

5 Year Environmental Implementation Plan

2019 – 2024
Version 18.0
18 December 2023

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Approver:	General Manager	Trent Scherer

Environment Improvement Projects

The environmental improvement project outlined in this implementation plan have been grouped into key focus areas shown in Table 1.

Table 1: Summary of improvement projects

Focus Area	Key Objective
Organisation cultural change	Risk reduction through empowering the entire workforce
Air Quality Management	Emission/particulate and risk reduction
Water Management	Impact mitigation
Land Management	Mitigate contamination: safe, stable and sustainable
Other	Amenity impact reduction

Explanation of the Implementation Schedule

The implementation schedule shown after each project table shows the study, engineering or execution phase, which are described below:

Study Phase

Projects shown in study phase are at the earliest part of the implementation process and require work to identify and assess options that will deliver the required environmental outcome. The outcome of the study phase is to determine the option that best meets the defined performance criteria. In selecting the preferred option during the study phase to take to the engineering phase, options are assessed against a number of criteria, including,

- How effectively each option mitigates the risk,
- Can the project be delivered in the required timeframe?
- What is the cost of each option compared to the expected environmental outcome?
- Can the option be practically constructed?
- Can the option be implemented within an operating refinery?
- What approvals will be required to deliver the option?
- Can the option be delivered safely?

Some projects are quite complex requiring more time and resources in determining the right option. Consequently the outcome of the study phase for a project will deliver the option to take forward to the engineering phase.

Engineering Phase

The engineering phase is where the detailed work is carried out and a set of documents is developed to allow the project to move into the final execution phase. The engineering phase covers traditional mechanical, civil, structural, process and electrical engineering input, which will provide a detailed design that can be constructed to meet applicable Australian, Queensland and QAL standards. Other aspects covered in the engineering phase include any required Commonwealth, Queensland and Local government approvals pertaining to environmental, planning and cultural heritage legislation. These approvals can only commence once the project design is nearing completion.

The output from the engineering phase will be a detailed design and issued for construction drawings (where required) that are based on risk reviews (process, safety, health, environmental and cultural), constructability reviews as well as hazard and operability assessments.

As stated, some projects will require a number of approvals from the Commonwealth, State and Local governments with approval time frames that may extend up to a year during the engineering phase for some of the more complex projects.

Towards the completion of the engineering phase QAL will be able to determine a more detailed performance indicator to demonstrate the environmental improvement at the completion of execution.

Execution Phase

The output of the engineering phase will be a package of work that will generally include a number of deliverables that will be tracked during the execution phase. The type and complexity of the project will determine the number of deliverables required and how the deliverables are phased, as some may need to be finished before another can begin.

How to Interpret the Tables

The study (gold) and engineering (blue) phase schedules are based on delivering milestones at the end of a specified quarter, i.e 2019 Q1 means Quarter 1 2019 January to March. The execution phase (green) schedules are based on delivering milestones within a calendar month.

This example shows the study phase milestone for a project is due in quarter 4 in 2018. This means that during quarter 4 the project will transition into the engineering phase and the implementation plan will be updated accordingly.

Task	Project Name					
	2018		2019			
	Q3	Q4	Q1	Q2	Q3	Q4
Description						

This example shows the engineering phase milestone due in 2019 quarter 2 and the implementation plan will be updated in quarter 2 to show the execution phase.

Task	Project Name					
	2018		2019			
	Q3	Q4	Q1	Q2	Q3	Q4
Description						

This example shows the execution phase will take 1 and a half years with the completion date of the project in April 2020.

Task	Project Name											
	2019				2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Description												

Organisational Cultural Change

QAL recognises that the culture of an organisation is a significant factor impacting the environmental performance of a business. While leadership commitment and governance structures are important to ensure that environmental improvement projects are effectively executed; our environmental improvement program will only succeed if we empower all of our employees to have due and proper consideration of environmental obligations and risks in their everyday tasks.

Redefining our site culture begins with our workforce having a greater understanding of the process safety aspects of our operation, and the significant potential environmental and community impact our operations can have. We then need to empower our workforce to reduce risk around process and environmental concerns to avoid them and respond when potential process safety and environmental concerns arise. The introduction of a disciplined system for organizing workplaces and the broader QAL operating environment is underway.

Improved housekeeping and understanding of process safety critical controls will lead to early detection of leaks, spillage and situations that could lead to potential environmental impacts.

Project (C1)	Site Cultural Change
Risk class	- IV/Critical
Environmental risks	- Failure of systems causing environmental incidents that impact on the receiving environment and community
Project solution / options	<ul style="list-style-type: none"> - Improve process safety and environmental risk detection for all QAL employees through a Process Safety Management System (PSMS) that ensures critical controls are identified and verified. - All QAL employees involved with ensuring critical controls are in place are aware of the importance of these controls and that they will be verified. - Cultural change will be incorporated into the operations systems including: <ul style="list-style-type: none"> • Functional workplace program • Annual environmental training for all employees • Daily HSE meetings (environment in work preparation) • Quarterly business updates, led by site senior executives • Routine engagement surveys • Purple banner reporting which includes the introduction of reporting category focused exclusively on environmental incidents
Objective / performance outcome	<ul style="list-style-type: none"> - Greater awareness of environmental risk and employee's role in controlling these risks. - Improved culture relating to process safety and environmental risk management throughout the entire organisation through the implementation of a PSMS.
Performance Indicator	<ul style="list-style-type: none"> - 90% of major hazard critical control health checks completed within the first 12 months after the PSMS is implemented across site (end of 2020). - Greater than 95% of employees completing annual environmental awareness training.
Cost estimate A\$ million	- \$1 annually
Project Stage	<p>Complete</p> <ul style="list-style-type: none"> - PSM Major Hazards defined, reviewed and results of the activities that determine if critical controls will work when called upon reviewed monthly by the Management Team.

