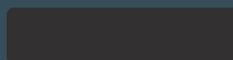
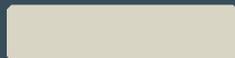


PART D

Appendices



BOTANY RAIL DUPLICATION

ENVIRONMENTAL
IMPACT STATEMENT



Botany Rail Duplication

Environmental Impact Statement

Part D – Appendices

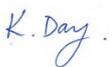
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Appendix A
Environmental assessment requirements (SEARs)

Table A.1 General standard SEARs

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>1 Environmental Impact Assessment Process</p> <p>The process for assessment of the project is transparent, balanced, well focused and legal.</p>	<p>1 The Environmental Impact Statement must be prepared in accordance with Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the Regulation).</p>	<p>Whole EIS</p>
	<p>2 It is the Proponent’s responsibility to determine whether the project needs to be referred to the Commonwealth Department of the Environment for an approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The Proponent must contact the Commonwealth Department of the Environment immediately if it is determined that an approval is required under the EPBC Act, as supplementary environmental assessment requirements may need to be issued to ensure a streamlined assessment under the Bilateral agreement can be achieved.</p>	<p>Section 3.3.2</p>
	<p>3 Where the project requires approval under the EPBC Act and is being assessed under the Bilateral Agreement the EIS should address:</p>	<p>N/A</p>
	<p>a Consideration of any Protected Matters that may be impacted by the development where the Commonwealth Minister has determined that the proposal is a Controlled Action.</p>	<p>N/A</p>
	<p>b Identification and assessment of those Protected Matters that are likely to be significantly impacted.</p>	<p>N/A</p>
	<p>c Details of how significant impacts to Protected Matters have been avoided, mitigated and, if necessary, offset.</p>	<p>N/A</p>
	<p>d Consideration of, and reference to, any relevant conservation advices, recovery plans and threat abatement plans.</p>	<p>N/A</p>
	<p>4 The onus is on the Proponent to ensure legislative requirements relevant to the project are met.</p>	<p>Chapter 3</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>2 Environmental Impact Statement</p> <p>The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.</p>	1 The EIS must include, but not necessarily be limited to, the following:	N/A
	a executive summary	Executive Summary
	b a description of the project, including all components and activities (including ancillary components and activities) required to construct and operate it including	Chapter 6 Chapter 7
	i the proposed route	Chapter 6.1
	ii all surface road work upgrades including road widening, intersection treatments, partial or full road closures and bridges	Section 6.3
	iii pedestrian and cyclist facilities including any temporary changes resulting from construction activities	Section 7.6.4
	iv construction and operational ancillary facilities and infrastructure	Section 7.4
	v the relationship of the project with existing and proposed road and freight transport services	Section 2.2.1
	c a statement of the objective(s) of the project	Section 1.2.1
	d a summary of the strategic need for the project with regard to its State significance and relevant State Government policy including the <i>NSW freight and Ports Plan 2018-2023</i> ;	Section 5.1 Appendix E
	e an analysis of any feasible alternatives to the project	Section 5.3
	f a description of feasible options within the project	Section 5.4 Appendix F
	g a description of how alternatives to and options within the project were analysed to inform the selection of the preferred alternative / option. The description must contain sufficient detail to enable an understanding of why the preferred alternative to and options(s) within the project were selected	Chapter 5 Appendix F
h a concise description of alternative construction methods that were analysed and preferred methods	Section 5.4	
i a concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts). Elements of the environment that are not likely to be affected by the project do not need to be described	Section 2.2.2	
j a demonstration of how the project design has been developed to avoid or minimise likely adverse impacts	Section 6.1.2 Section 7.1.1	

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	k the identification and assessment of key issues as provided in the 'Assessment of Key Issues' performance outcome	Identified in Appendix B Assessed in Chapters 8 to 23
	l a statement of the outcome(s) the proponent will achieve for each key issue	Section 24.4
	m measures to avoid, minimise or offset impacts must be linked to the impact(s) they treat, so it is clear which measures will be applied to each impact	Section 24.3
	n consideration of the interactions between measures proposed to avoid or minimise impact(s), between impacts themselves and between measures and impacts	Chapters 8 to 22
	o an assessment of the cumulative impacts of the project taking into account other projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed	Chapter 23
	p statutory context of the project as a whole, including:	N/A
	i how the project meets the provisions of the EP&A Act and EP&A Regulation	Section 3.2
	ii a list of any approvals that must be obtained under other Acts or laws before the project may lawfully be carried out	Section 3.1
	q a chapter that synthesises the environmental impact assessment and provides:	Chapter 24 and Chapter 25
	i a succinct but full description of the project for which approval is sought	Section 25.1
	ii a description of uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved in the next stages of the project	Section 24.6
	iii a compilation of the impacts of the project that have not been avoided	Section 24.1
	iv a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts	Section 24.3
	v a compilation of the outcome(s) the proponent will achieve	Section 24.4

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	vi the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts	Section 25.2
	r relevant project plans, drawings, diagrams in an electronic format that enables integration with mapping and other technical software	Whole EIS as Figures
	s The EIS must only include data and analysis that is reasonably needed to make a decision on the proposal. Relevant information must be succinctly summarised in the EIS and included in full in appendices. Irrelevant, conflicting or duplicated information must be avoided.	Whole EIS
<p>3 Assessment of Key Issues*</p> <p>Key impacts are assessed objectively and thoroughly to provide confidence that the project will be constructed and operated within acceptable levels of impact. / *Key issues are nominated by the Proponent in the SSD project application and by the department in the SEARs.</p> <p>*Key issues need to be reviewed throughout the preparation of the EIS to ensure any new key issues that emerge are captured. The key issues identified in this document are not exhaustive but are key issues common to most CSSI projects.</p>	1 The level of assessment of likely impacts must be proportionate to the significance of, or degree of impact on, the issue, within the context of the proposal location and the surrounding environment. The level of assessment must be commensurate to the degree of impact and sufficient to ensure that the Department and other government agencies are able to understand and assess impacts	Whole EIS
	2 For each key issue the Proponent must:	N/A
	a describe the biophysical and socio-economic environment, as far as it is relevant to that issue	Chapters 8 to 22
	b describe the legislative and policy context, as far as it is relevant to the issue	Chapters 8 to 22
	c identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts	Chapters 8 to 22
	d demonstrate how options within the project potentially affect the impacts relevant to the issue;	Chapters 8 to 22
	e demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	Chapters 8 to 22
	f detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant)	Chapters 8 to 22
	g detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Chapters 8 to 22
	3 Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered and the proposed measure justified taking into account the public interest.	Section 5.4

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>4 Consultation</p> <p>The project is developed with meaningful and effective engagement during project design and delivery</p>	<p>1 The project must be informed by consultation, including with relevant government agencies, infrastructure and service providers, special interest groups, affected landowners, businesses and the community. The consultation process must be undertaken in accordance with the current guidelines.</p>	<p>Chapter 4</p>
	<p>2 The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received.</p>	<p>Chapter 4</p>
	<p>3 The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.</p>	<p>Chapter 4</p>
<p>1 Transport and Traffic</p> <p>Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts.</p> <p>The safety of transport system customers is maintained.</p> <p>Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.</p>	<p>1 The Proponent must assess construction transport and traffic (vehicle (including freight, port and airport traffic), pedestrian and cyclists) impacts, including, but not necessarily limited to:</p>	<p>Section 8.3 Section 5.2 in Technical Report 1</p>
	<p>a a considered approach to route identification and scheduling of transport movements, particularly outside standard construction hours;</p>	<p>Section 8.3 Sections 5.1.4, 5.1.5 and 5.2.1 in Technical Report 1</p>
	<p>b the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management, movements and track machines);</p>	<p>Section 8.3.1 Section 5.1.4 and 5.2.1 in Technical Report 1</p>
	<p>c construction worker parking</p>	<p>Section 8.3 Section 5.1.3 in Technical Report 1</p>
	<p>d the nature of existing traffic (types and number of movements rail and road) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements) and impacts on these routes;</p>	<p>Section 8.2.2 Section 4.3 in Technical Report 1</p>
	<p>e access constraints and impacts on public transport, pedestrians and cyclists; and</p>	<p>Section 8.3 Sections 5.2.1 in Technical Report 1</p>
	<p>f the need to close, divert or otherwise reconfigure elements of the road and cycle network associated with construction of the project and measures to minimise any impacts and delays.</p>	<p>Section 8.3 Sections 5.2.2, 5.2.3, 6.2.2 and 6.2.3 in Technical Report 1</p>
	<p>2 The Proponent must assess the operational transport impacts of the project for both Road and Rail</p>	<p>Section 8.4 Section 5.3 in Technical Report 1</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>2 Noise and Vibration – Amenity</p> <p>Construction noise and vibration (including airborne noise, ground borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity.</p> <p>Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.</p>	<p>1 The Proponent must assess typical and realistic construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must take into consideration impacts to sensitive receivers and include consideration of sleep disturbance, and as relevant, the characteristics of noise and vibration (for example, low frequency noise).</p>	<p>Sections 9.3 and 9.4 Chapter 5 in Technical Report 2</p>
	<p>2 The assessment of construction noise and vibration impacts must address:</p>	<p>N/A</p>
	<p>a the nature of construction activities (including transport and redistribution of traffic (including local feeder roads, tonal or impulsive noise-generating works, as relevant)</p>	<p>Section 9.3.2 Section 5.10.1 in Technical Report 2</p>
	<p>b the intensity and duration of noise (both air and ground borne) and vibration impacts. This must include consideration of extended construction impacts associated with ancillary facilities (and the like) and construction fatigue;</p>	<p>Section 9.3 Section 5.2 in Technical Report 2</p>
	<p>c the identification of receivers, existing and likely, during the construction period;</p>	<p>Section 9.2.2 Chapter 2 in Technical Report 2</p>
	<p>d the nature, sensitivity and impact to receivers;</p>	<p>Section 9.3 Chapters 2 and 5 in Technical Report 2</p>
	<p>e the need to balance timely conclusion of noise and vibration generating works with periods of receiver respite, and other factors that may influence the timing and duration of construction activities (such as traffic management);</p>	<p>Section 4.1.1.1 in Technical Report 2</p>
	<p>f noise impacts of out-of-hours work and proposed activities including utility works, estimation of the number of out-of-hours activities required, timeframes and justification for these activities in terms of the <i>Interim Construction Noise Guideline</i> (DECCW, 2009);</p>	<p>Section 9.3.1 Section 4.1.1.1 and Section 5.2 in Technical Report 2</p>
	<p>g a cumulative noise and vibration assessment inclusive of impacts from the project (including concurrent project construction activities);</p>	<p>Chapter 7 in Technical Report 2</p>
	<p>h a cumulative noise and vibration assessment of the impacts from the project and the construction of other relevant development in the vicinity of the proposal;</p>	<p>Section 9.5 Chapter 7 in Technical Report 2</p>
<p>i details and analysis of the effectiveness of mitigation measures to adequately manage identified impacts, including cumulative impacts as identified in (g) and (h) and a clear identification of residual noise and vibration following application of mitigation measures; and</p>	<p>Section 9.6 Chapter 8 in Technical Report 2</p>	

