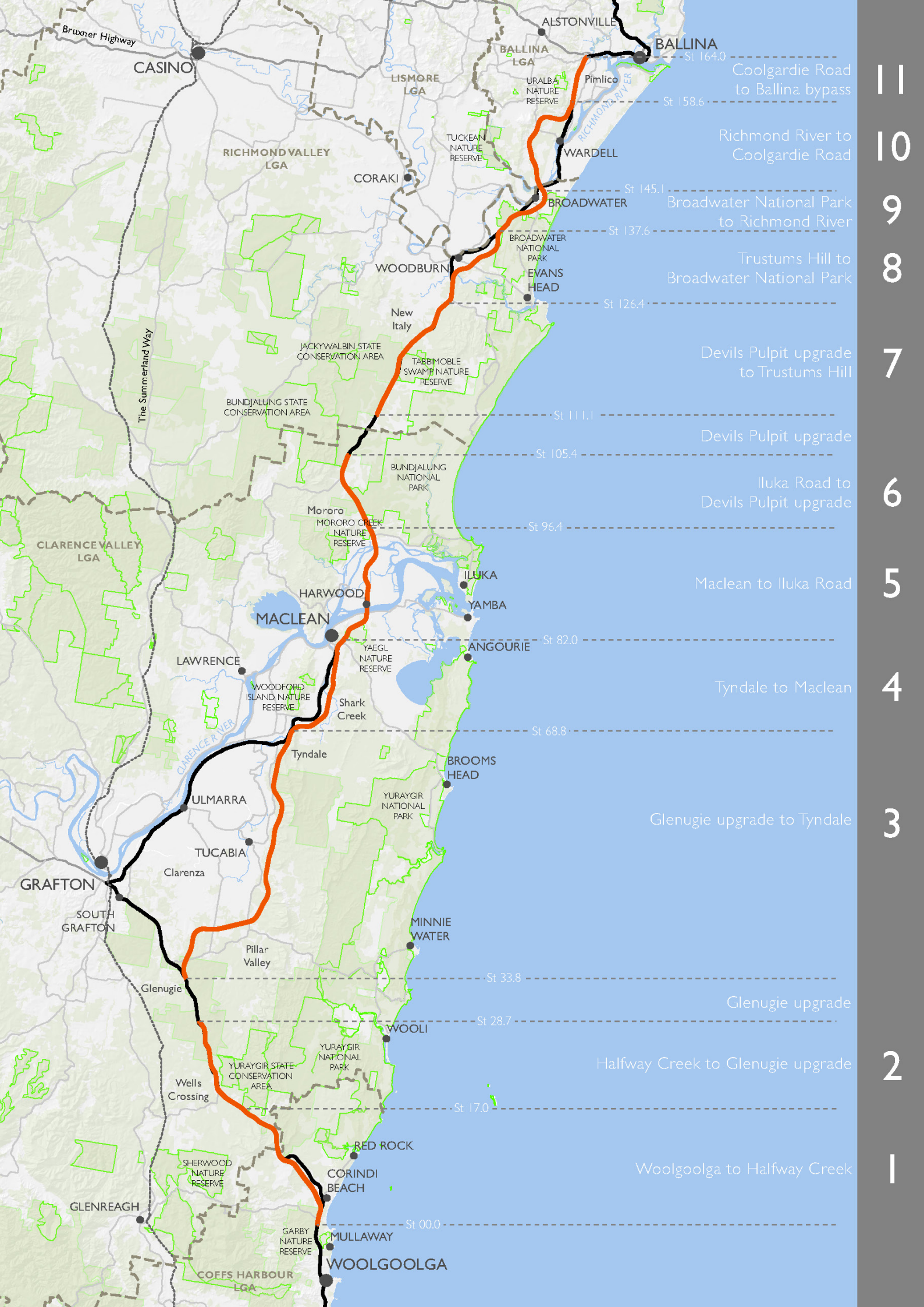


NSW Roads and Maritime Services

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE SUBMISSIONS / PREFERRED INFRASTRUCTURE REPORT

Chapter 5

November 2013



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5. Revised environmental management measures

The environment impact statement for the project identified a range of environmental outcomes and management measures that would be required to avoid or reduce the environmental impacts.

After consideration of the issues raised in the public submissions, the environmental management measures for the project (refer to Chapter 19 of the environmental impact statement) have been revised.

The adjustments to the measures were made to:

- Make additional commitments based on the response to submissions within this report.
- Make additional commitments based on the findings of the studies within this report.
- Modify the wording so that the outcome of the commitment is clearer to implement.
- Delete a measure as the commitment has been achieved.
- Delete a measure as it is sufficiently covered by a preceding measure.
- Delete a measure as it is covered within a preceding measure eg a Roads and Maritime specification, or a management plan for the issue.

Appendix H provides a comparison between the measures presented in the environmental impact statement and those now in Table 5-1.

Should the project be approved, the environmental management measures in Table 5-1 will guide the subsequent development phases of the Woolgoolga to Ballina upgrade.

The following definitions apply in relation to the revised environmental management measures:

Pre-construction

Work in respect of the project that includes

- a. *Undertaking design, survey, acquisitions, fencing, investigative drilling or excavation, archaeological salvage or investigative work, environmental investigations, building/road dilapidation surveys.*
- b. *Establishing ancillary facilities/construction work sites (in locations meeting the criteria identified in the Conditions of Approval or fully assessed in the EIS and/or the Submissions / Preferred Infrastructure Report, and with proposed and adequate mitigation).*
- c. *Minor clearing or translocation of native vegetation associated with b) above.*
- d. *Installation of environmental impact measures, fencing, enabling works.*
- e. *Early works that do not require clearing of native vegetation.*
- f. *Other activities determined by the Environmental Representative to have minimal environmental impact (eg minor access roads, adjustments to services/utilities) and consistent with the project order.*

Note – work where heritage, threatened species, populations or endangered ecological communities would be affected by that work, is classified as construction, unless otherwise approved by the Director General in consultation with the Office of Environment and Heritage.

Construction

All work in respect of the project other than that defined as a preconstruction activity/work.

Operation

The operation of the project, but not including commissioning trials of equipment, or temporary use of parts of the project during construction.

Table 5-1: Environmental management measures for the project

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Hydrology and flooding					
Flood models	HF1	HF1	Flood models for the areas of the project that are in the Clarence, mid Richmond and lower Richmond rivers will be updated to inform detailed design.	Pre-construction	4, 5, 6, 8, 9 and 10
	HF2	HF2	Roads and Maritime will update the bathymetrical data at the relevant crossing of the Clarence River to inform detailed design of the crossing.	Pre-construction	4, 5
Operational impacts on cane drains	HF3	HF3	Cane drain diversions will be designed and constructed in consultation with the relevant cane industry stakeholders and impacted landowners. This will consider the potential diversions detailed in the Working Paper – Hydrology and flooding and the additional assessment provided in Chapter 3 of the Submissions / Preferred Infrastructure Report.	Pre-construction and construction	All
Permanent road fencing	HF4	HF4	Any permanent fencing at culvert and bridge crossings will consider the potential for blockage and be designed and operated to maintain the existing flood regime.	Pre-construction	All
	HF5	-	Detailed design for permanent road fencing will consider hydrology and flooding impacts.	Pre-construction	All
Scour protection	HF6	HF5	Scour and erosion protection measures at temporary and permanent waterway crossings will be provided upstream and downstream of the highway, particularly within 50 metres of Class 1 waterways or within the range of the Oxleyan Pygmy Perch as identified in section 3.9.6 of the Working paper – Biodiversity and the supplementary biodiversity assessment in Appendix J of the Submissions / Preferred Infrastructure Report. This will be undertaken in consultation with the Department of Primary Industries (Fisheries).	Pre-construction.	All
Waterway diversions	HF7	HF6	Waterway diversions will be designed in consultation with Office of Environment and Heritage, NSW Office of Water and Department of Primary Industries (Fisheries) so that the final diversion mimics, where feasible and reasonable, the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna.	Construction	All
	HF8	HF7	Revegetation of waterway diversions and surrounding areas will be undertaken in accordance with the following principles: <ul style="list-style-type: none"> • Diversions will be stabilised prior to the diversion receiving flows, in conjunction with the establishment of other scour and erosion control measures. • Diversions will establish appropriate vegetation communities along the channel bed and banks, using endemic native species. 	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Management of flows for aquatic habitat and movement	HF9	HF8	Velocities of flood flows through watercourse and floodplain structures (ie bridges and culverts) will be assessed during detailed design in areas identified as known and potential habitat for the Oxleyan Pygmy Perch and the Purple-spotted Gudgeon in consultation with Department of Primary Industries (Fisheries). The design of these structures will consider the predicted changes to velocities from the existing case due to the project.	Pre-construction	All
Picaninny Creek diversion	HF10	HF9	Batter stability will be assessed and sufficient room provided on both sides of the diversion to allow access for maintenance and to meet batter stability requirements.	Pre-construction	3
Impacts on farm dams	HF11	HF10	Farm dams located within or partially within the project boundary will be acquired as part of the acquisition process in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Pre-construction	All
	HF12	HF11	Potential impacts to farm dams located downstream of the project that are fed by catchments upstream, and that have a diversion of rainfall as a result of the project, will be considered during the relevant property acquisition process.	Pre-construction	All
Evacuation and access	HF13	HF13	Detailed design will consider flood access and evacuation for affected landowners including changes in stock access routes.	Pre-construction	All
	HF14	HF14	The level of flood immunity of Eggins Drive into Corindi will be built at a 100 year ARI as agreed with Coffs Harbour City Council.	Construction	1
Construction impacts on cane drains	HF15	HF16	The potential impacts of ancillary facilities and haul roads on cane drains will be further investigated and addressed when ancillary facility locations are confirmed. The design of these ancillary facilities will be developed in consultation with relevant cane industry stakeholders, affected landowners, and in accordance with the following principles: <ul style="list-style-type: none"> Maintain conveyance characteristics of existing cane drains. Provide adequate capacity in temporary drainage to prevent blockages. 	Pre-construction and construction	4, 5, 6, 8,9,10,11
Goodwood Street underpass	HF16	HF17	A drainage structure with an equivalent capacity of the current Goodwood Street underpass will be installed for the duration of construction.	Construction	4
Bridge pier construction	HF17	HF18	Any temporary infrastructure associated with the construction of bridges in the Clarence River, Clarence North Arm, Richmond River, Tuckombil Canal and Emigrant Creek will be secured or removed from the river and floodplain during flood events so not to create a debris hazard or blockage during a flood event.	Construction	5, 8 and 10
	HF18	-	Appropriate span lengths of bridges will be specified during detailed design that considers the susceptibility of individual watercourse crossings to debris blockage.	Pre-construction	All
	HF19	HF19	All work within 40 metres of a permanent watercourse, crossed by the project, will be undertaken in accordance with the NSW Office of Water 'Guidelines for Controlled Actions' and industry best practice including maintaining where feasible and reasonable the geomorphic integrity and natural hydrological flow regime.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Temporary fencing	HF20	HF20	The design of temporary fencing at culvert and bridge crossings will consider the potential for blockage and be designed and operated in a manner that does not result in impacts on flooding.	Construction	All
Climate change impacts	HF21	HF21	The need for design modifications to address changes in flood behaviour as a result of climate change will be considered in accordance with Roads and Maritime' Climate Change Plan (Roads and Maritime, 2012).	Pre-construction and operation	All
Impacts of ancillary facilities on flooding	HF22	HF22	Recommendations made in Table 8-8 of Working paper – Hydrology and flooding to minimise the flood impacts of ancillary facilities will be considered in the final location and layout of ancillary facilities.	Pre-construction	All
Meeting flood management objectives	HF23	HF23	Design objectives (for road flood immunity and flood management will apply during the detailed design phase. Where these objectives are not met, Roads and Maritime will work to either: <ul style="list-style-type: none"> • Achieve compliance through modified embankment or drainage design. • Achieve an acceptable level of mitigation of impacts through alternative design measures (eg raised access tracks) in consultation with the affected land owner. 	Pre-construction	All
Drainage structures	HF24	HF24	The design of drainage structures across Chatsworth Island will be further reviewed during detailed design to enable the most appropriate and cost-effective structures to be installed.	Pre-construction	5
	HF25	HF25	Maintenance regime of drainage structures will be considered during detailed design.	Pre-construction	All
	HF 26	-	Additional culverts north of Chaffin Creek at the overflow channel around station 52.6, will be hydraulically modelled and confirmed during the detailed design to manage potential flood impacts, to meet the flood management objectives detailed in the EIS.	Pre-construction	3
	HF 27	-	Roads and Maritime, in consultation with Clarence Valley Council and the relevant landowner, will consider opportunities to improve the drainage system performance in the Shark Creek area, where feasible and reasonable, during the detailed design phase.	Pre-construction	4
	HF 28	-	The detailed design of the bridges over Shark Creek and Tyndale cane drain 1 and 2 (Crackers and Lee drain) will consider fauna connectivity in addition to the hydraulic function of these structures.	Pre-construction	4
	HF 29	-	Detailed design will investigate viable options to maintain the existing flood behaviour in James Creek.	Pre-construction	5
On-going consultation on drainage matters	HF 30	HF26	Consultation with affected landowners will be undertaken during detailed design and construction regarding flooding impacts on properties, residences and other structures.	Pre-construction and construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section	
Soils, sediment and water						
Design of cut-and-fill batters	SSW1	SSW1	Batter slope gradients will be designed to minimise erosion of select topsoil.	Pre-construction	All	
	SSW2	SSW2	Where feasible, bench cuttings will be diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream.	Pre-construction	All	
Management of soils, sediment and water issues	SSW3	SSW3	As part of the Construction Environmental Management Plan, a soils and water management plan <i>will</i> be prepared and include (but not limited to): <ul style="list-style-type: none"> • Erosion and sediment control plans for all stages of construction. • Consideration of soil erodibility. • At-source erosion controls (eg check dams). • Sedimentation basin construction and management. • Protection of waterways. • Acid sulfate soil sub-plan issues (including from groundwater drawdown). • Management of stockpiles. • Tannin leachate management control. • Batch plant/ chemical storage controls. • Water quality monitoring and checklists. • Detailed consideration of measures to prevent, where possible, or minimise any water quality impacts. 	Pre-construction	All	
	SSW4	SSW4	Erosion and sediment control plans will be developed in line with current Roads and Maritime specifications and as detailed in the Working paper – Water quality.	Pre-construction	All	
	SSW5	SSW5	A soil conservationist will be engaged during detailed design to inform the soils and water management plan.	Pre-construction	All	
	SSW6	SSW6	Sedimentation basins and water quality ponds will be sized and located in accordance with the principles identified in the Working paper – Water quality.	Pre-construction and construction	All	
	SSW7	SSW7	Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.	Construction	All	
	SSW8	SSW8	Any necessary approvals will be obtained in accordance with Roads and Maritime specification G36 for permanent and temporary waterway crossings.	Construction	All	
	SSW9	-	All work potentially affecting wetlands will be undertaken in consideration of the requirements outlined in the NSW Wetlands Management Policy 2010.	Construction	All	
	Stockpile management	SSW10	SSW9	Topsoil, earthworks and other excess spoil material will be stockpiled and managed in accordance with Roads and Maritime Stockpile Management Guidelines (Roads and Maritime, 2011a) and the “Management of Surplus Material” in Section 3.9 of the Submissions / Preferred Infrastructure Report.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	SSW11	SSW12	Where reasonable and feasible, stockpiles will: <ul style="list-style-type: none"> • Not require removal of areas of native vegetation. • Be located outside of known areas of weed infestation. • Be located such that waterways and drainage lines are not directly or indirectly impacted. 	Construction	All
	SSW12	SSW13	Where practicable, stockpiles will be located away from areas subject to concentrated overland flow. Stockpiles located on a floodplain be finished and contoured so as to minimise loss of material in flood or rainfall events.	Construction	All
	SSW13	SSW16	Topsoil will be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required.	Construction	All
	SSW14	SSW17	All construction stockpiles will comply with the requirements of the <i>Protection of the Environment Operations Act 1997</i> and NSW Waste Avoidance and Resource Recovery Strategy 2007 for any waste activities that involve the generation, storage and/or disposal of waste and also consider the NSW Resource Recovery Exemptions as applying the storage of stockpiled material.	Construction	All
	SSW15	SSW18	Stockpiles containing potential acid sulfate soils will be lined, bunded and covered in accordance with relevant guidelines.	Construction	All
	SSW16	SSW19	Management of tannin leaching from vegetation mulch will be in accordance with Roads and Maritime' Environmental Direction – Management of Tannins from Vegetation Mulch (Roads and Maritime, 2012).	Construction	All
Management of contamination	SSW17	SSW21	A Stage 1 Preliminary Site Investigation will be conducted to verify past and present potentially contaminating activities, potential contaminants of concern and the need for further investigation. This will include a review of past highway crashes and spills and the associated contamination risks.	Pre-construction	All
	SSW18	SSW22	If necessary, a Stage 2 Detailed Site Investigation will be undertaken to: <ul style="list-style-type: none"> • Provide information on the type, nature, extent and concentrations of contamination present, and the corresponding risks to human health and the environment. • Examine pathways of contaminant dispersal and exposure, the potential for off-site impacts and the management requirements and options. 	Pre-construction	All
	SSW19	SSW23	If required, a Stage 3 Remedial Action Plan will be produced, detailing the remediation goals, environmental safeguards, and any necessary approval and licence requirements in accordance with NSW Office of Environment and Heritage guidelines.	Pre-construction	All
	SSW20	SSW24	Where further assessment indicates that further action is not required, Roads and Maritime' Contaminated Land Management Guideline (RTA, 2005a) will be applied to address any contamination issues and prevent any associated adverse impacts.	Pre-construction	All
	SSW21	SSW26	A hazardous materials buildings assessment will be carried out before the demolition of any structures or buildings to identify the issues of concern and the management requirements. This is required under Clause 1.6 of Australian Standard AS 2601 – 2001 The Demolition of Structures.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Emergency spill response	SSW22	SSW27	An emergency spill response plan will be developed and incorporated into the soils and water management plan. This plan will detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals.	Construction	All
	SSW23	SSW28	The storage, handling and use of the chemicals and fuels will be in accordance with the Work Health and Safety Act 2000 and Workcover's Storage and Handling of Dangerous Goods Code of Practice (WorkCover, 2005).	Construction	All
Acid sulfate soils	SSW24	SSW29	Strategies to remove / reduce risks associated with acid sulfate soils will be identified.	Pre-construction and Construction	All
	SSW25	SSW31	An acid sulfate soils management plan will be implemented in accordance with Guidelines for the Management of Acid Sulfate Materials (Roads and Maritime 2005) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (DECC 2008), where there is a probability of encountering acid sulfate soils during construction.	Construction	All
Soil erosion and sedimentation control	SSW26	SSW33	Appropriate erosion and sediment controls, following the guidelines of the 'Blue Books' (Landcom, 2004 and DECC, 2008a), and Roads and Maritime' Technical Guideline – Temporary Stormwater Drainage for Main Road Construction (Roads and Maritime, 2010b) will be established before the start of construction and maintained in effective working order for the duration of the construction period until site stabilisation.	Construction	All
	SSW27	SSW35	Works within waterways will consider the need to maintain fish passage, in consultation with the Department of Primary Industries (Fisheries).	Construction	All
	SSW28	SSW37	Flow discharge points will be designed with erosion controls to manage the flow velocities.	Pre-construction	All
Design and maintenance of construction sedimentation basins	SSW29	SSW40	Where appropriate, construction phase sedimentations basins will be designed so they could be retained and used as permanent operational water quality ponds, where required for operational purposes.	Pre-construction	All
	SSW30	SSW43	Sizing of sedimentation basins that drain into the Solitary Islands Marine Park will be reviewed to consider the use of 90th percentile sedimentation basins.	Pre-construction	1
	SSW31	SSW45	Sedimentation basins will be inspected at regular intervals and following significant rainfall events to assess available water storage capacity, water quality, structural integrity and debris levels.	Construction	All
	SSW32	SSW46	Where appropriate, an approved flocculent will be applied to sedimentation basins as early as possible so that early mixing of flocculants occurs. Water quality will be tested prior to discharge in accordance with any licence requirements.	Construction	All
	SSW33	SSW47	Where sediment has built up in a basin to a point where the total sediment storage zone has reached capacity, sediment will be removed and appropriately disposed of.	Construction	All
	SSW34	SSW48	Water from sedimentation basins will be used for construction purposes, such as dust suppression, where feasible.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	SSW35	SSW49	When sedimentation basins require pumping out rather than discharge via a flow outlet, a float will be attached to the suction hose or the hose will be located inside a bucket to prevent sediment from the basin floor from being discharged.	Construction	All
	SSW36	SSW50	Records will be kept of water quality monitoring and erosion and sediment control inspections, including details of rain events, use of flocculants, discharge, sediment removal and dewatering activities.	Construction	All
Chemical use and storage	SSW37	SSW51	Physical controls to address the potential risks associated with the use and storage of chemicals on site will include: <ul style="list-style-type: none"> • Use of appropriately bunded storage facilities for chemicals and fuels. • Use of appropriately bunded areas for refuelling and washdown. • Availability of effective spill kits at all construction sites. 	Construction	All
Ancillary facility management	SSW38	SSW53	At ancillary facilities, management of runoff and spills will include: <ul style="list-style-type: none"> • Restricting vehicle movements to designated pathways where feasible. • Paving areas that will be exposed for extended periods, such as car parks and main access roads, where reasonable and feasible. • Diverting off-site runoff around sites where required. • Locating chemical or other hazardous material storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface; otherwise, areas be lined if they are to be located over a shallow groundwater source less than two metres deep. 	Construction	All
	SSW39	SSW55	Soil and water management at borrow source sites will be in line with Volume 2E of the Blue Book which covers water management of mines and quarries.	Construction	8 and 10
	SSW40	SSW57	Discharges from the sediment basins during construction that do not meet the water quality parameters for Oxleyan Pygmy Perch habitat should not be discharged into the waterways that are known habitat for Oxleyan Pygmy Perch. Strategies will be implemented during construction to manage discharge of basin water, so that water depth and physico-chemical conditions are not changed in areas of Oxleyan Pygmy Perch habitat. Discharge protocols and criteria will be developed in consultation with Department of Primary Industries (Fisheries) and Office of Environment and Heritage during detailed design.	Construction	1, 2, 7, 8 and 9
Management of groundwater intersection	SSW41	SSW58	Further assessment involving geotechnical boreholes, monitoring boreholes and water quality testing at cutting sites will be undertaken at Type A cutting sites to monitor impacts on local groundwater reserves.	Pre-construction	All
	SSW42	SSW59	Where groundwater is released, recharge of the water table is the preferred option of managing groundwater. This will be facilitated by collecting groundwater in grassed swales for infiltration back to the groundwater source. Where possible, these swales will divert the groundwater around the construction area so that the groundwater does not further mix with construction runoff.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	SSW43	SSW60	If recharging is not possible or suitable, then discharging groundwater will be collected via the sedimentation basins before discharge into natural waterways. If discharging to downstream groundwater, then the potential effects of mounding ¹ will be mitigated.	Pre-construction	All
	SSW44	SSW61	Dewatering of excavations will be undertaken in line with Roads and Maritime' Technical Guideline – Environmental Management of Construction Site Dewatering (Roads and Maritime, 2011c), and in accordance with any licence conditions.	Construction	All
Contaminated groundwater	SSW45	-	Further investigations will be undertaken to identify any impacts from contaminated groundwater from the former landfill sites at Firth Heinz Road and Crowleys Road.	Pre-construction	3
Prevention of groundwater impacts	SSW46	SSW62	The proposed management strategy to address potential impacts at type A cuttings includes: <ul style="list-style-type: none"> • Pre-works investigations – geotechnical investigations to determine groundwater condition (quality parameters: electrical conductivity, groundwater depth, geological information), presence of actual or potential acid sulfate soils, presence or potential of salinisation, establishing groundwater monitoring sites, and gathering of other pertinent information. • Assessment – including the EIS assessment, the pre-works investigations carried out, groundwater modelling of cuts (and the Rous Water Woodburn borefield site), and predictions made from those results. • Monitoring – to assess whether the investigation and its predictions are accurate and to instigate early intervention in the unlikely case/s that the actual outcomes deviate from predictions. Monitoring start before construction, and continue during construction. Monitoring also continue into the operation phase of the project. • Mitigation – implement environmental and engineering management measures where predictions and/or modelling and monitoring suggest that these are required to minimise impacts on groundwater. 	Pre-construction and construction	All
	SSW47	SSW63	The monitoring of locations in the vicinity of type B cuttings and major embankments will commence before construction to identify the need to implement any mitigation measure.	Pre-construction, construction	All
	SSW48	SSW64	If required to manage groundwater impacts at type A and type B cuttings and major embankments, the following engineering mitigation measures will be considered: <ul style="list-style-type: none"> • Engineering measures that transfer the seepage water downstream. Standard practice will be to collect the seepage from the cut face in the drainage system for the highway, which will be diverted into water quality basins before being released back into the creek or natural drainage system at some point downstream. • Engineering impact mitigation measures that transfer the seepage water (where present) into the groundwater ecosystem immediately downslope of the cutting or embankments. 	Pre-construction and construction	All

