Roads and Traffic Authority of NSW

Oxley Highway to Kempsey
Upgrading the Pacific Highway

Environmental Assessment

MAIN VOLUME

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7. Construction of the Proposal

This chapter describes the construction aspects of the Proposal, including options for the contractual arrangements for construction delivery, issues to be addressed during detailed design and an indicative construction methodology.

The Director-General's environmental assessment requirements require a detailed description of the Proposal. **Table 7-1** indicates where the aspects of the Director-General's environmental assessment requirements that relate to the description of the Proposal are addressed, either in this chapter or in other chapters (in *italics*).

Table 7-1 Detailed description of the Proposal

Environmental assessment requirements	Where addressed
A **detailed description** of the Project including:	*Chapter 6 The Proposal*
• Route alignment and corridor width.	*Chapter 6 The Proposal*
• Design elements (e.g. requirements for LOS, pedestrian and cyclists, rest areas and service centres etc).	*Chapter 6 The Proposal*
• Differentiate the limits of the Project with respect to the existing Pacific Highway, including operational/ maintenance responsibilities.	*Chapter 6 The Proposal*
• Potential staging.	**Section 7.3**
• Ancillary facilities (e.g. compound site, batching plants etc).	**Section 7.6**
• Resourcing (e.g. construction material needs, spoil disposal, natural resource consumption including water).	**Sections 7.4.1**, **7.4.3**, **7.4.4** and **7.5**

7.1 Proposal delivery

Subject to approval and the Chief Executive of the RTA deciding that the Proposal should proceed, the most appropriate delivery method would be identified by the RTA. Procurement models may include:

- A conventional detailed design contract, followed by a separate construction contract. A competitive tendering process to select a suitable contractor would be undertaken for both the final design and subsequent construction phases.
- Detailed design and construction awarded through a competitive tendering process to select a contractor and its nominated design team.
- Detailed design, construct and maintain, where the construction contractor is also responsible for maintenance for a nominated period.
- An alliance contract where the RTA would formally partner with a selected contractor/s and design consultancy firm/s to be jointly responsible for detailed design and construction.

The Proposal concept design and environmental assessment were not predicated on any particular contract packaging, procurement model or construction method. Subject to approval, the RTA would consider the options for delivery, and select and implement the most suitable procurement model in compliance with this Environmental Assessment and the conditions of approval.

The RTA would be responsible for overseeing the construction, including inspections, monitoring and auditing works performed by the contractor(s).

7.2 Detailed design

7.2.1 General

This Environmental Assessment is based on a concept design that has been prepared to:

- Demonstrate that the construction of the Proposal is feasible.
- Identify environmental constraints and opportunities.
- Define the extent of property acquisition.

Subject to approval and the Chief Executive of the RTA deciding that the Proposal should proceed, the RTA would procure tenders for the detailed design and/or construction of the Proposal, depending on the method of delivery selected and subject to funding.

The detailed design would be a refinement of the concept design and would incorporate findings from this Environmental Assessment, any subsequent submissions report and requirements of any conditions of approval issued by the Minister for Planning. While the detailed design would progress using the concept design as a basis, alternative approaches identified through improved knowledge may be incorporated into the detailed design.

There is a potential that environmental management measures and construction methodology could be updated prior to the commencement of construction. The RTA would consider incorporating any such changes into the detailed design to help minimise the Proposal's environmental impacts.

Examples of possible refinements to the design could include:

- Earthworks balance.
- Service and access roads.
- Location, design and sizing of the floodplain structures.
- Location and sizing of sedimentation basins.
- Location and type of flora and fauna management measures.
- Location and type of noise management measures.
- The staging options for the construction works.
- Traffic management.

7.2.2 Key issues for detailed design

Detailed design of the Proposal would be guided by the key principles developed during the concept design and environmental assessment phase. The development of the detailed design would be required to:

- Be consistent with the design criteria and design principles on which the concept design was based, as described in this Environmental Assessment and any subsequent submissions report and conditions of approval.
- Address any additional issues associated with the development of the concept design proposed in this Environmental Assessment and any subsequent submissions report and conditions of approval.
- Meet any conditions of approval arising from the approval process under Part 3A, unless changes to the conditions of approval are subsequently agreed.
- Incorporate community and government agency requirements through the implementation of a consultation plan to identify and resolve further concerns raised by the community and other stakeholders.
- Avoid identified environmentally sensitive areas and significant species wherever possible.
- Develop and refine proposed environmental management measures.
- Appropriately develop and incorporate the urban design strategy and landscape concept plan (see **Chapter 17 Visual amenity and urban design**).
- Establish detailed proposals for construction delivery method and construction staging that address constructability, traffic capacity and safety during construction, geotechnical issues, all relevant RTA specifications and design requirements, current guidelines and policies, and practicality/cost-effectiveness.
- Address risk management during construction and operation.
- Provide a level of definition sufficient to support a construction contract that would meet all RTA's requirements for the completed highway upgrade.
- Ensure that the detailed design allows for safe and cost-effective maintenance of the Proposal during operation in accordance with occupational health and safety requirements and relevant RTA specifications.

