Zeehan Zinc

Tailings Storage Facility

Operation, Maintenance and Surveillance Manual

September 2007

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1. Facility Overview

Figures 1, 2 and 3 provide an overview of the Zeehan Zinc Mine Site, showing the areas covered by this manual and indicating their major components and main features. The data is summarised in Table 1.

Table 1 TSF Overview – Major Components and Main Features

Major Component	Features
Tailings Pipeline and Pumps	
Tailings Pipeline	250 mm DN PE100 PN10 HDPE. Discharge into TSF via single sub aqueous discharge Approx 1 km long from mill
Tailings Dam and Polishing Pond	
Tailings Dam	Embankment Stage 1, RL 216m crest level. Capacity of 1.3Mm3 of tailings & waste rock(approx). Spillway, 1:1000 year AEP flood capacity, overflow in polishing pond.
Waste rock storage	Forms the downstream portion of the TSF for future lifts continually developed with high NAG rock capped with low NAG rock during mining
Polishing Pond	Embankment Capacity of 45ML spillway, 1:1000 year AEP flood, overflow to Comstock Creek Floating inlet, pump station and return water pipeline
Comstock Diversion	
Diversion Dam	3m high dam constructed of clay with coarse rock armouring
Diversion Channel	3m wide cut with batters of 1.5H:1V
Wetland/aeration ponds	To aerate adit water and settle out precipitated
Water Ponds	
Settling Pond (Paul's Dam)	Excavated Pit Capacity of 10ML Collects stormwater which is then pumped to Clear Water Pond after settlement Floating intake and pump station.
Clear Water Pond	Embankment (Turkey's Nest)

Capacity of 20ML

Floating inlet and pump station

Figure 1 Facility Overview - Water Ponds

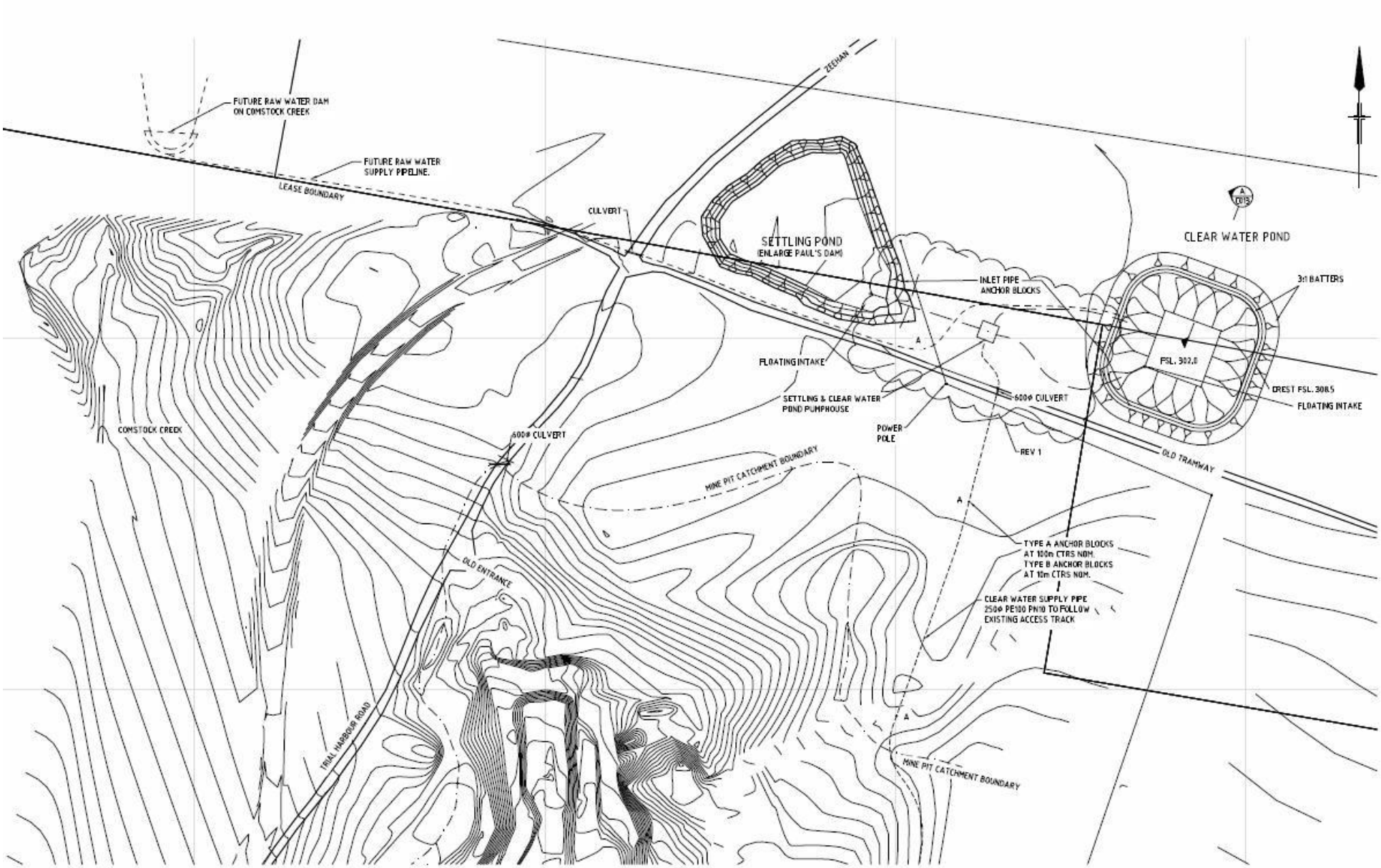


Figure 2 Facility Overview 2 – Plant Area

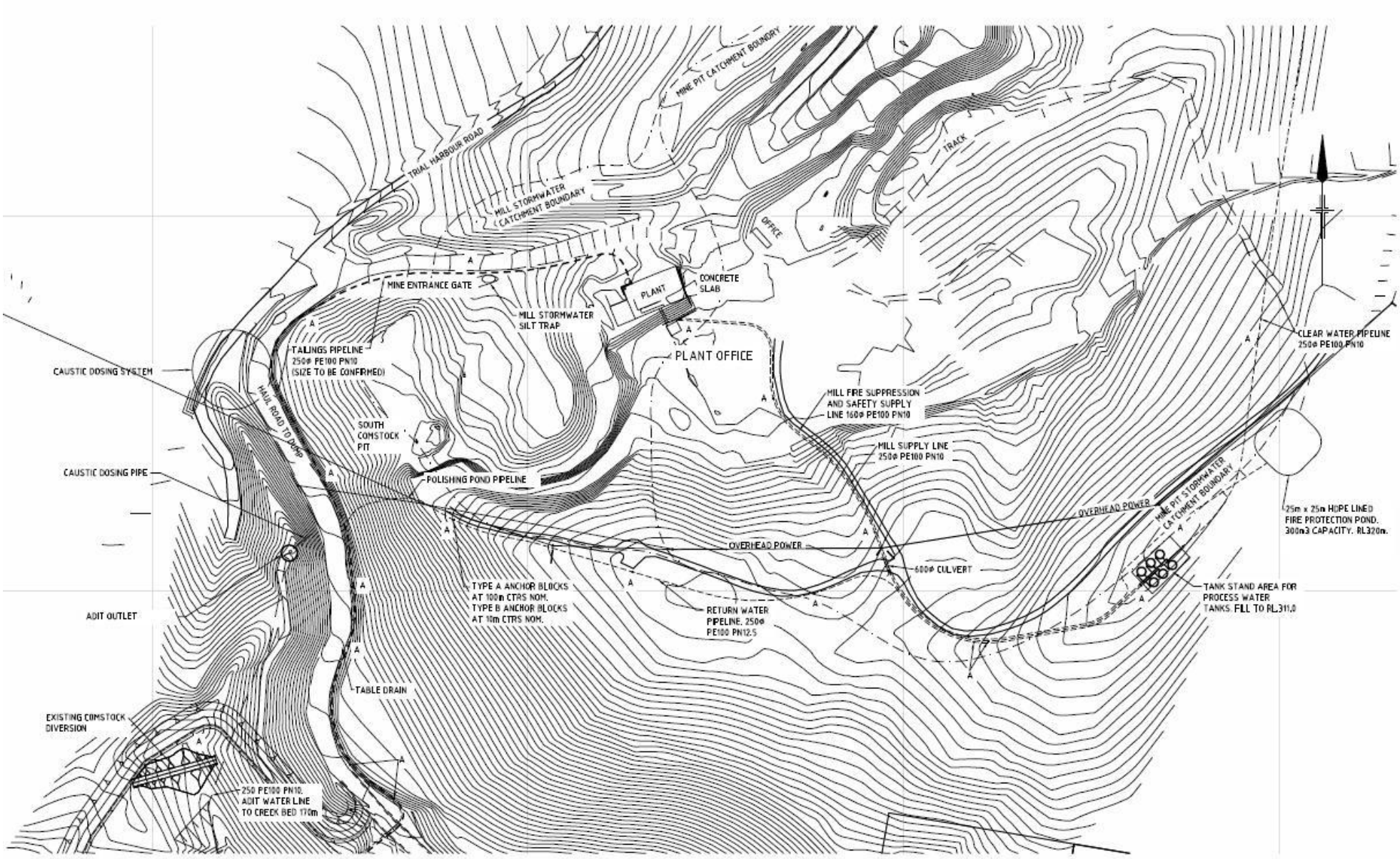
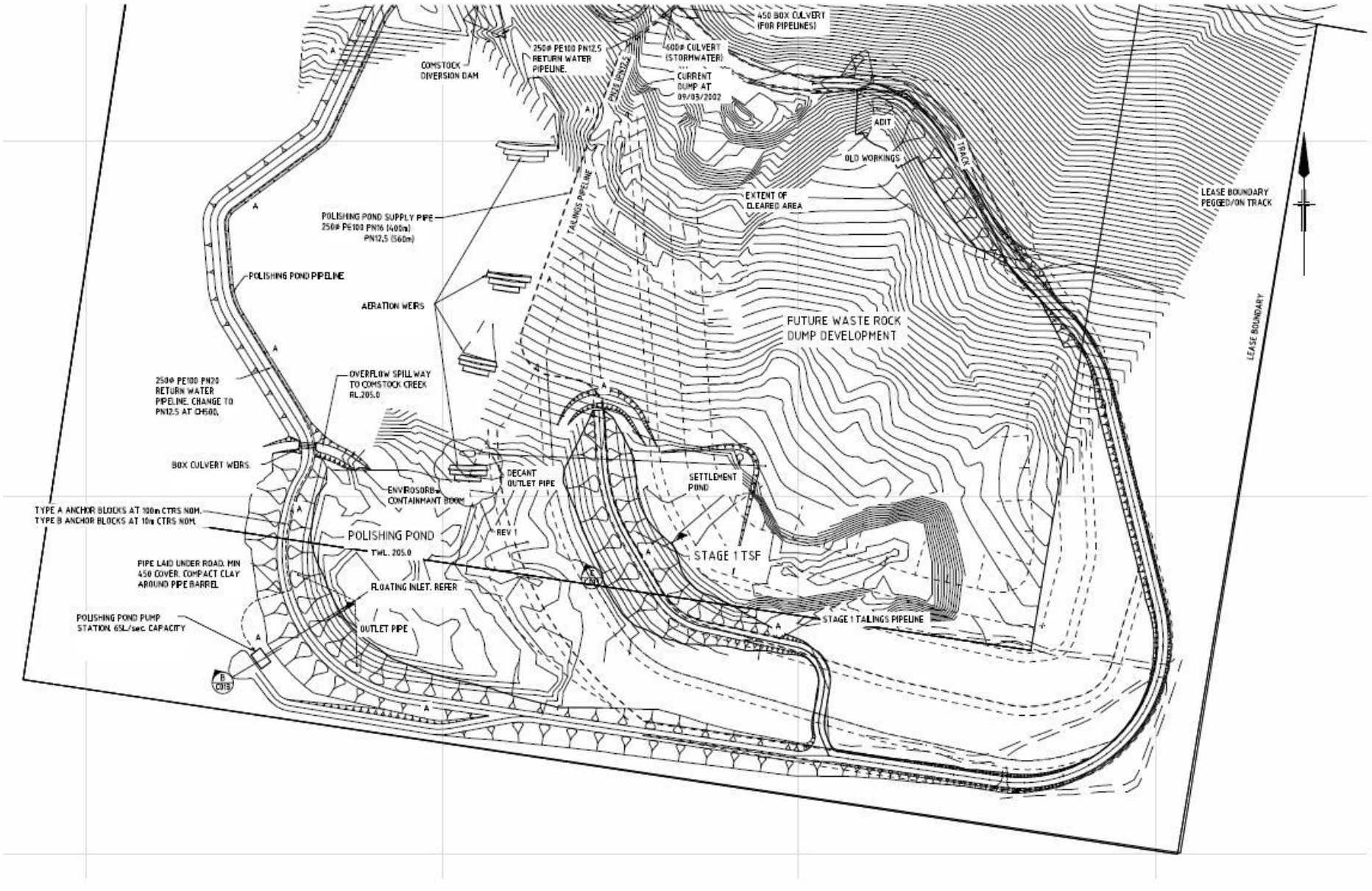


Figure 3 Facility Overview 3 – TSF and Polishing Pond



2. OMS Manual

2.1 Objectives of the OMS Manual

The objectives of the Operation, Maintenance and Surveillance (OMS) Manual are to provide guidelines and support to Zeehan Zinc (ZZ) mine operators and managers to manage the TSF performance in a safe manner.

The OMS Manual **provides**:

- Emergency Response Plan
- Management Plan of tailings beach development,
- Construction methodology of the waste rock disposal,
- Operating Procedures,
- Surveillance and Maintenance Procedures, including Inspection Report Forms.

2.2 OMS Manual Information

The OMS Manual is intended to provide practical advice to the TSF operators giving appropriate and easily accessible information. However it is essential for operators and managers to recognise and understand the TSF features in order to optimise the performance and safety management of the facility. Therefore additional information on design, operations and surveillance is attached in Appendices.

The OMS Manual has been developed in accordance with the Australian National Committee on Large Dams (ANCOLD) Guidelines (2003) and therefore complies with the Tasmanian Dam Safety Legislation (2003). It also meets the requirements of the Tasmanian Department of Primary Industry and Water (DPIW) with the development of a Dam Emergency Response Plan.

According to ANCOLD Hazard Rating, a rating of 'Very Low' is adopted for the TSF Stage 1, however further risk assessment should be carried out for the future lifts of the TSF, that are expected to be rated as "Significant" . A conservative approach was adopted for TSF Stage 1: this manual recommends to undertaken a surveillance program meeting the requirements specified in ANCOLD for a "Significant" rated facility. The polishing pond, clear water dam and settling pond are rated as 'Very Low'.

The Hazard rating for the TSF is shown in Appendix B – B1

3. Organisation, Structure, Individual Responsibilities

3.1 Site Management Structure

The following table lists the individuals having responsibilities for operation, maintenance, surveillance and/or emergency preparedness and response for the facility, including external advisors and service providers.