¹ An outward and upward expansion of the free water table caused by surface recharge.

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	SSW49	SSW65	Major embankments will be designed to enable distributed flow of surface waters.	Pre-construction and construction	All
Prevention of potential impacts on groundwater quality	SSW50	SSW66	Measures to manage high-risk groundwater impact areas will continue to be considered through the detailed design process. In identified areas, the design of water quality controls will be reviewed and the need for additional controls may be identified.	Pre-construction	All
	SSW51	SSW67	Where reasonable and feasible, sites used for batch plants, refuelling and chemical storage will be managed so that no groundwater intrusion occurs.	Pre-construction and construction	All
Prevention of impacts on Rous Water bore fields	SSW52	SSW68	All construction runoff to the Rous Water bore fields will be diverted to appropriate sedimentation controls basins. No runoff will bypass the basins untreated, regardless of the size of the footprint of the work. In addition, all basins in the bore fields will be clay lined to prevent seepage. If required, the depth of the basins will be reduced from the standard depth of two metres to one metre in these areas to avoid penetration of the natural clay layer, with the volume of the basins maintained by increasing their footprint where reasonable and feasible.	Construction	8
	SSW53	SSW69	Sizing of sedimentation basins in the Rous Water bore fields will be reviewed to consider the use of 90th percentile basins.	Construction	8
	SSW54	SSW70	The following construction activities will not be permitted within the Rous Water bore field catchment without additional control measures to reduce risk of impact to the borefield and groundwater: <ul style="list-style-type: none"> • Refuelling. • Washdown. • Storage of chemicals or other hazardous substances. • Installation of concrete batch plants. 	Construction	8
	SSW55	SSW71	Water quality ponds will be designed to be shallower between stations 131.1 and 134.0 (namely one metre compared to two metres) to avoid penetration of the natural clay layer, where possible. Alternatively, where not feasible, clay capping/ lining of the basin will be undertaken or consideration of appropriately designed swales.	Pre-construction	8
	SSW56	SSW72	Alternative operational water quality management measures such as the use of biofilters, sand filters or measures used in the Tintenbar to Ewingsdale Pacific Highway upgrade project will be considered during detailed design.	Pre-construction	8
	SSW57	SSW73	Consultation will be undertaken with Rous Water to co-ordinate mitigation actions including the definition of appropriate buffer zones between the project and bores.	Pre-construction	8
	SSW58	-	Consultation will be undertaken with Rous Water to address the 12 elements of the Australian Drinking Water Guidelines Management Framework.	Pre-construction	8
Protection of water quality	SSW59	SSW75	All permanent water quality basins will incorporate measures to contain accidental fuel and chemical spills resulting from vehicle accidents on the highway. Basins will be designed to accommodate a spill volume of up to 40,000 litres.	Operation	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	SSW60	SSW76	For water quality treatment in floodplains and other locations with minimal changes in gradient, grassed swales will be considered during detailed design.	Pre-construction	All
	SSW61	SSW77	Appropriate scour protection for drainage measures will be determined during detailed design.	Operation	All
Monitoring programs	SSW62	SSW78	Surface water quality monitoring will be undertaken in accordance with Roads and Maritime' Guideline for Construction Water quality Monitoring (RTA, 2003), and as per the framework outlined in the Working paper – Water quality.	Pre-construction	All
	SSW63	SSW79	Groundwater monitoring will be undertaken in accordance with the framework outlined in the Working paper – Groundwater (Section 5.2).	Construction	All
Ordnance contamination	SSW64	SSW80	Consultation will be undertaken with Department of Defence regarding the potential for unexploded ordnance to be encountered east of Broadwater.	Pre-construction	9
Biodiversity					
Monitoring strategy	B1	B1	The Ecological Monitoring Program (Appendix K) and will be finalised in consultation with relevant State and Commonwealth agencies and incorporate any specific conditions of approval and feedback from the expert review.	Pre-construction	All
Fauna connectivity	B2	B2	The Connectivity Strategy will be further developed during detailed design, in consultation with relevant State and Commonwealth agencies, building upon the Connectivity Strategy in Appendix A of the Working paper – Biodiversity and the Supplementary Biodiversity Assessment in Appendix J of the Submissions / Preferred Infrastructure Report.	Pre-construction	All
	B3	B3	All fauna connectivity structures will be developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity and the Supplementary Biodiversity Assessment in Appendix J of the Submissions / Preferred Infrastructure Report.	Pre-construction	All
	B4	-	Opportunities for improved connectivity for koala and Long-nosed Potoroo will be further investigated between station 144.2 and station 146.6.	Pre-construction	9 and 10
Fauna exclusion fencing	B5	B4	Fauna exclusion fencing locations and design will be further developed in accordance with the design principles outlined in the Connectivity Strategy in Appendix A of the Working paper – Biodiversity.	Pre-construction and construction	All
	B6	B5	Fauna exclusion fencing in low-lying floodplains between stations 35.0 and 80.2 will where feasible and reasonable, be placed higher on fill embankments to reduce damage from flooding.	Construction	3 and 4
Arboreal crossings	B7	B6	Tree height surveys will be conducted at proposed arboreal crossing zones to determine the most appropriate location to place rope or pole structures. Where feasible, the design will place arboreal crossing zones where average tree heights exceed 20 metres, and/ or taller trees are able to be safely retained close to the road edge.	Pre- construction	All
Widened median	B8	B7	The design and construction of fauna exclusion fencing, drainage or fauna underpass structures in widened medians minimise vegetation clearing.	Pre-construction and construction	1, 2 and 7

