Hexham TSF Flood Emergency Management Plan

1 October 2021

Plan Approval Table

Position	Name	Signature	Date
Regional Maintenance Manager	Dave Mayo		6/10/21

Revision History

Rev	Date	Author	Comments
1	04/02/2104	Martin Hicks	Final
2	06/02/2014	Martin Hicks	Update following DP&I comments
3	12/02/2014	Martin Hicks	Update following OEH comments
4	13/08/2014	Heath Anderson	Update Ops Phase Stage 1
5	05/02/2015	Heath Anderson	Update Ops Phase Stage 2
6	09/01/2018	Harry Egan	Minor edits following OPA.
7	13/05/2019	Harry Egan	Update following 2018 IEA
8	28/04/2020	Harry Egan	Update to include turning angle
9	01/10/2021	Harry Egan	Annual update

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Glossary

Term	Definitions
AEP	Annual Exceedance Probability
the Approval	State Significant Infrastructure MP07_0171 MOD 1
Aurizon	Aurizon Operations Pty Ltd
ARTC	Australian Rail Track Corporation
BoM	Bureau of Meteorology
CMF	Combined Maintenance Facility
CWR	Coal Washery Reject
DAF	Dissolved aeration floatation
EPL	Environmental Protection Licence
EP&A Act	*Environmental Planning and Assessment Act 1979*
FEMP	Flood Emergency Management Plan
NCC	Newcastle City Council
NoW	NSW Office of Water
OEMP	14-PLA-0004-HEX Aurizon Hexham TSF Operational Environmental Management Plan
PASS	Potential acid sulphate soils
PF	Provisioning Facility
PMF	Probably Maximum Flood
SES	State Emergency Services
the Site	Hexham Train Support Facility
SoC	Statement of Commitments
SSI	State Significant Infrastructure

1.0 Introduction

1.1 Site Description

The Aurizon Operations Pty Ltd (Aurizon) Hexham Train Support Facility (the Site) has a total area of 255ha and is located at Hexham approximately 16km north-west of the Newcastle Central Business District.

The Site shares borders with the Main Northern Railway and Pacific Highway to the east and the New England Highway to the north. To the south and west rural properties and the Hexham Swamp Nature Reserve are adjacent. The Site is located within a predominantly industrial setting, with only a small number of residential dwellings within the local vicinity.

The Site's history as a coal handling facility has resulted in the southern portion of the site containing an abandoned rail loop corridor and coal washery reject (CWR). CWR is retained within vegetated stockpiles however it is also present extensively in sub surface deposits. Remediation completed during the construction of the TSF infrastructure has resulted in excavated CWR and Potential Acid Sulphate Soil (PASS) being stockpiled in the southern portion of the site

Brancourts Manufacturing and Processing Pty Ltd are currently licensed to use a portion of the site for a waste water treatment plant and effluent irrigation area under Environmental Protection Licence (EPL) 816. Effluent is irrigated over the above mentioned CWR stockpiles.

1.2 Operational Activities

The Site provides routine and ad hoc provisioning and maintenance services to outbound locomotives and wagons. The treatment of generated septic and operational waste water is undertaken onsite through the utilisation of a septic treatment plant and dissolved aeration floatation (DAF) plant.

Infrastructure associated with the Site and the above-mentioned operational activities are restricted to approximately a 38 hectare portion of the Site and consists of:

- Seven train tracks (10.5 kilometres) parallel to the existing mainline, turning angle and a shunt track;
- a provisioning building, service vehicle garage and combined maintenance/administrative centre;
- surface water management infrastructure including retention basins;
- bulk fuel storage area; and
- A wastewater treatment plant with on-site effluent irrigation and DAF.

1.3 Legislative Context

The project was assessed and approved as State Significant Infrastructure (SSI) under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Site was approved by a delegate of the Minister for Planning and Infrastructure under MP07_0171, dated 10 October 2013. The Hexham TSF Turning Angle (the Turning Angle) Modification MP 07_0171 MOD 1 (SSI-6090) (the Approval) was approved on the 09 October 2019.

This Flood Emergency Management Plan (FEMP) has been developed and implemented as required by Condition C15 of the Approval. A matrix of the conditions of approval and Statement of Commitments (SoC) is included as Appendix A. This matrix identifies where these conditions/commitments have been addressed in the FEMP.

The FEMP has been developed with reference to the Guidelines for the Preparation of Environmental Management Plans (Department of Planning, 2004) and should be read in conjunction with the 14-PLA-0004-Hex Aurizon Hexham TSF Operational Environmental Management Plan (OEMP), Rev 10 (October 2021).

1.4 Purpose and Objectives

The FEMP details the key information and instructions to manage flood risk during the operational phases of the Site. Key elements of the plan include identification of local incident management procedures, safety requirements, commercial implications, training requirements and record keeping requirements.

2.0 Site Flood Context

The Site is located within the floodplain of the lower Hunter River. As a result, there is potential for floodwaters to inundate the Site and surrounding land. In severe floods the depth of inundation across surrounding lands can be substantial and last at elevated levels for several days. Hence, there is potential for employees at the TSF, to be exposed to an increased risk during times of major flooding.

Despite the Site being constructed above the predicted peak level for the 2% Annual Exceedance Probability (AEP) flood, provisions are required for rarer floods up to the Probable Maximum Flood (PMF) (0.001% AEP event or greater).

Information detailed in the FEMP has been sourced from the following assessments:

- Hexham TSF - Turning Angle Flood Assessment (BMT, 27 May 2019)
- Hexham Relief Roads and Long-term Train Support Facility Joint Flood Impact Assessment (BMT WBM, 2013);
- Newcastle City-Wide Floodplain Risk Management Study and Plan (BMT WMB, 2012);
- New South Wales State Disaster Plan (SEMC, 2010); and
- NSW LTTSF Flooding Risk Assessment Report (Engenicom, 2013).

2.1 Historical Context

Hexham is situated on the southern banks of the Hunter River between the main river channel and Hexham Swamp. During the1955 flood, floodwaters entered the Swamp across the New England Highway between Hexham Bridge and Tarro. Computer based flood modelling has since confirmed that this flow path is a major floodway during large floods.

Although the New England Highway in the Hexham area has been raised over the last 50 years or so, this floodway has been maintained. Newcastle City Council (NCC) has dedicated this low lying land between Hexham and Tarro as a flood reserve, classified as floodway in Council's City-wide Floodplain Risk Management Study and Plan (2012)

Nonetheless, floodwaters that overtop the river's banks are not necessarily contained within the defined floodway. In large floods, floodwaters spill out across the floodplain filling Hexham Swamp. In these circumstances most of the existing development in the Hexham area is likely to be at least partly inundated. In major floods, water levels remain in the overbank areas for at least 72 hours.

2.2 Flood Levels

Major floods that have occurred in the Hunter over the last 50 years and their estimated AEP is detailed in Table 1. Surface water height at Hexham Bridge for relevant AEP events are included in Table 2.

The largest flood at Hexham since completion of the Lower Hunter Flood Mitigation Scheme occurred in 1978. This flood reached a peak water level at Hexham of approximately 2.0m AHD.

Table 1 - Hexham Historical Floods

Year	Hexham Peak Water Level (m AHD)	Hexham Flood Probability (AEP)
1955	3.8	1%
1971	1.6	>10%
1972	1.6	>10%
1977	1.8	10%
1985	1.6	>10%
1990	1.6	>10% AEP
2007	1.7	>10% AEP

Table 2 - Hexham AEP Flood Heights

AEP Event	Hexham Bridge Peak Flood Level (m AHD)
PMF	8.0
1%	3.8
2%	2.9
5%	2.3
10%	1.9

2.3 Potential Flood Mechanisms

There are two potential flooding mechanisms that could cause inundation of the Site:

- Overtopping of the banks of the Hunter River upstream of Hexham Bridge and discharge across the New England Highway and into Hexham Swamp; and
- Backwater flooding due to filling of Hexham Swamp by floodwaters overtopping the Pacific Highway downstream of Hexham Bridge.

Flooding at Hexham would typically be due to mainstream Hunter River floods overtopping the river bank upstream of Hexham Bridge. Floodwaters from the Hunter River flow in a south-westerly direction towards the New England Highway where they cross the floodplain between Tarro and Hexham.

