Boat Ramp

A new sealed access road from the White House to a boat launching ramp located in the south-east corner of the pit between the Royal and Martha hazard zone is provided for.

The south wall boat ramp is assumed to include a jetty for ease of launching and retrieving craft. As previously, the ramp is assumed to be a concrete slab of around 200m^2 in area and x 0.5m thick.

3.1.6.5 Recreational Pontoons

In the event of sudden closure, a swimming pontoon is provided for, located at the western end of the pit. The shape of the pontoon approximates that shown in the pit closure concept plan (Figure 2) and includes a submerged swimming area.

3.1.6.6 Carpark

The assumption is that the Whitehouse carpark would be used. The carpark is sealed and in good condition.

3.1.6.7 Access Road and Carpark Maintenance

It is expected that maintenance of the access roads and carpark would be necessary, and is provided for.

3.1.6.8 Interpretation Boards

OceanaGold has placed interpretation boards and signage around the pit rim walkway. The assumption is that no further interpretation boards would be necessary in the event of sudden closure.

3.1.6.9 Lookouts and Seating

The assumption is that existing lookouts and seating are appropriate and no further allowance is made in this year's bond report.

3.1.7 Planting and Landscaping

3.1.7.1 Native and Exotic Tree Planting

Some further planting may be necessary in the surface facilities area only. The assumption is to plant around 1.2ha of kanuka vegetation as shown in Figure 2, plus some other individual trees.

3.1.7.2 Mowing

Some of the walkways, plantings and viewing platforms that are either built or proposed on land around the pit perimeter are or will be on land not managed by the Martha Trust. It is unclear who will be responsible for these areas in the long term. OceanaGold and the Hauraki District Council will need to resolve this issue in the future. Maintenance may be self-funding through tourism operations and grazing, but as this remains unresolved, is provided for.

3.2 Post-Closure

In the absence of an obvious owner for the pit lake recreational facilities, routine maintenance is provided in perpetuity for the:

- Access road, parking areas and boat ramp;
- Floating pontoons;
- Pit rim walkway;
- Lake outlet structure; and
- Parkland (mowing).

Event-driven maintenance is included on a two to 10-year cycle for the pontoons, pit rim walkway and lake outlet on the assumption that major rainstorms or earthquakes could require additional effort beyond the routine. Refurbishment and replacement is included for the floating docks and the lake outlet structure on 30- year and 50-year cycles respectively.

4 CONVEYOR, PROCESS PLANT AND WTP

4.1 Closure

4.1.1 Decommissioning

4.1.1.1 Process Plant and Water Treatment Plant

All buildings, plant and equipment associated with the conveyor, polishing pond stockpile, process plant and water treatment plant will be decommissioned and removed from site.

Concrete footings, plinths, bunds etc. would be either buried or broken up and disposed of in the tailings storage facilities.

As introduced in last year's Plan, it is proposed to decommission and remove the water treatment plant. OceanaGold is in negotiation with the Councils on removing the water treatment plant, which is expected to require a consent variation. At the time of this review, there was no indication that either Council would oppose the plant's removal, which is the assumption adopted for the Plan.

4.1.1.2 Conveyor

For the conveyor, there has been a strong desire indicated by members of the community (expressed through the WCV) to leave the Union Hill tunnel open and incorporate the conveyor corridor as an extension to the Waihi walkway network. Allowing public access to the conveyor tunnel introduces safety and additional maintenance obligations, none of which should fall to OceanaGold under sudden closure, or to the Martha Trust post-closure. The conveyor walkway option is not included in the Plan.

Once the mechanical plant and any PAF and concrete is removed from along the conveyor trace, the area would be ripped. The portals at each end of the conveyor tunnel would be plugged with a $10m^3$ concrete bulkhead to prevent access.

The conveyor passes through Armco culverts beneath Grey Street and Barry Road. Some decision would need to be made regarding these culverts. In practice they could either be left open to allow stormwater drainage to pass to the Barry Road silt pond, or alternatively they could be filled. In the case of the Barry Road culvert this may involve ripping up the road to fill beneath it. Further work is needed closer to closure to accurately identify how these culverts would be rehabilitated.

The land along the conveyor route is owned by various parties including LINZ. It does not form any of the land to be handed over to the Martha Trust at the end of closure.

4.1.2 Contaminated Soil

There is no expectation of a major issue with contaminated soil. Nevertheless, investigations of potentially contaminated soils at the processing plant area, and its removal, is provided for. A volume equivalent to 1m depth of material across 20% of the mill area is assumed.

4.1.3 Stockpile Removal

There are currently no stocks of waste rock or ore on the Polishing Pond stockpile, which will remain the situation throughout the Plan period. If any ore remains in the ROM stockpile at 30 June 2019, it would be processed in short order.

4.1.4 Revegetation

The assumption is that the processing plant area could be a future industrial site for Waihi and that many of the buildings, offices, carparks and roads would be left in place.

The remaining two thirds of the process plant area (i.e. that area not occupied by buildings and roads), the conveyor trace, and the WTP and stockpile areas will be recontoured, topsoiled, fertilised and grassed. It is assumed that the restored land would be used for the purposes of grazing, and maintenance costs have not been included because this land would either be sold or leased to a local farmer. For the conveyor trace, maintenance costs will fall to the owner of the land.

4.2 Post-Closure

With the areas secured and returned to productive pasture, or owned by others, there are no post-closure obligations associated with the conveyor, stockpile areas, or process plant water treatment plant areas.

5 WASTE DISPOSAL AREA

5.1 Closure

5.1.1 Overview

The conceptual closure plan for the tailings storage facilities (TSF) initially prepared in 1998 remains fundamentally unchanged (refer Figure 3). It comprises a partial capping of the tailings against the embankment crest, retention of part of the impoundments as shallow ponds, and planting of the embankments and capping including a wetland littoral zone around the ponds. Spillways would be constructed to discharge into and from Storage 2.

Figure 4 shows the areas that would need to be rehabilitated for Storage 1A. For the scenario of sudden closure within the coming year it is assumed that:

- The bulk of the 24ha is assumed to be PAF that will be covered with compacted, low permeability Zone G, followed by Zone H growth layer and topsoil.

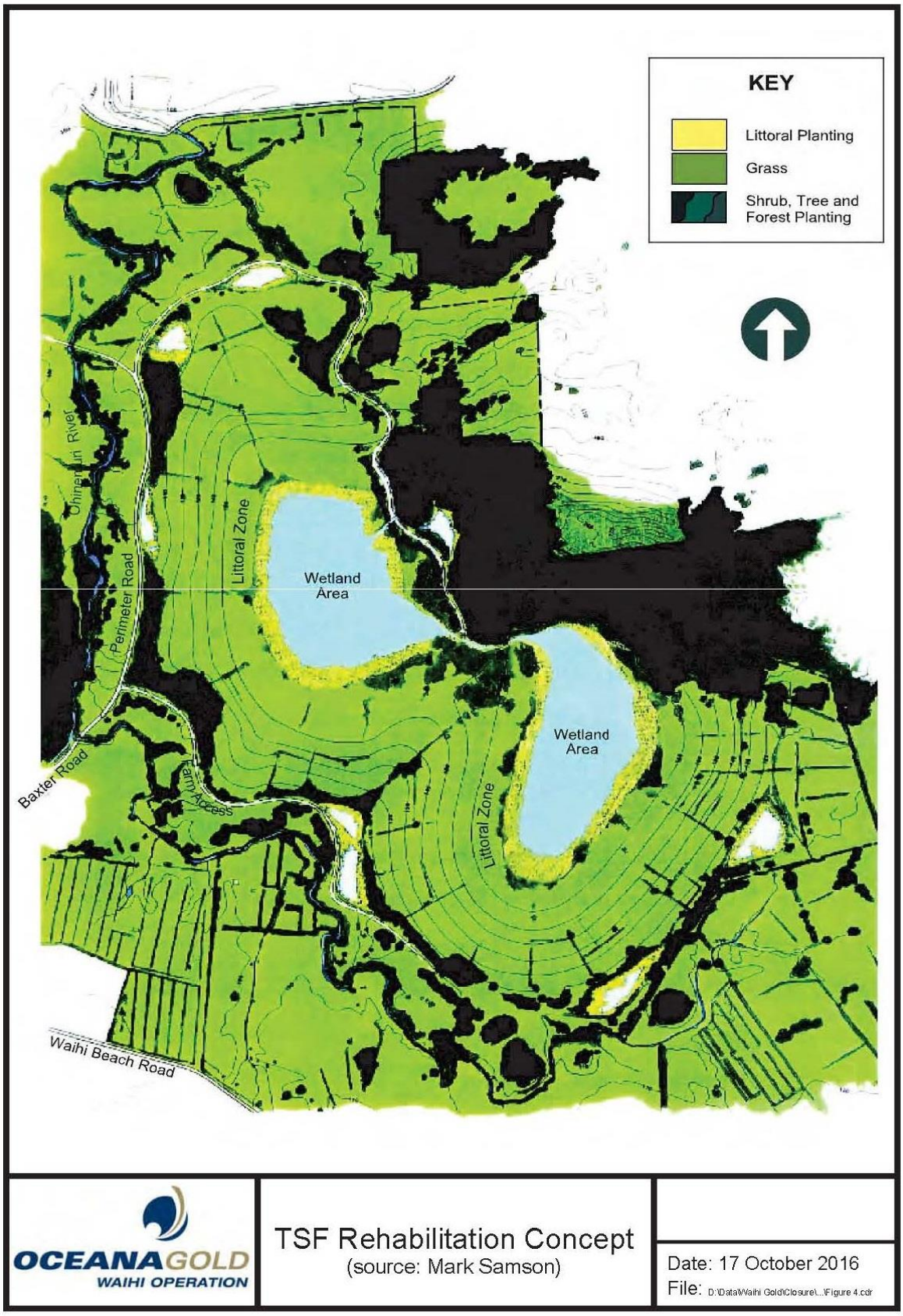


Figure 3: TSF Rehabilitation Concept

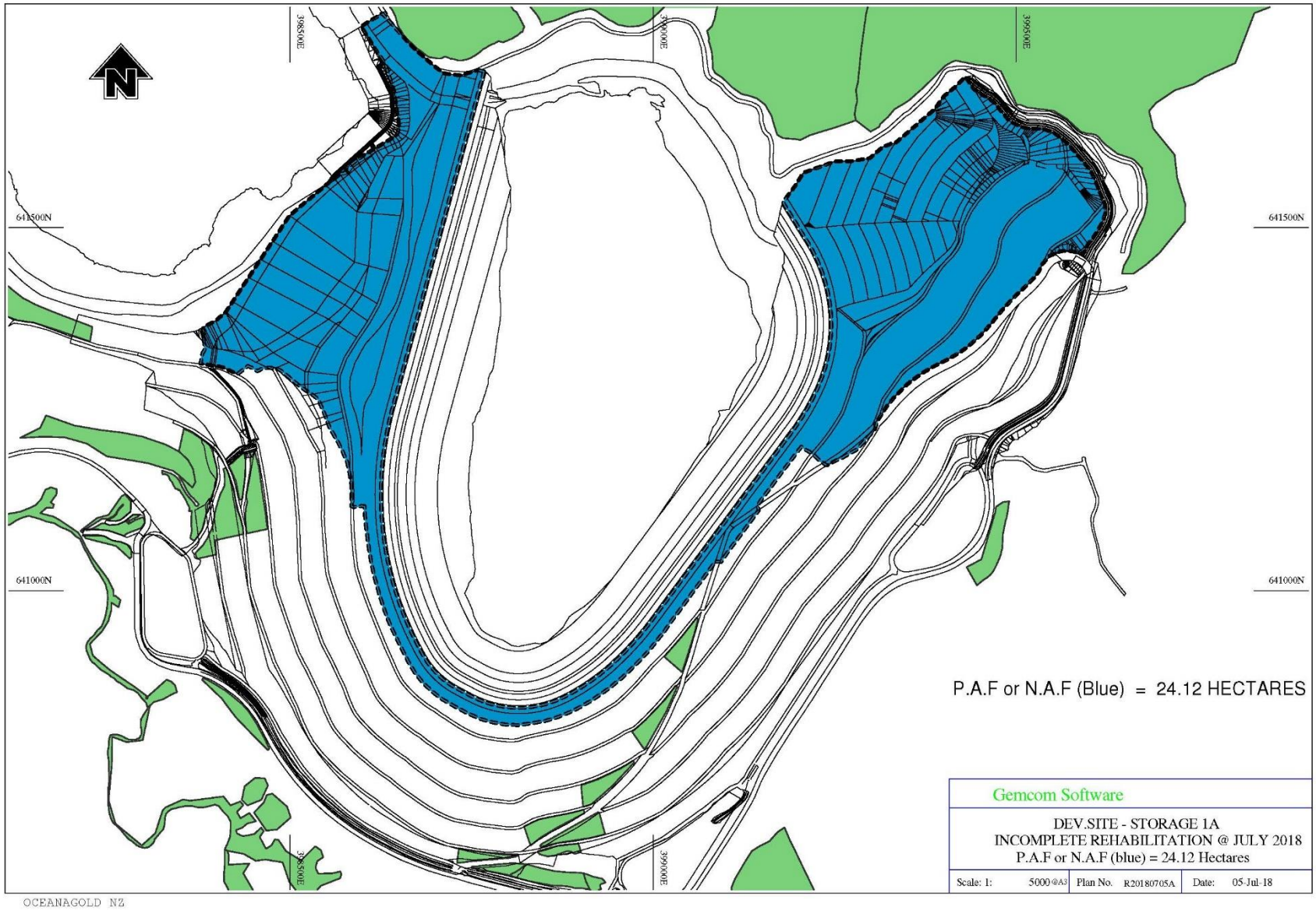


Figure 4: TSF1A Areas for Rehabilitation

- Rehabilitation of the unfinished parts of the waste rock embankments would commence immediately following sudden closure;

- Additional capping would be completed on the Storage 2 tailings pond, and revegetated using riparian planting along the pond edge and pasture elsewhere;

- The rehabilitated Storage 2 pond water would continue to flow into a tributary of the Ohinemuri River (TB1), north of the tailings storage facilities;

- Rehabilitation of the Storage 1A tailings pond would need to be delayed for a period, assumed to be around one year, to allow the tailings to consolidate prior to receiving capping and plantings as described for Storage 2;

- Once water quality in the Storage 1A pond improves sufficient to obviate the need for continued treatment, the pond would discharge to the Storage 2 pond and thence to the Ohinemuri via the TB1 tributary;

- Some modifications to the underdrainage system would be progressively implemented, diverting individual drains to the river as water quality improves;

- As one of the last activities, the haul roads and waste loadout area, which are assumed to be sheeted with PAF, would be covered with a 0.6m thick Zone G layer to exclude air and water before receiving growth layers, topsoil and plantings;

- The NAF stockpile footprints, primarily those of the Northern stockpile and ignimbrite stockpile located to the east of the Storage 2 pond, would be recontoured and planted; and

- Some water reticulation and fencing across the rehabilitated areas is installed for farming purposes.

5.1.2 Waste Rock Embankments

The total area assumed to be PAF, including the Waste Loadout, the workshop area, the eastern haul road, the eastern and central stockpiles and the Storage 1A embankment is 28.69ha. Rehabilitation of these areas would comprise:

- a Zone G capping layer with a thickness of 1.5m on the Storage 1A embankment;

- a Zone G capping layer with a thickness of 0.6m on the other PAF areas;

- a Zone H subsoil layer, with a thickness of 0.5m across the total area; and

- a topsoil layer, nominally 100 mm thick, across the full area to which fertiliser is added and grass seed sown.

The materials balance available for rehabilitation was reassessed as part of this review. This indicated a surplus of all material required to complete the rehabilitation works. As identified last year, for the waste disposal area there is an overall surplus of NAF material but a portion of this NAF may not have physical properties suitable for compacting to the specification required for Zone G. The shortfall this year is significantly less than derived last year (16,000m^3 cf. 80,000m^3). The shortfall is addressed by either amending the required volume of unsuitable NAF, or obtaining the required volume of suitable NAF from an alternative source.

As noted last year, OceanaGold is proposing to seek specialist advice on whether it can reduce the thickness of the Zone G cover on the embankment from 1.5m to something less. If so, there would be a surplus of suitable NAF to construct the Zone G layer. The materials balance will be reviewed again for the next bond review.

The assumption is that two construction seasons would be necessary to complete the embankment rehabilitation works.

5.1.3 Native Plants

The assumption is that there may be some awkward or steep areas that would be better planted in native shrubs than grassed/grazed. Planting of an area of 2ha is provided for, including five years of maintenance.

5.1.4 Tailings Capping

Only Correnso ore will be processed during this bond period, and preliminary indications are that the tailings are less reactive than those from the other Waihi mines, possibly NAF. Should they prove to be NAF, then the previously-allowed limestone would not be required. However, as it has yet to be shown that the tailings are NAF, the continued assumption is that limestone would be applied to the tailings surface prior to placement of the capping material at an application rate of 80 t/ha.

Once limestone application is complete, geotextile would be laid prior to capping with 1.5m of ignimbrite, 0.5m of subsoil and 0.1m of topsoil.

