HUNTER VALLEY
OPERATIONS

HVO FINE REJECT MANAGEMENT STRATEGY

DOCUMENT NUMBER

HVOOC-1797567310-1364

STATUS
Approved

REGULATOR APPROVAL DATE

19/1/2023

VERSION
4.0

HVO EFFECTIVE DATE
1/8/2023

OWNER
Senior Mining Engineer - Projects

TABLE OF CONTENTS

1 | EXECUTIVE SUMMARY

This document presents a Life of Mine Fine Reject Management Strategy for Hunter Valley Operations (HVO) to satisfy Schedule 4 condition 28A of DA 450-10-2003. In this report "Life of Mine" refers to the maximum approved development consent at HVO, which is the South Project Approval 06_0261. All approved Tailings Storage Facilities (TSFs) at HVO operate under the North Project Approval 450-10-2003.

The strategy is based on the planned production schedule starting from January 2021 to March 2030.

Fine rejects (tailings) are produced from two plants, namely the Hunter Valley Coal Preparation Plant (HVCPP) and the Howick Coal Preparation Plant (HCPP). The planned combined tailings production rate for both plants is estimated to range from 1.13 to 1.55 Mm3 per year. The current mining consent period (HVO South) extends to March 2030. The provided tailings production rates imply a tailings storage requirement of 13.95 Mm3, referTable 3-2 – Planned Tailings Production Rates (Mm^3).

HVO's current tailings disposal strategy satisfies the predicted HVO tailings storage requirements to March 2030 by utilising existing (constructed) TSFs Carrington In-Pit (CIP) and Cumnock Void (via agreement with Glencore), and proposed West Pit TSF.

HVO have adopted a tailings disposal strategy that utilises secondary (or Pipe Head) flocculation for all active storages.

2 | INTRODUCTION

This report presents an update of a previous study undertaken by ATC Williams Pty Ltd (ATCW), document ref. 101041R96 Rev 2 dated September 2018 [Ref 1], for the management of fine rejects at Hunter Valley Operations (HVO) for the period July 2018 to 2030 inclusive. March 2030 is the expiry date of the development consents held by HVO South Project Approval 06_0261. ATCW notes that HVO North's consent Modification 6 (MOD 6) allows for the use of the existing Carrington Pit (Carrington In-Pit (CIP) Tailings Storage Facility (TSF) to be filled with fine rejects.

HVO is located approximately 24 kilometres (km) north-west of Singleton, New South Wales (NSW). The mining and processing activities at HVO are geographically divided by the Hunter River into HVO North and HVO South. While HVO is managed as one operation, HVO North and HVO South each have separate planning approvals.

It is noted that HVO is jointly owned by Yancoal Australia and Glencore Coal Pty Ltd.

This report was prepared for submission to the NSW Department of Planning, Industry & Environment (DPIE), to satisfy Schedule 4 condition 28A of DA 450-10-2003, which states:

The Applicant shall prepare and implement a life of mine fine reject management strategy to the satisfaction of the Director-General. The strategy must:		
(a)	*be prepared in consultation with DRE and NOW, and submitted to the Director-General for approval by 30 June 2015.*	Addressed in Section 9 |
(b)	*describe potential locations and design options for the*	Addressed in Section 3 | and Figure 4.1 |.

	emplacement of fine reject on site.	
(c)	*assess any material short term and long term impacts on surface and groundwater resources associated with each option.*	Addressed in summary in Appendix A: and in more detail in existing or subsequent consents, EISs and individual operating and maintenance manuals for tailings storage facilities.
(d)	*describe the measures that would be implemented to avoid, minimise, manage and monitor any adverse impacts of the fine reject emplacements over time.*	Addressed in summary in Appendix A: and in more detail in existing or subsequent operating and maintenance manuals for tailings storage facilities.
(e)	*describe how the fine reject emplacements would be rehabilitated and describe potential options for future land uses.*	Addressed in Section 6 |**,** App**en**dix A: and existing or subsequent MOPs. The MOP is required to be consistent with the approved EIS and Final Landform and Landuse Plans included in the HVO North Project Approval as Appendix 6 and 7.
(f)	*be integrated with the Rehabilitation Management Plan and Agricultural Land Reinstatement Management Plan for the mine.*	The information in the fine reject management strategy is consistent with the Rehabilitation Management Plan and the Agricultural Land Reinstatement Management Plan for HVO North for. These documents describe the status of the tailings storage facilities and how the rehabilitation of the active facilities will be undertaken. These documents are required to be consistent with the approved EIS and will be utilised in the development of the site closure management plan that is to be reviewed and approved prior to closure.

3 | BACKGROUND

3.1 | CURRENT MINING PLAN

HVO North currently undertakes mining in West Pit and HVO South currently undertakes mining in Cheshunt and Riverview Pit.

Run-of-mine (ROM) coal contains overburden and interburden material from above and below the target coal seams. The coal washing process in the CPP processes the ROM coal to generate reject material. Two forms of reject material are produced: coarse and fine. The coarse material is hauled to active emplacement areas, whilst the fine reject material is pumped as a slurry from the CPP to fine reject emplacement facilities. HVO North has two CPP's, the HVO CPP (HVCPP) and Howick CPP (HCPP).

Table 3.1 outlines rehabilitated and current approved TSFs.

Table 3-1: TSF Status

SITE	STATUS	TAILINGS SOURCE	START	FINISH	ESTIMATED REHABILITATION TIMEFRAME	ESTIMATED CAPPING VOLUME KBCM, AND (SOURCE)
LEMINGTON 1 TSF CELL A	Rehabilitated					
LEMINGTON 1 TSF CELL B	Rehabilitated					
LEMINGTON 2 TSF	Rehabilitated					
LEMINGTON 3 TSF	Rehabilitated					
LEMINGTON 4 TSF CELL A	Rehabilitated					
LEMINGTON 4 TSF CELL B	Rehabilitated					
LEMINGTON 5 TSF	Rehabilitated					

SITE	STATUS	TAILINGS SOURCE	START	FINISH	ESTIMATED REHABILITATION TIMEFRAME	ESTIMATED CAPPING VOLUME KBCM, AND (SOURCE)
HOWICK TSF	Rehabilitated					
EASTERN TSF	Rehabilitated					
WESTERN TSF CELL A	Rehabilitated					
WESTERN TSF CELL B	Rehabilitated					
SOUTH EAST TSF	Inactive. Capping commenced in 2017		Nov 2002	Jun 2004	2017-2023	550 (Mine spoil adjacent to TSF)
CENTRAL TSF	Inactive (consolidation void filling permitted annually)		2001	Mar 2009	Est. 2026-2029 (may require some tailings deposition to fill consolidation void)	500 (Carrington out of pit dump)
BOB'S DUMP TSF	Inactive	HCPP	2001	Dec 2012	Est. 2023-2026	1000 (Mitchell and Wilton Pits)
DAM 6 TSF (STAGE 2)	Inactive (consolidation void filling permitted annually)	HCPP	Jan 2013	Dec 2021	Est. 2031-2035	1000 (Mitchell and Wilton Pits, stockpiled)
NORTH VOID TSF	Inactive (consolidation void filling permitted annually)	HVCPP	Jan 2004	Feb 2019	Est. 2030-2040	5000 (Carrington out of pit dump)

SITE	STATUS	TAILINGS SOURCE	START	FINISH	ESTIMATED REHABILITATION TIMEFRAME	ESTIMATED CAPPING VOLUME KBCM, AND (SOURCE)
CUMNOCK VOID TSF	Active	HCPP	Oct 2015	2025	Glencore's responsibility	
CARRINGTON IN-PIT	Active	HVCPP	Feb 2019	2029	Est. 2038-2040	4000 (Carrington out of pit dump)
WEST PIT	Future	HCPP & HVCPP	Sept 2025	Beyond 2030	2038-2040	TBC

3.2 | TAILINGS PRODUCTION

The tailings production schedule is current as 2021. The strategy is based on a tailings production schedule commencing January 2021 and continuing to March 2030. The schedule reflects the production from the HVCPP and the HCPP.