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	B9	-	Where feasible and reasonable, native vegetation forming part of the identified widened medians will not be disturbed for any ancillary construction purpose including access tracks, stockpiles, materials laydown and ancillary facilities.	Construction	1, 2 and 7
Flora and fauna management plan	B10	B8	A Flora and Fauna Management Plan will be prepared in accordance with Roads and Maritime Biodiversity Guidelines – Protecting and managing biodiversity on RTA projects (RTA, 2011a).	Pre- construction	All
Threatened species management sub-plans	B11	B9	<p>The threatened species management plans prepared for the project will be finalised, as relevant to the element of the project to be constructed. Development of the plans will include responding, where feasible and reasonable to:</p> <ul style="list-style-type: none"> • Recommendations from expert review undertaken as part of the Submissions / Preferred Infrastructure Report (and detailed in section 1.4 of the management plans). • Any conditions of approval. • Results from baseline monitoring undertaken. <p>The threatened species management plans will be finalised in consultation with the relevant State and Federal government agencies.</p>	Pre- construction	All
Re-establishment of native vegetation	B12	B17	A landscape management plan will be developed to provide specific details for the re-establishment of native vegetation on batters, cut faces, surrounding sediment basins and other areas disturbed during construction. This includes details for the appropriate removal and restoration of temporary creek crossings. The landscape management plan will be developed in line with Roads and Maritime Biodiversity Guidelines (RTA, 2011a), the design principles identified in the Connectivity Strategy and the design principles in Working paper – Urban design, landscape character and visual impact.	Pre-construction	All
Minimising loss of vegetation and habitat	B13	B18	<p>Disturbance and clearing of vegetation will be minimised, particularly:</p> <ul style="list-style-type: none"> • Avoiding and minimising vegetation removal wherever possible through the detailed design process. • Placing water quality basins in the optimal location for treating surface runoff. During detailed design, the location of water quality treatment measures will consider minimising vegetation removal, particularly where there is the potential for threatened plant species, threatened fauna habitat or in identified regional wildlife corridors. 	Pre-construction and construction	All
Bridge and culvert design	B14	B19	Instream structures such as bridges and culverts will be designed and managed to minimise any potential impact to flow regimes and fish passage, in accordance with Fairfull and Witheridge (2003).	Pre-construction	All
	B15	B20	<p>During detailed design, the waterway class will be confirmed and the design will be reviewed to include appropriate crossing structures for the relevant waterway class at the following locations:</p> <ul style="list-style-type: none"> • Unnamed waterway station 114.0 • Oaky Creek station 122.5 • Nortons Gully station 123.6 • Unnamed waterway station 133.4 	Pre-construction	7 and 8

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<ul style="list-style-type: none"> • Unnamed waterway at station 134.7 • Tributary of Macdonalds Creek at station 135.5 • Montis Gully tributary at station 141.8 • Eversons Creek station 143.6 		
	B16	B21	All drainage structures between stations 134.5 to 143.0 will be reviewed in consultation with Department of Primary Industries (Fisheries) to ensure suitable connectivity for threatened fish species is maintained.	Pre-construction	8 and 9
	B17	B22	<p>Each permanent waterway crossing is to be designed to ensure no physical, hydraulic and behavioural barriers to aquatic fauna movements. Impacts be minimised by ensuring that:</p> <ul style="list-style-type: none"> • The natural stream flow and velocity are maintained as closely as possible. • Surface level of any causeway is the same or lower than the natural stream bed to reduce interference with flow. • Habitat within a culvert is as natural as possible (eg allow rock and bed materials to infill the culvert base). • There is the maximum light penetration. • Fauna and fish passage standards are maintained, as detailed in the Connectivity Strategy, including minimum design widths, including for natural banks, while also providing for scour protection and cut and fill batters. • Bridges will be designed and sized to ensure peak flood velocities are not increased by more than one metre per second than the existing flood event, where Oxleyan Pygmy Perch have been confirmed. 	Pre-construction	All
	B18	B23	<p>Bridge structures will be designed to minimise impacts to flow regimes and fish passage. Where feasible and reasonable the following principles will apply:</p> <ul style="list-style-type: none"> • Bridge piers to be located outside the main channel. • Bridge structures to be designed to prevent an increase of backup of water during times of flood that will enable Plague Minnow to access waterbodies where they are currently not found (eg Broadwater National Park). • Construction not alter or reduce flow where there are existing or potential Oxleyan Pygmy Perch populations (primarily within Sections 7, 8 and 9). 	Pre-construction	All
Temporary and permanent waterway diversions/crossings	B19	B24	Where temporary access tracks are required over drainage lines with no flow, fords may be installed.	Construction	All
	B20	B25	Where possible, existing crossings will be used. Where this is not feasible or reasonable, the temporary crossings will be designed to minimise impacts on the existing aquatic ecology and water quality.	Construction	All
	B21	B27	<p>Temporary waterway access track mitigation measures include:</p> <ul style="list-style-type: none"> • Installation and subsequent decommissioning of temporary crossings will be undertaken outside of Oxleyan Pygmy Perch spawning seasons (October to December), where Oxleyan 	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			Pygmy Perch have been confirmed. <ul style="list-style-type: none"> • Temporary crossings will be constructed from clean fill using pipe or box culvert cells to carry flows. • All temporary works (eg crossings, flow diversion barriers) will be removed as soon as practicable and in a way that does not promote future channel erosion. • The preferred temporary structure for crossing waterways will be consistent with Witheridge (2002). • Scour protection works will be established at temporary crossings as required. • At the completion of construction, the temporary crossings will be removed and rehabilitated. 		
Fish translocation	B22	B28	Fish that become stranded due to temporary access crossings or construction of temporary or permanent creek diversions must be captured and translocated following the Department of Primary Industries Fisheries Guidelines – A Guide to Acceptable Procedures and Practices for Aquaculture and Fisheries Research.	Construction	All
Pre-clearing surveys	B23	B29	The pre-clearing process will be consistent with Roads and Maritime Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA projects (RTA, 2011a) and include: <ul style="list-style-type: none"> • Pre-clearing surveys by an experienced ecologist for large bird nests, particularly for listed species such as the Black-necked Stork, Eastern Osprey, Square-tailed Kite and Little Eagle during the nesting and breeding season (July to December) and tree roosting (eg Southern Myotis) or cave dwelling bats in trees or existing culvert/bridge structures. If the species is present in or directly adjacent to the project footprint (including ancillary facilities), measures to manage any species be considered, if required. • Mapping the location of any threatened flora and/or fauna species, Threatened Ecological Communities and habitat. • Construction traffic will be restricted to defined access tracks, fenced prior to the start of construction and maintained until construction is complete. 	Pre-construction and construction	All
Exclusion zones	B24	B30	The location of exclusion zones will be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a)). Permanent fauna exclusion fencing for the project (as described in the Connectivity Strategy), where reasonable and feasible, will be installed prior to clearing and can function as exclusion fencing.	Construction	All
Staged removal process	B25	B31	A staged habitat removal process will be implemented consistent with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).	Construction	All
Re-use of woody debris and bushrock	B26	B32	Woody debris and bushrock will be re-used on site for habitat improvement where possible and will be detailed in the landscape management plan in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).	Construction	All
Weed management	B27	B33	A weed management plan will be developed as part of the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and the Introductory Weed Management Manual (Richards, 2004).	Pre-construction and construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	B28	B34	A site assessment by an ecologist or person trained in weed identification will be undertaken to identify the presence and extent of Alligator weed. If present, management measures in the Weed Management Plan will be in accordance with the Department of Primary Industries Alligator Weed control manual (van Oosterhout, 2007).	Pre-construction	7-10
Pathogen management	B29	B35	Measures to prevent the introduction and/or spread of pests and disease causing agents such as bacteria and fungi will be incorporated into the CEMP, in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).	Pre-construction and construction	All
	B30	B36	If pathogens are identified on site: <ul style="list-style-type: none"> • Testing may be required to confirm the presence of pathogens. • Advice from government departments will be sought on practical hygiene management measures. • Fenced exclusion zones will be identified to restrict access into contaminated areas. 	Construction	All
Nest boxes	B31	B37	Nest boxes be installed as per Roads and Maritime Biodiversity Guidelines (RTA, 2011a) and a nest box strategy developed as part of the CEMP, detailing: <ul style="list-style-type: none"> • The number and type of nest boxes required based on the number, quality and size of the hollows that be removed. • Specifications for nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance. • Installation timeframes, including the installation of 70 % of nest boxes prior to the removal of any vegetation in the vicinity of the hollows. 	Pre-construction and construction	All
Fauna handling	B32	B38	To prevent injury and mortality of fauna during the clearing of vegetation and drainage of farm dams, an experienced and licensed wildlife carer and/or ecologist will be present to capture and relocate fauna where required. Further details regarding fauna handling and vegetation clearing procedures are provided in the Roads and Maritime Biodiversity Guidelines (RTA, 2011a).	Construction	All
Riparian and aquatic habitat management	B33	B39	Prior to any disturbance of waterway banks, a thorough inspection by a qualified ecologist will be undertaken for aquatic fauna such as turtle nests.	Construction	All
	B34	B40	Where possible, streams will be crossed perpendicular to flow, with crossing sites selected to avoid unstable banks, bends in the channel, deep pools and confluences with other channels.	Pre-construction	All
	B35	B42	The bed and banks are to be reinstated to a condition similar to or better than the original condition ensuring that there are no adverse impacts on the aquatic values (different measures may be required for each crossing) and where feasible and reasonable, avoid impacts on geomorphic processes.	Construction	All
	B36	B44	All construction materials used for permanent watercourse crossings (rocks and gravel) are to be free of fine particles to minimise turbidity.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	B37	B45	Instream and riparian disturbance will be minimised and sediment, woody snags or debris removed from a stream or stream channel will be minimised. Trimming or 'lopping' of branches and logs will be considered as a first option before moving.	Construction	All
	B38	B46	Any instream woody debris removed during construction will be replaced at the completion of the works within the same waterways from which it was removed, where feasible and reasonable.	Construction	All
	B39	B49	Where feasible and reasonable within the road corridor, existing pools will be retained upstream and downstream of crossings within known habitat of the Oxleyan Pygmy Perch to provide resting and refuge habitat near crossing structures.	Construction	1,2,7,8, and 9
	B40	B50	Appropriate plant species will be incorporated into the rehabilitation of disturbed aquatic habitats and drains as a result of construction.	Construction	All
	B41	B51	All construction sediment and erosion control measures will be put in place during the construction process and may include sediment and erosion control curtains in the waterways to control turbidity generated during the construction and restoration process.	Construction	All
	B42	B52	No turbid water generated from the construction corridor or construction area is to be discharged to any waterway unless in accordance with relevant Environment Protection Licence conditions and developed in consultation with Environment Protection Agency and Department of Primary Industries (Fisheries).	Construction	All
Timing of in-stream works	B43	-	No in-stream work will occur in known Oxleyan Pygmy Perch habitat during the Oxleyan Pygmy Perch spawning season (October to December inclusive) or within 24 hours of the commencement of any rainfall event (>10 millimetres).	Construction	1,2,7,8, and 9
Water quality	B44	B54	Operational spill basins are to be installed at key locations ie near Broadwater National Park and other key drainage lines that lead directly into threatened fish habitat.	Operation	All
	B45	B55	Chemicals and fuels will be appropriately stored and banded, away from waterways and drainage lines.	Construction	All
	B46	B56	Discharges from sediment basins and/or treatment wetlands located in Oxleyan Pygmy Perch habitat that do not meet the water quality parameters for Oxleyan Pygmy Perch (to be determined through pre-construction water quality monitoring) will not be discharged directly into waterways, with other methods or uses employed to discharge. This could include, but not be limited to: <ul style="list-style-type: none"> • Spraying onto adjacent open grass areas or used for construction purposes such as dust. • Treating the water to ensure the pH is between 5.0 and 6.5 and total suspended solids of less than 50 mg/L, before discharging, depending on environmental protection licensing requirements. 	Construction	1,2,7,8, and 9
	B47	B58	Water quality monitoring will be undertaken to assess the effectiveness of (and where necessary amend) water, sediment and erosion management strategies that aim to protect native fish species, their habitat and other aquatic flora and fauna species. Water quality monitoring program be undertaken	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			in line with details in Appendix B of the Working paper – Biodiversity.		
Stockpile and ancillary facilities management	B48	B59	Where feasible and reasonable, stockpiles will be located above the 1:100 year flood level with appropriate management control measures in place such as bunding.	Construction	All
	B49	B60	Specific management measures will be implemented to limit impacts from stockpiling of material for bridgeworks at known and potential areas of Oxleyan Pygmy Perch during the spawning seasons of October to December.	Construction	1,2,7,8, and 9
	B50	B61	Batch plants will be located at least 300 metres away from Oxleyan Pygmy Perch habitat where sediment erosion not runoff into waterways (due to the risk of high alkaline runoff).	Construction	1,2,7,8, and 9
	B51	B62	Ancillary facilities will be located in cleared or sparsely treed portions of the ancillary facility sites, and avoid unnecessary clearing of native vegetation.	Pre-construction and construction	All
	B52a		Ancillary facility - Section 2 site 1a: <ul style="list-style-type: none"> Flag and avoid hollow bearing trees Revegetation of the section of the site in the road reserve or the entire site (if practicable). 	Construction	2
	B52b		Ancillary facility - Section 2 site 5a: <ul style="list-style-type: none"> Avoid isolated trees and flag and avoid hollow bearing trees where possible. Site to remain cleared to benefit emus. 	Construction	2
	B52c		Ancillary facility - Section 2 site 6a and 6b: <ul style="list-style-type: none"> Site to remain clear (not vegetated) to benefit emus. 	Construction	2
	B52d		Ancillary facility - Section 3 Site 1: <ul style="list-style-type: none"> This compound site that was used for the Glenugie Upgrade and has been revegetated post-construction. A site inspection and survey is required prior to construction to determine its suitability for future use as an ancillary site. Avoid mature trees. Revegetation of the section of the site in the road reserve or the entire site (if practicable). 	Construction	3
	B52e		Ancillary facility - Section 3 Site 2: <ul style="list-style-type: none"> Provide a buffer of 50 metres minimum from creek and sediment fencing where required. Avoid mature trees. Revegetation of the section of the site in the road reserve or the entire site (if practicable). 	Construction	3
	B52f		Ancillary facility - Section 3 Site 4: <ul style="list-style-type: none"> Ancillary site to be restricted to the western parts of the site adjoining Wooli Road. Vegetation in the road reserve along Wooli Road to be protected from disturbance. The population of the Slender Screw Fern plants is to be avoided. Existing trails or disturbed areas to be used for access to site. Bostock Road not to be used for 	Construction	3

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			access.		
	B52g		Ancillary facility - Section 3 Site 8: <ul style="list-style-type: none"> Identify and mark <i>Angophora robur</i> during pre-clearing and provide exclusion fencing. 	Construction	3
	B52i		Ancillary facility - Section 3 Site 9: <ul style="list-style-type: none"> Provide buffer to the surrounding forest. Identify and mark <i>Angophora robur</i> during pre-clearing and provide exclusion fencing Provide sediment fencing on eastern boundary where required. Avoid and buffer koala feed trees in the northwest corner of the site. Buffer required from edge of the forest to reduce edge effects, sediment fencing where required. 	Construction	3
	B52j		Ancillary facility - Section 5 Site 6: <ul style="list-style-type: none"> Consult with OEH on future use of this site post-construction, which may have offset potential with assisted regeneration and could be considered as a potential addition to Mororo Creek Nature Reserve Flag and buffer habitat patch on southern boundary. 	Construction	5
	B52k		Ancillary facility - Section 5 Additional site 9: Provide buffer around Mororo Creek and sediment fencing to protect riparian areas Flag and buffer habitat patch on southern boundary	Construction	5
	B52l		Ancillary facility - Section 6 Site 3a and 3b: <ul style="list-style-type: none"> Mark and avoid small dam in north-west corner of site and buffer activities from a large remnant patch adjoining to the north. Avoid scattered mature trees where possible. 	Construction	6
	B52m		Ancillary facility - Section 6 site 5: <ul style="list-style-type: none"> Site is currently being used as a compound site for the Devils Pulpit upgrade. On completion of construction for that project, the site would be stabilised with a quick growing cover crop to stabilise the site. A site inspection and survey is required prior to construction to confirm the suitability of the site. Site to be rehabilitated post- construction. 	Pre-construction, construction	6
	B52n		Ancillary facility - Section 7 Site 1: <ul style="list-style-type: none"> To be used for only low risk activities, no chemical or fuel storage on site. 	Construction	7
	B52o		Ancillary facility - Section 7 Site 2a and 2b: <ul style="list-style-type: none"> To be used for only low risk activities, no chemical or fuel storage on site. 	Construction	7
	B52p		Ancillary facility - Section 7 site 3: <ul style="list-style-type: none"> Provide sediment fencing along eastern boundary. 	Construction	7
	B52q		Ancillary facility - Section 7 Site 4:	Construction	7