Table 2 Designated Personnel for Operation, Maintenance and Surveillance (OMS)

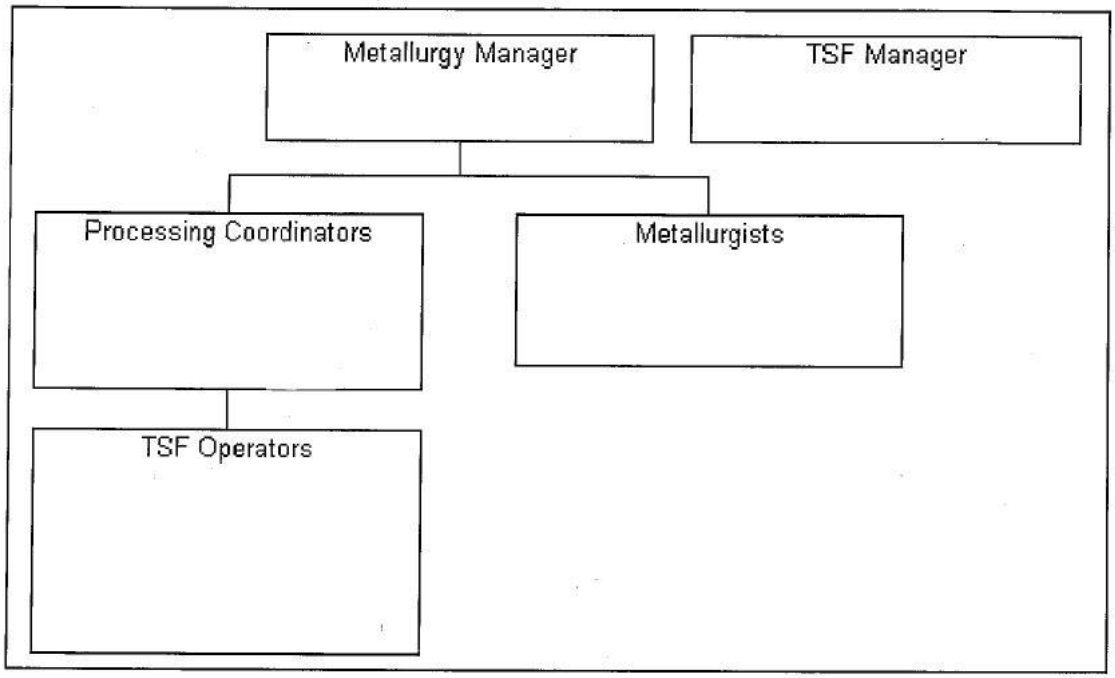
Role	OMSE	Responsibility	Contact Details
General Manager	-	Statutory	
TSF Manager	OMS	Overall direction, planning and safety	
Metallurgy Manager	OMS	Management, training and reporting	
Processing Coordinator	OMS	Routine Inspection and Reporting	
Environmental Manager	S	Environmental management, compliance and reporting	
Environmental Officer	S	Environmental monitoring	
Maintenance Manager	M	Maintenance – Civil, Electricity	
Surveyor	S	Surveying	
TSF Design Engineer	S	Intermediate, & Comprehensive inspection	David Brett 2 Salamanca Square, Hobart TAS 7000 Ph 03 6210 0698

Note: O: Operation, M: Maintenance, S: Surveillance, E: Emergency preparedness and response.

3.2 TSF Surveillance Organisation Chart

Figure 2 shows Zeehan Zinc Limited organisation chart for TSF surveillance.

Figure 4 TSF Surveillance Organisation Chart



4. Emergency Response Plan

Emergency Response Plan

The Emergency Response Plan (ERP) defines the responsibilities and provides procedures to identify incidents, undertake remedial actions and initiate emergency response.

Zeehan Zinc Ltd is responsible for the surveillance, maintenance and operation of the TSF, Polishing Pond, Clear Water Dam and Settling Pond embankments.

The Metallurgy Manager is responsible for implementing operational and emergency response procedures.

Notification procedures for Failures or Impending Failures (Red Level) are given in Section 4.3 and attached in Appendix B – Section B1.

Notification procedures for significant observations other than failures or impending failure cases (Orange Level) are given in Section 3.4 and attached in Appendix B- Section B1.

Incidents that could result in dam failure are described in Section 4.3.

All incidents should be adequately responded to and remedied, with assessment of why the incident occurred and how to reduce the risk of future recurrence.

All incidents should be recorded and listed in this manual.

Incident Report Form — attached in Appendix B – Section B3

Incident Report List — attached in Appendix B – Section B3.

Incidents and accidents associated with the management of tailings should be reported immediately.

Emergency Response Procedure – Pipeline
Emergency Response Procedure – Earthquake
Emergency Response Procedure – Flooding
Emergency Response Procedure – Seepage

attached in Appendix B – Section B2.

4.1 Embankments Details

General	Location relative to nearest Town:	Zeehan, Tasmania
	Location Coordinates:	5359788 N, 357304 E
	TSF owner and operator:	Zeehan Zinc Limited
	TSF Embankment - Operating	Significant hazard category
	Polishing Pond Embankment - Operating	Very Low hazard category
	Downstream area	Comstock Creek
TSF Embankment	Embankment	
	Type:	Zoned earth embankment (Stage 1)
	Crest Level	RL 216 (RL 250 at end of life)
	Height	6m for Stage 1 (40m at end of life)
	Crest length:	200 m (approx) Stage 1, (630m at end of life)
	Crest width:	6 m
	Reservoir	
	Catchment area	10,500 m^2
	Normal Operating Level (NOL)	RL 214m (Stage 1)
	Full Supply Level (FSL)	RL 215m (Stage 3A)
	Capacity between NOL and FSL	6.5ML (0.6m freeboard plus storage for 1:1000AEP 72 hr)
	Spillway	
	Type (primary)	Decant tower
	Type (secondary)	Broad crest weir spillway channel IL 215m
	Invert level (primary)	RL 212m (Stage 1)
	Invert Level (secondary)	RL 215m (Stage 1)
	Capacity (primary and secondary)	2.6 m^3/s 1:1000AEP
	Outlet	
	System	Decant and Spillway discharge to Polishing Pond
Polishing Pond Embankment	Embankment Type	Zoned earth and rockfill embankment.
	Embankment Crest Level	RL 207 (7m high)
	Embankment Crest length:	240m
	Embankment Crest width:	6m
	Spillway	Broad crest weir, IL 206, 6.4 m3/s capacity

4.2 Responsibilities

Zeehan Zinc Ltd is responsible for the surveillance, maintenance and operation of the Tailings Storage Facility and Polishing Pond.

The Metallurgy Manager is responsible for implementing operational and emergency procedures i.e.:

- Monitoring the dam during normal operations, major storms, emergency situations, and following earthquakes;
- Implementing the Notification Procedures; and
- Declaring and terminating emergency situations.

Metallurgy Manager Contact Details: ……..

4.3 Emergency Notification Procedure

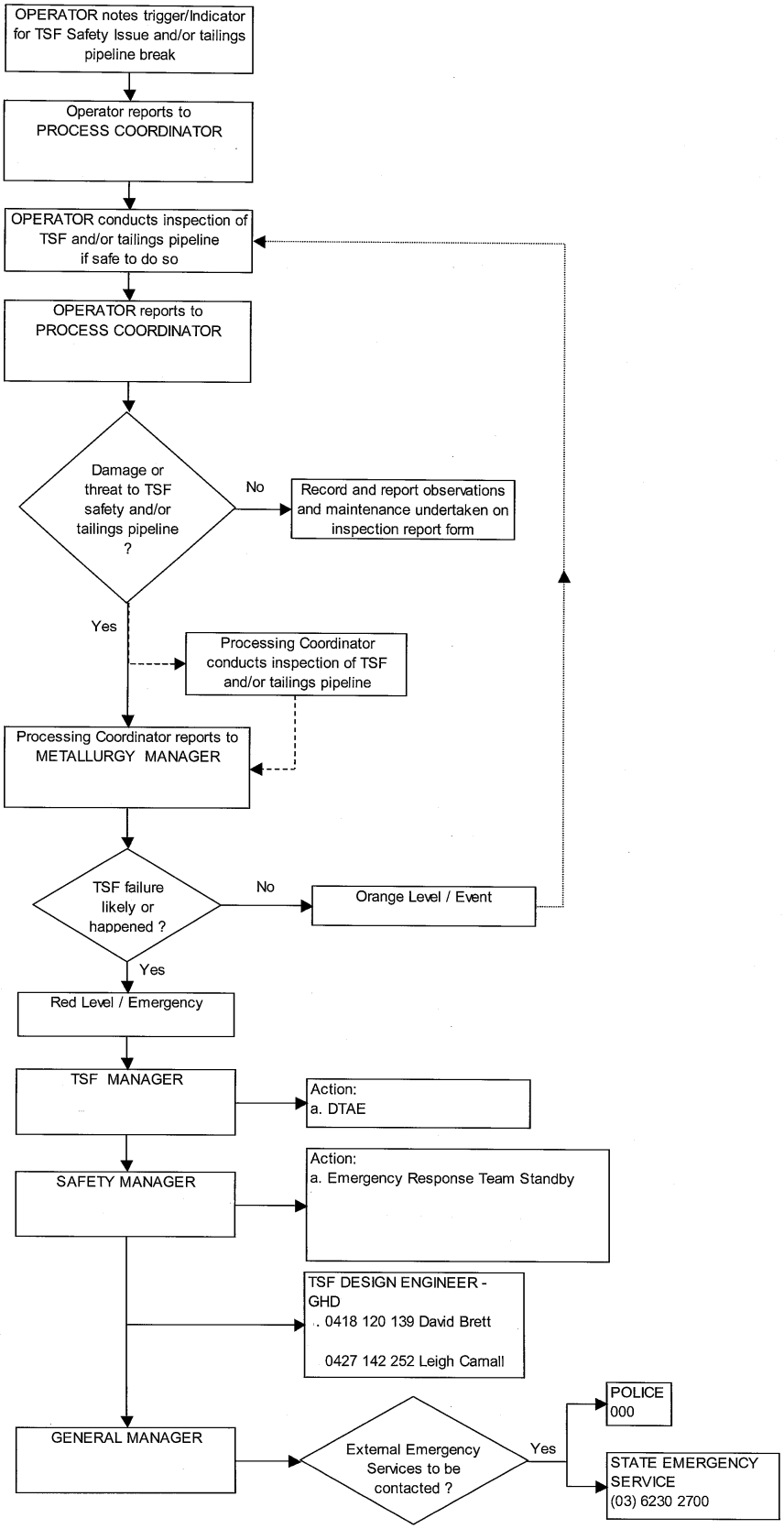
Two levels of notification are defined as follows:

Table 3 Emergency Levels

Emergency Level	Situation	Action
Red Level	Failure or Pending Failure	Notification and immediate Emergency Actions
Orange Level	Significant observations/incidents that affect the TSF safety or/and tailings pipeline or can lead to a TSF failure	Notification, Maintenance, Monitoring and Closure

Emergency Notification Procedure presented in Figure 3 and attached in Appendix B – Section B2.

Figure 5 Emergency Notification Procedure



4.4 Emergency Evaluation and Classification

Timely implementation of the Emergency Response Procedures (ERP) is a crucial element in its effectiveness and appropriate effective warning systems are imperative for downstream occupants and emergency authorities to minimise loss of life and property damage.

Provided in this section are steps to manage some, not necessarily all, of the events that can lead to the failure of the dam. Once an emergency situation has been identified and evaluated, it should be classified as to its urgency so that the appropriate action can be taken.

The Emergency Response Procedure presented in Figures 4 to 8 are attached in Appendix B – Section B2:

- Emergency Response Procedure – Pipeline
- Emergency Response Procedure – Earthquake
- Emergency Response Procedure – Flooding
- Emergency Response Procedure – Seepage

Figure 6 Emergency Response Procedure – Pipeline

Details to be confirmed on finalisation of mill site arrangement and tailings pipeline.