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	<p>j a description of how community preferences have been taken into account in the design of mitigation measures and consider tailored mitigation, management and communication strategies for vulnerable community members.</p>	<p>Section 9.6.1 Sections 8.1 and 8.2 in Technical report 2</p>
	<p>2 The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required.</p>	<p>N/A – no blasting is required</p>
	<p>3 The operational noise and vibration assessment must include consideration of operational plant and equipment and increases in freight rail movements.</p>	<p>Section 9.4 Chapter 6 in Technical Report 2</p>
<p>3 Noise and Vibration-Structural Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Increases in noise emissions and vibration affecting environmental heritage as defined in the <i>Heritage Act 1977</i> during operation of the project are effectively managed.</p>	<p>1 The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage).</p>	<p>Section 5.7 in Technical Report 2</p>
	<p>2 The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required.</p>	<p>N/A – no blasting is required</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>4 Heritage</p> <p>The design, construction and operation of the project facilitates, to the greatest extent possible, the long-term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.</p>	<p>1 The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts and visual impacts) to the heritage significance of:</p>	<p>N/A</p>
	<p>a Aboriginal places and objects, as defined under the <i>National Parks and Wildlife Act 1974</i> and in accordance with the principles and methods of assessment identified in the current guidelines;</p>	<p>Sections 16.3 and 16.4 Chapter 7 of Technical Report 10</p>
	<p>b Aboriginal places of heritage significance, as defined in the Standard instrument – Principal Local Environmental Plan;</p>	<p>Sections 16.3 and 16.4 Chapter 7 of Technical Report 10</p>
	<p>c environmental heritage, as defined under the <i>Heritage Act 1977</i>;</p>	<p>Section 15.3 Chapter 9 of Technical Report 9</p>
	<p>d items listed on the State, National and World Heritage lists;</p>	<p>Section 15.3 Chapter 9 of Technical Report 9</p>
	<p>e heritage items and conservation areas identified in local and regional environmental planning instruments applicable to the project area</p>	<p>Section 15.3 Chapter 9 of Technical Report 9</p>
	<p>2 Where impacts to State or locally significant heritage items are identified, the assessment must:</p>	<p>N/A</p>
	<p>a include a significance assessment and statement of heritage impact for all heritage items including the Botany Water Reserves/Botany Wetlands and underbridges (Botany Road, O’Riordan Street and Robey Street) (including significance assessment);</p>	<p>Chapter 6 of Technical Report 9</p>
	<p>b consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant)</p>	<p>Chapter 9 of Technical Report 9</p>
	<p>c outline measures to avoid and minimise those impacts in accordance with the current guidelines; and</p>	<p>Chapter 11 of Technical Report 9</p>
<p>d be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed, the relevant consultant must meet the NSW Heritage Council’s Excavation Director criteria).</p>	<p>Section 1.6 in Technical Report 9</p>	

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	3 Where archaeological investigations of Aboriginal objects are proposed, these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the <i>Code of Practice for Archaeological investigation of Aboriginal Objects in NSW</i> (DECCW 2010).	N/A – no archaeological excavations are proposed
	4 Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.	N/A – no impacts to Aboriginal objects and/or places are proposed
<p>5 Biodiversity</p> <p>The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity.</p> <p>Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.</p>	1 The Proponent must assess biodiversity impacts in accordance with Section 7.9 of the <i>Biodiversity Conservation Act 2016</i> (BC Act), the Biodiversity Assessment Method (BAM), and documented in a <i>Biodiversity Development Assessment Report</i> (BDAR) or a BDAR waiver sought where applicable.	Technical Report 4
	2 The BDAR must include information in the form detailed in section 6.12 of the BC Act, clause 6.8 of the <i>Biodiversity Conservation Regulation 2017</i> , and the BAM.	Technical Report 4
	3 The BDAR must be submitted with all digital spatial data associated with the survey and assessment as per Appendix 10 of the BAM.	Data will be provided to the EES Group of the DPIE (formally OEH) as required on submission of the EIS
	4 The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the <i>Biodiversity Assessment Method Order 2017</i> under section 6.10 of the BC Act.	Section 3.8 in Technical Report 4
	5 The BDAR must include details of the measures proposed to address offset obligations.	Section 11.7.2 Chapter 10 in Technical Report 4
	6 The Proponent must assess any impacts on biodiversity values not covered by the BAM. This includes a threatened aquatic species assessment (Part 7A <i>Fisheries Management Act 1994</i> – FM Act) to address whether there are likely to be any significant impacts on listed threatened species, populations or ecological communities listed under the FM Act.	Section 6.3 and Section 8.2.4 in Technical Report 4
	7 The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the <i>Biodiversity Conservation Act 2016</i> , <i>Fisheries Management Act 1991</i> and <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act).	Section 8.5 in Technical Report 4

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>6 Flooding</p> <p>The project minimises adverse impacts on existing flooding characteristics.</p> <p>Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.</p>	<p>1 The Proponent must assess and (model where required) the impacts on flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account sea level rise and storm intensity due to climate change) including:</p>	<p>Sections 13.3 and 13.4</p> <p>Chapter 3 and Chapter 5 of Technical Report 6</p>
	<p>a any increases in the potential flood affectation of other properties, assets and infrastructure;</p>	<p>Sections 13.3.3 and 13.4.2</p> <p>Sections 5.1.2 and 5.2.1 of Technical Report 6</p>
	<p>b consistency (or inconsistency) with applicable Council floodplain risk management plans and Rural Floodplain Management Plans;</p>	<p>Section 5.2.2 of Technical Report 6</p>
	<p>c compatibility with the flood hazard of the land;</p>	<p>Sections 4.3 and 5.2.2 of Technical Report 6</p>
	<p>d compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land</p>	<p>Section 13.4.2</p> <p>Sections 4.3 and 5.2.1 of Technical Report 6</p>
	<p>e adverse effects to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the project;</p>	<p>Section 5.2.1 of Technical Report 6</p>
	<p>f downstream velocity and scour potential</p>	<p>Section 13.3.3</p> <p>Section 5.2.1 of Technical Report 6</p>
	<p>g impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Services and Council; and</p>	<p>Section 4.2.1</p> <p>Sections 5.2.2 and 6.1 of Technical Report 6</p>
	<p>h any impacts the development may have on the social and economic costs to the community as a consequence of flooding</p>	<p>Section 19.4.5</p> <p>Section 5.2 of Technical Report 6</p>
	<p>2 The assessment should take into consideration any flood studies undertaken by local government councils and state government agencies.</p>	<p>Section 13.1.1</p> <p>Section 3.4 of Technical Report 6</p>
<p>3 The EIS must include maps illustrating the following features relevant to flooding as described in the NSW floodplain Development Manual (2005)</p>	<p>As below</p>	
<p>a flood prone land</p>	<p>Figure 4.5 in Technical Report 6</p>	

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	b flood planning areas and any areas below the flood planning level	Figure B.6 in Annexure B of Technical Report 6
	c hydraulic categorisation (floodways and flood storage areas); and	Figure B.7 in Annexure B of Technical Report 6
	d Flood hazard	Figure B.8 in Annexure B of Technical Report 6
<p>7 Water – Hydrology</p> <p>Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources</p>	<p>1 The Proponent must describe (and map) the existing hydrological regime for any surface and groundwater resource (including reliance by users and for ecological purposes) likely to be impacted by the project, including stream orders</p>	<p>Section 14.2</p> <p>Sections 4.2 and 4.3 of Technical Report 6</p> <p>Chapter 4 of Technical Report 7</p> <p>Section 3.4.2 and 4.1 of Technical Report 8</p>
	<p>2 The Proponent must assess (and model if appropriate) the impact of the construction and operation of the project and any ancillary facilities (both built elements and discharges) on surface and groundwater hydrology in accordance with the current guidelines, including:</p>	<p>Sections 13.3, 13.4, 14.3 and 14.4</p> <p>Chapter 3 of Technical Report 6</p> <p>Chapters 1 and 6 of Technical Report 7</p> <p>Sections 5.1 and 5.2 of Technical Report 8</p>
	<p>a natural processes within rivers, wetlands, estuaries, marine waters, and floodplains, that affect the health of the fluvial, riparian, estuarine or marine system and landscape health (such as modified discharge volumes, durations and velocities), aquatic connectivity and access to habitat for spawning and refuge.</p>	<p>Section 5.2.1 of Technical Report 6</p> <p>Chapter 4 of Technical Report 7</p> <p>Sections 5.1 and 5.2 of Technical Report 8</p> <p>Sections 8.2.4 and 8.7.4 of Technical Report 4</p>
	<p>b impacts from any permanent and temporary interruption of groundwater flow, including the extent of drawdown, barriers to flows, implications for groundwater dependent surface flows, ecosystems and species, groundwater users and the potential for settlement;</p>	<p>Sections 14.3.2 and 14.4.2</p> <p>Chapters 5 and 6 of Technical Report 7</p> <p>Section 8.7.5 of Technical Report 4</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	<p>c minimising the effects of proposed stormwater and wastewater management during construction and operation on natural hydrological attributes (such as volumes, flow rates, management methods and re-use options) and on the conveyance capacity of existing stormwater systems where discharges are proposed through such systems; and</p>	<p>Section 14.4.1 Sections 5.1.2 and 5.2.1 of Technical Report 6 Chapters 5 and 6 of Technical Report 7 Section 6.2 of Technical Report 8</p>
	<p>d water take (direct or passive) from all surface and groundwater sources with estimates of annual volumes during construction and operation.</p>	<p>Section 4.11 and Chapters 5 and 6 of Technical Report 7 Sections 5.1 and 5.2 of Technical Report 8</p>
3	<p>The Proponent must identify any requirements for baseline monitoring of hydrological attributes.</p>	<p>Chapter 8 of Technical Report 7 Section 6.2.3 of Technical Report 8</p>
4	<p>The assessment must include details of proposed surface and groundwater monitoring.</p>	<p>Chapter 8 of Technical Report 7 Section 6.2.3 of Technical Report 8</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>8 Water – Quality</p> <p>The project is designed, constructed and operated to protect the NSW water quality objectives where they are currently being achieved, and contribute towards achievement of the water quality objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable)</p>	<p>1 The Proponent must:</p>	<p>N/A</p>
	<p>a describe the background conditions for any surface and groundwater resources likely to be affected by the proposal;</p>	<p>Section 14.2 Chapter 4 in Technical Report 7 Chapter 4 in Technical Report 8</p>
	<p>b state the ambient <i>NSW Water Quality Objectives</i> (NSW WQO) and environmental values for the receiving waters relevant to the project, including the indicators and associated trigger values or criteria for the identified environmental values</p>	<p>Section 14.1.1 Section 2.2 and Chapter 4 and 5 of Technical Report 7 Section 3.4 in Technical Report 8</p>
	<p>c identify and estimate the quality and quantity of all pollutants that may be introduced into the water cycle by source and discharge point and describe the nature and degree of impact that any discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of nontrivial harm to human health and the environment;</p>	<p>Section 14.3.1 and 14.4.1 Section 4.14 and Chapters 5 and 6 of Technical Report 7 Sections 5.1 and 5.2 of Technical Report 8 <i>Note: no construction water discharges are proposed</i></p>
	<p>d identify the rainfall event that the water quality protection measures will be designed to cope with;</p>	<p>Section 14.6.1 Section 6.1.1 in Technical Report 8</p>
	<p>e assess the significance of any identified impacts including consideration of the relevant ambient water quality outcomes;</p>	<p>Sections 14.3 and 14.4 Chapters 5 and 6 of Technical Report 7 Sections 5.1 and 5.2 of Technical Report 8</p>
	<p>f demonstrate how construction and operation of the project will, to the extent that the project can influence, ensure that;</p>	<p>N/A</p>
	<p>i Where the NSW WQOs for receiving, waters are currently being met they will continue to be protected; and</p>	<p>Sections 14.3.1 and 14.4.1 Sections 4.7.2 and 6.2 in Technical Report 8</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	ii Where the NSW WQOs are not currently being met, activities will work toward their achievement over time;	Sections 14.3.1 and 14.4.1 Sections 4.7.2 and 6.2 in Technical Report 8
	iii Justify, if required, why the WQOs cannot be maintained or achieved over time;	Sections 14.3.1 and 14.4.1 Section 6.2 in Technical Report 8
	iv demonstrate that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented;	Section 14.6 Chapter 7 of Technical Report 7 Section 6.2 in Technical Report 8
	v identify sensitive receiving environments (which may include estuarine and marine waters downstream) and develop a strategy to avoid or minimise impacts on these environments; and	Sections 14.2 and 14.6 Sections 4.6 and 6.2 of Technical Report 8
	vi identify proposed monitoring locations, monitoring frequency and indicators of surface and groundwater quality.	Chapter 8 of Technical Report 7 Section 6.2.3 of Technical Report 8
	2 The assessment should consider the results of any current water quality studies, as available, for the catchment areas traversed by the proposal	Section 4.14 in Technical Report 7 Section 4.7 of Technical Report 8
	<p>9 Soils</p> <p>The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.</p>	<p>1 The Proponent must assess the potential for contamination and any impacts associated with the management of contaminated soils and water resources including, but not limited to:</p> <p>a a detailed assessment of the extent and nature of any contamination of the soil, groundwater and soil vapour;</p> <p>b an assessment of potential risks to human health and the environmental receptors in the vicinity of the site;</p> <p>c a description and appraisal of any mitigation and monitoring measures; and</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	d consideration of whether the site is suitable for the proposed development.	Section 8.6 in Technical Report 5
	2 Any assessment of contamination must be in accordance with relevant guidelines produced or approved under the <i>Contaminated Land Management Act 1997</i> ;	Section 2.1 in Technical Report 5
	3 The Proponent must identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Section 12.6 Section 8.6 in Technical Report 5
10 Air Quality The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	1 The Proponent must undertake an air quality impact assessment (AQIA) for construction and operation (from increases in freight rail movements) of the project in accordance with the current guidelines.	Chapter 10 Technical Report 3
	2 The Proponent must ensure the AQIA also includes the following:	N/A
	a Identification of all receivers (including residential and commercial);	Section 10.2.3 Section 4.2 in Technical Report 3
	b demonstrated ability to comply with the relevant regulatory framework, specifically the <i>Protection of the Environment Operations Act 1997</i> and the <i>Protection of the Environment Operations (Clean Air) Regulation (2010)</i> ;	Section 10.1.1 Chapter 5 in Technical Report 3
	c the identification of potential sources of air pollution (including odour sources and from the disturbance of contaminated land) during construction and operation;	Sections 10.3 and 10.4 Chapters 5 and 6 in Technical Report 3
	d any proposed air quality monitoring	Section 10.6 Chapter 7 in Technical Report 3
	e a cumulative local and regional air quality impact assessment	Section 10.5 Section 6.6 in Technical Report 3