Investigations into the impact of raising the level of the New England Highway between Tarro and Hexham established that the road, which is higher than the general level of the floodplain, controls the discharge of floodwaters south from the Hunter River into Hexham Swamp. The Main Northern Railway, which is located about 100 metres west of the New England Highway in this area, acts as a secondary control on floodwaters entering the Swamp.

Longitudinal profiles of the New England Highway between Hexham and Tarro indicate that the low point (2.1 mAHD) in the road is located about 900 metres north of Hexham Bridge. Based on the design flood levels listed in Table 2, a flood slightly more severe than the 10% AEP event at Hexham would be required to cause overtopping of this section of the New England Highway.

Hexham Swamp can also be flooded when the Pacific Highway south of Hexham Bridge is overtopped. This would require the swampland between the Pacific Highway and the Great Northern Railway to fill and floodwaters to 'back-up' upstream, leading to inundation of the Hexham area.

As shown in Figure 1 the Pacific Highway between Hexham Bridge and Sandgate forms a barrier between the South Arm of the Hunter River and Hexham Swamp. The road surface along this stretch of the highway is higher than most of Hexham Swamp. However, for drainage purposes, there are a number of low points along the road across which floodwaters can spill from the South Arm into the Swamp.

Therefore, overtopping of the New England Highway will occur first, and be the critical flooding mechanism that would lead to the onset of flooding across the Aurizon Site. Available elevation information for this section of the highway indicate that low points occur at the locations listed in Table 3 and highlighted in Figure 1.

Table 3 - Approximate Flood AEP Resulting in Overtopping

Low Point	Description	Road Surface (mAHD)	Approximate Flood AEP Resulting in Overtopping
A	New England Highway 900 m north of Hexham Bridge	2.1	10%
B	Intersection of New England Highway & Pacific Highway (Hexham Bridge)	2.0	5%
C	Intersection of Pacific Highway & Shamrock Street	2.0	2%

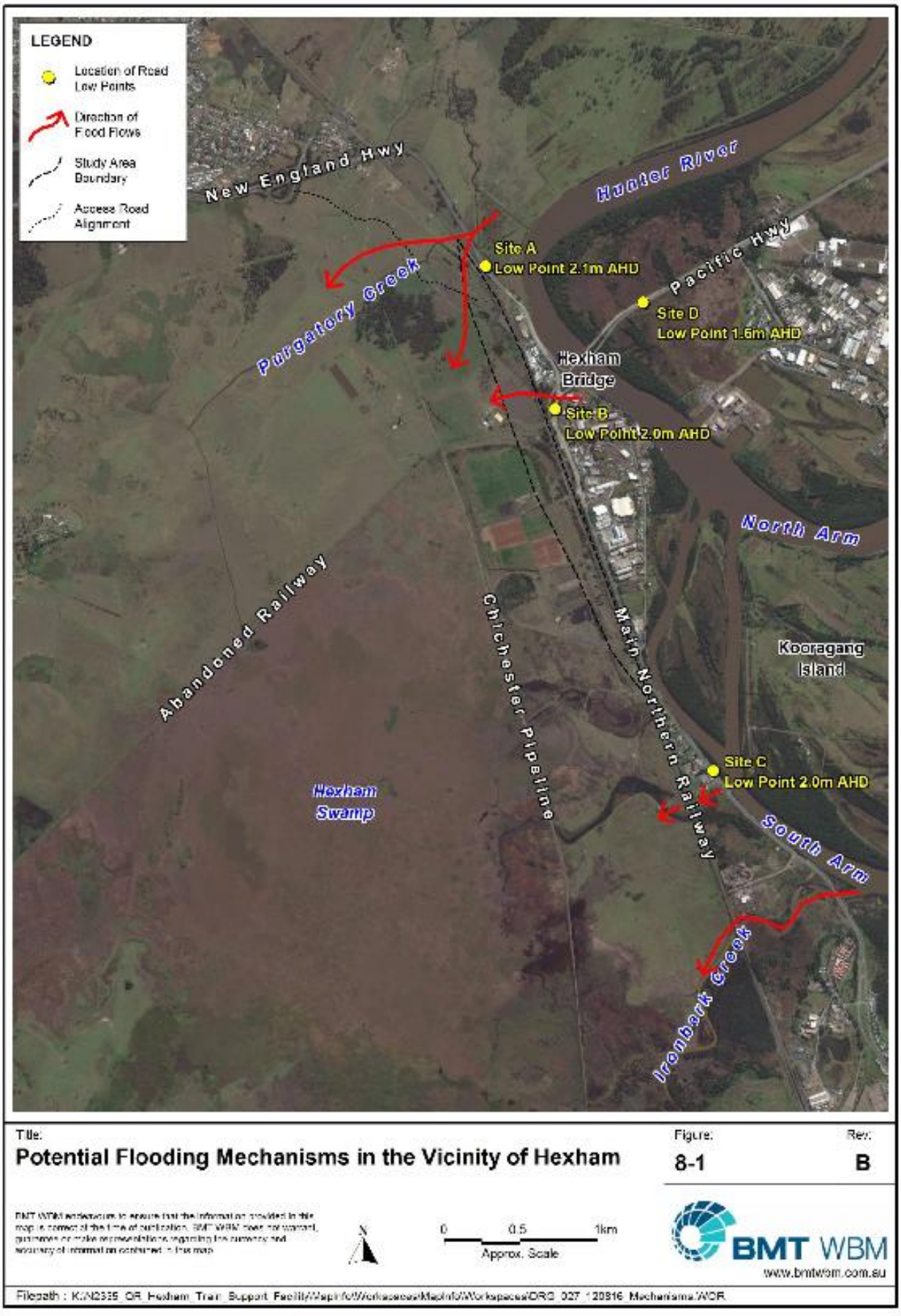


Figure 1 - Potential Flooding Mechanisms

3.0 Flood Emergency Response

The successful implementation of emergency response measures is highly dependent on the flood awareness of the local community and work force in the flood plain and their knowledge of the protocols that need to be followed during a major flood.

The key to ensuring the safety of the workforce in times of major flooding will be the dissemination of flood intelligence during the onset of a major flood so that they can take advantage of the warning time that is available. This can occur through interpretation of Bureau of Meteorology (BoM) Flood Bulletins and State Emergency Service (SES) flood warnings.

It is estimated that a flood warning time of around one to two days will be available prior to the onset of flooding at the Site. Accordingly, there would be ample time for Site staff to relocate stock and equipment to areas above the predicted peak level of the oncoming flood.

Whilst the Site infrastructure, Combined Maintenance Facility (CMF) and Provisioning Facility (PF), floor levels are approximately equivalent to the predicted peak 2% AEP flood level, inundation from greater events may occur and would likely result in damage to components of the facility. Structural damage is unlikely due to estimated flood velocities remaining low.

Flood education and emergency response training will need to be undertaken for the Site workforce. This should include the identification of flood wardens and staff responsible for relocating stock and equipment so that it is not damaged during a major flood event.

3.1 Flood Warning Times

The issuing of flood warnings is the responsibility of the Lower Hunter SES and is communicated via flood bulletins that are distributed to local radio and television stations. These bulletins advise the general severity of flooding, as well as the current and expected peak flood level at key locations such as Maitland and Raymond Terrace.

The SES does not give flood level projections for areas downstream of Raymond Terrace due to the potential influence of the tide on peak flood levels. The indicative Hexham flood peak time of arrival is estimated from upstream gauges located at Maitland and Greta. The time of arrival has been calculated using the MIKE 11 flood model developed for the 1994 Flood Study and is summarised in Table 4.

Once the flood level rises in the Hunter River rises above the New England Highway at Hexham, the Swamp can fill to a level of over 2m AHD within a few hours despite a day or more of warning time being available before the onset of flooding. It is therefore essential that if people are on the Site at the onset of flooding to Hexham Swamp, that they begin evacuation immediately.

Table 4 - Hexham Flood Lag Time

Location	Lag Time (Hrs)				
	1% AEP	2% AEP	5% AEP	10% AEP	1955 Flood
Maitland (Belmore Bridge)	29	21	20	18	20 (31)
Hinton (Paterson confluence)	11	13	12	16	6 (9)
Green Rocks	6	7	8	8	5 (5)
Raymond Terrace	3	2	3	5	2 (1)

* Time within bracket is actual time taken for flood peak to reach Hexham.

3.2 Site Evacuation

During major floods there are three vehicular routes available for evacuation from the Site to areas with an elevation of at least 10 m AHD which is above the peak flood level estimated for the PMF event. Floodwaters are considered unsafe for vehicular traffic to negotiate once the product of the depth of floodwaters exceeds about 0.4 m.