Comments	<ul style="list-style-type: none"> - At least one example of functional workplace implemented in every section onsite, with several in many sections. Continued deployment required until full site coverage is achieved. Dedicated team now supporting the functional workplace implementation to ensure progress is maintained. - All PSM major hazard workshops complete with monthly results reported to the board. <ul style="list-style-type: none"> • CCMP process (deep dive by GM on Critical Controls) ongoing on completed major hazards. • Monthly managers review process implemented and chaired by General Manager. • A Pathway-to-Compliance has been developed for every Major Hazard and is tracked monthly. • Two independent consultants are currently reviewing the PSM system to look for opportunities to make it even more robust. - ERM organisation psychologist team supporting the organisational cultural change process, including: <ul style="list-style-type: none"> • Development of >75 actions focusing on environmental stewardship, • Actions are fully integrated into the QAL Business Strategy, <ul style="list-style-type: none"> ▪ Functional workplace, waste minimization, including significantly increasing recycling, and actions arising out of the QAL Environment Committee remain the primary focus areas in 2023.
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Implementation Schedule

Site Culture Change										
Task	2018	2019				2020				
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Site Cultural Change	Complete	Complete				Complete				
	Study	Engineering		Execution						

Air Quality Improvement Projects

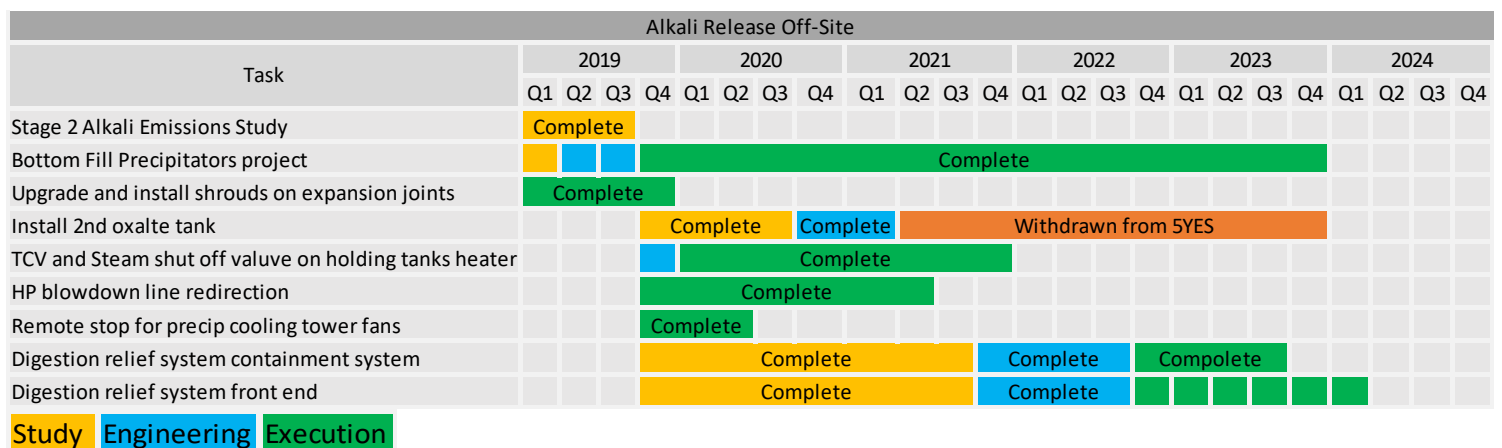
QAL's 5-year air quality improvement plan, supported by targets, actions and program of works is summarised below. Capital spend is estimated at between A\$19 million to A\$38 million.

Project (A1)	Alkali Release Off-Site
Risk class	- IV/Critical
Environmental risks	- Alkali release to atmosphere with potential to impact air quality and property in the surrounding communities
Project solution / options	- Implement the identified projects to reduce the alkali release risk.
Objective / performance outcome	- Reduce identified Class III and IV alkali release risks to Class I and II to mitigate impact to the community
Performance Indicator	- No alkali release events from completed projects due to QAL operations or maintenance activities
Cost estimate A\$ million	- 49

<p>Project Stage</p>	<p>Execution</p> <ul style="list-style-type: none"> - Digestion relief system – front end. <ul style="list-style-type: none"> • Installation of new back pressure lines between the digester and the first flash tank have been installed. This allows the installation of the shut off valves. <ul style="list-style-type: none"> ▪ There have been a number of integration issues between the new valves and level indicators, the digestion safety system (HIMA) and the operating system (DCS) which have been identified and rectified during the phases of the project. A programming issue with the new valves has been identified that causes them to open too fast when a digestion unit is being brought back online. A solution has been identified to rectify this issue, however it must be fixed before the valves can be brought online. ▪ The solution will push the project into Q1 2024. • Improving reliability of level detection in the flash tanks as a lead indicator of a blocked flash tank outlet, <ul style="list-style-type: none"> ▪ An additional level indicator has been added to the three highest risk flash tanks, ▪ Based on feedback from level and other online indication (pressure) the valves will be closed by operator intervention. <p>Projects completed</p> <ul style="list-style-type: none"> - Existing equipment (identified as Class III and IV Risk) including piping, valving and fixtures on the Digester Pilot Steam Lines and the Flash Tank pilot steam lines have been replaced. - New oxalate vent tank has been installed and commissioned. - Upgrade and install shrouds on expansion joints; - Flash tank relief header shroud installation; - Digestion heater vent diversion; - Flash tank relief header shroud installation; - Upgrade and install shrouds on expansion joints, - Remote stop for precip cooling towers – precip cooling tower fans to be stopped by the control room if conductivity of cooling water increases (conductivity increases are likely due to caustic liquor ingress) - HP blowdown line redirection – redirect blowdown lines to reduce steam and alkali at the entrainment separators. - Install an upgraded temperature control valve on the holding tanks contact heater steam supply line to manage steam supply to the contact heater, including stopping steam flow during upset conditions that may cause alkali emissions. - Digestion relief system - containment system <ul style="list-style-type: none"> • The project improves the separation of steam and slurry through:
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	<ul style="list-style-type: none"> ▪ Installation of higher efficiency entrainment separators on all digestion units, and ▪ Replacement of the Unit 2 relief tank to maximise separation efficiency, and ▪ Removal of redundant equipment inside the Unit 1 and 3 relief tanks. <ul style="list-style-type: none"> - Bottom fill precipitators – reduce turbulence in the top of the tanks during filling to stop alkali misting. - <p>Project to be withdrawn from 5YES</p> <ul style="list-style-type: none"> - Install second new oxalate tank. <ul style="list-style-type: none"> • The installation of the new oxalate vent tank has significantly reduced alkali releases. • The new oxalate vent tank is operating and is expected to be able to operate for 10 years before requiring significant maintenance where the vessel will be unavailable for a number of days, • The pre-existing oxalate vent tank is still installed and will provide short term redundancy if there are any issues with the new vent tank, • QAL have developed a decarbonization strategy for the refinery, which includes replacing, where possible, steam used in the process, • There are electrical alternatives, which will create a vacuum to allow the oxalate building to operate, and • The project has been withdrawn as the alkali risk reduction has been achieved and can be sustained.
Comments	