7.3 Potential staging

The Proposal is approximately 37 kilometres in length and could be constructed in stages. A decision on possible staging options would be made at the detailed design and pre-construction stage. The decision would be made with reference to conditions of approval, funding models available at the time, Pacific Highway upgrade priorities, and other engineering and environmental considerations.

As already outlined, there is a range of staging options available for the construction of the Proposal. The Proposal has been designed to safely allow for staging of the construction by section, as well as a progressive upgrade to full motorway standard.

The construction delivery method adopted would consider:

- Minimising road user delays.
- Local road and property access.
- Land acquisition process.
- Earthworks balance both within each section and across all sections.
- Areas that may require early earthworks (eg pre-loading) on the floodplains.
- The sequence in which completed sections could be opened to traffic.

Some of the potential staging options are discussed below.

7.3.1 Staging by section

The Proposal is a combination of sections (**Figure 6-1a** and **Figure 6-1b**) that are either a duplication of the existing highway or a realignment of the existing highway. The earthworks for the Proposal is generally balanced across the full length, with most of the cut material proposed to be won from the Cooperabung Hill and Maria River State Forest areas and then being hauled to the south for use as fill material for the floodplain embankments in the southern half of the Proposal. As such, these cut to fill operations may be undertaken as early works packages.

Should staging by section be required a possible construction sequence would be:

- Early works – cuttings, excavations, stockpiling and rock processing, haulage and placement in floodplains or import material from outside the Proposal.
- Stage 1 – Oxley Highway to Blackmans Point Road interchange.
- Stage 2 – Blackmans Point Road interchange to Cooperabung Creek.
- Stage 3 – Cooperabung Creek to Mingaletta Road.
- Stage 4 – Mingaletta Road to Stumpy Creek.

The timing and sequence of delivery of the four different sections would be subject to funding, delivery of the adjoining Kempsey to Eungai Pacific Highway upgrade, early works packages and sourcing of construction materials.

It is also possible that early construction of some elements of the proposed traffic arrangement at Sancrox Road could be required to suit the requirements of potential industrial development on land adjacent to the Proposal in this area. If this work were to proceed it would be undertaken as early works forming part of Stage 1 discussed above.

7.3.2 Staging by construction standard

While the overall Proposal is for a dual carriageway motorway standard highway throughout, one feasible staging option could be to construct Sections A and B (to Haydons Wharf Road) to the motorway standard because they are bypass sections and to construct Sections B (north of Haydons Wharf Road), C and D (**Figure 6-1a** and **Figure 6-1b**) initially as a four-lane arterial standard road and upgrade these sections to motorway standard at a later time. In this option, Sections A and B (to Haydons Wharf Road) would be constructed to motorway standard in any case.

Design features of the arterial standard design are described in **Section 6.1**. A detailed description of the arterial standard for Sections B (north of Haydons Wharf Road), C and D is provided in **Sections 6.3.2, 6.3.3** and **6.3.4** respectively.

The key features of upgrading these arterial standard sections up to the full motorway standard would include:

- Removal of all at-grade intersections.
- Construction of an overbridge to connect Wharf Road to the proposed service road on the western side of the upgraded highway. Access to the Proposal would be via the Kundabung Road overbridge (southbound) or left-in slip lane (northbound) located approximately 2.3 kilometres to the north.
- Construction of an overbridge to connect Mingaletta Road with the proposed service road on the western side of the upgraded highway. Access to the Proposal would be via the Kundabung Road traffic arrangement described above located approximately 4.5 kilometres to the north.
- Removing all private accesses to the upgraded highway.
- Providing appropriate service and access road connections as described in **Section 6.4.5**.

7.3.3 Environmental impact assessment of the possible staging option

This Environmental Assessment addresses the potential impacts of the possible staging option as described in **Section 7.3.2** above. As the construction footprint and associated environmental impacts of the full motorway standard upgrade would generally be greater than those of this staging option, the Environmental Assessment is focused on the ultimate motorway upgrade proposal.

However, consideration has been given throughout the Environmental Assessment to the likely impacts of this staging option. Where the impacts of this staging option are considered to be substantially different from those of the motorway upgrade, those impacts have been described and assessed separately in the relevant sections of the Environmental Assessment.

In most cases, the environmental protection and impact management measures that are proposed in this Environmental Assessment are applicable to both the motorway upgrade and the possible staging option.

In addition, a staging report would be prepared prior to the start of construction if the procurement model adopted for the construction results in the Proposal being delivered in stages. The staging report would:

- Describe the proposed staging arrangements.
- Identify and assess any potential environmental impacts associated with the proposed staging arrangements that are different to, or have not been assessed as part of this environmental assessment.
- Identify any additional management measures (commitments) that would be implemented as a result of the staging process.

7.4 Construction activities

7.4.1 Construction period

The construction of the Proposal would be expected to take three to five years, however this would be dependent on funding and the construction delivery method and staging options adopted.

7.4.2 Construction approvals and licensing

As discussed in **Chapter 4 Planning and approvals**, prior to construction commencing, approvals and licences in addition to the Part 3A project approval may be required.