Figure 7 Emergency Response Procedure – Earthquake

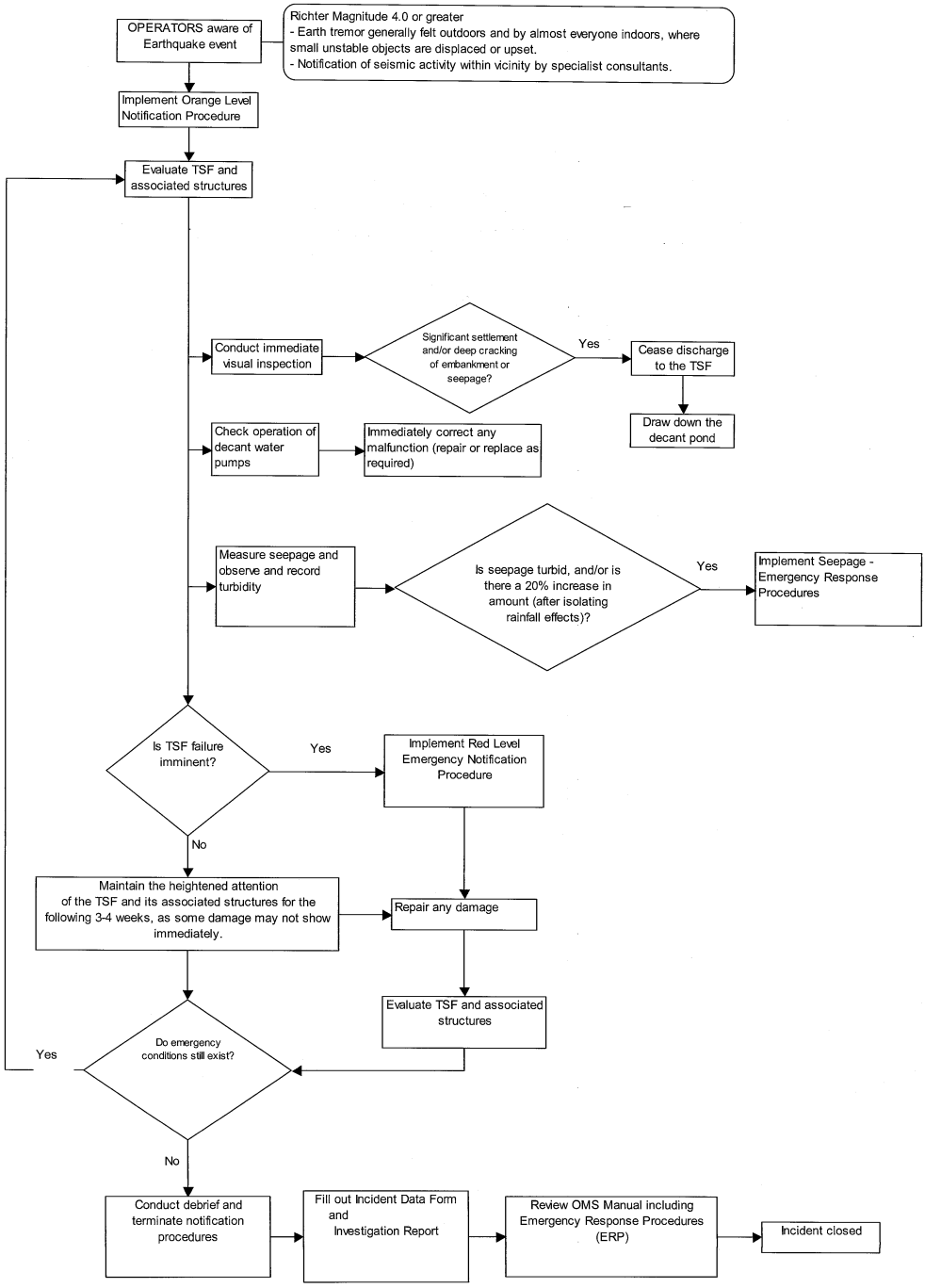


Figure 8 Emergency Response Procedure – Flooding

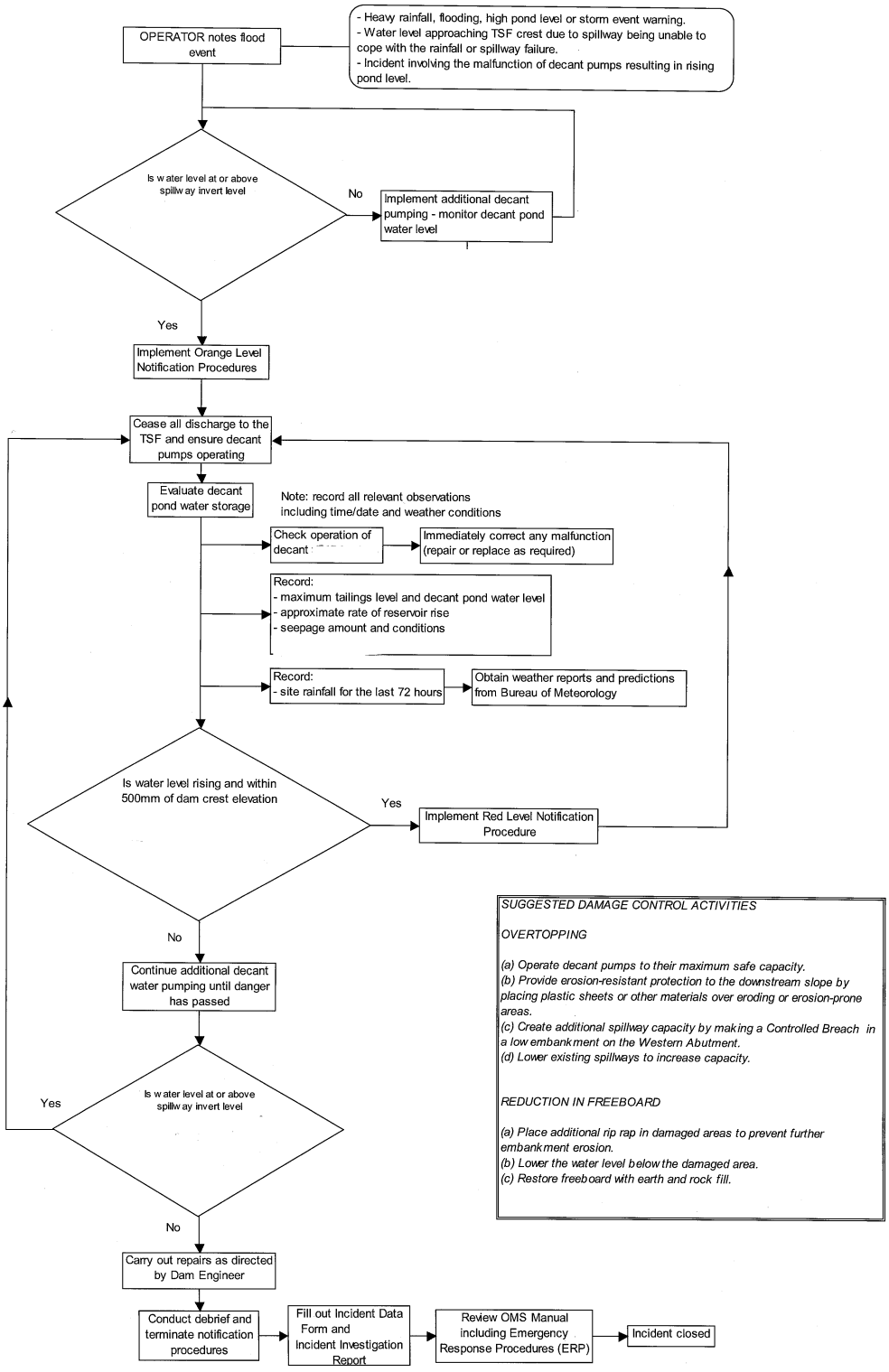
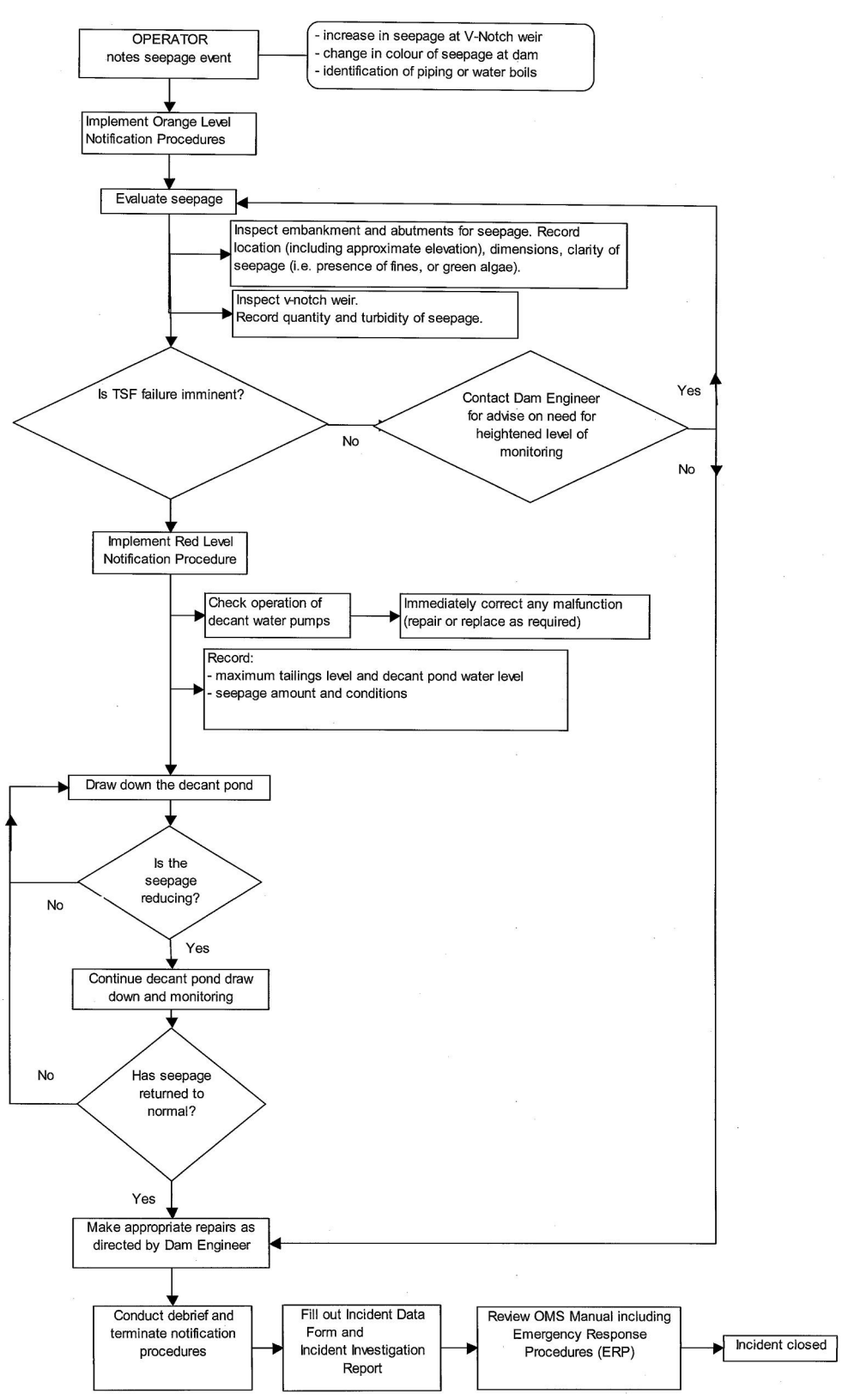


Figure 9 Emergency Response Procedure – Seepage



Embankment Structural Failures

Table 4 lists some of the main embankment structural failures that could be initiated by the emergency events or progressive instability.

Table 4 Embankment Structural Failures – Indicator and Action

Structural Failure	Indicators	Damage Control Activity
Slide in upstream or downstream face of embankment	Longitudinal cracking	(a) Lower the water level at a rate and to a level that is considered safe given the slide condition. If the outlet is blocked, pumping, siphoning or a **Controlled Breach**[1] may be required. (b) Restore lost freeboard if required by placing sandbags or filling in the top of the slide. (c) Stabilise slides on the downstream slope by weighting the toe area with additional soil, rock or gravel.
Mass Movement of the Dam on its Foundation	Spreading or Mass Sliding	(a) Immediately lower the water level until movement stops. (b) Continue lowering water level until a safe level is reached. (c) Continue operation at reduced level until repairs can be made.
Excessive Settlement of the Embankment	Longitudinal and/or transverse cracking Low area on the crest	(a) Lower the water level by releasing it through the outlet or by pumping, or siphoning. (b) Lower water to a safe level. (c) Continue operating at a reduced level until repairs can be made.
Erosion Seepage or Piping	Water surface disturbances such as whirlpools (vortices) in reservoir (probably associated with significant downstream leakage, soft spots or boggy areas).	(a) Plug the flow with whatever material is available (hay bales, bentonite or plastic sheeting if the entrance for the leak is within the reservoir). (b) Lower the water level until the flow decreases to a rate unlikely to cause erosion or until the flow stops. (c) Place a blanket filter (a protective sand and gravel filter) over the exit area to hold materials in place. (d) Continue lowering the water level until a safe elevation is reached. (e) Continue operating at the reduced level until repairs are made.

4.5 Incident Reporting

All incidents should be recorded completing ZZL Incident Investigation Report in accordance to the guidelines to be followed and requirements to be met by ZZL. All incidents should be adequately responded to and remedied, with assessment of why the incident occurred and future prevention of.

Incidents and accidents associated with the management of tailings should be reported via a tailings specific Incident Data Form, which will be attached to ZZL Incident Investigation Report after completion.

- **Tailings Incident Data Form** presented in Figure 9 and attached in Appendix B – Section B3.
- **Tailings Incident List** attached in Appendix B – Section B3.

Figure 10 Tailings Incident Data Form

Date : _____ Checked : _____
(by supervisor)

TAILINGS INCIDENT DATA FORM
Completed after any incident,
and attached to Incident Investigation Report

Incident
Date : _____
Time : _____
Reported by : _____
Incident notification : _____

** Any relevant information (photographs, incident notice or report, TSF/Environmental Engineer, DTAE) on the incident, please attach documents.*

INCIDENT DESCRIPTION

_____
_____
_____
_____

INCIDENT CONSEQUENCES

Environmental damages?	Yes ☐ No ☐	_____
Environmental damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Structural damages?	Yes ☐ No ☐	_____
Structural damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Embankment damages?	Yes ☐ No ☐	_____
Embankment damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Operationnal consequences	Yes ☐ No ☐	_____
Consequences level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Operations Management Review required?	Yes ☐ No ☐ _____	Actioned ☐ _____

ACTIONS UNDERTAKEN

Maintenance performed?	Yes ☐ No ☐ Routine ☐ TSF Specific ☐	_____
Monitoring required?	Yes ☐ No ☐ _____	Actioned ☐ _____
	_____	_____
Emergency Procedure implemented	Yes ☐ No ☐ Orange ☐ Red ☐	_____
Procedure update required?	Yes ☐ No ☐ _____	Actioned ☐ _____
TSF Engineer Consultancy involved?	Yes ☐ No ☐ Recommendations ☐ Special Inspection ☐	

REPORTING

Report to TSF Safety Coordinator?	Yes ☐ No ☐ _____	Actioned ☐ _____
Report to TSF Management?	Yes ☐ No ☐ _____	Actioned ☐ _____
Report to DPIWE?	Yes ☐ No ☐ _____	Actioned ☐ _____
Listed on Incident Report List?	Yes ☐ No ☐ _____	Actioned ☐ _____

Comments / Sketches / Further Comments

3/02/2007 Tailings Incident Data Form Issue 1 Page 1 of 1

4.6 Access and Communication Procedures

Table 5 gives the main information concerning site access and communication.

Table 5 Access and Communication Procedures

Site Access	Trial Harbour Rd
Site Access Requirements	4WD vehicle with visible orange flashing light
Site Communication	Radio and mobile phones
Emergency Situation	A qualified/experienced observer will be at the dam when flood conditions, or signs of serious structural distress have been identified.

5. Tailings Discharge Management

5.1 Tailings Discharge Parameters

The proposed tailings discharge rates for the first 3 years of operations are as follows:

Year 1	200,000 tpa
Year 2	400,000 tpa
Year 3	800,000 tpa

This OMS manual will require updating as production rate changes.

5.2 Discharge Management Objectives

5.2.1 Tailings Discharge Management Plan –Initial Short Term

The tailings are identified as potential acid forming. Therefore the tailings are required to be maintained under water and the discharge to be sub-aqueous. Once testing on the tailings to confirm their acid producing potential is completed the tailings may be able to be left exposed, at this point the OMS Manual should be updated. This OMS Manual details the discharge requirements and operations for this management plan.

5.2.2 Tailings Discharge Management Plan – Long term

The intention of the long-term tailings management plan if it is proven the tailings are NAF is to develop an exposed beach profile with the decant pond toward north-eastern end of the reservoir towards the access road and optimise the storage capacity. It is anticipated that the tailings will be discharged from the full length of the embankment wall by spigotting.

5.2.3 Tailings Discharge Requirements – Long Term

The tailings discharge shall be undertaken to comply with the following requirements:

» Develop a flat uniform beach sloping to grade towards the decant pond located at the eastern central end of the reservoir towards the access road (towards the decant tower).

» Manage particle segregation such that the coarser particles are placed along the TSF wall and reservoir sides and the finer particles towards the decant pond. This segregation is required to ensure drainage close to the embankment to allow upstream construction and the formation of lower permeability layers in the vicinity of the decant pond to minimise potential seepage.

» Ensure that thin layers of tailings are placed and allowed to dry before placing the next layer to maximise drying and density.

5.3 Tailings Discharge System

Figure 5 gives an overview of the Tailings Discharge System and Table 3 lists the main equipment and its features.

Figure 11 Tailings Discharge System – Overview on System

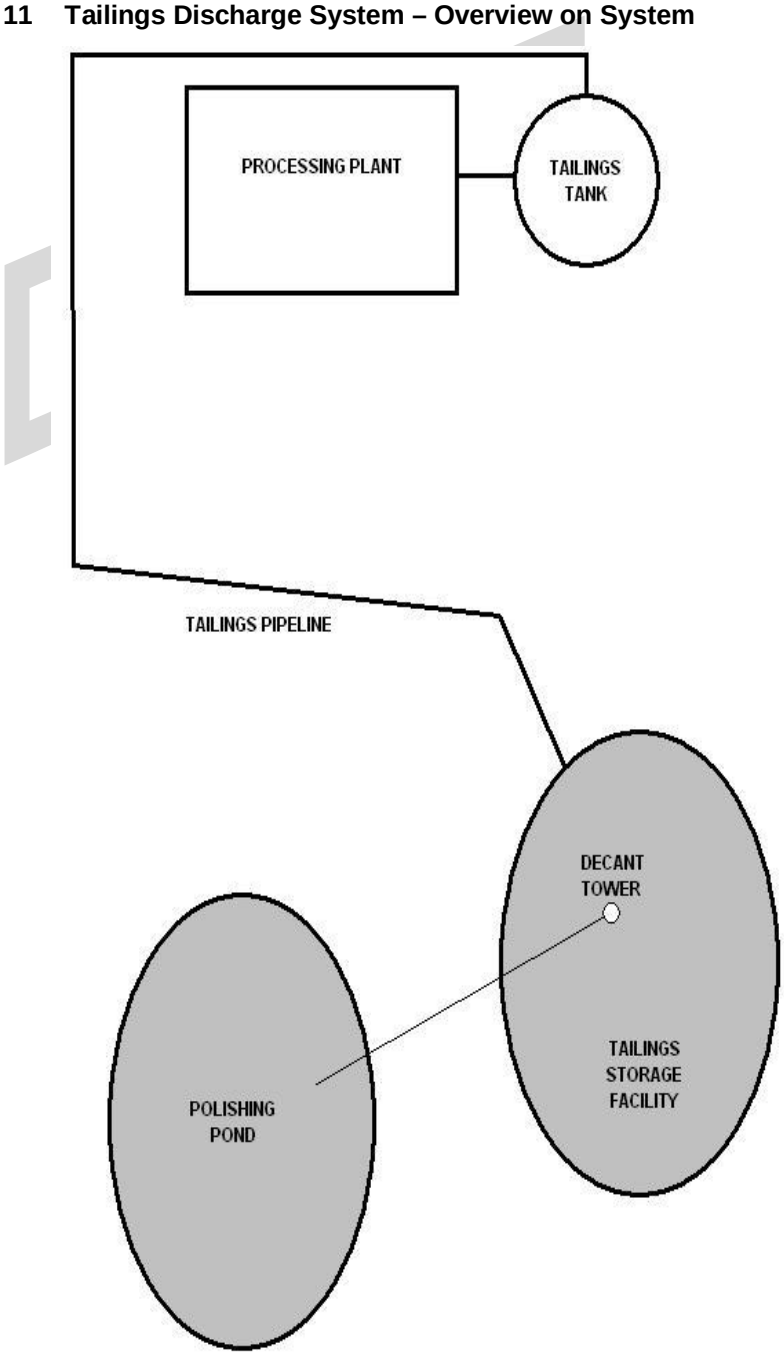


Table 6 Tailings Discharge System – Main Equipment and Features

Equipment	Features	
Tailings Pumps	Location	Processing Plant
	Purpose	Transport the tailings to TSF
	Arrangement	2 pumps in series
	Operation	manual
	Monitoring	to be confirmed
Tailings Pipeline	Location	Along haul road and other access tracks
	Product	110mm DN PE100 PN10 HDPE
	Installation	Along access road to STWRD
	Arrangement	1 km long (approx) from processing plant to TSF
	Flow rate	65m3/s
	Monitoring	to be confirmed
Tailings discharge	Location	Along dam wall
	Product	8mm minus
	Operation	manually move discharge as required

5.4 Tailings Discharge Management Plan

The present operation plan has been designed based on the available data, which will be reviewed once the operations system is completed and commissioned. Refer to Appendix G for figures relating to Tailings Management.