Planned tailings production rates adopted for this Strategy schedule are summarised in Table 3.2 below.

Table 3-2 – Planned Tailings Production Rates (Mm^3)

COAL PREPARATION PLANT	2021	2022	2023	2024	2025	2026	AVERAGE ANNUAL (2027 – 2030)	TOTAL TO MARCH 2030
HUNTER VALLEY COAL PREPARATION PLANT	1.02	1.12	1.01	0.98	1.05	1.01	1.11	**10.62**
HOWICK COAL PREPARATION PLANT	0.11	0.24	0.27	0.32	0.44	0.36	0.40	**3.33**
TOTAL	**1.13**	**1.36**	**1.28**	**1.3**	**1.49**	**1.37**	**1.51**	**13.95**

The estimated planned tailings production for the period is 13.95 Mm^3, at an average annual combined (for both plants) production rate of 1.39 Mm^3.

The strategy for HCPP relies heavily on continuation of the washed and bypass product ratios. If this strategy changes, and the ratio of washed product increases, the predicted TSF lifespan will decrease as a result of increased tailings production.

3.3 | TAILINGS PROPERTIES

ATCW undertook a study in 2014 to assess the geotechnical characteristics of representative tailings samples in a laboratory. The results from the study are used as a basis for the study but are not detailed herein. For reference, the results of this testing are documented in the following report:

ATC Williams, "*Rio Tinto Coal Australia, Hunter Valley Operations (HVO), Factual Report on Tailings Testing", Ref 101041R89 Rev 1, September 2014. [Ref 2]*

As a result of a finding from the Resource Regulators Targeted Assessment Programme for Tailings Closure, HVO has committed to undertake tailings sampling to gather data on its geochemical properties. This is commencing in 2022.

3.4 | STATUS OF TAILINGS STORAGE FACILITIES AT HVO

A site overview illustrating the location of each of the existing and proposed future TSFs is presented in Figure 3.1. Details of current approved TSFs for HVO North are listed in Table 3-1. Approved HVO South facilities are not detailed as they are not proposed for inclusion as part of this strategy. Existing and proposed future TSFs forming part of the Updated Fine Reject Management Strategy are detailed in Appendix A:.

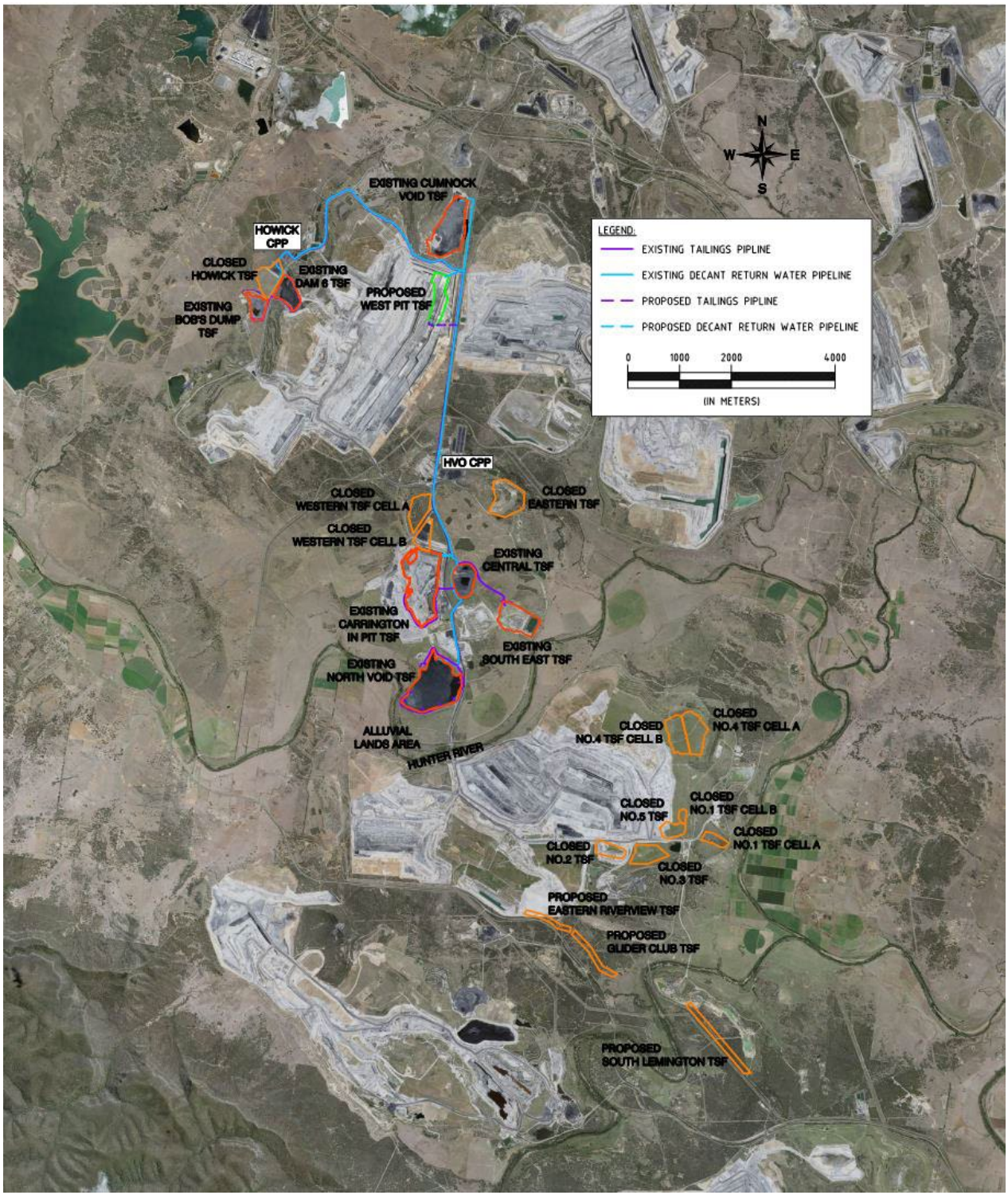

Figure 3-1: Site Overview

All HVO TSFs are owned and operated by HVO, except for Cumnock Void TSF which is owned and operated by Glencore. HVO have a commercial Joint Tailings Facility Agreement (JTFA) in place that defines Glencore as the owners and operators of this facility, but for which HVO has access rights for a defined volumetric capacity for tailings storage.

The remnant allowance has been estimated to be 1.05 Mm^3 of void space.

4 | TAILINGS DISPOSAL STRATEGY

4.1 | OVERVIEW

HVO have implemented secondary flocculation across their current active TSFs and have committed to continue with this practice for all proposed future TSFs.

HVO South currently has no active tailings storage facilities. All previously active facilities have been closed, capped and rehabilitated. Three proposed locations for the storage of tailings, discussed in the current HVO South EIS as shown in Figure 3-1, have been designated for the disposal of tailings generated by the (currently decommissioned) Lemington Coal Preparation Plant (LCPP), and are not large enough to cater for the addition of tailings produced at either HCPP or HVCPP in the North. The tailings production profiles used in the development of this strategy assume that all coal produced at both HVO North and HVO South operations is processed through the HVO North processing plants (HCPP & HVCPP). Changes to the Tailings Management Strategy will be required if the option to recommission the LCPP is implemented in the future.

Mine scheduling is a limiting factor in using tailings to backfill final voids in the South. Ideally, whilst HVO is still producing tailings, the operation would prefer to utilise existing voids for tailings storage, as this minimises the operation's footprint, reduces the size of the final open void and is more cost effective to the operation; but this can only be done after active mining has ceased within the pit.