The Proposal is a scheduled activity under Schedule 1 of the *Protection of the Environment Operations Act 1997* as it involves construction of a freeway, tollway or main road with four lanes, located outside the metropolitan area and greater than 5 kilometres in length. An environment protection licence would be required for construction under chapter 3 of the *Protection of the Environment Operations Act 1997*. A licence is not required for the operation or maintenance of any road.

Should construction of the Proposal involve accessing groundwater or surface water, as discussed in **Section 7.5.2**, approval under the *Water Act 1912* would also be required.

7.4.3 Typical construction activities

A summary of the typical construction elements and activities for the Proposal is provided in **Table 7-2**. These activities are not necessarily in order of implementation, as the timing and extent of work undertaken could vary depending on the construction delivery method adopted, the construction staging and the funding available at that time.

Table 7-2 Typical construction activities

Element	Activities
Pre-construction	
Preliminary activities	• Geotechnical investigations. • Survey. • Property acquisition.
Site establishment	• Site set out defining boundaries and sensitive environmental areas. • Site compounds and temporary infrastructure sites. • Implement initial environmental safeguards for protection of environmentally sensitive areas.
Relocation of services	• Identification and consultation with appropriate authorities. • Relocation of existing utilities.
Construction	
Site preparation	• Clearing and grubbing of vegetation. • Mulching for re-use into landscaping activities where possible. • Stripping and stockpiling of topsoil and spoil. • Diversion drains. • Construction of haulage and construction access roads for major elements of construction.

Element	Activities
Structures	• Piling for bridges. • Construction of bridges and vehicular underpasses. • Fauna crossings. • Replacement of existing structures where necessary.
Earthworks	• Drilling and blasting. • Pre-loading and installation of wick drains for soft soils on floodplains. • Excavation of unsuitable material. • Cuttings and fill embankments. • Pavement foundation and subsurface drainage. • Batter treatments. • Haulage of construction materials.
Drainage	• Transverse drainage culverts. • Longitudinal drainage along the upgraded highway. • Diversion drains and sedimentation basins.
Pavement	• Pavement construction (asphalt and concrete pavements). • Concrete and asphalt batch plants (where required).
Interchanges, traffic arrangements and connections to the existing highway	• Southern connection to existing Pacific Highway. • Sancrox Road traffic arrangement. • Blackmans Point Road interchange. • Haydons Wharf Road half interchange. • Kundabung Road traffic arrangement. • Yarrabee Road traffic arrangement. • Northern connection to the Kempsey to Eungai upgrade.
Other construction works	• Flora and fauna protection measures including fencing and specialised crossings. • Install roadside furniture including safety barriers, street lighting, line marking and signposting. • Site rehabilitation and landscaping. • Construction of temporary haul roads. • Temporary infrastructure sites such as communications towers, batch plants, crushing plants, stockpile and storage areas, casting yards and launching ramps for river crossings. • Construction of new service and access roads to provide access for residents' to the upgraded highway. • Construction of rest areas and truck stopping bays for both north and southbound traffic movements.
Finishing works	
Removal of temporary work sites	• Remove and restore temporary work sites.
General site clean up	• Ensuring the site is left in a clean condition.

7.4.4 Construction methods

Conventional techniques would generally be used during the construction of the Proposal and adapted for specific environmental constraints along the alignment. These techniques would be further developed for the construction of major and minor bridges, major flood relief structures, treatment of soft soils on floodplains and blasting in hard rock cuttings.

Bridges

The Proposal includes 15 crossings of minor watercourses and two large bridge structures, one across the Hastings River and one across the Wilson River. Flood relief structures would also be required on the Hastings and Wilson river floodplains. The watercourse crossing over the Wilson River may require access to Dalhunty Island for bridge construction activities. This would be determined as part of the detailed design of this bridge. The Proposal would also cross the North Coast Railway line on the northern side of the Wilson River. A temporary level crossing of this railway line may be required during construction. This would be negotiated with ARTC as part of the detailed design.

The construction of the other bridge structures would generally follow conventional bridge construction techniques. Several construction techniques could be used for the construction of the major watercourse crossings across the Hastings and Wilson rivers. One option for the construction of these major bridges could be to incrementally launch the bridges across the river from one of the abutments.

Bridge types and construction techniques would be determined during the detailed design stage. The final choice of bridge type would be based on relevant performance criteria and a balance between engineering, urban design, environmental and cost considerations. At each bridge site, temporary construction compounds and laydown areas would be established, to provide for the storage of construction materials and equipment. This compound would be used for formwork fabrication as well as the development of footings and other structural elements for the bridge construction.

Dependent on the bridge structures selected for the Proposal, onsite or offsite concrete pre-casting yards could be utilised to manufacture major bridge structural elements prior to being delivered to the site as complete units. These units could include concrete bridge piles, girders or deck units. If offsite pre-casting yards are used, completed bridge elements would be delivered to the construction site utilising large heavy vehicles and suitable escort vehicles.

Temporary laydown areas would be required at the construction sites prior to the incorporation of the structural elements into the bridge structure. Depending on the construction methodology employed, there could also be significant numbers of deliveries for concrete, steel reinforcing and other bridge construction material or equipment.