Review comments from last year indicated that revegetation may produce superior results without subsoils and topsoil placed over the ignimbrite capping. It is assumed that this comment may have been specific to the planting of the riparian margins of the cap. In any event, the closure works assumption for this Plan remains that soils will be placed across all of the capped area.

The tailings capping requirement was reviewed this year with input from Engineering Geology. The capping objective is to minimise the area of capping while protecting the embankment crest by ensuring sufficient separation between the crest and the residual pond edge. A capping area of around one third the existing pond area was considered adequate, and adopted for TSF1A. This equates to a capping width of around 70m.

TSF2 already has more than one third of the original pond area capped, although there are zones along the western shoreline where the separation between crest and water's edge is only 40-50m. The assumption is that additional capping will occur in these zones, bringing the average width of the capping for TSF2 to around 80m.

It is expected that capping of TSF2 could be completed over one summer (Year 1), while Storage 1A may need to be capped over two consecutive summers depending on tailings consolidation and pore pressure dissipation rates.

5.1.5 Riparian Planting around Tailings Pond Areas

A strip of riparian planting along the shoreline of each of the tailings ponds as described last year is provided for. This will comprise a 2-3m strip of wetland plants on the lake margin, outside of which (on the cap) is a 5-8m wide strip laid with locally-sourced Manuka slash (fascining).

The remaining areas of capping receive subsoils and topsoil, fertiliser and grass.

5.1.6 Tailings Pond Spillways and Siting

In June 2013, OceanaGold's predecessor engaged Engineering Geology to produce drawings for the outlets/spillways for the tailings ponds. Those drawings were included in that version of the Plan, and are not repeated here.

5.1.7 Underdrainage Modifications

It is expected that underdrainage (seepage) could be progressively discharged as the drainage quality and volume from individual drains improves. It is assumed that this takes place progressively over the period of closure. Gravity outlet systems would be constructed to allow the ten toe drain sumps and one seepage outlet for TSF2, and five toe drain sumps and two seepage outlets for TSF1A to discharge direct to the receiving waters.

As previously, the ability to divert good quality seepage to the nearby Ruahorehore Stream is built into the TSF1A seepage collection system, and that only a small amount of work would be necessary to institute the diversions. In contrast, more work would be required and has been assumed for TSF2.

5.1.8 Limestone Addition to Haul Roads

The requirement for applying limestone to the haul roads, as assumed in some of the past Plans, is confirmed by EGi to be unnecessary.

EGi also offered an alternative of ripping and liming these areas to form NAF prior to the placement of plant growth and topsoil layers. The alternative approach may be less expensive, and warrants further investigation for future Plans.

5.1.9 Eastern Haul Road Capping

Once the embankment and tailings rehabilitation is complete, the haul roads would be decommissioned and rehabilitated. Due to the material used for sheeting, the assumption is that the road surfaces are PAF. The Eastern Haul Road is assumed to be capped with 0.6m of Zone G material, followed by Zone H material (0.5m depth) and topsoil (0.1m depth).

5.1.10 Rehabilitation of Stockpile Areas

In the event of sudden closure, it is expected that the land beneath the Northern NAF stockpile and the ignimbrite stockpile would require some minor recontouring prior to topsoiling with 100 mm of topsoil and grassing (topsoil is not required on the topsoil stockpiles). This is a conservative assumption as material from both stockpiles will be used for rehabilitation elsewhere in the waste disposal area, and the recontouring would be done as part of the material recovery.

The main stockpile areas were checked using GIS and adjusted slightly from previous years, the totals used for deriving the cost being:

Location of NAF Areas	Area (ha)
Northern NAF Stockpile	14.83
Ignimbrite Stockpile	3.39
Topsoil E (Torrens)	1.00
Topsoil F (South)	2.32

Rehabilitation is assumed to occur progressively over two years.

Rehabilitation of the central stockpile is included with the rehabilitation of the waste rock embankments.

5.1.11 Ponds

It is assumed that for sudden closure, the following collection ponds would be retained around the waste disposal area:

- West silt pond
- South silt pond
- S3
- S4
- S5

These ponds could provide water storage opportunities for other water users in the future. OceanaGold already has an agreement with a neighbouring landowner providing future access to one of the collection ponds (S4) for use as a future source of water for frost protection or for pasture irrigation. It is also noted that in 2014 Hauraki District Council consented a new water take for Waihi township above the processing

plant site near the Golden Valley Bridge, and the ponds could provide potential water storage. It may also be possible for an industrial water user to set up at the processing plant site and to use the water that is stored on site. In summary, the ponds could be a valuable asset/water source in the future for the Martha Trust, or for others. As assumed last year, the assumption is that the ponds will be retained.

The same assumption applies to the WTPCP and Polishing Ponds.

Some work associated with pond outlets, e.g. provision of a culvert under the perimeter road from S1, is provided for.

The assumption is that NCP would be filled in at closure, but that this work would be done as part of the recovery of material from and rehabilitation of the northern NAF stockpile.

5.1.12 Fencing, Water Reticulation and Farm Races

It is assumed that once rehabilitation has taken place, fencing and water reticulation would be completed on the embankments.

The fencing on the TSF2 embankment is essentially complete. For TSF1A, some additional fencing and water reticulation is required. On the capped tailings areas for both TSFs, fencing will also be required, particularly to separate the riparian plantings from the areas of pasture.

The total area of new fencing is 55ha. It is assumed that all areas are fenced into 1ha paddocks, with a mix of nine wire battened fences and fences with four electric wires. Timing is assumed to coincide with that of completion of capping and planting, i.e. in Year 1 for TSF2 and spread across Years 2 and 3 for TSF1A.

Six new water troughs with associated pipework and installation, as assumed previously, are included, giving a total of 24 troughs on the TSFs.

Formation of farm races at the waste disposal area would be spread across the three years of TSF rehabilitation works.

5.1.13 Drain Maintenance

The embankments are constructed, and drainage is progressively installed, so that the embankments do not pond water. While construction of drains as a separate work item is not required, maintenance is required of the surface drainage systems during the closure period. In the first four years of closure the assumption is that surface drains would require cleaning while earthworks were being carried out. The amount of silt reaching the ponds would quickly reduce as rehabilitation works were completed and vegetation becomes established. The assumption is that during the closure period monthly checks would be carried out to determine what if any maintenance of the drains may be necessary.

Once rehabilitation is complete there would be minimal erosion, similar to adjacent farmland, and drain maintenance would decrease.

5.1.14 One-off events

It is possible that the occurrence of one-off events such as heavy rainstorms may require review/design of remedial work/construction work, e.g. slumping that might block the perimeter drains and require stabilisation or settlement/deformation of an outlet weir from the pond that requires reconstruction of the outlet weir. It is assumed that such events could occur randomly at intervals ranging typically between two and 10 years.

5.2 Post-Closure

5.2.1 Waste Rock Embankments

Annual walkover surveys and reports by a professional engineer, in line with the requirements stipulated by NZSOLD, are assumed for the waste rock embankments in perpetuity. In addition, the Site Management Coordinator (refer s7.1.6) would undertake regular and routine embankment walkover checks and wilding tree control.

Provision is also made for routine maintenance of the embankments, for additional event-driven maintenance on a six-year to 20-year cycle, and for further more extensive maintenance effort following extreme events on a 50-year cycle.

Routine and event-driven maintenance, and periodic (50-year cycle) refurbishment of the TSF pond outlets is included in perpetuity.

5.2.2 Other

It is assumed that fences, water supply, farm races and the like are maintained by whomever leases the land.

6 UNDERGROUND MINES

6.1 Closure

6.1.1 Decommissioning

As in the previous Plans, removal of underground pumping equipment soon after the cessation of mining is assumed.

6.1.2 Underground Workings/Decline

Conditions of consent require the backfilling of a short section of the Trio access development, of the two existing ventilation shafts, and of the Favona portal.

For Correnso, the consent conditions require the backfilling of any open stopes existing at 30 June 2019, and of certain sections of overlapping development.

A review of the underground volumes to be backfilled as required under the conditions of the consents is as follows;

Description	Quantity (m^3)
Backfill Correnso stopes and stacked development	111,000
Backfill Trio decline (approx. 200m)	5,000
Backfill portal	2,650
TOTAL	118,650

There is unlikely to be significant waste rock volumes on the surge stockpile at 30 June 2019, so the bulk of the backfill material would be sourced from the waste disposal area.

6.1.3 Boxcut

Rehabilitation of the box cut would be one of the last underground-associated activities to take place. It would involve battering down of the box cut, bringing in material and recontouring to blend it in with the natural contours of the landscape.

The majority of the work would comprise dozing in the sides of the boxcut, the material from which is NAF. The area would then be topsoiled and grassed.

6.1.4 Ventilation/Escape Shafts

There are two, 2.4m diameter shafts (a ventilation shaft and an escape shaft) for Favona as well as the Trio Vent Shaft which has a diameter of 3.5m, to be backfilled. The escape shaft contains a ladderway that would need to be removed before filling with waste.

Assuming a depth of 100m and shaft diameter of 2.4m for the two Favona shafts, and a depth of 138m and diameter of 3.5m for the Trio ventilation shaft, approximately 500m^3 of backfill material would be needed for each of the Favona shafts, and 1,400m^3 would be required for the Trio Ventilation Shaft. The shafts are steel lined and based on similar work underground it would be feasible to fill these shafts by tipping waste rock down them.

Concrete would then be poured to secure the top of the shafts. It is assumed that one ready mix truck full (5m^3) of low strength concrete would be sufficient for the two Favona shafts, and 15m^3 would be necessary for the Trio Ventilation shaft (total 25m^3 of concrete for all three shafts).

6.1.5 Stockpiles

As there is currently no material on the Polishing Pond Stockpile, and none planned to be placed there, the associated cost is limited to restoring the land beneath the stockpile.

Up to 40,000m^3 of waste rock could be on the surge stockpile near the underground portal to be used as underground backfill. However, volumes are often less.

The assumption is that the following stockpile footprints will require rehabilitation.

Stockpile	Footprint (m^2)
Polishing Pond Stockpile	50,500
Ore and Waste Stockpile, and magazine	32,400
TOTAL	82,900

The assumption is that any PAF material will have been removed for placement underground, and that the whole area requires ripping, topsoiling and grassing.

6.1.6 Ponds

The assumption is that at closure, a number of ponds around the Mill area would need to be filled as follows:

Pond	Volume (m^3)	Area (m^2)
Mill Collection Pond	4,243	5,400
Favona Stockpile Collection Pond	13,800	7,900
TCP1	159	1,000
TCP2	1,831	1,800
TOTAL	20,033	16,100

Rehabilitation comprises dozing in the walls of the ponds to form free-draining landforms before the areas are topsoiled and grassed.

6.1.7 Haul Roads

The haul roads from the underground portal to the stockpiles and Process Plant would be ripped, topsoiled, fertilised and grassed. Removal of an assumed 1m depth of PAF is included.

6.1.8 Access Road

The access road around the Process Plant area is sealed and would be useful for future farm access. For this reason, it is assumed to be left in place.

6.1.9 Water Management

During rehabilitation operations, clean water from undisturbed areas of the catchment above the portal would continue to be directed around the work areas until earthworks were complete and a successful pasture had developed. The open drain would then be filled to eliminate a potential safety hazard and the need for ongoing maintenance. Fill material would be sourced from the 'unsuitables' stockpile at the waste disposal area. It is assumed that approximately 4,000 m^3 of material would be needed to complete the work.

6.1.10 Ancillary Facilities

In the event of sudden closure it is likely that the Favona/Trio office would be retained for some form of use post-mining.

As described above for the process plant area, excavation and removal of an average of 1m of contaminated material over part of the area is assumed.

6.1.11 Fencing

Upon completion of rehabilitation, the security fence surrounding the shafts would no longer be necessary, and would be removed. Depending on the final land use, the security fence around the processing plant may also be removed.

6.1.12 Maintenance

Depending upon the final land use, ongoing maintenance may be limited to normal pasture maintenance or weed control. This will involve fertilising the soil, removing weeds etc. In the early years, land restored to pasture will need to be managed in such a way that it is not overgrazed or pugged. After that time, the area should be able to be managed in a similar way to surrounding farmland. The assumption is that the farmer/new owner would take responsibility for this task.

6.1.13 SUPA

While it is possible that consent will be granted and that work on SUPA could start within this Plan period, it is considered unlikely that any associated closure works above those already described would be required.

6.2 Post-Closure

No ongoing maintenance or monitoring associated with the underground mines is assumed beyond Closure.

7 ADMINISTRATION

This section covers the management, monitoring and maintenance elements of closure, aftercare and post-closure.

7.1 Closure

7.1.1 Staffing Overview

It is assumed that the Councils would need staff to complete rehabilitation and closure activities until such time that the site reaches Closure, at which time the Martha Trust is able to take responsibility of the ongoing management of the site. The Councils' responsibilities would include completing all physical rehabilitation and closure tasks, monitoring and maintenance, water treatment, and the necessary administrative tasks.

Initially, a greater number of staff would be required, and it is expected that a Site Manager with engineering experience would be needed for the first two years to oversee the bulk of the rehabilitation earthworks around the site. By Year 3, much of the remaining work would relate to environmental monitoring, inspections, and general maintenance as opposed to major decommissioning and earthworks activities. By Year 5, it is expected that environmental monitoring and maintenance would be the remaining routine tasks. At that point in time, all activities could be managed by one person, referred to as the Site Management Coordinator.

The staffing assumptions are outlined in the following sub-sections.

7.1.2 Site Manager

The Site Manager would be a full-time role for the initial two years while the bulk of the demolition of plant and earthmoving activities were taking place. One of the Site Manager's initial tasks would be to draw up a tender document for the rehabilitation of the site, and then to form a Rehabilitation Earthworks contract. The Site Manager would oversee all works on site and act as the Company Liaison Officer, including managing a liaison forum to keep residents and interested parties informed of rehabilitation activities if such a forum is deemed desirable by the Councils. It is assumed that no Council Liaison Officer would be necessary, given that the Councils would be carrying out the work.

Beyond Year 2 it is expected that the environmental staff, and later the Site Management Coordinator, would take on the main site management role.

7.1.3 Management Support

It is assumed that some logistics/administrative support would be needed during the first four years of closure. The equivalent of one person employed full time for the first three years to undertake logistics/clerical duties while the bulk of the closure activity was taking place, and part-time in Year 4, is provided for.

7.1.4 Accountancy

It is assumed that a full-time accountant would be necessary for a period of two years. Beyond that time it could be assumed that there would be only minor accountancy requirements including annual tax statements and accounts, and for that reason the costs have been progressively reduced over the remainder of the 13-year closure period.

7.1.5 Environmental

One Environmental Officer and one Environmental Technician are assumed to be required on a full time basis for Years 1 to 2. Beyond that time, the Environmental Officer would continue through to Year 5.

As part of the transfer from Environmental Staff to the Site Management Coordinator, a long term Surveillance and Maintenance Manual would be prepared for the waste disposal area and the Pit Lake Area. The Site Management Coordinator would be expected to follow the requirements of the manual. The manual would include monitoring and maintenance requirements, check sheets and trigger levels to warn of any possible problems at an early stage. The Manual would also include a requirement for inspections by appropriately qualified professionals, reducing in frequency over time. At the time of these inspections, all monitoring data would be reviewed, and the Surveillance and Maintenance Manual would be updated and amended as necessary.

By Year 5, the Environmental Officer would be retained on site on a part-time basis (or alternatively full time for six months) for the purpose of training the Site Management Coordinator.

7.1.6 Site Management Coordinator

The position would commence in Year 5, with some overlap with an Environmental Officer for the purposes of training. This would be a full-time role for Years 5 to 8, reducing to part-time thereafter.

The Site Management Coordinator would be responsible for the following;

- engaging contractors and consultants to provide necessary external services;
- undertaking routine inspections at regular intervals, after heavy rain as necessary, and following unusual events such as earthquakes;
- determining whether the pit lake outlet and tailings pond outlets require clearance, and carrying out any necessary work in a timely manner;
- identifying and removing noxious weeds above lake level in the open pit;
- identifying and scaling down rocks on the pit walls that may be a public safety issue;
- identifying and removing any large trees in the vicinity of the tailings ponds, pit lake or embankment that could be susceptible to wind throw and potential damage (e.g. to capping layers or blocking outlets) and removing in a timely manner;
- determining whether any surface drains require maintenance, and either carrying out that work if minor, or arranging suitable contractors if necessary;
- arranging reagent supply and maintenance on an as required basis for the limestone addition plant;
- carrying out pest and weed control;
- arranging for contract mowing of grassed areas adjacent to the pit lake on a regular basis;
- maintaining buildings and facilities as necessary, e.g. access roads, farm races, carparks, lookouts and later the amenities block adjacent to the lake etc.;
- regularly inspecting the waste disposal area to ensure that grazing is being carried out responsibly, fertiliser and lime is being applied as necessary, and that nothing untoward such as cracking and erosion are occurring;
- inspecting and maintaining/replacing pH and conductivity meters, water level dippers and flow meters; and
- entering data and maintaining records.

7.1.7 Gardener/Caretaker

In the event of sudden closure, it would also be necessary to hire a gardener/caretaker to maintain existing plantings and generally keep things tidy and secure for a period spanning Years 1 to 5.