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<ul style="list-style-type: none"> Provide buffer of minimum 50 metres from the wetland on northern boundary and sediment fencing where required. Avoid tree removal where possible 		
	B52r		Ancillary facility - Section 8 Site 2a, 2b and 2c: <ul style="list-style-type: none"> Recommend use for stockpile only, no chemical or fuel storage on site. 	Construction	8
	B52s		Ancillary facility - Section 8 Site 3: <ul style="list-style-type: none"> Provide bunding around the site. No chemical storage. 	Construction	8
	B52t		Ancillary facility - Section 9 Site 1: <ul style="list-style-type: none"> Provide buffer and sediment fencing at southern end. Provide sediment fencing at southern end of site, stockpiling only at northern half, no chemical storage 	Construction	9
	B52u		Ancillary facility - Section 9 site 2: <ul style="list-style-type: none"> Provide sediment fencing at southern end of site, stockpiling only at northern half, no chemical storage 	Construction	9
	B52v		Ancillary facility - Section 9 site 3: <ul style="list-style-type: none"> Provide sediment fencing at southern end of site, stockpiling only at northern half, no chemical storage 	Construction	9
	B52w		Ancillary facility - Section 10 site 1b: <ul style="list-style-type: none"> Revegetation of the section of the site in the road reserve or the entire site (if practicable). 	Construction	10
	B52x		Ancillary facility - Section 10 site 3b: <ul style="list-style-type: none"> Map and avoid strip of trees along northern boundary 	Construction	10
	B52y		Ancillary facility - Section 10 site 4: <ul style="list-style-type: none"> Revegetate site post-construction, focus on approaches to land bridge and avoid <i>Arthraxon hispidus</i>. 	Construction	10
Slender Screw Fern	B53	B64	The project footprint in section 1 will to be reviewed to identify any opportunities to avoid significant impacts to the existing population.	Pre-construction	1
	B54	B65	The project footprint and placement of sedimentation basins will be evaluated to minimise impacts to Slender Screw Fern.	Pre-construction	6
Biodiversity Offset Strategy	B55	B66	The Biodiversity Offset Strategy (detailed in Appendix C of the Working paper – Biodiversity) will be developed further, in consultation with relevant State and Commonwealth agencies, and implemented during detailed design.	Pre-construction	All
Interchange at Wardell	B56	-	Street lighting on the western roundabout at the interchange at Wardell will be designed to reduce light spill during detailed design. This could include using deflection shields around the lights or using a UV light, with reduced UV light emissions.	Pre-construction	10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	B57	-	Further investigation will be undertaken of the road runoff capture and storage to the east side of the existing Pacific Highway between station 158.2 and 159.4 to protect remaining in situ aquatic habitats south of Laws Road.	Pre-construction	11
	B58	-	Roads and Maritime owned land surrounding the dedicated landbridge at station 156.0 be revegetated in accordance with the connectivity strategy and the landscape management plan.	Construction	10
Impacts to Lang Hill	B59	-	The Lang Hill Environmental Management Work Statement be further developed and implemented during the use and rehabilitation of the borrow site.	Pre-construction and construction	8
	B60	-	The creekline on the 'Lang Hill' property will should be fenced off from cattle and the vegetation allowed to regenerate to improve the habitat conditions downstream.	Construction and operation	8
<i>Maundia triglochinooides</i>	B61		Detailed design will investigate measures to reduce impacts to <i>Maundia triglochinooides</i> : <ul style="list-style-type: none"> Near Redbank Creek (population 14). Near North of New Italy (population 12). 	Pre-construction	1 and 7
Urban design and landscape					
Noise wall visual impacts	UD1	UD1	If further noise modelling identifies that noise walls are required, further visual assessment address the visual implications of the change. Their location and design will be in accordance with the Noise Wall Design Guideline (RTA, 2007) and the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.3).	Pre-construction	All
Clarence River and Richmond River bridge impacts	UD2	UD2	Changes to the design of the Clarence and Richmond rivers bridges from this EIS, will require further visual assessment. Any changes will consider the principles identified in Working Paper – Urban design, Landscape Character and Visual Impact (Section 4.6.2), the performance criteria outlined in Chapter 5 of the EIS and funding arrangements.	Pre-construction	5, 9 and 10
Landscaping and planting strategy	UD3	UD3	The project will be carried out in accordance with the urban design and landscaping strategy, as identified in Section 11.4.1 of this EIS. Detailed landscape design for all project batters, and median planting areas will be developed in accordance with the Landscape Guidelines (RTA, 2008), the requirements of the Working Paper – Biodiversity (Section 5.2.2) and the landscape strategy to provide a robust, successful and effective planting design.	Pre-construction	All
Design of urban design features and road furniture	UD4	UD5	The built form of the project, including consideration of the height, bulk, scale, materials and finishes for: <ul style="list-style-type: none"> Bridges. Retaining walls. Cuttings and embankments. Road barriers. Signage. Fences. Clear zones. 	Pre-construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<ul style="list-style-type: none"> • Topsoil management. • Water quality control ponds. • Fauna crossing. • Place marking and cultural plantings. <p>The project will be designed in accordance with the design principles identified in Working Paper – Urban Design, Landscape Character and Visual Impact, and relevant Roads and Maritime guidelines.</p>		
Shadowing	UD5	UD6	Further assessment will be undertaken of the impact of overshadowing on areas surrounding the project, particularly around Harwood Bridge, interchanges and overpasses near residential properties.	Pre-construction	All
Visual impacts from viewpoints	UD6	UD7	Measures to mitigate visual impacts to viewpoints will be implemented, as identified in Table 11-42 and Working Paper – Urban Design, Landscape Character and Visual Impact. If any further viewpoints were identified during detailed design that have a moderate–high or high impact, screen planting also be considered.	Construction	All
Construction visual impacts	UD7	UD8	Disturbed areas will be progressively revegetated throughout the construction period.	Construction	All
Visual impacts of ancillary facilities	UD8	UD9	Where required, typical landscape treatments for ancillary facilities in forest areas will include: <ul style="list-style-type: none"> • Providing screen planting. • Considering reinstatement of disturbed forest in heavily forested. • Considering the importance of the visual landscape at each location and allowing restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable. • Negotiating with private landowners, as applicable, to determine future treatments for other non-forested ancillary facility locations. • Re-grading disturbed areas to achieve a sustainable and functional landform. • Stabilising all surfaces in accordance with good engineering and environmental practice. 	Construction	All
Visual impacts of ancillary facilities	UD9	UD10	Typical landscape treatments for ancillary facilities in agricultural areas will include: <ul style="list-style-type: none"> • Considering returning remnant agricultural land to agricultural uses. • Providing screen planting. • Reinstating riparian vegetation through ancillary facilities, where practicable, in the open landscape. • Considering the visual landscape at each ancillary facility and considering restoration of important forest vegetation to prominent ridge lines or other landscape elements where feasible and reasonable. • Re-grading disturbed areas to achieve a sustainable and functional landform. • Stabilising all surfaces in accordance with good engineering and environmental practice. 	Construction	All
Visual impact of borrow sites	UD10	UD11	The extent of excavation and the landscaping strategy at borrow sites will be reviewed considering material requirements on the project and the visual impact on the resultant cuttings.	Pre-construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	UD11	-	Any backfilling of the Lang Hill and West of Wardell borrow sites will be undertaken with available surplus material from the project. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3), design principles (UD5) and the intended future land use of the sites.	Construction	8 and 10
	UD12	-	Any backfilling of the Eatons and Gibson borrow sites will be undertaken with available surplus material from the project. Landscaping on the site use indigenous species, including those species suitable for Koala. The landscaping will connect to the existing vegetation to the east of the project by a fauna land bridge to be constructed at station 147.6. Rehabilitation of the sites will be undertaken in accordance of the landscape strategy (UD3) and design principles (UD5).	Construction	10
Monitoring of landscaping and rehabilitation	UD13	UD12	Landscape and rehabilitation works will be monitored and remedial measures implemented where required until vegetation has stabilised.	Operation	All
Earth mounds	UD14	UD13	The mounding profile of any earth mound will blend suitably into the existing landscape setting. Any mounding to be landscaped will be compacted in 1.5 metre layers with 1:3 maximum batter slopes where reasonable in consideration of constraints within the project corridor. Where feasible and reasonable, permanent mounds will be treated with ameliorants and overlaid with topsoil to minimum 150 millimetres to ensure suitable planting conditions are achieved.	Construction	All
Aboriginal heritage					
General impacts to Aboriginal archaeological sites	AH1	AH1	Where artefact concentrations per square metre (over all depths) encountered are 50 per cent greater than previously encountered, additional salvage excavation using hand tools will be undertaken. If these artefact concentrations are encountered during machine excavation, then machine excavation will stop within 20 metres of the artefact concentrations. Up to, but no more than, an additional six square metres will be excavated in this situation at that site, unless rare features are encountered, in which case discussions with the registered Aboriginal stakeholders and NSW Office of Environment and Heritage will be undertaken to agree on a suitable approach.	Pre-construction and construction	All
	AH2	AH2	For areas avoided by construction, exclusion zones will be put in place. These will be fenced with high visibility construction webbing or other similar fencing and have a 'Do Not Enter' sign. Exclusion zones will be marked on construction plans and be maintained until construction is completed. A representative of the Local Aboriginal Land Council will be present during establishment of the fencing.	Construction	All
	AH3	-	If any part of the project (such as an ancillary facility) is located in an area which has not been subject to Aboriginal heritage field survey and assessment, an assessment will be undertaken before that part of the project proceeds.	Pre-construction	All
	AH4	AH3	Salvage excavation and systematic collection of previously recorded artefacts that will be impacted by the project, along with any other impacted sites that are identified prior to or during construction, are to be undertaken by qualified archaeologists in conjunction with the registered Aboriginal stakeholders: The location of excavations will be within the area of the site to be impacted, and be decided upon in the	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			field by a qualified archaeologist and registered Aboriginal stakeholders. If any datable material is located, a minimum of two samples (per archaeological site) will be subject to radiocarbon, standard or accelerated mass spectrometry dating. For all salvaged material, suitable storage will be agreed upon with the registered Aboriginal stakeholders prior to commencing salvage in those areas.		
	AH5	AH4	Heritage evidence collected will be curated in an appropriate manner, as determined in consultation with the registered Aboriginal stakeholders and the NSW Office of Environment and Heritage and in accordance with the National Parks and Wildlife Act 1974, details of the material's nature and context will also be provided.	Construction and post-construction	All
	AH6	AH5	A detailed technical report documenting the results of the salvage excavations and the archaeological material analysis will be prepared. A summary report (to be made public) will be developed to accompany the technical report.	Construction and post-construction	All
	AH7	AH6	Site records will be lodged with NSW Office of Environment and Heritage for any previously unrecorded evidence that is identified and for any evidence that is salvaged.	Construction and post-construction	All
	AH8	-	Aboriginal Site Impact Recording (ASIR) forms will be lodged with the Aboriginal Heritage Information Management Systems (AHIMS) Register within three months of sites being impacted.	Construction	All
Human skeletal remains	AH9	AH7	An unexpected finds (including human skeletal remains) procedure will be developed in accordance with Roads and Maritime' Standard Management Procedures: Unexpected Archaeological Finds 2012.	Construction	All
Aboriginal stakeholder consultation	AH10	AH8	Aboriginal focus group consultation (through letters or meetings); will occur at least once every six months, prior to and during construction (unless management actions have been completed).	Pre-construction and construction	All
Awareness of Aboriginal heritage	AH11	AH10	Aboriginal culture awareness training for all relevant staff and contractors will occur prior to commencing work on-site. This could include information about the Aboriginal culture and history of the locality, the location of sites and items that require protection and movement corridors within the project boundary, heritage management measures and protocols, and legal obligations. This training will be developed in consultation with suitably trained personnel from local Aboriginal organisations represented by the relevant registered stakeholders for that area.	Pre-construction and construction	All
	AH12	AH12	An Aboriginal heritage interpretation strategy will be prepared as part of the Aboriginal heritage management plan. Measures will include opportunities for promoting salvage and investigation, the recovery of information, permanent installations and ways of marking the presence of Aboriginal people in the landscape, including, signage, interpretation products such as written materials, and through place naming.	Pre-construction and construction	All
	AH13	AH14	Compliance auditing of the cultural heritage management measures will be undertaken as part of the environmental management audit regime.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Ancillary facilities	AH14a	-	<p>Ancillary facility - Section 1, Site 1a (at Taylors Run 2):</p> <ul style="list-style-type: none"> All previously recorded artefacts must be recovered and removed off-site, and passed to registered Aboriginal stakeholders for reburial or storage at a chosen location, subject to a care agreement being established. If the Aboriginal archaeological site is not to be impacted, an exclusion zone will be established as per management measure AH2. <p>Ancillary facility - Section 1, Site 1a (at Taylors Run 3):</p> <ul style="list-style-type: none"> Exclusion zones will be established as per management measure AH2. <p>Ancillary facility - Section 1, Site 1a (at Taylors Run 1):</p> <ul style="list-style-type: none"> The surface scatter portion of this Aboriginal archaeological site outside the proposed ancillary facility will be avoided. An exclusion zone with a buffer of 15 metres of the surface artefact point will be established as per management measure AH2. Any ground disturbance impacts to the archaeological site in the ancillary facility, will require the top soil down to the sterile clay layer to be graded, stockpiled separately (within a portion of the ancillary facility area), and reinstated at the same area following completion of the activity. Any portions of the Aboriginal archaeological site not to be impacted will be protected by exclusion zones as per management measure AH2. <p>Ancillary facility - Section 1, Site 1a (at WWC37 (22-1-0344)):</p> <ul style="list-style-type: none"> Within the Aboriginal archaeological site in the boundary of the project, after salvage activities, but before any other ground disturbance, the top soil down to the sterile clay layer will be graded from the area, stockpiled separately and used in batters (not fill) of the road/bridge. This will be undertaken in consultation with the relevant registered Aboriginal stakeholders and will be engaged to direct this activity. In addition: The salvage to be excavated by machine is 30 % of the Aboriginal archaeological site. The older house nearest to the river within the Aboriginal archaeological site will be removed, with minimal ground disturbance, before salvage excavations being undertaken, so that this area may be targeted for a portion of the salvage. Their nominated site officers are present during removal of the plastic covering the blueberry bush rows, to identify artefacts on the surface under the plastic – an archaeologist will also be present to document finds. All cultural material recovered will be subject to detailed analysis, which will be included in a technical report, including detailed discussion and interpretation. Any portions of the Aboriginal archaeological site that are not to be impacted will be protected 	Pre-construction and construction	1