Ground improvement is likely to be required for the establishment of the bridge footings. Depending on the construction methodology there could be a variety of alternative ground improvement methodologies utilised including bored or driven piles. At the construction compounds, there would be a need for establishment of adequate erosion and sediment control measures. These controls would be required to manage concrete pours and site establishment to prevent releases into drainage lines or watercourses.

The development of protected and reinforced batters on each side of the bridge would generally be required to protect the bridge footings and the environment. Construction management measures that could be required would depend on the local environment but could include the use of silt fencing, temporary sediment basins, rock checks and clean water diversions. Depending on the structure and its location, permanent scour protection could also be required around the bridge footings.

Soft soil treatment

Where an embankment is to be constructed over soft soils, various construction techniques could be employed. These techniques include installing wick drains separately or in conjunction with preloading the embankment, and driving piles at bridge abutments.

Wick drains and other soft soil treatments, including dynamic compaction and surcharge loading, allow the road to settle more quickly. The treatments provide for more effective ground stabilisation in areas where the soils do not have sufficient structural strength to support the development of a roadway in a manageable construction timeframe.

Some examples of different soft soil treatments that could be employed include:

- Deep soil mixing: a deep soil mixing machine mixes either a wet or dry cement/concrete slurry material into the soft soils. This treatment uses cement as a mixing agent to provide a low strength cement column to stabilise the soils, which can then be worked into the development of structures like culverts. It is also used in the development of foundations.
- Preloading: fill embankments are used to raise the road above floodplains to reduce the risk of the road being cut by floodwaters. As the underlying ground conditions in the floodplain are sometimes weak, fill material can be placed for the embankments in these areas early in the construction process to help reduce the amount of settlement of the embankment that occurs after the road has been opened to traffic.
- Dynamic compaction: this uses a heavy weight, raised and dropped from a crane to compact placed material into the soft soils or compact granular materials in the soil. This increases the bearing capacity of soils and reduces settlement time. Dynamic compaction has been used for construction of airport runways, roads and highways, storage tanks and other uses.
- Wick drains: this treatment uses a wicking rig, which is similar to a drill rig. A flexible tube of wicking material is punched through a drainage layer and the base material below, to a sufficient depth to allow effective movement of the groundwater under the road up through the wicking material and into that drainage layer. As material is loaded onto the alignment, water is forced through the tubing into the drainage layer and out from under the road material.
- Stone columns: in this treatment, a specialised tube is filled with rocks and is pushed by crane into the soft soils. The rocks are released, leaving a stone column behind. This behaves in the same way as a wick drain only on a larger scale and allows groundwater to move through the stone column out into the drainage layer. In addition to this, the stone columns would also provide some structural support to the soft soils.
- Timber piles: closely spaced timber piles are driven into the soft soils to increase the bearing capacity of the soil and remove the need to provide a period for settlement of the fill embankments.

Blasting

There are a range of cuttings across the alignment which would require excavation. The majority of these are likely to be excavated utilising conventional techniques such as ripping by bulldozers. Depending on the rock types encountered there could be a requirement to undertake blasting. Any blasting would be undertaken in accordance with appropriate noise and vibration criteria as discussed in **Chapter 16 Noise and vibration**.

The type of construction techniques used for rock removal in the deep cuttings in the Cooperabung Hill and Maria River State Forest would be influenced by the rock type, together with the proximity of surrounding residences. The construction technique would be determined during the detailed design phase and following further detailed geotechnical investigations.

Haulage

The Proposal would require the delivery of resources that cannot be sourced onsite. Examples are fuel, plant and equipment, cement and sand for concrete production, and fill dependent on the staging option (if any) selected. The existing highway and controlled access points to the Proposal would be used for the delivery of materials and machinery from offsite.

Generally there are two broad options for the haulage of materials during construction that have been considered in the preparation of this Environmental Assessment. These include the use of the existing highway and/or the construction of temporary haulage tracks along the Proposal.

Haulage along the existing highway is likely to have an impact on traffic and safety for other road users. Haulage along temporary haulage tracks would require the construction of either temporary crossings or permanent bridges at creeks or watercourses. The design and construction of temporary crossings would be undertaken in accordance with relevant standards and legislative requirements, and in consultation with relevant government agencies. The use of the existing highway or haulage tracks, or a combination of both, would depend on the adopted staging option as well as the construction delivery technologies employed at the time. However, the volume of construction and haulage traffic on the existing highway would be minimised wherever possible.

7.5 Equipment, demand on resources and labour

7.5.1 Construction plant and equipment

Table 7-3 shows a summary of the typical construction plant and equipment that would be used during the construction of the Proposal.