7.1.8 Water Treatment Plant Operators

The assumption is that staff comprising a supervisor and six operators would be needed to run the water treatment plant for the assumed three years of decant and other water treatment.

It may be that the labour costs could be reduced by automating the water treatment plant or manning it for example during daytime hours and not at night. This will be given further consideration in future Plans.

7.1.9 Geotechnical Monitoring

Assistance would be required to ensure that:

- rehabilitation operations take place in accordance with the required engineering specifications as required by the conditions of consent, and the requirements of the Building Act; and
- ongoing monitoring and maintenance requirements are being attended to.

Assistance would be required for two construction seasons (October to March, i.e. six months each) to test the embankment and haul road capping. The role requires a Senior Technician. The Councils could choose to retain the existing contractors, Geotechnics, to carry out this role.

7.1.10 Surveying Assistance

Surveying would be required over the entire closure period, but primarily during the initial two years during which the bulk earthworks are completed. As the lake is being filled and earthworks are being completed at the waste disposal area, surveyors would be needed for the purposes of monitoring, and to produce as built plans. In the longer term, surveying would be required for the purposes of monitoring only.

7.1.11 Fixed Plant Maintenance Technicians

The assumption is that operating plant (including pumping and pipeline systems and any associated flowmeters/telemetry etc.) would require maintenance for the first two years. This would include maintenance of the seepage system and tailings decant pumps. The work would be carried out by the WTP staff.

7.1.12 Ancillaries

7.1.12.1 Vehicles

Vehicles would need to be provided for those staff members who need them. It is assumed that four to five vehicles are needed for Years 1 and 2, reducing progressively beyond that point as shown below.

	Year							
	1	2	3	4	5	6	7	8-13
Site Manager	1	1						
Underground (Miner)	0.5							
Environmental	1	1	1	1	1	1	1	
WTP Operators	1	1						
Maintenance	1	1	1	1	1	1		
Site Co-Ordinator							1	1
Total Number	4.5	4	2	2	2	2	2	1 p.a.

7.1.12.2 Office Expenses

For the early years of closure, offices would be needed for the various staff on site. There are a number of office facilities around the site that could be utilised, e.g. the pit Whitehouse and/or the underground office facilities.

Office expenses would include such things as cleaning, tea, coffee, couriers, postage, photocopying, printing, stationery, phone, power and computing facilities.

7.1.12.3 Long Term Building/Administration Costs

In the long term, there would need to be equipment storage and office facilities for use by the Site Management Coordinator. It is assumed this building is required from Year 6 onwards. The running costs allowed include general repairs and maintenance, power, telephone, consumables (tea/coffee, stationery, couriers, postage etc.), water and computer hire.

7.1.12.4 Long Term Maintenance Costs

Long term maintenance costs are expected to include consumables required for long term maintenance activities such as weed/pest control, minor seeding/planting, maintenance of facilities e.g. signs, repair of security fencing, etc. The work would be carried out by the Site Management Coordinator.

7.1.12.5 Scout Den

As part of their agreement with OceanaGold, the Scouts had the option of moving their building near to the pit lake at some later date if they wished. They have since confirmed that they wish to remain in their current location.

7.1.12.6 Rates

The assumption is that the area around the lake becomes a public park and hence is not rateable. Similarly, the waste disposal area is to be managed for the benefit of the public and also should not be rateable. All other land will revert to new owners who will be responsible for paying rates as necessary on those areas. The assumption is that in the interim the land would be subject to a rural rate, decreasing as land is divested.

7.1.12.7 Insurances

The conditions of consent specify that the Rehabilitation Bond should:

> "…*enable the Councils in the event of the bonds being called upon, to purchase Industrial and Special Risk Insurance in the sum of $12 million (1998 dollars) and Public Liability Insurance in the sum of $5 million (1998 dollars)*…"

Using the CPI, the inflated level of cover for these two policies is currently around $17 million and $7 million respectively.

7.1.13 Water Treatment Costs

The post-mining volumes requiring water treatment were reviewed. Last calendar year's treatment volumes, excluding mine dewatering volumes and adjusted for average rainfall are adopted.

The decant water volumes for treatment also assume an additional 50,000m^3 in Year 1 to reduce the volume on TSF1A from its current 150,000m^3 to assist drying of tailings prior to capping.

As previously, three years of treatment to remove metals from all sources, and an initial six months of cyanide treatment for decant and water from the Mill Contingency Pond (MCP), is assumed.

7.1.14 Environmental Management and Monitoring

7.1.14.1 Overview

It is expected that if the mine closed suddenly, the Councils would continue to require a level of monitoring, maintenance and reporting that would reduce as closure proceeds in preparation for handing the relevant areas over to the Martha Trust.

Many monitoring activities would cease, but some monitoring of revegetation and discharge quality, for example, would need to continue for a period. Once dewatering ceases, the monitoring focus would change from settlement and possible effects on bore users, to rebound and monitoring for the occurrence of springs as the lake level rises. Elution water would not be required once ore processing had ceased, and biological monitoring would not be required once discharges from the water treatment plant cease.

A peer review comment on last year's Plan was that it contained no provision for peer review during the closure period, which is correct and was explicitly stated in previous Plans. The assumption is that peer review would not be required if the Councils were managing the site, as opposed to OceanaGold, because there would be no perceived need for "independence".

The function of the peer review panel is to provide independent advice to both OceanaGold and to the Councils in specific technical areas that the latter cannot provide from in-house expertise. The peer review panel provides an independent check, particularly for the Councils, that the advice provided by OceanaGold's specialists is appropriate.

The assumption under sudden closure is that OceanaGold ceases to exist as a viable entity, that mining ceases, and that the Councils take over responsibility for closing the site. Under these circumstances, the Councils would be expected to continue to seek technical advice, and would engaged suitably qualified specialists directly. Whether those advisors are the existing peer reviewers, or any other appropriately qualified party, would be up to the Councils. In any event, there is no need for the Councils to engage two sets of specialists, each set providing advice covering the same disciplines.

It is assumed that of the Council's will continue to require to engage technical support for the following disciplines for which there is currently a peer review role;

- Hydrogeology;
- Geochemistry;
- Revegetation;
- Geotech – underground[5];
- Geotech – TSFs; and
- Geotech – pit.

The level of technical input required through the closure period is assumed to comprise:

- Advice from the full suite of advisors at current peer reviewer levels for Years 1 and 2 for finalising closure criteria, for assessing pit wall stability and modelled lake water quality prior to the start of pit rewatering, and for checking underground backfilling;
- Beyond Year 2, little to no input required in relation to the underground mines, revegetation, and TSF stability, with reduced inputs on lake (and other) water quality;
- Pit stability advice continues at current levels into Year 3, which is assumed to coincide with the period of least stability during rewatering;
- Reduced technical support required during Years 4 to 6;
- Increased support in Year 7, and some in Year 8 in relation to lake water quality prior to the lake's first discharge;
- Minimal advice during Years 9 to 12; and
- Advice from the full suite of advisors in Year 13 to provide final sign off against closure criteria (in practice, sign off on TSF stability and revegetation could, in all probability, be provided earlier than Year 13).

In addition to the above, provision is included for a range of other specialist inputs from Council staff and/or consultants including:

- Updating pit factors of safety;
- Defining pit stability and closure criteria;
- Pit wall prism monitoring interpretation;
- Prism monitoring trend analyses;
- Ground rebound and spring monitoring;
- Pit lake water quality monitoring and reporting;
- Pit lake water quality management handover report preparation;
- Preparation of a maintenance and surveillance monitoring plan for the waste disposal area;
- Undertaking deformation surveys of the waste rock embankments;

[5] With the lapsing of the Martha Exploration Project consents (under the Martha Mining Licence), this role is now redundant, but provision is included for an underground geotechnical specialist.

- An updated dam breach analysis;
- A dam safety review;
- Preparation of an emergency action plan;
- Tailings and piezometric level monitoring;
- Waste disposal area inspections and reports;
- Waste disposal area water monitoring;
- River and stream water quality monitoring; and
- Monitoring of private bore water levels and responses.

Also included is equipment replacement, maintenance, calibration and physical work involved in undertaking the monitoring.

Further detail of the key elements of closure period monitoring follow.

7.1.14.2 General

7.1.14.2.1 Rehabilitation and Closure Plan

The Rehabilitation and Closure Plan is revised annually over the life of the project. Under sudden closure, no further revisions would be required.

7.1.14.2.2 Monitoring of Noise and Vibration

No blast vibration monitoring is assumed during the closure period. Even if some blasting were required, e.g. to form the lake outlet tunnel (currently assumed to be bored) or to remove foundations, the monitoring requirement is expected be minimal.

Similarly some minimal noise monitoring could continue while construction operations were being carried out and only during the day time as work would not be carried out at night.

7.1.14.2.3 Surveying

The costs of surveying at the waste disposal area, settlement monitoring and maintenance of the in-pit robotic maintenance system are provided for.

7.1.14.2.4 Revegetation Inspection

Revegetation of the embankment has to date been well managed, and based on years of experience there should be no issue in terms of revegetating the remaining areas. Nevertheless, the Councils could seek advice on rehabilitation matters. The assumption is that inspections would need to take place during the closure period, but they would be phased out over time.

During the early stage of the closure period (Years 1 to 3), it is expected that the Soil Scientist would carry out an annual inspection and write a report in addition to reviewing the Rehabilitation and Closure Plan and/or providing advice when needed. After Year 3, the bulk of the rehabilitation works would be complete, and inspections should only need to take place every five years until the end of the closure period.

7.1.14.2.5 Environmental Monitoring Equipment

The assumption is that the monitoring equipment held on site at present would be available for immediate use by the Councils, and later the Martha Trust.

7.1.14.2.6 Monitoring Equipment, Maintenance & Consumables

Servicing equipment, repairs, and replacement of consumables are provided for, progressively reducing after Year 3 as water treatment ceases.

7.1.14.3 Martha Mine

7.1.14.3.1 Pit Slope Monitoring

Under sudden closure, it is assumed that a considerable amount of geotechnical work would be required prior to flooding the pit; including updating factors of safety; finalising closure criteria studies; hazard mapping; reviewing, and if appropriate revising, the pit wall monitoring system; groundwater monitoring; crack monitoring etc.

There will be some initial works and set up required. The frequency and intensity of monitoring is expected to reduce with time.

Peer review comment received on last year's bond questioned the adequacy of the pit slope monitoring programme. This has not changed since originally developed in 2009 at which time, it is understood, the programme was considered acceptable to the Councils and the peer reviewer. OceanaGold considers the programme to be current, and for completeness the description of the programme is attached as Appendix A.

7.1.14.3.2 Lake Filling Surface Rebound/Spring Monitoring

Once lake filling commences, it is expected that monitoring would focus on surface rebound and spring monitoring as opposed to dewatering induced settlement. The monitoring involved is expected to include surveying and piezometer monitoring.

The Waihi township survey takes place twice a year and takes two people approximately twenty working days to complete, and requires a professional surveyor to supervise the process and write up the data. The data is then adjusted by Engineering Geology Ltd, and an annual report prepared.

For the rebound monitoring, some rationalisation of the current monitoring programme could be assumed, by reducing the number of survey sequences. The assumption is that the monitoring could be reduced by about one half.

The assumption is that the surveying would take place on a six monthly basis during lake filling and for three years beyond. This is because changes to the rhyolitic tephra, which is sensitive to pore pressure, would occur at the end of lake filling and it is the rhyolitic tephra on which the town is built. An additional three years of surveying beyond the end of lake filling is recommended to cover any lag period that might occur.

7.1.14.3.3 Lake Water Quality – Monitoring and Reporting

Water quality monitoring is assumed throughout the full closure period, with the monitoring intensity reducing once the lake is full and discharging.

7.1.14.4 Waste Disposal Area

7.1.14.4.1 Maintenance/Surveillance

Following central Government's decision not to enact the expected dam safety regulations, it is questionable whether the scope of monitoring and surveillance of the TSFs assumed for previous Plans remains relevant; that scope being based on the expected introduction of new regulations. While a reduction in scope could be justifiable, the decision is to retain the surveillance described and included in previous Plans.

7.1.14.4.2 Water Monitoring

Water monitoring at the waste disposal area during the closure and post closure periods is expected to consist of the following:

- Groundwater quality and water levels,
- Underdrainage water quality and flows,
- Tailings pond water quality,
- Embankment runoff water quality.

Underdrainage from the tailings storage facilities would flow direct to receiving waters via gravity outlets following modifications to the existing seepage system. For TSF2, it is assumed that there would be ten toe drain sumps and one seepage outlet, and for TSF1A, there would be five toe drain sumps and two outlets for seepage. All of these would flow via gravity.

Similarly, the overflow from the rehabilitated tailings ponds would require monitoring, and hand-held pH and conductivity meters would be appropriate for this purpose. Water reporting to the collection ponds is now discharged without treatment provided in-line monitoring indicates appropriate water quality. Further advances in rehabilitation prior to and following sudden closure would result in pond water quality improvements, and the existing monitoring could be continued for a period. Drainage flows would be best monitored in the long term using a bucket and stopwatch. Groundwater levels could be measured if this was deemed necessary.

7.1.14.4.3 Ohinemuri River/Ruahorehore Stream Monitoring

During the closure period, particularly while treated water was being discharged, the assumption is that some of the current, very extensive biological and water quality monitoring would continue, reducing with time.

As a final downstream check during the post closure period, sampling within the Ohinemuri River and Ruahorehore Stream (both upstream and downstream of the site) is assumed to occur twice a year.

7.1.14.5 Underground Mines

The assumption is that some monitoring of private bores would be carried out. This might involve two private bores to the East (e.g. Des Forges bore). The monitoring would take place as the lake level rises and there is a corresponding readjustment in the surrounding groundwater levels. Beyond that time the lake would be a sink with groundwater moving towards the lake.

The assumption is that the bores would be sampled six monthly for a range of cations and anions, pH, EC and iron and manganese.

7.2 Post-Closure

7.2.1 Martha Trust

Provision for the administration and running of the Martha Trust in perpetuity is included. It is assumed that Trustees will draw an honorarium, and will be covered by Trustees liability insurance. Other Trust-specific operating requirements include asset insurance cover, public liability insurance and accounting, legal and consulting services.

7.2.2 Staffing

The Martha Trust will employ one part-time staff member; the Site Management Coordinator, who will be familiar with and managing the site at the time it is handed over to the Trust. This is essentially a continuation of the role as described above in s7.1.6, but need not be the same individual as the Trust will be able to

engage another person should it so choose and as the need arises. However, the position would be permanently retained, reporting to the Trustees.

The Site Management Coordinator will be provided with a vehicle and the tools and equipment required to undertake the routine maintenance and monitoring tasks. Equipment maintenance and consumables, along with a building and its associated operating and maintenance, are provided for.

7.2.3 Environmental Management and Monitoring

The Site Management Coordinator's responsibilities will include routine checking and maintenance tasks associated with the pit lake, its outlet, and the waste disposal area, and engaging and paying others to undertake monitoring or maintenance work where the scope or scale is beyond that of the Site Management Coordinator's responsibilities or capabilities.

Specifically, the role will undertake the:

- Routine maintenance tasks described in s3.2 and s5.2 in perpetuity;
- Management of the continued pit wall monitoring for four years (or 10 years from the time of the initial lake discharge), including the servicing and calibration of equipment, and the coordination of consulting inputs and reporting;
- Maintenance and supply of limestone to the pit lake water treatment plant, and the replacement or refurbishment of plant as required;
- Collection of surface water and groundwater samples, delivery for analysis, the maintenance of a monitoring database and the routine reporting of results to the Councils; and
- Reporting to the Trustees.

8 RESIDUAL RISK

8.1 Background

An assessment of the residual risk associated with the closed site was first undertaken in 1997 (and reported in 1998 in the first Capitalisation Sum report). While some changes were made to that assessment in subsequent years, the first full assessment review was undertaken and reported in the 2015 Capitalisation Sum report. That review was supported by a range of other risk studies, including an updated risk assessment and dam breach analysis for the waste rock embankments (2011) and the first pit wall risk assessment (2014).

The pit wall risk assessment was reviewed and updated in 2016. At the time of preparing this Plan, the updated assessment findings were in draft form, but initial feedback on the draft is that the conclusions are overly conservative. The updated findings, including the noted conservatism, are included in this latest residual risk assessment.

The conditions of consent require assessment of the residual risks for the closed site, i.e. for the post-closure period. Residual risk through the closure period was included for the first time in the 2014 residual risk assessment. Both closure and post-closure residual risks are included in this Plan.

The closure risk assessment is based on the post-closure risk assessment, excluding any risk events that cannot occur during the closure period. It is derived by:

- Taking the post-closure risk assessment and checking it for completeness, incorporating any changes since the previous assessment;
- Identifying which of the events in the risk register could occur during the closure period and which during the post-closure period; and
- Quantifying each risk event appropriate to the period in which it is assumed to occur.

Detail of the risk assessment method is contained in the bond reports. The method is known to the Councils, having been developed in conjunction with them in 1997, is described in the 2015 Capitalisation Sum report, and that description is repeated in this year's version of the Capitalisation Sum report. The full description is not repeated here.