» **PHASE 1 -START UP TAILINGS DISCHARGE : TSF Crest RL216m**

The intention of discharge during this period is to ensure that the tailings are deposited sub-aqueous and maintained under water filling the rock borrow extents.

The following method is proposed;

» Lay the tailings pipe along the dam wall to the eastern end to the furthest extent of rock borrow.

» Extend single point end discharge down the batter to allow sub-aqueous discharge at any time.

» Discharge from adequate location to target the lowest point of the borrow.

» Change the discharge point along dam crest progressively toward north end to fill the rock borrow and maintain a decant pond over the discharged tailings.

» Discharge from decant tower will occur once pond has reached RL212.6m

» Decant water can be pumped to Polishing Pond if required for water recycle below minimum decant invert.

PHASE 2 ESTABLISH ROUTINE TAILINGS MANAGEMENT

The intention of discharge during this period is to dispose the tailings along the full embankment. Commission the Stage 1 decant tower that will be operated to maintain a pond over the full reservoir and allow freeboard to cope with the design flood. Refer to the water management section for the water management requirements.

The following works are proposed:

» Sequence the discharge over the full embankment wall progressively relocating the discharge point working from eastern dam wall to the northern end.

» Lay the pipe down the batter to allow sub-aquaeous discharge at any time.

» Change outlet points regularly with a minimum weekly trial to be undertaken.

» Stage 2 decant tower is to be constructed in this period

PHASE 3 TRANSITION FROM TSF EMBANKMENT STAGE 1 TO STAGE 2 Crest to RL220m

The routine tailings management proposed above should be established prior to the lift of the embankment to Stage 2 and maintained during the period when the embankment is lifted. Stage 2 construction requires construction over the Stage 1 crest using low/high NAG rock, therefore the following tailings discharge and construction sequence must be maintained to continually operate TSF during raising.

The following works are proposed:

» Prior to the commencement of the lift of the embankment, discharge the tailings from the eastern end of the embankment to initiate the sequence below.

» Sequence the lift of the embankment with the tailings discharge progressing the construction and discharge from the eastern end of the embankment to the northern end.

» At the completion of the embankment lift at the northern end, progressively relocate the tailings discharge point towards the eastern end of the embankment and continue the established routine tailings management.

» Lay the pipe further down the batter of the raised embankment to allow sub-aqueous discharge at any time.

» Change outlet points regularly with a minimum weekly.

PHASE 4 TRANSITION FROM TSF EMBANKMENT STAGE 2 TO STAGE 3 Crest to RL230m

Above RL220m it is proposed to begin forming an exposed tailings beach at which point to upstream construction will be adopted. Tailings discharge may be changed from single end point to multiple point spiggoting with sub aerial discharge. The water cover will be reduced and the decant pond will be concentrated.

Note that a feasibility study will be required prior to upstream lift construction and he OMS manual will be reviewed and updated.

The following works are proposed:

» Prior to the commencement of the lift of the embankment, discharge the tailings from the eastern end of the embankment to initiate the sequence below.

» Sequence the lift of the embankment with the tailings discharge progressing the construction and discharge from the eastern end of the embankment to the northern end.

» At the completion of the embankment lift at the northern end, progressively relocate the tailings discharge point towards the eastern end of the embankment and continue the established routine tailings management.

» Change outlet points regularly with a minimum weekly.

PHASE 5 TRANSITION FROM TSF EMBANKMENT STAGE 3 TO STAGE 4 Crest to RL240m

Repeat process as outlined above.

PHASE 6 TRANSITION FROM TSF EMBANKMENT STAGE 4 TO STAGE 5 Crest to RL250m

Repeat process as outlined above.

5.5 Tailings Discharge and Earthworks Management

To facilitate the transition of continuous construction, the downstream batter of Stage 2 embankment should be constructed up to the elevation of Stage 1 embankment over the full length of the embankment.

The earthworks to bring the dam wall elevation to the designed Stage 2 elevation shall then be sequenced with the tailings discharge as proposed above.

Tailings will be initially discharged from the eastern abutment, and gradually retracted towards the northern abutment as the level of tailings increases, it is estimated the discharge point should be moved weekly.

High NAG waste rock will be placed, from the upstream crest, onto the tailings beach to prepare for upstream construction. Upstream construction will commence at the eastern abutment whilst tailings are being discharged towards the northern abutment, such that discharging of tailings is not interrupted. Once discharge has reached the northern end, tailing discharge will recommence at the eastern abutment from the beach level and begin covering the older tailings. This process will be repeated as upstream lifts are constructed. Note that a feasibility study will be required prior to upstream lift construction and he OMS manual will be reviewed and updated.Stripped material from the TSF is to be stockpiled for use in rehabilitation works on the TSF embankment. Any potential sources for clay identified during stripping are to be removed for capping purposed.

6. Waste Rock Disposal

While operating the TSF, a long term waste rock storage and disposal will be implemented forming the downstream batter of the TSF. The waste rock will be continually disposed and compacted to form the downstream batter and upstream construction pad for the future stages of the TSF.

6.1 Waste Rock Characterisation

A comprehensive study of the different rock types on site was undertaken to define the potential of acid generating of the material. The SEMF report "Comstock Mine Visual Waste Rock Characterisation Manual" 2006 defines 6No. different rock types and some typical testing procedures for classification of acid producing potential.

6.2 Waste Rock on Site Classification

The intention of the on site classification is to define the potential acid drainage of the waste material to implement a environmental friendly disposal encapsulating the acid generating material into the batter.

It is essential that the operators excavating the rock and constructing the TSF with the waste rock to be familiar with the WRC Manual.

A continued program of Acid Drainage (AD) testing will be implemented to classify the waste material. The proposed program is described in the GHD report "Waste Rock Disposal Management Program" 2007.

6.3 Waste Rock Disposal Requirements

The waste rock disposal shall be undertaken to comply with the following requirements:

- Hard and high NAG (Net Acid Generating) material to be encapsulated into the embankment to limit the risk of acidic seepage.
- Soft and low NAG to be placed over the downstream batter.
- Clay layer of adequate thickness to be placed over the soft and low NAG waste material if the latter material does not have an adequate permeability to limit the infiltration.

7. Water Management

7.1 Water Management Plan

7.1.1 Water Management Plan

The proposed water management plan for the site is outlined below for further details the Water Management Report for the site is attached in Appendix G;

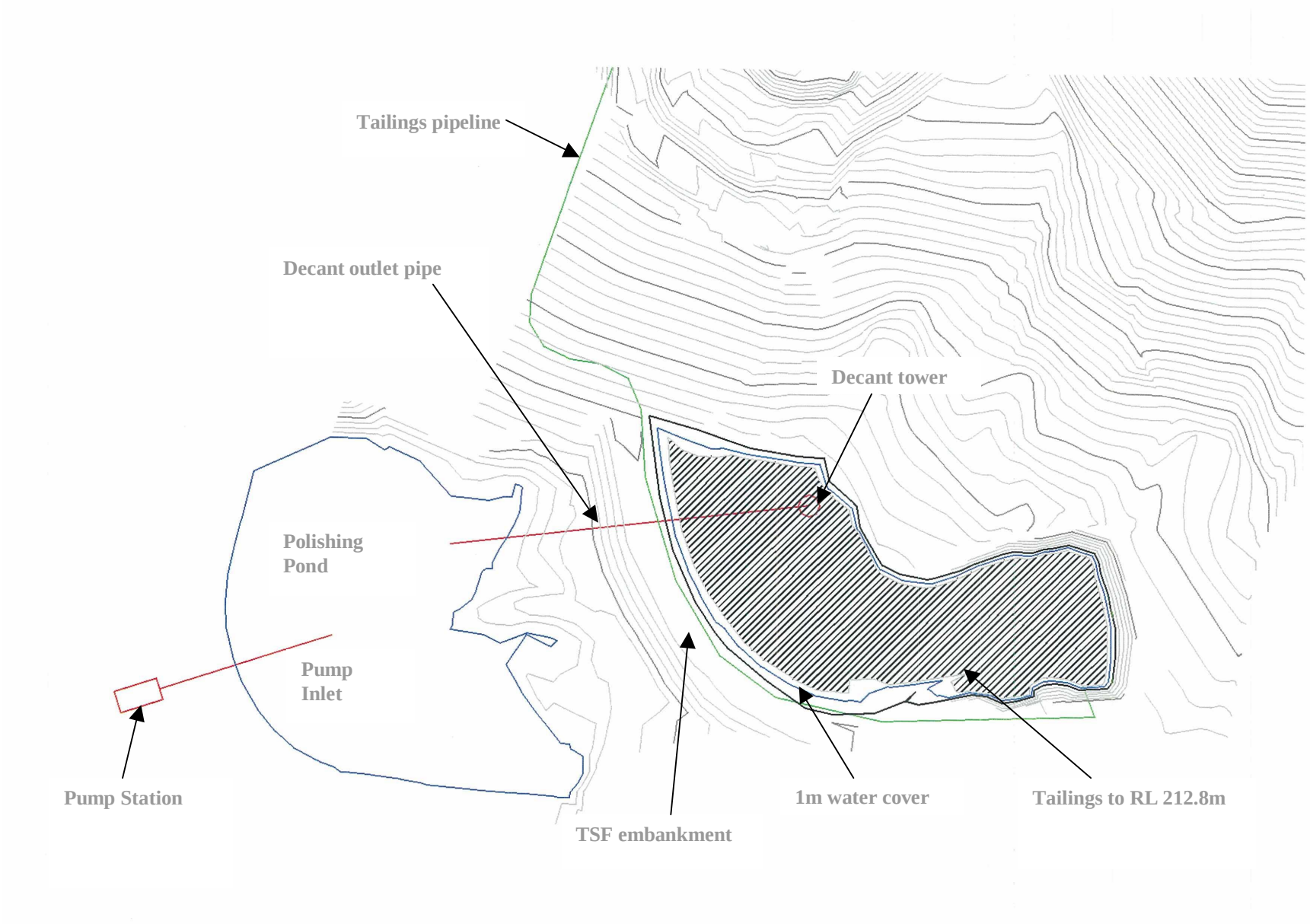
- Three sources for process water are available;
    - Clearwater Dam (fed by Settling Pond)
    - Polishing Pond (fed by catchment and TSF decant water)
    - Adit (treated and diverted to the (Polishing Pond)
- 6No. Header Tanks above the mill contain approximately 1hr of process water supply and feed process water to mill by gravity.
- Header Tanks are filled from Clear Water Dam and Polishing Pond.
- Priority water supply nominated as the Clear Water Dam as pump head is less than the Polishing Pond.
- Water levels are maintained by using electrically driven pumps. The pumps are controlled via respective level sensing devices and control systems

7.1.2 TSF Water Management Requirements

The water management shall be undertaken to comply with the following requirements:

- Have the storage capacity to contain the inflows during a 72 hr 1 in 1,000 AEP storm event (6.5ML).
- Maintain 0.6 m freeboard below the invert of the spillway.
- Above freeboard requirements equates to 1.2m of total freeboard required in pond up to filling of Stage 1 to RL215m.
- A minimum 1.0m water cover is to be maintained over the tailings until tailings are proved to be NAF (Non Acid Forming) and approval is given to once expose tailings.

Figure 12 Water Management – TSF and Polishing Pond Stage 1



7.2 Water Management System

Figure 7 gives an overview of the Water Management System and Table 10 lists the main equipment and its features.

Figure 13 Water Management – Overview on System

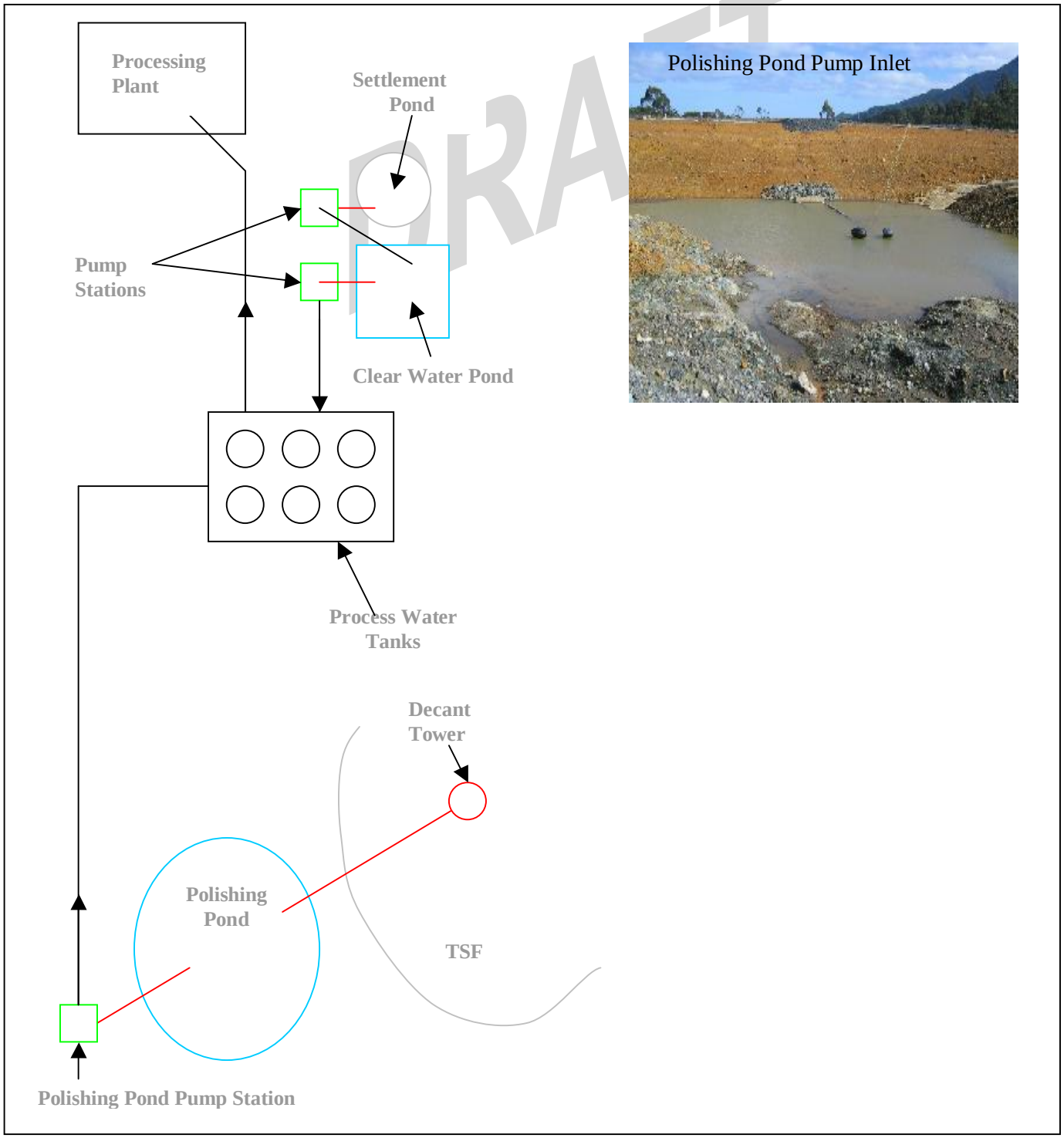


Table 7 Water Management – Main Equipment and Features

Equipment	Features	
TSF Decant Tower	Location	North eastern side of TSF
	Arrangement	1050 mm ND Class 2 RC Flush joint pipes coupled to 225mm DN PE100 PN10 outlet pipe
	Flow rate	130 l/s
	Operation	To maintain a specific water cover. Refer to water management plan, Section 7.1.
	Control	Manual
Polishing Pond Pumps	Location	Downstream toe of Polishing Pond
	Arrangement	2 in series
	Flow Rate	65 l/s
	Operation	Supply water to Process Water Tanks
	Control	To be confirmed
Settlement and Clear Water Pond Pumps	Location	South east corner of settlement pond
	Arrangement	2 duty standby
	Flow rate	65 l/s
	Operation	Operating when level in dam is sufficient
	Control	To be confirmed

7.3 Water Management Operations

7.4 Operating Procedure

7.4.1 Supply Header Tanks

» Water level in the supply header tanks is to be maintained between the low and high limits by pumping water from either the Clearwater Dam or the Polishing Pond.

» A low level signal from the header tanks will start pumping to the tanks and initiate low level indication in the site control room.

» A high level signal from the header tanks will stop pumping to the tanks and initiate high level indication in the site control room.

» Pumping from the Clearwater Dam is the primary means of filling the header tanks.