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			by exclusion zones as per management measure AH2.		
	AH14b	-	<p>Ancillary facility - Section 1, Site 1a, 1b (at WWC39 (22-1-0343)):</p> <ul style="list-style-type: none"> • If impact to WWC39 is necessary, salvage excavation of the portion of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. • If impacts to the Aboriginal archaeological site are necessary, following archaeological salvage the top soil down to the sterile clay layer will be graded from the area, stockpiled separately and placed in batters. • Where ground disturbance is not necessary, geotextile fabric and crushed rock or similar will be used to protect the ground from compaction. • The area of the Aboriginal archaeological site not to be impacted will be protected by an exclusion zone as per management measure AH2. 	Pre-construction	1
	AH14c	-	<p>Ancillary facility - Section 1, Additional site 5:</p> <ul style="list-style-type: none"> • Sub-surface test excavation will be undertaken prior to the use of the ancillary facility. This will be conducted in accordance with the methodology used in the working paper, and will occur several months before any ground disturbance in this location. Further recommendations for the Aboriginal archaeological site will then be made in consultation with the registered Aboriginal stakeholders. 	Pre-construction	1
	AH14d	-	<p>Ancillary facility - Section 2, Site 1b (at Lemon Tree Road 1 (13-4-0180)):</p> <ul style="list-style-type: none"> • An exclusion zone will be established around this Aboriginal site as per management measure AH2. 	Construction	2
	AH14e	-	<p>Ancillary facility - Section 2, Site 3 (at Kungala Road 1 (13-4-0181)):</p> <ul style="list-style-type: none"> • Sub-surface test excavation will be undertaken prior to construction, conducted in accordance with the methodology used in the working paper, and occur several months before any ground disturbance at this location. Further recommendations for the Aboriginal archaeological site will then be made in consultation with the registered Aboriginal stakeholders, including potentially establishing a care agreement will be necessary to enable this. • Any portions of the Aboriginal archaeological site that are not to be impacted will be protected by exclusion zones as per management measure AH2. 	Pre-construction and construction	2
	AH14f	-	<p>Ancillary facility - Section 2, Site 4 (at Wells Crossing Artefacts 1 (13-4-0183)):</p> <ul style="list-style-type: none"> • If this Aboriginal archaeological site is to be impacted, salvage excavation of the portion of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. 	Pre-construction	2

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	AH14g	-	Ancillary facility - Section 2, Site 5b (at WWC139 (13-4-0157)): <ul style="list-style-type: none"> The Aboriginal archaeological site that is not to be impacted will be protected by exclusion zones as per management measure AH2. 	Construction	3
	AH14h	-	Ancillary facility - Section 3, Site 3b (at WX2I Site 8 (09-4-0108)): <ul style="list-style-type: none"> All previously recorded artefacts will be recovered and removed off-site before construction, subject to a care agreement being established. All cultural material recovered will be subject to detailed analysis, which will be included in a technical report, including detailed discussion and interpretation. 	Pre-construction	3
	AH14i	-	Ancillary facility - Section 3, Site 6b (at Old Tucabia Dump 1 (13-4-0184)): <ul style="list-style-type: none"> An exclusion zone will be established at the boundary of the Aboriginal archaeological site (including a buffer based on the drip zone of the tree) as per management measure AH2. 	Construction	3
	AH14j	-	Ancillary facility - Section 3, Site 9 (at Upper Coldstream 1 (13-4-0182)): <ul style="list-style-type: none"> All previously recorded artefacts will be recovered and removed off-site, subject to a care agreement being established. Any portions of the Aboriginal archaeological site not to be impacted will be protected by exclusion zones as per management measure AH2. 	Pre-construction and construction	3
	AH14k	-	Ancillary facility - Section 4, Site 1: <ul style="list-style-type: none"> Sub-surface test excavations will be undertaken in accordance with the methodology used in the working paper, and will occur before any ground disturbance at this location. Further recommendations for the Aboriginal archaeological site will then be made in consultation with the registered Aboriginal stakeholders. 	Pre-construction	4
	AH14l	-	Ancillary facility - Section 4, Site 3: <ul style="list-style-type: none"> This property could not be accessed for field investigations. Sub-surface test excavations are to be undertaken. This will be conducted in accordance with the methodology used in the working paper, and will occur before ground disturbing work for the project or ancillary activities being undertaken at this location. Further recommendations for the Aboriginal archaeological site will then be made in consultation with the RAPs. 	Pre-construction	4
	AH14m	-	Ancillary facility - Section 4, Site 5 (at Hirst 3 (13-1-0192)): <ul style="list-style-type: none"> This Aboriginal archaeological site is to be avoided if possible unless agreement can be reached with the RAPs. An exclusion zone will be established as per management measure AH2. If agreement to use the site is reached with RAPs, salvage excavation of the portion of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. 	Pre-construction	4

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	AH14n	-	Ancillary facility - Section 5, Site 7 (at Mororo Creek 1 (13-1-0191)): <ul style="list-style-type: none"> This Aboriginal archaeological site within the ancillary facility location will be avoided. An exclusion zone at least five metres outside the boundary of the Aboriginal archaeological site will be established as per management measure AH2. 	Construction	5
	AH14o	-	Ancillary facility - Section 5, Site 5 and Site 7 (at Mororo Creek 2 (13-1-0193)): <ul style="list-style-type: none"> This Aboriginal archaeological site within the ancillary facility location will be avoided. An exclusion zone at least five metres outside the boundary of the Aboriginal archaeological site will be established as per management measure AH2. 	Construction	5
	AH14p	-	Ancillary facility - Section 7, Site 1: <ul style="list-style-type: none"> A site walk over survey will be undertaken to confirm whether sub-surface test excavations are required. This will be conducted in accordance with the methodology used in the working paper, and will occur several months before any ground disturbance at this location. Further recommendations and use of the Aboriginal archaeological site will be developed in agreement with the registered Aboriginal stakeholders. 	Pre-construction	7
	AH14q	-	Ancillary facility - Section 7, Site 3 (Dubaijeen Site (New Italy 1)): <ul style="list-style-type: none"> Salvage excavation of the portion of the Aboriginal archaeological site to be used will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. The excavations apply to the portion of the site that be impacted by the project as well as the ancillary facility. Any portions of the Aboriginal archaeological site that are not to be impacted will be protected by exclusion zones as per management measure AH2. 	Pre-construction and construction	7
	AH14r	-	Ancillary facility - Section 7, Site 4 (The Gap Rd 1(13-1-0194)): <ul style="list-style-type: none"> If impact to The Gap Rd 1 is necessary, salvage excavation of the portion of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. Any portions of the Aboriginal archaeological site that are not to be impacted will be protected by exclusion zones will be established as per management measure AH2. 	Pre-construction and construction	7
	AH14s	-	Ancillary facility - Section 10, Site 1a: <ul style="list-style-type: none"> A site walk over survey will be undertaken to confirm whether sub-surface test excavation is required. This will be conducted in accordance with the methodology used in the working paper, and will occur several months before any ground disturbance at this location. Further recommendations for the Aboriginal archaeological site will then be made in consultation with the registered Aboriginal stakeholders. 	Pre-construction	10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	AH14t	-	Ancillary facility - Section 10, ancillary facility 5At Rudgley Site 1 (04-4-0167): <ul style="list-style-type: none"> This Aboriginal archaeological site will be avoided, where practical, using an exclusion zone as per management measure AH2. If avoidance is not possible, salvage excavation of the portion of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. Any portions of the Aboriginal archaeological site that are not to be impacted will be protected by exclusion zones as per management measure AH2. 	Pre-construction and construction	10
	AH14u	-	Ancillary facility - Section 10, Site 6 (Site 12 (11-2-0082)): <ul style="list-style-type: none"> If avoidance is not possible, salvage excavation of all portions of the Aboriginal archaeological site to be impacted will be undertaken as detailed in the Ancillary facility and design change CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. Any portions of the Aboriginal archaeological site that are not to be impacted will be protected by exclusion zones as per management measure AH2. 	Pre-construction and construction	10
	AH14v	-	Ancillary facility - Section 11, Site 1a: <ul style="list-style-type: none"> The ground will be inspected for any Aboriginal archaeological material by an archaeologist and registered Aboriginal stakeholders during and following clearing activities. Any archaeological material will be recorded, removed from the Aboriginal archaeological site, and a suitable location for the material determined in consultation with the stakeholders. An AHIMS record will be submitted for any finds and any locations where the material is to be stored – unless reburied on or near Aboriginal archaeological site, establishing a care agreement will also be necessary. 	Pre-construction and construction	11
Impacts on WWC39	AH15	AH16	Salvage excavation will be undertaken within the portion of the site to be impacted by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Woolgoolga to Wells Crossing) and in consultation with RAPs. An exclusion zone will be erected around 40% of the site that will be avoided by construction as per management measure AH2.	Pre-construction	1
Impacts on WWC46	AH16	AH17	Salvage excavation will be undertaken within the portion of the site to be impacted by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Woolgoolga to Wells Crossing) and in consultation with RAPs.	Pre-construction	1
Impacts on WWC Dirty Creek 1	AH17	AH18	Prior to ground disturbance to WWC Dirty Creek 1c (22-1-0403), the ground surface be inspected within 50 m of the site for any Aboriginal archaeological material by an archaeologist and RAP nominated site officers. Any archaeological material be recorded, removed from the site, and a suitable location for the material determined in consultation with the RAPs. The AHIMS record will be updated with any new finds and any locations where the material is to be stored – unless reburied on or near site, establishing	Pre-construction	1

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			a care agreement be necessary.		
Impacts on Tyndale 2	AH18	AH19	Salvage excavation be undertaken within the portion of the site to be impacted by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Wells Crossing to Iluka Road) and in consultation with RAPs.	Pre-construction	4
Impacts to Chaffin Creek Scarred tree	AH19	-	Chaffin Creek scarred tree (Chaffin Creek Tree 2): <ul style="list-style-type: none"> Before construction, an exclusion zone will be established as per management measure AH2. An arborist will be consulted to develop a management strategy to ensure the health and preservation of the tree. 	Pre-construction	3
Impacts on IR2W4	AH20	AH20	Salvage excavation will be undertaken within the portion of the site to be impacted by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Iluka Road to Woodburn) and in consultation with RAPs.	Pre-construction	8
Impacts on Gittoes Jali	AH21	AH21	For the Gittoes Jali (09-1-0204, 09-1-0205, 09-1-0203) site: <ul style="list-style-type: none"> Where possible, impacts on the Gittoes Jali site will be reduced or avoided. Avoided areas will be protected by an exclusion fence as per management measure AH2. If avoidance is not an option, then extensive salvage will be undertaken as per the methodology detailed in the Ancillary facilities and design change CHAR (refer to Appendix D of the Submissions/ Preferred Infrastructure Report). Any sediment from the site to 0.6 metre depth proposed to be used outside the site will be sieved to remove any cultural material. Paint wells and grinding rock: <ul style="list-style-type: none"> Residue analysis will be undertaken to determine if any pigment is found within the wells. This will be undertaken by a suitably qualified consultant. The location of these paint wells will be accurately plotted and drawn. If the paint wells cannot be avoided, they will be relocated; this requires consultation with the registered Aboriginal stakeholders. Geomorphology assessment: <ul style="list-style-type: none"> A geomorphology assessment will be undertaken. The assessment will be non-invasive, but could use observations of the machine salvage excavation. Borrow site: <ul style="list-style-type: none"> Haul routes from the project formation to the borrow source that limit direct impacts to Aboriginal heritage will be confirmed in consultation with Registered Aboriginal Parties. 	Pre-construction and construction	8
Impacts on E2/2	AH22	AH22	For the E2/2 (13-1-01-09) site: <ul style="list-style-type: none"> Salvage excavation will be undertaken at and around the shell midden by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. 	Pre-construction and construction	9

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<ul style="list-style-type: none"> Any sediment from the site to 1.5 m metre depth proposed to be used outside sites will be sieved to remove any cultural material. Shell Midden: <ul style="list-style-type: none"> A sequence of dates (radiocarbon or AMS) will be collected from the hand excavation. All shell recovered will be subject to analysis including minimum number of individuals (MNI) and weight (g). An analysis of the number of individual specimens (NISP) may also be undertaken if deemed appropriate. Overburden: <ul style="list-style-type: none"> All overburden will be removed and sieved for cultural materials. Geomorphology assessment: <ul style="list-style-type: none"> A geomorphology assessment will be undertaken. The assessment will be non-invasive, but could use observations of the machine salvage excavation. 		
Impacts on Aboriginal heritage Site 11	AH23	AH23	For Site 11 (13-1-0189): <ul style="list-style-type: none"> Salvage excavation will be undertaken by the project footprint as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment from the sites to 1.5 metre depth proposed to be used outside the site will be sieved to remove any cultural material. Geomorphology assessment: <ul style="list-style-type: none"> A geomorphology assessment will be undertaken. The assessment will be non-invasive, but could use observations of the machine salvage excavation. 	Pre-construction and construction	9
Impacts on Melino site	AH24	AH24	For the Melino (04-4-0173) site: <ul style="list-style-type: none"> Salvage excavation will be undertaken at the artefact scatter including a discrete knapping floor as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment from the sites to 1.5 metre depth proposed to be used outside the site will be sieved to remove any cultural material. Shell Midden: <ul style="list-style-type: none"> Salvage excavations as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. A sequence of dates (radiocarbon or AMS) will be collected from the hand excavation. All shell recovered will be subject to analysis including minimum number of individuals (MNI) and weight (g). An analysis of the number of individual specimens (NISP) may also be undertaken if deemed appropriate. 	Pre-construction and construction	10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<p>Area surrounding the shell midden:</p> <ul style="list-style-type: none"> Salvage excavations will be undertaken as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. <p>Geomorphology assessment:</p> <ul style="list-style-type: none"> A geomorphology assessment <i>will</i> be undertaken. The assessment <i>will</i> be non-invasive, but could use observations of the machine salvage excavation. 		
Impacts on Site 1	AH25	AH25	<p>For Site 1 (04-4-0179):</p> <ul style="list-style-type: none"> Further salvage excavations will be undertaken as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment to one metre depth from the site proposed to be used outside the site will be sieved to remove any cultural material. 	Pre-construction and construction	10
Impacts on Site 2	AH26	AH26	<p>For Site 2 (04-4-0178):</p> <ul style="list-style-type: none"> Salvage excavation will be undertaken as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment to 1.5 metres depth from the site proposed to be used outside the the site will be sieved to remove any cultural material. Excavation at Site 2 will be undertaken at a time of the year when the water table is at its lowest, to ensure maximum depth can be reached with a machine. 	Pre-construction and construction	10
Impacts on Site 3	AH27	AH27	<p>For Site 3 (04-4-0175):</p> <ul style="list-style-type: none"> Further salvage excavations will be undertaken as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment to 1.5 metres depth from the site proposed to be used outside the site will be sieved to remove any cultural material. Excavation at Site 3 will be undertaken at a time of the year when the water table is at its lowest, to ensure maximum depth can be reached with a machine. 	Pre-construction and construction	10
Impacts on Site 4	AH28	AH28	<p>For Site 4 (04-04-0132):</p> <ul style="list-style-type: none"> Further salvage excavations will be undertaken as detailed in the Working paper Aboriginal Cultural Heritage (Woodburn to Ballina) and in consultation with RAPs. Any sediment to 0.5 metre depth from the site proposed to be used outside the the site will be sieved to remove any cultural material. 	Pre-construction and construction	10
Impacts on Site 12	AH29	AH29	<p>For Site 12 (04-4-0176):</p> <ul style="list-style-type: none"> An exclusion zone be established at the boundary of the site where construction is to occur within 10 m of the site, as per management measure AH2. 	Pre-construction and construction	10, 11