In a 10% AEP event floodwaters are unlikely to overtop highways or pose an encumbrance to vehicle movement at Sites A, B and C. Site D is likely to be inundated to a depth of approximately 0.4 m resulting in this evacuation route not being safe for use.

In a 5% AEP event the water depth at Site A would be about 0.5m resulting in it and Site D not being suitable for use. Minor overtopping of Site B by approximately 0.1m would also be expected.

Exceedance of a 2% AEP event is likely to result in significant impacts to all evacuation routes although a flood warning time of approximately 24 hours is available which will allow sufficient time to evacuate the Site.

Site evacuation routes and the referred to sites are detailed in Table 5 shown in Figure 2 respectively.

Table 5 - Evacuation Routes

Route	Description	Distance (km)	Route Low Point (m AHD)
1	New England Highway via the Tarro Interchange and Site Access Route.	3.5	1.1 (Access Route)
2	Pacific Highway via the New England Highway, Tarro Interchange and Site Access Route.	9.0	1.1 (Access Route) 2.0 (Pacific Highway)
3	Tomago via the Pacific Highway, Tarro Interchange and Site Access Route.	6.5	1.1 (Access Route) 1.6 (Pacific Highway)

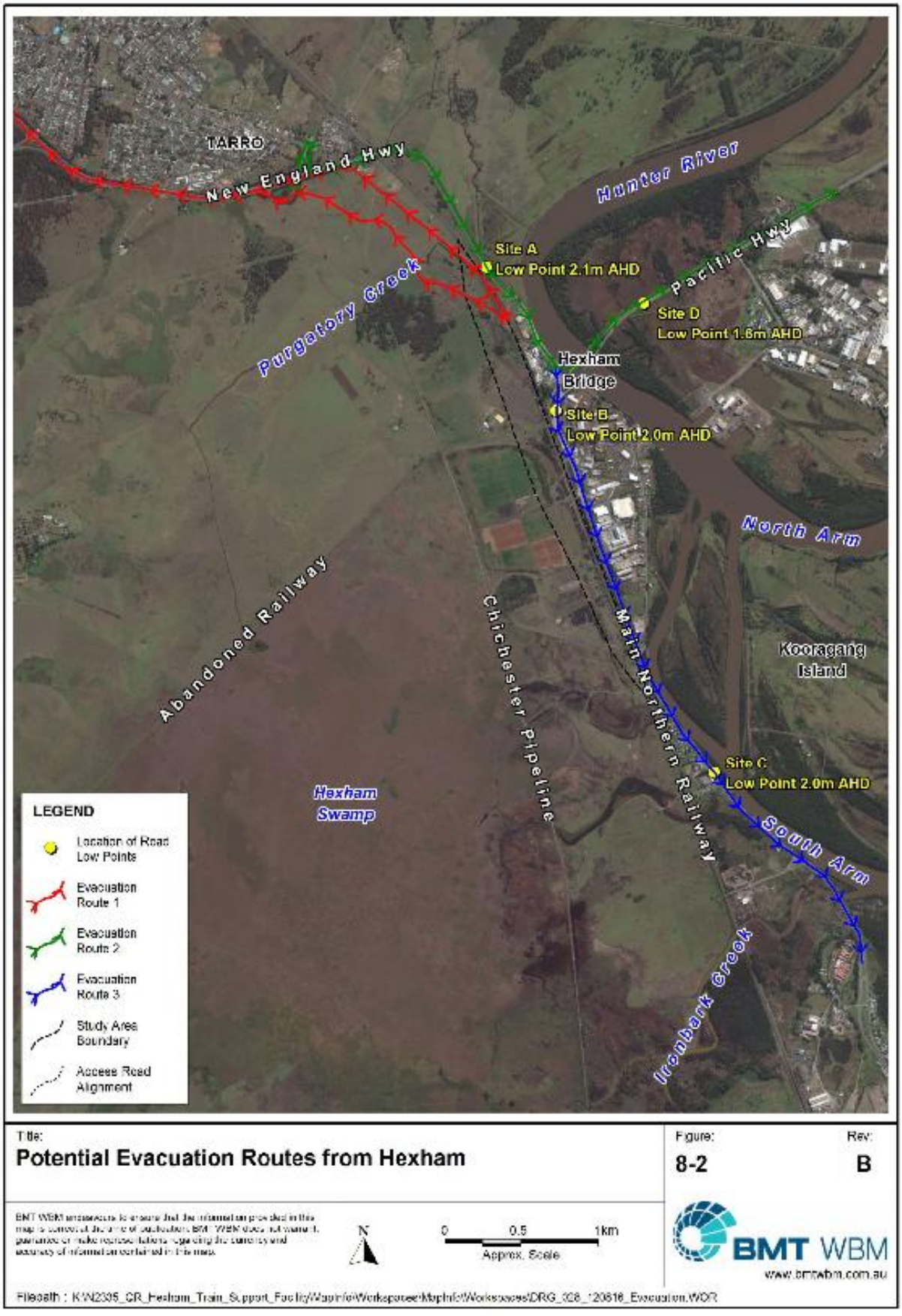


Figure 2 - Evacuation Routes

3.3 Recovery

Operational recovery following a flood event will focus on checking for damage to infrastructure, making repairs and re-opening the Site whilst minimising delays to operation. This recovery effort will need to be coordinated with Australian Rail Track Corporation (ARTC) as flood damage to rail infrastructure external to the site is also likely to have occurred and will likely determine the extent to which some repair/recovery actions can be undertaken.

Some actions to ensure the site is safe and functional include:

- Confirm that flooding impacts to the Site access road did not result in erosion impacts. Undertake repairs as required;
- check rail ballast and embankments for erosion damage. Flooding and debris can impact structural integrity and can also cause obstruction and blockages in the stormwater network on site; and
- Check signalling and electrical boxes for damage with a qualified electrician to gain clearance to turn power back on.

3.4 Responsibilities and Contact

Details of the nominated persons to coordinate response to flood events with ARTC and emergency services are detailed in Table 6.

A flood event response plan checklist for the mitigation of and preparation for potential flood impacts is included as Appendix C for implementation by the Maintenance Superintendent or delegate.

Table 6 - Responsibilities and Contacts

Position	Name	Contact Details	Responsibilities
GM Coal Operations	Samuel McSkimming	0400 972 231	Authorisation to close TSF
Regional Maintenance Manager	Dave Mayo	0404 048 742	Assign key responsibilities
Regional Maintenance Superintendent (RMS)	David Price	0404 048 742	Authorisation to stop works and coordinate flood preparation.
Deployment	Deployment	1800 068 033	Train movement and rail network communication
Principal Safety Advisor	David Keating	0400 979 434	Emergency response procedures
Adviser Environment NSW	Harry Egan	0438 136 697	Reporting

4.0 Compliance and Reporting

4.1 External Reporting Requirements

As required by Condition F5 of the Approval a:

*" **Flood Review Report** shall be prepared following each of the following flood events at the SSI site – 1%, 2%, 5% and 10% AEP flood events to assess the actual flood impacts against those predicted in Appendix D of the Preferred Infrastructure Report referred to in condition B1(c). The Report shall be prepared by an appropriately qualified person(s) and include:*

(a) identification of the properties and infrastructure affected by flooding during the reportable event;

(b) a comparison of the actual extent, level and duration of the flooding event against the impacts predicted Appendix D of the document referred to in condition B1(c);

(c) where the actual extent and level of flooding exceeds the predicted level with the consequent effect of adversely impacting on property(ies), structures and infrastructure, identification of the measures to be implemented to reduce future impacts of flooding including the timing and responsibilities for implementation.

Flood mitigation measures shall be developed in consultation with the affected property/structure/infrastructure owners, NoW and City of Newcastle."

4.2 Corrective Actions

As per Section 4 of the OEMP:

- Identified non-conformances with the SGMP, legislative or other requirement will be managed in accordance with *BSEMS-STD25 Operational Non Conformance & Incident Reporting*; and
- Corrective and preventative actions arising from non-conformances will be managed in accordance with *BSEMS-STD05 Effectiveness of Corrective & Preventative Actions*.

Non-conformances will be identified by the completion of routine auditing and inspections of the site undertaken as per Section 4 of the OEMP.