Table 7-3 Construction plant and equipment

	Construction work sites (compounds)	Service relocation	Structures	Earthworks	Structural pavement	Other road works (including service and access roads)
Fuel storage tanks	✓					
Concrete and asphalt batch plants	✓					✓
Crushing plants			✓	✓		✓
Trucks and small equipment	✓	✓	✓	✓	✓	✓
Cranes and elevated platform vehicle	✓	✓	✓			✓
Water carts	✓			✓	✓	✓
Backhoes, trenchers and excavators	✓	✓	✓	✓	✓	✓

	Construction work sites (compounds)	Service relocation	Structures	Earthworks	Structural pavement	Other road works (including service and access roads)
Bulldozers, scrapers and graders				✓		✓
Drilling and blasting equipment			✓	✓		
Soft soil treatment equipment				✓		
Piling rigs			✓	✓		
Concrete saws, concrete pumps and concrete curing equipment		✓	✓		✓	✓
Concrete paver, asphalt paver and bitumen sprayer					✓	✓
Barges and small boats			✓			
Fences	✓					✓
Sheds	✓					✓
Light vehicles	✓	✓	✓	✓	✓	✓

Note: Plant and equipment requirements are subject to refinement during detailed design.

7.5.2 Materials

The Proposal would require significant resources for construction. A resource plan to source materials for construction would be developed at the detailed design phase and further refined at the time of the award of the construction contract. These resources could include:

- Road base quality gravel.
- General fill gravel.
- Sand and aggregates for concrete.
- Water.
- Bitumen.
- Cement.
- Fuel.

Sources of raw materials such as cement, bitumen, fuel and water have been considered during the development of concept design and preliminary estimates of raw materials for construction have been calculated. These estimates, along with geotechnical site investigations, and research into local aggregate sources have been used to estimate the amount and quality of bulk earthwork and pavement materials available. It is expected that these materials would be sourced primarily from within the Proposal.

Geotechnical investigations indicate that the material generated from the majority of the cuttings over the length of the Proposal would be suitable for general fill. Some material extracted north of the Wilson River, between Cooperabung Drive and Mingaletta Road, and through the Maria River State Forest would be suitable for select fill and upper zone formation material. Borrow sites could be developed along the Proposal to provide material for construction. Design refinements during the detailed design phase, such as adjusting cuttings, could also result in further sources of materials. Given that the Proposal would be constructed over a number of years it is considered that sufficient material would be available for construction of the Proposal.

Alternative material sources, if required, include local and regional quarries. Quarries in the area include Sancrox Quarry, Johns River Quarry, Grants Head Quarry, Yarrabee Road Quarry and Cooperabung Drive Quarry.

Earthworks

Regardless of the staging option selected, material would be required for the fill embankments across the floodplains. During the detailed design phase, the balance of earthworks would be reviewed depending on what staging option was adopted (if any), and the potential sources of material for the floodplains. Earthworks scenarios could include:

- Material is sourced from some of the larger cut locations in the northern part of the Proposal and transported to the floodplains in the southern part of the Proposal.
- Material could be imported from external sources should the southern sections be staged earlier than the northern sections.
- If excess material is generated by the adopted staging option, it could require stockpiling within the Proposal boundaries (if possible), used for early establishment of embankments in other sections of the Proposal, disposal offsite or could be used for other Pacific Highway upgrades.

Excess material, or spoil material that is not suitable for use in road construction could be produced during construction. Disposal or reuse of this excess spoil material would be undertaken within the Proposal boundaries as the first option. Potential uses for this material could include use in landscaping treatments or as noise/landscaping mounds.

Water usage for construction

Water would be required during construction for:

- Road construction.
- Dust suppression.
- Concrete mixing.
- Human consumption.

There are a range of water sources along the Proposal which could be utilised during construction. These include utilisation of recycled water (eg from construction activities), potable water, surface water and groundwater. Surface runoff water collected in sedimentation basins during construction would be used for a number of purposes including dust suppression. As discussed in **Chapter 14 Groundwater** there is a number of groundwater bores located in the vicinity of the Proposal, which would also be used.

Where possible, water used during the construction would be sourced from sustainable supply sources. Alternative water sources such as recycled water could be utilised if available and where the quality of the water is suitable for construction use and meets relevant occupational health and safety standards. During the detailed design phase, water sources for the construction of the Proposal would be determined.

Table 7-4 demonstrates the indicative water requirements for the construction of the Proposal.

Table 7-4 Indicative water requirements for construction

Water	Construction activities	Approximate water usage rate
Potable or recycled water	Earthworks (compaction etc)	18 litres per cubic metre for compaction, 70 litres per cubic metre for stabilisation
Potable or recycled water	Dust suppression	Variable: dependant upon season, area etc, peak demand not expected to exceed 70,000 litres per day
Potable or recycled water	Vegetation watering (from water cart)	Variable: dependant upon season, area etc, peak demand not expected to exceed 70,000 litres per day
Potable water	Concrete production	200,000 litres per day per plant

Waste

The construction contractor would be required to minimise and manage waste generated during the construction of the Proposal. Recycling, re-use and non-reusable waste disposal strategies and plans would be developed by the contractor. The strategies and plans would be consistent with the objectives of the *Waste Avoidance and Resource Recovery Act 2001,* the *NSW Waste Avoidance and Resource Recovery Strategy* (DECC 2007b*)* and other relevant legislation.

Where possible, waste material generated during construction activities would generally be re-used. For example some excavated materials can be re-used as general fill and road sub grade replacement while some vegetated material would be re-used as mulch for landscaping purposes. Waste management is discussed further in **Chapter 20 Other environmental issues**.