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>11 Health and Safety</p> <p>The project avoids or minimises any adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety.</p>	1 The Proponent must assess the potential health impacts of the project, in accordance with the current guidelines.	Chapter 2 of Technical Report 13
	2 The assessment must:	N/A
	a describe the current known health status of the affected population	Section 21.2.2 Chapter 4 of Technical Report 13
	b assess health risk associated with exposure to environmental hazards	Sections 21.3.4 and 21.4.4 Chapters 6, 7 and 8 of Technical Report 13
	c assess the effect of the project on other relevant determinants of health such as the level of physical activity and access to social infrastructure	Sections 21.3.4 and 21.4.4 Chapter 9 of Technical Report 13
	d assess opportunities for health improvement;	Chapters 6 to 9 of Technical Report 13
	e assess the distribution of the health risks and benefits; and	Section 8.9 in Technical Report 13
	f discuss how, in the broader social and economic context of the project, the project will minimise negative health impacts while maximising the health benefits.	Chapters 6 to 9 in Technical Report 13
	3 The Proponent must assess the likely risks of the project to public safety, paying particular attention to pedestrian safety, the handling and use of dangerous goods.	Sections 21.3.1, 21.3.2, 21.4.1 and 21.4.2 Chapter 8 in Technical Report 13
<p>12 Hazards and Risk</p> <p>The project avoids or minimises any adverse impacts arising from the use or proximity to hazardous goods. The project avoids, to the greatest extent possible, risk to public safety.</p>	1 The Environmental Impact Statement must:	N/A
	a report on the consultation outcomes with all operators of high pressure dangerous goods (HPDG) pipelines within or in the vicinity of the proposal with regards to <i>Australian Standard AS 2885 Pipelines – Gas and liquid petroleum</i> ;	Section 4.1 in Technical Report 14
	b demonstrate that, during construction and operation phases of the proposal, the proposal would not lead to non-compliance of the existing HPDG pipelines with the current edition of AS 2885 - Pipelines—Gas and liquid petroleum; and,	Sections 21.3.3 and 21.4.3 Chapter 6 of Technical Report 14

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
	<p>c include a preliminary risk screening completed in accordance with <i>State Environmental Planning Policy No. 33 – Hazardous and Offensive Development and Applying SEPP 33</i> (DoP, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the proposal during construction and operation phase. Should preliminary screening indicate that the development is "potentially hazardous," during construction and or operation phase, a Preliminary Hazard Analysis (PHA) must be prepared in accordance with <i>Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis</i> (DoP, 2011) and <i>Multi-Level Risk Assessment</i> (DoP, 2011).</p>	<p>Sections 21.3.2 and 21.4.2 Chapter 5 of Technical Report 14</p>
	<p>3 The Environmental Impact Statement must outline the impacts to the operation of the airport, including encroachment into the prescribed airspace, potential impacts to airport Communication, Navigation and Surveillance Systems, light spill and landscaping associated with the construction and operation of the project.</p>	<p>Sections 21.3.5 and 21.4.5 Chapter 5 of Technical Report 15</p>
<p>13 Socio economic, land use and property</p> <p>The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.</p>	<p>1 The Proponent must assess social and economic impacts in accordance with the current guidelines.</p>	<p>Sections 19.3 and 19.4 Sections 2.1, 6.1 and 6.2 of Technical Report 12</p>
	<p>2 The Proponent must assess impacts from construction and operation on potentially affected properties, infrastructure, businesses, recreational users and land and water users, including utility operations, property acquisitions / adjustments, access, amenity and relevant statutory rights.</p>	<p>Sections 17.3, 17.4, 18.3, 18.4, 19.3 and 19.4 Sections 6.1 and 6.2 of Technical Report 12</p>

CATEGORY / DESIRED PERFORMANCE OUTCOME	ITEM	ADDRESSED IN EIS
<p>14 Sustainability</p> <p>The project reduces the operating costs of ARTC and ensures the effective and efficient use of resources. conservation of natural resources is maximised.</p>	<p>1 The Proponent must assess the sustainability of the project in accordance with the <i>Infrastructure Sustainability Council of Australia</i> (ISCA) Infrastructure Sustainability Rating Tool and recommend an appropriate target rating for the project.</p>	<p>Section 24.5</p>
<p>15 Waste</p> <p>All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and / or disposed of lawfully and in a manner, that protects environmental values</p>	<p>1 The Proponent must assess predicted waste generated from the project during construction and operation, including:</p> <ul style="list-style-type: none"> a classification of the waste in accordance with the current guidelines; b estimates / details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance; c handling of waste including measures to facilitate segregation and prevent cross contamination; d management of waste including estimated location and volume of stockpiles; e waste minimisation and reuse; f lawful disposal or recycling locations for each type of waste; and g contingencies for the above, including managing unexpected waste volumes. <p>2 The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste particularly with relation to sediment/leachate control, noise and dust.</p>	<p>Sections 20.2 and 20.3</p> <p>Section 20.2.2</p> <p>Section 20.2.2</p> <p>Sections 20.2.2, 20.3.2 and 20.5.2</p> <p>Section 20.2.2</p> <p>Section 20.1.4</p> <p>Sections 20.2.2 and 20.5.4</p> <p>Sections 20.2.2 and 20.5.4</p> <p>Sections 20.2.2 and 20.3.2</p>
<p>16 Climate Change Risk</p> <p>The project is designed, constructed and operated to be resilient to the future impacts of climate change.</p>	<p>1 The Proponent must assess the risk and vulnerability of the project to climate change in accordance with the current guidelines.</p> <p>2 The Proponent must quantify specific climate change risks with reference to the NSW Government's climate projections at 10km resolution (or lesser resolution if 10km projections are not available) and incorporate specific adaptation actions in the design.</p>	<p>Section 22.2</p> <p>Chapters 3, 4 and 5 of Technical Report 16</p> <p>Section 4.2.1 and Chapters 5 and 6 of Technical Report 16</p>

Appendix B

Risk register

B1. Overview

An environmental risk assessment has been undertaken as part of the process of preparing the Botany Rail Duplication EIS. The purpose of undertaking the risk assessment process is to identify key issues to be incorporated into the impact assessment.

The environmental risk assessment has been carried out in the form of a preliminary, desktop level risk assessment, to broadly assess the potential environmental impacts and risks associated with construction and operation of the project. The environmental risk assessment identifies and ranks potential impacts with the aim of refining and prioritising the scope of the environmental assessment including the specialist studies which support this EIS.

The environmental impact assessment addresses the issues that have been confirmed as key issues through this environmental risk assessment process. Key issues are those issues that have high or very high impacts (actual or perceived) and require comprehensive assessment to determine the severity of potential effects and to identify appropriate management and mitigation measures.

B2. Environmental risk assessment process

B2.1 Risk analysis framework

The environmental risk analysis was undertaken in general accordance with the principles of the Australian/New Zealand Standard *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* (Australian/New Zealand Standard 2004). The risk analysis involved assessing the risk level of each identified potential impact by identifying the consequences of the impact and the likelihood that the impact can occur.

B2.1.1 Evaluating consequence

Consequence is defined as the implication of an impact. The consequences of an impact require a degree of subjective assessment as they may consist of several elements (refer to Table B2.1).

Table B2.1 Consequences of occurrence

CONSEQUENCE	DESCRIPTION
Extreme	<ul style="list-style-type: none"> • Long-term (greater than 12 months) and irreversible large-scale environmental, social or economic impacts • May be local or wider spatial extent (including up to state-wide) • One or more fatalities • Resulting in major prosecution under relevant environmental legislation • Extended substantial disruption and impacts to stakeholders or customers
Major	<ul style="list-style-type: none"> • Medium to long-term (6 to 12 months) and potentially irreversible • May be local or wider spatial extent (no greater than nearby local government areas) • Two to ten serious injuries • Extensive remediation required • Resulting in a fine or equivalent penalty under relevant environmental legislation • Severe disruptions or long-term impacts to stakeholders or customers

CONSEQUENCE	DESCRIPTION
Moderate	<ul style="list-style-type: none"> • Short to medium-term (1 to 6 months), reversible and/or well-contained impacts • May be local spatial extent (the site and nearby surrounds) • One serious injury • Minor remedial actions • Moderate disruptions or impacts to stakeholders or customers
Minor	<ul style="list-style-type: none"> • Short-term (less than 1 month), and reversible • May be localised spatial extent (within site boundaries) • One or more minor injuries • Within environmental regulatory limits • Minor or short-term disruptions or impacts to stakeholders or customers
Not significant	<ul style="list-style-type: none"> • Very short-term and readily reversible (not significant) • No appreciable changes to environment • No injuries • Negligible impacts to environment, stakeholders or customers

B2.1.2 Evaluating likelihood

The likelihood of an impact occurring can be described in terms of probability. Overlaying this is the need to recognise the uncertainty that may be associated with the possible impacts, particularly during the initial risk assessment process. Where there is scientific uncertainty a cautious approach will identify a higher level of risk (worst-case scenario).