In the event that chronic exceedances of the listed performance criteria are recorded an investigation into the cause, potential impacts and feasible mitigation options will be triggered. The investigation will be undertaken by Aurizon and in consultation with suitably qualified contaminated land consultant if required in accordance with Section 4 of the OEMP.

APPENDICIES

APPENDIX A – Minister Conditions of Approval MP07_0171 and Statement of Commitments

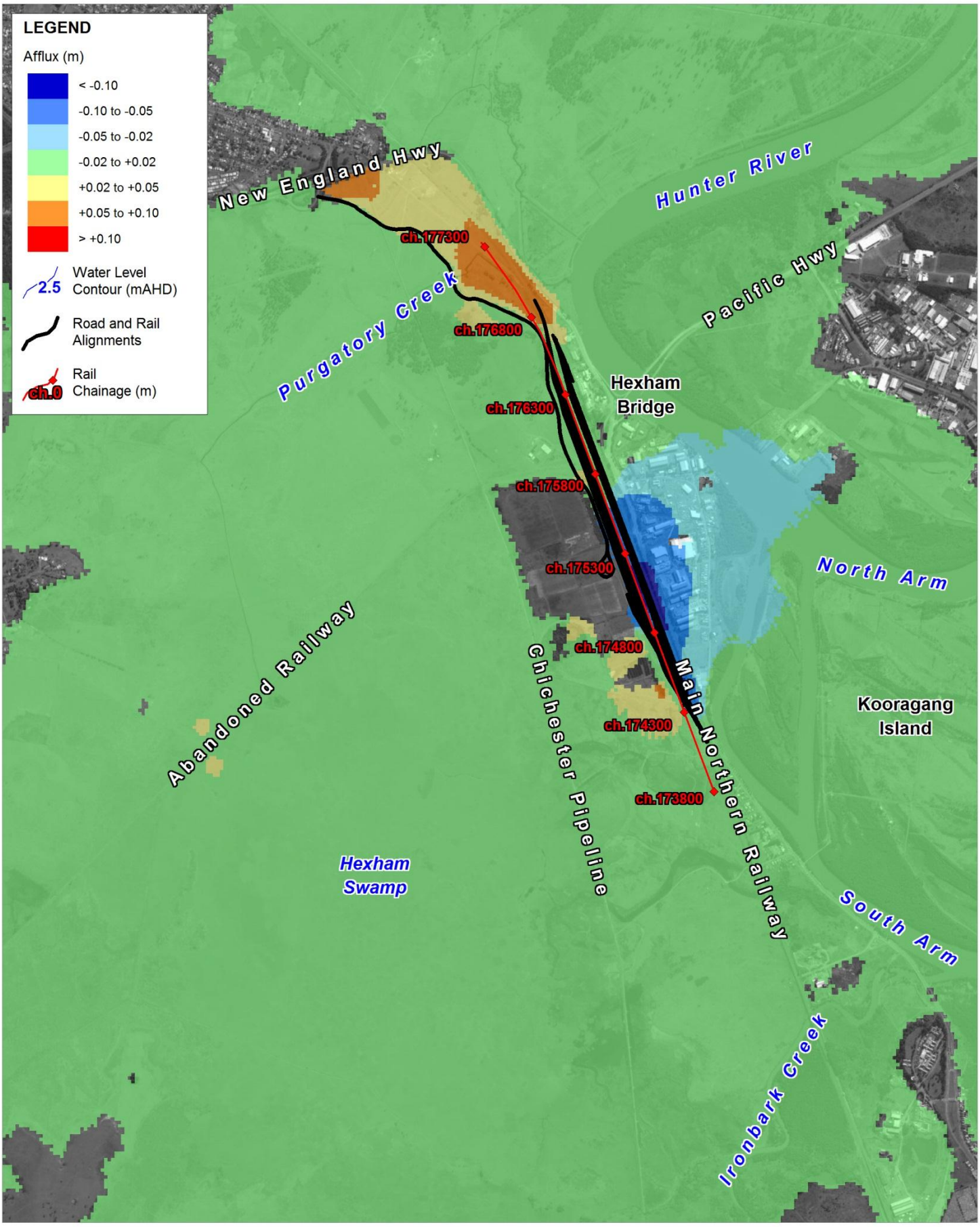
Relevant Minister Conditions of Approval

MCoA	Description	OEMP Section
C13	All buildings or structures below the 10% AEP level shall be constructed of flood compatible materials.	Noted
C14	Electrical supply and signalling locations associated with the operation of the SSI shall be elevated above the 1% AEP flood level and include a freeboard of 250 millimetres.	Noted
E37	The Proponent shall ensure that all fuels, dangerous goods and hazardous substances used in the construction of the SSI are stored in bunded locations above the 1% AEP flood level, unless otherwise agreed by the Director-General.	Noted
E38	The Proponent shall ensure that all areas used for the storage and treatment of acid sulfate soils during construction of the SSI are located or elevated above the 1% AEP flood level, unless otherwise agreed by the Director-General.	Noted SMP
F5	A Flood Review Report shall be prepared following 1%, 2%, 5% and 10% AEP flood events to assess the actual flood impacts against those predicted.	Section 4.1

Statement of Commitments

SoC	Commitment	OEMP Section/Management Plan
Item 3	Operation of the TSF will be undertaken in accordance with the Environmental Management Plan (EMP). The EMP will address all measures to be implemented to minimise and manage potential environmental impacts during the operation of the TSF. The EMP will include the following plans:	OEMP
	A. Flood Emergency Management Plan;	FEMP

APPENDIX B – Flood Inundation Areas



Title:

Impact of Proposed Works on Peak 1% AEP Flood Level with Flood Mitigation

Figure: **5-2**

Rev: **A**

N

0 0.5 1km

Approx. Scale

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www.bmtwbm.com.au

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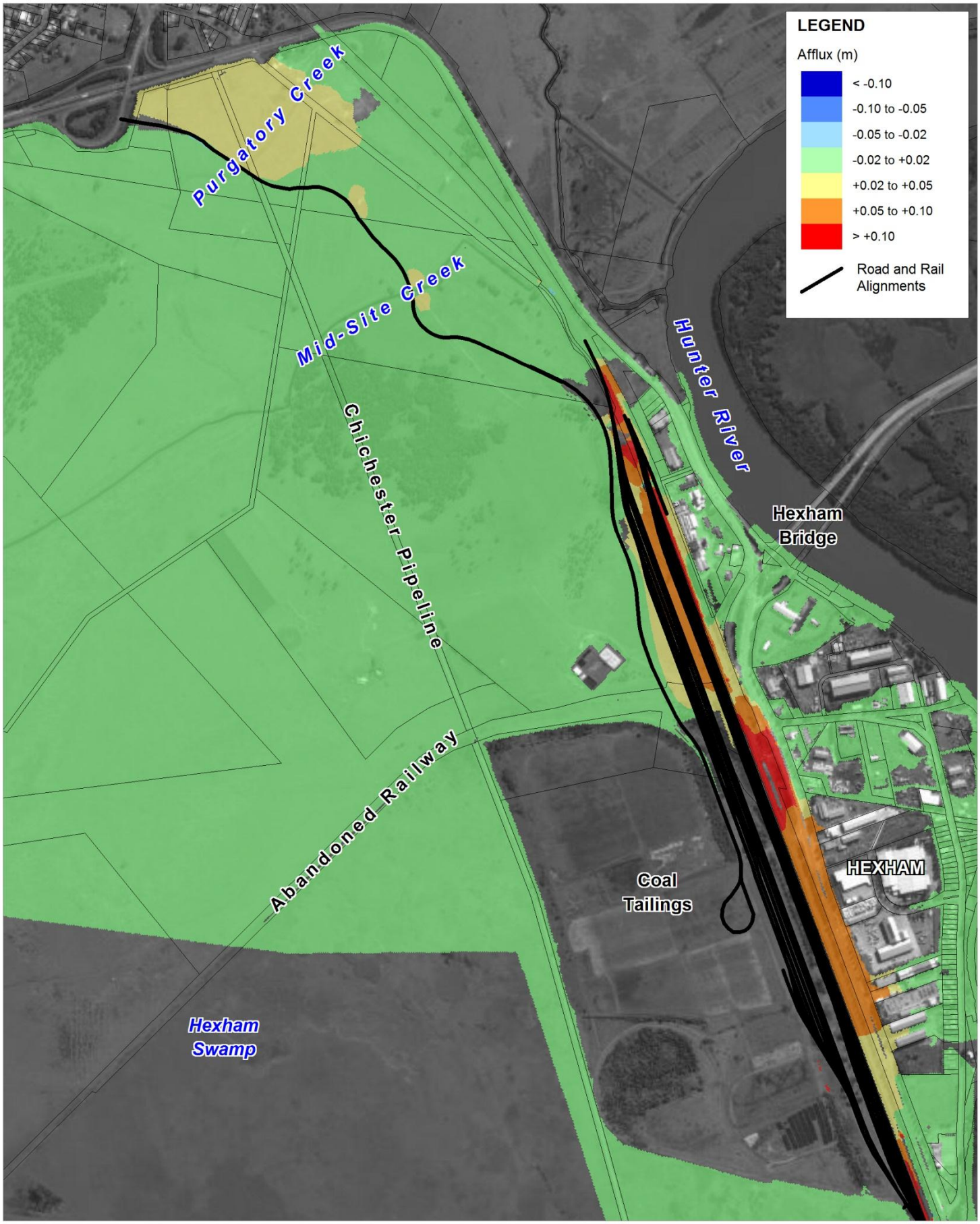