Energy

Energy consuming activities would occur for the duration of the construction phase. The main demands on energy would be from plant and machinery such as scrapers, dozers, rollers and other construction plant using fuels such as diesel. Other activities such as batch plants, rock crushing plants and works depots would use electricity and diesel fuel. During the operation phase, electricity use would generally be limited to street lighting to be provided at select locations (eg interchanges). Other electricity use would be limited to materials sourced for maintenance activities. Energy usage and greenhouse gas emissions are discussed in **Chapter 20 Other environmental issues**.

7.5.3 Work hours and labour

Construction would normally be limited to the following hours:

- Between 6am and 6pm Monday to Friday.
- Between 7am and 4pm Saturday.

There would be no works outside these hours, or on Sundays or public holidays, except:

a) For works that do not cause construction noise to be audible at any sensitive receivers.

b) For the delivery of materials required outside these hours by the Police or other authorities for safety reasons.

c) Where work is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.

d) For any other work as agreed through negotiations between the RTA and potentially affected sensitive receivers. Any such agreement must be recorded in writing and a copy kept on site for the duration of the works.

e) Where the work is identified in the construction noise and vibration management plan and approved as part of the construction environmental management plan.

f) As otherwise agreed by the DECCW.

Local residents and the DECCW must be informed of the timing and duration of work approved under items (d) and (e) at least 48 hours before that work commences. Hours of work would be addressed in the construction noise and vibration management plan, which would be finalised in consultation with the Department of Planning and the DECCW.

The size and composition of the construction workforce is expected to vary and would depend on the delivery and staging options adopted. The workforce would comprise labourers, plant operators, engineers, concreters and others. An onsite workforce of up to approximately 300 people could be employed at any given time during the construction phase.

7.6 Ancillary construction facilities

In addition to the permanent works for the Proposal, the construction contractor would require temporary access to land for a range of construction related facilities, logistics and activities. These would include:

- A main site compound(s) and several minor site compounds that incorporate site offices, sheds and storage compounds.
- Bridge compounds.
- Concrete and asphalt batch plants.
- Rock crushing plants.
- Stockpile sites.
- Spoil disposal areas.

7.6.1 Site compounds

The construction contractor would require site compounds for offices, car parking, toilets and lunchrooms, and storage areas for plant and construction materials.

The contractor could use multiple site compounds along the route to minimise traffic movements. More than one compound could also be required for each construction stage to allow the contractor to locate resources adjacent to major activities such as large bridge structures (**Section 7.6.2**), large cuts or large fill areas. Site compounds could be collocated with batch plants (**Section 7.6.3**). The location of these compounds would depend upon the selected delivery method and construction staging (if any). All site compounds would be fenced for security and safety purposes.

Generally the location of site compounds would be consistent with the site criteria identified in **Section 7.6.7** while:

- Allowing for safe and easy access to the work site.
- Being located on relatively flat ground with good drainage.
- Allowing for the containment and treatment of run-off.
- Allowing for water, electricity and phone services to be provided without additional environmental impact.

7.6.2 Bridge compounds

The construction contractor would require compounds in the vicinity of all proposed bridges. Larger compounds would be required at the Hastings and Wilson river crossings possibly on both the northern and southern banks, while other crossings such as Cooperabung Creek and Pipers Creek would typically require smaller compounds. Bridge compounds would also be required for construction of overbridges along the Proposal. Bridge compounds would primarily be used for storage of materials, plant and equipment required for bridge construction.

7.6.3 Concrete and asphalt batch plants

The supply of concrete and asphalt is essential during construction. Concrete would be required for the construction of bridges and for road pavements. Onsite concrete and asphalt batch plants are generally more cost effective and environmentally sustainable than importing these resources from external sources, depending on the location of existing offsite batch plants. If offsite batch plants are used, these would be permanent commercial facilities that are independent of the Proposal and are fully licensed, with established environmental controls in place.

Example of a concrete batch plant

More than one concrete batch plant is likely to be required. Asphalt batch plants would be required where the road is not considered suitable for concrete surfacing. Batch plants would also require workforce offices and other facilities and could be located with site compounds (**Section 7.6.1**).

The final location of the batch plants would be determined at the detailed design stage and would be consistent with the criteria identified in **Section 7.6.7**. The location of the batch plants would also be influenced by the staging option and construction delivery method to be adopted.

7.6.4 Rock crushing plant

Crushing plants would be required to produce sized aggregates for concrete and asphalt production as well as select road base material. Crushing plants would require adjacent land for stockpiling material. It is desirable for crushing plants to be located in close proximity to the concrete and asphalt batch plants (**Section 7.6.3**) to provide an efficient supply of material. Rock crushing plants could also include a screening operation depending on the size of materials required for the different components of the construction. The location of the crushing plant sites would be determined by the contactor during construction and could be associated with rock cuttings across the Proposal. Locations would be consistent with the criteria identified in **Section 7.6.7**.

7.6.5 Stockpile sites

Stockpiling would be required for general fill material, select material, rock and other imported material at various locations along the Proposal. Stockpile areas could also be used for the temporary storage of vegetation, topsoil, spoil and rocks cleared at the commencement of construction.