8.2 Findings

An abridged version of the risk register listing the credible and material risk events, and the period during which each risk exists (the exposure period), is summarised in Table 2 overleaf. A full copy of the risk register is provided in Appendix B.

8.2.1 Risk Profile

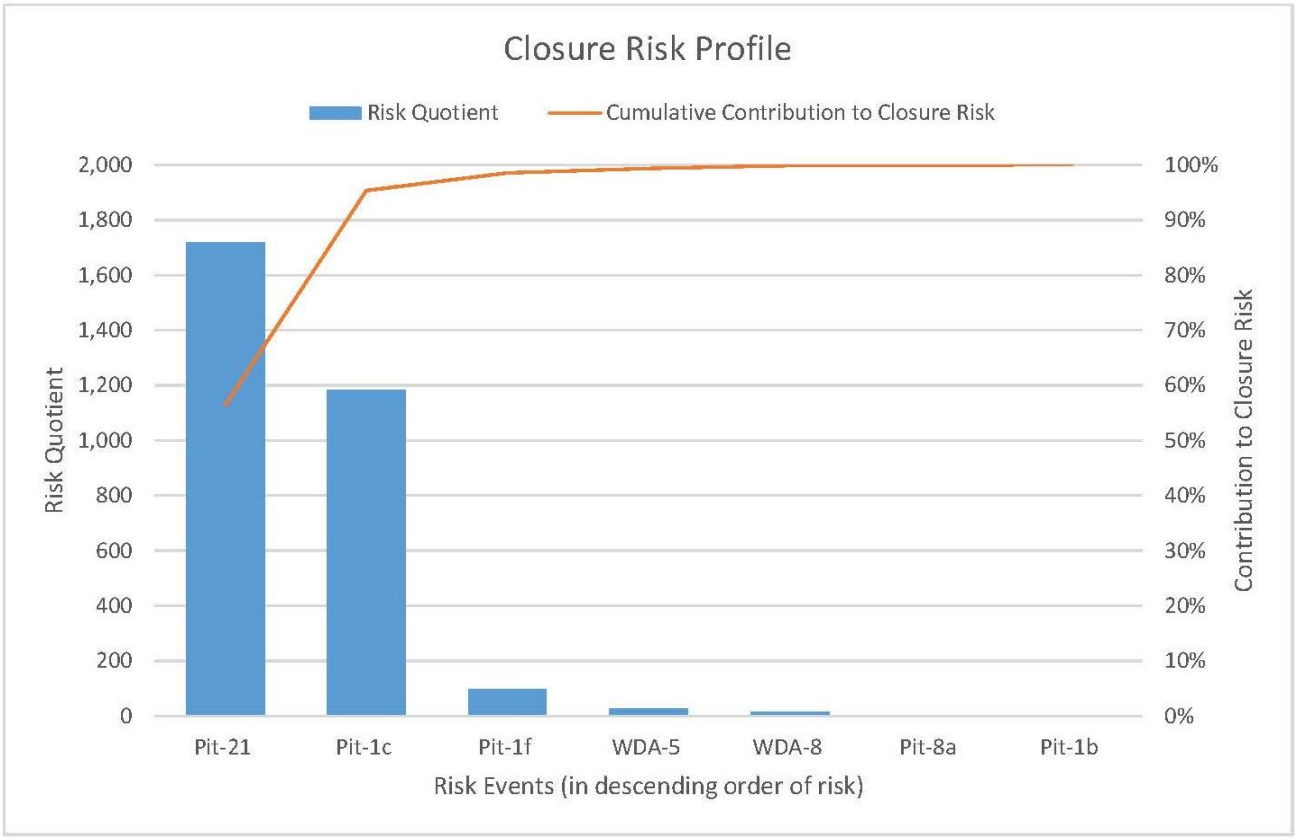
The risk profile ranks all of the analysed risk events in descending order of risk quotient (the product of likelihood and consequence). It provides a clear focus on those events that pose the greatest risk. The risk profiles for both the closure and post-closure periods are shown in Figure 5.

8.2.1.1 Closure Risk Profile

Figure 5 shows that during closure the Pit-21 Hazard zone collapse and Pit-1c Pit wall failure – damage risk events dominate the profile.

Table 2: Risk Register Summary

Risk Event ID	Short Description	Exposure Period		Comment
		Closure	Post-Closure	
Pit-1b	Pit wall failure - safety	✓	✓	Likelihood of a wall failure causing serious injury or loss of life derived from updated pit wall risk assessment.
Pit1-c	Pit wall failure - damage	✓	✓	New risk event. Likelihood and magnitude derived from updated pit wall risk assessment.
Pit-1e	Pit wall failure - floodwave		✓	Seiche analysis confirms that wall failures cannot generate waves capable of overtopping pit rim. Risk only exists once the lake is full and open to the public.
Pit 1f	Pit wall failure prevention	✓	✓	New risk event. Assumed preventative action taken against pending pit wall failure, incurring cost to Councils during closure, or the Martha Trust post-closure.
Pit-7b	Pit lake outlet failure		✓	Risk assumed to be material only once outlet formed and in use.
Pit-8a	Pit lake water quality	✓	✓	Buffering of lake water pH incurs greater cost than assumed in closure estimate.
Pit-21	Hazard zone collapse	✓	✓	
WDA-5	TSF bypass seepage	✓	✓	
WDA-8	Catastrophic tailings release	✓	✓	
WDA-27	Delay in reducing PIC		✓	Only a risk to the Martha Trust, which is assumed to seek a lower potential impact classification (PIC) to reduce embankment surveillance costs.



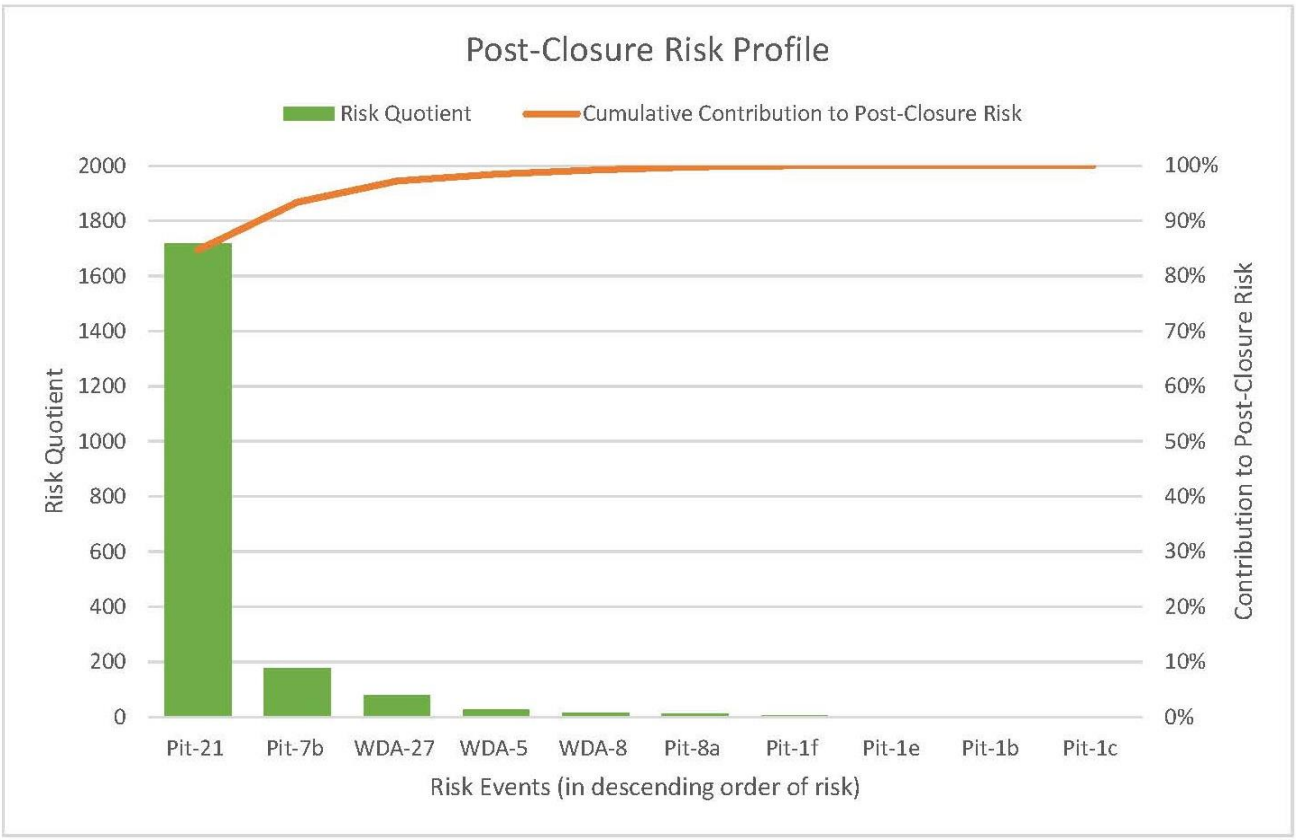


Figure 5: Risk Profiles

The risk quotient provides a quantitative and directly comparable value of the risk each event poses during the closure period. For example, the second-highest ranked risk event (Pit1-c Pit wall failure – damage, risk quotient = 1,200) poses 70% of the closure risk posed by the top-ranked risk event (Pit-21 Hazard zone collapse, risk quotient = 1,700). The third-highest ranked risk event (Pit-1f Pit wall failure prevention) poses a little over 5% of the risk posed by Pit-21.

The risk profile also shows the cumulative contribution of each event to the total closure risk. Pit-21 poses around 55% of the total closure risk, and, with Pit-1c included, the two top-ranked risks represent about 95% of the total closure risk.

8.2.1.2 Post-Closure Risk Profile

The post-closure risk profile is also dominated by the Pit-21 Hazard zone collapse risk event. The event has the same risk quotient as exists through the closure period. However, because the risk posed by the other post-closure risk events is either equal to or less than that during the closure period, the Pit-21 risk event represents 85% of the total post-closure risk.

The total post-closure risk is about two thirds that assessed for the closure period.

The events that pose the same level of risk in the closure and post-closure periods, listed in descending order of risk, are:

- Pit-21 Hazard zone collapse;
- WDA-5 TSF bypass seepage; and
- WDA-8 Catastrophic tailings release.

Events that pose a lower risk in the post-closure period than during the closure period, listed in descending order of risk and their post-closure risk expressed as a percentage of the closure risk (in brackets) are:

- Pit-1f Pit wall failure prevention (4%);
- Pit-1b Pit wall failure – safety (76%); and
- Pit-1c Pit wall failure - damage (effectively 0%).

The risk associated with Pit-8a Pit lake water quality increases in the post-closure period, which is to be expected.

There are also three events that pose a material risk only in the post-closure period. Listed in descending order of risk these are:

- Pit-7b Pit lake outlet failure;
- WDA-27 Delay in reducing PIC; and
- Pit-1e Pit wall failure – floodwave.

APPENDIX A

MARTHA PIT SLOPE MONITORING PROGRAMME

MARTHA OPEN PIT

OPEN PIT MINE CLOSURE: TIMELINE AND ACTIVITIES

INDEX

FIGURES

1.0 INTRODUCTION

1.1 Setting

The essential basis for the various consents and conditions imposed as part of the Licence was that the pit was to be left in a safe and stable condition and was, post closure, to be used as a future recreational facility. However since approval, the various collapses and events related to historic workings, together with the subsequent IGNS Hazard Risk Zoning mean that some of the conditions may need to be re-evaluated and re-assessed. It is the expectation of NWG that the relevant regulatory authorities will seek significant documentation and assurances about the future performance of the Martha Pit during and after closure. This outline has been formulated in that setting.

1.2 Scope

This document has been prepared to outline in general terms the Company's proposed method of closure for the Martha open pit presented at the October 2009 Peer Review Meeting. Open Pit Closure, unlike other aspects of the operation will take considerable time and it is therefore relevant to outline the activities expected to be undertaken during this extended timeframe as well as the collection and use of monitoring information to provide a practical methodology of satisfying the Company's obligations under the License conditions.

The information is provided in the form of a Gantt chart showing the discrete activities together with their interaction, links and timing and a brief description of these individual activities.

1.3 Limitations

This report is specifically aimed at outlining the geotechnical aspects of pit closure with respect to planned activities and timelines. It specifically does not address issues such as pit lake water quality, geochemistry, groundwater effects outside of the pit boundaries and amenity values.

2.0 PIT CLOSURE TIMELINE

Figure 1 shows the project timeline for the Open Pit closure works. For convenience, the schedule is grouped under seven main categories, these are:

- Pit completion activities including removal of pumps and commencement of flooding.

- Pit wall stability monitoring including GEOMOS, ground water effects and integration with Waihi township monitoring.

- Hazard zoning and its potential effects on land use.

- Stability definition, the word “stable” is used in the Mining License and requires definition over the extent of the closure studies.

- Engineering studies including geotechnical calculations, and risk assessments.

- Pit wall physical rehabilitation works including works around the pit perimeter and rim.

- Milestones as set out in the Mining License / Land use Consents.

When developing the timeline, it is assumed that pit operations effectively cease in mid Year2 with the last ore being mined and transported to the Mill for processing. The pit walls and excavation are then assessed for a further 1 year until completion of milling operations (milling operations require open pit water for the circuit) and the pumps are then switched off and removed mid Year3. Pit flooding is then estimated to take 7 years to fill 32M cubic metres to 1104mRL. Pit flooding is completed mid Year10. Monitoring will then continue for at least one to two years to check compliance with the conditions and criteria developed.

Activities are sequenced to fit in with these occurrences. Monitoring frequency decreases with time, physical works to the pit walls can be conducted over the full 10 years of the project, and engineering studies are focused at the front end of the project with confirmations at the tail end of the project incorporating and calibrating monitoring data.

3.0 FINALISATION OF PIT OPERATIONS

3.1 Pit Wall Assessment

During the period following completion of the mining operations and completion of milling, pit wall assessment will be undertaken and may involve:

- Mapping of major structures (using Sirojoint or similar).

- Intersection of underground stopes / openings.

- Wall prism monitoring.

- Planning for remedial works.

- Geotechnical drilling and testing.
- Installation of instrumentation.
- Updating the geotechnical model.

3.2 Remove Pumps from No 7 Shaft

Pit dewatering is currently conducted by three Flygt submersible pumps located in the historic No 7 shaft on the North wall. Pumping rates are currently around 4,000 cubic metres per day. However, the capacity of the system is up to 12,000 cubic metres per day. The water level is maintained at around 890mRL and has been kept at that level since August 2006.

These pumps will be decommissioned and removed from the No 7 shaft after Open Pit Peer Review sign off for “Open Pit Mining Completion” is received.

3.3 Pit Flooding

It is assumed that the existing mine dewatering pumps would be used to pump water from the Ohinemuri River to fill the pit lake, although in practice various options for pumping and pipe work will be investigated. Pit flooding is estimated to take 6 to 7 years based on natural inflows, water take from the River and engineering constraints on the rate of rise of the water table.

3.4 Timing of Activities

The following is a summary of the activities and approximate start / duration activities outlined in this section of the report:

Task Name	Start	Duration
Pit Completion	Mid Yr2	
Pit Wall Assessment	Mid Yr2	1 Year
Remove Pumps from No7 shaft	Mid Yr3	3 months
Pit Flooding	Mid Yr3	6-7 years

4.0 PIT WALL STABILITY MONITORING

As the pit enters its final phases of open pit mining, with subsequent flooding, rehabilitation and eventual closure there will need to be a change in the pit wall monitoring philosophy. The change will be away from intensive

monitoring of the walls to ensure the safety of operational personnel working below or on top of the pit walls towards an approach that addresses long term stability considerations.

4.1 Pit Wall Monitoring

The slope monitoring system for the Martha pit continues to be based upon surveying of prisms distributed across the various walls using robotic electronic surveying units (Total Stations). Total Stations are located in base stations on the crest of the north and south walls. In addition, surveying of the lower sections of the pit walls that are not visible from the robotic base stations are being performed by automatic monitoring from a third robotic unit.

A horizontal spacing of approximately 50 m horizontally is being used for the prisms, which were being installed on every catch bench (20 m vertical separation). This equates to the normal industry practice for prism distribution.

4.1.1 Monitoring System

The GEOMOS robotic survey monitoring system is considered to be appropriate for the current mining conditions, pit flooding and final closure and post closure monitoring. A station on the north wall and a station on the south wall is considered appropriate, these stations should be located such that they:

a) are central within the wall to minimize distance to target,

b) are sited for accurate free station measurements,

c) are in a location were public access can be excluded.

The Total Station units will require periodic calibration and maintenance. In addition, there will be a requirement to store and analyze the data from the system.

4.1.2 Repeatability of measurements

As the pit progresses from operations to closure, fewer monitoring points than the current 160 prisms are likely to be required. Based upon current performance it is likely that twelve long term monitoring points will suffice after the pit has been flooded. These long term monitoring points will need to be:

a) above the proposed lake level,

b) are in a location where public access can be excluded.

c) formed on a rigid permanent base (not warratah), with prisms able to be easily replaced (screwed mounting plate),

d) easily accessed for cleaning and replacement of prisms.