Each identifiable impact can be assigned likelihood between rare and almost certain (refer to Table B2.2). In simplifying the possible impacts for the purpose of a risk assessment, an element of subjectivity is introduced. The purpose of the risk assessment is not necessarily to agree on the probability of any particular impact, but to facilitate an understanding of the relative probability of different impacts.

Table B2.2 Likelihood and probability of occurrence

LIKELIHOOD	DESCRIPTION	PROBABILITY
Almost Certain	Expected to occur	>85%
Likely	Probably will occur	50-85%
Possible	May occur	21-49%
Unlikely	Not expected to occur in most circumstances	1-20%
Rare	May occur in exceptional circumstances	<1%

B2.1.3 Environmental risk assessment matrix

Based on the assessment of consequence and likelihood any foreseeable impact can be assigned a risk level. This determines the significance of the environmental risk associated with a given impact. Table B2.3 is to be read as a matrix, with increasing consequence left to right and decreasing likelihood top to bottom.

Table B2.3 Environmental risk assessment matrix

LIKELIHOOD	CONSEQUENCE				
	Not significant	Minor	Moderate	Major	Extreme
Almost Certain	Medium	Medium	High	Very high	Very high
Likely	Low	Medium	High	High	Very high
Possible	Low	Medium	Medium	High	High
Unlikely	Low	Low	Medium	Medium	High
Rare	Low	Low	Low	Medium	High

Minimising very high impacts and high impacts were considered the highest priority and were the focus of the concept design and environmental assessment.

B3. Environmental risk assessment

Using the risk framework discussed in section B2.1, an environmental risk assessment was undertaken for the construction and operation of the project and is presented in Table B3.1. The environmental risk assessment included consideration of each of the key issues and their associated impacts. The assessment was based on evidence, previous experience and professional judgement of potential risks, and their consequence, likelihood and significance.

The preliminary risk assessment for the project involved:

- identifying potential key issues
- identifying potential key impacts/risks associated with each of these key issues
- evaluating the likelihood of occurrence and consequence in accordance with the definitions provided in section B2.1
- assigning a risk ranking/priority using Table B2.3.

Table B3.1 Environmental risk assessment

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Traffic, transport and access - construction	Construction traffic impacts, including temporary delays to local and regional traffic	Almost Certain	Moderate	High	Almost Certain	Moderate	High
	Closure of roads due to proposed bridge works and including the congestion impacts due to diversions.	Almost Certain	Major	Very High	Almost Certain	Moderate	High
	Impacts on pedestrian and cyclist movements in the vicinity of the project	Almost Certain	Minor	Medium	Almost Certain	Minor	Medium
	Impacts to emergency services through delays in access due to works	Possible	Major	High	Unlikely	Major	Medium
	Impacts to access to private property	Likely	Minor	Medium	Unlikely	Minor	Low
Traffic, transport and access - operation	Capacity for additional freight train movements	-	-	-	-	-	-
	Increase in efficiency of transportation of freight goods	-	-	-	-	-	-

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Noise and vibration – construction	Noise impacts on local residents and sensitive receivers from construction activities within standard work hours	Almost Certain	Moderate	High	Almost Certain	Minor	Medium
	Noise impacts on local residents and sensitive receivers from construction activities for out of hours works	Almost Certain	Major	Very High	Almost Certain	Moderate	High
	Noise impacts on local residents and sensitive receivers from construction traffic for day works	Likely	Minor	Medium	Possible	Minor	Medium
	Noise impacts on local residents and sensitive receivers from construction traffic out of hours	Almost Certain	Moderate	High	Possible	Minor	Medium
	Damage to structures including heritage structures (i.e. bridge) from vibration caused by construction activities	Possible	Moderate	Medium	Unlikely	Minor	Low
	Damage to structures including heritage structures from vibration caused by operation of trains	Unlikely	Minor	Low	Unlikely	Minor	Low
Noise and vibration – operation	Noise impacts on local residents and sensitive receivers from the operation of trains	Almost Certain	Major	Very High	Almost Certain	Minor	Medium
Air quality – construction	Generation of dust during construction (from exposed soil/stockpiles, excavation and vehicle movements)	Almost Certain	Moderate	High	Almost Certain	Minor	Medium
	Impacts from emissions from vehicles or plant during construction	Possible	Moderate	Medium	Unlikely	Minor	Low
	Odours from disturbance of contaminated soils	Unlikely	Minor	Low	Unlikely	Minor	Low
	Mobilisation of asbestos fibres from disturbance of contaminated soils	Almost Certain	Major	Very High	Almost Certain	Minor	Medium

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Air quality – operation	Generation of dust from transport of uncovered loads	Unlikely	Minor	Low	Unlikely	Minor	Low
	Impacts on local air quality during operation from maintenance vehicles and emissions from an increase in trains	Likely	Minor	Medium	Possible	Not significant	Low
Biodiversity – construction	Clearing of native vegetation resulting in loss of fauna habitat	Almost Certain	Moderate	High	Almost Certain	Moderate	High
	Direct impacts on threatened species and endangered populations and communities (terrestrial) from clearing	Possible	Minor	Low	Almost Certain	Minor	Medium
	Direct impacts on threatened species and endangered populations and communities (aquatic) from clearing	Unlikely	Minor	Low	Unlikely	Minor	Low
	Increased potential for pest plants and animals during construction from movement of vehicles, machinery and materials in and out of the site	Unlikely	Minor	Low	Unlikely	Minor	Low
	Impacts to groundwater dependant ecosystems as a result of groundwater drawdown	Rare	Moderate	Low	Rare	Minor	Low
	Indirect impacts due to increased dust, sedimentation and erosion, noise, light	Likely	Minor	Medium	Possible	Minor	Medium
	Disturbance to aquatic habitats and reduced water quality as a result of fugitive sediments and altered hydrology	Likely	Minor	Medium	Possible	Minor	Medium
	Native fauna mortality from vehicle strikes due to construction vehicles	Possible	Moderate	Medium	Possible	Minor	Medium
	Domesticated animal mortality from vehicle strikes	Unlikely	Minor	Low	Unlikely	Minor	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Biodiversity - operation	Native fauna mortality from train strikes	Possible	Minor	Low	Possible	Minor	Low
	Domesticated animal mortality from train strikes	Unlikely	Minor	Low	Unlikely	Minor	Low
	Native fauna mortality from maintenance vehicle strikes	Rare	Minor	Low	Rare	Minor	Low
	Domesticated animal mortality from maintenance vehicle strikes	Rare	Minor	Low	Rare	Minor	Low
	Impacts on fauna from noise and light during operation	Unlikely	Minor	Low	Unlikely	Minor	Low
	Increased potential for pest plants and animals during maintenance from movement of vehicles, machinery and materials in and out of the rail corridor	Rare	Minor	Low	Rare	Minor	Low
Protected and sensitive lands – construction / operation	Direct and indirect impacts on protected areas managed by NSW Biodiversity and Conservation Division of DPIE and/or DPI Fisheries	Unlikely	Minor	Low	Unlikely	Minor	Low
	Direct and indirect impacts on Key Fish Habitat as mapped and defined in accordance with the Fisheries Management Act 1994 (FM Act)	Possible	Minor	Low	Possible	Minor	Low
	Direct and indirect impacts on waterfront land as defined in the Water Management Act 2000	Likely	Moderate	High	Unlikely	Minor	Low
	Direct and indirect impacts on land or waters identified as Critical Habitat under the Biodiversity Conservation Act 2016, FM Act or EPBC Act	Rare	Not significant	Low	Rare	Not significant	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Contamination – construction	Impacts associated with the disturbance of contaminated soil during construction	Almost Certain	Major	Very High	Almost Certain	Not significant	Medium
	Contamination of soils/groundwater due to spills and leaks during construction	Likely	Minor	Medium	Possible	Minor	Medium
Contamination – operation	Minor spills and leaks from lubricator, trains or maintenance vehicles	Almost Certain	Minor	Medium	Likely	Minor	Medium
Hydrology – construction	Changes to flow patterns and altered hydrology due to construction in watercourses	Possible	Moderate	Medium	Unlikely	Minor	Low
	Blockages of flow paths affecting low flows through erosion and sedimentation control structures	Almost Certain	Moderate	High	Possible	Minor	Medium
	Sedimentation and changes to geomorphology (aggradation in bed channels) in watercourses	Possible	Moderate	Medium	Unlikely	Not significant	Low
Hydrology – operation	Impacts on upstream and downstream drainage due to the introduction of built structures such as embankments, culverts and bridges	Likely	Moderate	High	Unlikely	Minor	Low
Flooding - construction	Impact of flooding on unprotected areas during construction resulting in wash-outs or erosion	Unlikely	Minor	Low	Rare	Minor	Low
	Temporary impact to the behaviour of local surface water systems during construction	Possible	Minor	Medium	Unlikely	Not significant	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Flooding - operation	Presence of or change to structures associated with the project could impact upstream and downstream local flood behaviour	Unlikely	Moderate	Medium	Rare	Minor	Low
	Change to structures associated with the project and track height could impact upstream and downstream regional flood behaviour	Possible	Minor	Medium	Unlikely	Minor	Low
Water quality and soil - construction	Reduced water quality (increased TSS and turbidity) due to earthworks and erosion and sedimentation near watercourses	Almost certain	Moderate	High	Unlikely	Minor	Low
	Impacts on water quality from contamination from spills and leaks during construction	Possible	Moderate	Medium	Unlikely	Minor	Low
	Impacts on groundwater quality and quantity during drawdown/extraction	Unlikely	Minor	Low	Rare	Minor	Low
	Loss or degradation of soil quality and landform stability during earthworks	Possible	Minor	Medium	Unlikely	Minor	Low
	Increased erosion and sedimentation due to excavation activities and vehicle movement	Almost Certain	Moderate	High	Almost Certain	Not significant	Medium