Title:

Impact of Proposed Works on Peak 2% AEP Flood Level with Flood Mitigation

Figure: 5-4

Rev: A

N

0 250 500m

Approx. Scale

BMT WBM

www.bmtwbm.com.au

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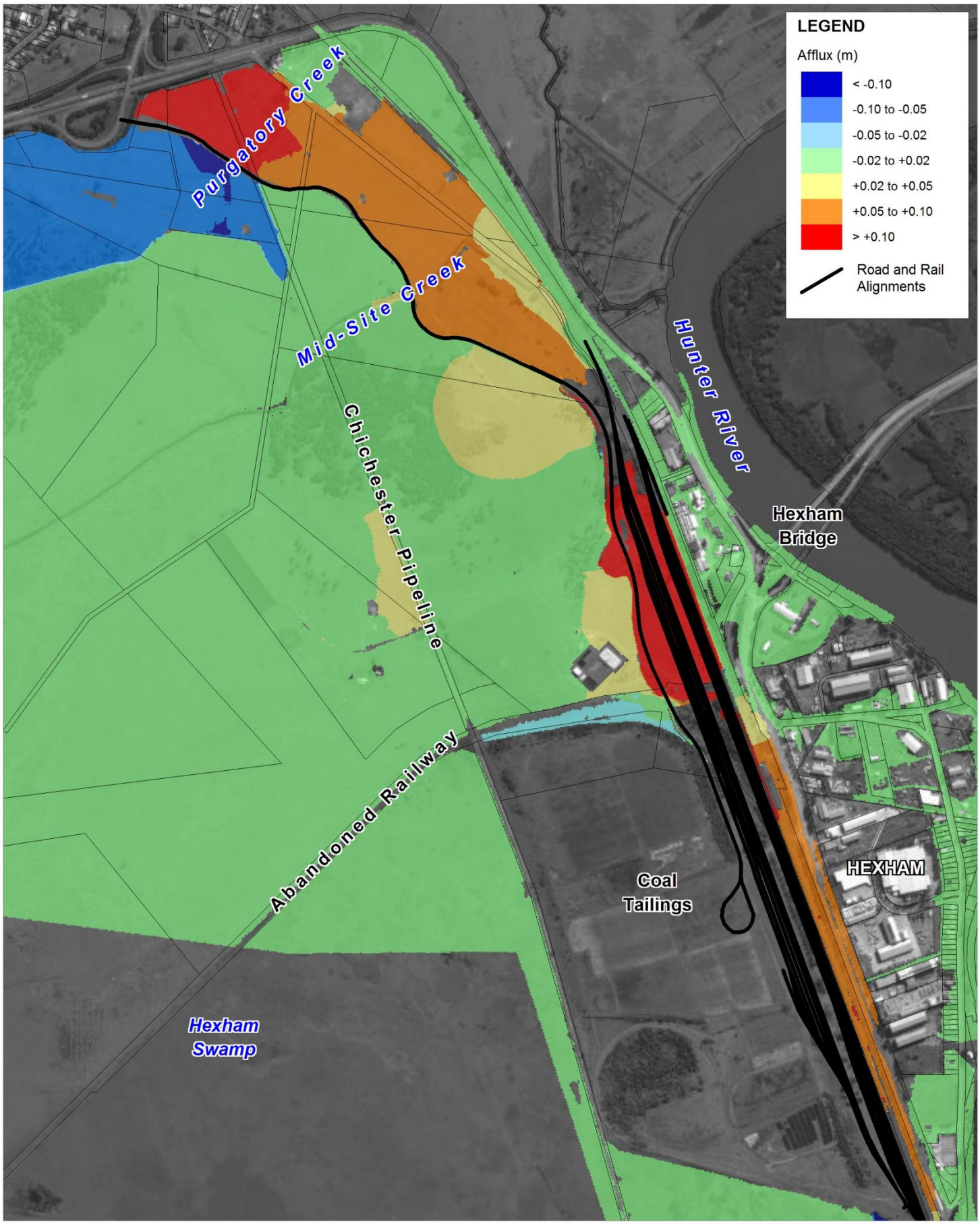

Title:

Impact of Proposed Works on Peak 5% AEP Flood Level with Flood Mitigation

Figure: 5-6

Rev: A

N

0 250 500m

Approx. Scale

BMT WBM

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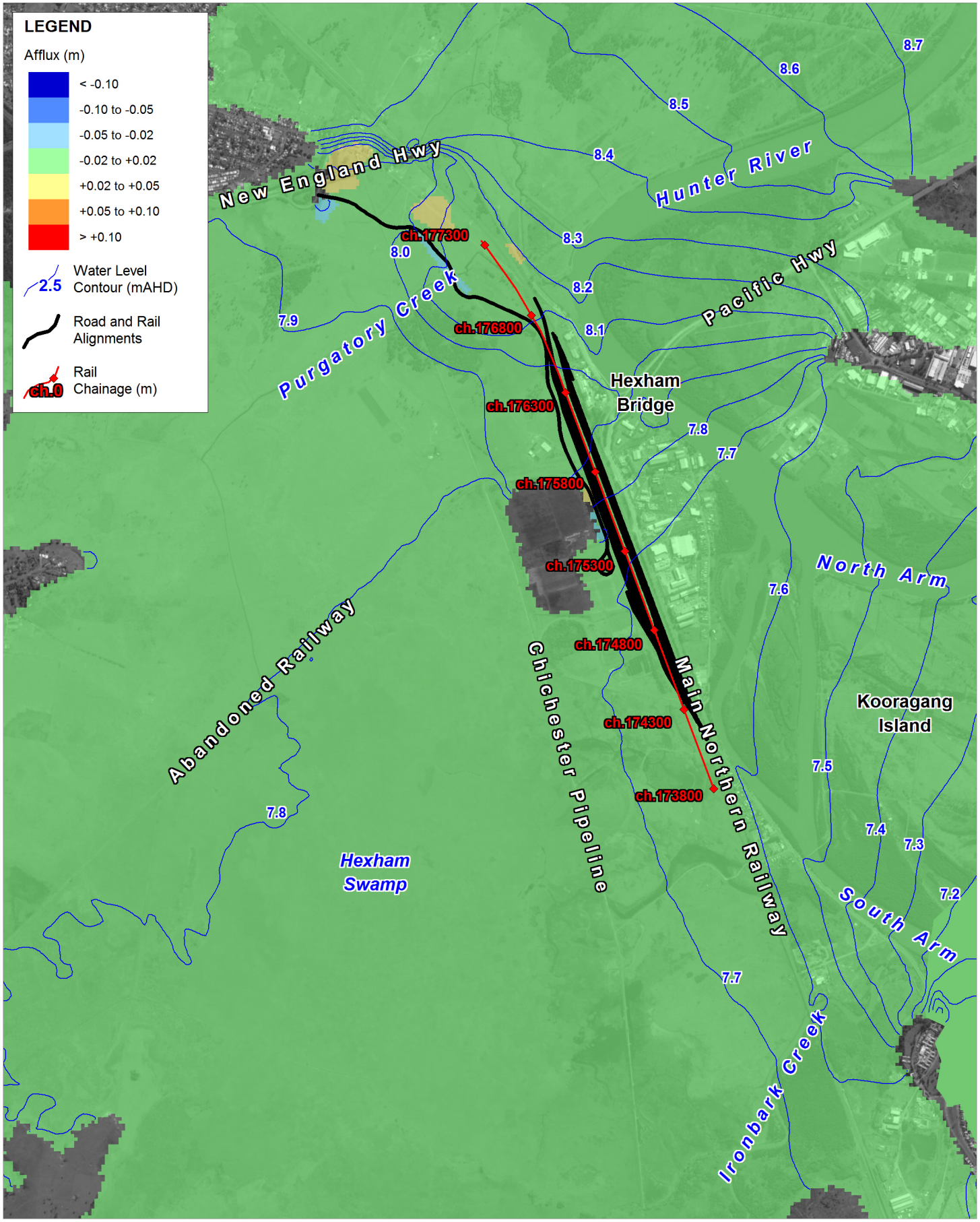