As HVO North Consent currently finishes prior to HVO South operations, the void remaining in the North (West Pit) will be suitable to backfill with tailings produced from the processing of coal from HVO South, pending approval. However, the currently proposed final voids in HVO South remain active mining areas until 2030 and will not be available for use as storage facilities.

In addition to the capacity constraints and scheduling, pumping tailings from HVCPP or HCPP to the approved HVO South facilities is not favoured due to both financial and environmental risks. This option is costly due to the pumping upgrades required to pump tailings the additional distance and spill containment upgrades to the Hunter Valley & Wollombi Brook Bridges.

The following sections describe the fine rejects management strategy that is based on HVO's decision to implement pipe head flocculation.

4.2 | FINE REJECT MANAGEMENT STRATEGY

The strategy utilises the existing TSFs Cumnock Void, Carrington In-Pit (CIP) and future West Pit (within a restricted area of West Pit that is yet to be mined) for tailings disposal.

The development of this strategy is based on a number of recent studies undertaken by ATCW for HVO. These studies include;

ATC Williams, "DRAFT Yancoal Australia, Hunter Valley Operations (HVO), North Void TSF Storage Optimisation Concept Study Report", Ref 101041.29R05, April 2018. [Ref 3]

ATC Williams, "Hunter Valley Operations (HVO), Carrington In-Pit TSF Capacity Review", Ref 101041.39-L001, 22 July 2018. [Ref 4]

For the development of the West Pit TSF, HVO advised the geometry, tailings deposition and layout of the TSF is consistent with the previous study undertaken in [Ref 1]. Tailings properties were assumed to be similar to those adopted for assessment of CIP TSF.

This proposed TSF filling strategy is presented in Figure 4.1 |.

Plant	TSF	Units	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Howick	Cumnock	Mm3	0.11	0.24	0.27	0.32	0.1					
	West Pit	Mm3					0.34	0.36	0.44	0.3	0.43	0.42
Hunter Valley	Carrington	Mm3	1.02	1.12	1.1	0.98	1.05	1.01	1.01	1.19	0.41	
	West Pit	Mm3									0.71	1.11

Figure 4-1: Proposed Filling Strategy

The proposed filling strategy indicates that the existing TSFs; CIP and Cumnock Void plus the proposed West Pit, have sufficient capacity to accommodate the tailings from both HVCPP and HCPP until at least 2030. The proposed filling strategy is based on the use of secondary flocculation of the tailings to be deposited in the TSF.

5 | TAILINGS MINIMISATION AND ALTERNATE DISPOSAL METHODS

Detailed studies have been undertaken previously to identify opportunities to reduce the storage requirements for tailings by alternate treatment and disposal methods. It is a statutory requirement that all TSFs be capped and rehabilitated at completion of filling. Alternatives investigated include Belt Press Filters, Vacuum Filters and Chamber Presses, to reduce the volume of fine tailings by lowering the water content prior to disposal. The filter press methods create a tailings paste which has a moisture content low enough to enable co-disposal in overburden dumps, thereby removing the need for a separate tailings storage facility. These alternatives were not considered viable due to capital and operating costs. The age of the preparation plants at HVO and the cost required to retrofit these alternate disposal methods was central to the assessment of viability of these options.

Another project undertaken in 2018 was optimising the thickener control at HVCPP. This project improved control over thickener underflow operation. One of the outcomes of this is that the average bulk density of the tailings slurry increased from 1.1 t/m^3 to 1.2 t/m^3 reducing the volume of water sent to the TSFs.

Work continues to minimise the volume of tailings solids through the optimisation of the fine coal circuits at HVCPP and HCPP. HVO is currently investigating ultrafine coal beneficiation as a means of improving recovery from HVCPP and HCPP. If proven viable, this initiative has the potential to significantly reduce the quantity of tailings produced at HVO.

6 | STORAGE CLOSURE AND REHABILITATION

It is a statutory requirement that all TSFs be capped and rehabilitated at completion of filling.

For HVO North's TSFs, the main elements of the closure and rehabilitation include:

1. Where possible, reducing tailings deposition rate (towards end of filling) to provide for development of a 5.0 m thick tailings crust to support closure activities, followed by
2. Placement of layers of capping fill materials, comprising typically mine overburden[1] material, at a minimum of 2.0 m thick;
3. Revegetation;
4. Final land use for the TSFs are either grassland or woodland areas based on the approved Rehabilitation Management Plan (MOP).

[1] It has been common practice in the past to utilise coarse rejects for the development of an initial cap followed by placement of mine overburden. Existing rehabilitated TSF's will likely include a coarse reject layer as part of the 2m cap.

Tailings deposition alone (with the addition of flocculant at the discharge point) is not capable of providing sufficient final density (and hence shear strength) to support placement of capping layers if the rate of filling remains high (i.e. typically above 1.0 m per year). Consequently, it may become necessary to reduce the rate of placement of tailings over the top part of the deposit. Reducing the tailings deposition rate is proposed in the final stages of filling the Carrington In-Pit TSF.

The method involves controlling the rate of rise during the final stages of filling so that significant desiccation occurs throughout the layer with a consequent increase in shear strength. Water is removed from the surface of the storage to enable the full surface to be exposed to evaporative drying. The intended effect is to develop a tailings crust with shear strengths high enough to support placement of layers of fill material with traditional earthmoving equipment which may include low ground pressure equipment. Assessment of strength development is undertaken prior to placement of an initial cap. Strength assessment includes shear vane testing and CPTu.

It is emphasised that continued (infrequent) deposition of tailings may be required after completion of official filling, to fill consolidation voids and maintain a tailings surface with positive surface drainage. This will help to maintain a dry tailings surface and assist with evaporative drying, and hence shear strength development.

Placement of capping layers with mine spoil material can then be undertaken to develop a domed surface that allows for rainfall runoff and with a minimum cover of 2 m. Detailed capping designs are produced by a suitably qualified engineer following cessation of tailings deposition. This design is consistent with consented final landform objectives and is submitted to the Resource Regulator as part of a High Risk Activity notification.

Material deemed suitable for capping is identified and, if necessary, stockpiled in proximity to each TSF. Where this has not occurred to date, sufficient material will be identified ahead of the closure of each facility (as part of the capping design) and will be reserved for that use. The volume of capping material takes into account ongoing settlement of the consolidating tailings to provide a free-draining surface. Volumes of material required and stockpile locations are detailed in Table 3-1: TSF Status. Sampling of capping materials will be undertaken as part of material selection to ensure adequacy for structural, water management and vegetation aspects.

This cover material may then be re-vegetated in accordance with established vegetation type and rehabilitation practices published in the Mine Operations Plan for HVO. Existing rehabilitated TSFs are revegetated primarily with pasture species and light woody vegetation. HVO considers a 2 m thick cap of overburden material to be an adequate growth medium for woodland vegetation without risk of compromising the integrity of the cap and exposing tailings. Long term scientific monitoring of the rehabilitation will provide data to confirm this. HVO will monitor any new research or industry findings that explore capping depth requirements for long-term stability.

Rehabilitation of the Cumnock Void TSF is under the responsibility of Glencore.