Ten plinths and posts similar to those used for instrument bases have been installed around the pit perimeter at 1120m RL access road and these are permanent long term monitoring stations.

4.1.3 Changes in frequency of measurements

The GEOMOS system offers the potential ability to monitor continuously pit walls. However, it is currently set for readings at daybreak and in the evening, i.e. twice daily. It is probable that, as pit operations wind down and pit flooding commences, this frequency will be reduced to weekly monitoring, unless unexpected instability occurs. Following completion of pit flooding, slope monitoring would then probably reduce over time to monthly, quarterly and annual monitoring provided there is little evidence of instability.

At each stage in the mining and closure process trigger levels will be set up to increase or reduce monitoring frequency based on the monitoring data.

4.1.4 Storage and handling of information with the change of personnel

A long term monitoring plan must recognize that changes in personnel will occur over time. The GEOMOS system is a proprietary system maintained by Leica and the data is stored in a proprietary database. As the pit passes through rehabilitation and closure it is highly likely that Newmont will contract out maintenance of the GEOMOS system to local contractors / surveyors / consultants. Data would be compared against the pre-agreed trigger limits and if unexpected trends were occurring, consultants would be called in as necessary to interpret the data and respond appropriately.

Fields in the GEOMOS database are available to record any comments or changes to the prisms such as relocation, damage to the plinths, persons conducting monitoring, etc. Full use of these note fields by the maintenance contractor will ensure integrity of data for adjustments during manipulation of data.

4.1.5 Identification of trends

Operational slope monitoring has identified different movement trends over different sectors of the wall. During the transition period from operational monitoring prisms to long term closure monitoring prisms there will be a need to calibrate the movements seen over sectors of the wall to ensure that the long term monitors truly reflect the movement sense seen in the walls.

Consideration needs also to be given as to whether the monitoring can be subdivided into underground subsidence monitoring and pit wall monitoring with the proposed number of prisms.

The data set generated by the long term closure monitoring will be much smaller than that generated by the operational monitoring. However the emphasis will be very much on quality of data rather than quantity so as to provide an indication of movement trends when filtered for such effects as local instability and/or movement associated with the underground workings.

4.2 Pit Wall Monitoring Extended Coverage

The detailed survey program proposed by HDC based on the recommendation from GNS has the potential to provide a broader geographic coverage of the ground movements in the main areas of interest outside the pit. A possible limitation with this survey is that the level of accuracy required to generate quality results will mean that the surveys will be relatively infrequent, e.g. twice a year.

To complement the HDC survey program, it is proposed to establish prisms on a number of HDC's survey stations at locations that can be "seen" from the existing GEOMOS fixed station(s). These points will then be surveyed automatically and frequently. Using the common survey point data, the GEOMOS results can be merged with those produced by HDC's survey program.

The following matters will need to be agreed between NWG and HDC through the closure phase;

- The location of appropriate joint survey stations
- Who is responsible for setting up the prisms on the agreed stations
- How (and who is) best to maintain the survey database(s)

4.3 Relocation of P16 Monitoring Station

When the Southern Stability Cutback was commenced in late 2006, the GEOMOS southern monitoring station was relocated to the south west corner of the pit away from operations. It will be desirable and practical for long term monitoring if the station can be relocated central within the south wall to improve accuracy of measurements due to shorter distances and the fact that many of the existing prisms are orientated towards the old location.

The current location of the total station on the north wall is suitable; however the south wall location should be moved approximately 200m to the east, with a new free station point within Waihi town.

4.4 Monitoring Ground Water Rebound

As noted previously the water level in the pit has been held constant since mid 2006 (4years) while the cutback has been mined. Upon completion of mining there would be a need to continue monitoring for dewatering induced settlement. This is not expected to be a problem however because the water level is held at a constant level rather than drawing it down further. Once lake filling commenced, it is expected that monitoring would focus on surface rebound and spring monitoring. The bi-annual settlement survey would identify surface rebound and pit wall inspections would identify springs. The monitoring involved is expected to include surveying and piezometer monitoring.

Ground water rebound is expected to be at its greatest rate as the water level passes through the softer sediments in the east wall.

4.5 Seddon Street Monitoring

Crack monitoring of Seddon Street has been undertaken by NWG since January 2008 on a quarterly interval. Eleven monitoring locations are installed. The crack monitoring in Seddon Street has previously indicated zones with different movement rates. It is important that this monitoring is continued through the closure period.

The Company installed an inclinometer between the cracks in Seddon Street and the open pit with the objective to monitoring the block movement. Installation of the inclinometer was completed in December 2007. The geotechnical drilling intersected a shear, precisely on a line projected between the surface cracking in Seddon Street and historic records of the location of the Royal Stope. It is important that this monitoring of this inclinometer is continued through the closure period.

4.6 HDC / GNS Annual Monitoring

4.6.1 Scope of Monitoring

A key recommendation of the 2008 GNS “Waihi Subsidence Assessment” report is the establishment of accurate lateral and vertical monitoring in areas of Waihi near the pit. GNS state,

> "*It will assist with better understanding the ground deformations associated with subsidence of the old underground mine workings and movements outside the mine close to the southern highwall*".

The monitoring system comprises regularly spaced metal pins along lines extending out from and around the cut-back southern, and the eastern pit rim, and adjacent to the underground mine stopes. Survey monitoring was not recommended beyond the northern and western walls of the open pit where pit wall monitoring by NWG showed there are no significant movements.

Other recommendations were:

- accurate survey monitoring along a series of points, initially established along road kerb lines to allow easy access for regular re-surveying;
- including in the new survey lines as many as possible of the points that are used for the six monthly settlement monitoring surveys in Waihi;
- installed without undue delay

The initial baseline survey was completed in late 2009 and comprises precise levelling for vertical monitoring in combination with an RTK GPS survey for lateral movement monitoring, along lines of points.

4.6.2 Survey Grids

The mine surveying which is performed on a local metric grid will need to be tied in to the NZTM2000 grid which is being employed by HDC for the Township monitoring to allow integration of the two data sets.

4.7 Timing of Activities

The following is a summary of the activities and approximate start / duration for this section of the report:

Task Name	Start	Duration
Pit Wall Monitoring Daily	Yr1	4 Years
Pit Wall Monitoring Monthly	Yr5	4 Years
Pit Wall Monitoring Quarterly	Yr9	3 Years
Extended Monitoring Coverage	Yr1	1 Year
Relocate P16	Yr2	3Months

Monitor Ground water rebound	Yr3	7 Years
Seddon Street Pin Monitoring	Yr1	11 Years
HDC / GNS Annual Monitoring	Yr1	11 years

5.0 HAZARD ZONING

5.1 Hazard Zone Assessment & Land Use

A Technical Working Party was established in 1999 following the collapse near Seddon Street to investigate the abandoned underground workings and the causes for the collapse. Following the further Barry Road Collapse in 2001 a report was prepared by IGNS to assess the causes of the collapses, assess the risk of future collapse and to investigate mitigation measures.

The IGNS Report was focussed principally on the formation of sinkhole collapses. The IGNS Report was also largely focussed on public areas outside the open pit. The Report defined a series of hazard zones mainly outside the open pit. This report was updated in 2008 and extended the Hazard Zones.

It is understood Hauraki District Council (HDC) have adopted the IGNS Hazard Plans as part of their district plan zoning.

It is understood the concept HDC is working towards is a Master Landscape and Land Use Plan which incorporates the IGNS Hazard Zones and any appropriate Buffer Zones relevant to potential instability surrounding and adjacent to the open pit. It is understood the Final Land Use Planning may prohibit occupied buildings and amenities within some of the Hazard Zones. Elsewhere access, walkways and tracks are planned provided the risk levels can be shown to be commensurate with general experience.

The items under consideration at this stage for the rehabilitated area are understood to include:

a) Areas with controlled and uncontrolled access. Areas with public access will include defined walkways, which may be in the form of “deformable boardwalks”.

b) Public access areas; including picnic areas and viewing platforms. Lake access; including a launching ramp, safe play zone, parking areas and amenity blocks.

c) A lake outlet structure.

In keeping with the historic and cultural significance of mining at Waihi, NWG plan to implement pit tours using in part the northern haul road and these will be ongoing after Pit Closure up to completion of pit flooding. NWG will need to seek advice about relevant safety aspects of this.

By way of comparison it is noted that tourism and public access is allowed and encouraged in other areas of New Zealand with significant geological hazards and guidance for planning may be available from these other areas, for example Rotorua.

5.2 Hazard Zone Assessment & Land Use Final Plan

Hazard Zones may be finalised upon completion of the pit flooding and rehabilitation works to also encompass public access to the recreational lake including places where people will gather such as boat ramps and park areas.

5.3 Timing of Activities

The following is a summary of the activities and approximate start / duration for this section of the report:

Task Name	Start	Duration
Hazard Zone Assessment / Land Use	Yr4	6 Years
Hazard Zone Assessment / Land Use Final plan	Yr10	Milestone

6.0 STABILITY DEFINITIONS

6.1 Stability Definition Preliminary

The varied Mining Licence and resource consents for the Extended Pit at Waihi were granted in 1998/9. At the time, it was intended that the pit would be left in a safe and stable condition and, post closure, would be used as a recreational facility. Mining Licence and consent conditions imposed at the time were based on the understanding of the planned open pit and the historic underground mining. Since that time there has been a great deal more information gathered about the open pit and the historic underground mining.

The conditions imposed for the Extended Pit were appropriate at the time; for example the north and west walls which are outside the cave affected zone is performing to design and is stable. In the future however, it is possible that it may be difficult to achieve the traditional definition of “stable” in areas where pit walls are located around and above the historic underground workings in

the cave affected zones. Continued movement is possible, just as it is in the identified GNS Hazard Risk Zones that surround the pit.

For this reason, the Company may consider a different approach for the preliminary definition of stability for use in setting its post closure targets. The approach is to move away from the term “stable” in its tradition sense, and to implement a risk-based approach that will ensure that the intent of the original conditions continues to be met, i.e. a safe and sustainable recreational facility is created for the benefit of the Waihi community.

The initial concept could be to use both narrative and quantitative criteria, viz:

6.1.1 Narrative Criteria

To ensure that the Mine Lake and its surrounds provide a safe and sustainable recreational facility for the benefit of the Waihi community.

6.1.2 Quantitative Criteria

a) A combination of design criteria depending on underground impact.

b) Risk of future subsidence collapse.

c) The understanding from geomorphology that if ongoing long term movement of the slopes will occur then the end result is a limiting slope angle as defined by the angle of repose.

d) Slopes not adversely affected by underground mining nor subject to major ongoing movement due to the underground mining to have a minimum FOS’s under static and seismic conditions.

e) Controlled access in areas with a significant risk of subsidence collapse and major deformation risk.

f) Slopes affected by ongoing significant movement due to underground mining to have a limiting maximum overall slope angle.

6.2 Stability Definition Calibration

The identification of long term trends in pit wall behaviour is required to demonstrate the long term stability of the pit walls and the response of the pit walls to events such as flooding and the presence of historic underground workings. Identification of trends will permit a closure criterion to be better defined and the Preliminary Stability Definition to be adjusted, refined to better meet the site specific conditions.

The definition should also include other forms of monitoring such as ground water settlement and township survey and will be subject to a peer review process.

6.3 Stability Definition Finalisation

Upon completion of pit-lake filling once stable conditions have been reached, the stability definition can be finalized using all available data and the Peer Review process. If the calibration process is diligently followed up to this time it is unlikely that any major revisions will be required to the definition.

6.4 Timing of Activities

The following is a summary of the activities and approximate start / duration for this section of the report:

Task Name	Start	Duration
Stability Preliminary Definition	Yr2	1 Year
Stability Definition Calibration	Yr4	9 Years
Stability Definition Finalisation	Yr 10	Milestone

7.0 ENGINEERING STUDIES

7.1 Update FOS Final Walls

A recalculation of the FOS for the pit walls in the same manner to 1999 for the final planned pit depth, but with any new slope geometry, water table conditions, and rock mass properties is appropriate. Also include recalculation of FOS for the pit at the completion of flooding and under seismic effects.

The study will also identify specific areas that the critical pool level may initiate instability during flooding. Critical pool level is a level at which, sometimes, during lake or reservoir filling, where because of local geology and geotechnical conditions the FOS of the wall may temporarily reduce.

7.2 Landslide Induced Wave Effects

Studies will be undertaken to re-examine the potential for displacement of water by instability or slumping, including the impact of seismic events. There have been two factors that have changed significantly since the licence hearings for the Extended Pit. The first is the impact of the underground workings, which have resulted in the ongoing global movements and this has increased the potential for pit wall instability to be generated over time. The second element is the results of more recent research into landslide and submarine landslide induced waves and the prediction of their impacts. These elements have allowed refinement of the evidence presented for the Extended Pit in this technical area.

An assessment is to be carried out of the potential water waves that could be created by a slope failure after pit closure. The impacts are only considered relevant once water is allowed to pond within the pit, i.e. allowing creation of a wave. Models will assess the wave height for various water levels within the pit, run-up height of the wave, consequence and likelihood of damage.

7.3 Identify Areas Prone to Softening

Studies will be continued to identify areas of the walls prone to softening. In addition the studies will target identifying any areas prone to softening during flooding that may initiate instability and where remedial treatment may be practically implemented. This will focus on two main areas, viz:

a) The two main geological units potentially subject to softening during pit flooding are the lower beds of the Ignimbrite Zone and the materials in the east wall.

b) Because of the likelihood of continued wall movement in the medium to long term, the strength of the materials forming the southern and eastern pit walls will be subject to some strength reduction over time.

On completion of flooding there will be a stable environment below the water surface and experience has shown this will be beneficial. However this is balanced by the fact that as movement continues the materials will have “free access to water” and it would be reasonable to assume that this will aid some softening and strength reduction. Hence in the east, south and southeast areas of the pit there is not a static situation post closure. This is different to the global support which the lake will provide to the pit walls.

7.4 Investigate Pit Remedial Works

Remedial treatment of the underground workings exposed in the pit walls would be local only and unlikely to significantly impact on future large scale pit wall performance.

Local remedial treatment of the 1962 and 1999 collapses may be required where they intersect the Cutback Pit.

There is a section of lake sediments in the Ignimbrite Zone in the upper north east pit above the haul road. This area may require some local flattening.

7.5 Define Areas to be made Inaccessible to Public

Based on the findings from engineering analysis, monitoring and risk assessments, areas of the pit may be made inaccessible to the public based on a predefined set of criteria. In effect isolating or eliminating the hazard. Areas that could fit in this category are steeper sections of the north wall above lake level, high hazard zones on the “Milking Cow” collapse and areas adjacent to the lake outlet structure.

7.6 Risk Assessments

GNS in their report "Waihi Subsidence Assessment" report that risk assessment evaluations suggest that vehicle, cycle and pedestrian access is acceptable on roads or tracks established through high sink-hole hazard areas. The Company has established public walkways as part of its ongoing rehabilitation efforts across these high hazard zones.

The Company proposes risk assessments to be carried out at the following time intervals:

- Immediately after cessation of operations
- Upon commencement of lake filling
- 2 – 3 years after lake filling
- Upon completion of lake filling

Risk assessments will involve panels of geotechnical experts, both internal and external, risk engineers, landscape planners, regulators and a facilitator.

7.7 Timing of Activities

The following is a summary of the activities and approximate start / duration for this section of the report:

Task Name	Start	Duration
Update FOS final walls	Yr1	1 Year
Water displacement slumping earthquake Tsunami	Yr1	1 Year
Remedial work to historic workings	Yr1	1 Year
Identify areas prone to softening	Yr1	3 Year
Investigate pit remedial work	Yr1	1 Year
Define areas to be made inaccessible to public	Yr5	2 Year
Risk assessment Yr2	Yr2	1Mo
Risk assessment Yr3	Yr3	1Mo
Risk assessment Yr5	Yr5	1Mo
Risk assessment Yr8	Yr8	1Mo

8.0 PIT WALL REHABILITATION PHYSICALS

8.1 Remove Ignimbrite to East Wall Buttress

Given the recent failure of the East Wall, it could be expected that some final stabilization works would be required. Based on current understanding, the most practical and cost effective method would involve excavating and trucking some of the surface material adjacent to the jaw crusher and placing the material to increase the size of the current buttress at the base of the blue shear. It is also likely ignimbrite will be dozed down the face to provide some armouring to the readily eroded materials (tuff, alluvium). Very preliminary designs have been prepared to date (Figure 2).

8.2 Fill Crusher Slot

The assumption is that there may be some PAF material remaining that could be pushed into the crusher slot where it would sit below water level. The crusher slot has a void volume of 61,500 BCM. Upon completion of lake filling, it is expected that the lower 7m of the crusher slot area would be below the level of the water table. For this reason, it would be appropriate to push the PAF material into the base of the crusher slot. Concrete on both sides of the reinforced earth walls would be left in place.

In terms of any remaining foundations, these could be left in situ due to their historical interest as opposed to being completely demolished. In addition, much of the cost associated with demolition is associated with transportation of the demolition materials. It is possible however that some demolition materials e.g. concrete could be disposed of on site e.g. in the crusher slot and this would minimise transportation costs.