As discussed in **Section 7.5.2** the main source of fill material from the Proposal is likely to be associated with the major cuts in the northern half of the Proposal (Sections C and D), while the major fill placement areas are located in the southern half of the Proposal (Sections A and B). As a result of this, the staging and delivery option adopted for the Proposal would influence the extent and size of stockpile sites. The contractor could establish stockpiles in the large cuts at Cooperabung Hill and Maria River State Forest prior to commencing haulage of the material to the Hastings and Wilson river floodplains.

Any excess material that is not considered suitable for use in road construction would be stockpiled prior to disposal.

The construction contractor would be required to manage stockpiles to:

- Minimise the generation of dust.
- Minimise erosion and the generation of sediment.
- Avoid impacts on surrounding watercourses, wetlands and ecologically sensitive habitat.
- Ensure appropriate and safe access is available to stockpiles for machinery and equipment.

7.6.6 Spoil disposal areas

A preliminary earthworks assessment has been undertaken as part of the concept design. The assessment confirms that if the entire Proposal is constructed as a single package, the Proposal's earthworks would be balanced. However, if required any shortfall could be met through design refinements or importing from external sources.

The final earthworks balance for the Proposal would be assessed following further geotechnical investigations and the preparation of the detailed design. The balance would be influenced by the delivery and staging option selected for the Proposal.

A spoil management strategy would be developed prior to construction if the assessment identifies a surplus of material. This strategy would identify opportunities for re-using the material onsite and locations outside the Proposal for re-use or disposal. Re-use onsite would be the priority.

7.6.7 Potential sites for ancillary facilities

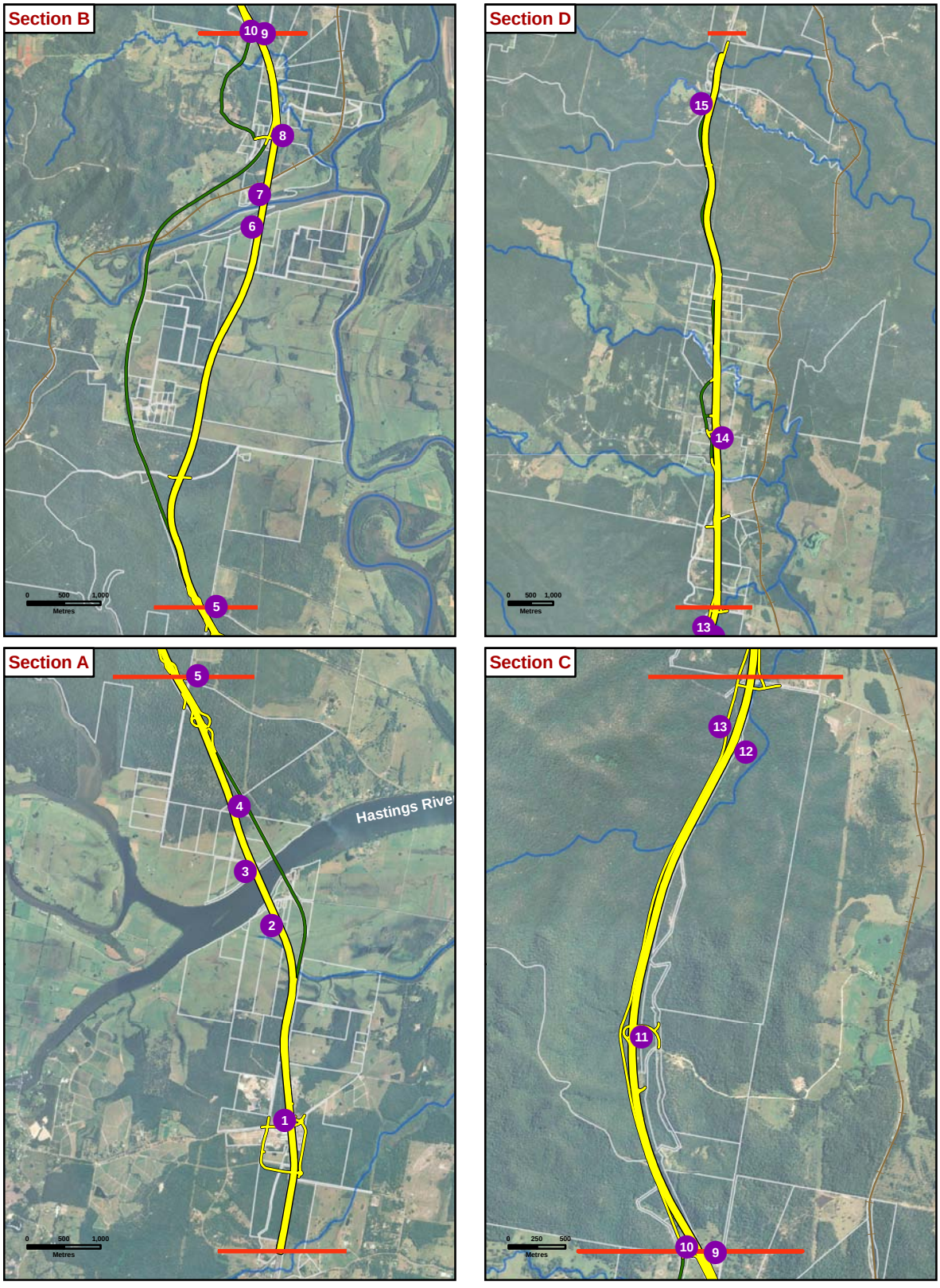
The Proposal area was reviewed to identify potential sites that could be suitable for the development of ancillary facilities. **Table 7-5** describes the potential ancillary facility sites, while **Figure 7-1** shows the location of these sites.