Implementation Schedule






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Alkali Release Off-Site

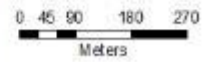
Legend

 Alkali and Odour Emissions Reduction

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:8,119



N 	Review By:	J. J. J.
	Created By:	Jonathan Deane
	Checked By:	
	Approved By:	Jonathan Deane

Project (A2)	Alumina Dust Emission Reduction
Risk class	- III/High
Environmental risks	- Alumina dust emissions from Boyne Smelters Limited (BSL) conveyor transfer points, product load-out and island and mainland alumina storage A-frames have a potential to impact on the air quality of surrounding communities.
Project solution / options	- Implement the identified projects to reduce the alumina dust release risk.
Objective / performance outcome	- Mitigation of alumina dust emissions
Performance Indicator	- No visible dust emissions from release points from completed projects.
Cost estimate A\$ million	- 49.8

Project Stage	<p>Complete</p> <ul style="list-style-type: none"> - BSL belt conveyor upgrade works, - The Island A-frame shed alumina handling upgrade, and - Alumina loadout, including the installation of a new ship loader. <p>Project to be withdrawn from 5YES</p> <ul style="list-style-type: none"> - Mainland shed alumina handling upgrade <ul style="list-style-type: none"> • The mainland alumina storage shed contributes approximately 4% to the overall visible dust emissions from QAL, • QAL has applied a rigorous engineering design to the alumina handling upgrades in partnership with an engineering service provider, whom has agreed to a no visible dust guarantee on the Island A frame shed, • The completion of the upgrades on the Island shed are required to ensure that visible dust emissions from the alumina loadout infrastructure, including the new alumina loader are minimised, • The system is designed to minimise the loadout of fine dust, at levels which can lead to significant visible dust events, through improvements to key materials handling systems, • QAL will monitor the operation of the island shed in regard to visible dust emissions and review the design of after 12 months operation with the upgrades installed, • Based on this timeline, it is estimated that the mainland shed upgrades will be scheduled for completion by 30 June 2026, • Given the low visible dust contribution from the mainland shed and the prolonged schedule, QAL has withdrawn the project from the 5YES portfolio.
Comments	

Implementation Schedule






Task	Alumina Dust Emissions Reduction																			
	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Alumina Loadout			Complete						Complete						Complete					
A-frames, alumina and hydrate transfer systems					Complete															
BSL alumina transfer upgrade	Complete																			
Island Shed Alumina Handling Upgrade													Complete				Complete			
Mainland Shed Alumina Handling Upgrade													Complete				Withdrawn from 5YES			
	Study	Engineering	Execution																	



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Alumina Dust Emissions

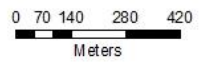
Legend

-  Ship Loadout
-  Island A Frame
-  BSL Conveyor and Transfer Points
-  Conveyors and Transfer Points
-  Mainland A Frame

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Coordinate System: GDA 1994 MGA Zone 58

Scale at A3: 1:12,834



N 	Revision	A
	Date	21/10/2018
	Created By	Jonathan Dalton
	Approved By	Jonathan Dalton

Project (A3)	Odour Emission to Community
Risk class	- III/High
Environmental risks	- Odour releases with potential for impact on air quality of surrounding communities.
Project solution / options	- Implement the projects identified to reduce digestion odour releases to the community.
Objective / performance outcome	- Minimise QAL odour profile within the community
Performance Indicator	- Reduction in volatile organics released from digestion, - Noticeable reduction in odour in the community.
Cost estimate A\$ million	- 27.8
Project Stage	<p>Completed</p> <ul style="list-style-type: none"> - Baseline odour sampling, - Non-thermal plasma trial, - Odour modelling based on baseline sampling, - Wash water heater trial, <ul style="list-style-type: none"> • The wash water heater trial demonstrated that odourous vapour can be condensed into the seawater flow sent to the waste tanks. - The new thermal oxidizer (TO) has been commissioned and its operation will reduce down time where spent liquor heaters are venting directly to atmosphere. - Evaporation heater vent condensate collection improvement project. - NTP Unit installation on Wash water tanks, and - Barometric seawater condensing units have been installed and will be commissioned.
Comments	

Implementation schedule

Study Engineering Execution

Task	Odour Emission to Community																					
	2019				2020				2021				2022				2023					
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4		
Odour source sampling and modelling	Complete																					
Blow off Tank vapour wash water heater condensing trial					Complete																	
Alternate odour treatment technology trial - Non thermal plasma			Complete																			
Evap heater vent condensate collection	Complete		Complete		Complete																	
Second thermal oxidiser	Complete		Complete																			
NTP Unit installation on Bad Wash Water Tank					Complete		Complete		Complete													
Relief Tank Odour Reduction - Barometric Seawater Condensing									Complete		Complete		Complete									
Relief Tank Odour Reduction - Air Stripping									Cancelled													

Implementation Schedule

Coal Stockpile Dust Mitigation																				
Task	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Install upgraded spinkler system	Complete				Complete				Complete											