In accordance with a Section 240 notice issued by the Resource Regulator, HVO undertook a TSF Closure Risk Assessment (ATC Williams 2020). The risk assessment did not identify any serious risks or aspects that were not subject to a reasonable level of control. Of the 21 risks identified in the register, four were assessed as being material risks with risk controls that ‘require improvement’. The S240 aspects requiring assessment, material risks identified by the risk assessment and recommended additional controls are described in Table 5.1. The risk assessment and actions are also included in the HVO Mine Operations Plan

Table 5.1: TSF Material Risks and Additional Controls

S240 Aspect (identified by Resource Regulator)	Material Risks identified in TSF Closure Risk Assessment	Recommended Action from Risk Assessment	Comments	Timing
Tailings Characterisation Include information on tailings characteristics (physical and geochemistry properties) in the MOP and frequency of routine testing. Provide information in MOP on further studies committed to in the risk assessment to "improve understanding and description of the geochemical properties of major and high risk lithological units	Conventional capping requires fill to be placed which may have variable geotechnical and geochemical properties, unwanted impact: • Poor planning results in incorrect material being allocated & stockpiled • Dispersive material is liable to erosion resulting in rework • Material may be prone to generating acidic or saline drainage • Poorly selected material may be prone to capillary action resulting in failed revegetation	1.Improve understanding and description of the geochemical properties of major and high risk lithological units. 2.Implement routine monitoring of the geochemical properties of fine/coarse rejects and waste rock (at least every two years)	1.Tailings characteristics are detailed in the Fine Reject Management Strategy. Relevant findings from additional monitoring will be updated in this Strategy. 2.Geochemical sampling and analysis is currently being undertaken for the Continuation Project EIS.	HVO have engaged a specialist consultant to develop a monitoring programme. Routine monitoring set to continue in 2023
Capping performance/design Include information in the MOP on the capping design as well as performance requirements of capping strategies to support the nominated rehabilitation outcomes. Noting uncertainty of the impact of saline tailings on tree growth, provide information in the MOP on further studies for any remaining knowledge gaps for cap design and associated timeframes for these studies	Tailings will consolidate pre capping, unwanted impact: • Ponding results in re-wetting and reduced beach strength • Rehydration of beach results in delays to rehabilitation program • Attempts to place cap prior to requisite strength gain results in deformations, safety risks & increased costs Tailings beach shear strength is strongly influenced by deposition practices, unwanted impact: • Rapid rate of rise limits the opportunity for • consolidation and drying • Poor thickener control directs too much	*1 Review the Operations & Maintenance Manual to incorporate the "Intermittent top-up" method in final deposition layers of the North Void TSF.* *2 Complete consolidation and evaporative drying modelling for Carrington Inpit TSF to determine options to optimise surface strength of the final deposition layers.* *3. Implement program of routine determination of placed beach density (at least annually)* *4. Implement program of routine monitoring of long term*	1.HVO are unable to commit to adding additional tailings to the TSF without agreement from EPA. EPA have indicated they would currently not permit additional tailings deposition until a barrier wall is installed. 2. This work will be undertaken in 2021 prompting a revision of the capping and rehabilitation timeframe for the Carrington In-Pit TSF. 3. Placed beach density is a part of the annual inspection program and reporting; utilising survey and production information 4. Annual settlement monitoring of	1.Pending EPA approval 2. ATC commenced this work Q4 2021 with a report received in June 2022. 3.No Action

	water to TSF & soft beach • If secondary flocculation not employed, results in missed opportunity to accelerate dewatering • inadequate management attention results in beaches that are unnecessarily soft at completion of filling • Ability to place conventional capping is delayed resulting in regulatory/stakeholder pressures	*settlement on rehabilitated TSF's (initially annually)*	rehabilitated TSF's will commence in 2021. *High level capping design methods are provided for in the Fine Reject Management Strategy. Detailed capping designs are produced by a suitably qualified engineer following cessation of tailings deposition. This design is consistent with final landform objectives and is submitted to the Regulator as part of a High Risk Activity notification.* *Tailings caps are at least 2m deep using non-reactive overburden. Greater than 95% of overburden materials mined at HVO are acid neutralising. Whilst salts can be generated from tailings the depth of cap and free-draining landform accounts for a low level of risk of impact to vegetation planted on the rehabilitated surface. As a result it was not identified as a material risk in the Risk Assessment and no action considered necessary beyond monitoring existing rehabilitation areas and ongoing sampling and selection of overburdens used for tailings capping.*	4.Lidar images have been captured in 2021 and monuments were installed in 2022
Capping material Provide information in the MOP on the source of capping material for all TSFs. Where uncertainty remains, provide information in the MOP on further studies to determine rehabilitation materials inventories and	Not identified as a material risk in the Risk Assessment.	*1. Identify source of capping material for Bobs Dump TSF and Dam 6W and include in 2021 LOM plan.*	Source and volume of capping material is detailed in the Fine Reject Management Strategy (Including Bobs Dump and Dam 6W).	No Action

associated timeframes for these studies				
Progressive rehabilitation Progressive rehabilitation schedule to be provided in MOP for all tailings facilities. It is acknowledged that the Cumnock TSF is managed by Ravensworth Operations. The requirements of Ravensworth Operations with regard to tailings from HVO is to be provided.	Not identified as a material risk in the Risk Assessment.		The rehabilitation schedule for all tailings facilities goes beyond the period of the MOP and is detailed in the Fine Reject Management Strategy. In accordance with the Cumnock Joint Tailings agreement Ravensworth are accountable for rehabilitation of the Cumnock TSF.	No Action No Action
Final landform design: Provide information on the final landform for the TSFs, including any significant surface water structures in the MOP. Provide information on how long term settlement/consolidation of the TSFs has been accounted for in the final landform design. Provide information on how long term stability of the final landform design has been assessed and if the design complies with ANCOLD guidelines specification for closure. If this hasn't been assessed, HVO to commit to undertaking further studies for long-term stability of landform on TSFs and provide associated timeframes for these studies.	TSF final landforms contained by constructed embankments must be geotechnically stable post rehabilitation	*1. Clarify status of constructed embankments that are used to contain fine rejects. Process should review historical data/documentation and include operational, post operational, and decommissioned TSF's.* *2. Install settlement monitoring stations on rehabilitated TSF's.* *3.Update LoM Fine Rejects Strategy to require assessment of strength development prior to placement of initial cap. Strength assessment to include both CPTu & shear vane testing.*	The conceptual final landform for TSF's is indicated in the MOP plans. Detailed design & regulatory approval is required prior to development of capping & final closure works. Design is undertaken for each individual facility based on parameters measured following decommissioning of the facility. Basis of Design includes requirement to account for consolidation settlement and ensure a free draining surface following full consolidation. HVO only has one out of pit TSF which is the Eastern TSF. The remainder are in-pit voids or buttressed within overburden emplacements. Failure mechanisms associated with in-pit tailings are limited to settlement and consolidation and should not require long term stability assessments.	1.Q2 2023 2. Lidar images have been captured in 2021 and monuments were installed in 2022 3. Captured in this plan

			The rehabilitated surface of the cap will be stabilised with vegetation and will erode at a rate consistent with natural landforms. Landform erosion stability assessments have been undertaken for the Eastern TSF and used to inform the remediation plan required under an Enforceable Undertaking with the EPA. The Eastern TSF is scheduled to be mined through within 25 years as part of the HVO Continuation Project.	
Water balance (implications for seepage): Provide information on water balance modelling undertaken in the MOP, focusing on predicted seepage post closure. If this hasn't been assessed, HVO to commit to undertaking water balance modelling (compare operational to post closure) and provide associated timeframes for studies	Closure planning for Carrington Final Void & In-Pit TSF is sensitive to water balance, unwanted impact: • Poor appreciation of CFV water balance results in groundwater conditions not in accord with Basis of Design for TSF Closure • High (even temporary) water levels result in seepage losses to receiving environment or overtopping to Hunter River • High dynamic range in water table exposes capped TSF during periods of low groundwater level • Fluctuations in post mining GW level inundates vegetation beyond its tolerance leaving a bare surface • Poor design of vegetation cover results in too much/too little removal of rainfall recharge	*1. Improve level of confidence/understanding of post mining groundwater levels in Carrington Final Void* *2. Identify & nominate the 'Base-case' closure strategy for the Carrington In-Pit TSF*	HVO has commenced an EIS to extend the mining footprint in West Pit which would mine through Carrington Final Void. On that basis HVO considers that any further work to better understand water balance and base case closure strategy for Carrington Final Void is unwarranted. Groundwater modelling is undertaken at the EIS stage and where relevant assesses potential for seepage from tailings. There are no predicted seepage impacts from HVO as part of this work. Groundwater modelling is validated by an extensive groundwater monitoring programme. Through this programme it was identified that seepage from the NV TSF was occurring and actions implemented to mitigate. *To ensure a comprehensive understanding of groundwater behaviour in tailings facilities HVO will seek specialist advice on additional*	1&2. No Action Assessed as part of new model development for HVO Continuation

			modelling required and additional groundwater monitoring	Project EIS in 2022.