» Low Clearwater Dam level, or a Clearwater pond pump fault, will inhibit the respective pump from operating and initiate a start on the Polishing Pond pump.

» Once the Polishing Pond pump has been started, it will complete one cycle of pumping the header tank to high level. Pumping to the header tank reverts back to the Clearwater Dam pump at the completion of one cycle, subject to the availability of a Clearwater Dam pump.

» Header tank level indication will be provided locally and in the site control room.

» Duty and standby pumps are fitted for each pumping operation, changeover from duty to standby pumps is controlled locally at the switchboard.

» Running and fault indication for each pump will be provided locally and in the site control room.

7.4.2 Settling Pond Pump Station

» Water level in the Clearwater Dam is to be maintained between the low and high limits by pumping water from the Settling Pond.

» A low level signal from the Clearwater Dam will start pumping from the settling pond, and initiate low level indication locally and in the site control room.

» A high level signal from the Clearwater Dam will stop pumping from the settling pond, and initiate high level indication locally and in the site control room.

» Duty and standby pumps are fitted for each pumping operation, changeover from duty to standby pump is controlled locally at the switchboard.

» Each pump will have running indication, locally and in the site control room.

» Each pump will have a discharge flow switch, to indicate low discharge flow rate. Low discharge flow rate will stop and inhibit the respective pump operation, initiate local indication and the control room alarm.

» An electrically actuated valve is installed in the settling pond pump station to allow back filling of the Clearwater Dam from the header tanks.

» The valve will be operated remotely from the site control room or locally at the pump station switchboard. Valve operation is manually initiated and will be inhibited when a Clearwater Dam pump is running.

» Valve position will be indicated on the plant control system, in the site control room and locally on the valve.

7.4.3 Polishing Pond

» Polishing Pond pump operation will be determined by supply header tank level and Clearwater pump performance as detailed above.

» Two pumps will be run in series as a pair to form the duty pump set, and two pumps will run in series as a pair to form the standby pump set.

» Changeover from duty to standby pump is controlled locally at the switchboard.

» Each pump will be fitted with soft starters and a delayed starting sequence will be used to further limit load during starting.

» Each pump will have running indication, locally and in the control room.

» Each pump will have thermal overload protection. Thermal overload will stop and inhibit the respective pump operation, initiate local indication and the control room alarm.

» The pump station will be fitted with a Magflowmeter to monitor discharge flow rate. Low flow rate will stop and inhibit the respective pump set, initiate local indication and the control room alarm.

» Low Polishing Pond level will stop and inhibit pump operation, initiate local indication and the control room alarm.

7.5 Water Quality

Initial operations to control water quality are by manual liquid caustic soda dosing. Water quality requirements set are +/-1 pH unit of water upstream of the mine.

Further information on the water quality will be available after commissioning of the TSF. The manual shall then be reviewed and updated.

7.5.1 Adit Caustic Dosing Systems

The adit from the historical underground works discharge water at a low pH level.

A manual caustic soda dosing system is used to control pH with a specified dosing requirements dependant on the flow measured from the adit V-Notch weir. The dosing system will maintain a level of pH lower than 5, at the weir discharge.

7.5.2 Tailings Caustic Dosing Systems

Water quality in the TSF will initially be controlled via a manual caustic soda dosing system at the tailings tanks. Caustic soda is introduced to the tailings tanks under a

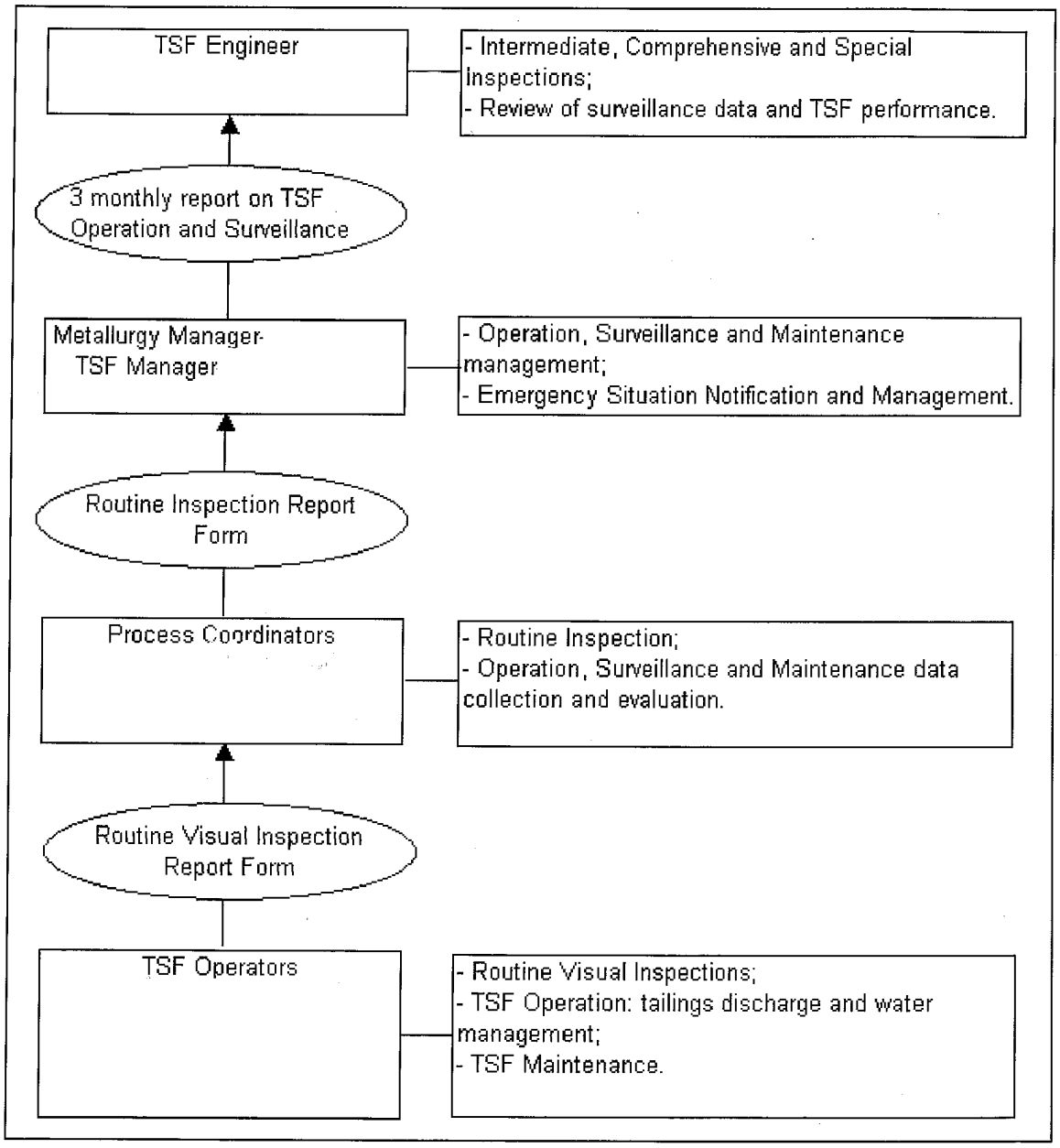
gravity fed line. Dosing requirements are to be adjusted according to pH monitoring twice daily at the TSF to meet pH control requirements.

8. TSF Surveillance

8.1 TSF Surveillance Management Structure

Figure 15 shows Zeehan Zinc Limited organisation chart focused on the TSF surveillance.

Figure 14 TSF Surveillance Management Chart



8.2 Operator's Surveillance Program

8.2.1 Routine Visual Inspection

The operators at Zeehan Zinc Mine carry out Routine Visual Inspection **daily** on the TSF. The purpose of this inspection is to GATHER and RECORD FACTS that may have an IMPACT ON the SAFETY and PERFORMANCE of the facility. The frequency of the operators surveillance is daily due continual waste rock placement in TSF.

The actions to be undertaken during the Routine Visual Inspection are detailed in Table 14.

Table 8 Routine Visual Inspections

	Action	Resource
Operation	Operate Tailings Pumps and spigots. Operate decant and water pumps. Observe waste rock placement.	Tailings Discharge and Water Management Plans, Sections 5.1 and 6.1.
Surveillance	Identify and report any deficiencies by visual observation of the embankment as part of the duties at the TSF. Prevent any environmental issues.	Routine Visual Inspection Form, Section 8.
Maintenance	Action, monitor and report to the TSF Safety Coordinator the appropriate maintenance action.	TSF Specific Maintenance, Section 8.
Emergency Response	Identify and respond to any observed deficiency requiring emergency response by implementing the appropriate procedure.	Notification Procedures, Section 4.3; Emergency Response Procedures, Section 4.4.

8.2.2 Routine Visual Inspection Report Form

A Routine Visual Inspection Report Form has been developed for TSF (including Polishing Pond) and presented in Figure 16 (also attached in Appendix E – Section E2).

The operator must have a good understanding of the Routine Visual Inspection Report Form operator to perform an efficient inspection and surveillance reporting. **The operator must** also be familiar with the safety issues and operation performance to report **any observation judged relevant concerning the safety and performance of the facility** (and would not be covered by the Inspection Report Form).

Figure 15 Routine Visual Inspection Report Form

OCEANIA TASMANIA
ZEEHAN ZINC MINE
ROUTINE VISUAL INSPECTION REPORT FORM
TSF

Date : _____ Checked : _____ (by supervisor)

Inspection
Name : _____
Time : _____
Weather : _____

TAILINGS	[Section 5 of OMS Manual]		
Delivery Line	Tailings pipeline condition	leaking ☐ blocked ☐	OK ☐ Actioned ☐
	Tailings pipeline flow rate	@ pumps ☐	OK ☐ Actioned ☐
		@ TSF ☐	OK ☐ Actioned ☐
Operating Sub-Aqueous Outlets	Satisfactory outflow	Yes ☐ No ☐	OK ☐ Actioned ☐
	Line condition	leaking ☐ blocked ☐	OK ☐ Actioned ☐
TSF EMBANKMENT	[Section 8.1 of OMS Manual]		
Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐		OK ☐ Actioned ☐
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐		
	sink hole ☐		OK ☐ Actioned ☐
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐		
	dry ☐ damp ☐ wet areas ☐		OK ☐ Actioned ☐
Decant Tower	Flowing	Yes ☐ No ☐	
		clear ☐ blocked ☐	OK ☐ Actioned ☐
WATER MANAGEMENT	[Section 6 of OMS Manual]		
TSF	Is minimum 1m water cover maintained?	Yes ☐ No ☐	OK ☐ Actioned ☐
	Water level ☐		
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐		OK ☐ Actioned ☐
Polishing Pond	Water level ☐		
	Water Quality	good ☐ bad ☐	OK ☐ Actioned ☐
Polishing Pond Pumps	# of pumps operating? (0, 1 or 2) ☐		OK ☐ Actioned ☐
Settlement Pond (Paul's Dam)	Water level ☐		
Clear Water Pond	Water level ☐		
Flow from Settlement Pond to Clear Water Pond			
	# of pumps operating? (0, 1 or 2) ☐		OK ☐ Actioned ☐
	Flowmeter reading ☐		OK ☐ Actioned ☐

Comments / Sketches / Further Observations

8.2.3 Maintenance Tasks and Reporting

Routine Maintenance

Routine scheduled maintenance tasks at a dam play a major role in ensuring the dam remains operating in a safe condition. The routine maintenance includes:

» Mowing and general minor repairs;

» Weed and/or re-growth management;

» Maintenance of electrical and mechanical equipment and systems (eg. servicing pumps and stand-by generator);

» Maintenance of monitoring equipment;

» Testing monitoring equipment and alarms;

» Testing security equipment;

» Testing communication equipment.

TSF Embankment Maintenance

Earthfill dam requires maintenance work directed at controlling seepage and erosion, in order to prevent deterioration of the structure and development of seepage paths.

The maintenance program for the TSF may include regular management of the issues presented in Table 15 in Section 9.1. It should be performed on the TSF, the polishing pond and the clearwater dam.

Maintenance Report List

All maintenance tasks should be recorded in the Maintenance Report List. All maintenance tasks should be adequately responded to and remedied, with assessment of why the incident occurred and future prevention of.

A maintenance Report List is attached in Appendix E - Section E3. This list has to be updated according to manual control and update procedure (Appendix A-Section 2).

8.3 Process Coordinator's Surveillance Program

8.3.1 Routine Inspection Goals and Actions

The Process Coordinator at Zeehan Zinc Mine carries out Routine Inspection **every week** on the TSF. The purpose of this inspection is to ASSESS THE STATUS of the TSF and its features in terms of its structural and operational SAFETY and PERFORMANCE.

The actions to be undertaken during the Routine Inspection are detailed in Table 15.

Table 9 Routine Inspection Goal and Actions

	Action	Resource
Operation	Evaluate and report the tailings discharge and water management plans performance with the tailings beach development and decant pond formation.	Tailings Discharge and Water Management Plans, Sections 5.1 and 6.1.
Surveillance	Identify and report any deficiencies, by structured observation of the TSF and surrounds, with recommendations for corrective actions.	Routine Inspection Form, Section 8
	Prevent any environmental issues.	
Maintenance	Inspect maintenance actions undertaken during the last month and evaluate TSF and equipment status.	Maintenance Report List, Section 8.2.3.
Emergency Response	Analyse incident data and evaluate on the surveillance and maintenance management performance.	Incident Report List, Appendix B – Section B3.

8.3.2 Routine Inspection Report Form

A Routine Inspection Report Form has been developed for the TSF (including Water Ponds), and is presented in Figure 17 (also attached in Appendix E – Section E1). **The Process Coordinator must** have a good understanding of the Routine Inspection Report Form to perform an efficient inspection and surveillance reporting.

Figure 16 Routine Inspection Report Form – TSF

OCEANIA TASMANIA
ZEEHAN ZINC MINE
ROUTINE INSPECTION REPORT FORM
TSF

Date : _____ Checked : _____ (by supervisor)

Inspection
Name : _____
Time : _____
Weather : _____

SUMMARY OF REQUIRED ACTIONS

Items requiring more detailed monitoring?	Yes ☐ No ☐ _____	Actioned ☐	_____
Maintenance required?	Yes ☐ No ☐ _____	Actioned ☐	_____
Inspection required by more senior personnel?	Yes ☐ No ☐ _____	Actioned ☐	_____
	Urgent ☐ Not urgent ☐ [If urgent contact (NAME) (NUMBER) or (NAME) (NUMBER)]		
Specialist advice required?	Yes ☐ No ☐ _____	Actioned ☐	_____

TAILINGS	[Section 5 of OMS Manual]		
Delivery Line	Tailings pipeline condition leaking ☐ blocked ☐	OK ☐ Actioned ☐	_____
	_____		_____
	Tailings pipeline flow rate @ pumps ☐	OK ☐ Actioned ☐	_____
	@ TSF ☐	OK ☐ Actioned ☐	_____
Water Level in TSF 1m above Tailings?	Yes ☐ No ☐	OK ☐ Actioned ☐	_____
	Water level ☐		
Operating Sub-Aqueous Outlets	Satisfactory outflow Yes ☐ No ☐	OK ☐ Actioned ☐	_____
	Line condition leaking ☐ blocked ☐	OK ☐ Actioned ☐	_____
TSF EMBANKMENT	[Section 8.1 of OMS Manual]		
Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐	OK ☐ Actioned ☐	_____
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐		
	sink hole ☐	OK ☐ Actioned ☐	_____
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐		
	dry ☐ damp ☐ wet areas ☐	OK ☐ Actioned ☐	_____
Downstream Toe	dry ☐ damp ☐ wet areas ☐ water boil ☐		
	water: clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
WATER MANAGEMENT	[Section 6 of OMS Manual]		
Decant Tower	Condition good ☐ damaged ☐ blocked ☐	OK ☐ Actioned ☐	_____
TSF	Water level ☐		
	Is there enough storage capacity (water quality, flood event) ?	Yes ☐ No ☐	
		OK ☐ Actioned ☐	_____
	Is minimum 1m water cover over tailings maintained?	Yes ☐ No ☐	
		OK ☐ Actioned ☐	_____
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐	OK ☐ Actioned ☐	_____
Polishing Pond	Water level ☐		
	V-Notch Weir Reading ☐ mm (ruler)		
	clear ☐ blocked ☐ water clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐	OK ☐ Actioned ☐	_____
Historic ADIT	V-Notch Weir Reading ☐ mm (ruler)		
	clear ☐ blocked ☐ water clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
Caustic Dosage System	Dosage Rate ☐ l/hr		
	Caustic bulka- box level above 20% ? Yes ☐ No ☐	OK ☐ Actioned ☐	_____
Settlement Pond	Water level ☐		
Clear Water Pond	Water level ☐		
Settlement Pond and Clear Water Ponds Pumps			
	Pumps operating ? Yes ☐ No ☐	OK ☐ Actioned ☐	_____

8.4 Metallurgy Manager - 3 monthly Surveillance Report

The 3 monthly Surveillance Report is written by the TSF Safety Coordinator to be forward to the TSF Engineer. The objective is to conclude on the TSF Operation Maintenance and Surveillance management.