8.3 Remove Stockpiles to Pit Base

Much of the previously large ignimbrite stockpile located in the Surface Facilities Area has now been removed and it now has a volume of around 20,000 cubic metres. The assumption is that some of this material would be used for landscaping purposes and the remainder of this material would be removed and placed in the base of the open pit for stabilization of the lowest walls and any “sinking cuts”.

8.4 Rip Rap Maintenance and Revegetation

Some areas of the 1104 berm have lost the rip rap protection previously placed. Where access is available or can be made available these areas will be upgraded or reinstated. Rip rap protection will also be placed on the existing north wall ramp and in areas affected by rehabilitation earthworks and at the lake outlet works.

Pit slopes above rip rap level will be re-vegetated where possible. Some regarding will be required for storm water management or for public access. This can be undertakes at any stage through the closure and rehabilitation.

8.5 Lake Outlet Works

On the basis of technical work carried out for the Extended Project, it was determined that the lake level should be set at RL1104 (mine datum). The level was set relative to the adjacent Mangatoetoe Stream, and historic mine workings at the western end of the pit were taken into account. In this regard the lowest known potential exit point was described as the former warm spring which flowed from an adit at RL 1106 (mine datum).

In cutting back the west wall for the Extended Project, old workings were discovered that would require further investigation prior to driving the lake outlet tunnel. In addition, capping of Grand Junction B shaft which is located in the vicinity of the lake outlet will be required.

8.6 Remedial Works to Slopes, Shafts and Old Workings

Remedial treatment of the underground workings exposed in the pit walls would be local only and unlikely to significantly impact on future large scale pit wall performance

Local remedial treatment of the 1962 and 1999 collapses may be required where they intersect the Cutback Pit.

There is a section of lake sediments in the Ignimbrite Zone in the upper north east pit above the haul road. This area may require local flattening due to the superficial slips.

8.7 Demobilise Plant Contractors Machinery

Fixed plant such as the crushers, conveyors and workshop are all easily removed as they are in modular units.

Demobilisation of the contractor's large machinery (190tonne diggers and 85t trucks) should only be undertaken once all the remedial work to the slopes, east wall and stockpiles has been completed. This work should to be planned prior to the end of Year 3. Minor earthworks can be completed with locally available equipment (40tonne diggers and 40t trucks) through the full rehabilitation and closure phases.

8.8 Timing of Activities

The following is a summary of the activities and approximate start / duration for this section of the report:

Task Name	Start	Duration
Remove Ignimbrite to East wall Buttress	Yr2	1 Year
Fill Crusher Slot	Yr2	1 Year
Remove Stockpiles to Pit Base	Yr2	1 Year
Rip Rap maintenance / re-vegetation	Yr9	1 Year
Remedial works to slopes / old workings	Yr2	1 Year
Demobilise Contractors Machinery	Yr2	1 Year

9.0 MILESTONES

HDC Resource Consent #97/98-105 Condition 3.19; Pit Construction (i) requires that; *the Peer Review Panel shall report in writing on the following times:*

- *Prior to commencing the extension related mining activities associated with the open pit;*
- *At all critical stages during development of the open pit e.g. initial work on forming the pit perimeter*
- *On completion of open pit mining;*
- *On completion of lake filling.*

And at least on the following matters:

- *pit slope stability monitoring*
- *rehabilitation and closure plans*

The milestones for regulatory approval included in this schedule are:

a) on completion of open pit mining and prior to pit flooding

b) on completion of pit flooding

c) on completion of Rehab of Area A

LIST OF SOME TECHNICAL TERMS USED IN THIS REPORT

TERM	DESCRIPTION
Acceptable Movement rate	A movement rate (from previous practical experience) below which walls have been shown to be operationally stable over a period in excess of five years~ 80mm/year.
Altered	Changes to andesite rock caused by hot mineral rich waters circulating in the rock (similar to that seen at Rotorua's Whakarewarewa). Rock can be softened to clay or hardened with silica.
Andesite	A common rock occurring as a surface deposit created from lava flows from volcanoes.
Batters	The slope of the faces cut in the pit.
Berm	A level area left on the slope to catch small rocks and sometimes provide man access
Buttress	Rock fill placed at the toe of an unstable slope to increase its factor of safety.
Carbonaceous shear	A shear on the north wall that is clay filled bounded by competent rock. Includes several coal like structures.
Chimney cave	Or sinkhole, collapse of rock into a stope that travels up to the surface. Normally vertical or close to vertical.
Extensometer	An extensometer is a device used to measure small/big changes in the length of an object. It is useful for stress-strain measurements. Its name comes from "extension-meter". Wires are anchored in a borehole and changes in length measured.
Fault	A fracture zone in the rock along which movement has taken place.
Feldspar	A common rock forming mineral
FOS	The stability of a slope is usually defined in terms of the relationship between those stresses acting to disturb the material (usually gravitational forces) and cause it to move and those factors tending to resist the driving stresses. This relationship is usually represented as the Factor of Safety (FOS), which is expressed as the ratio between shear strength and shear stresses.
Ignimbrite	Created when superheated gases and rock fragments flow rapidly from a volcano. At Martha two distinct types the welded ignimbrite (which is fine grained, welded together, blocky) and sandy ignimbrite (which is coarser grained and a loose unconsolidated material).
Ignimbrite Zone	A zone that lies on the east wall above andesite

	comprising ignimbrite, tuffs and alluvium.
Inclinometer	An inclinometer is an instrument for measuring angles of slope or tilt or inclination of an object with respect to gravity. It is lowered down a drill hole and measurements taken every half a meter.
Inter ramp angle	The slope of the pit from the haul road up to the crest of the pit. Includes batters and berms.
Monitoring	The systematic measurement and tracking of the changes in the shape or position of the pit wall slopes.
Piezometer	A piezometer is a small diameter observation well used to measure the hydraulic head of groundwater in aquifers.
RL	Reduced Level. At Martha sea level is set at 1000 metres RL and pit levels are derived from this. i.e. 930 RL is 70metres below sea level.
Robotic Theodolite	An automatic survey instrument that measures angles and distances.
Shear	A Fault in which movement has occurred along closely spaced planes often leaving a polished clay surface.
Sinking Cut	Final goodbye cut in the open pit by mining out the floor and last part of the pit access ramp.
Stope	Excavation in an underground mine from which ore is extracted to leave a void.
Stope Fill	Soil or rock material used to backfill the hole left by a Stope.
Tuff	Created from the fall of ash from a volcanic eruption –at Martha it is like beach sand.

Figure 1 OPEN PIT CLOSURE TIMELINE

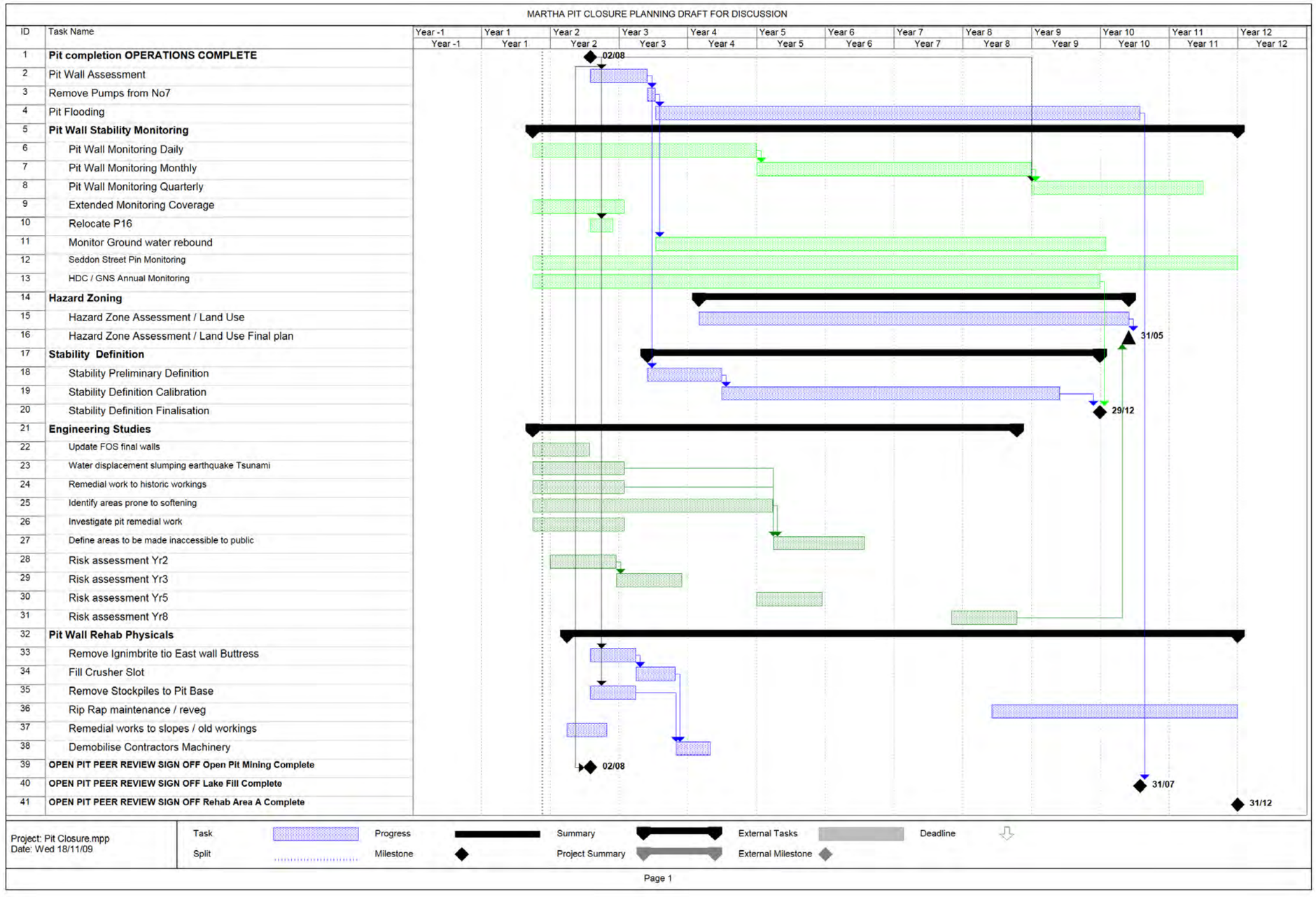
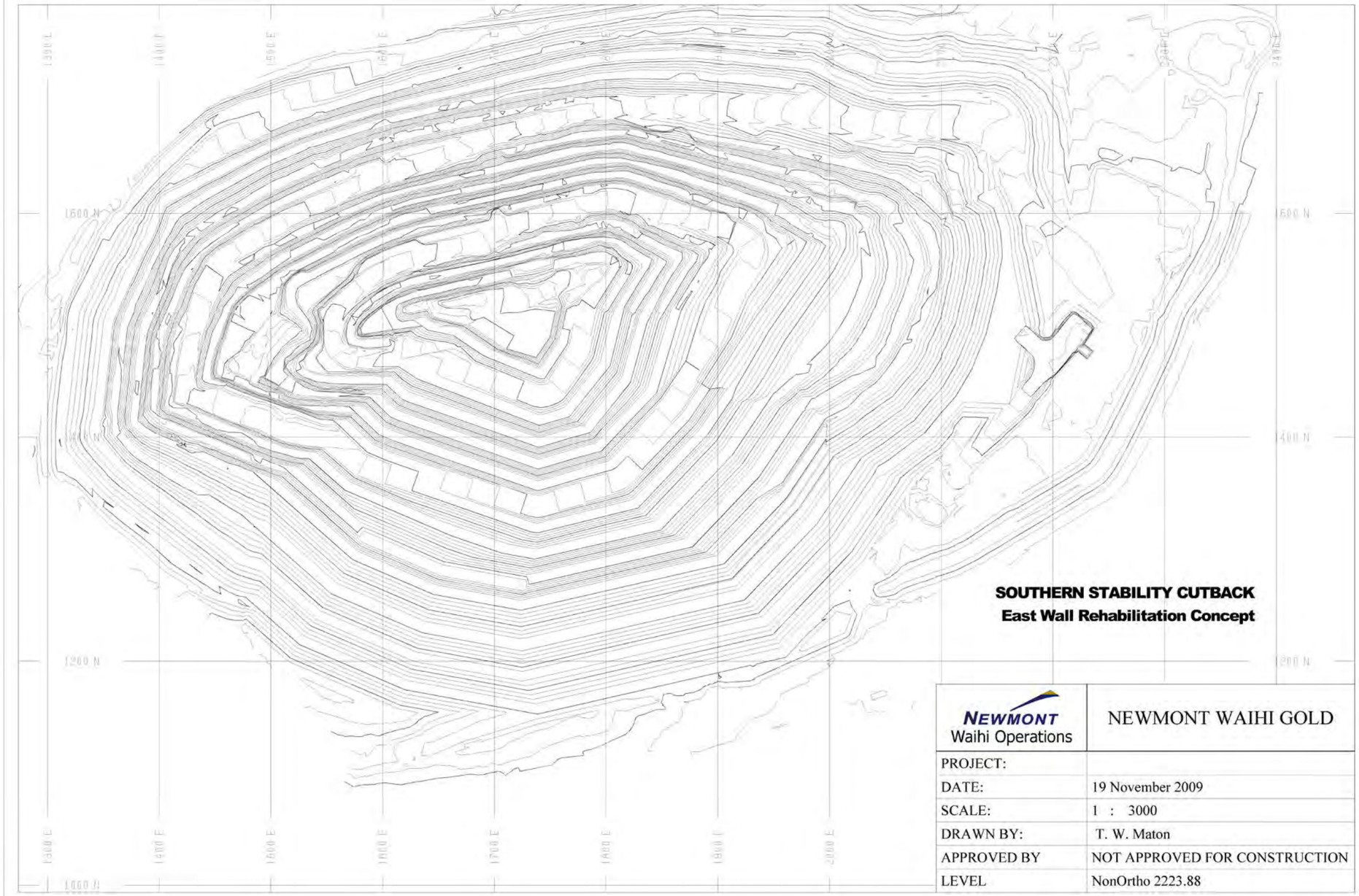


Figure 2 EAST WALL REHABILITATION CONCEPT



APPENDIX B

RESIDUAL RISK REGISTER

OCEANA GOLD NEW ZEALAND LIMITED - CLOSURE AND POST-CLOSURE RISK ASSESSMENT

Risk Register

Created: 20 December 2013 — Captured all risks from 1997 assessment.

Latest update: 20 July 2016 — Updated based on post-closure risk workshop outputs and latest pit wall risk assessment.