7 | SUMMARY

This document presents the Life of Mine Fine Reject Management Strategy for Hunter Valley Operations.

The study has been based on the current Life of Consent that expires in March 2030 (HVO South).

Both existing and approved future tailings storage facilities were assessed, and general arrangement plans are presented in Appendix A:.

The proposed sequence for tailings disposal is based upon the availability of each TSF at the time of emplacement, its location relative to the coal processing plants and the predicted storage capacity.

The opportunity for the Carrington In-pit TSF to undergo a reduced rate of tailings emplacement was also considered. To achieve this the proposed West Pit TSF will need to be brought online to operate in parallel.

HVO's current life of mine fine reject management strategy utilises secondary flocculation and satisfies the predicted HVO tailings storage requirements to March 2030 by utilising existing TSFs Carrington In-Pit and Cumnock Void (via agreement with Glencore), and proposed West Pit TSF.

To fulfil the requirements of a best practice Fine Reject Management Strategy, consideration was given to the current life of mine plan by integrating TSFs in a practical schedule and ensuring that TSFs are cost effective, and minimise environmental risk and disturbance by filling open voids.

8 | REVIEW AND IMPROVEMENT

The Strategy will be reviewed within three months of the submission of the Annual Review, submission of an incident report (relevant to the TSF's), submission of an independent environmental audit report or any modification to the conditions of the HVO North Consent.

Within 6 weeks of conducting any such review, HVO will advise the Secretary of the outcomes and provide revised documents (where required) to the Secretary for review and approval.

9 | CONSULTATION

Initial consultation occurred with DRE (NSW Resources Regulator) on 7/4/2015 and NOW (DPE Water) on 31/3/2015. Document was simultaneously sent to the DP&E, DRE and NOW for subsequent review. DRE and DP&E provided further comments which have been addressed in this document. No further comments were provided by NOW.

In this revision the Resource Regulator's findings from their Targeted Assessment Programme on Tailings Closure in 2020 have been referenced as commitments in Section 6.

Version 4 received consultation comments from NSW Resources Regulator, these are capture in Table 9.1. DPE Water provided a response indicating no comments.

Consultation with	Comments	HVO Response
NSW Resources Regulator	Received 4-3-2022	Noted

	The Resources Regulator's expectations are that as part of any future development application for a new or modified mining project, that alternatives to conventional slurry disposal techniques be investigated and implemented where feasible to maximise sustainable rehabilitation outcomes.	
	while conventional slurry tailings disposal techniques continue to be utilised on site, it is the expectation that measures are implemented to maximise the strength profile of the impounded tailings to facilitate effective capping and encapsulation of the tailings dam as part of the rehabilitation of the site.	Addressed in sections 4.1 |, 6 | and where relevant Appendix A: for individual facilities.
	as a Rehabilitation Management Plan (RMP) will need to be prepared, published and implemented under the Mining Regulation 2016, further detail to that outlined in the LOMFRMS will be required in the RMP in relation to the following: • the average depth of each tailings emplacement to assist in understanding the long-term desiccation and consolidation/settlement strategy • details of in-active and decommissioned tailings storage facilities that are yet to be achieve successful rehabilitation. This is particularly relevant to the long-term management strategy being adopted for the Eastern TSF erosion stability issues • detail regarding how risks associated with tailings management will be reviewed, including the implementation of critical control measures.	Addressed in Section 6.1 of the Rehabilitation Management Plan 2022.
DPE Water	Received 12-1-2022. Nil Advice.	Nil

10 | DOCUMENT INFORMATION

10.1 | REFERENCE INFORMATION

Reference information, listed in Table below, is information that is directly referred to for the development of this document

REFERENCE	TITLE
(1)	ATC Williams, “Hunter Valley Operations, Life of Mine Fine Reject Management Strategy”, Ref 101041R96 Rev1, December 2015.
(2)	ATC Williams, “Hunter Valley Operations, Factual Report on Tailings Testing”, Ref 101041R89 Rev 1, September 2014.
(3)	ATC Williams, “Hunter Valley Operations, North Void TSF Storage Optimisation Concept Study Report”, Ref 101041.29R05 Draft, April 2018.
(4)	ATC Williams. “Hunter Valley Operations (HVO), Carrington In-Pit TSF Capacity Review”, Ref 101041.39-L001, 22 July 2018.
(5)	ATC Williams. “HVO TSF Closure Risk Assessment”, June 2020.
(6)	ATC Williams. “Carrington in-pit tailings storage facility – tailings consolidation and evaporative drying (vadose zone) modelling”, June 2022

10.2 | CHANGE INFORMATION

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in table below. Example detail shown below.

VERSION	DATE	CHANGE DETAILS
0	30/06/15	Final issue – original
1	21/12/15	Revised following RTCA consultation with DRE and DP&E
2	28/09/18	Update of strategy and general revision

VERSION	DATE	CHANGE DETAILS
3	29/12/21	Revised following North Void TSF Seepage Pollution Reduction Programme, Tailings Closure Risk Assessment and Resource Regulator Tailings Targeted Assessment Programme. Update to tailings deposition status
4	19/01/23	Minor updates including incorporation of Carrington TSF consolidation assessment and consultation comments from NSW Resources Regulator. DPE Approved 19/01/2023.

APPENDIX A: DESCRIPTION OF TAILINGS STORAGE FACILITIES

North Void TSF

Description

North Void TSF is located in HVO North, coordinates E 310786 N 6401829 (MGA Zone 56). It is positioned north of the Hunter River and alluvial lands area, and south of Carrington Pit. Figure A1 illustrates the location and general arrangement of North Void TSF in its current configuration.

TSF Details

The North Void TSF consists of a single cell formed in the void between existing waste dumps on the north and east sides, the Alluvial Lands backfill (including the Main Embankment) to the south and the mining High Wall to the west. The current design details of North Void TSF including embankment design, tailings disposal methodology, and water recovery are documented in:

Australian Tailings Consultants, "Coal & Allied Operations Ltd., Design Report for Hunter Valley North, North Pit Tailings Storage". Ref 101026R02, March 2003.

North Void TSF utilises the following Operation and Maintenance Manual, which details the surveillance requirements for the facility:

ATC Williams, "Hunter Valley Operations, North Void Tailings Storage Facility, Operation and Maintenance Manual (Version 3.0)". Ref 101041R19, June 2019.

The North Void TSF is now considered to be at capacity, and future deposition of tailings would be limited to that required to minimise (or prevent) the surface expression of consolidation. That is, it is proposed that occasional deposition of tailings be undertaken to fill the developing consolidation void and maintain positive surface drainage.

A summary of design parameters is provided in Table A.1 below.

Table A-1 – North Void TSF Design Parameters

Item	Parameters
Development Stage	Current
Status	Inactive (with annual deposition to fill the consolidation void permitted)
Current Operational Period	4-6 weeks annually
Consequence Category	Low (subject to design)
Tailings from Coal Process Plant	HVCPP
Tailings modification	Secondary flocculation
Maximum Embankment Height	70 m RL
Maximum Tailings Level (head of beach (HOB))	RL 69.0 m
Beach Slope	First 100m from deposition – 2.5% Second 100m from deposition – 1.0% Third 300m from deposition – 0.3%

	Remainder of beach – 0.2%
Staged Tailings Dry Density (for pipe head flocculation)	0.9 t/m^3
Tailings Storage Volume	Minor (not included in this strategy)
Tailings Storage Capacity	Minor (not included in this strategy)
Flood Management	In-void storage

Tailings Deposition

The implementation of secondary flocculation necessitated that additional tailings depositions points be positioned along the western perimeter of the storage to improve filling characteristics, as illustrated in Figure A1. The existing tailings deposition points along the southern perimeter have been maintained. Spigot numbers and locations change from time to time to manage beaching.