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Water quality and soil - operation	Potential for pollution of watercourses due to operation (freight materials, contaminants from train operation)	Possible	Minor	Medium	Unlikely	Minor	Low
	Modification to existing drainage infrastructure resulting in water quality impacts	Unlikely	Minor	Low	Rare	Minor	Low
	Impacts on water quality from contamination from spills and leaks during operation	Unlikely	Minor	Low	Unlikely	Minor	Low
	Impact to surface water quality and receiving environments due to increased runoff from increase in impervious surfaces	Rare	Minor	Low	Rare	Minor	Low
	Increased potential for erosion and sedimentation due to including vegetation removal and creation of embankments during operation of the project	Possible	Moderate	Medium	Possible	Not significant	Low
Non-Aboriginal heritage – construction	Design that detracts from the heritage significance of a nearby items	Unlikely	Minor	Low	Unlikely	Minor	Low
	Impacts on listed heritage items or items with heritage values due to demolition, altered historical arrangements and access, visual amenity, landscape and vistas and curtilage	Almost certain	Moderate	High	Almost Certain	Moderate	High
	Damage to heritage items from vibration during construction or operation	Unlikely	Moderate	Medium	Unlikely	Minor	Low
	Disturbance of unknown or unidentified items or places of non-Aboriginal heritage significance	Possible	Minor	Low	Unlikely	Minor	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Non-Aboriginal – operation	Change to the values of a heritage items	Unlikely	Minor	Low	Unlikely	Minor	Low
Aboriginal heritage – construction	Disturbance of known or unidentified items or places of Aboriginal heritage significance	Possible	Moderate	Medium	Unlikely	Minor	Low
Land use, social and business impacts - construction	Positive impacts due to job creation and local spending	-	-	-	-	-	-
	Impacts on land use as a result of property acquisition	Almost Certain	Minor	Medium	Almost Certain	Minor	Medium
	Impacts on land use - billboards	Almost Certain	Major	Very High	Almost Certain	Moderate	High
	Impacts on businesses (and deliveries) due to road closures, particularly full road closures associated with bridge works	Unlikely	Moderate	Medium	Unlikely	Moderate	Low
	Establishment of compound sites within private property	Almost Certain	Minor	Medium	Almost Certain	Minor	Medium
	Business impacts due to impacts on advertising billboards located along Qantas and Joyce Drive	Almost Certain	Major	Very High	Possible	Minor	Low
	Positive impacts due to enhanced efficiencies and capacity for transporting goods	-	-	-	-	-	-
Land use, social and business impacts - operation	Impacts to local amenity due to increased frequency of trains.	Almost Certain	Moderate	High	Possible	Minor	Low
	Visual impacts to nearby residents and business owners due to the presence of construction compounds and work areas	Almost Certain	Moderate	High	Possible	Moderate	Medium

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Landscape and visual – construction	Light impacts from out-of-hours work during construction	Almost Certain	Moderate	High	Possible	Minor	Low
	Adverse impacts on landscape character during construction	Likely	Moderate	High	Possible	Moderate	Medium
	Impacts on visual amenity due to the introduction of built elements, including new bridges and embankments, and the removal of vegetation which currently provides some screening	Almost Certain	Moderate	High	Unlikely	Minor	Low
Landscape and visual– operation	Visual impact of operational lighting	Unlikely	Minor	Low	Unlikely	Minor	Low
	Inappropriate management of waste generated during construction resulting in excessive waste being directed to landfill	Possible	Minor	Low	Unlikely	Minor	Low
Resource and waste – construction	Increased littering from maintenance teams	Rare	Not significant	Low	Rare	Not significant	Low
	Increased demand on local and regional resources during construction	Almost Certain	Minor	Medium	Possible	Minor	Low
Resource and waste – operation	Impacts from transport, storage and use of hazardous substances and dangerous goods	Possible	Moderate	Medium	Possible	Minor	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Risks and safety - construction	Impact to utilities including pipelines	Possible	Major	High	Unlikely	Major	Medium
	Reduced safety for road users and pedestrians during construction particularly in the vicinity of houses, businesses and townships	Possible	Moderate	Medium	Unlikely	Moderate	Low
	Adverse health from noise and air pollution during construction	Possible	Minor	Low	Unlikely	Minor	Low
	Potential for project to exacerbate bushfires (storage of dangerous goods, construction site issues such as smoking or hot works)	Rare	Minor	Low	Rare	Minor	Low
	Potential for environmental damage resulting from a bushfire passing through the site (e.g. explosion of fuel storages/tanks, vehicles and machinery)	Rare	Minor	Low	Rare	Minor	Low
	Impact from spill or accident during the transport, storage and use of hazardous substances and dangerous goods	Possible	Moderate	Medium	Unlikely	Moderate	Low
Risks and safety - operation	Potential for train strike for pedestrians crossing line, near houses, businesses and townships.	Rare	Major	Low	Rare	Major	Low
	Adverse health from noise during operation	Possible	Minor	Low	Unlikely	Minor	Low
Climate change - operation	Impacts to infrastructure due to increased heat and rainfall/flooding	Possible	Minor	Medium	Unlikely	Minor	Low
	Increased electricity and fuel use during construction and operation	Almost Certain	Minor	Medium	Possible	Minor	Low

KEY ISSUE	POTENTIAL IMPACT/RISK	INITIAL RISKS			POST MITIGATION RISKS		
		LIKELIHOOD	CONSEQUENCE	RISK RATING	LIKELIHOOD	CONSEQUENCE	RISK RATING
Cumulative impacts – construction	Impacts associated with Botany Rail Duplication and the Gateway road project being constructed simultaneously in a similar location including traffic, noise, air, non-Aboriginal heritage, land use and property and social impacts	Almost Certain	Major	Very High	Almost Certain	Moderate	High
	Impacts associated with the project and other projects located in the proximity of the project such as WestConnex	Almost Certain	Moderate	High	Likely	Minor	Medium
Cumulative impacts - operation	The project along with Gateway road project and WestConnex would result in improved transport infrastructure which would benefit the community	-	-	-	-	-	-

B4. Summary of analysis and identification of key issues

The environmental risk analysis undertaken has confirmed the following issues as key considerations for the project which require further assessment in the form of specialist studies (determined as any issue with a potential risk of high or above):

- Traffic and transport
- Noise and vibration
- Air quality
- Biodiversity
- Contamination
- Flooding and water (groundwater, quality and hydrology)
- Non-Aboriginal heritage
- Aboriginal heritage
- Landscape and visual amenity
- Social and business impacts
- Cumulative impacts.

While the issues of land use, soil and health and safety also included impacts which were assessed as high, the impacts are considered to be well understood based on previous experience with similar projects, and implementation of standard design and management measures would minimise these risks. Therefore, these risks have been assessed within chapters of the EIS.

The environmental risk analysis undertaken as part of this report did not identify any impacts with a risk level of very high once mitigation measures are applied. This is because very high impacts would have been identified through the initial project planning stages, and the project route and design modified to avoid very high impacts, or mitigation measures identified. This EIS includes a discussion of the options, which were considered prior to selection of the current project.

Appendix C
Environmental Planning and Assessment Regulation
2000 checklist

Table C.1 Requirements of Schedule 2 (Part 3) of the Environmental Planning and Assessment Regulation 2000

REQUIREMENT	EIS REFERENCE
6. form of environmental impact statement	
An environmental impact statement must contain the following information	
a the name, address and professional qualifications of the person by whom the statement is prepared,	Certification page
b the name and address of the responsible person,	Certification page
c the address of the land:	Certification page
i in respect of which the development application is to be made, or	Certification page
ii on which the activity or infrastructure to which the statement relates is to be carried out,	Certification page
d a description of the development, activity or infrastructure to which the statement relates	Certification page and Chapter 6
e an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule	Certification page
f a declaration by the person by whom the statement is prepared to the effect that: <ul style="list-style-type: none"> <li data-bbox="252 1070 1098 1102">i the statement has been prepared in accordance with this Schedule, and <li data-bbox="252 1115 1098 1196">ii the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and <li data-bbox="252 1227 1098 1281">iii that the information contained in the statement is neither false nor misleading. 	Certification page
7. Contents of the environmental impact statement	
An environmental impact statement must also include each of the following:	
a a summary of the environmental impact statement,	Executive Summary
b a statement of the objectives of the development, activity or infrastructure,	Section 1.2.1
c an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Section 5.3, section 5.4 and Appendix F
d an analysis of the development, activity or infrastructure, including:	
i a full description of the development, activity or infrastructure, and	Chapter 6 (Description and operation) and Chapter 7 (Construction)
ii a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	Chapter 2 (Location and setting) and Chapters 8 to 23 (impact assessment)
iii the likely impact on the environment of the development, activity or infrastructure, and	Chapters 8 to 23 (impact assessment chapters)

REQUIREMENT	EIS REFERENCE
<p>iv a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and</p>	<p>Chapters 8 to 23 (impact assessment chapters) and Technical Papers 1 to 16</p>
<p>v a list of any <u>approvals</u> that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,</p>	<p>Chapter 3</p>
<p>e a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),</p>	<p>Chapter 24 (consolidated management and mitigation measures)</p>
<p>f the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).</p>	<p>Chapter 24</p>

Appendix D
Additional statutory requirements

D1. Other NSW approval requirements

D1.1 Approvals not required for State significant infrastructure

In accordance with section 5.23(1) of the EP&A Act, the following approvals, which may have otherwise been required to undertake the project, would not be required:

- a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*
- an approval under Part 4, or an excavation permit under section 139, of the *Heritage Act 1977*
- an Aboriginal heritage impact permit under section 90 of the *National Parks and Wildlife Act 1974*
- a water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000*.

In addition, Division 8 of Part 6 of the *Heritage Act 1977* (relating to making heritage orders) does not apply to prevent or interfere with the carrying out of approved State significant infrastructure.

D1.2 Approvals to be applied consistently

In accordance with section 5.24(1) of the EP&A Act, the following approvals that are potentially required cannot be refused:

- an environment protection licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (POEO Act)
- a consent under section 138 of the *Roads Act 1993*.

The approval requirements of these Acts as they relate to the project are summarised below.

D1.3 Consideration of requirements under relevant NSW legislation

Other NSW environmental planning legislation directly relevant to the approval and assessment of the project are considered below. The requirements of the EP&A Act are described in Chapter 3.

D1.4 Protection of the Environment Operations Act 1997

The POEO Act establishes, amongst other things, the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. An environment protection licence (EPL) is required under Chapter 3 of the POEO Act to undertake a scheduled activity or scheduled development work. The definitions of scheduled activities provided in Schedule 1 includes:

'33 Railway systems activities

1. This clause applies to railway systems activities, meaning:

a) The installation, on site repair, on-site maintenance or on site upgrading of track. Including the construction or significant alteration of any ancillary works.

b) The operation of rolling stock on track.'

The project meets this definition and is therefore a scheduled activity.

ARTC holds an existing EPL (EPL 3142) that authorises the carrying out of railway systems activities on certain parts of the NSW rail network. This includes construction of new track in the metropolitan area less than three kilometres in length, including associated ancillary works. In relation to operation, it may be appropriate to amend this licence to include operation of the project. This would be considered as part of ongoing consultation with the NSW Environment Protection Authority prior to commencement of the project.

D1.5 Roads Act 1993

Under Section 138 of the *Roads Act 1993*, approval from the relevant roads authority is required to disturb, erect a structure, or carry out a work in, on or over a public road. Clause 5(1) of Schedule 2 to the Roads Act exempts public authorities from this requirement, except in relation to works on or over classified and Crown roads.

The project includes works to bridges over two classified roads – O’Riordan Street and Southern Cross Drive. Approval under section 138 of the Roads Act would be required for these works.

D1.6 Water Management Act 2000 and Water Act 1912

The *Water Management Act 2000* and *Water Act 1912* control the extraction of water, the use of water, the construction of works such as dams and weirs and the carrying out of activities in or near water sources in NSW. The provisions of the Water Management Act are being progressively implemented to replace the Water Act. Since 1 July 2004 the new licensing and approvals system has generally been in effect in those areas of NSW covered by operational water sharing plans. The study area is covered by the Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011.

While it is proposed that construction of the project would involve excavation, it is not proposed to undertake any groundwater extraction, dewatering or interfere with the Botany aquifers as part of the construction of the project. As such, it is not expected that these requirements under the Water Management Act and the NSW Aquifer Interference Policy (DPI 2012) would be relevant to the project.