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
PIT							
1.1	Pit-1a	Failure of wall near pumphouse	Damage to Cornish pumphouse. Capital/clean up cost $1.5-3M. Relocation would represent worst-case, at cost of $3M Plus establish two additional monitoring benchmarks $2-5k. Annual O&M costs $2-4k p.a.			Post-Closure	Since this risk was originally identified, the pumphouse has been moved from pit rim, which mitigates the risk that is now considered immaterial. The risk was identified and quantified in the original 1998 risk assessment, so this is a change from the inputs to the initial Capitalisation Sum derivation.
1.2	Pit-1b	Pit wall failure - safety	Serious injury or loss of life	9.7E-02	7.4E-02	Closure & Post-Closure	The fatality risk associated with a pit wall failure is shown to be acceptable, so could be considered to be immaterial and excluded on that basis. In any event the Martha Trust would not incur direct costs relating to a serious injury or fatality, e.g. the societal cost of a fatality, typically referred to as the value of statistical life. NZ's Accident Compensation Act ensures that the Trust is most unlikely to be directly liable, and the Trust's operating costs include the payment of premiums for public liability insurance in perpetuity. A wall failure resulting in injury could however result in an enquiry into the ongoing safety risk in order to prevent a recurrence. For the Trust, the cost would be limited to that associated with engaging professional advice (legal, engineering etc.). Physical remedial works are covered in Pit-1c.
1.3	Pit-1c	Pit wall failure - damage	Damage to property	1,184	0	Closure & Post-Closure	Pit wall failure and risk has been assessed in a separate study (Lane, 2016), the results from which are used as inputs. The model provides for costs associated with any magnitude failure, but assumes dependence between moderate, large and major failures on each wall. Only one (the one with the largest risk quotient), is assumed to occur during each model simulation (2,000 simulations run). While there is some relationship between Pit-1b and Pit1-c, the likelihood associated with Pit-1b is many magnitudes less than that of Pit-1c, that any dependence can reasonably be, and is, ignored. Damage to the existing power lines was considered, and is assumed to be covered in the fixed component of the occurrence cost. In practice, these will be removed as part of the closure works and there would be no consequence.
1.4	Pit-1d	Pit wall failure - buffer area				Post-Closure	Pit wall failure and risk has been assessed in a separate study (Lane, 2016), the results from which are used as inputs. Failure affecting the buffer zone around the pit perimeter is included in Pit-1c.
	Pit-1e	Pit wall failure - floodwave	Serious injury or loss of life caused by a floodwave generated by a large and rapid wall failure into the lake, and damage to property should the wave overtop the pit perimeter.	0.0E+00	3.2E-01	Post-Closure	This risk was first identified in the 2014 risk assessment review. Seiche magnitude and risk has been assessed in separate studies (PSM and Lane, 2014, respectively), the results from which are used as inputs. The current closure plan limits the areas near lake level to the launching ramp and swimming pontoons. The PSM study shows that wave heights are insufficient to overtop the pit rim at any other location. There remains a fatality risk for anyone present at either of these sites at the time of the seiche, however that risk is significantly less than analysed for a potential east end park, which has been shown to be negligible. As described for event Pit-1b, the Trust would not be liable for any related societal cost sand the Trust's operating costs include the payment of premiums for public liability insurance in perpetuity. Because a seiche is generated by a wall failure, and the enquiry-related costs are already included for a fatal wall failure in risk event Pit-1b, no similar cost need inclusion as an occurrence cost for the seiche risk. It is however likely that a large wave would damage both the launching ramp and swimming pontoons. The occurrence cost to repair that damage is assumed to be 50-100% of the initial construction costs.
	Pit-1f	Pit wall failure prevention	Cost to implement prevention actions	97	4	Closure & Post-Closure	This is a new risk identified during the 2016 pit wall risk assessment/review. It provides input to the risk cost to the rehabilitation bond, agreed to by OGC during the 2015 peer review meeting, and to the risk cost for the capitalisation sum. The prevention cost is based on unloading of approx 10% of the top of the wall, but only applies to large and major failures as it is not cost-effective for smaller failures..
2.1	Pit-2a	Dust	Non-compliance with consent limits			Post-Closure	This risk only exists during operations, and potentially at some reduced level during the closure period. It was excluded as it is not a post-closure issue.
2.2	Pit-2b	Contaminated soil	Cost of remediation			Post-Closure	This issue was excluded on the assumption that any contaminated areas would be identified and excavated, the excavated material being disposed of to the tailings storage facilities, early in the closure period and prior to the Councils signing off that all closure criteria are met. Not a post-closure issue.
3.1	Pit-3a	Rebound damage to pumphouse	Cost of repair			Post-Closure	Excluded during the 1998 assessment of the basis that the settlement and rebound effects would be minor and less than those occurring during dewatering (none), and would be complete by the end of the closure period. The risk could not therefore exist post-closure and was excluded from the analysis. Confirmed in the 2014 review.
3.2	Pit-3b	Rebound damage to buildings	Cost of repair			Post-Closure	Excluded during the 1997 assessment of the basis that the settlement and rebound effects would be minor and less than those occurring during dewatering (none), and would be complete by the end of the closure period. The risk could not therefore exist post-closure and was excluded from the analysis. Confirmed in the 2014 review.
3.3	Pit-3c	Rebound damage to services	Cost of repair			Post-Closure	As for buildings.
4.1	Pit-4a	Dewatering affects groundwater supplies	Cost to provide equivalent alternative water supplies			Post-Closure	Conceivably could occur during dewatering and for part of the pit flooding period, but hasn't. Presents no risk following closure.
4.2	Pit-4b	Groundwater contamination	Cost to provide equivalent alternative water supplies			Post-Closure	During pit rewatering there could be a reversal of the existing inward flow of groundwater such that contaminated water from within the old mine workings potentially affects water quality in bores surrounding the township. However, any outward flow would be into the lower aquifer, which is too deep and has insufficient yield to be used for water supply purposes (at this time). Final lake level is going to be lower than the pre-existing groundwater level in Martha Hill so flows after pit flooding groundwater flows will again be towards the pit prior to the start of the post-closure period.

TABLE B-1: RISK REGISTER

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
5.1	Pit-5a	Blast noise	Excessive noise due to blasting recorded outside pit boundaries.			Operations	Operational risk only.
5.2	Pit-5b	Pumphouse damage	Repair of blast vibration induced damage to pumphouse.			Operations	Operational risk only. The risk of structural damage to the Pump House as a result of blasting vibration was originally identified as a separate issue as the risk was considered greater here than for other structures in Waihi due to its proximity to the pit and its design/construction.
5.3	Pit-5c	Blast vibration	Non-compliance with consent limits			Operations	Operational risk.
5.4	Pit-5d	Fly rock	Worker and public safety			Operations	Operational risk.
6.1	Pit-6a	Noise	Non-compliance with consent limits			Operations	Operational risk.
6.2	Pit-6b	Stringent noise standards	Unworkable limit has significant cost implications on mining contract.			Operations	Operational risk.
7.1	Pit-7a	Flooding	Pit lake discharge causes flooding in Mangatoetoe catchment			Post-Closure	Lake discharge issues can only occur after lake filling is complete. The lake discharge weir will be designed to maximise flood routing such that the proportion of lake flow in the Mangatoetoe reduces with increasing rainfall. Given the necessary sign-off processes within the consents, and those required to achieve "closure", this is not considered a credible post-closure risk
7.2	Pit-7b	Outlet failure	Cost to repair or replace damaged outlet structures.	0	176	Post-Closure	Routine maintenance of the outlet structure and tunnel is assumed to be required during the post-closure period. This is a base cost included in the Martha Trust's operational budget. Post-closure, there is a risk that the proposed lake outlet tunnel and associated structures could be damaged, for example as a result of an earthquake. This may be insurable. As underground structures are less susceptible to earthquake damage than above-ground structures, the likely consequence is that some maintenance of the works would be required, particularly at the portals. The 1998 estimate of cost to undertake this work was $80,000 to $400,000 (median and P95). These values are retained in 2016, but adjusted for inflation. The 1998 assessment also considered an increased maintenance costs would be incurred following a failure. The $2,000 to $5,000 estimate has been adjusted for inflation.
8.1	Pit-8a	Lake water quality	Additional cost to treat lake water	4	11	Closure & Post-Closure	This risk was included in the 1998 assessment, at which time chemical modelling indicated a lake water quality suitable for discharge. Recent modelling indicates otherwise, and the base costs include treatment (alkalinity addition) in perpetuity. The 2014 review based the revised consequential cost to represent an increase of 50-100% of the annual base cost (median and P95), and increased the likelihood by an order of magnitude. These assumption are retained, with adjustment for inflation. Given the currently assumed water treatment system required in the base case to maintain lake quality, the previously identified alternative mitigation options are redundant.
8.2	Pit-8b	Aquatic biology	Degraded lake water quality reduces diversity of biota			Post-Closure	A less-than-expected water quality could reduce the diversity of biota in the lake. However, unless the water quality is compromised to the point where it cannot be used for recreational purposes (refer Pit-8-c) or discharged without treatment (Pit-8a), there is no consequence.
8.3	Pit-8c	Public amenity/health	Degraded lake water quality prevents the lake's use or poses health hazard.			Post-Closure	Failure to meet safe swimming water quality equates to a failure to meet a closure criterion, meaning that closure is not achieved. Once closure is achieved, the issue can't be a post-closure risk as the proposed base case lake mitigation option (water treatment) must be capable of achieving this minimum standard. The risk that achieving the minimum standard may cost more than expected is covered in the preceding risk event (Pit-8a).
9.0	Pit-9	Lake filling delays	Additional overhead costs associated with extended rewatering period			Closure	The rehab bond assumes a certain period to flood the pit, but a if series of droughts reduces river flow, rewatering could take longer and there would be increased costs. Assumed closure period already includes a 12-month delay allowance, which is considered sufficient to render this risk inconsequential. A closure risk, but not in the post-closure period.
10.0	Pit-10	Regulatory change	Additional treatment costs or installation and operation of alternative discharge to the Ohinemuri River.			Post-Closure	Such a change could result in an unacceptable discharge quality necessitating a delay in gaining permission to discharge, or necessitating change to the currently proposed discharge, e.g. the piping of the lake outlet to the Ohinemuri River where the additional dilution prevents significant adverse effect, and/or treatment of lake water prior to discharge (covered in risk event Pit-8a). In any event, this issue would need to be resolved before OGC receives sign-off from the Council indicating that site closure has been attained. This is therefore not a post-closure risk.
11.1	Pit-11a	Fuels and solvents				Post-Closure	The management of these substances is undertaken in accordance with the appropriate regulations. Any contamination of soils in the pit or ancillary area as a result of spills during operation is expected to be cleaned up as part of the closure activities. The cost associated with this work is a base cost. This ceases to be an issue during closure, and hence is not a post-closure risk.
11.2	Pit-11b	Explosives				Post-Closure	As for fuels and solvents.
12.1	Pit-12a	Noise bund ARD				Operation & Closure	If some unoxidised material is incorporated in the bund, acidic run-off and/or leachate could result. This has not been an issue during operations, so is considered to be a non-issue. Significant attention was given to the identification and handling of potentially acid-forming (PAF) rock during bund construction. These processes did identify mis-classified PAF fill during bund construction and resulted in re-excavation and removal of the affected areas.
12.2	Pit-12b	Noise bund instability				All	A slump or failure of the outside shoulder of the bund could block Eastern Stream and cause flooding. The consequence is the cost of repair of the bund, repair of any resulting flood damage to, and possible purchase of, neighbouring properties and a fine for an unauthorised discharge. With the removal of the bund early during the closure period, this ceases to be an issue. Circumstances have changed since 1998 and, following identification of the subsidence hazard zones, there are no longer any adjacent private properties that could be affected.
13.0	Pit-13	Uncontrolled spring flow				Post-Closure	Some increase in spring flows or "damp" areas could potentially occur as groundwater level returns to near pre-mining levels. This issue is not considered credible due to the conservative level adopted for the lake level, and the distance from the lake to town areas that lie below this level, virtually eliminate this issue. For the areas of town at an elevation of less than RL1104 m, i.e. primarily in the south and west, no mining was undertaken so no risk exists.
14.1	Pit-14a	Mine manager's house damage				Post-Closure	Mine manager's house has been removed

TABLE B-1: RISK REGISTER

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
14.2	Pit-14b	Grand Junction refinery damage				Post-Closure	No risk from mining once mining and rehab is completed. Relocated refinery building at less risk during rehabilitation activities than prior to its relocation.
14.3	Pit-14c	Grand Junction powerhouse damage				Operation & Closure	Base costs allow for reinstatement of columns. No other deliberate or accidental damage considered credible in the post-closure period.
15.0	Pit-15	Revegetation failure				Post-Closure	It has been accepted by the Councils that rehabilitation will not be possible for all of the pit wall exposed above the lake.
	Pit-16	Vandalism of WTP	Cost of repair or replacement to lake water treatment plant.			Closure & Post-Closure	Normal insurance against theft or vandalism mitigates this risk. Insurance premiums are included as a base case of the Martha Trust operating costs.
	Pit-17	Unidentified PAF	If not Identified and removed/remediated, PAF could adversely affect lake or other surface waters (excludes pit walls and noise bund, which are covered elsewhere).			Closure	With the exception of pit wall PAF areas above lake level, identification and remediation of PAF is an obligation during closure activities, and satisfactory resolution is required to achieve closure. There is currently no waste rock in stockpile in the SFA, and following cessation of mining in 2015, no possibility of the current situation changing. The surface of the SFA will be covered with NAF from the noise bund. The risk that the noise bund material contains PAF is covered elsewhere (Pit-12a).
	Pit-18	Public safety	Drownings, accidents involving lake users.			Post-Closure	The Martha Trust cannot be responsible for swimming/boating safety accidents within the pit lake, but could be implicated if any accidents were directly attributable to the mining remnants, e.g. pit wall failure etc. The pit wall risk assessment indicates that the level of post-closure lives risk was *de minimis* . The Martha Trust operating costs provide for the Trust to purchase and maintain public liability insurance.
	Pi-19	Lake fails to fill	Unable to create promised recreational lake. Cost of change to closure plans, or sealing to allow filling.			Closure	Not a credible risk. Lake level is set at 2m below the lowest known potential outlet, and some 10m below the groundwater level existing prior to the start of the modern mining period.
	Pit-20	LINZ prevent lake access	LINZ excludes the public from using the lake, and Martha Trust from undertaking lake-related maintenance.			Post-Closure	LINZ manages the land under the lake and much of the land surrounding the lake, including the lake outlet site. As the manager of the land on behalf of the people of NZ, it is inconceivable that LINZ would exclude the public from using the lake and surrounding amenities, or could successfully do so. Nor is it reasonable to assume that it would prevent the Trust from undertaking lake-related management/maintenance activities, as in doing so LINZ would inherit that responsibility. The OGC proposal is to return to the closure plan with an east end park, meaning access to the lake would not be via LINZ land (unless the area can be extracted from the Trust deed and passed to LINZ)
	Pit-21	Hazard zone collapse	Serious injury or fatality. Cost to fence off and remediate collapsed area, and potentially to realign affected section of pit rim walkway.	1,718	1,718	Closure & Post-Closure	This is a new risk not considered in 1998, and follows the identification of hazard zones in 2002. Hazard zone collapse risk has been assessed in a separate study (Lane, 2014) from which the likelihood of a future collapse is drawn. If the risk were to apply, it would relate to the pit rim walkway development over the Mary, Martha and Empire hazard zones. It is assumed that as the land owner, the Trust would need to make the area safe by fencing off the collapse, rerouting any affected walkway. Also include for some native planting to mitigate visual effects. The Royal and Edward zones overlie areas that, for the most part, do not form parts of the Trust land, so would not contribute materially to the risk. However, collapses into the historic underground workings are a legacy issue for the NZ government and for HDC, not for OGC or the Trust, and without any occurrence cost falling to the Trust, the risk is excluded from any potential contribution to the Capitalisation Sum.
PROCESS PLANT, WTP AND CONVEYOR CORRIDOR							
16.1	Mill-1a	Conveyor noise				Post-Closure	Operational issue only.
16.2	Mill-1b	Mill noise				Post-Closure	Operational issue only.
16.3	Mill-1c	Noise exceedance				Post-Closure	Operational issue only.
17.1	Mill-2a	Conveyor dust				Post-Closure	Operational issue only.
17.2	Mill-2b	Lay-down area dust				Post-Closure	Extended Project construction issue only.
17.3	Mill-2c	Stockpile dust	Effects on crops, amenity, health, soil contamination, or a non-compliance.			Post-Closure	Operational risk. This was identified as five separate risks in the 1998 assessment, all of which were excluded.
18.0	Mill-4	Minewater pipeline burst				Post-Closure	Operational issue only.
19.0	Mill-5	Decant pipeline burst				Operation & Closure	Operational and short term (3 years) closure issue only.
20.0	Mill-6	Tailings pipeline burst				Post-Closure	Operational issue only.
21.0	Mill-7	Seepage pipeline burst				Operation & Closure	Seepage quality needs to be suitable for direct discharge prior to achieving Closure. Not a post-closure risk.
22.0	Mill-8	Collection pond pipeline burst				Operation & Closure	These pipes will be decommissioned by the end of closure, and the pond water quality will have improved considerably in response to rehab completion, so this is not a post-closure issue.
23.0	Mill-9	Mill bridge failure				All	Post-closure, while the bridge is expected to remain, its use will limited to farm purposes for which the Martha Trust is not responsible. A risk of failure does not exist post-closure.
24.1	Mill-10a	WTP chemical spills				Post-Closure	Operational issue only.
24.2	Mill-10b	WTP tank collapse				Operation & Closure	If the WTP is mothballed, as proposed in 1998, then the tanks would contain only water and there would be no consequence of a failure. However, the WTP is over-sized for providing treatment for any contaminated water stream arising at the closed site. It is also over-sized for use as a community treatment facility, although part of the WTP could be retained and used for this purpose - in which case it would not be a Martha Trust responsibility. OGC is proposing to decommission the WTP as part of the closure works, which would occur prior to achieving closure. Once removed, there is no possible risk.
25.0	Mill-11	Treated water out-of-spec				Operation & Closure	Operational and closure risk, after which treatment ceases (by definition) and the risk ceases to exist.
26.1	Mill-12a	Mill chemical spills				Post-Closure	Operational issue only.
26.2	Mill-12b	Mill tank collapse				Post-Closure	Operational issue only.
27.0	Mill-13	Chemicals handling and storage				Post-Closure	Operational issue only.
28.1	Mill-14a	Stockpile - soil contamination				Post-Closure	Leaching of oxidation by-products is expected to cause soil contamination beneath the ore stockpile. As it will occur, the issue is not a risk and has been accounted for in the base cost of the process plant clean-up at the end of operations.
28.2	Mill-14b	Stockpile - groundwater contamination				Post-Closure	Some minor quantities of stockpile leachate may be reaching groundwater and affecting quality. A cut-off drain was installed down-catchment of the mill and ancillary areas (down-catchment of the Mill Contingency Pond) that could be re-commissioned in the unlikely event that contaminated groundwater appears 10 to 13 years after removal of the contaminants from the stockpile. Covered in WDA-5.