Title:

Impact of Proposed Works on Peak PMF Flood Level

Figure: **B-1**

Rev: **B**

N

0 0.5 1km

Approx. Scale

BMT WBM

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APPENDIX C – Flood Event Response Plan

Stage	Stage Description	Task	Description
Monitor	Weekly weather / rainfall forecast monitoring	Monitor	• Bureau of Meteorology (BOM) weather forecasts on a weekly basis.
Flood Alert	Increased level of alert. WATCH and ADVISE of possible flooding.	Monitor	• BOM warning website: http://bom.gov.au/nsw/warnings/index.shtml.
		Notify	• Notify on-site supervisors of flood alert, watch or advice.
Plan Activation	The plan is activated by the issue of a Flood Warning by the BOM for the Lower Hunter River, or a 'white alert' level has been reached at the Glennies Creek Dam.	Monitor	• BOM warning website. • ABC local radio (2NC) AM frequency 1233.
		Notify	• Deployment of flood warning. • All on-site personnel of flood warning and potential site closure.
Escalation 1	If the BOM predicts the event is escalating for the Hunter River, height predictions for key gauges are to be issued.	Monitor	• BOM website and ABC local radio. • road closures via RMS website: http://livetraffic.rta.nsw.gov.au/desktop.html.
		Notify	• All site personnel and close site to external visitors. • Deliveries / truck movements that the site is closed due to flood events. • Deployment of flood escalation.
		Stop Works	• Supervisors are to organise work teams to close-out work areas.
		Prepare	• Facility Coordinator is to review procedures and delegate planning responsibilities to site personnel. • Ensure fuel is available for generators and test run. • Check lids, bungs and valves are in place / closed for the bulk fuel storage area (diesel and oil stored in above ground 90,00) L self bunded tanks. • Move any portable fuel/oil containers to secure storage area above 1% AEP. • Flex drives and de-watering pumps. • Ensure correct tie –down materials are on hand (if required).

Stage	Stage Description	Task	Description
			• Sandbag entry to storage areas and pits. • Move all mobile equipment and plant outside of known or predicted 1% AEP flood level (check MSDS for chemical storage compatibility) and ensure all bungs/lids are in place. • Lock storage areas. • De-mobilise non-essential personnel from site (i.e. away from danger).
		Record	• Complete preparation checklists.
Escalation 2	If the BOM predicts major flooding for the Hunter River.	Monitor	• BOM website and ABC local radio and RMS website for road closures.
		Notify	• Activate internal alarm and move all people on-site to a common area for dissemination of information. • Live-Run of decision to evacuate.
		Turn Off	• Turn off power to non-essential systems to minimise damage to equipment.
		Evacuate	• Instruct a supervised evacuation for all staff on-site. • Note: some roads may be closed, all staff must be notified of these road closures prior to commencement of evacuation.
		Record	• Maintain a register for all site personnel leaving the site, transport mediums and their destination.
During Flood	Continue to monitor flood conditions	Monitor	• BOM website and ABC local radio and RMS website for road closures.

APPENDIX D – Flood Risk Assessment

NSW LTTSF Flooding Risk Assessment Report

Prepared for

AURIZON

engenicom

engenicom

RISK ASSESSMENT REPORT

Risk Assessment Report Prepared for	Aurizon
Risk Assessment Subject	Flood Risk Assessment of the Aurizon NSW Long Term Train Support Facility

Risk Assessment Acknowledgement

	Name	Signature	Date
Originator:	Cameron Cox		20/06/2013
Approved:	Frank Rossi		20/06/2013
Revision:	Released		

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1 EXECUTIVE SUMMARY

The Aurizon NSW Long Term Train Support Facility is currently in the environmental approvals phase of the project and is currently under assessment by the Department of Planning and Infrastructure. As part of the environmental approvals process, the NSW Office of Environment and Heritage have requested an operational risk assessment to be conducted to determine risks associated with potential flooding events in the Hexham floodplain. The Hexham location is subject to inundation from flood waters from the Hunter River. The risk assessment was conducted and reported in compliance with AS/NZS ISO31000: 2009: Risk Management – Principles and Guidelines.

The risk assessment was undertaken by a suitably qualified and experienced team on the 19th June, 2013 at the Engenicom office. The risk assessment review was facilitated by Cameron Cox (Engenicom HSEC - Manager).

The team conducted a structured Flooding Risk Assessment to:

- identify hazards
- assess risk
- identify current controls
- identify unacceptable risks, and
- Develop additional controls for unacceptable risks.

1.1 Key Loss Areas

The team identified the following key loss areas that were ranked Significant or High using the Engenicom Risk Assessment Matrix Tool:

- Damage to buildings from flood waters

1.2 The Way Forward

An action plan identifying recommended additional controls is produced within this document. These actions need to be allocated to an organisation with the capacity and authority to implement the required controls. An audit of this risk assessment action plan (with auditor sign off) conducted as part of the action plan sign off is recommended

Regular reviews should be conducted on the progress of implementing the additional controls. These controls are to be incorporated into the ongoing operational safety and environmental management plans for the continued management of risks.

2 ACTIONS REQUIRED

The additional control table in section11 of this document relates the actions below to the hazard and activity they are to control.

Action	Responsibility	Timeframe
Aurizon to develop flood evacuation plan. All persons entering the site need to refer to Aurizon Flood Evacuation Plan	Aurizon	Prior to commencement of operations
Daily inspections of bunded areas during operations to be included into the OEMP	Aurizon	Prior to commencement of operations
Implement Flood Evacuation Plan, which includes procedure for site flood preparation, bund clean-out and valve isolations	Contractor	Prior to construction
Spill reporting procedures to be included into Operational Environmental Management Plan	Aurizon	Prior to commencement of operations
Develop chemical inventory register	Aurizon	Prior to commencement of operations
Water quality monitoring program included in the OEMP	Aurizon	Prior to commencement of operations
Maintain overland flow paths around construction compound if possible	Contractor	Prior to and during construction
Reinstate flow paths following construction phase where possible to meet pre-construction conditions	Contractor	Post construction
Align construction buildings and equipment in dominant direction of flood flows	Contractor	Prior to and during construction
Maintain integrity of storm water channels with regular maintenance especially following a rain even	Aurizon	Prior to commencement of operations
Develop and implement inspection procedures for storm water channels following a flood event and protocols for recommencing safe operation following inspection	Aurizon	Prior to commencement of operations
Where practical treated acid sulphate soils to be stockpiled above 1:100yr flood event level.	Contractor	During construction
ASS treatment area to be established on an impermeable base and bunded	Contractor	During construction

Action	Responsibility	Timeframe
Exposed constructed area staged and managed to minimise exposure	Contractor	During construction
Contractor to develop flood evacuation, emergency management plans and flood recovery plans	Contractor	Prior to construction
Site induction to include flood preparation and evacuation procedures	Contractor	Prior to construction
Flood depth markers and access road boundary indicators to be installed	Contractor	During construction
Raise electrical equipment in site compound above flood level	Contractor	Prior to and during construction
Store hazardous chemicals in raised areas where possible	Contractor	Prior to and during construction
Raise storage areas/containers above flood levels	Contractor	Prior to and during construction
Emergency spill equipment	Contractor	Prior to and during construction
Install appropriate signage	Contractor	Prior to and during construction
Plant and equipment to be moved to higher ground during flood events	Contractor	Prior to and during construction
Audit of CEMP	Aurizon	During and Post-construction
Implementation of sediment and erosion control plans	Contractor	Prior to and during construction

3 SCOPE

The scope of this risk assessment was to identify the hazards and assess the risks relating to the construction and operation of the NSW LTTSF during flood events. The activities assessed related to fuel storage, including storage of 630 000 litres of diesel, treatment and storage of acid sulphate soils, storage of hazardous chemicals, emergency management and construction. The risk assessment may also be used for compliance documentation during construction and operations.