The report should documents the following:

» Tailings Discharge and Water Management performance with the development of the tailings beach and decant pond and the water quality. Photographic and statistical summaries of relevant observations during the inspections should be produced.

» Surveillance and Maintenance Management performance with statistics on incidents and maintenance tasks, and review of the safety status of the TSF.

Consulting the report, the TSF Engineer could advise the review of the following:

» Tailings Discharge Management Plan Section 5.1,

» Water Management Plan Section 7.1,

» Surveillance and Maintenance Program Sections 8 and 9.

8.5 Polishing Pond Surveillance

8.5.1 Routine Inspection Goals and Actions

The Environmental Technician at Zeehan Zinc Mine carries out Routine Inspection **every week** on the Polishing Pond. The purpose of this inspection is to ASSESS THE STATUS of the embankment and its features in terms of its structural SAFETY.

The actions to be undertaken during the Routine Inspection are detailed in Table 16.

Table 10 Routine Inspection Goal and Actions

	Action	Resource
Surveillance	Identify and report any deficiencies, by structured observation of the embankment and surrounds, with recommendations for corrective actions. Prevent any environmental issues.	Routine Inspection Form, Section 7.5.2.
Maintenance	Inspect maintenance actions undertaken during the last month and evaluate equipment status.	Maintenance Report List, Section 7.2.3.
Emergency Response	Analyse incident data and evaluate on the surveillance and maintenance management performance.	Incident Report List, Appendix B – Section B3

8.5.2 Routine Inspection Report Form

A Routine Inspection Report Form has been developed for the Polishing Pond (including Water Ponds), and is presented in Figure 17 (also attached in Appendix E – Section E1). **The Process Coordinator must** have a good understanding of the Routine Inspection Report Form to perform an efficient inspection and surveillance reporting.

Figure 17 Routine Inspection Report Form – Polishing Pond

OCEANIA TASMANIA Date : _____ Checked : _____

ZEEHAN ZINC MINE (by supervisor)

ROUTINE INSPECTION REPORT FORM **Inspection**

POLISHING POND Name : _____

Time : _____

Weather : _____

SUMMARY OF REQUIRED ACTIONS

Items requiring more detailed monitoring?	Yes ☐ No ☐ _____	Actioned ☐	_____
Maintenance required?	Yes ☐ No ☐ _____	Actioned ☐	_____
Inspection required by more senior personnel?	Yes ☐ No ☐ _____	Actioned ☐	_____
	Urgent ☐ Not urgent ☐ [If urgent contact (NAME) (NUMBER) or (NAME) (NUMBER)]		
Specialist advice required?	Yes ☐ No ☐ _____	Actioned ☐	_____
	_____		_____

POLISHING POND EMBANKMENT [Section 8.1 of OMS Manual]

Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐	OK ☐ Actioned ☐	_____
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐		
	sink hole ☐	OK ☐ Actioned ☐	_____
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐		
	dry ☐ damp ☐ wet areas ☐	OK ☐ Actioned ☐	_____
Downstream Toe	dry ☐ damp ☐ wet areas ☐ water boil ☐		
	water: clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
Spillway	obstructions ☐ discharge ☐ erosion ☐	OK ☐ Actioned ☐	_____
V-Notch Weir	Reading ☐ mm (ruler)		
Weir clear ? (Y/N)	☐	OK ☐ Actioned ☐	_____
Water sample ? (Y/N)	☐	OK ☐ Actioned ☐	_____
Water clear ? (Y/N)	☐	OK ☐ Actioned ☐	_____
Water Level in Polishing Pond	☐		

Comments / Sketches / Further Observations

8.6 TSF and Polishing Pond Instrumentation

The following tables list the TSF and Polishing Pond instrumentation equipment.

Table 11 TSF Tailings Discharge Instrumentation

Instrument	Location	Purpose	Frequency
Level indicator	Above Tails Tank	Monitor the level in the Tank	Continuous SCADA audible alarm
Tailings Pipeline	Adjacent SWRD access road	Monitor for leaks	Daily
Caustic Dosing	Tails Tank	Check for leaks, and level in caustic bulkabox.	Daily
Caustic Dosing	Adit	Check for leaks, and level in caustic bulkabox.	Daily

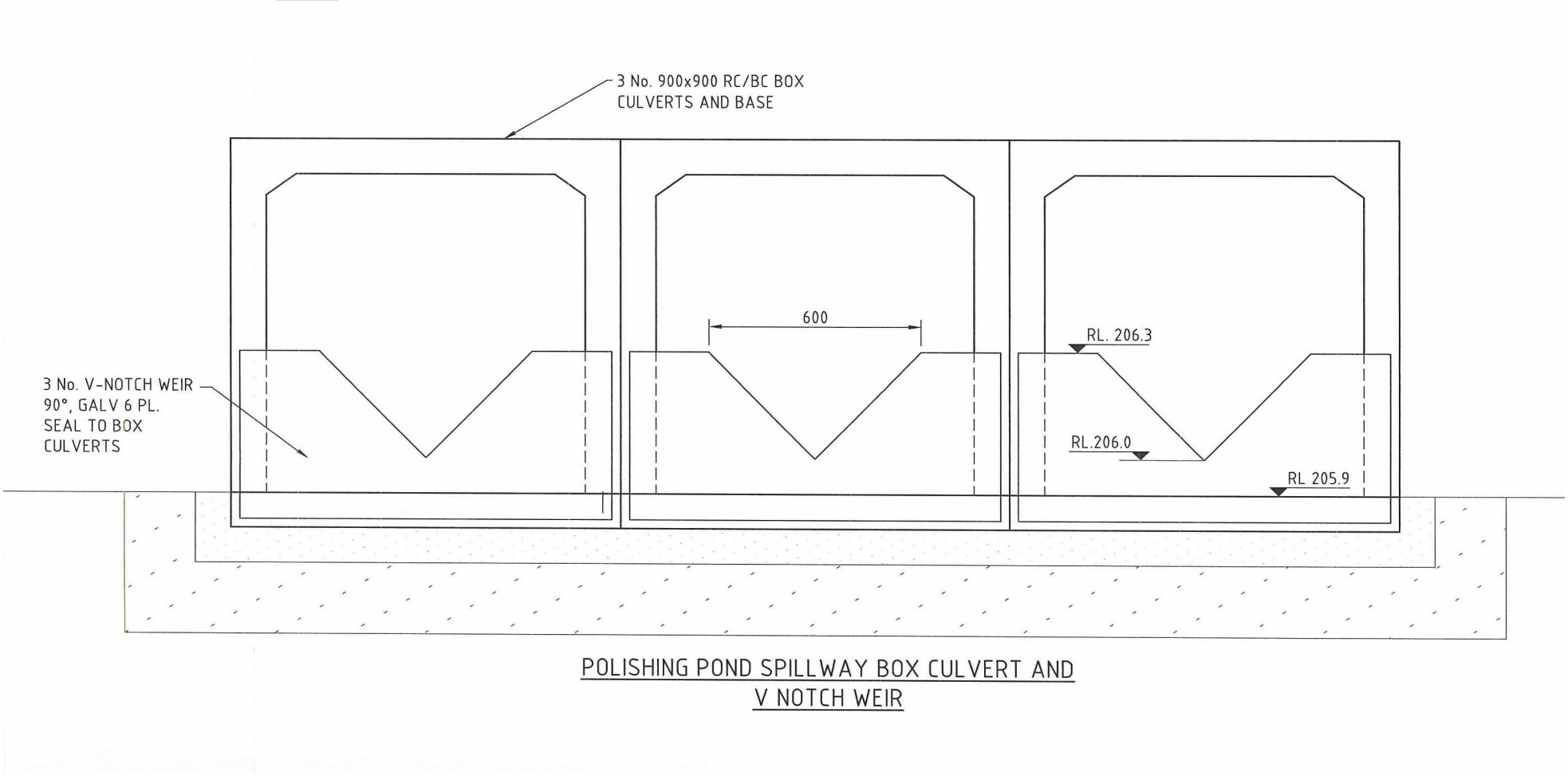
Table 12 TSF Water Management Instrumentation

Instrument	Location	Purpose	Frequency
Water level sensors	Header tanks	Monitor the level in the water Tanks and control PP, CW pumps.	Weekly (Routine Visual Inspection)

Table 13 Polishing Pond Embankment Instrumentation

Instrument	Location	Purpose	Frequency
V-Notch weir	As shown on Figure 20	Monitor the quantity of seepage overflowing the V-notch weir	Monthly (Routine Inspection)

Figure 18 Polishing Pond V-Notch Weirs



9. Maintenance

Maintenance

Maintenance should be regularly performed. When minor problems are identified during an inspection, they should be dealt with as quickly as possible to avoid any complications. Therefore, it is essential that all personnel working at the TSF should maintain visual awareness of the facility in the course of their normal duties.

Embankment maintenance is detailed in Table 22, Section 8.1.

This section initiates a maintenance database, which should be kept itemising all equipment onsite, make and model, estimated operating life, date of installation, maintenance and predicted change out date. This database may also be used to provide comments on suitability of equipment i.e. comments on rate of wear and usability

All dam, delivery system, decant system and electrical and instrument equipment maintenance should be recorded in the maintenance database.

All maintenance issues identified onsite should be remediated as soon as possible.

9.1 Embankment Maintenance

Earthfill embankment requires maintenance work directed at controlling seepage and erosion, in order to prevent deterioration of the structure and development of seepage paths.

The maintenance program for the TSF may include regular management of the issues presented in Table 21. It should be performed on the TSF, the polishing pond and the clearwater pond.

Table 14 Embankment Maintenance - Maintenance and Consulting Actions

Issues Requiring Maintenance	Maintenance Action	Consulting Action
CREST		
Ruts along crest	Re-grade and re-compact crest to original elevation with a slope towards the upstream crest edge. Provide surface resistance to rutting by adding gravel.	
Longitudinal/Transverse cracks	Excavate and backfill with compacted clay to prevent seepage. Monitor area for future movement.	
Low area	Re-grade the crest to the original design.	A TSF engineer should determine the cause and recommend method to repair and prevent reoccurrence.
Sinkhole		A TSF engineer should determine the cause and recommend method to repair.
UPSTREAM FACE		
Breaching and Scarps (erosion)	Re-grade the upstream slope to the original design grade. Provide adequate slope protection.	
Cracks and slide or slump	Cease tailings discharge and drawn down the decant pond.	A TSF engineer should determine the cause and recommend a course of action.
Sinkhole	Draw down the decant pond. Look for other sinkholes and their exit. Examine outflow for dirty water.	A TSF engineer should evaluate the situation and recommend a course of action.
DOWNSTREAM FACE		
Longitudinal Cracks	Drying cracks should be sealed.	A TSF engineer should determine the cause of the cracks and recommend a course of action.
Slump or slide	Cease tailings discharge and drawn down the decant pond.	A TSF engineer should determine the cause and recommend a course of action.

Issues Requiring Maintenance	Maintenance Action	Consulting Action
Seepage	Examine outflow for 'dirty' water (cloudy, sediments present). Advise environmental representative for chemical analysis. Monitor flow and drawn down the decant pond if seepage flows increase. Contain seepage.	A TSF engineer should assess the situation and recommend a course of action. Consult a TSF engineer immediately if flow volume increases or if dirty water is present.
Cave in/Collapse	Monitor area for change.	A TSF engineer should determine the cause and recommend a course of action.
Erosion	Re-grade slope and seed a shallow rooting vegetative cover.	
DOWNSTREAM TOE		
Seepage water from a water boil (water bubbling up from the ground)	Examine outflow for 'dirty' water (cloudy, sediments present). Monitor flow and drawn down the reservoir if seepage flows increase.	A TSF engineer should evaluate the situation and recommend a course of action. Consult a TSF engineer immediately if flow volume increases or dirty water is present.
Standing water	Provide adequate drainage to a containment area to prevent ponding. Identify seepage path.	Consult a TSF engineer immediately if flow volume increases or dirty water is present.
SPILLWAY / CHANNEL		
Eroded channel/slide	Repair with compacted fill. Provide adequate erosion protection. Re-grade the channel if necessary.	
Blocked channel	Remove the blockage. Prevent future blockage.	
Rills	Backfill with compacted material.	

9.2 Main Equipment

Table 15 lists the main equipment involved in the supply of tailings and process water.

Table 15 Main Equipment

Equipment	Features
Tailings Tanks	
Tailings Pumps	
Tailings Pipeline	HDPE PN10 PE100
Polishing Pond Pumps	2 pumps sets in series Aquaplus
Clearwater Dam Pumps	2 pumps sets duty standby Varisco

9.3 Pumps

9.3.1 Polishing Pond Pumps

Table 16 presents the main characteristics of the Polishing Pond Pumps. Maintenance inspections should be performed in accordance with the manufacturer's specifications attached in Appendix F.

Table 16 Polishing Pond Pumps Characteristics

Make	Aquaplus
Model	AQUAP80-26-S10 C/W 75kW
Manufacturer	Malcolm Thompson Pumps

Table 17 lists the main design requirements.

Table 17 Polishing Pond Pump Design Requirements

Requirement	Description
Duty	Transport TSF return water and Adit water to Header Tanks
Flow	65 l/s
Head	130m
Suction	DN150mm

9.4 Tailings Pipeline

9.4.1 Pipeline

The maintenance program for the 110DN PN10 PE100 pipeline may include regular management of the issues presented in Table 25.

Table 18 Pipeline Maintenance – Action and Frequency

Issues Requiring Maintenance	Maintenance Action	Maintenance Frequency
Rupture in pipeline at flanges	Replace section of pipe and repair flange	as required
Wear on pipeline	Plan rotation of the pipe if signs of wall thinning	2-monthly basis
Blockage in pipeline	Flushing according to procedure	after every Tank transfer of tailings dam
Scale in pipeline	Pigging	to be defined when issue encountered

Table 19 presents the design requirements of the tailings pipeline.

Table 19 Tailings Delivery Pipe Design Requirements

Requirement	Description
Flow rates	X L/sec at full production X L/sec potential short-term flow
Minimum flow velocity	X m/s
System Friction Head	
System Static Head	

9.5 Electrical and Instrumentation Equipment

9.5.1 General

Electrical equipment be completed on finalisation of plant.

9.5.2 Electrical Equipment

Table 26 lists the electrical equipment of the TSF.

Table 20 Electrical Equipment of the TSF

Equipment	Features	Maintenance
Control Panels	Mainly contains: o power supply distribution, o variable speed drive.	Keep air filter clean
Readout box		

9.6 Contamination Management

Prior to undertake each maintenance task, consideration must be given to prevention of contamination of unprotected ground. This consideration should be included in both the Job Safety and Environment Analysis (JSEA).

Appendix A

OMS Manual Complementary Information

OMS Manual Sections 1 and 2

Section A1
OMS Manual Status

Section A2
Competency and Training

Section A3
Reference Documents

Section A1

OMS Manual Status

The OMS Manual must be kept current and should be revised regularly, consistent with continual improvement and particularly after significant incidents.

OMS Manual History

This is the first issue of the OMS Manual. It covers the TSF at its Stage 1, RL 216m the OMS is a working document should be revised during Stage 2 construction and after a workshop with operation personal.

Documentation Changes

Any change or update performed on the manual should be done in accordance with the control and update policy presented below and recorded in the following table.

Table 21 OMS Manual – Documentation Change or Update

Change	Section	Name	Date

OMS Manual Control and Update

Table 22 lists the key updating tasks to be performed and the personnel in charge of them.

Table 22 OMS Manual Control and Update

Tasks	Personnel	Frequency
Distributing and filing the manual and supporting document	Zeehan Zinc Ltd	as required
Reviewing and Updating the manual	TSF Design Engineer / ZZL	annually
Removing and archiving out of date materials	TSF Design Engineer / ZZL	as required

As soon as some experience is gained in tailings discharge management, a review of this manual should be performed. Tailings characteristics have to be assessed, discharge and water management improved with the assistance of professional dam engineers.