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
28.3	Mill-14c	Stockpile - surface water contamination				Operations	An operational risk. The stockpiles will be empty at closure, and the area contoured, covered and planted as part of the closure activities.
29.0	Mill-15	MCP discharge				Post-Closure	Operational risk only.
30.0	Mill-16	Contaminated soil				Post-Closure	Site clean-up of contaminated soils within the process plant area is covered as a base cost (refer also Mill-14a).
31.0	Mill-17	Hazardous material storage/handling				Post-Closure	Operational risk only.
32.0	Mill-18	Regulatory change to discharge standards				Operations	A business risk during operations. During the early part of closure while the WTP is still in service, the significantly reduced volumes for treatment mean that the mass load and concentrations of contaminants will less and the available dilution proportionately greater. The treated water discharge ceases during closure and there is no post-closure risk.
33.0	Mill-19	Conveyor tunnel collapse				Operations	During operations, this is a business risk only. Opportunities to leave the tunnel open for future tourism purposes is still under consideration, and may be considered if no liability is transferred to the Martha Trust. The current default option is to plug both portals with concrete to prevent access - no consequence in the post-closure period.
34.0	Mill-20	Insufficient WTP capacity				Post-Closure	Operational risk only.
35.0	Mill-21	Unacceptable air emissions				Post-Closure	Operational risk only.
	Mill-22	Chemical spill from WTP	Environmental damage to Ohinemuri River			Operation & Closure	The lime spill into the Waitekauri at Golden Cross initiated a review of whether a similar incident was possible at Waihi. To attain closure, the WTP would no longer be operating. Whether mothballed, as originally proposed, or decommissioned and removed as currently proposed, there would be no remaining bulk storage of lime or any other chemical, hence no potential to spill.
WASTE DISPOSAL AREA							
36.0	WDA-1	Collection pond water quality				Operation & Closure	One of the success criteria that OGC must attain before site closure is complete is that collection pond water quality must not discharges must not cause an exceedance of the in-river water standards. Water quality in the ponds relies primarily on successful completion of rehabilitation on the waste rock embankment structures. Once successfully rehabilitated, the risk of poor water quality occurring in the ponds was considered by the expert panel to be inconceivable. The panel's position was based on experience with improving run-off quality as rehabilitation advances, and the risk is further mitigated by the role of the site management coordinator (which is broader than proposed in 1998)
37.0	WDA-2	Collection pond sediment discharge				Post-Closure	The operational risk. Once the embankments are capped, experience and practice shows that the quality of run-off improves and sediment in the minor quantities that might flow through these very large ponds poses no risk to the receiving environment.
38.0	WDA-3	Perimeter drain failure	A small topsoil slump from the toe of the embankment, or a localised failure of the perimeter bund, causes deterioration in site discharge water quality.			Closure & Post-Closure	In 1998, the likelihood of either failure was assessed as low, and with little to no post-closure consequences the risk was excluded. The role of the site management coordinator was expanded to deal with exactly this sort of event, and costs for event-driven maintenance is included in the base cost - the risk is mitigated.
39.1	WDA-4a	Contractors workshop - contaminated soil				Closure	Removal of any contaminated soil is an expected requirement of closure. This is a base cost.
39.2	WDA-4b	Solvents, hydrocarbon spill				Closure	Management of hazardous substances is covered by regulation. Any contamination by these products would be cleaned up at closure.
39.3	WDA-4c	Workshop pad ARD				Post-Closure	No PAF material used in the construction of the pad on which the workshop is founded, and any surface contamination would be removed as part of the rehabilitation activities, the cost of which is included in the base costs.
40	WDA-5	Tailings bypass seepage	Cost to install and operate K drain(s) and a small passive treatment system.	25	25	Closure & Post-Closure	The potential for bypass seepage from the tailings is limited by the: • Low permeability of the tailings, which increases with time due to consolidation; • Natural containment provided by the generally low permeability bedrock, particularly the weathered bedrock; and • Upward groundwater gradients. This risk event now also includes the consequences of drainage system failure - previously WDA-9. To warrant any remedial action, the volume and/or quality of seepage would need to be capable of having an adverse effect on the receiving surface waters- much of the current seepage, especially from TSF2 wouldn't have a significant adverse effect. The risk is further mitigated by the role and responsibilities of the site management coordinator. If bypass seepage did occur in the post-closure period, it would be in such minor quantities and of a quality that no detectable change would be expected to be measurable following dilution. Additionally, the ongoing monitoring of seepage quality shows improvements with time as the TSFs mature and the control processes designed to control acid generation (soil and water covers) take effect. In summary, the likelihood for potential bypass seepage affecting the rivers is low. As this risk event represents several events (WDA-5, 6, and 9), the expert panel increased the likelihood from the 10^{-5} per annum assessed in 1998 by half an order of magnitude. It is worth noting that an engineering risk assessment of the waste rock embankments (Lane, 2011) assessed the combined likelihood of a contaminant (leachate) release due to collection system failure or earthquake was 2.4 x 10^{-5} p.a. during the operational period and 2.5 x 10^{-7} p.a.in the post-closure period. The likelihood assessed by the expert panel in 2014 is twice the operational likelihood derived during the earlier detailed study and more than two orders of magnitude greater than that derived for the post-closure likelihood. Given that the causes/initiating events of (leachate and/or tailings) bypass seepage are not limited solely to the drain failure, the 2014 likelihood is considered a reasonable estimate for the operational period. While it is grossly overstated for the post-closure period, the 2014 value has been retained for conservatism. Assuming bypass seepage did occur, the solution would be to install a K drain near to area of concern and to collect and treat seepage prior to discharge as has been the practice during operations. For the minor quantities involved, a passive treatment system such as a small wetland or mussel shell reactor place close to the area of concern would be appropriate.
41.0	WDA-6	Waste rock bypass seepage				Post-Closure	Refer above to WDA-5. While the source is different, the causative agent, the collection systems, and the environmental pathways are the same as for tailings seepage. The solution would also be the same, and based on experience the likelihood is also similar. The consequence assigned to WDA-5 assumes several K drains and one or two passive treatment systems, which is sufficient to include seepage reporting to the groundwater beyond the toe of the waste rock embankments originating from either source.

TABLE B-1: RISK REGISTER

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
42.0	WDA-7	Perimeter bund ARD				Post-Closure	While included in the 1998 as an unknown, with passing time it is possible to eliminate this risk event. It is known that some small quantities of PAF are contaminating the perimeter bund around TSF1A (TSF2 was constructed before PAF material was excavated from the Martha pit). The extensive monitoring of groundwater and surface water demonstrates that this material is not having a significant, or possibly even measurable, effect on the surface receiving waters.
43	WDA-8	Catastrophic tailings release	Repair of breach to encapsulate PAF waste rock and tailings. Clean-up of tailings deposited in the flood plain down-catchment. Compensation for affected landowners. Management, legal and regulatory costs.	16	16	Closure & Post-Closure	In the original risk assessment (1998), based on the evidence of Dr. Trevor Matuschka, a sudden release of tailings due to an embankment failure was assessed as being inconceivable. On technical grounds, the proposal was to exclude this risk event from inclusion in the risk cost. However, at that time it was accepted that tailings dams failure was of particular interest to the Councils and the public due to then-recent events in Spain (Los Frailes) and at Golden Cross. As a result, Waihi Gold decided to include this risk for political reasons. A sudden release of tailings is typically an insurable risk, and in 1998 the solution was to include a consequence equal to the cost of insurance premiums for a period of 50 years, beyond which the catastrophic failure was deemed not to be credible. By adopting this approach, no recognition was given to likelihood of failure, i.e. by including the cost of premiums in the Capitalisation Sum, the assumption was of a 100% probability of failure on the day the Trust inherited ownership of the closed site liabilities. One of the objectives of the first-principles review of the Capitalisation Sum in 2014 was to assess the need and appropriateness of insurance. There are two reasons for reviewing this aspect. First, if coverage of the risk events can be included in the risk cost (contingent liability) component of the Capitalisation Sum, then the Trust should not be burdened with the cost of unnecessary premiums. Secondly, if cover for the risk events can be included in the risk cost component, then doing so offers better security as the required funds will be available without relying on an insurance company to decide whether or not there are circumstances that warrant honouring the policy or not. Thirdly, if insurance does provide the best risk treatment, the review provides background information for assessing the reasonableness of the cost of insurance cover. The inputs to the 2014 review were based on a detailed engineering risk assessment (Lane, 2011), a dam break analysis (Matuschka, 2011) and a detailed remediation estimate (Storer, 2014). The approach in this review is to ignore insurance as an option in the first instance, and to derive a risk cost based solely on the risk assessment outputs. If necessary, the inclusion of insurance cover in the risk cost can be included if it offers a more cost-effective treatment, i.e. reduces the overall contingency liability component of the Capitalisation Sum. The likelihood of a catastrophic release of tailings in the post-closure period is derived in a separate study (Lane, September 2011), and is considered negligible (1 in 1 million). The very low likelihood means that the risk could be considered to be immaterial and excluded from the assessment, however it is retained at this stage for continuity and to see if its inclusion is warranted. The consequences of an embankment breach are also defined in a separate study (Engineering Geology, July 2012), which were used to estimate a cost for clean up, structural repair, compensation and administration and management costs (Storer, 2014).
44.0	WDA-9	Seepage release	Collection and treatment of released seepage following drainage system failure			Post-Closure	This issue relates to release of tailings pore fluids or waste rock leachate as a result of failure of the underdrainage system, i.e. it differs from the issue of bypass seepage addressed in issues 40 and 41. During the 2014 review, the expert panel assessed that drain failure did not pose a credible risk. It is known that the drains will block and/or fail over time. This is not a concern geotechnically, nor environmentally unless the seepage is of sufficiently poor quality and/or occurring in such quantities as to adversely affect the receiving water. The collection and treatment of such seepage is covered above in WDA-5.
45.0	WDA-10	Waste rock embankment damage				Post-Closure	This issue was assessed and is included in the engineering risk assessment, and above in risks event WDA-8. the repair of minor damage due to wind-thrown vegetation, rainfall or earthquake etc. is covered in the Martha Trust's operating costs, i.e. the site management coordinator.
46.0	WDA-11	Embankment overtopping				Closure & Post-Closure	This is a possible initiating event for a catastrophic failure of the embankment release of tailings, which is covered in WDA-8. Post-closure, tailings pond water is of suitable quality to discharge and other than the potential geotechnical consequences covered in WDA-8, any overflow would have no adverse effect.
47.0	WDA-12	Wildlife health				Post-Closure	Operational risk only.
48.0	WDA-13	Revegetation failure				Post-Closure	Experience over the past 25 years indicates that OGC's revegetation procedures are effective and confirms that there is no realistic likelihood of large failures. Repair of small failures are included in the base costs.
49.0	WDA-14	Non-compliant noise				Post-Closure	Operational risk only.
50.0	WDA-15	Tailings dust				Operation & Closure	There has been no tailings dust issue during operations even when a substantial beach formed on TSF2 due to the regional weather and poor drainage characteristics of the tailings, which prevent the tail drying out. Post-closure, tailings will be inundated to a depth sufficient to ensure a water cover even following an extended drought, eliminating the risk of tailings dust.
51.0	WDA-16	Waste rock dust				Operations	Operational risk only. No exposed waste rock in post-closure period.
52.0	WDA-17	Loss of dust control				Post-Closure	Operational risk only.
53.0	WDA-18	Regulatory change to discharge standards				Closure	Achieving a pond water quality suitable for discharge is one of the success criteria that OGC needs to meet before Closure is attained (and has already been achieved for TSF2). This is not a post-closure risk
54.0	WDA-19	Hazardous material storage/handling				Post-Closure	Operational risk only.
55.0	WDA-20	Tailings ponds significantly larger than planned				Post-Closure	There is no consequence if the proportions of covered to pond areas differ in reality following rehabilitation of the tailings storage facilities surface to that promoted during the consent process.
56.0	WDA-21	Flood erosion damage at TSF toe				Post-Closure	Remediation of event-driven damage is provided for in the Martha Trust operating costs, i.e. is a base cost.
57.0	WDA-22	Insufficient NAF material for rehab.				Closure	This is not a post-closure risk. Routine updates are made of the material balances required for completion of the waste rock embankment construction (for which these is an excess) and rehabilitation (for which there is sufficient quantities).
58.0	WDA-23	Failure to achieve Zone A spec.				Post-Closure	Operational risk only.
59.0	WDA-24	Failure to achieve Zone G spec.				Post-Closure	Operational risk only.

1998 ID	ID	Short Description	Consequences	Risk Quotient Closure	Risk Quotient Post-Closure	Exposure Period	Comments
60.0	WDA-25	Degraded tailings pond water quality				Post-Closure	The only credible initiating event would be exposure of tailings for a considerable period, i.e. sufficient for them to drain and de-saturate sufficiently to allows sulphide oxidation to occur during an extended drought. The closure proposal is to set the final water level in the TSF impoundments sufficiently above the tailings level to avoid exposing the tail under most extreme drought events. Even if an extreme drought were to drop the water level to tailings level or less, the period(s) of exposure would be short and very infrequent, and the inherent buffering capacity in the tail would prevent water quality degradation until it is all consumed. Over time, the tail will be buried under a layer of inert sediment from up-catchment, providing an additional factor of safety against water quality degradation.
61.0	WDA-26	Impacts of rare & endangered species				Operations	No species were identified within the currently disturbed footprint, and no proposal to increase that area. Not a post-closure risk.
	WDA-27	Delay in achieving low PIC	Incremental cost of continuing the surveillance required for a medium/high PIC for a further period of 2 to 12 years	0	78	Post-Closure	The expectation is that once tailings deposition ceases, followed by a period of consolidation and capping of the impoundment perimeter(s), a potential impact assessment will reduce the PIC from a medium (or high) to low classification, with a commensurate reduction in the required level and cost of surveillance on the embankments. The base case assumption is that reclassification will be achieved by closure. If a reduction in PIC is not achieved at closure, the Martha Trust will be required to continue with the higher level of surveillance until the reclassification is achieved. The delay of 2-12 years represents a period of 15 to 25 years beyond the last tailings deposition.
OFF-SITE & MISCELLANEOUS							
62.0	Off-1	Contractors accident				Operation & Closure	This is a business risk that exists only during operations and part of closure and therefore is not for consideration within this assessment.
63.0	Off-2	Traffic				Post-Closure	Operational risk only.
64.0	Off-3	Bulltown Road tip				Post-Closure	A concern was raised about the potential for leachate from the tip to enter the pit lake and compromise the water quality. Consideration of the separation distances between the two facilities eliminated this as a risk - the tip and the pit are sited in different catchments.
65.0	Off-4	Unacceptable visual impacts				Post-Closure	Operational risk only.
66.0	Off-5	Road stopping not approved				Operations	In 1998, there was a very small risk that the Hauraki District Council might not pursue the applications to stop the roads required for the Extended Project. This was never a post-closure risk, and the expert panel excluded it from quantification (and HDC stopped the roads that allowed the Extended Project to proceed). While not the same roads as considered in the Extended Project, the 2014 expert panel identified it as a potential risk to the current closure concept for the pit. However, if HDC doesn't want to stop any of the roads around Grey St/Slevin St, then there is no need to pursue this further. It is not a post-closure risk.
67.0	Off-6	Receiving environment degradation by others				Post-Closure	Operational risk only.
68.0	Off-7	Community opposition to project				Post-Closure	Operational risk only.
69.0	Off-8	Unacceptable CO_2 discharges				Post-Closure	The imposition of, for example, a carbon tax is a business risk. It ceases at the end of operations.
70.0	Off-9	Decrease in property values				Closure	A study in support of the Extended Project consent applications showed that the operation has increased property values in Waihi, a prediction that has been confirmed by subsequent studies. OGC has given an undertaking to divest itself of its holdings at the end of the project in a way that prevents significantly and artificially depressing the property market. It is expected, that in order to maximise its commercial return, OGC will abide by this commitment. The sale of property is not included as a cost reduction in either the Rehab Bond or the Cap Sum, is not a Martha Trust responsibility, and is not a post-closure risk.
71.0	Off-10	Charitable Trust cannot be established				Post-Closure	The Martha Trust has already been established, although it is not yet active. Recent changes to the charitable trust legislation have not changed the Trust's charitable status.
	Off-11	Monitoring boreholes fail	Collapse or drainage into monitoring boreholes causes localised settlement and property damage.			Closure & Post-Closure	Some groundwater monitoring boreholes may be operating up until the achievement of closure. The concern was a repeat of the Gladstone Rd incident. Several factors militate against this being an issue. First, groundwater would have rebounded to pre-mining levels, meaning that drainage down the hole cannot occur. Secondly, new bores are grouted during installation of the piezometers. Thirdly, while some of the old monitoring wells are open, as they rely on manual dipping of water levels, if these were to create a problem they would have already done so.
	Off-12	Mining remnant liability	Damage to historic mining remnants requires remediation and additional protection works.			Post-Closure	The historic remnants located on land currently proposed to be owned and managed by the Martha Trust are limited to the Grand Junction refinery and power house. The refinery is surrounded with a security fence, and could remain closed if necessary. The optimal solution would be to allow public use/access provided this was done in a way that avoids increasing the Trust's liability. Final details are being worked on as part of the ongoing closure planning. The power house foundations are too robust to be considered a damage liability, which would not be the Trust's responsibility in any event.
	Off-13	Inability to relinquish land	NWG is unable to divest all of its land holdings			Closure & Post-Closure	This is a risk to OGC only. It is relates primarily to Union Hill and Slevin Park as the urban and rural properties will always be saleable.
UNDERGROUND							
	UG-1	Sinkhole formation	Fatality or serious injury to member(s) of public. Remediation of property damage.			Post-Closure	Given the detailed geotechnical evaluations and peer review, and the backfilling of all areas of potential ground instability, this was not considered a credible post-closure risk.