Study
Engineering
Execution



Coal Stockpile Dust Emissions

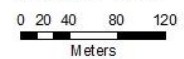
Legend

- Strategic Coal Stockpile
- Working Coal Stockpile

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:3,946



Revision: A
 Date: 21/10/2016
 Created By: Jonathan Dalton
 Reviewed By:
 Approved By: Jonathan Dalton

Project (A5)	Bauxite Transfer Dust Emissions
Risk class	- III/High
Environmental risks	- Fugitive dust emissions from bauxite transfer system have the potential to impact on air quality in the surrounding community.
Project solution / options	- Implement identified project to minimise the release of bauxite dust from the conveyor.
Objective / performance outcome	- Reduced dust emissions from bauxite transfer systems
Performance Indicator	- Bauxite dust emissions from return side of the wharf conveyor are mitigated.
Cost estimate A\$ million	- 1.07
Project Stage	Complete - Install a belt washer station and improved scrapers
Comments	

Implementation Schedule


Bauxite Transfer Dust Reduction Study												
Task	2019				2020				2021			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Install belt wash station and upgrade scrapers	Complete			Complete			Complete					
	Study	Engineering	Execution									



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Bauxite Transfer Dust Emissions

Legend

 Bauxite conveyor and transfer points

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:12,500

0 70 140 280 420
Meters

	Revision:	1
	Date:	20/12/2023
	Created By:	Jonathan DeLore
	Approved By:	Jonathan DeLore

Project (A6)	Ash Dam Dust Emissions
Risk class	- III/High
Environmental risks	- Fugitive dust (ash) emission emissions have the potential to impact on air quality of surrounding communities.
Project solution / options	- Implement the identified project to reduce ash dust releases from the ash dam.
Objective / performance outcome	- Minimise dust generation from ash dam cells 3 and 4
Performance Indicator	- Ash dam dust is reduced after rain events.
Cost estimate A\$ million	- 6.9
Project Stage	Execution <ul style="list-style-type: none"> - Install new ring main and saltwater pump to provide seawater to be applied to Cell's 3 and 4 during a rain event. <ul style="list-style-type: none"> • Delays to the project are primarily around the need to re-design some aspects of the suction pipeline. • This project is expected to be completed in Q1 2024. - Boilerhouse ash slurry pumps will be utilized to apply saltwater and ash to Cell 2 in the event of a rain event.
Comments	Dust occurs after rainfall, due to the fresh water breaking the salt crust formed on the surface of the cells.

Implementation Schedule

Study Engineering Execution

Task	Ash Dam Dust Emissions																							
	2019				2020				2021				2022				2023				2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Engineering for dust mitigation on ash dam	Complete				Complete																			



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**Ash Dam
Dust Emissions**

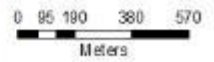
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 Ash ponds

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Scale at A3 1:16,763



	Revision:	1
	Date:	20/12/2023
	Created by:	Jonathan DeLore
	Approved by:	Jonathan DeLore

Water Management Improvement Projects

QAL's plan to improve water quality management over the next five years is supported by targets, actions and a program of works summarised below. Capital spend is estimated at between A\$90 million to A\$175 million.

Project (W1)	Raw Material Spill from Wharf
Risk class	- IV/Critical
Environmental risks	- Release of raw materials including caustic and bauxite to Gladstone harbour during unloading operations has the potential to impact on the water quality of Port Curtis.
Project solution / options	- Implement the identified project to reduce the risk of raw materials spills from the wharf into Port Curtis.
Objective / performance outcome	- Reduce risk of release of raw material spills during unloading operations
Performance Indicator	- Gaps in the wharf are filled in.
Cost estimate A\$ million	- 0.961
Project Stage	Complete - Gaps within the wharf bunds have been filled with panels to stop the release of materials to the water in this area.
Comments	

Implementation Schedule

Raw Material Spill from Wharf																				
Task	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Fill in openings on wharf																				

Study
Engineering
Execution



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Raw Material Spill from Wharf

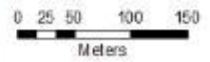
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 Wharf - Raw Material Spill

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3: 1:4,442



	Revision:	1
	Date:	28/12/2023
	Created By:	Jonathan DeLor
	Approved By:	Jonathan DeLor

Project W2	Coal Stockpile Stormwater Runoff
Risk class	- III/High
Environmental risks	- Release of coal contaminated stormwater to receiving environment has the potential to impact on the water quality in Port Cutis.
Project solution / options	- Implement the identified projects to reduce the TSS and pH risk for releases from the WCSP.
Objective / performance outcome	- Mitigate risk of coal contaminated stormwater leaving the coal stockpile catchment area - Mitigate the risk from high pH water released from the west contaminates pond.
Performance Indicator	- Stormwater releases from the WCSP are compliant with the EA.
Cost estimate A\$ million	- 2.646
Project Stage	<p>Complete</p> <ul style="list-style-type: none"> - Improvement in neutralisation capability in the west coal stilling pond, including <ul style="list-style-type: none"> • Automation of the seawater inlet valve, • Improved seawater distribution to maximise mixing. - TSS functionality improvements for the west coal stilling pond have been completed, including: <ul style="list-style-type: none"> • Works to stop seepage around the weir, • Re-establish the functionality of the dividing wall for sediment control and contaminated water segregation. <ul style="list-style-type: none"> ▪ Install additional fingers to lengthen the flow path and allow for easier desilting.
Comments	

Implementation Schedule

Coal Stockpile Stormwater Runoff																				
Task	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Phase 2 Study	Complete																			
Improve west coal stilling pond functionality - Neutralisation									Complete				Complete							
Improve west coal stilling pond functionality - TSS					Complete				Complete											
	Study	Engineering	Execution																	




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Coal Stockpile Runoff

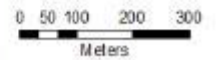
Legend

-  East Coal Stilling Pond
-  West Coal Stilling Pond
-  Strategic Coal Stockpile
-  Working Coal Stockpile

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:9,884



	Reviewed By:	J. DELANEY
	Created By:	JONATHAN DELANEY
	Checked By:	
	Approved By:	JONATHAN DELANEY