To facilitate preparation of the tailings surface for future rehabilitation, it is recommended that occasional deposition of tailings be undertaken, at least once annually (for a period of 4 – 6 weeks, or as required), to fill the developing consolidation void and maintain positive surface drainage to north-east corner of the TSF where collected surface water run-off can be recovered with pumping equipment. Re-commencement of deposition is subject to regulatory approval related to management of seepage and installation of a low permeability barrier wall in the northwest corner of the facility. The barrier wall is regulated as a Pollution Reduction Programme in HVO's Environmental Protection Licence. Following a construction feasibility assessment in 2021, HVO has proposed to design and construct the barrier wall by February 2023.

Water Recovery

Tailings deposition is managed to ensure that a decant pond forms where decant water recovery infrastructure is positioned. A water balance report is provided to the EPA at the end of each quarter, recording the estimate input volumes and water removed by pumping and evaporation.

Closure and Rehabilitation

The proposed timing of operation and closure is itemised in Table 2.1 in the main report text. Active deposition into the NV TSF ceased on 31 January 2019.

The conceptual NV TSF rehabilitation plan involves covering the tailings surface with a minimum 2 m thick cover of inert mine spoil material, and development of a free draining landform that would be suitable for pasture or woodland development in accordance with MOP and Development Consent.

It is proposed that the landform will be completed by placement of mine spoil fill material with low ground pressure earthmoving plant and equipment. The aim is to manage the tailings surface to promote strength development to eliminate the need for geosynthetic reinforcement materials. It is proposed that preparation of the tailings surface for capping and rehabilitation comprise the following elements:

- Development of shear strength through the action of consolidation;
- Active water management (i.e. maintaining the tailings surface in a dry state) to promote shear strength development by the action of solar drying and desiccation; and
- Continued irregular tailings deposition (with secondary) flocculation to fill the anticipated consolidation depression and maintain positive surface drainage. This will help facilitate the active water management.

To enable access for fill placement, a suitable strength of the tailings deposit needs to be developed. This can be achieved with a combination of the factors above. The Operation and Maintenance Manual for the facility describes these factors.

Consolidation

Consolidation modelling was conducted for the maximum depth tailings profile using one dimensional modelling. The results indicate that approximately 9 m of consolidation is expected under self-weight alone over a period of approximately 34 years. This equates to 0.26 m/year of additional tailings per year. Depositing thin layers of tailings is proposed to maintain the tailings surface at the current level, and ensure that surface drainage is maintained, minimising the potential for development of low areas that could result in permanent ponding of water. After five years of surface drying subsequent to the cessation of full time tailings deposition, results of the evaporative drying modelling (for the scenario where 0.26 m of tailings are deposited per year) indicate that a crust of greater than 25 kPa strength is predicted to have developed to a depth of approximately 2.8 m.

Evaporative Drying and Initial Capping

The predicted undrained shear strength profile achieved after three to five years from the end of full time deposition may be suitable to commence capping work in discrete areas. Capping of the tailings surface at the western perimeter could potentially commence five years after commencement of the proposed program for intermittent annual deposition of finite tailings layers. However, actual commencement of capping will be influenced by external factors not considered in the modelling, including prevailing climate conditions, operational and safety constraints and regulatory approvals. Monitoring of crust depth development will occur via shear vane and CPTu investigation when sufficient surface strength enables this work. This information will be used to update consolidation and evaporative drying modelling.

General Closure Plan Approach

The general closure plan for the NV TSF involves the following:

- Continue to actively dewater the surface of the NV TSF, by pumping, to prevent accumulation of rainfall runoff;
- Regular deposition of tailings in thin layers to compensate for ongoing consolidation of the tailings deposit and maintain positive surface drainage.
- Deposition continued from the western perimeter, with decant recovery from the eastern end, as per current practices;
- Continue to routinely monitor tailings shear strength development in the upper 3 m of the tailings (with field shear vane testing), until areas achieve a sufficient strength profile to enable access with CPTu equipment to assess potential suitability for construction of initial the capping layer(s);
- Undertake a staged approach to fill placement starting from the Western Perimeter as tailings shear strength at the NV TSF perimeter (close to the deposition points) will be faster than at the centre of the NV TSF. A minimum five year program of staged capping is anticipated. It is envisaged that after completion of Stage 1 capping along the western perimeter, that the tailings deposition points be advanced over the completed layer, progressing the deposition points towards the centre of the NV TSF. This procedure would then be repeated following completion of each stage of layer placement;

• Once initial capping is completed over the entire NV TSF surface, undertake final landform construction to achieve a free-draining rehabilitated profile over the entire NV TSF area to account for ongoing consolidation and in-line with the long term land use objectives.

Management of Impacts on Surface and Groundwater Resources

Potential Adverse Impacts:

Potential adverse impacts of the TSF include seepage to alluvium and the Hunter River and overflow of the facility during extreme rainfall events.

Controls:

The TSF is located in a mining void and surrounded by deposited overburden, except for the western side which is flanked by a high-wall. A low permeability groundwater barrier wall extends around the eastern and southern sides of the TSF to mitigate connection of tailings water with the Hunter River. The Carrington Pit Void provides a groundwater sink in the vicinity of the TSF. Ground and surface water monitoring is undertaken on a regular basis around the periphery of the TSF in accordance with an approved monitoring programme. The monitoring programme contains Trigger-Action-Response-Plans to identify and manage variations in water quality.

In 2018 assessment of monitoring data indicated potential seepage occurring from the north west corner of the tailings dam. This information was reported to regulatory authorities and instigated a number of mitigating actions, including:

- Commencing secondary flocculation to increase tailings density and consolidation.
- Additional deposition points on the western side of the facility to push decant water to the eastern side of the facility
- Installation of additional piezometers in the Carrington Billabong area and increased monitoring frequency
- Ceasing deposition in January 2019
- Groundwater modelling to quantify seepage rate and effectiveness of mitigating actions
- Option assessment of seepage mitigation engineering (ie barrier walls, pump-out systems)
- Ecological Risk Assessment of the Carrington Billabong River Red Gums.
- Identification of specific groundwater and ecological criteria to assess against monitoring data.

Monitoring data over two years indicates the initial controls have been effective in mitigating seepage from the facility. As part of a Pollution Reduction Programme in the Environmental Protection Licence HVO undertook feasibility assessment of constructing a low permeability barrier wall in the north west corner of the facility. This was submitted to the EPA in June 2021. HVO's Environmental Protection Licence has since been varied to require design and construction of the barrier wall by February 2023. further geotechnical assessment is required as part of the design work.

Specific Trigger Action Response Plans remain in place to monitor impacts to River Red Gums, groundwater and surface water. An Annual Analysis report is prepared at the end of each calendar year by

a suitably qualified specialist and assesses the collected data to determine the effectiveness of existing controls. This report is provided to the EPA.

The TSF is provided with a 1m freeboard to accommodate for runoff from extreme rainfall events. Furthermore, a levee wall surrounding the TSF separates surface runoff from the Hunter River and protects against flooding of the TSF up to a 1:100 year flood event.

Dam 6 TSF

Description

Dam 6 TSF is located in HVO North, coordinates E 307944 N 6409411 (MGA Zone 56). It is positioned adjacent to the rehabilitated Howick TSF, and east of Bob's Dump TSF. Figure A2 illustrates the location and general arrangement of Dam 6 TSF.