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Impacts on the Gumi Site	AH30	AH30	For the Gumi site (04-4-0180): <ul style="list-style-type: none"> The tree (registered on AHIMS database) will be removed and the trunk will be relocated to an area agreed to with the registered stakeholder groups and Roads and Maritime – an arborist will be consulted to guide in the removal of the tree. The final tree location will be visually protected with culturally sensitive plantings or by existing vegetation. Access to the tree will be provided for local Aboriginal people to enable them to be able to use the tree as a teaching site. 	Pre-construction and construction	10
Impacts on the Melino Scarred Tree	AH31	AH31	For the Melino Scarred Tree 4 (04-4-0166) site: <ul style="list-style-type: none"> Prior to construction a 15 metre exclusion zone will be established around the scarred tree as per management measure AH2. An arborist will be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Impacts on the MST3 Scarred Tree	AH32	AH32	For the MST3 (04-4-0131) site: <ul style="list-style-type: none"> Prior to construction a 15 metre exclusion zone will be established around the scarred trees as per management measure AH2. An arborist will be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Impacts on the C21 Scarred Tree	AH33	AH33	For the C21 (04-4-0107) site: <ul style="list-style-type: none"> Prior to construction a 15 metre exclusion zone will be established around the scarred trees as per management measure AH2. An arborist will be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Impacts on the MSRT2 Scarred Tree	AH34	AH34	For the MSRT2 (04-4-0130) site: <ul style="list-style-type: none"> Prior to construction a 15 metre exclusion zone will be established around the scarred trees as per management measure AH2. An arborist will be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Impacts on the Rudgley Scarred Tree	AH35	AH35	For the Rudgley Scarred Tree (04-4-0170) site: <ul style="list-style-type: none"> Prior to construction a 15 metre exclusion zone will be established around the scarred trees as per management measure AH2. An arborist will be consulted to develop an ongoing management strategy to ensure the preservation and health of the tree. 	Pre-construction and construction	10
Coolgardie Road, Rudgley Scarred Tree 2	AH36	-	An exclusion zone will be established 5 metres from the boundary of Rudgley Scarred Tree 2 as per management measure AH2.	Pre-construction	10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Coolgardie Road, Rudgley Site 2	AH37	-	The area of site to be impacted be subject to salvage excavation as detailed in the Addendum CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. All cultural material recovered will be subject to detailed analysis, interpretation and reporting.	Pre-construction	10
Impacts to Corridors of Movement	AH38	AH36	Educational and cultural signage will be placed at viable locations along the highway in this locality, potentially describing the history of Aboriginal occupation of the area. At a minimum, signage will include acknowledging the area as the traditional lands of the Gumbaynggir peoples. Any signage will be subject to approval by the registered Aboriginal stakeholders.	Pre-construction and construction	1
	AH39	AH37	Tyndale and Woodford Island Corridors of Movement: <ul style="list-style-type: none"> Pedestrian access across the project will be provided, if reasonable and feasible within the existing local road network, to maintain the connectivity of this corridor of movement. 	Pre-construction and construction	3
	AH40	AH38	Pillar Valley Corridors of Movement: <ul style="list-style-type: none"> Pedestrian access across the project will be provided, if reasonable and feasible within the existing local road network, to maintain the connectivity of this corridor of movement. 	Pre-construction and construction	3
Direct impact on culturally significant places	AH41	AH39	Place B: <ul style="list-style-type: none"> To maintain connectivity, access will be provided across the project area, from the end of Richmond Road, Pine Tree Road, or Fischer Street to Broadwater National Park during construction and operation, in consultation with the traditional owners. Pedestrian access within the project boundary will be provided, where feasible and reasonable from the eastern side of the project to the western side of Broadwater National Park. A connection from the existing Pacific Highway to Broadwater National Park along Eversons Lane be considered, in consultation with traditional owners and relevant land owners. 	Pre-construction and construction	9, 10
	AH42	AH40	Place D: <ul style="list-style-type: none"> Welcome to country signage will be installed within the highway corridor between Woodburn and Wardell and information on culture installed at the rest area in Section 10, as agreed with the registered Aboriginal parties. 	Pre-construction and construction	9, 10
	AH43	AH41	Place K: <ul style="list-style-type: none"> A geomorphological assessment will be undertaken, including the geomorphological setting of the archaeological sites within this landscape, and how the landscape has formed and changed over the last 40,000 years. This take into account both the cultural and scientific significance of the place. A report will be produced by a geomorphologist in conjunction with an archaeologist / anthropologist. 	Pre-construction and construction	11

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Indirect impact on culturally significant places	AH44	AH42	Place E: <ul style="list-style-type: none"> This place will be fenced prior to and during construction to avoid incidental impact. Surface water runoff from the construction site or from the highway pavement during operation of the project will be prevented from directly entering into Place E. 	Pre-construction and construction	9
Indeterminate impact on culturally significant places	AH45	AH43	Place C: <ul style="list-style-type: none"> An education package will be prepared. This will include at a minimum a printed document detailing the story of the occupation of this area and the ensuing massacre. Further research and interviews will be undertaken for this purpose. Where possible, oral recordings and/or video footage will also be compiled into the package. Caution will be undertaken in and around the project in this area with regard to potential human remains. 	Pre-construction and construction	9, 10
Mororo Road cutting site	AH46	-	Before construction at Mororo Road, between station 97.45 and 98.9, a field inspection of the area to be cleared and excavated will be undertaken by an Aboriginal heritage consultant with Registered Aboriginal Parties.	Pre-construction	6
Old Bagotville Road Lot 109 DP1137975	AH47	-	As the property occurs in an area of low-moderate Aboriginal heritage potential, survey, and if necessary test excavation, should be undertaken to determine the presence and extent of potential archaeological evidence. This will be conducted in accordance with the methodology agreed with RAPs, and prior to ground disturbing works for the project and/or proposed design change. Further recommendations for the site will then be made in consultation with the RAPs.	Pre-construction	10
Saezza 1 artefact scatter: salvage excavation	AH48	-	The area of this site to be impacted will be subject to salvage excavation as detailed in the Addendum CHAR (Appendix D of the Submissions/ Preferred Infrastructure Report) and in consultation with RAPs. All cultural material recovered will be subject to detailed analysis, interpretation and reporting. The portion of the site that not be impacted (at least 70%), will be protected by fencing as per management measure AH2.	Pre-construction	10
Non-Aboriginal (Historical) heritage					
Unidentified historical heritage materials, features and/or deposits	HH1	HH1	If at any time during construction associated with the project, unidentified historical heritage materials, features and/or deposits are found, the Roads and Maritime Standard Management Procedure: Unexpected Archaeological Finds (20121) will be followed.	Construction	All
Awareness of non- Aboriginal heritage items	HH2	HH3	Contractors will be given awareness training on non-Aboriginal historical heritage prior to commencement of construction works to ensure understanding of potential heritage items and the procedure in the event of discovery of historical heritage materials, features or deposits, or the discovery of human remains.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	HH3	-	The Heritage management plan will be developed in consultation with the Heritage Council of NSW.	Construction	All
	HH4	-	Should the impact to any historic heritage item change during detailed design, further assessment of impacts on the items will be undertaken.	Pre- construction	All
Ancillary facilities	HH5	-	At project section 1, site 2: a temporary barrier fence will be erected between item 39 and the ancillary site. The fence will remain in place until the conclusion of the use of the ancillary site at which time it will be removed.	Construction	1
	HH6	-	At project section 10, site 4: a temporary barrier fence will be erected to protect the drainage channel that is not directly impacted by the project (item 43). The fence will remain in place until the conclusion of the use of the ancillary site at which time it will be removed.	Construction	10
	HH7	HH5	Where local or state significant heritage items not previously identified are identified on an ancillary site and use of the site will impact on the heritage significance of the item, the site will not be used for ancillary facilities.	Pre- construction	All
	HH8	HH6	Where local or state significant heritage items are identified on an ancillary site and use of the site will not impact on the heritage significance of the item, appropriate management measures (such as barrier fencing) will be put in place to clearly identify the heritage item and exclude use of the ancillary site within the heritage item's curtilage. Use of these ancillary facilities may commence: <ul style="list-style-type: none"> • When the appropriate protective measures have been implemented. • When the relevant records have been updated and/or completed. 	Pre- construction	All
	HH9	HH7	Any new ancillary facility and spoil placement locations not identified as part of this EIS will require a non-Aboriginal heritage assessment, with a database search and site walkover to identify any potential heritage items. If items are found, HH4, HH7-HH8 will be followed.	Pre- construction	All
Impacts on item 2: House, sheds and stockyards, Milleraa	HH10	HH8	A temporary barrier fence will be erected between the stockyards and the works area prior to road construction works commencing. The fence will remain in place until the conclusion of the works in the vicinity of the items at which time it will be removed. The batter slope will not be constructed within five metres of the stockyards.	Pre- construction and construction	1
	HH11	HH9	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	1
Impacts on item 7: Service station complex, Halfway Creek	HH12	HH10	Salvage excavation (of the coach way station and early coach road) will be undertaken from the project boundary along the front of the complex buildings to the edge of the existing highway before construction starts in the vicinity of the heritage item. Excavations will be undertaken in accordance with Heritage Branch guidelines and under the supervision of an appropriately qualified and experienced historical archaeologist. An appropriate research design and methodology will be prepared to best realise the research potential of this area of the site.	Pre- construction and construction	2

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	HH13	HH11	The batter slope for the motorway upgrade will not be constructed within eight metres of the bar/restaurant building.	Construction	2
	HH14	HH12	A temporary fence will be erected between the bar/restaurant building and the motorway upgrade construction before work starts in the vicinity of the heritage item. The fence will remain in place until construction is completed, at which time it will be removed.	Pre- construction and construction	2
	HH15	HH13	A photographic condition survey will be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre- construction and construction	2
	HH16	HH14	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	2
Impacts on item 36: North Coast Railway Branch Tramway	HH17	HH15	Archival photographic recording will be undertaken in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its removal.	Pre- construction	2
Impacts on item 11: Tyndale residence, Tyndale	HH18	HH16	Prior to the start of construction, the location and condition of the mature bunya trees will be recorded by an arborist. In consultation with an arborist, protective fencing will be erected adjacent to the property boundary to control impacts on the trees.	Pre- construction and construction	3
	HH19	HH17	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	3
Impacts on item 12: Cane barge and former Ashby ferry, Maclean	HH20	HH18	A photographic condition survey will be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre- construction	4
	HH21	HH19	Where appropriate, and before construction commences, any loose or unstable components of the heritage item will be secured to minimise vibration impacts and remain secured until the conclusion of construction, at which time the securing mechanism/s will be removed. Any methods to secure the heritage item will be reversible and not cause damage to the item.	Pre- construction and construction	4
Impacts on item 17: Harwood tram tracks, Harwood	HH22	HH21	The Petticoat Lane tram tracks section will have a protective covering placed over them, (eg a geo textile fabric and heavy duty metal sheeting or similar) to minimise impacts from construction in the area. The covering will be secured before construction and will remain in place until the end of construction.	Pre- construction and construction	5
Impacts to item 20: Harwood Bridge, Harwood	HH23	HH22	The design of the new bridge will be undertaken in accordance with Bridge Aesthetics: Design Guidelines to Improve the Appearance of Bridges in NSW Roads and Maritime 2012 with specific reference to section 6.1, New bridges next to existing bridges.	Pre- construction	5

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Impacts on item 21: Convent, Harwood	HH24	HH23	An archival photographic recording will be made of the convent building and its surrounds in accordance with the Heritage Branch guidelines How to Prepare Archival Records of Heritage Items (NSW Heritage Office, 1998) prior to its removal or relocation.	Pre- construction	5
	HH25	HH24	The feasibility of relocating the building to an appropriate site within the Harwood Heritage Conservation Area will be investigated. The investigation will be undertaken in consultation with an appropriately qualified house removal contractor and an appropriately qualified heritage consultant.	Pre- construction	5
Impacts on item 34 Townsend Residence, Townsend	HH26	HH25	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	5
Impacts on New Italy Settlement (State Heritage Register 1648), New Italy Museum Complex (item 23: New Italy Settlement sites, New Italy)	HH27	HH26	A photographic condition survey will be undertaken of the current condition of the heritage items with any damage to the item from construction to be repaired once construction is complete.	Pre- construction and construction	7
	HH28	HH27	Monitoring of dust will be undertaken at this location in accordance with the project dust management plan.	Pre- construction and construction	7
	HH29	HH28	A temporary fence will be erected between the State Heritage Register boundary and the construction works before work starts in the vicinity of the heritage item. The fence will remain in place until construction is completed at which time it be removed.	Operational	7
	HH30	HH29	Appropriate directional signage to the New Italy Museum Complex will be installed at both the interchange at Woodburn and interchange at Iluka Road to divert visitors onto the service road in order to access the museum complex. Signage will comply with relevant Pacific Highway signage policy.	Operation	7
Impacts on New Italy Memorial and Stone-lined well (item 23: New Italy Settlement sites, New Italy)	HH31	HH33	Monitoring of dust will be undertaken at this location in accordance with the project dust management plan.	Pre- construction and construction	7
	HH32	HH34	A temporary fence will be erected between the location of the memorial and flagpole and the construction works (within five metres of the heritage items) before work starts in the vicinity of the heritage item. The fence will remain in place until conclusion is completed at which time it will be removed.	Pre- construction and construction	7
Impacts on Roder's stone-lined well and orchard (item 23: New Italy Settlement sites, New Italy)	HH33	HH35	Salvage excavation will be undertaken to salvage any subsurface artefacts related to the well and adjacent wall. Excavations will be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist and in accordance with the Heritage Branch guidelines, including an appropriate research design and methodology to best realise the research potential of this area of the site. Consideration will be given to providing salvaged artefacts to the New Italy Museum.	Pre- construction and construction	7
	HH34	HH36	Before construction starts in the vicinity of the orchard, the location and condition of each of the mango trees will be recorded by an arborist.	Pre- construction and construction	7
	HH35	HH37	Protective barrier fencing to protect the mango orchard will be erected between the construction area and the trees with a buffer of at least five metres. This will be erected before construction starts in the	Pre- construction	7

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			vicinity of the items and remain in place until the end of construction at which time it will be removed.	and construction	
	HH36	HH38	An archival photographic recording will be made of the mango orchard and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its demolition.	Pre- construction	7
Impacts on Historic New Italy Village Area	HH37	HH39	If any historical heritage remains are discovered at the New Italy Village Area during construction, management measure HH1 will be applied.	Pre- construction and construction	7
Impacts on item 26, Broadwater	HH38	HH40	An archival photographic recording will be made of the buttery/creamery, the dairy and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to demolition.	Pre- construction	9
	HH39	HH41	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	9
	HH40	-	Further investigations for gold shafts within and adjacent to the project corridor will occur near item 26.	Pre- construction	9
Impacts on item 27: Meerschaum Vale brickworks, Wardell	HH41	HH42	If brick material or any other historical heritage remains are discovered during works, management measure HH1 will be applied.	Construction	10
Impacts on item 28, Broadwater	HH42	HH43	An archival photographic recording will be made of the stone quarry and small clay pit in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to construction.	Pre- construction	9
	HH43	HH44	Salvage excavations to the south of the quarry will be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist. Salvage excavation will be undertaken in accordance with the Heritage Branch guidelines including an appropriate research design and methodology to best realise the research potential of this area of the site.	Pre- construction	9
	HH44	HH46	A photographic condition survey and structural audit of the brick-lined well will be undertaken of the current condition of the heritage item with any damage to the item from construction to be repaired once construction is complete.	Pre- construction	9
	HH45	HH47	Should blasting be required in the vicinity of this item, a detailed assessment of the level of vibration at the brick-lined well will be undertaken based on factors including distance from the blast site and the quantity of the explosive, and modelling of the predicted vibration levels. This assessment may result in additional mitigation measures for the structure including, but not limited to: <ul style="list-style-type: none"> • Construction of temporary or permanent supports or shoring within the brick-lined well. 	Pre- construction and construction	9