Project (W3)	Waste line 4 Integrity
Risk class	- IV/Critical
Environmental risks	- Failure of Waste Line 4 into marine or terrestrial environments will result in release of partially neutralised red mud with a potential to contaminate land or water and impact on the water quality in South Trees Inlet and Port Curtis.
Project solution / options	- Implement the identified project to increase the operational life of waste line 4, while reducing the risk of failure.
Objective / performance outcome	- No loss of containment incidents
Performance Indicator	- 20 years life of waste line 4 with minimal risk of loss of containment incidents
Cost estimate A\$ million	- 38.288
Project Stage	Complete
Comments	

Implementation Schedule

Waste Line 4 Capacity																	
Task	2018	2019				2020				2021				2022			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Waste line 4 capacity replacement	Complete	Complete				Complete				Complete							
Study	Engineering	Execution															



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Waste Line 4

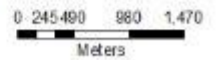
Legend

 Waste Line 4

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:44,421



	Revised By:	J. J. J.
	Created By:	Jonathan Deller
	Checked By:	Jonathan Deller
	Approved By:	Jonathan Deller

Project (W4)	East & West Contaminants Ponds
Risk class	- III/High
Environmental risks	- The East and West contaminants ponds capture contaminated stormwater runoff for recycling into the process. Insufficient capacity has the potential to impact the capability of the contaminated stormwater treatment system prior to release and has a potential to impact on the water quality in Port Curtis. A further potential impact exists for groundwater from the unlined east contaminants pond.
Project solution / options	- Implement the identified projects to meet the containment requirements in the EA.
Objective / performance outcome	- Ensure containment ponds prevent land and groundwater contamination and mitigates the risk of stormwater contamination
Performance Indicator	- Study phase identifies options to prevent land and groundwater contamination from contaminants ponds and they are progressed to engineering.
Cost estimate A\$ million	- 21.393
Project Stage	<p>Complete</p> <ul style="list-style-type: none"> - Install new pump in west contaminates pond and pipeline to east contaminates pond, and - The east contaminates pond (ECP) project - tanks have been completed and are in operation. The east contaminates pond has been taken out of service, which means that no contaminated runoff can enter the pond and lining will be completed in Q1 2024.
Comments	

Implementation Schedule



East and West Contaminants Ponds																				
Task	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
West contaminates pond				Complete				Complete				Complete				Complete				
East contaminates pond								Complete				Complete				Complete				Complete
	Study	Engineering	Execution																	



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Contaminants Ponds

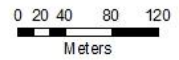
Legend

-  East Pond
-  West Pond

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Coordinate System: GDA 1984 MGA Zone 58

Scale at A3 1:4,274



	Revision	A
	Date	21/10/2016
	Created By	Jonathan Dalton
	Approved By	Jonathan Dalton

Project (W5)	Refinery Water Release Management
Risk class	- III/High
Environmental risks	- Releases from the sweetening bauxite pond and the west gate wetland have the potential to impact on water quality in Port Cutis.
Project solution / options	- Implement the identified projects to reduce the risk of non-compliant water releases from the refinery.
Objective / performance outcome	- Ensure pH, suspended solids and other release water quality parameters are maintained within limits and no uncontrolled release to receiving environment
Performance Indicator	- Stormwater management ponds meet licensed discharge limits. - 85% availability of online instruments at the sweetening bauxite pond and wetland release point
Cost estimate A\$ million	- 6.439
Project Stage	<p>Complete</p> <p>Mill 10 sump;</p> <ul style="list-style-type: none"> • Improve management of bauxite in the bund, • Ensure grades within the bund are correct, • Install an additional drive-in sump to allow for collection of bauxite and fast reclaim. <p>- Bauxite Sweetening Pond:</p> <ul style="list-style-type: none"> • Pre-treatment pond to reduce bauxite and bauxite fines from the mono bauxite stockpile entering the bauxite sweetening pond. <p>- Wetland Release:</p> <ul style="list-style-type: none"> • V-notch weir and flow meter installed, • Continuous water quality monitoring installed. <p>- Sweetening Bauxite Pond</p> <ul style="list-style-type: none"> • Continuous water quality monitoring installed, • A level sensor installed. <p>- Westgate pond - Improve capacity and functionality:</p> <ul style="list-style-type: none"> • Increase capacity of the pond • Install mid pond continuous pH monitoring, • Relocate the seawater discharge location to allow for better access and mixing in the pond.
Comments	




Implementation Schedule

Study **Engineering** **Execution**

Refinery water release improvement																							
Task	2019				2020				2021				2022				2023						
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4			
Phase 2 Study				Complete																			
Install V notch weir and continuous monitoring at Westgate Release Point	Complete																						
Install continuous monitoring at sweetening bauxite pond Release Point	Complete																						
Mill 10 bauxite stormwater pre-treatment upgrade								Complete				Complete											
Westgate pond improvements								Complete				Complete											
Bauxite sweetening pond bauxite stormwater runoff Pretreatment from mono stockpile								Complete				Complete											



Refinery Stormwater Legend

-  Mill 10 Area
-  Sweetening Bauxite Pond
-  West Gate Release

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Coordinate System: GDA 1984 UTM Zone 58
 Scale at A3: 1:11,105
 0 62.5 125 250 375
 Meters

N
 Review Date: 18/12/2023
 Created By: Jonathan Dallas
 Drawn By: Jonathan Dallas
 Approved By: Jonathan Dallas

Project (W6)	RDA Surface/Ground water Impacts
Risk class	- IV/Critical
Environmental risks	- Impacts to surface and groundwater from the RDA that have the potential to impact on the water quality in South Trees Inlet and Port Curtis and terrestrial ecosystems surrounding the RDA.
Project solution / options	- Progress projects in engineering to execution, Implement identified projects to reduce seepage and surface water impacts at the RDA
Objective / performance outcome	- Prevent impact of contaminants from RDA on groundwater - Mitigate the impact of the RDA on adjacent surface water systems and ensure relevant environmental values are protected
Performance Indicator	- Vegetation in the Black Breasted Button Quail (BBBQ) habitat does not show any signs of degradation and rehabilitated areas (to be completed) show no sign of impact after cut off wall is installed and soil in impacted areas is flushed. - A robust monitoring program is in place for the early detection of impact to vegetation, groundwater and marine communities.
Cost estimate A\$ million	- 40.45