TSF Details

Dam 6 TSF is an in-void tailings storage facility that provides storage for tailings produced from the Howick CPP. The storage is completely encapsulated by surrounding spoil dumps, and as such the storage does not come under the jurisdiction of the NSW Dams Safety Committee.

The current design details of Dam 6 TSF including embankment design, tailings disposal methodology and water recovery are documented in:

ATC Williams, "Rio Tinto Coal Australia, Hunter Valley Operations, Dam 6 Tailings Storage Facility, Design Report". Ref 91031R33, June 2007.

Dam 6 TSF utilises the following Operation and Maintenance Manual, which details the surveillance requirements for the facility:

ATC Williams, "Hunter Valley Operations, Dam 6 Tailings Storage Facility, Operation & Maintenance Manual, (Version 2.0)". Ref 101041R71 Revision 3, July 2019.

The filling of Dam 6 is by secondary flocculation to generate increase tailings density and thus storage capacity, in conjunction with a steeper tailings beach slope.

A summary of design parameters is provided in Table A.2 below.

Table A-2 – Dam 6 TSF Design Parameters

Item	Parameters
Development Stage	Current
Status	Inactive (full and consolidating, ceased deposition August 2020)
Operational Period	Intermittent operation to fill consolidation depression
Consequence Category	Low, not a declared facility
Tailings from Coal Process Plant	HCPP
Tailings modification	Secondary flocculation (from January 2019)
Maximum Embankment Height	180.0 m RL

Maximum Tailings Level (head of beach (HOB))	179.6 m RL
Beach Slope (Conventional Tailings)	0.3 %
Staged Tailings Dry Density (at end 2018) at completion of conventional deposition	0.85 t/m^3
Beach Slope with Secondary Flocculation (As inferred from recent aerial survey)	Top 50m of beach length – 1.5% Middle 200m beach length – 0.5% Bottom remainder of beach length – 0.25%
Staged Tailings Dry Density (at end of deposition with Pipe head flocculation)	0.8 t/m^3
Total Design Tailings Storage Volume (conventional deposition)	2.50 Mm^3
Available Tailings Storage Volume from November 2019	0 Mm^3
Available Tailings Storage Capacity from November 2019	0 Mt
Flood Management	In-void storage

Tailings Deposition

Tailings deposition is undertaken with secondary flocculation. Tailings deposition is undertaken from spigots located around the perimeter of the storage. A general arrangement is illustrated in Figure A2. Spigot numbers and locations change from time to time to manage beaching.

Deposition of tailings from HCPP into Dam 6 TSF ceased in August 2020, with deposition transferring to Cumnock TSF.

Water Recovery

Tailings deposition is managed to facilitate decant pond development such that decant water can be recovered as required by a suitable pumping method.

Closure and Rehabilitation

The facility is now considered full, however additional deposition will be required over the next few years to fill in the depression left by ongoing consolidation. Similar to the other TSFs, the tailings will need time to consolidate and form a crust that has sufficient shear strength to support capping works. A period of five years is proposed from the time that there is sufficient surface strength to commence capping.

Management of Impacts on Surface and Groundwater Resources

Potential Adverse Impacts:

Potential adverse impacts of the TSF include seepage to natural groundwater aquifers or overflow of the facility during extreme rainfall events.

Controls:

The Dam 6 TSF is located in a mining void and waste dump. It is surrounding by mining areas and the West Pit mine creates a groundwater gradient to the east. Surface and groundwater are contained within the mine. Ground and surface water monitoring is undertaken on a regular basis in accordance with an approved monitoring programme. The monitoring programme contains Trigger-Action-Response-Plans to identify and manage variations in water quality.

Cumnock TSF

Description

Cumnock Void is located to the north of HVO, coordinates E 311065 N 6410661 (MGA Zone 56). It is positioned directly north of West Pit, an active mining area. Figure A3 illustrates the location of Cumnock Void TSF. This TSF is positioned in an open cut void (Cumnock 3) in which mining was completed at the end of 2008 by Glencore.

The Cumnock Void TSF is a shared facility, between Glencore and HVO. Glencore has utilised the majority of their allotted capacity and are currently not utilising Cumnock TSF for active deposition of tailings.

TSF Details

Cumnock TSF is a remnant open cut mine void located at the neighbouring Ravensworth Mine and that is used as a TSF as part of Glencore's Ravensworth Mine Operations.

A commercial agreement is currently in place between Glencore and HVO which sees the facility shared by the two mining operations. As part of the shared agreement, construction of an embankment along the eastern side of the void was required to allow for the continued filling of the void with coal tailings to a maximum RL 109m AHD. The associated works also included construction of an embankment near the settlement ponds at the northern end of the dam, and construction of an emergency spillway in accordance with NSW Dams Safety Committee requirements.

A summary of the known design parameters is provided in Table A.3 below.

Table A-3 – Cumnock Void TSF Design Parameters

Item	Parameters
Development Stage	Current
Status	Operational
Operational Period	Aug 2020 onwards
Consequence Category	Significant
Tailings from Coal Process Plant	HCPP
Tailings modification	Secondary flocculation
Maximum Embankment Height	111.75 m RL
Maximum Tailings Level	109.0 m RL

Cumulative Tailings Density (at end of deposition)	0.9 t/m^3
Tailings Storage Volume (Feb 2021)	1.77 Mm^3
Tailings Storage Capacity (Feb 2021)	1.59 Mt
Flood Management	Spillway

Tailings Deposition

Deposition into Cumnock Void TSF occurs from perimeter spigots. A general arrangement is illustrated in Figure A3, with tailings treated with secondary (or pipe head) flocculation prior to deposition. Deposition recommenced August 2020.

Water Recovery

Tailings deposition is managed to facilitate decant pond development such that decant water can be recovered as required by a suitable pumping method. Closure and Rehabilitation

In accordance with the commercial agreement for management of Cumnock void the closure and rehabilitation of the TSF is Ravensworth's responsibility.

Management of Impacts on Surface and Groundwater Resources

Potential Adverse Impacts:

Potential adverse impacts of the TSF include seepage to natural groundwater aquifers or overflow of the facility during extreme rainfall events.

Controls:

The Cumnock Tailings Facility is jointly owned by HVO and Ravensworth Operations and their managing entities. As a landowner of an area that includes a component of the Cumnock void, HVO has an approval that enables the partial use of the void for tailings deposition and an agreement with Ravensworth Operations who manage the facility.

The surface and groundwater assessment of the Cumnock Void was undertaken within the Ravensworth EIS and all surface and groundwater monitoring is managed and reported by Ravensworth.

The modelling predicts that the use of Cumnock void as a TSF will not impact groundwater resources as any seepage from the facility reports to the adjacent mined pits where it is managed according to the approved site water management plan.

With regard to surface water impacts Cumnock TSF is located at the top of a tributary of an unnamed creek which flows east into Davis Creek and flows south west into Bayswater Creek. These creeks have been extensively modified due to current and historic mining activities.

The construction of Cumnock TSF has been designed to spill any flood flows through the embankment spillway.

Ponded water is removed from the tailings surface by pumping as required and sufficient freeboard is maintained by Ravensworth Operations. This protocol ensures that surface water is managed and the risk of overtopping the spillway is reduced.

Carrington In Pit (CIP) TSF

Description

Carrington Pit is located in HVO North, coordinates E 310539 N 6403913 (MGA Zone 56) and located west of the Central TSF and directly north of the North Void TSF. Carrington Pit has been mined to its consented limits and is currently an open void located in HVO North. The location and general arrangement of CIP TSF is illustrated in **Figure A4**.

TSF Details

The CIP TSF is wholly contained within a remnant void in the Carrington Pit. There are six proposed tailings discharge points, located on the south, west and east walls, and a low point at the north of the TSF.

ATCW undertook a study to assess the capacity of CIP TSF and the use of secondary flocculation of the tailings to be deposited in the TSF. Secondary flocculation was the preferred method of tailings deposition because it maximises the use of the available space in the void.