D2. Commonwealth approval requirements

D2.1 Environment Protection and Biodiversity Conservation Act 2016

D2.1.1 Approval required

Under the EPBC Act, proposed ‘actions’ that have the potential to significantly impact on matters of national environmental significance, the environment of Commonwealth land, or that are being carried out by an Australian Government agency, must be referred to the Australian Minister for the Environment and Energy for assessment. If the Minister determines that a referred project is a ‘controlled action’ under the EPBC Act, the approval of the Minister would be required.

Due to consideration of potential ecological impacts to EPBC listed species, the location of the project adjacent to Commonwealth Land (Sydney Airport) and the proposed temporary use of some Commonwealth Land as a compound site to the south of General Holmes Drive), a Commonwealth referral under the EPBC Act is proposed to be submitted as part of the project.

D2.2 Airports Act 1996

D2.2.1 Airport land

Works on Commonwealth-owned land leased to SACL (Sydney Airport land) are subject to the planning and assessment framework prescribed by the (Commonwealth) *Airports Act 1996* (the Airports Act) and associated regulations, including the (Commonwealth) Airports (Building Control) Regulations 1996 (the Building Control Regulations).

Section 90 of the Airports Act requires that works defined as major airport development must not be carried out except in accordance with an approved major development plan. Section 99 requires approval to carry out a building activity on an airport site.

As described in section 7.5.6 of the EIS, construction would involve temporary lease and use of some areas of Sydney Airport land for construction site compounds and temporary construction access.

These works would not meet the definitions of major airport development under section 89 of the Airports Act, however the works may be defined as a building activity for the purposes of section 99. The need for a building approval, and the type of approval required (as defined by the Building Control Regulations), would be confirmed in consultation with SACL and the Airport Building Controller as part of the ongoing development of the project.

D2.2.2 Airspace protection

Part 12 of the Airports Act and the *Airports (Protection of Airspace) Regulations 1996* (the Airspace Regulations) establish a framework for the protection of airspace at, and around airports.

Section 181(1) of the Airports Act defines the prescribed airspace as ‘...an airspace specified in, or ascertained in accordance with, the regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for the airspace to be protected under this Part’. The Airspace Regulations define the ‘prescribed airspace’ around Sydney Airport.

The prescribed airspace consists of the obstacle limitation surface (OLS) and the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surface. The OLS provides a protected space that is free of obstructions for aircraft flying into and out of the airport. It defines the lower limits of an airport’s airspace, which should be kept free of obstacles during the initial and final stages of flight or manoeuvring. Intrusions into the OLS require approval under the Airports Act.

The PANS-OPS protects aircraft flying into and out of the airport when the flight is guided solely by instruments in conditions of poor visibility. The PANS-OPS surface is generally situated above the OLS. Intrusions into the PANS-OPS surface are prohibited.

The Airports Act (section 183) defines any activity that intrudes into an airport’s prescribed airspace to be a ‘controlled activity’, which requires approval. Controlled activities include:

- permanent structures, such as buildings, intruding into the protected airspace
- temporary structures such as cranes intruding into the protected airspace; or
- any activities causing intrusions into the protected airspace through glare from artificial light or reflected sunlight, air turbulence from stacks or vents, smoke, dust, steam or other gases or particulate matter.

Carrying out a controlled activity without approval is an offence under Section 183 of the Airports Act.

Certain construction activities associated with the project (such as construction of the new bridges over Southern Cross Drive, Robey Street and O’Riordan Street) would involve the use of cranes that would intrude temporarily into the OLS.

A controlled activity approval would be obtained prior to construction. Existing rail operations currently operate under an existing approval to allow for transient intrusion of the OLS by trains that use the current alignment in proximity to General Holmes Drive.

Appendix E
Strategic planning review

E1. Strategic planning review

A summary of the plans and strategies that are relevant to the need for, and development of, the project is provided below.

E1.1 National strategic planning

E1.1.1 Inquiry into National Freight and Supply Chain Priorities

The Inquiry into National Freight and Supply Chain Priorities was initiated by the former Australian Minister for Infrastructure and Transport in 2017. The inquiry was tasked with identifying priorities for Australia for the next 20 years, to improve freight and supply chain efficiency and capacity, and manage the costs of transporting goods through Australia's major national container ports, airports, intermodal terminals and pipelines.

Feedback from Ports Australia during the Inquiry process concluded that while terminal capacity at most ports across Australia can meet predicted needs for the next 20 years with reasonable investment, some container ports such as Port Botany and the Port of Melbourne have constraints associated with their land based transport connections.

The inquiry report (Commonwealth of Australia 2018) noted that road transport will experience increased congestion and associated higher costs over the next 20 years, and that investing in efficient rail freight connections to major ports and rail freight paths through metropolitan networks will take pressure off the road system.

The report includes a number of critical action areas, of which action 4.3 is relevant to the project: 'Provide additional funding to ensure efficient rail freight connections to major ports and rail freight paths through metropolitan networks, including port rail projects, such as completing the duplication of the Port Botany freight rail line.'

E1.1.2 National Land Freight Strategy

The National Land Freight Strategy is a partnership between the Commonwealth, State, Territory, local governments and industry to drive efficient and sustainable freight logistics within Australia. The strategy identifies six major challenges facing freight today that require coordinated policy action and effort by governments and industry to:

1. Ensure there are long term and integrated plans in place for freight
2. Invest in the right infrastructure at the right time
3. Improve access, investment and charging arrangements for heavy vehicles
4. Create better and more consistent regulation
5. Enhance understanding of the freight task and its associated challenges
6. Build community understanding and support for the role of freight in society

While not specifically identified within the plan, the Botany Duplication project would be consistent with addressing two of the challenges identified. The project would ensure it would contribute to the integrated, long term planning for ensuring efficient, sustainable freight logistics in Australia (challenge 1) and that funding for freight infrastructure is allocated to critical elements (challenge 2).

E1.1.3 Australian Infrastructure Plan and Priority List

The *Australian Infrastructure Plan* (Infrastructure Australia, 2016) sets out the infrastructure challenges and opportunities that Australia faces over the next 15 years and the solutions required. The plan was informed by a comprehensive review of existing and required infrastructure over the coming decades.

The plan has four main themes:

- productive cities, productive regions
- efficient infrastructure markets
- sustainable and equitable infrastructure
- better decisions and better delivery.

In relation to the second theme, the plan recognises that 'Demand for freight rail infrastructure is projected to grow substantially in coming decades.'

As part of the *Australian Infrastructure Plan*, the Infrastructure Priority List (Infrastructure Australia 2018) is designed to give guidance to decision makers and provide transparency for industry and the community. It is a 'rolling' list that is updated periodically as proposals move through development and delivery and in response to emerging challenges and opportunities.

The 'Port Botany freight rail duplication' is included as a high priority near-term (0–5 years) initiative on the Infrastructure Priority List in the national connectivity category. The priority list notes that:

- the rail line is currently operating close to capacity. Additional demand arising from growth in interstate, intrastate and import/export freight has the potential to create a bottleneck along this line, impacting on reliability and restricting the efficient movement of freight across the broader Sydney rail network
- as Sydney's primary container port, it is vital that Port Botany maintains throughput capacity to meet demand over the long term
- currently, around 19 per cent of Port Botany containerised freight is moved using the rail network. Increasing this mode share will require additional capacity on the Port Botany line and the broader Sydney freight rail network
- the duplication will form part of a broader strategy designed to drive growth in rail mode share for freight to and from Port Botany.

E1.1.4 National Ports Strategy

The *National Ports Strategy* (Infrastructure Australia and the National Transport Commission 2011) was developed as part of a collaborative approach to the future development and planning of Australia's port and freight infrastructure. The strategy covers both bulk commodity ports and container ports, identifying:

- the most effective regulatory and governance frameworks
- ways to improve land planning and corridor preservation
- future infrastructure requirements of Australia's ports, including road and rail links.

The strategy notes that there are major efficiency implications for Australia if significant improvements are not made to ports and related landside road and rail systems over the coming decades.

The project is consistent with this strategy as it involves improvements to the rail network accessing Port Botany.

E1.2 NSW planning

E1.2.1 Future Transport Strategy 2056

The *Future Transport Strategy 2056* (Transport for NSW 2018a) is a suite of strategies and plans for transport developed in conjunction with the Greater Sydney Commission's *A Metropolis of Three Cities – the Greater Sydney Region Plan* and supporting regional plans, and Infrastructure NSW's *State Infrastructure Strategy*. The *Future Transport Strategy 2056* provides an integrated 40 year vision, directions and outcomes for transport in NSW. The vision for the future of transport is based on six outcomes:

- customer focussed
- successful places
- a strong economy
- safety and performance
- accessible services
- sustainability.

The strategy recognises that the freight rail network will be an integral part of Sydney's transport system into the future. It notes that: 'The strategic freight network will use major city-shaping corridors and increasingly rely on dedicated freight rail corridors for movements between ports and intermodal terminals in the Central and Western Cities'.

The strategy recognises the Botany Line as part of Sydney's strategic freight network, and notes that:

The strategic freight network includes the most significant corridors that support the movement of goods. This includes corridors connecting trade gateways, freight precincts and centres across Greater Sydney as well as corridors that connect the region with outer metropolitan areas and regional NSW. Supporting the safe, efficient and reliable movement of goods around Greater Sydney will require a high capacity network for movement between trade gateways and convenient access to service centres.

The project is consistent with the strategy as it will support the continued functioning of the Botany Line as part of Sydney's freight network into the futures, and the safe, efficient and reliable movement of goods along the line.

E1.2.2 State Infrastructure Strategy 2018-2038: Building Momentum

The *State Infrastructure Strategy 2018-2038* (Infrastructure NSW 2018) establishes the strategic directions, projects and initiatives to meet the infrastructure needs of a growing population and a growing economy.

The strategy investigates infrastructure demands over the next 20 years. With respect to Port Botany, it notes that container trade through the port is expected to grow by 62 per cent between 2016 and 2036, increasing from 2.36 to 3.83 million twenty foot equivalent units. The strategy notes that 'maintaining the efficiency of infrastructure networks and access to the international trade gateways of Sydney Airport and Port Botany will be critical to support the ongoing competitiveness of the city and of NSW'.

With respect to transport, the strategy notes that rising congestion on parts of the road network and crowding on sections of the rail network will increase travel times and affect the reliability of the freight network. The strategy recommends shifting demand towards more efficient modes of transport, and unlocking the capacity of current assets by modernising systems and addressing bottlenecks.

The project is consistent with the following strategic directions in the strategy:

- improve access to international gateways
- optimise existing infrastructure networks to provide greater capacity for better services.

The following recommendation (recommendation 60) also includes reference to the project:

Infrastructure NSW recommends that Transport for NSW finalise business cases by the end of 2018 to enable the NSW Government to partner with the Commonwealth Government to fund investment in Sydney Gateway, Botany Rail Duplication and Foreshore Road/Botany Road, as well as the Moorebank Intermodal Terminal Road Access Strategy, to remove bottlenecks on connections to and from Sydney Airport and Port Botany and to capitalise on development of the Moorebank Intermodal Terminal. (Planning: 0-5 years; Investment: 0-5 years).

E1.2.3 NSW Freight and Ports Plan 2018-2023

The *NSW Freight and Ports Strategy* (Transport for NSW, 2018c), which supports the *Future Transport Strategy 2056*, sets the NSW governments' priorities for the sector over the next five years. The plan identifies priority action areas and initiatives to provide industry with continuity and certainty required for long term investments in the sector.