Project Stage	<p>Execution</p> <ul style="list-style-type: none"> - RMD 1 GW seepage <ul style="list-style-type: none"> • The sub-surface drain (SSD) will be partially complete and will intercept a portion of the seepage from RMD 1. Two sumps that collect the seepage will be operational. • The SSD will be finished in Q1 2024. <p>Completed</p> <ul style="list-style-type: none"> - EE Stage 1 – install cut-off wall to mitigate impact on BBBQ bird habitat; - EE Stage 2 – Install a cut off wall along the eastern side of the HRMD. - Install a drain along the eastern side of the HRMD. - Install a cut off wall and drain along the western side of the northern decant pond – cell 1 to intercept potential seepage from the pond. - RMD 2 NE Corner SW, - HRMD (historic red mud dam) north and west seepage mitigation – the sub-surface drain has been completed, capturing any seepage from the HRMD and the cut-off wall, which is partially completed with be finished in Q1 2024.
Comments	<ul style="list-style-type: none"> - Groundwater removal on the dam side of the cut-off wall at the BBBQ habitat has resulted in sustained lower water levels demonstrating that the cut-off wall is functioning as designed. <ul style="list-style-type: none"> • BBBQ movements have been recorded in the habitat; <ul style="list-style-type: none"> ▪ A survey identified 95 BBBQ movements in 2021 compared to 0 in 2016.

Implementation Schedule

Task	RDA Surface/Groundwater Impacts																							
	2019				2020				2021				2022				2023				2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
EE Stage 1 - Install cut-off wall to mitigate impact on BBBQ habitat and recovery pumps	Complete																							
EE Stage 2 - Install cut-off wall/trench along eastern side of historical RDA		Complete		Complete																				
Cell 1 cut-off wall and drain									Complete															
HRMD North and West Seepage Mitigation													Complete				Complete							
RMD 2 NE Corner SW													Complete		Complete									
RMD 1 GW seepage															Complete									
Study	Engineering				Execution																			



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**RDA
Groundwater
Impacts**

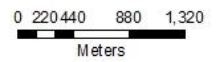
Legend

-  EE Stage 1
-  EE Stage 2

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Coordinate System: GDA 1994 MGA Zone 58

Scale at A3 1:39,597



	Revision	A
	Date	21/12/2018
	Created By	Jonathan Dalton
	Approved By	Jonathan Dalton

Project (W7)	RDA Release to Receiving Environment
Risk class	- IV/Critical
Environmental risks	- The chemistry of the red mud dam discharge into South trees Inlet has been changing over the past 5 to 10 years. This, together with the siltation of South Trees Inlet and decrease in water flow, has resulted in low dissolved oxygen between the discharge site and confluence of the Boyne River and has the potential to impact on the water quality in South Trees Inlet and the Boyne River.
Project solution / options	- Projects identified are implemented to reduce the risk of environment harm to the receiving environment.
Objective / performance outcome	- Ensure the environmental values of South Trees Inlet are protected in the long term.
Performance Indicators	- Engineering options are progressed to execution. - Releases to the environment comply with release limits set out in the EA.
Cost estimate A\$ million	- 148.671
Project Stage	<p>Engineering</p> <ul style="list-style-type: none"> - Alternate Discharge Location <ul style="list-style-type: none"> • The BSL wharf has been chosen at the preferred alternate discharge location, • Detailed design of the pipeline route and diffuser has been finalised, • The engineering stage of this project will be complete in Q1 2024, • This project is anticipated to be completed in early 2025. <p>Execution</p> <ul style="list-style-type: none"> - Cell 2 of the northern management and treatment area will continue to be constructed in 2024 and will be linked with cell 1 when completed. - The project is currently scheduled to be completed in Q3 2024. <p>Complete</p> <ul style="list-style-type: none"> - Construction of Cell 1 of the northern decant management and treatment area has been completed.
Comments	

Implementation Schedule

Task	RDA Alternative Discharge Location																							
	2019				2020				2021				2022				2023				2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Northern Decant Pond - Cell 1				Complete	Complete																			
Northern Decant Pond - final configuration					Complete																			
Alternate Discharge Location					Complete																			

Study
Engineering
Execution



RDA Discharge

Legend

- Licenced Discharge Point

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Coordinate System: GDA 1984 UTM Zone 56
 Scale at A3: 1:44,421
 0 245 490 980 1,470
 Meters


 Revision: 0
 Date: 28/12/2018
 Created By: Jonathan Dallas
 Approved By: Jonathan Dallas

Project (W8)	High Risk Pipelines
Risk class	- IV/Critical
Environmental risks	- Caustic release to the environment as a result of failure of pipeline from the storage area (island) to refinery (mainland) across causeway with potential to impact on the water quality in Port Curtis.
Project solution / options	- Investigate options to upgrade high risk pipelines (caustic and contaminated water) to reduce the risk of a pipeline failure
Objective / performance outcome	- Reduce the risk of off-site contamination
Performance Indicator	- High risk pipelines are installed to provide a 20-year life with a reduction in likelihood of failure.
Cost estimate A\$ million	- 12.8
Project Stage	Complete
Comments	

Implementation Schedule


High Risk Pipelines																
Task	2019				2020				2021				2022			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Investigate options for replacement of high risk pipelin	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete	Complete
	Study	Engineering	Execution													



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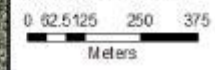
High Risk Pipelines

Legend

 High Risk Pipelines

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Coordinate System: GDA 1984 UTM Zone 58
Scale at A3: 1:11,096



N 	Revision:	1
	Date:	20/12/2023
	Created By:	Jonathan DeLore
	Approved By:	Jonathan DeLore

Land management improvement projects

QAL's five-year land stewardship program, supported by targets, actions and a program of works is summarised below. Capital spend is estimated at between A\$20 million to A\$35 million.