The filling of the CIP TSF commenced in February 2019, at completion of deposition into North Void TSF. Filling is predicted to be complete by 2029, which includes a period of reduced rate of filling to allow the tailings to desiccate for future rehabilitation works. To provide this, the balance of tailings produced from the HVCPP would require to be transported to the West Pit TSF from mid 2025, approximately.

A summary of the concept design parameters is provided in Table A.4 below.

Table A-4 – Proposed Carrington In Pit TSF Design Parameters

Item	**Statistics**
Development Stage	Current
Status	Active
Operational Period	Current
Consequence Category	Low (not a declared facility)
Tailings from Coal Process Plant	HVCPP
Tailings modification	Secondary Flocculation
Maximum Storage Elevation	40 m RL
Maximum Tailings Level	39.5 m RL
Beach Slope	Top 25% of beach length – 2.0% Upper middle 25% beach length – 1.0% Lower middle 25% beach length – 0.5% Bottom 25% beach length – 0.2%
Cumulative Tailings Dry Density (at end of deposition)	0.9 t/m^3
Tailings Storage Volume (design)	11.38 Mm^3
Tailings Storage Volume (Estimate) from June 2019	10.82 Mm^3

Tailings Storage Capacity from June 2019	9.74 Mt
Flood Management	In-void storage

Tailings Deposition

Tailings deposition using secondary flocculation is undertaken from from perimeter deposition points. A general arrangement is illustrated in Figure A4. Spigot numbers and locations change from time to time to manage beaching.

This storage is proposed to be operated continuously with tailings produced from HVCPP.

Water Recovery

Water recovery is typically undertaken from the northern end of the TSF.

At present the facility is also being utilised as a combined water storage, necessitated by above average rainfall across 2021 and 2022. This is a temporary requirement with an alternate water storage coming available in 2023 at which time dewatering of Carrington in-pit TSF would re-commence. Combined water and tailings would be stored to up to 39.5m AHD in accordance with proposed maximum tailings fill level.

Closure and Rehabilitation

The closure and rehabilitation of the TSF will be undertaken beyond 2030 and would be conducted in line with all other TSF's onsite. The conceptual final landform for Carrington has the facility being maintained as an evaporative sink maintaining a local groundwater gradient towards the facility. A conceptual Final Void Management Plan has been submitted to the DPE, with a detailed plan to be developed in 2023.

To understand capping and rehabilitation timeframes, ATC Williams (May 2025) undertook consolidation and evaporative drying modelling. Summary outcomes are:

- Consolidation modelling has been conducted for the maximum depth tailings profile using one dimensional modelling.
- Approximately 7.2 m of tailings consolidation is expected under self-weight alone over a period of approximately 33 years.
- The effects of pipe head flocculation appear to be adequate for promoting development of crust strengths.
- After 5 years of surface drying subsequent to the cessation of full time tailings deposition, results of the evaporative drying modelling indicates that a crust of greater than 25 kPa strength is predicted to have developed to a depth of approximately 6.0 m, considered sufficient for mechanical placement of capping layers.

Management of Impacts on Surface and Groundwater Resources

Potential Adverse Impacts:

Potential adverse impacts of the TSF include seepage to natural groundwater aquifers or overflow of the facility during extreme rainfall events.

Controls:

Carrington In-Pit TSF is designed to operate as an evaporative sink for long term management of ground and surface water within the TSF and broader Carrington area. The maximum tailings fill level of 39.5 m AHD means that the tailings is stored up to 20 m below the Hunter River and base of alluvium (58 to 60 m AHD). Groundwater gradients will be drawn away from the river mitigating any potential for seepage from the facility. The depth below natural surface provides adequate storage for extreme rainfall events. Ground and surface water monitoring is undertaken on a regular basis in accordance with an approved monitoring programme. The monitoring programme contains Trigger-Action-Response-Plans to identify and manage variations in water quality.

West Pit TSF (Proposed)

Description

West Pit is located in HVO north, coordinates E 310875 N 6409251 (MGA Zone 56). Upon completion of mining activities in the north-east end of West Pit in 2026, this proposed TSF is to be positioned within the remnant open-cut void.

Mining is planned to continue easterly in the southern section of West Pit. As the southern end of the pit progresses past the eastern limit of the northern end of the pit, the northern void will be partially utilised for mine spoil with a portion allocated to form the proposed West Pit TSF. The proposed TSF would be located in the northeast corner of the final pit boundary and south of Cumnock Void TSF. The conceptual arrangement of the proposed West Pit TSF is illustrated in Figure A5.

TSF Details

A concept design was previously prepared for the purpose of satisfying tailings storage requirements for this study. The proposed TSF would be bounded by natural ground to the north and east, and mining overburden backfill (spoil) to the west and south.

It is noted that the previous study undertaken for the filling of the West Pit TSF only considered conventional tailings and not secondary flocculation. As such, ATCW undertook the secondary flocculation tailings deposition for the TSF as part of these works. The tailings assume parameters similar to the CIP TSF.

A summary of the concept design parameters is provided in Table A.5 below.

Table A-5 – Proposed West Pit TSF Design Parameters

Item	Statistics
Development Stage	-
Status	Proposed, Concept only
Operational Period	Q3, 2025
Consequence Category	Low (subject to design)
Tailings from Coal Process Plant	HVCPP & HCPP
Tailings modification	Secondary Flocculation
Maximum Embankment Height	Not applicable

Maximum Tailings Level	105.5 m RL
Beach Slope	Top 25% of beach length – 2.0% Upper middle 25% beach length – 1.0% Lower middle 25% beach length – 0.5% Bottom 25% beach length – 0.2%
Tailings Dry Density (at end of deposition)	0.9 t/m^3
Tailings Storage Volume	4.0 Mm^3
Tailings Storage Capacity	3.6 Mt
Flood Management	In-void storage

Tailings Deposition

Tailings deposition is proposed from three spigots located along the southern pit edge as shown in Figure A6 using secondary flocculation. This storage is proposed to be operated continuously from its earliest availability in 2025. Spigot numbers and locations change from time to time to manage beaching.

Water Recovery

A decant collection system is proposed to be located at the northern end of the pit.. The decant system would be consistent with existing operating systems onsite.

Closure and Rehabilitation

Because this pit is continually utilised up until the end of the consent period and is not filled, no closure capping with tailings is proposed for this storage, as this activity would occur beyond this timeframe if required, however closure capping activities would be conducted in line with all other TSF onsite.

Management of Impacts on Surface and Groundwater Resources

Ground and surface water impacts would be assessed as part of any approvals process for this proposed modification. However, the risks and controls would be substantially the same as the Dam 6 TSF.

APPENDIX B: APPROVAL OF MANAGEMENT PLAN

Department of Planning and Environment

NSW GOVERNMENT

Our ref: DA450-10-2003-PA-51

Andrew Speechly
Manager – Environment and Community
HV Operations Pty Ltd
1011 Lemington Road
Lemington NSW 2330

19/01/2023

Subject: Approval of Revised Fine Reject Management Strategy

Dear Mr Speechly

I refer to the revised HVO North Fine Reject Management Stratgy (FRMS) (Version 4, dated November 2022), which has been prepared in accordance with condition 28A of Schedule 3 of DA450-10-2003.

The Department has carefully reviewed the revised FRMS and is satisfied that it addresses the relevant requirements of the development consent.

Accordingly, the Planning Secretary has approved the revised FRMS (Version 4, dated November 2022).

You are reminded that if there are any inconsistencies between the FRMS and the conditions of consent, the conditions prevail.

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact me on (02) 4908 6896.

Yours sincerely

Joe Fittell
Team Leader
Resource Assessments
As nominee of the Planning Secretary

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150 www.dpie.nsw.gov.au 1
Locked Bag 5022, Parramatta NSW 2124