Revisions to design during operations should follow a defined review and approval process, appropriately involving company management, site personnel and regulators. The review and approval process involves:

1. Identification of the need for change either by management, operator, inspector or TSF Design Engineer;
2. Review of proposed change by ZZL;
3. Review of proposed change by TSF Design Engineer;
4. Implementation into OMS Manual; and
5. Communicate to all Operators and designated personnel and train where necessary.

If the proposed change will not affect the operation and performance of the TSF, then Step 3 may be removed from the review process.

Table 23 identifies the main changes that could occur, which would require review, update and improvement of the OMS Manual:

Table 23 OMS Manual Revisions

Revision	Responsible Personnel
Incorporation of as-built records of construction	TSF Design Engineer
Variation of performance from design	TSF Design Engineer
Changes in site management organisation, facility description, roles and responsibilities, and operating and reporting procedures	ZZL
Suggestions for improvement (best practice)	TSF Design Engineer
Regulatory change	ZZL

Section A2

Competency and Training

It is essential for the integrity of operations that the facility management structure and individual roles, responsibilities and required competencies of personnel be clearly defined and that the personnel have an appropriate understanding of their respective roles and responsibilities.

Scope of Training

ZZL is to provide appropriate training to ensure that all personnel working at the facility, including contractors and suppliers, understand the following:

» the OMS Manual,

» the factors that constitute sound performance of a tailing and water management facility,

» how deviations from expected performance may indicate developing problems.

Refresher training is to be undertaken annually.

Specific Operator Training

Training for operators of the ZZL TSF should include the following information:

» Roles and responsibilities;

» Managing change;

» Overview of the TSF including:
  – Components;
  – Water management, water balance, management requirements;
  – Spillway;
  – Decant system;
  – Instrumentation, Switchboards and SCADA system and Alarms.

» Tailings Discharge Management including:
  – Method of discharge;
  – Phases of discharge;
  – Surveillance and performance evaluation.

» Surveillance including:
  – Responsibilities;
  – TSF Log Book;
  – Data collection and evaluation; and
  – Automated surveillance.

» Alarms:
  – Automated Alarms
  – Manual Surveillance Alarms

» Maintenance;

» Legislative and licence requirements;

» Emergency Response Procedures including:
  – Types of emergencies; and

- Level of response.

Onsite training shall also be provided to operators consisting of field instruction to the satisfaction of the trainer and ZZL, followed by a minimum of four supervised inspections including full manual readings.

Competency Assessment

The training shall include a competency assessment of all operators based on the information included in the training to identify an understanding of:

» the key components of the TSF,

» responsibilities and surveillance requirements,

» failures and emergency response, and

» demonstrate inspection requirements including:

- manual reading of all instrumentation onsite, and
- automated instrumentation.

The training should be undertaken by personnel experienced in the management of the ZZL TSF and the requirements of the OMS Manual.

It is the responsibility of ZZL to determine if a trainee or operator is competent to undertake his/her role.

Competency and Training

» ZZL shall provide appropriate training to all personnel working at ZZL TSF.

» Training will include both office and field instruction.

» Training shall include a competency assessment based on the information included in the training.

Section A3

Reference Documents

Regulatory Requirements

Table 24 lists the regulatory approvals required for the TSF.

Table 24 TSF Regulatory Approvals

Approval	Reference Documents

Design References

Table 25 lists the reports that shall be used for reference on site and design details of the facility. Copies of these documents are held by Zeehan Zinc Administration.

Table 25 Design References

Report	Author	Issue date	Features

Appendix B

Emergency Planning and Response

OMS Manual Section 3

Section B1
ANCOLD Hazard Rating –TSF and Polishing Pond

Section B2
Notification Procedures and Emergency Response Procedures

Section B3
Incident Report Form and List

Section B1

ANCOLD Hazard Rating

Applicant Name	Zeehan Zinc TSF
Stream Name	Comstock Creek
Estimated Capacity at FSL	1.2Mm3 (tailings & rockfill)
Location	Comstock Mine, Zeehan

Damage and Loss	**Estimate**	**Severity Level**			
		Negligible	Minor	Medium	Major
ESTIMATED COSTS (The costs are indicative only. For future reference the costs are in 1998 values and should be					
Residential	Not expected	YES	.	.	.
Commercial	$10 000 - $1M	.	YES	.	.
Infrastructure	$10 000 - $1M	.	YES	.	.
Dam repair or replacement cost	$100 000 - $10M	.	YES	.	.
Provision of temporary services by owner	$1M - $10M	.	.	YES	.
Clean up	$1M - $10M	.	.	YES	.
Estimated cost severity level =	**MEDIUM**				
SERVICE AND BUSINESS RELATING TO THE DAM					
Importance of the system and need to replace the dam	Essential to maintain supply	.	.	.	YES
Effect on services provided by owner	Reduced services with reasonable restictions (80% of full	.	.	YES	.
Practicality of replacing the dam	No impediment	YES	.	.	.
Community resistance to replacement	Some reaction but short lived	.	YES	.	.
Effect on continuing credibility	Severe widespread reaction	.	.	YES	.
Political implications	None expected	YES	.	.	.
Impact on financial viability	Able to absorb in one financial year	.	YES	.	.
Value of water in storage (Assessed by the owner in relatio	Negligible	YES	.	.	.
Service and business damage and loss severity level =	**MAJOR**				
SOCIAL					
Loss of services to the community	None expected	YES	.	.	.
Public health adversely affected	No effect	YES	.	.	.
Cost of emergency management	<100 person days	.	YES	.	.
Dislocation of people	No effect	YES	.	.	.
Dislocation of business	No effect	YES	.	.	.
Employment affected	No jobs lost	YES	.	.	.
Production affected	Regional output affected by <10%	.	YES	.	.
Post disaster trauma and stress	None expected	YES	.	.	.
Injured and hospilised	Nil	YES	.	.	.
Loss of reservoir recreational facility	None expected	YES	.	.	.
Loss of other recreational facilities	None expected	YES	.	.	.
Social damage and loss severity level =	**MINOR**				
NATURAL ENVIRONMENT					
Area of impact	>10 km2	.	.	.	YES
Vegetation and forest damage	Minor	.	YES	.	.
Duration fo impact	1 month - 1 yr	.	YES	.	.
Significant factors	Forested land may contain environmental factors	.	YES	.	.
Ecological effects	Significant habitat may exist	.	.	YES	.
Habitat units	Major effect	.	.	.	YES
Natural environment damage and loss severity level =	**MAJOR**				
Highest damage and loss severity level =	**MAJOR**				

Population at Risk (PAR)	0	HAZARD CATEGORY =	**Significant**
PAR includes all those persons who would be directly exposed to flood waters within the dam break affected zone if they took no action to evacuate			

Note 1: With a PAR of 5 or more people, it is unlikely that the severity of damage and loss will be "Negligible"
Note 2: "Minor" damage and loss would be unlikely when the PAR exceeds 10
Note 3: "Medium" damage and loss would be unlikely when the PAR exceeds 1000
Note 4: Change to "Significant" where the potential for one life being lost is recognised
Note 5: Change to "High" where there is the potential for one or more lives being lost
Note 6: See section 2.7 and 1.6 of ANCOLD guidelines

Applicant Name	Zeehan Zinc Polishing Pond
Stream Name	Comstock Creek
Estimated Capacity at FSL	40Ml
Location	Comstock Mine, Zeehan

Damage and Loss	**Estimate**	**Severity Level**			
		Negligible	Minor	Medium	Major
ESTIMATED COSTS (The costs are indicative only. For future reference the costs are in 1998 values and should be					
Residential	Not expected	YES	.	.	.
Commercial	$10 000 - $1M	.	YES	.	.
Infrastructure	$10 000 - $1M	.	YES	.	.
Dam repair or replacement cost	$100 000 - $10M	.	YES	.	.
Provision of temporary services by owner	$10 000 - $1M	.	YES	.	.
Clean up	$10 000 - $1M	.	YES	.	.
Estimated cost severity level =	**MINOR**				
SERVICE AND BUSINESS RELATING TO THE DAM					
Importance of the system and need to replace the dam	Restrictions needed during peak days and peak hour	.	.	YES	.
Effect on services provided by owner	Services can easily be replaced	YES	.	.	.
Practicality of replacing the dam	No impediment	YES	.	.	.
Community resistance to replacement	None expected	YES	.	.	.
Effect on continuing credibility	None expected	YES	.	.	.
Political implications	None expected	YES	.	.	.
Impact on financial viability	Able to absorb in one financial year	.	YES	.	.
Value of water in storage (Assessed by the owner in relatio	Negligible	YES	.	.	.
Service and business damage and loss severity level =	**MEDIUM**				
SOCIAL					
Loss of services to the community	None expected	YES	.	.	.
Public health adversely affected	No effect	YES	.	.	.
Cost of emergency management	<100 person days	.	YES	.	.
Dislocation of people	No effect	YES	.	.	.
Dislocation of business	No effect	YES	.	.	.
Employment affected	No jobs lost	YES	.	.	.
Production affected	Regional output affected by <10%	.	YES	.	.
Post disaster trauma and stress	None expected	YES	.	.	.
Injured and hospilised	Nil	YES	.	.	.
Loss of reservoir recreational facility	None expected	YES	.	.	.
Loss of other recreational facilities	None expected	YES	.	.	.
Social damage and loss severity level =	**MINOR**				
NATURAL ENVIRONMENT					
Area of impact	0.1 km2 - 1 km2	.	YES	.	.
Vegetation and forest damage	Minor	.	YES	.	.
Duration fo impact	1 month - 1 yr	.	YES	.	.
Significant factors	Forested land may contain environmental factors	.	YES	.	.
Ecological effects	Likely to alter, say fish habitat	.	YES	.	.
Habitat units	Minro effect on weland or forest	.	YES	.	.
Natural environment damage and loss severity level =	**MINOR**				
Highest damage and loss severity level =	**MEDIUM**				

Population at Risk (PAR)	0	**HAZARD CATEGORY =** **Low**
PAR includes all those persons who would be directly exposed to flood waters within the dam break affected zone if they took no action to evacuate		

Note 1: With a PAR of 5 or more people, it is unlikely that the severity of damage and loss will be "Negligible"
Note 2: "Minor" damage and loss would be unlikely when the PAR exceeds 10
Note 3: "Medium" damage and loss would be unlikely when the PAR exceeds 1000
Note 4: Change to "Significant" where the potential for one life being lost is recognised
Note 5: Change to "High" where there is the potential for one or more lives being lost
Note 6: See section 2.7 and 1.6 of ANCOLD guidelines

Section B2

Notification Procedures and

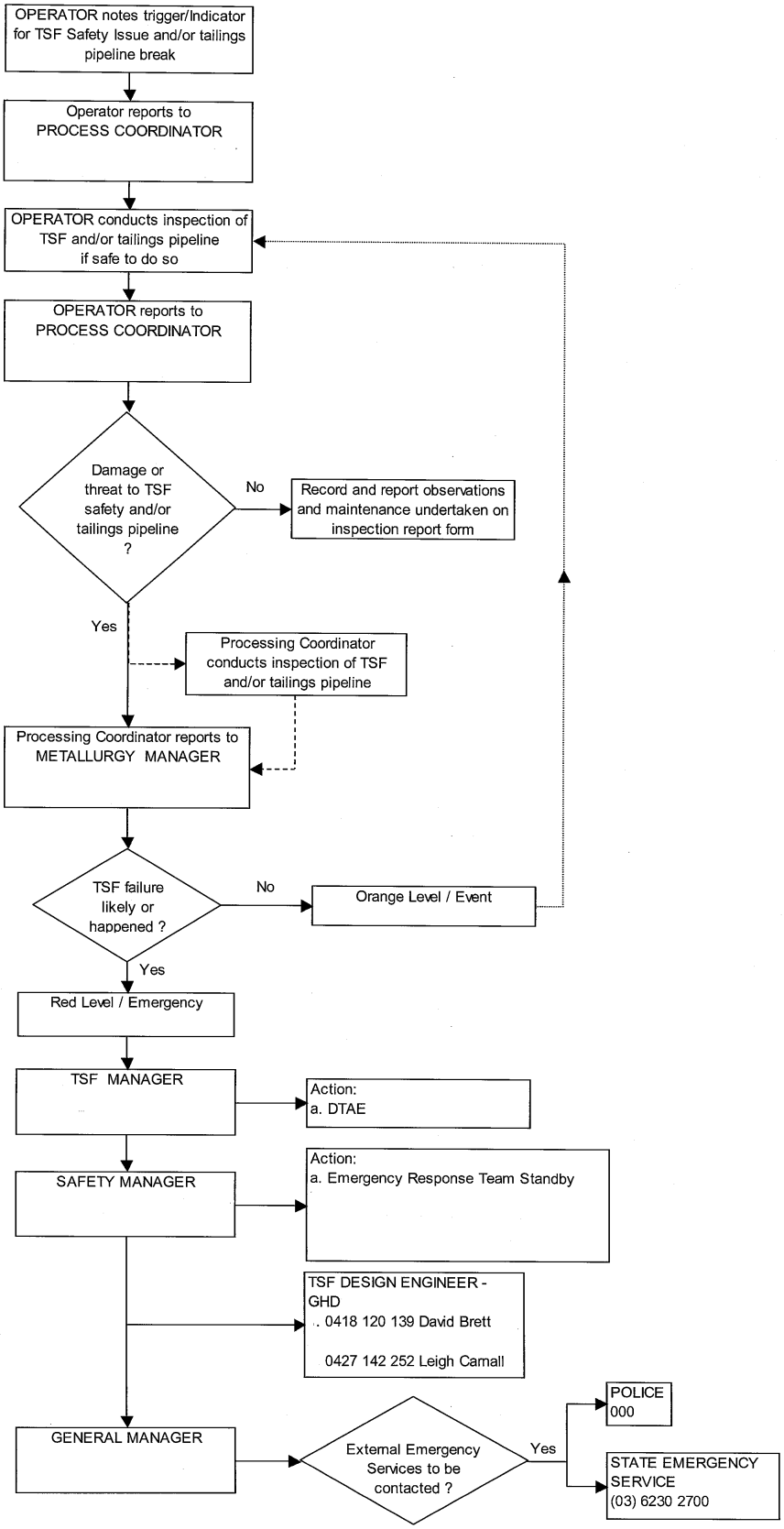
Emergency Response Procedures

OMS Manual Section 3 – Emergency Response Plan

- Emergency Notification Procedure

- Emergency Response Procedure – Pipeline
- Emergency Response Procedure – Earthquake
- Emergency Response Procedure – Flooding
- Emergency Response Procedure – Seepage

Emergency Notification Procedure



Section B3

Incident Report Form and List

Date : _____ Checked : _____
(by supervisor)

TAILINGS INCIDENT DATA FORM
Completed after any incident,
and attached to Incident Investigation Report

Incident
Date : _____
Time : _____
Reported by : _____
Incident notification : _____

** Any relevant information (photographs, incident notice or report, TSF/Environmental Engineer, DTAE) on the incident, please attach documents.*

INCIDENT DESCRIPTION

_____
_____
_____
_____

INCIDENT CONSEQUENCES

Environmental damages?	Yes ☐ No ☐	_____
Environmental damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Structural damages?	Yes ☐ No ☐	_____
Structural damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Embankment damages?	Yes ☐ No ☐	_____
Embankment damages level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Operationnal consequences	Yes ☐ No ☐	_____
Consequences level?	Low ☐ Medium ☐ High ☐ Very High ☐	_____
Operations Management Review required?	Yes ☐ No ☐ _____	Actioned ☐ _____

ACTIONS UNDERTAKEN

Maintenance performed?	Yes ☐ No ☐ Routine ☐ TSF Specific ☐	_____
Monitoring required?	Yes ☐ No ☐ _____	Actioned ☐ _____
Emergency Procedure implemented	Yes ☐ No ☐ Orange ☐ Red ☐	_____
Procedure update required?	Yes ☐ No ☐ _____	Actioned ☐ _____
TSF Engineer Consultancy involved?	Yes ☐ No ☐ Recommendations ☐ Special Inspection ☐	

REPORTING

Report to TSF Safety Coordinator?	Yes ☐ No ☐ _____	Actioned ☐ _____
Report to TSF Management?	Yes ☐ No ☐ _____	Actioned ☐ _____
Report to DPIWE?	Yes ☐ No ☐ _____	Actioned ☐ _____
Listed on Incident Report List?	Yes ☐ No ☐ _____	Actioned ☐ _____

Comments / Sketches / Further Comments

Appendix C

Tailings Discharge Management Standard Task Procedures

OMS Manual Section 5

Pre-start checks and operations of all equipment to be identified by ZZL operators and included in OMS Manual

Standard Task Procedures

for Tailings Discharge Operations

Information to be supplied by ZZL Operators.