Project (L1)	Integrity of Bunds and Drains
Risk class	- IV/Critical
Environmental risks	- Seepage from bunded refinery areas has the potential to contaminate groundwater.
Project solution / options	- Projects identified are implemented to reduce the risk of seepage from bunded areas and drains.
Objective / performance outcome	- Restore the integrity of refinery area bunds and drains
Performance Indicator	- All areas identified for remediation are repaired
Cost estimate A\$ million	- 43
Project Stage	<p>Complete</p> <ul style="list-style-type: none"> • Above ground section of 7th street drain, • HID ¾, • A precipitation row concrete remediation works, • Tertiary tanks 1-4 nib wall replacement, • Sulphuric acid tank bund interim remediation, • 5th Street drain, • EF row concrete remediation works, • Bravo Street Drain, • Sierra Street Drain, • Tertiary tank 5 bund repairs, • 9th Street Drain, • New sulphuric acid storage and handling facility, • 1st Street Drain (above ground), • November Street Drain (above ground), • HID1/5 bund repair, • Filter Press South Floor, • HID 2/6 bund, • Fill tanks 1&2 bund, • Secondary settler No. 7 sump, • Tertiary Tanks 7,8,9 sump, and • F/G row sump and bund, • East West Road (Above Ground) drain, • Papa Street drain, • East West Road (Below Ground) drain, and • Lima Street drain.
Comments	

Implementation Schedule


Task	Integrity of bunds and Drains																					
	2018		2019				2020				2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
5th Street Drain repairs				Complete																		
Bravo Street Drain repair				Complete																		
Sierra Street Drain repairs				Complete																		
Installation of new sulphuric acid storage facility							Complete															
EF Row concrete remediation works						Complete																
Tertiary tanks 1-4 nib wall replacement					Complete																	
Sulphuric acid tank interim bund remediation					Complete																	
Above Ground Section of Seventh Street Drain repair	Complete																					
HID 3/4 bund repair	Complete																					
HID 1/5 bund repair										Complete												
Tertiary tank 5 bund remediation								Complete														
9th Street drain repairs									Complete													
1st Street Drain (above ground)												Complete										
November Street Drain (above ground)												Complete										
Filter Press South Floor																Complete						
East West Road (Above Ground) drain																					Complete	
Papa Street Drain																					Complete	
East West Road (Below Ground) drain																					Complete	
Lima Street drain (Underground)																					Complete	
HID 2/6 Bund																					Complete	
Fill Tanks 1&2 Bund																					Complete	
Secondary Settler 7 sump																					Complete	
Tertiary Tanks 7,8,9 sump																					Complete	
F/G Row sump and bund																					Complete	
Study																						
Engineering																						
Execution																						



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Integrity of Bunds and Drains

Legend

 Bunds and Drains

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This map is a summary of the information contained in the site assessment report and is not intended to be used as a substitute for the full report. It is the user's responsibility to ensure that the information is used in accordance with the intended purpose of the report.

Coordinate System: GDA 1984 UTM Zone 56
Scale at A3: 1:9,359
0 50 100 200 300
Meters

Revision:	1	Author:	JONATHAN DILLON
Created By:	JONATHAN DILLON	Reviewed By:	JONATHAN DILLON
Approved By:	JONATHAN DILLON	Approved By:	JONATHAN DILLON

Project (L2)	Ground Water Impact to South Trees Island Tank Farm
Risk class	- III/High
Environmental risks	- Caustic impact to ground water and potential to migrate to receiving environment (DES EPO STAT 1249 related) and has the potential to impact on groundwater quality.
Project solution / options	Maintain and monitor current extraction program beneath bund 4, South Trees Island
Objective / performance outcome	- Historic ground water impact to South Trees Island does not migrate and is reduced over time
Performance Indicator	- No increase in pH in groundwater bores outside of bund with extraction system operational
Cost estimate A\$ million	- 1.7
Project Stage	Complete
Comments	-



Groundwater Impacts at South Trees Island Tank Farm

Legend

- Bund 2
- Bund 4


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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:2,981

0 15 30 60 90

Meters


 Revision: A
 Date: 21/10/2016
 Created By: Jonathan Dalton
 Reviewed By:
 Approved By: Jonathan Dalton

Project (L3)	Mineral Waste Disposal Facility – Stage 2
Risk class	- III/High
Environmental risks	- Potential for land contamination from landfilled mineral wastes and potential for impact on water quality in South Trees Inlet; secondary potential impact to effectiveness of current recycling program.
Project solution / options	- Projects identified are implemented to reduce the risk of seepage from the mineral waste disposal facility and historically placed material.
Objective / performance outcome	- Execute the design for the mineral waste disposal facility.
Performance Indicator	- Minimise and contain leachate from the mineral waste disposal facility.
Cost estimate A\$ million	- 17.834
Project Stage	Complete <ul style="list-style-type: none"> - Mineral Waste Disposal Facility stage 2 - An interception drain located south of the mineral waste disposal facility has been identified as the best option to minimise the risk of seepage migration.
Comments	


Implementation Schedule

Mineral Waste Disposal Facility																								
Task	2019				2020				2021				2022				2023							
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Implement design for stage 2 of the MWDF	Complete				Complete																			
Mineral waste seepage mitigation							Complete		Complete				Complete											
	Study	Engineering	Execution																					



Mineral Waste Facility - Stage 2

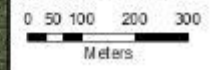
Legend

 Mineral Waste Facility

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3: 1:9,359



Revision	1	2014/01/14
Created By	Jonathan Deller	
Checked By	Jonathan Deller	
Approved By	Jonathan Deller	