4 OBJECTIVE

The objective of this risk assessment was to identify hazards associated with the construction and operation of the NSW LTTSF during flooding events, with the following expected outcomes:

- Protect the health and safety of all personnel
- Protect assets, which include the environment
- Ensure compliance with legislation and recognised industry requirements
- Provide NSW Office of Environment and Heritage with a documented risk assessment
- Satisfy Aurizon Work Health and Safety and Environmental obligations in regards to hazard identification and control
- Identify the high risk hazards
- To provide a basis for Aurizon to review existing controls and formulate actions to control areas of concern

5 CONTEXT

5.1 Strategic Context

Aurizon is bound by legislation as documented in the Workplace Health and Safety Act and various Environmental Acts and Regulations. These documents target workplace safety and environmental management and require that businesses organize and manage their activities in a manner that anticipates and prevents circumstances that may result in injury, death, or environmental harm.

5.2 Organisational Context

Aurizon are committed to improving workplace safety and environmental management. This is reflected by Aurizon's Health, Safety and Environmental Management System which demonstrates Aurizon's commitment to minimizing harm to people and the environment.

5.3 Risk Management Context

The goal of the risk assessment was to identify all known or potential hazards arising from flooding during the operation and construction of the NSW LTTSF. The risk assessment focused on risks to people, property, and environment.

The scope of the analysis was as follows:

- Establish and review the scenarios associated all tasks employees and contractors are required to perform.
- Consider any comments regarding potential risks
- Conduct an operational and construction risk assessment analysis during flooding events.
- Rank the associated risks relative to their potential to cause injury, or environmental harm considering current controls
- Develop an action plan to eliminate or manage the risks
- Document the risk review findings in report format.

Aurizon and the civil contractor are responsible for the implementation of the recommendations made in this report.

6 RISK ANALYSIS PROCEDURE

6.1 Risk Assessment Team

Hazard identification and the determination of consequence and probability levels were achieved using the collective knowledge and experience of the following personnel.
The role of the team members was to provide their expertise, experience and technical knowledge. The team members are shown in the table below:

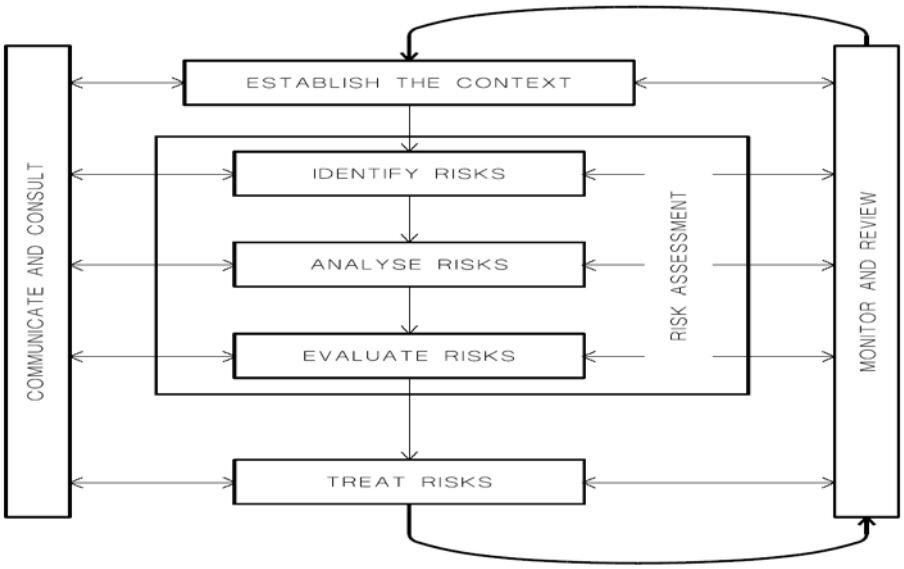
Name	Organization	Position	Qualifications	Industry Experience
Cameron Cox (Facilitator)	Engenicom	HSEC Manager	Bachelor Of OHS Masters Business CertIV Workplace Assess and Training	• 7 years rail and Risk/OHS/ Environment
Shay Gill	Engenicom	Senior Advisor – Environment	• B. Environmental Science (ENV Mngt)	• 15 yrs environmental planning
Warwick Biggs	GHD	Design Manager	• B. Mechanical Engineering	• 25 years of mining, rail and industry
Brett Peterkin	Engenicom	Stakeholder Manager	• Bachelor of Applied Science (Systems Agriculture) • Master of Applied Science • (Extension and Rural Development)	• 20 years stakeholder engagement – natural resources, rail construction, mining

Frank Rossi	Engenicom	Project Manager	• Cert Structural Eng Bachelor of Engineering (Civil) • Master of Business Administration	• 20 years

6.2 Risk Assessment Method

Figure 1 outlines the overall framework utilized for the risk assessment.

Figure 1 : Risk management process (ISO31000:2009)



6.3 Workplace Risk Assessment and Control

The risk assessment process identified the major hazards associated with the operation of the NSW LTTSF during flooding events in accordance with AS/NZS ISO31000:2009 Risk Management..

Once the hazards were identified, the risks were assessed and assigned a prioritized ranking. Risks were ranked according to the consequences and probability matrix that is identified within this report. Following prioritization, controls for high and significant risks were identified and Aurizon management personnel will assign responsibility to each task for the development and implementation of these controls.

6.4 Core Assumptions

The participants of the risk assessment agreed to the following assumptions prior to the exercise commencing:

- All employees and contractors will present themselves in a fit and healthy state in readiness for work
- All plant and equipment will be fit for purpose
- All personnel will be competent to undertake the relative activities
- Company Policies and Procedures will be enforced
- The equipment will work as designed

Risk Rating Matrix

PROBABILITY *(of it happening)*

CONSEQUENCE *(if event occurred)*

Rating	Note: Consequence may consist of a single event or may be a cumulative impact					A Certain	B Probable	C Possible	D Remote	E Improbable
	Personal Injury	Equipment or Material Damage	Business Interruption	Environment	Reputation	Will occur	Likely to occur	Could occur	Unlikely to occur	Practically impossible
1 - Catastrophic	Fatality	>$5 M	>3 months	Massive leak or spill	International Impact	**1 (H)**	**2 (H)**	**4 (H)**	**7 (S)**	**11 (S)**
2 - Major	Serious Bodily Injury	$1M to $5M	1-3 months	Major leak or spill	National Impact	**3 (H)**	**5 (H)**	**8 (S)**	**12 (S)**	**16 (M)**
3 - Moderate	Lost Time Injury / Illness	$100K to 1M	1 week to 1 month	Localized leak or spill	Regional Public Impact	**6 (H)**	**9 (S)**	**13 (S)**	**17 (M)**	**20 (L)**
4 - Minor	Minor Injury/Illness	$10K to $100K	1 day to 1 week	Minor leak or spill	Some Public Concern	**10 (S)**	**14 (S)**	**18 (M)**	**21 (L)**	**23 (L)**
5 - Insignificant	No Injury	Up to $10,000	Up to 1 day	Slight leak or spill	No Public Concern	**15 (S)**	**19 (M)**	**22 (L)**	**24 (L)**	**25 (L)**

Risk Matrix Result	Risk Ranking		Ranking Definitions
1 to 6	**1**	**High Risk**	Imperative to eliminate or reduce to a lower level by the introduction of control measures. Management planning required at senior levels. The risk must be reported to Senior Management.
7 to 15	**2**	**Significant Risk**	Corrective action required, senior management attention required.
16 to 19	**3**	**Moderate Risk**	Corrective action to be determined, management responsibility must be specified.
20 to 25	**4**	**Low Risk**	Corrective actions where practical, manage by routine procedures.