The plan notes transport of freight via the shared rail network is constrained by the needs of the passenger transport, particularly during peak times, and maximising infrastructure investment and increasing infrastructure is required to accommodate the future growth of freight movements in NSW, expected to be 28 percent by 2036.

The plan identifies a number of initiatives being investigated or committed to that will focus on improving rail freight capacity in areas where it currently depends on the shared network through the segregation of freight and passenger lines. The duplicate the final three kilometres of the Port Botany Rail Line is identified as one committed initiative.

E1.3 Metropolitan/regional planning

E1.3.1 A Metropolis of Three Cities – the Greater Sydney Region Plan

A Metropolis of Three Cities – the Greater Sydney Region Plan (Greater Sydney Commission 2018a) sets a 40 year vision (to 2056) and establishes a 20 year plan to manage Greater Sydney's growth and change. The plan is built on a vision of three cities, where most residents live within 30 minutes of jobs, education, health facilities, and other services:

- Western Parkland City
- Central River City
- Eastern Harbour City.

The plan notes that:

- efficient trade gateways, freight and logistics networks are required for the region to be more internationally competitive
- Port Botany and Sydney Airport are Greater Sydney's two nationally significant trade gateways, with significant growth projected
- retaining internationally competitive operations at Port Botany and Sydney Airport is vital for a productive NSW economy
- ensuring transport networks can support the needs of the trade gateways is of national significance
- providing for a growing Greater Sydney requires an efficient and effective road and rail freight network integrated with ports and airports.

The plan includes ten directions and 40 objectives for the future of Sydney. The project is consistent with the following objectives:

- Objective 3 – Infrastructure adapts to meet future needs.
- Objective 15 – The Eastern, Greater Parramatta and the Olympic Peninsula, and Western Economic Corridors are better connected and more competitive.
- Objective 16 – Freight and logistics network is competitive and efficient.

E1.3.2 Eastern City District Plan

The Greater Sydney Commission's five district plans are a guide for implementing the *A Metropolis of Three Cities – the Greater Sydney Region Plan* at a district level. These 20 year plans are a bridge between regional and local planning. Their purpose is to inform local environmental plans, community strategic plans and the assessment of planning proposals.

The project is located in an area subject to the *Eastern City District Plan* (Greater Sydney Commission 2018b). The plan notes that Sydney Airport and Port Botany are global gateways that form part of the Eastern Economic Corridor. The plan notes that:

- Port Botany will grow significantly
- Port Botany is the freight hub for NSW and a major focus of NSW's freight network
- a significant freight and logistics task will remain in the Eastern City District
- opportunities provided by improved links to Port Botany will improve freight movements from the Eastern Harbour City across Greater Sydney and to Port Kembla/Illawarra, supporting the functions of critical economic gateways and freeing up road capacity.

The project is consistent with the following planning priorities:

- E7 Growing a stronger and more competitive Harbour CBD
- E9 Growing international trade gateways
- E10 Delivering integrated land use and transport planning and a 30-minute city.

The plan recognises the project as an important freight-related initiative, and includes the following action: '*Action 31. Protect and grow Port Botany by investigating duplication of Port Botany freight line.*'

E1.3.3 Greater Sydney Services and Infrastructure Plan

The *Greater Sydney Services and Infrastructure Plan* (Transport for NSW 2018c), which forms part of the *Future Transport Strategy 2056*, sets the strategic direction for transport in NSW over the next 40 years. Building on the state-wide transport outcomes identified in the *Future Transport Strategy 2056*, the plan identifies specific transport outcomes for Greater Sydney, and the policy, service and infrastructure initiatives to achieve these outcomes.

The project will assist in achieving outcome 8, which relates to the 'safety and performance' outcome under the *Future Transport Strategy 2056*. Outcome 8 is 'Efficient and reliable freight journeys supported by 24/7 rail access between key freight precincts with convenient access to centres'. Relevant to this outcome, the plan recognises that the productivity of Sydney and many regional NSW communities depends on container goods being moved safely, efficiently and reliably within Greater Sydney, and that the efficiency of freight movements in Sydney has a significant impact on the wider freight industry and economy. The plan notes that upgrading the Botany Line to increase capacity will assist in achieving this outcome.

The plan also defines the vision for Sydney's future transport networks, including the strategic freight network. The plan notes that 'A key task for the freight network over the next 40 years will be to support growing demand between ports in the east, particularly Port Botany'. The plan includes 'Duplication of Port Botany freight rail line' as an initiative for investigation (0–10 years) as one of the transport initiatives for the

Eastern Harbour CBD. These initiatives include those focussed on unlocking capacity on existing rail corridors.

E1.3.4 Navigating the Future: NSW Ports' 30 Year Master Plan

NSW Ports began operations in mid-2013 under a 99-year lease for Port Botany, Port Kembla, the Cooks River Intermodal Terminal and the Enfield Intermodal Logistics Centre. *Navigating the Future: NSW Ports' 30 Year Master Plan* documents the actions required to create a sustainable port supply chain that will meet the needs of NSW over the next 30 years and beyond. It details expected trade growth and outlines the actions to address this growth. The plan notes that:

- Port Botany is vital to the economic wellbeing of Sydney and NSW and is NSW's only container port and the largest bulk liquid and gas port
- most of Port Botany's trade caters for Sydney's consumers and businesses, with 80 per cent of import containers delivered within a 40 kilometres radius from Port Botany
- Port Botany will be required to cater for growing trade volumes over the next 30 years
- more containers will be transported by rail, supported by a network of existing and new metropolitan intermodal terminals – NSW Ports' has a target of three million TEUs of containers being moved to and from Port Botany by rail by 2045 (around 40 per cent of forecast container volumes), with the Cooks River Intermodal Terminal and Enfield Intermodal Logistics Centre supporting this task
- the Enfield and Cooks River intermodal terminals will be inland extensions to Port Botany, with Cooks River operating as an extended port gate and the Enfield Intermodal Logistics Centre a key logistics hub in the central-west of Sydney
- container volumes could more than triple from 2.3 million to 8.4 million TEUs over the next 30 years
- maximising the capacity of Port Botany and its ability to meet the predicted growth in freight throughput requires a combined investment in, and optimisation of, both road and rail networks.

The plan identifies five objectives to respond to these needs and sustainably cater for forecast trade growth. The project will assist in achieving objective 2 'Grow rail transport of containers'. With regard to this objective, the plan notes that:

- maximising the transport of containers by rail between Port Botany and Sydney metropolitan intermodal terminals will be essential for cost-effective, efficient and sustainable container distribution throughout Sydney. Growth in use of rail will benefit the road networks surrounding the port by reducing the numbers of trucks. Significant growth in containers moved by rail will reduce the growth of trucks around Port Botany and will enable the port to achieve its optimum capacity
- Port Botany will not achieve an annual container throughput of over seven million TEU without rail becoming a more significant component of the port logistics chain.

The plan notes a number of actions under this objective, including: 'Duplicate the Port Botany Freight Rail Line between Port Botany and Mascot to increase reliability for rail operations and create long-term capacity to achieve the rail target'.

E1.3.5 Sydney Metropolitan Freight Strategy

The purpose of ARTC's *Sydney Metropolitan Freight Strategy* (ARTC 2015) is to document the challenges, opportunities and the most effective solutions to achieve rail freight growth in Sydney. The strategy notes that ARTC's fundamental objective in the Sydney area is to facilitate the growth of rail freight in the short, medium and long term.

The strategy notes that rail market share at Port Botany is predicted to increase from 14 per cent in 2014 to 42 per cent in 2028, and that capacity improvements on the network are required to address this increase.

To meet future capacity requirements under the most likely future demand scenario, the strategy notes the need to proceed with a new entry loop at Warwick Farm and to undertake 'full duplication of the track from Mascot to Botany Yard'.

Appendix F
Options assessment

F1. Options considered

This appendix provides a description of the key project design options that were considered as part of the ongoing design development project following identification of the preferred option. The preferred options would be subject to further design refinement as part of the detailed design of the project.

F1.1 Overview

The key project design options that were considered included:

- rail alignment between Robey and O’Riordan streets
- bridges over Robey and O’Riordan streets
- ground treatment near Mill Stream
- bridge over Botany Road
- bridge over Mill Stream
- rail alignment between Mill Stream and Banksia Street.

F1.2 Rail alignment between Robey Street and O’Riordan Street

F1.2.1 Existing situation/key issues

Between Robey Street and O’Riordan Street, the rail corridor is tightly constrained by surrounding land uses, including existing buildings to the north (the Stamford Plaza hotel and an office building) and the road corridor for Qantas Drive to the south. The project site for the Sydney Gateway road project (currently being developed by Transport for NSW) also adjoins the rail corridor in this location.

The existing rail track is situated on an embankment between the Robey and O’Riordan Street bridges, elevated above the road level. The embankment and surrounding land is vegetated with mature trees, which assist in screening the rail corridor from surrounding land uses. There are a number of large advertising billboards/structures located within/adjoining the rail corridor.

There are also a number of services within this section of the corridor, including an ethylene gas pipeline and a Jemena high pressure gas main.

F1.2.2 Options considered

Two main options were considered for the location of the duplicated track between Robey and O’Riordan streets. The options are summarised below.

Option 1: Duplication on the south (down) side of the existing track

This option involves providing the second track on the south (down) side of the existing track. Features of this option include:

- an embankment with retaining walls (area of about 1,475 square metres) to minimise impacts on properties and services and about 7,360 cubic metres of fill
- utility relocations and protection,
- the existing track would need to be modified slightly to raise the level and modify horizontal alignment
- replacing the bridges over Robey Street and O’Riordan Street.

Option 2: Duplication on the north (up) side of the existing track

This option involves providing the second track on the north (up) side of the existing track. Features of this option include:

- an embankment with retaining walls (area of about 595 square metres) to minimise impacts on properties and services and about 4,880 cubic metres of fill
- utility relocations and protection limited to services crossing the rail corridor
- the existing track would need to be modified slightly to raise the level and modify horizontal alignment,
- staging of works to provide ongoing rail access during construction
- replacing the bridges over Robey Street and O’Riordan Street.

F1.2.3 Assessment

The options assessment involved a multi-criteria analysis (MCA) including weighting the value of various risks and opportunities. The criteria used to undertake the MCA included:

- | | |
|----------------------------------|---|
| • property impacts | • temporary works |
| • number of billboards impacted | • signalling |
| • amount of acquisition required | • track slews |
| • urban design | • utility impacts |
| • constructability | • impacts to the high-pressure gas main |
| • possession risk | • other impacts |
| • construction access | • track alignment |
| • road traffic impact | • future proofing |
| • adjacent worksite interaction | • maintenance |
| • environmental impact | • maintenance access |
| • sustainability | • lifecycle costs. |

Each criterion was subjectively weighted, and the options were assessed against each with a score assigned based on the results of the assessment.

F1.2.4 Preferred option

Based on the assessment, Option 1 (duplication of the track to the south side of the existing track) performed better and was identified as the preferred option. The key differentiators between the options in terms of scoring were constructability and program risks and potential impacts to utilities. Option 1 offered the following key advantages compared to Option 2:

- Option 1 would be located further from existing buildings (including Stamford Plaza) and would maintain the existing separation distance between the buildings and nearest track.
- The majority of works to construct Option 1 could be undertaken while the freight rail corridor is operating, and there are lower constructability risks. This would result in there being a significant reduction in rail freight movements transferring on to the road network.
- Option 1 would require less temporary works to be undertaken as part of construction including reduced track slewing and signalling staging works.
- Option 1 would require a shorter overall construction timeframe to complete, resulting in reduced period of amenity (including noise and vibration) and access impacts.