Project (L4)	Sewerage System Upgrade
Risk class	- III/High
Environmental risks	- Potential for land contamination from sewerage system installed during initial and subsequent plant construction phases and potential to contaminate groundwater. - Introduction of inadequately treated effluent to the RDA.
Project solution / options	Project identified is completed to stop leaks from the sewer system and provide a functioning sewage treatment plant.
Objective / performance outcome	- Reduce the risk of the release of sewage to land.
Performance Indicator	- Sewerage system is fully functional.
Cost estimate A\$ million	- 4.770
Project Stage	Complete - Refurbish existing sewage treatment plant, and - Install a new pipeline to the treatment plant replacing the section with the leak.
Comments	

Implementation Schedule


Sewerage System																				
Task	2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Complete engineering for the sewerage system at the refinery	Complete				Complete								Complete							
	Study	Engineering	Execution																	



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Sewerage System Review

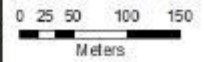
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 Sewage Treatment Plant

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3: 1:4,600



	Reviewed By:	J. DELANEY
	Checked By:	JONATHAN DELANEY
	Drawn By:	JONATHAN DELANEY
	Approved By:	JONATHAN DELANEY

Project (L6)	Closure Pilot - RDA rehabilitation
Risk class	- II/medium
Environmental risks	- Implementation of a long-term effective cover system for closure at the RDA
Project solution / options	- Undertake research of cover systems for closure of the RDA.
Objective / performance outcome	- Determine if a long-term cover system can be sustained at the RDA.
Performance Indicator	- Study phase identifies options for long term remediation of the red mud dams. - Trial plot at RDA sustains vegetation to show proof of concept for the project.
Cost estimate A\$ million	- 1.75
Project Stage	Engineering - The remaining four years of the strategy will determine the long term viability of making technosoils from red mud.
Comments	- A Pilot rehabilitation trial is established at the Residue Disposal Area. - QAL and the University of Queensland were recognised with the 2019 Partners in Research Excellence Awards for work on the development of technosoils at the RDA.

Implementation Schedule


RDA Closure Rehabilitation																								
Task	2018				2019				2020				2021				2022				2023			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Investigate closure cover options for the RDA	Complete																							

Study Engineering Execution



**RDA Rehabilitation -
Pilot Study**

Legend

 Rehabilitation Trial Area

Project (L7)	Oil/water facility resizing
Risk class	- II/Medium
Environmental risks	- Land contamination from oily wastes with the potential to impact groundwaters and the water quality in South Trees Inlet.
Project solution / options	- Install an oil/water separator at the waste transfer facility
Objective / performance outcome	- To improve management of oily wastes.
Performance Indicator	- Management of oily/water on site is improved. - Oil spills at the refinery are reduced.
Cost estimate A\$ million	- 1.28
Project Stage	Complete - All oil/water separator and storage facility has been completed and has been commissioned.
Comments	- This facility provides a permanent location for the storage of oil waste prior to transport off-site to a recycling facility.

Implementation Schedule

Oil/water Separation Facility										
Task	2018	2019				2020				
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Complete design for upgrade to oil/water separator at waste transfer station	Complete	Complete								


Study Engineering Execution



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Proposed Oil Water Facility

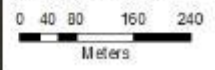
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 Oil water facility

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Coordinate System: GDA 1984 UTM Zone 58

Scale at A3 1:7,019



North Arrow	Revision	1
	Date	20/12/2023
	Created By	Jonathan DeLore
	Checked By	Jonathan DeLore
	Approved By	Jonathan DeLore

Project (L8)	Strategy for Caustic Storage
Risk class	- III/High
Environmental risks	- Current South Trees Island storage location has risks (substrate) for location of a tank farm and a risk of groundwater contamination.
Project solution / options	- Investigate options for a long-term caustic storage tank farm.
Objective / performance outcome	- Confirm current locations suitability for the tank farm or; - Identify suitable alternate locations for the caustic storage tank farm
Performance Indicator	- Execution phase – all operational caustic storage tanks are inspected, all faults repaired and returned to service with RPEQ signoff.
Cost estimate A\$ million	- 24.431
Project Stage	Complete - Tank 1515 - Tank T15Q005 - Tank T15Q006
Comments	

Implementation Schedule

Caustic Storage Strategy

Task	2019				2020			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Inspect and repair tank T1515	Complete							
Inspect and repair tank T15Q005			Complete					
Inspect and repair tank T15Q006				Complete				



Study Engineering Execution




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Groundwater Impacts at South Trees Island Tank Farm

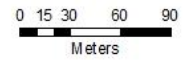
Legend

-  Bund 2
-  Bund 4

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Coordinate System: GDA 1984 MGA Zone 58

Scale at A3 1:2,981



N ↑	Revision	A
	Date	21/10/2016
	Created By	Jonathan Dalton
	Approved By	Jonathan Dalton

Other Environmental Improvement Projects

In addition to projects that address the specific environmental parameters of air, water and land, projects that address other aspects of the operation have also been identified below.

Project (O1)	Noise Emissions
Risk class	- III/High
Environmental risks	- Community noise impact from operational and maintenance works.
Project solution / options	- Review current noise impact management including: <ul style="list-style-type: none"> • Efficacy of implemented controls on hydro-blasting • Adequacy of noise monitoring program; • Noise source assessment; • Plant and equipment noise mitigation options; and • Operational improvements (e.g. timing of noisy work practices).
Objective / performance outcome	- Reduce QAL noise footprint
Performance Indicator	- Study phase – <ul style="list-style-type: none"> • Verifies high risk noise sources are adequately managed.
Cost estimate A\$ million	- 0.174
Project Stage	Study - Complete Complete - Emergency diesel generator building noise reduction paneling has been installed.
Comments	- Noise surveys show that QAL meets the EA conditions, - High noise generating activities, such as hydroblasting are regulated through on-site procedures that limit the time these activities can be undertaken. Specific high noise exposure areas will be targeted in conjunction with occupational hygiene projects. These projects will target plant and equipment that exceed occupational exposure limits and will have an improvement on environmental noise.

Implementation Schedule

Noise Emissions									
Task	2018	2019				2020			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Review current noise impact management						Complete			

Study
Engineering
Execution