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
			<ul style="list-style-type: none"> Stabilisation of the brick-lined well. Installation of vibration monitoring devices. 		
	HH46	HH48	Protective barrier fencing will be erected around the brick-lined well with a 15-metre buffer before the start of construction and will remain in place until the conclusion of the work, at which time it will be removed.	Pre- construction and construction	9
	HH47	HH49	Due to the proximity of the well to the roadway, the well may be closed for safety reasons. Any measures to close the well will enable access in the future for heritage research or other purposes and that no detrimental physical impact on the well occurs.	Construction	9
Impacts on item 29: 'Stonehenge' Property, Wardell	HH48	HH50	An archival photographic recording will be made of the main residence and the drainage system and its surrounds in accordance with the Heritage Branch guidelines How To Prepare Archival Records Of Heritage Items (NSW Heritage Office, 1998) prior to its demolition. A detailed survey and recording of the location of the drainage system within the 'Stonehenge' property will also be undertaken.	Pre- construction	10
	HH49	HH51	Architectural noise treatment to the house will be investigated and provided where reasonable and feasible and in consultation with a qualified heritage consultant. Consideration will be given for the need to revise the SOHI for this item when the specific architectural noise treatment options are identified.	Pre- construction	10
Impacts on item 38: Cemetery reserve	HH50	HH52	To protect the heritage item from construction activities, the boundary of the reserve will be clearly identified on site/construction plans as an area of exclusion, and temporary barrier fencing will be constructed continuously along the project boundary: <ul style="list-style-type: none"> Immediately south of the cemetery reserve. Where it crosses the south east corner of the cemetery reserve. Where it follows the east boundary of the cemetery reserve. 	Pre- construction and construction	9
Impacts on Item 33: High Conservation Value Old Growth Forest	HH51	HH53	Detailed design will consider the extent to which clearing High Conservation Value Old Growth Forest within the project boundary may be minimised.	Pre-construction	2, 6 and 7
	HH52	HH54	The area to be cleared will be clearly identified on-site. High Conservation Value Old Growth Forest adjacent to areas to be cleared will be delineated to avoid accidental disturbance on further areas.	Construction	2, 6 and 7
Impacts on Item 43: Drainage channels, Broadwater	HH53	-	An archival photographic recording be made of the drainage channels and its surrounds in accordance with the Heritage Branch guidelines prior to its destruction.	Pre-construction	10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Traffic and transport					
Construction traffic management	T&T1	T&T1	<p>Construction traffic management plans will be prepared and implemented for work sites. They will include:</p> <ul style="list-style-type: none"> • Identification of all public roads to be used by construction traffic. • Management methods to direct construction traffic to use identified roads. • Identification of all public roads that may be partially or completely closed during construction, and the expected timing and duration of closures. • Details on likely impacts on existing traffic (including pedestrians, vehicles, cyclists and disabled persons). • Temporary traffic arrangement measures, including property access. • Details on access to construction sites, including entry and exit locations, and measures to prevent construction vehicles queuing on public roads. • A response plan for any incident involving construction traffic. • Mechanisms for monitoring, reviewing and amending the success of the plans. <p>The traffic management plans be prepared in consultation with councils.</p>	Pre-construction and construction	All
Bulk earthworks haulage	T&T2	T&T2	<p>A strategy will be prepared for bulk earthworks haulage between the crossing of the Richmond River and the interchange at Wardell. The strategy will seek to maximise the extent of haulage within the project boundary and limit the need to haul material through the town of Wardell.</p>	Pre-construction and construction	10
Inspection of roadwork traffic schemes	T&T3	T&T3	<p>Traffic control schemes will be inspected as follows:</p> <ul style="list-style-type: none"> • Pre-start and pre-closedown inspections of short-term traffic controls. • Weekly inspections of long-term traffic controls. • Night-time inspections of long-term traffic controls. 	Construction	All
Vehicle movement	T&T4	T&T4	<p>Vehicle movement plans and haulage route plans will be prepared. Drivers will be briefed on these vehicle movement plans during project induction.</p> <p>Deliveries be planned to occur outside peak traffic periods, where possible.</p> <p>To minimise queuing of construction vehicles on the highway, site personnel use two-way radios to call up haulage trucks from layover areas on a 'just in time' basis.</p>	Construction	All
Road occupancy	T&T5	T&T5	<p>Applications for Road Occupancy licences will be submitted to Roads and Maritime Services and the relevant council at least 10 working days prior to proposed occupancy.</p>	Pre-construction and construction	All
Road damage	T&T6	T&T6	<p>Pre-construction road dilapidation reports will be prepared for all roads likely to be used by construction traffic.</p> <p>Post-construction road dilapidation reports will be prepared following the completion of construction for all roads assessed prior to construction.</p> <p>Dilapidation resulting from construction activity will be repaired.</p> <p>Copies of road dilapidation reports will be sent to the relevant roads authority.</p>	Pre-construction and construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Property and road access	T&T7	T&T7	Access be maintained to properties during construction including, where necessary and feasible, temporary alternative access unless otherwise agreed with property owners. Where any legal access is permanently affected, alternative access to an equivalent standard to and from a public road will be provided where a property has no other legal means of access and where such alternative access is feasible and practical. Where alternative access arrangements are not feasible or practical and a property is left with no access to a public road, negotiations will be undertaken with the relevant property owner for acquisition of the property in accordance with the provisions of the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> .	Construction	All
Bus services	T&T8	T&T8	Where changes in access affect bus stop locations, temporary alternatives will be provided in conjunction with bus operators and affected schools to maintain access during construction.	Construction	All
Access to State forests	T&T9	T&T9	Where access to State forest land is affected during construction, a new access route will be provided in consultation with the Department of Primary Industries (Forests NSW).	Construction	All
Maritime traffic	T&T10	T&T10	Where maritime traffic access to the Clarence and Richmond rivers is affected during construction of bridge crossings, appropriate signage will be provided indicating alternative means of access and the timing of the works.	Construction	5 and 10
Waterway access	T&T11	-	Access to the Clarence and Richmond rivers will be maintained for industry and recreational waterway users.	Construction	5 and 10
Access and connectivity	T&T12	T&T13	Access to Glenugie State Forest around the interchange at Eight Mile Lane and Lookout Road will be further reviewed in consultation with State Forest Corporation.	Pre-construction and construction	3
	T&T13	T&T15	The layout of the intersection at Yamba Road will be reviewed to better meet the needs of truck movements from Harwood Mill, where reasonable and feasible.	Pre-construction	5
	T&T14	T&T17	The need for a full interchange at Yamba Road will be investigated should traffic growth warrant it in the future and when funding is available.	Pre-construction	5
	T&T15	T&T18	The need for a full interchange with south facing ramps at Watts Lane, Harwood will be investigated should traffic growth warrant it in the future and when funding is available.	Pre-construction	5
	T&T16	T&T19	The need for the overpass and the arrangement of local access at Chatsworth Road will be reviewed at the detailed design stage depending on specific staging and delivery of the highway.	Pre-construction	5
	T&T17	T&T20	The need for the overpass and arrangement of local access at Carrols Lane will be reviewed at the detailed design stage depending on specific staging and delivery of the highway.	Pre-construction	5
	T&T18	T&T16	Connectivity between the shared user path from Harwood Bridge to Yamba Road would be reviewed to refine pedestrian and cyclist access	Pre-construction	5

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Noise and vibration					
Construction noise					
Noise	CNV1	CNV1	Affected receivers will be notified prior to the commencement of out of hours work. Notification includes contact details of project personnel in charge of the out of hours works.	Construction	All
Noise	CNV2	CNV2	Construction will be timetabled to minimise noise impacts where feasible and reasonable. This may include time and duration restrictions and respite periods. These measures will be considered after consultation with affected receivers.	Construction	All
Noise	CNV3	CNV3	Haulage routes will be located as far away as possible from residential receivers, where this is reasonable and feasible.	Construction	All
Noise	CNV4	CNV6	Equipment will be maintained in efficient working order.	Construction	All
Noise	CNV5	CNV7	Quieter construction methods will be used, where there are sensitive receivers potentially affected and where this is considered reasonable and feasible. These may include grinding, rock splitting or terrain levelling instead of hydraulic rock breaking.	Construction	All
Noise	CNV6	CNV8	Where acceptable from a work health and safety perspective, quieter alternatives to reversing alarms (such as spotters, closed circuit television monitors and 'smart' reversing alarms) will be used, particularly during night-time activities.	Construction	All
Noise	CNV7	CNV9	All noise complaints received will be dealt with promptly. Construction methods may need to be altered to reduce noise impacts at the affected locations.	Construction	All
Noise	CNV8	CNV10	Machinery will not be turned on prior to the work hours outlined in this EIS. This will include daily maintenance activities and/or 'warming up' of engines.	Construction	All
Noise	CNV9	CNV11	Truck movements will be restricted to identified haulage routes and the routes outlined in the Construction Traffic Management Plan.	Construction	All
Noise	CNV10	CNV12	Where it has been identified as necessary (eg in response to community complaints), noise monitoring will be undertaken to check that the noise mitigation measures are effective.	Construction	All
Noise	CNV11	CNV13	The use of temporary noise shielding will be considered at locations where substantial exceedances of noise criteria are predicted.	Construction	All
Noise	CNV12	CNV14	Static noise sources, such as generators, pumps and lighting towers, will be located as far as possible from sensitive receivers.	Construction	All
Noise	CNV13	CNV15	Regular noise monitoring will be undertaken during proposed construction hours at a representative receiver location, between: <ul style="list-style-type: none"> • 6am to 7pm, Monday to Friday. • 8am to 5pm, Saturday. 	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Noise	CNV14	CNV16	The selection of plant and equipment will be based on noise emission levels. This equipment will be operated and maintained so that noise emissions are minimised.	Construction	All
Vibration	CNV15	CNV17	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any structure or service, a building condition survey will be conducted and preliminary vibration monitoring undertaken by a qualified contractor.	Construction	All
Vibration	CNV16	CNV18	Where piling, hydraulic hammering or dynamic compaction is proposed within 50 metres of any heritage structure or potentially structurally unsound service, a building condition survey will be conducted and preliminary vibration monitoring undertaken by a qualified contractor. A follow-up survey will be conducted in response to any vibration complaints.	Construction	All
Vibration	CNV17	CNV19	Appropriately sized equipment will be selected to minimise vibration emissions, where required.	Construction	All
Blasting (controlled)	CNV18	CNV20	A blast management plan will be prepared prior to the start of blasting activities.	Pre-construction	All
Blasting (controlled)	CNV19	CNV21	Where sensitive receivers are located close to the blast site, a series of trials will be undertaken at a reduced scale to determine site-specific blast response characteristics, to define allowable blast sizes to occur within the criteria.	Construction	All
Blasting (controlled)	CNV20	CNV22	Controlled blasting activities will only be undertaken between the hours of: <ul style="list-style-type: none"> 9am to 5pm, Monday to Friday. 9am to 1pm, Saturday. These times may be increased with the written agreement of affected residents. Where the blast management plan has identified potential impacts on sensitive receivers, these hours will be subject to change.	Construction	All
Blasting (controlled)	CNV21	CNV23	A minimum of 24 hours' notice will be provided to all residences located within 500 metres of any blast, including an indication of blasting times and a contact name and telephone number.	Construction	All
Construction Blasting (controlled)	CNV22	CNV24	Monitoring of overpressure and vibration levels will be undertaken for each blast at the potentially most affected receivers.	Construction	All
Blasting (controlled)	CNV23	CNV25	A building condition survey will be undertaken for all buildings located within 200 metres of the proposed blasting area prior to the start of blasting. The proponent will be responsible for rectifying any damage occurring from the blasting, with the cost to be borne by the proponent.	Construction	All
	CNV24	-	Should blasting be required within 200 metres of the water reservoirs at the Lang Hill borrow source, a dilapidation or preconstruction condition survey will be undertaken before blasting work commences in consultation with Richmond Valley Council and Rous Water.	Construction	8
Blasting (controlled)	CNV25	CNV26	The maximum instantaneous charge (MIC) will be reduced to the lowest possible level by the use of delays, reduced diameter holes, and/or deck loading.	Construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Blasting (controlled)	CNV26	CNV27	Adequate stemming will be provided and exposed detonating cord be eliminated (by covering with at least 300 millimetres of quarry dust or road base).	Construction	All
Blasting (controlled)	CNV27	CNV28	Secondary blasting will be eliminated. (A rock breaker or drop hammer will be used instead of popping). Effort will be made to eliminate the need for toe shots (eg by better control of drill patterns).	Construction	All
Blasting (controlled)	CNV28	CNV29	Weather conditions at the time of the blast will be assessed. Blasting will be avoided where possible during heavy cloud cover and/or if a strong wind is blowing towards residences. Days of severe temperature inversion will be avoided where possible or, (if not possible) blasting will occur between 11am and 1pm.	Construction	All
Blasting (controlled)	CNV29	CNV30	Strict control will be exercised over the spacing and orientation of all blast drill holes. Holes will be spaced in such a manner that the explosive force is just sufficient to break the stone to the required size.	Construction	All
Blasting (controlled)	CNV30	CNV31	Controlled blasting times will be determined in consideration of site-specific conditions and in consultation with affected residents and take place, where possible, when impacts are likely to be the least intrusive (eg all blasts be fired at a set time acceptable to residents and preferably when the background noise is highest).	Construction	All
Consultation	CNV31	CNV32	<p>Identified receivers will be notified by letter of the proposed hours and asked for comment and feedback. This will include justification for the proposed extended working hours along with the benefits the community can expect.</p> <p>Where the community or individual residents wish to receive further clarification on the proposed hours, individual interviews or public meetings will be organised to address any further issues. Discussions will be sufficiently detailed to provide a general summary of the expected impacts but also how this relates to individual receivers. At this stage, more detail will be available regarding the proposed construction activities to be undertaken in the extended hours.</p> <p>Property owners will be provided with the complaints management procedures to be in place for extended working hours.</p> <p>Feedback will be collected to help determine the final adopted working hours for the project, with community consultation continuing throughout the project.</p>	Pre-construction	All
Operation noise					
Road traffic noise	ONV1	ONV1	Architectural treatments will be considered for noise-affected receivers identified in the EIS and Submissions / Preferred Infrastructure Report (Appendix F), subject to confirmation at the detailed design stage.	Pre-operation	All
Road traffic noise	ONV2	ONV2	Low noise wearing surface will be implemented in areas identified in section 5.3.21 of the EIS.	Pre-operation	1,3,4,5,8, and 10

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Road traffic noise	ONV3	ONV3	No later than one year after commencement of operation of the project stages as they are constructed, Roads and Maritime will undertake operational noise monitoring to compare the actual noise performance of the project against predicted noise performance. The report will include, but not necessarily be limited to: <ul style="list-style-type: none"> Noise monitoring to assess compliance with the operational noise levels predicted. A review of the operational noise levels in terms of criteria and noise goals. Methodology, location and frequency of noise monitoring undertaken. Details of any complaints and enquiries received in relation to operational noise. Any required recalibrations of the noise model. An assessment of the performance and effectiveness of applied noise mitigation measures. Any additional feasible and reasonable measures required. 	Post-operation	All
Land use and property					
Property acquisition and managing surplus land	LU1	LU1	Ongoing communication and consultation will be undertaken with directly affected property owners about the property acquisition process. This includes the provision of information on the timing of acquisitions, and the process for property acquisitions under the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> and Roads and Maritime' Land Acquisition Policy (RTA, 1999).	Pre-construction	All
	LU2	LU2	Ongoing consultation will be undertaken with directly affected property owners during the detailed design phase to identify measures to mitigate potential impacts on the use and viability of land. This will relate to matters such as adjustments to fencing, access, farm infrastructure and relocation of impacted ancillary structures, as required.	Pre-construction	All
Fencing Strategy	LU3	LU3	Property adjustments will be completed for fencing, access tracks, cattle underpasses and other farm infrastructure in consultation with the impacted land owner.	Pre-construction	All
	LU4	-	The Fencing Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).	Pre-construction	All
Property acquisition and managing surplus land	LU5	LU4	Sterilisation and severance of land uses and lots will be minimised by amalgamating severed parcels of land together, where possible, with provision of road access, in accordance with the project's remnant land use strategy.	Pre-construction	All
	LU6	LU5	Where required, acquisition of State forests will be minimised in accordance with the provisions of the <i>Forestry Act 2012</i> . Revocation of land dedicated or reserved as national parks or nature reserves will be in accordance with the <i>National Parks and Wildlife Act 1974</i> . Acquisition of land owned by Local Aboriginal Land Councils will be in accordance with the provisions of the <i>Aboriginal Land Rights Act 1983</i> .	Pre-construction	All
	LU7	LU6	A remnant land strategy to minimise land use severance and sterilisation, and a mitigation strategy for final land uses will be developed in consultation with cane industry stakeholders, Coffs Harbour City, Clarence Valley, Richmond Valley and Ballina Councils.	Pre-construction	All