It is important to always remember that STP's are designed to ensure your safety and the safety of others and therefore must be adhered to **at all times**. If any deviation from the set procedure is required, authorisation must be obtained from the Process Coordinator or his/her representative.

If you are not in agreement with information stated in the STP, the matter should be brought to the attention of the Training Co-ordinator and the Process Coordinator, through the completion of the **Change Request Form**.

If amendments are found to be warranted they will be made and personnel will be informed. Operating procedures are not effective unless they are up to date therefore it is important if you have a printed copy to ensure that it is the latest version by contacting the Training Co-ordinator. The OMS Manual must be updated and incorporate the updated STP.

Appendix D

Water Management Standard Task Procedures

OMS Manual Section 6

Standard Task Procedures for Water Management Operations:

Polishing Pond and Clearwater Dam Pump Operation and Check,

Standard Task Procedures for Water Quality Management:

Collection of Water Samples for Analysis,

Measurement of Water pH levels,

Total Suspended Solids (TSS) Analysis,

Sulphate (SO_4^{-2}) Analysis.

Standard Task Procedures

for Water Management Operations and Water Quality

Polishing Pond and Clearwater Dam Pump Operation and Check,

Collection of Water Samples for Analysis,

Measurement of Water pH levels,

Total Suspended Solids (TSS) Analysis,

Sulphate (SO_4^{-2}) Analysis.

Information to be supplied by ZZL Operators.

It is important to always remember that STP's are designed to ensure your safety and the safety of others and therefore must be adhered to **at all times**. If any deviation from the set procedure is required, authorisation must be obtained from the Process Coordinator or his/her representative.

If amendments are found to be warranted they will be made and personnel will be informed. Operating procedures are not effective unless they are up to date therefore it is important if you have a printed copy to ensure that it is the latest version by contacting the Training Co-ordinator or alternatively viewing them on the site intranet. The OMS Manual must be updated and incorporate the updated STP.

Appendix E

TSF Surveillance

OMS Manual Section 7

Section E1
Further Information on Surveillance

Section E2
Inspection Report Forms

Routine Visual Inspection Report Form –TSF,

Routine Inspection Report Form – TSF,

Routine Inspection Report Form – Polishing Pond.

Section E3

Maintenance Report List

Maintenance Report List

Section E1

Further Information on Surveillance

Objective

The objective of the Surveillance Plan is to define the Zeehan Zinc Limited responsibilities, and activities designed to:

» Verify performance parameters, and identify unusual conditions that may endanger the dam;

» Provide a warning system for actions to prevent the failure of the embankment; and

» Provide warning on conditions likely to impact on the environment or community.

Components of Surveillance Plan

The dam safety surveillance program includes:

» Inspections:

  – Routine inspections undertaken by the Zeehan Zinc Limited Operations staff;

  – Annual and comprehensive inspections undertaken by TSF Design Engineer;

» Monitoring;

» Collection of other information relating to dam performance (eg. investigation, design and construction reports);

» Evaluation and interpretation of observed data and other information at various levels; and

» Comprehensive (surveillance) assessments undertaken by TSF Design Engineer.

TSF Surveillance Inspections

TSF Surveillance Inspections are conducted to determine the status of the dam and its features in terms of its structural and operational safety. Five general levels of dam safety inspection are recommended in ANCOLD 2002. Table 26 shows the inspections carried out at Zeehan Zinc **for TSF and Polishing Pond**.

Table 26 Five TSF Surveillance Inspections for ZZL

Type of Inspection	Personnel	Purpose	Frequency
Routine Visual (Not required for Polishing Pond)	Operations Personnel	The identification and reporting of deficiencies by visual observation of the embankment as part of their duties at the dam.	Twice weekly
Routine	Processing Coordinators	The identification and reporting of deficiencies, by structured observation of the dam and surrounds, with recommendations for corrective actions.	Weekly
Intermediate	TSF Engineer	The identification of deficiencies by visual examination of the dam and review of surveillance data against prevailing knowledge with recommendations for corrective actions. The tailings and water management shall be assessed. Equipment is inspected but not necessarily operated.	Annually
Comprehensive	TSF Engineer and Specialists (where required)	The identification of deficiencies by a thorough onsite inspection; by evaluating surveillance data; and by applying current criteria and prevailing knowledge. Equipment should be test operated to identify deficiencies.	5 yearly
Special / Emergency	TSF Engineer and Specialists	The examination of a particular feature of a dam for some special reason (eg. after earthquakes, heavy floods, emergency situation) to determine the need for pre-emptive or corrective actions. The review of the tailings management according to the beach development.	As required

Monitoring

Dam monitoring is one means of determining trends in structural performance. It helps verify design parameters and assumptions, construction techniques, analyse adverse events, and verify apparent satisfactory performance. In addition, monitoring will give notice of any activities that could impact on the environment.

This process consists of **the collection, recording, analysis and presentation of data** from measuring devices installed at or near the TSF.

Inspections

The most important activity in a dam surveillance program is the frequent and regular site inspections for any abnormalities in conditions and for deterioration of dam and its associated structures. Dam safety inspections should be conducted **to determine the status of the dam and its features in terms of its structural and operational safety**. Different levels of inspection are required for different purposes. Five general levels of dam safety inspection are recommended in ANCOLD 2002 as shown in Table 26 above.

Inspections should be carried out by **experienced people**, trained to recognise deficiencies in dams. Where unusual observations are detected by the operations staff, then inspections, requiring technical evaluations, should generally be carried out by a dams engineer, and other specialists. ZZL shall ensure that all operational personnel are suitably trained and are aware of the consequences of failure of the TSF and of the deficiencies that have been found in similar storages.

TSF Log Book

The TSF Log Book encompasses the documentation of investigation, design, construction, operation, maintenance, surveillance, remedial action, as well as all monitoring measurements.

The documentation of operation includes procedures on the use sequence / schedule of the outlets spigots and the water management (decant water level, pumping activity, seepage). Photographic and statistical summaries should also be collected to help in the performance evaluation.

Much of the information will never be changed and is suitable for reduction and permanent storage electronically with backups. Sufficient information should be kept on hand in the Log Book in easily accessible form to meet any situations, which could arise.

Surveillance Data Evaluation

Evaluation in this context means the on-going assessment of the safety of a dam based on data obtained from inspections and monitoring, in terms of its condition and operation. Evaluation is an important step where decisions affecting the safety and operation of the dam are made. Many dam deficiencies are detected by visual inspections. There are cases where instrumentation has not detected problems that are known to exist. There are also situations where an instrument may purport to indicate an anomaly but no visual distress can be seen. Surveillance data evaluation is necessary concerning both decant and tailings management for the TSF.

Day-to-day evaluation is to be undertaken by the ZZL operations staff and any anomalies are raised to be verified by the TSF Design Engineer. An anomaly constitutes a change in operating parameters away from the normal trend developed with continuous monitoring. An anomaly may also constitute a data trend away from design parameters.

Performance and observation evaluation of a more comprehensive nature should be undertaken by the TSF Design Engineer who experienced and qualified to make recommendations based on their interpretations.

Comprehensive Surveillance Reports

Comprehensive Surveillance and Reports are an in-depth review of the performance of a dam with a view to stating whether or not the dam is considered to be safe. They should be prepared at regular

intervals (minimum of every five years) with the Hazard category reviewed every five years. The report should summarise and extend previous reports to provide a clear picture of long-term trends. The reports should be prepared by experienced TSF Design Engineer who is familiar with the dam in term of its components and history.

Section E2

Inspection Report Forms

Routine Inspection Report Forms have been developed for the TSF and Polishing Pond **to help the operator and TSF Safety Coordinator performing efficient inspections and surveillance reporting.**

The operators and TSF Safety coordinator must also be familiar with the safety issues and operation performance to report **any observation judged relevant concerning the safety and performance of the facility** (and would not be cover by the Inspection Report Forms).

Routine Visual Inspection Report Form –TSF,

Routine Inspection Report Form –TSF,

Routine Inspection Report Form – Polishing Pond.

Figure 20 Routine Visual Inspection Report Form

OCEANIA TASMANIA
ZEEHAN ZINC MINE
ROUTINE VISUAL INSPECTION REPORT FORM
TSF

Date : _____ Checked : _____
(by supervisor)

Inspection
Name : _____
Time : _____
Weather : _____

TAILINGS [Section 5 of OMS Manual]

Delivery Line	Tailings pipeline condition	leaking ☐ blocked ☐	OK ☐ Actioned ☐
	Tailings pipeline flow rate @ pumps		OK ☐ Actioned ☐
	@ TSF		OK ☐ Actioned ☐
Operating Sub-Aqueous Outlets	Satisfactory outflow	Yes ☐ No ☐	OK ☐ Actioned ☐
	Line condition	leaking ☐ blocked ☐	OK ☐ Actioned ☐

TSF EMBANKMENT [Section 8.1 of OMS Manual]

Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐	OK ☐ Actioned ☐
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐	
	sink hole ☐	OK ☐ Actioned ☐
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐	
	dry ☐ damp ☐ wet areas ☐	OK ☐ Actioned ☐
Decant Tower	Flowing Yes ☐ No ☐	
	clear ☐ blocked ☐	OK ☐ Actioned ☐

WATER MANAGEMENT [Section 6 of OMS Manual]

TSF	Is minimum 1m water cover maintained? Yes ☐ No ☐	OK ☐ Actioned ☐
	Water level	
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐	OK ☐ Actioned ☐
Polishing Pond	Water level	
	Water Quality good ☐ bad ☐	OK ☐ Actioned ☐
Polishing Pond Pumps	# of pumps operating? (0, 1 or 2)	OK ☐ Actioned ☐
Settlement Pond (Paul's Dam)	Water level	
Clear Water Pond	Water level	
Flow from Settlement Pond to Clear Water Pond		
	# of pumps operating? (0, 1 or 2)	OK ☐ Actioned ☐
	Flowmeter reading	OK ☐ Actioned ☐

Comments / Sketches / Further Observations

Figure 21 Routine Inspection Report Form – TSF

OCEANIA TASMANIA
ZEEHAN ZINC MINE
ROUTINE INSPECTION REPORT FORM
TSF

Date : _____ Checked : _____ (by supervisor)

Inspection
Name : _____
Time : _____
Weather : _____

SUMMARY OF REQUIRED ACTIONS

Items requiring more detailed monitoring?	Yes ☐ No ☐ _____	Actioned ☐	_____
Maintenance required?	Yes ☐ No ☐ _____	Actioned ☐	_____
Inspection required by more senior personnel?	Yes ☐ No ☐ _____	Actioned ☐	_____
	Urgent ☐ Not urgent ☐ [If urgent contact (NAME) (NUMBER) or (NAME) (NUMBER)]		
Specialist advice required?	Yes ☐ No ☐ _____	Actioned ☐	_____

TAILINGS	[Section 5 of OMS Manual]		
Delivery Line	Tailings pipeline condition leaking ☐ blocked ☐	OK ☐ Actioned ☐	_____
	Tailings pipeline flow rate @ pumps ☐	OK ☐ Actioned ☐	_____
	@ TSF ☐	OK ☐ Actioned ☐	_____
Water Level in TSF 1m above Tailings?	Yes ☐ No ☐	OK ☐ Actioned ☐	_____
	Water level ☐		
Operating Sub-Aqueous Outlets	Satisfactory outflow Yes ☐ No ☐	OK ☐ Actioned ☐	_____
	Line condition leaking ☐ blocked ☐	OK ☐ Actioned ☐	_____
TSF EMBANKMENT	[Section 8.1 of OMS Manual]		
Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐	OK ☐ Actioned ☐	_____
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐		
	sink hole ☐	OK ☐ Actioned ☐	_____
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐		
	dry ☐ damp ☐ wet areas ☐	OK ☐ Actioned ☐	_____
Downstream Toe	dry ☐ damp ☐ wet areas ☐ water boil ☐		
	water: clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
WATER MANAGEMENT	[Section 6 of OMS Manual]		
Decant Tower	Condition good ☐ damaged ☐ blocked ☐	OK ☐ Actioned ☐	_____
TSF	Water level ☐		
	Is there enough storage capacity (water quality, flood event) ?	Yes ☐ No ☐	
		OK ☐ Actioned ☐	_____
	Is minimum 1m water cover over tailings maintained?	Yes ☐ No ☐	
		OK ☐ Actioned ☐	_____
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐	OK ☐ Actioned ☐	_____
Polishing Pond	Water level ☐		
	V-Notch Weir Reading ☐ mm (ruler)		
	clear ☐ blocked ☐ water clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
Spillway	erosion ☐ rill / slide ☐ discharge ☐ obstructions ☐	OK ☐ Actioned ☐	_____
Historic ADIT	V-Notch Weir Reading ☐ mm (ruler)		
	clear ☐ blocked ☐ water clear ☐ coloured ☐	OK ☐ Actioned ☐	_____
Caustic Dosage System	Dosage Rate ☐ l/hr		
	Caustic bulka- box level above 20% ? Yes ☐ No ☐	OK ☐ Actioned ☐	_____
Settlement Pond	Water level ☐		
Clear Water Pond	Water level ☐		
Settlement Pond and Clear Water Ponds Pumps			
	Pumps operating ? Yes ☐ No ☐	OK ☐ Actioned ☐	_____

Figure 22 Routine Inspection Report Form – Polishing Pond

OCEANIA TASMANIA
ZEEHAN ZINC MINE
ROUTINE INSPECTION REPORT FORM
POLISHING POND

Date : _____ Checked : _____
(by supervisor)

Inspection
Name : _____
Time : _____
Weather : _____

SUMMARY OF REQUIRED ACTIONS

Items requiring more detailed monitoring?	Yes ☐ No ☐ _____	Actioned ☐	_____
Maintenance required?	Yes ☐ No ☐ _____	Actioned ☐	_____
Inspection required by more senior personnel?	Yes ☐ No ☐ _____	Actioned ☐	_____
	Urgent ☐ Not urgent ☐ [If urgent contact (NAME) (NUMBER) or (NAME) (NUMBER)]		
Specialist advice required?	Yes ☐ No ☐ _____	Actioned ☐	_____
	_____		_____

POLISHING POND EMBANKMENT [Section 8.1 of OMS Manual]

Upstream Wall	erosion ☐ cracking ☐ slump / slide ☐ sink hole ☐	OK ☐ Actioned ☐ _____
Crest	low areas ☐ cracking: longitudinal ☐ transverse ☐ breach ☐	
	sink hole ☐	OK ☐ Actioned ☐ _____
Downstream Wall	erosion ☐ cracking ☐ slump / slide ☐ seepage ☐ cave in ☐	
	dry ☐ damp ☐ wet areas ☐	OK ☐ Actioned ☐ _____
Downstream Toe	dry ☐ damp ☐ wet areas ☐ water boil ☐	
	water: clear ☐ coloured ☐	OK ☐ Actioned ☐ _____
Spillway	obstructions ☐ discharge ☐ erosion ☐	OK ☐ Actioned ☐ _____

V-Notch Weir — Reading [ ] mm (ruler)

Weir clear ? (Y/N)	[ ]	OK ☐ Actioned ☐ _____
Water sample ? (Y/N)	[ ]	OK ☐ Actioned ☐ _____
Water clear ? (Y/N)	[ ]	OK ☐ Actioned ☐ _____

Water Level in Polishing Pond [ ]

Comments / Sketches / Further Observations

Section E3

Maintenance Report List

MAINTENANCE REPORT LIST

Completed after any maintenance task.

Issue date: __________

List Number: __________

All maintenance tasks should be adequately responded to and remedied, with assessment of why the incident occurred and future prevention of. } REPORTING

DATE	MAINTENANCE DESCRIPTION	PERSONEL		REPORTING
		maintenance performed by	checked/ approved by	Specify document to refer to for details.

Appendix F

Water Management Report

Appendix G

Tailings Management Plans

Figures 01-06

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
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