Identification of potential ancillary facility sites has been based on typical requirements for other Pacific Highway upgrades, knowledge of the environmental and social attributes of the area and consideration of the likely construction requirements.

Table 7-5 Potential ancillary facility sites

Location	Site description
1	This site is in an area that has previously been cleared. There are commercial operations on the eastern and western side of the existing Sancrox Road intersection.
2	This site is located on the Hastings River floodplain on extensively cleared agricultural land. Fernbank Creek is located to the south of the site.
3	This site is located on the northern bank of the Hastings River. There are residents located further north along the Proposal.
4	This site is located on the western side of the existing highway to the north of Hastings River. Cairncross State Forest is located immediately to the north of this site.
5	This site is located on Blackmans Point Road. The area has previously been cleared. The site borders Cairncross State Forest and the Rawdon Creek Nature Reserve is located on the western side of the existing highway.
6	This site is located on the southern side of the Wilson River adjacent to the proposed watercourse crossing. The area has been extensively cleared. There are residential properties nearby and some fringing riparian vegetation along the edge of Hacks Ferry Road.
7	This site is located on the northern side of the Wilson River adjacent to the proposed watercourse crossing. The area has been extensively cleared for agriculture. There are some residential properties nearby.
8	This site is located at the proposed Haydons Wharf Road traffic arrangement to the east of the existing highway. The area has been cleared.
9	This site is located near Cooperabung Drive on cleared land to the east of the existing highway.
10	This site is located on the western side of the existing highway immediately north of the existing northern intersection of Cooperabung Drive with the Pacific Highway. Cooperabung Creek Nature Reserve is located to the west of this site.
11	This site is located near Yarrabee Road on the eastern side of the existing highway. The area is on cleared land currently used as a stockpile area for highway maintenance.
12	This site is located on the eastern side of the existing highway and is currently vegetated. However, this site would be located within an area to be cleared for development of the proposed rest area. Barrys Creek runs towards the east of the site. This site is located in Ballengarra State Forest.
13	This site is located on the western side of the existing highway and is currently vegetated. However, this site would be located within an area to be cleared for development of the proposed rest area. Barrys Creek runs towards the east of the site. This site is located in Ballengarra State Forest.
14	This site is located on predominantly cleared land to the west of the existing highway.
15	This site is located on cleared land to the west of the Old Coast Road. The Maria River is located to the north of the site.

Figure 7-1 Potential ancillary facility site locations



Note: 2004 Aerial photography, Cadastral boundaries are indicative only.

The locations and types of ancillary facilities would be determined by the construction contractor in accordance with this Environmental Assessment and conditions of approval once the staging option (if any) and construction methods are determined. Site selection would be based upon the criteria identified in **Table 7-6**.

Table 7-6 Site selection criteria for ancillary facilities

Site selection criteria	Site compounds	Bridge compounds	Batch plants	Rock crushing plant	Stockpile sites	Spoil disposal areas
Environmental criteria						
Minimum preferred distance from residences or other activities that may be affected	200 m	200 m	200 m	300 m	50 m	50 m
More than 100 m from watercourses or protected wetlands	✓✓	A	✓✓	✓✓	✓✓	✓✓
Sites of low conservation significance for flora, fauna and heritage	✓✓	✓	✓✓	✓✓	✓	✓
Ideally not located within a 1 in 100 year floodplain	✓✓	A	✓✓	✓✓	✓	✓
Construction requirements						
Close proximity to the proposed works	✓✓	✓✓	✓✓	✓✓	✓	✓
Ready access to the local road network	✓✓	✓✓	✓✓	✓✓	✓	✓
Minimum area preferred (indicative)	1 – 2 ha	1 ha	1 ha	2 ha	1 ha	1 ha
Within the boundaries of the Proposal	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
Access to a water source of appropriate quality	✓	NR	✓✓	✓✓	NR	NR

✓✓ – site compliance highly desirable

✓ – site compliance desirable

A – site compliance not possible, requires application of appropriate management measures

NR – not relevant

Further sites could be identified during the detailed design and construction phases and would be considered against the stated criteria. The construction contractor would be required to manage the potential environmental impacts associated with any ancillary facilities in accordance with the construction environmental management plan, including but not limited to:

- Minimise the generation of dust.
- Minimise erosion and the generation of sediment.
- Avoid impacts on surrounding watercourses, wetlands and ecologically sensitive habitat.
- Avoid areas of ecological and heritage sensitivity.
- Ensure appropriate and safe access is available.
- Minimise noise generation.
- Minimum light spill from the site.