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
	LU8	-	The requirement for a retaining wall structure at station 83.2, between the road reserve and adjoining property, will be confirmed during detailed design.	Pre-construction	5
Property access during construction	LU9	LU7	Access to properties near construction works will be maintained, including where required for the movement of farm equipment and livestock between properties, unless otherwise agreed with landowners.	Construction	All
	LU10	LU8	Where temporary changes to property access are required during construction, alternative access will be determined in consultation with affected property owners and tenants.	Construction	All
	LU11	LU9	There will be ongoing communication with local communities about changes to the local road network, including likely delays and disruptions and alternative accesses if required.	Construction	All
Construction impacts to primary industry, including forestry, and agriculture uses	LU12	LU11	Where possible, onsite reuse of any spoil is the preferred solution for managing the impacts, although alternative options for the reuse or disposal of spoil will be identified in the surplus material management plan.	Construction	All
	LU13	-	The management of surplus material will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of the Submissions and Preferred Infrastructure Report (Roads and Maritime, 2013).	Pre-construction	All
	LU14	LU12	Forestry Corporation of NSW will be able to harvest millable timber in affected State forests prior to works commencing. However, consideration will also be given to opportunities for the productive use of trees removed from non-State forest areas of the project, including ancillary facilities where necessary.	Construction	All
	LU15	LU13	Environmental management measures will be implemented to minimise potential for impacts on adjoining agricultural uses, including from changes in water quality and spread of weeds and pests.	Construction	All
	LU16	LU14	Where pesticides are required during construction, implement appropriate environmental management measures to avoid potential impacts on adjoining agricultural properties.	Construction	All
	LU17	LU15	There will be ongoing consultation and communication with managers of agricultural properties to identify any potential impacts on nearby construction workers from farm operations (ie use of pesticides on agricultural properties).	Construction	All
	LU18	LU16	Ongoing consultation and communication will be undertaken with commercial fishing and relevant aquaculture operators about construction activities within and near the Clarence and Richmond rivers. Stakeholders include the estuary prawn trawl fishery, and estuary general fishery within the Clarence River, the NSW Department of Primary Industries (Fisheries) and licensed fishing interests within the Richmond River regarding the timing and duration of construction, potential impacts (including changes to river access) and proposed mitigation measures.	Construction	All
Utilities and infrastructure	LU19	LU17	Relocation or adjustment of infrastructure will be planned to minimise disruptions and impacts on surrounding properties.	Construction	All
	LU20	LU18	Communication will be undertaken with nearby communities about the timing and duration of potential disruptions to infrastructure.	Construction	All

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Property management	LU21	LU19	Roads and Maritime' land that is required for the project will be appropriately maintained. This will be undertaken by regional Roads and Maritime officers or a designated local authority. Roads and Maritime manage the leasing and maintenance of property identified as suitable for tenants.	Operation	All
	LU22	LU20	Excavation works near Lot7008 DP92609 will be carefully managed in consultation with Richmond Valley Council to minimise potential impacts on any unknown heritage items including potential burials.	Construction	9
Operational impacts to primary industries	LU23	LU21	Ongoing consultation will be undertaken with owners of agricultural properties affected by the project – through acquisition, changes to local access or fragmentation of properties – about potential impacts on farming operations and potential measures to manage or mitigate identified impacts.	Operation	All
	LU24	LU22	Consultation with Forestry Corporation will be undertaken regarding access to and within State forests where required, in accordance with the <i>Forestry Act 2012</i> .	Operation	All
	LU25	LU23	Consultation with Forestry Corporation will be undertaken regarding the relocation of fire trails directly impacted by the project's construction or operation.	Operation	All
Cane Farm Strategy	LU26	LU25	The Cane Farm Strategy will be further developed during detailed design, in consultation with relevant stakeholders. This will build upon the principles of the strategy described in Chapter 3 of this Submissions and Preferred Infrastructure Report.	Pre-construction	All
Property access	LU27	LU26	As far as possible, property accesses will be reinstated or new access provided, in consultation with impacted landowners.	Operation	All
	LU28	-	Access to national parks and nature reserves will be reinstated in consultation with the relevant department in Office of Environment and Heritage.	Operation	All
Mining and petroleum production	LU29	LU28	Consultation will be undertaken with land owners operating quarries adjacent to the project, including those near Tucabia, Broadwater and Bagotville, and relevant NSW State government agency. Consultation aim to identify appropriate management measures for each affected quarry, particularly regarding operational approvals in terms of site access, extraction limits, blasting limits, and timing of works, noise and vibration.	Pre-construction	3, 9 and 10
	LU30	LU29	Consultation will be undertaken with the relevant State Government agency to consider any future coal seam gas production in the vicinity of the project.	Pre-construction	All
Utilities and infrastructure	LU31	LU30	Consultation will be undertaken with service and utility providers to verify locations, impacts and any relocation or construction protection work required.	Operation	All
	LU32	-	Consultation will be undertaken with Rous Water and local Aboriginal stakeholders before the removal of part or any of the abandoned pipelines through Lang Hill will be undertaken in consultation	Pre-construction	8
	LU33	LU31	Consultation will be undertaken with Richmond Valley Council during the detailed design phase, regarding the location and timing of the Broadwater Sewerage Scheme rising pump station, located off Broadwater-Evans Head Road.	Pre-construction	9

Issue	ID number	Previous number	Environmental management measure	Timing	Relevant section
Social and economic					
Consultation	SE1	SE1	Consultation will be undertaken with local business owners, industry and tourism operators directly affected by construction and located closest to construction works. The focus will be on the timing, duration and likely impact of construction activities, to identify appropriate measures to manage potential impacts.	Pre-construction and construction	All
	SE2	SE2	Consultation will be undertaken with managers of community services and facilities near the proposed construction works, to ensure that potential impacts are appropriately managed.	Pre-construction and construction	All
	SE3	SE3	Consultation will be undertaken with residents and local communities closest to construction works about construction activities, including timing, duration and likely impacts.	Pre-construction and construction	All
By-passed towns	SE4	SE4	Signage will be implemented for bypassed towns in accordance with Roads and Maritime signage guidelines and in consultation with relevant councils. Signage on the project will identify bypassed townships (Grafton, Ulmarra, Tyndale, Maclean, New Italy, Woodburn, Broadwater and Wardell) as places for 'stopovers' for fuel, supplies and short term accommodation, to support demand for goods and services within these townships.	Construction and operation	All
	SE5	SE5	Roads and Maritime will work with Councils affected by the upgrade, where relevant, to support strategies by local councils and/or chamber of commerce and industry to promote townships and villages as stopovers for tourist.	Construction and operation	All
Existing Pacific Highway	SE6	-	Roads and Maritime will work with Councils affected by the upgrade, during detailed design, to discuss the classification of the existing Pacific Highway and, where appropriate, the required transfer process of state road assets to Council.	Pre-construction	All
Access and connectivity	SE7	SE6	Maintain access to properties near to the project during construction, including, where required, for the movement of farm equipment and livestock between properties, and for access to the Berry Exchange and other affected agribusinesses.	Construction	All
	SE8	SE7	Where temporary changes to property access are required during construction, alternative access will be determined in consultation with affected property owners and tenants.	Construction	All
Access and Connectivity	SE9	SE9	Undertake consultation with the Harwood Island Public School and other community facilities located adjacent to the project about proposed changes to local access.	Operation	All
	SE10	SE10	Undertake early and ongoing communication and consultation with emergency services to allow planning for potential changes to response patterns and input into the design development.	Operation	All
	SE11	SE14	Access to Broadwater mill land between MacDonalds Street and River Road will be reviewed at the detailed design stage.	Pre-construction	9
	SE12	SE15	The access arrangements for local traffic at Whytes Lane and the tie into the Ballina bypass upgrade will be reviewed together with any potential boundary refinements at the detailed design stage.	Pre-construction	11

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Greenhouse gas emissions					
Embodied carbon in concrete production	GH1	GHG2	Flyash content within concrete will be specified where feasible. Contractors will be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Pre-construction and construction	All
Re-use of excavated road materials	GHG2	GHG3	Reuse of excavated road materials will be maximised as far as possible where they are cost, quality and performance competitive to reduce use of materials (with embedded energy).	Pre-construction and construction	All
Embodied carbon in steel	GHG3	GHG4	Steel with high recycled content will be specified where feasible where they are cost, quality and performance competitive. Contractors will be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Pre-construction and construction	All
Carbon in fuel	GHG4	GHG5	The feasibility of using biofuels (biodiesel, ethanol, or blends such as E10 or B80) will be investigated by the contractor, taking into consideration the capacity of plant and equipment to use these fuels, ongoing maintenance issues and local sources. Works will be planned to minimise fuel use.	Construction	All
Energy consumption: construction	GHG5	GHG6	An energy management plan will be developed during the construction of the project. The plan will include a commitment to monitor on-site energy consumption and identify and address on-site energy waste.	Pre-construction and construction	All
Energy consumption: operation	GHG6	GHG7	Roads and Maritime will investigate the use of LED lighting in place of incandescent lamps as part of the project's detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives will have to meet lighting standards for major roads.	Pre-construction	All
Education	GHG7	GHG8	An education program will be developed and delivered to the construction personnel to promote energy-efficient work practices.	Construction	All
Air quality					
Air quality management during construction	AQ1	AQ2	<p>An air quality management plan will be prepared and implemented by the contractor during construction to mitigate dust. The air quality management plan will address all aspects of construction including spoil handling, machinery operating procedures, soft soil treatments, stockpile management, traffic management, haulage, dust suppression and monitoring. The following dust mitigation measures will be used on-site and included as part of the management plan:</p> <ul style="list-style-type: none"> • Covering materials transported to and from construction sites. • Covering or spraying water on stockpiles of soil or other potential dust generating materials, particularly during dry or windy conditions. • Temporarily seed and stabilise temporary stockpiles that are planned to be in place for long periods. • Imposing speed limits for vehicles and equipment travelling on unsealed surfaces. • Minimising the extent of disturbed areas as far as practicable. This will be achieved by staging the works to minimise the number of disturbed areas at any one time. 	Construction	All

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			<ul style="list-style-type: none"> Progressively rehabilitating disturbed areas as soon as practicable. Suppressing dust on unsealed surfaces, temporary roadways, stockpiles and other exposed areas using water trucks, hand held hoses, temporary vegetation and other practices. Modifying or stopping dust generating activities during very windy conditions. Installing wheel wash facilities at appropriate locations to reduce tracking of mud and soil off-site. Monitoring air quality, both visually, using instrumentation and/or depositional dust gauges, near representative sensitive receptors to verify the effectiveness of controls. Amend controls where necessary to minimise any impacts identified through monitoring, consider the use of mitigation measures (such as covers) where dust is impacting water tanks or other drinking water sources, and cannot be controlled at the dust source. 		
Waste management					
Sustainable management of resources	WM1	WM1	The cut-and-fill balance of the project will be further refined to obtain as much material as possible for reuse on the project.	Pre-construction	All
	WM2	WM2	<p>A resource management strategy will be prepared for construction of the project to identify the hierarchy for sourcing and use of resources. It include the following provisions:</p> <ul style="list-style-type: none"> Available project cutting material (including Select Material Zone (SMZ) and verge material) will be used for the construction of embankments, SMZ and verge within that section to the extent that it is suitable. Project sections with a deficit in material import surplus material from other project sections in preference to external sources. Where possible, the distances that earthworks materials are moved across the project as a whole be minimised, notwithstanding the above two requirements. Contractors will reduce the amount of unsuitable waste generated during excavations, where feasible (eg treatment at source). The generation and management of unsuitable material during project earthworks will be monitored to ensure appropriate management of the issue. <p>The resource management strategy will also identify:</p> <ul style="list-style-type: none"> Details on materials that be sourced from the project (including location and type). Viable material suppliers (including water) near the project. Proposed sustainable material sources practices (such as use of recycled materials or wastewater). Materials that could be recycled and re-used on-site or transferred to other project sections. 	Pre-construction and construction	All
Minimising construction waste	WM3	WM3	A waste register will be maintained by each contractor, detailing types of waste collected, amounts, date, time, and details of disposal.	Construction	All
	WM4	WM4	Where possible, materials will be bought in bulk to minimise the amount of package required. Sources	Construction	All

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			of material that have sustainable packaging design, recycled and recyclable packaging will be favoured over other material sources where cost effective.		
	WM5	WM5	Waste material generated on-site (including chemical, fuel and lubricant containers, and solid and liquid wastes) will be classified and disposed of in accordance with the Protection of the <i>Environment Operations Act 1997</i> and Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009).	Construction	All
	WM6	WM6	Waste minimisation and management measures will be developed based on the principles in the <i>Waste Avoidance and Resource Recovery Act 2001</i> , the NSW Government's Waste Reduction and Purchasing Policy, and waste exemptions including: <ul style="list-style-type: none"> • Excavated Natural Material Exemption (EPA, 2008)). • Excavated Public Road Material Exemption (EPA, 2012)). • Raw Mulch Exemption (EPA, 2008). • Reclaimed Asphalt Pavement Exemption (EPA, 2012). • Recovered Aggregate Exemption (EPA, 2010). • Stormwater Exemption (EPA, 2008). • Treated Drilling Mud Exemption (EPA, 2011). Measures seek to avoid, minimise, re-use, recycle, treat or dispose of waste streams during construction and address transport and disposal arrangements.	Construction	All
	WM7	WM8	Millable timber will be harvested for reuse off site. All other felled timber will be reused on-site in the form of habitat recreation or mulch in landscaping and erosion and sedimentation controls. Where mulch cannot be reused on-site, consideration will be given to making the mulch available to the public in accordance with the Roads and Maritime Environmental Direction 25 (2012) and the Raw Mulch Exemption (EPA, 2008).	Construction	All
	WM8	WM9	Sediment removed from sedimentation basins will be used, where appropriate, on-site in landscaping and/or flattening of batters.	Construction	All
	WM9	WM11	Where feasible, the contractor will be required to re-use materials. This could include, but is not limited to, concrete formwork or surplus concrete pours.	Construction	All
	WM10	WM12	Site inductions and on-site training will be required to include waste minimisation principles and measures.	Construction	All
	WM11	WM13	At site compounds, on-site recycling facilities will be provided for recycling paper, plastic, glass and other re-useable materials.	Construction	All
	WM12	WM14	Regular visual inspections will be conducted to ensure that work sites are kept tidy and to identify opportunities for reuse and recycling.	Construction	All

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Management of waste water	WM13	WM15	Water captured in excavations will be required to be either: <ul style="list-style-type: none"> • Managed in accordance with the construction Soil and Water Management Plan. • Transferred to a licensed sediment basin, treated and discharged in accordance with any licence conditions that apply to the discharge of water, or, • Re-used for construction water or dust suppression. 	Construction	All
Management of operational wastes	WM14	WM17	Appropriate waste and recycling facilities will be provided at rest areas and heavy vehicle checking stations.	Operation	All
	WM15	WM18	All operational waste will be managed in accordance with the Roads and Maritime waste management procedures and Environmental Management System.	Operation	All
	WM16	WM20	Collection and removal of roadside litter will be undertaken in accordance with the Roads and Maritime Environmental Management System.	Operation	All
	WM17	WM21	Sediment removed from operational water quality basins will , where appropriate, be classified in accordance with the Waste Classification Guidelines (DECCW, 2009), and be disposed of in accordance with the <i>Protection of the Environment Operations (Waste) Regulation 2005</i> .	Operation	All