7 HAZARDS LISTED BY ACTIVITY

P #	Process Activity	SP #	Sub Process Activity	H#	Hazard / Issue	Existing Controls	Initial Risk C	Initial Risk P	Initial Risk R	Additional Controls
1	Property and Infrastructure	1.1	Buildings	1.1.1	Damage to buildings due to flooding	Administration and Office areas are above the 1:100yr flood level with 250-500mm freeboard for safety. All electrical low voltage systems be designed above the 1:20ARI where possible. Substations and high voltage connections to be above 1:100ARI	4	A	10 (S)	Aurizon to develop flood evacuation plan. All persons entering the site need to refer to Aurizon Flood Evacuation Plan.
			Buildings	1.1.2	Chemicals/ Hazardous substances potentially released from buildings due to flooding	Monitoring stations in Hunter River will provide sufficient warning of flooding event to allow implementation of flood preparation procedures. Raise storage areas/containers above 1:100 yr flood levels Bunded areas have a pump and storage tank to hold spilled material which are above the 1:100yr flood event Oil and water separator is above 1:100yr flood level	4	D	21 (L)	Daily inspections of bunded areas during operations to be included into the OEMP Implement Flood Evacuation Plan, which includes procedure for site flood preparation including bund clean-out, chemical/equipment relocation and valve isolations

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
			Diesel Storage	1.1.3	Potential release of diesel fuel into existing drains due to flooding	Bund around diesel pumps designed above the 1:50yr event Bunded areas have a pump and storage tank to hold spilled material which are above the 1:100yr flood event 630,000L Diesel Storage tanks are double skinned, self-bunded and anchored – The Fuel system is designed for the flood situation, as follows: The tanks are above the flood level (the bottom of the tank is reached in the 100 year event) the tank outlet is in the top or the top of the front end (depending on the supplier) and is well above the 100 year flood level. The fuelling system is a fully closed system, other than the breather points. The breathers for the diesel tanks are above the tank	4	D	21 (L)	Daily inspections of bunded areas during operations to be included in the OEMP Spill reporting procedures to be included in the OEMP Implement Flood Evacuation Plan, which includes procedure for site flood preparation including - chemical/equipment relocation bund clean-out and valve isolations

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
						level and are also significantly above the 100 year flood event (in the order of 2 metres above, depending on selected supplier). The pumps are above the 50 year flood event. The pumps are sealed (are like a piece of pipe) and have no environmental risks if they get inundated. Flood warnings will ensure locomotives will not be in the area during flood events.				
			Coolant and oil storage	1.1.4	Potential release of coolant and oil into existing drains due to flooding	Storage tanks are double skinned, self-bunded and located on the high ground near the CMF building and not impacted by the 1:100yr flood event Outlets are above 1:100yr flood events Bunded areas have a pump and storage tank to hold spilled material which are above the 1:100yr flood event	4	D	21 (L)	Daily inspections of bunded areas during operations to be included in the OEMP Spill reporting procedures to be included in the OEMP Implement Flood Evacuation Plan, which includes

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
										procedure for site flood preparation including - chemical/equipment relocation, bund clean-out and valve isolations
			Hazardous goods storage facility	1.1.5	Storage of typical cleaning products and chlorine for loco maintenance potentially released during flooding event	Small quantities held on site Separate building located on higher ground near CMF Spill kits located across the site Chemicals stored above 1:100yr flood level	5	D	24 (L)	Regular inspections and monitoring of leaks/spills Develop chemical inventory register
2	Water Management	2.1	Drainage	2.1.1	Ponding of water due to poor drainage. Surface runoff concentrated and creating potential hazardous flow	Design storm water channels and drainage system for controlled flows Design surface drainage for runoff velocity / depth requirements Design surface drainage to minimise ponding Define and demarcate work areas around water hazards Flooding event will cause inundation rather than isolated flows and therefore not likely to result in concentrated flows	5	E	25 (L)	Aurizon to develop flood evacuation plan. All persons entering the site need to refer to Aurizon Flood Evacuation Plan

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
			Drainage	2.1.2	Stormwater containing sediment or contaminants runoff from site	Drainage system, including floating wetlands in sediment basins used to polish runoff water	4	D	21 (L)	Site inspections, water quality monitoring program included in the OEMP Regular environmental inspections to be included in OEMP
			Drainage	2.1.3	Flooding of adjoining properties due to overtopping of Hunter River under Hexham Bridge and overland flow restricted by track formation	Lower track level designed and constructed not to restrict overland flood flow has been adopted	5	E	25 (L)	
			Flow distribution	2.1.4	Flow distribution to Hexham swamp around compound area is affected during construction	Construction Environmental Management Plan and Stormwater Management Plan Satellite compound to be located on existing built up area above existing flood path	4	D	21 (L)	Maintain overland flow paths around construction compound if possible Reinstate flow paths following construction phase

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
						Construction compound is below existing rail level				where possible to meet pre-construction conditions Align construction buildings and equipment in dominant direction of flood flows
			Flow distribution	2.1.5	Change to flow distribution through adjacent Hexham area	Design of facility incorporates track levels design that eliminates impact of flow distribution and flood levels Flood modeling completed	4	D	21 (L)	Maintain integrity of stormwater channels with regular maintenance especially following a rain event Develop and implement inspection procedures for storm water channels following a flood event and protocols for recommencing safe operation following inspection
			Stockpiled Acid Sulphate	2.1.6	Potential acid sulphates	Treatment areas for ASS located outside of 1:100yr	4	E	23 (L)	Where practical treated acid

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
			Soils		released into surrounding wetland area due to flooding	flood events ASS stockpiles are treated and neutralised as per ASSMAC guidelines ASS Management Plan Flood warnings provide sufficient time to manage excavations to prevent acid release during construction				sulphate soils to be stockpiled above 1:100yr flood event level. Excavation areas staged and managed to minimise exposure of PASS. ASS treatment area to be established on an impermeable base and bunded Flood emergency response management plan Water quality monitoring program
3	People	3.1	Construction staff	3.1.1	Construction staff become isolated due to flood waters	Lag between rain events and flooding Flood warning system	4	E	23 (L)	Contractor to develop flood evacuation plans and flood recovery plans Site induction to include flood preparation and evacuation

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
										procedures
			Private Landowners	3.1.2	Private landowners become stranded, due to severe flooding	Construction does not impact on flood levels Roads to be designed at the same relative level as existing access roads	4	E	23 (L)	Flood depth markers and access road boundary indicators to be installed
4	Construction	4.1	Site compound	4.1.1	Construction site offices and facilities are flooded above floor level and electrical services are affected	Compound to be established to withstand up to 1:20 yr flood event	4	D	21 (L)	Raise electrical equipment in site compound above flood level
			Hazardous chemicals	4.1.2	Hazardous chemicals used during construction potentially leak during floods		4	D	21 (L)	Store hazardous chemicals in raised areas where possible Raise storage areas/containers above flood levels Emergency spill equipment Install appropriate signage Plant and equipment to be moved to higher

							Initial Risk			
P #	**Process Activity**	**SP #**	**Sub Process Activity**	**H#**	**Hazard / Issue**	**Existing Controls**	**C**	**P**	**R**	**Additional Controls**
										ground during flood events.
			Stockpile material	4.1.3	Sediment and Erosion	Construction Environmental Management Plan to be implemented (including daily inspection and regular maintenance of erosion and sediment controls). Locate stockpiles outside flood areas where possible Sediment controls at the base of stockpiles Stormwater Management Plan	4	C	18 (M)	Audit of CEMP Implementation of sediment and erosion control plans
			Damage to access tracks	4.1.4	Flooding causes damage to haul roads and existing access tracks	Design of access roads takes into consideration of flood flow Regular maintenance of access roads Flood depth markers	4	D	21 (L)	Regular inspections and monitoring

8 REFERENCES

1.		NSW Workplace Health and Safety Act	2011
2.		NSW Workplace Health and Safety Regulations	2011
3		AS/NZS ISO31000 Risk Management	2009

9 RISK ASSESSMENT REVIEW CHECKLIST *

Item	Requirement	Yes	No
1	Is the reason for the review defined	X	
2	Are the objectives of the review stated	X	
3	Is there a description of the system being assessed	X	
4	Are the boundaries clearly and unambiguously defined	X	
5	Is there a summary of the strategic, corporate and risk management context	X	
6	Are the participants identified together with their organizational roles and experience in relation to the matter under consideration	X	
7	Is the range of experience and expertise of the team appropriate	X	
8	Is the facilitator identified together with related experience	X	
9	Is the facilitator appropriate	X	
10	Is the method of identifying the risks clearly defined	X	
11	Is the reason for the choice of methodology explained	X	
12	Is the method of assessing likelihood and consequence of the risk identified	X	
13	Is the reason for the choice of methodology explained	x	

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