F1.3 Bridges over Robey and O’Riordan streets

F1.3.1 Existing situation/key issues

The existing Botany Line crosses Robey and O’Riordan streets via bridges located above the road corridors. Assessment of the existing bridges identified that they are not wide enough to enable the duplicated track to be constructed on the bridges, with new structures being required to support the duplicated track.

Additionally, an outcome of the alignment MCA process for Robey Street and O’Riordan Street (refer to section F1.2 above) was the identification of two sub options for bridge structures. Rather than resolve this during the alignment selection assessment, it was determined that the two options should be considered in their own MCA process on the preferred alignment. This was also done so that the design of each option could be further progressed to ensure that key risks are adequately understood.

In this section of rail corridor, the existing rail track is located on an embankment that extends between the two bridges, elevated above the road level. The existing bridges are listed as heritage items by Transport for NSW’s section 170 heritage conservation register.

F1.3.2 Options considered

Two options were considered to provide sufficient room for the duplicated track in this location. The options are summarised below. It should be noted that the consideration and assessment of these options was also linked to the assessment of the track alignment options for this section of the project (refer to section F1.2 previously).

Option 1 – Individual bridges and retaining walls

This option involved constructing two new bridges over Robey and O’Riordan streets (a bridge over each road), and a bridge abutment between the two bridges to support the new section of track.

At Robey Street, a new single span underbridge would be constructed to the south of the existing bridge. Once the track new alignment is completed the existing bridge could be demolished, allowing train operations to continue unaffected. A new single span underbridge structure would then be constructed to the north of the newly constructed underbridge (noting the existing underbridge would be retained due to insufficient vertical clearance to the road).

At O’Riordan Street, a new single span underbridge would be constructed to the south of the existing bridge. Once the track new alignment is completed the existing two span bridge would be demolished, allowing train operations to continue unaffected. A new single span underbridge structure would then be constructed to the north of this newly constructed underbridge (noting the existing underbridge cannot would not be retained due to insufficient vertical clearance to the road).

The construction methodology for both bridges was based on two separate concrete through girder decks with rail plank approach spans. The substructure would comprise concrete and abutment headstocks (in-situ or precast) supported on cast in-situ bored piles socketed into bedrock.

Option 2 – New viaduct

This option would involve constructing a new viaduct to support the rail tracks from the north of Robey Street to the east of O’Riordan Street. The viaduct would comprise a 19-span elevated structure between and crossing the two roads. The structure would consist of through-girder crossings of Robey and O’Riordan streets, and elevated spans between the two crossings. No fill would be required to construct this option.

F1.3.3 Assessment

An assessment of each of the options was undertaken to assist in weighting the value of various risks and opportunities. The criteria used to undertake the assessment included:

- constructability
- works to existing alignment
- operational network impacts
- possession risk
- construction access
- road traffic impact
- adjacent worksite interaction
- track alignment
- property impacts
- no. of billboards impacted
- amount of acquisition required
- utility impacts
- impacts to the high-pressure gas main
- other impacts
- maintenance.

Each criterion was subjectively weighted, and the options were assessed against each with a score was assigned based on the results of the assessment.

F1.3.4 Preferred option

Based on the assessment, Option 1 (individual bridges) performed better and was identified as the preferred option. The key differentiators between the options in terms of scoring were constructability risks (possession risks and need for temporary works). Option 1 also offered the following key advantages compared to Option 2:

- fewer enabling works required, with less risk to the construction program (Option 2 would rely on short term possessions that would introduce inefficiencies into construction works)
- fewer temporary works required
- a lower amount of modification would be required to the existing embankment(s)
- ability to maintain rail freight operations without the need to have lengthy periods of rail shutdown. This would reduce the need to temporarily increase of freight movements on to the existing heavily road network
- reduced impacts to vegetation as a result of the construction and location of a viaduct structure
- reduced visual impacts (Option 1 would provide a similar visual outcome to the existing arrangement in comparison to Option 2)
- reduced ongoing maintenance requirements.

F1.4 Ground treatment near Mill Stream

F1.4.1 Existing situation/key issues

The existing Botany Line crosses Mill Stream via a 28 metre long three-span underbridge. Mill Stream is located in the Botany Wetlands, which is a listed on the State Heritage Register. The wetlands are also significant ecologically. Mill Stream flows into Mill Pond to the south of the rail corridor. To provide for the duplicated track, it is proposed to widen the approach embankments and duplicate the bridge (to the south (down line) side of the existing track).

F1.4.2 Options considered

The widened embankment would be subject to settlement of the substrate due to the increased deadload and dynamic load from the freight trains. Five ground treatment options to meet geotechnical serviceability requirements in this location were considered. The options are summarised below.

- Option 1: Do nothing (no treatment) and accept the settlement predictions
- Option 2: Remove and replace compressible soils
- Option 3: Dynamic compaction
- Option 4: Surcharging
- Option 5: Continuous modulus columns (CMC's) – use of a combination of continuous flight auger piled foundation and concrete injected columns over load transfer platforms to support the embankment and provide a retaining wall to encapsulate the new fill material.

F1.4.3 Assessment

The general approach to evaluation of the ground treatment options considered the following broad principles:

- adopt treatment options with a proven successful track record in similar conditions
- minimise impacts on the ethane gas pipeline
- reduce the whole-of-life cost by selecting a cost-effective treatment option with minimal ongoing maintenance costs
- reduce disturbance of existing ground conditions.

An assessment of each of the options was undertaken to assist in determining the preferred option.

The criteria used to undertake the assessment included:

- settlement viability
- impact on ethane gas pipeline
- technical constructability viability
- ground disturbance
- cost effective
- safety in design.

F1.4.4 Preferred option

The assessment identified that Option 5 (continuous modulus columns and new retaining wall) performed the best and was identified as the preferred option. This option offered the following key advantages:

- it would minimise post construction settlement by transferring the embankment load through the loose/compressible soil units into the underlying more competent stratum
- minimises ground disturbance and impacts to the ethane gas pipeline.

F1.5 Bridge over Botany Road

F1.5.1 Existing situation/key issues

The existing three-span underbridge was originally constructed in the 1920's with the superstructure being replaced in 2002 with a twin track steel through girder. This structure currently carries a single track with cast in sockets provided for the duplicated track alignment. The existing masonry piers and abutments are supported on a mass concrete transfer structure supported on existing timber piles.

F1.5.2 Options considered

Two options were considered for the bridge over Botany Road being:

- Option 1 – Full replacement of the Botany Road underbridge
- Option 2 – Minor remediation works to the existing bridge.

F1.5.3 Assessment

In order to assess the potential options, ARTC undertook Load Rating Assessment of the bridge, including fatigue analysis in 2016. These assessments identified that the bridge was within acceptable limits (subject to further investigation of the underlying timber pile foundation in order to validate the structural capacity of these and future design life).

F1.5.4 Preferred option

Based on the assessment above, the preferred option was identified to undertake minor remediation works to the bridge. As part of this option, the existing bridge superstructure (bridge deck, primary supporting members and parapets), substructure (masonry piers, abutments and wing walls) and foundations (existing concrete foundation and timber piles). Remediation works would be required to the existing bridge deck (refer to Chapter 6 of this EIS for details).

F1.6 Bridge over Mill Stream

F1.6.1 Existing situation/key issues

To the south of Southern Cross Drive, the rail corridor crosses Mill Stream over an existing bridge. Mill Stream flows is part of the wider Botany Wetlands. These wetlands are of both heritage and ecological significance. This section of track is also constrained on by vegetation to each side of the existing track.

The existing Mill Stream bridge consists of a single track, three span bridge supported by existing embankments at each end 2 piers adjacent the mean flow level of Mill Stream. The existing bridge is not wide enough to support the proposed duplication of the rail track on the bridge. Assessment of the existing bridge identified that it is assumed to be structurally adequate and can be retained as part of the project.

F1.6.2 Options considered

As it was considered that the existing bridge over Mill Stream was considered suitable for retention as part of the project, two options were considered to provide a second bridge over Mill Stream to allow for the additional track alignment. The options considered included:

- Option 1 – a single span bridge supported on widened approach embankments
- Option 2 – a two-span bridge supported on widened approach embankments with one pier located to the northern side of Mill Stream to align with the existing pier (outside the alignment of Mill Stream mean flows).

F1.6.3 Assessment

The assessment considered site access for the constructability of the new underbridge structure and the ability to site a suitably sized crane to lift in elements of the bridge during construction. The assessment also considered the depth of the bridge beam superstructure and the effects on the hydrological performance of Mill Stream in order to mitigate flow of water within Mill Stream (afflux), in addition to the location of the piles and the temporary work impacts on the existing Mill Stream.

F1.6.4 Preferred option

Option 2 (two-span bridge supported on a central pier) was identified as the preferred option. This option would offer the following key advantages:

- shorter individual spans resulting in increased freeboard (clearance between the lower limit of the bridge superstructure and the high water surface level) above Mill Stream
- lighter bridge elements resulting in a smaller crane and less temporary works.

F1.7 Rail alignment between Mill Stream and Banksia Street

F1.7.1 Existing situation/key issues

Between Mill Stream and Banksia Street the rail corridor is surrounded by a range of land uses:

- commercial – including the Sir Joseph Banks Corporate Park in the area bounded by Mill Stream, Botany Road, Lord Street and the southern side of the rail corridor
- recreation – including the Botany Aquatic Centre on the southern side of the rail corridor and the Eastlake Golf Course on the north side of the corridor
- residential – including new apartment developments in Botany and Pagewood between Myrtle and Bay streets on both sides of the rail corridor, and older style housing between Bay and Banksia streets.

There are also a range of potential environmental, land use and other design issues which were identified in this section of the corridor, including:

- asbestos contaminated material was identified in fill material located within the rail corridor
- potential for acid sulfate soils below the natural ground level
- ethylene and ethane gas pipes located at the edge of the track formation on the northern (up) side and southern (down) side of the rail corridor
- an existing open drainage channel located on the northern (up) side of the corridor
- the need to tie-in to the existing tracks at the south-eastern end of the project site (which are currently located on the south-western (down) side of the rail corridor)

- no existing vehicular access to the northern (up) side of the rail corridor from Bay Street or Myrtle Street
- Botany Water Reserves (also known as Botany Wetlands or Botany Swamps) which is listed on the State Heritage Register.

F1.7.2 Options considered

Two options were considered for the location of the duplicated track between Mill Stream and Banksia Street. These options included:

- Option 1 – duplication on the south (down) side
- Option 2 – duplication on the north (up) side.

F1.7.3 Assessment

The options assessment considered a range of potential characteristics of each option including:

- length of new track
- length of reused existing track
- length of ethylene and ethane gas pipeline relocation
- length of new cess drain
- length of new pit and pipe
- quantity of cut material
- access road within rail corridor
- connection to existing tie-in point
- impact to asbestos contaminated material
- impact to existing infrastructure.

F1.7.4 Preferred option

Option 1 (duplication on the south (down) side of the existing rail track) was identified as the preferred option. This option would offer the following key advantages:

- a shorter length overall length of track would be required
- minimal works to tie into existing tie-in point
- reduced impact on the existing ethylene and ethane gas pipelines
- reduced impact on the existing drainage channel and associated mature vegetation
- reduced new drainage infrastructure required to convey overland flows from the Eastlake Golf Course.