

## Chapter 7 Construction issues

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*This chapter describes the general approach to the construction of the Proposal. Sites for ancillary construction activities are identified, together with likely environmental impacts and relevant mitigation measures. The approach to waste management is outlined and an energy statement provided. The likely schedule for the construction of the Proposal is also presented as well as information on land acquisition.*

### 7.1 Delivery methods

The options under consideration for delivery of the Proposal include:

- design by the RTA or a consultant followed by competitive tendering by contractors for a construction-only contract
- design and construction (D&C) contract awarded after competitive tendering to a contractor with design team
- design, construct and maintain (DCM) contract with maintenance for a nominated period.

The Concept Design and the EIS are not predicated on any particular contract packaging, delivery or construction method. If the Proposal proceeds, and closer to the time of construction, the RTA will consider the options for project delivery, and select and implement the preferred method in compliance with this EIS and the conditions of approval.

### 7.2 Construction methods

The construction staging and construction methods outlined in this chapter are intended to present a feasible and realistic staging and methodology in sufficient detail to allow an assessment of the likely nature and extent of environmental impacts during construction. Requirements for construction methods would be developed in more detail in the tender specification and would subsequently be developed and finalised by the successful construction contractor(s) in consultation with the RTA.

The detailed construction methodology prepared by the construction contractor(s) would be in the form of Construction Method Statements based on the commitments and obligations contained in this EIS. The construction contractor(s) may adopt alternative construction methods provided that the level of adverse impact during construction is not substantially different from the impact of the methodology presented below. It is also expected that the construction method developed by the contractor(s) would vary from that described in this chapter as a result of detailed design changes, community and stakeholder representations, the conditions of approval by the Minister for Infrastructure and Planning, and the chosen delivery method.

#### 7.2.1 Typical construction sequence

The detailed method of construction for the Proposal would depend on the staging and the specific approach of the construction contractor(s) in meeting contractual obligations. However, it could be expected to be along the following lines for each section of the proposed works:

- acquisition of land
- adjustment of existing public utilities

- pre-clearing investigations to confirm locations of flora and fauna of conservation significance
- site establishment including survey set-out, safety fencing of site, and establishment of site compounds, access points and access routes
- installation of traffic management measures to control highway and construction traffic during construction
- installation of temporary erosion, sediment and water quality controls including diversion drainage, sedimentation basins and cross-flow culverts
- establishment of stockpile areas
- clearing of vegetation and mulching of plant material for reuse
- stripping, stockpiling and management of topsoil
- treatment of any soft soil areas under embankments
- earthworks
- installation of drainage lines, fauna underpasses and local access
- establishment of asphalt and concrete batch plants
- bridge construction
- subgrade preparation and pavement construction
- topsoil rehabilitation and revegetation of batters and berms
- landscaping
- installation of noise mitigation measures (note that, where possible, noise mitigation measures would be installed earlier in the construction process where not dependent on completion of earthworks and where they would be of benefit in reducing construction noise)
- line marking and signposting
- interchange lighting
- finishing works (including general site clean up and removal of site compounds).

As the delivery method and construction staging for this project have not yet been determined, there may be some variation to this sequence and the preferred method of undertaking particular works. However, the construction method would have to comply with the construction concepts and environmental management requirements presented in this EIS and the Construction Environmental Management Plan (CEMP). This would be prepared by the selected construction contractor(s) for implementation throughout construction. An outline of the matters to be addressed in the CEMP is provided in Chapter 21

### 7.2.2 Construction staging

The assessment of options for staging of construction requires consideration of both the size of construction packages and the order of construction of the various sections of the Proposal.

Appropriate staging of construction both within and between construction stages would be required to ensure continuity of access along the highway and to and from adjacent properties and intersecting roadways. Staging of construction should also consider the land acquisition process, availability of fill material (earthworks balance of each section), areas where pre-consolidation of embankments will be required, funding availability, and the remaining life of existing bridges designated for replacement.

Key factors influencing the order of construction of the Proposal are:

- An excess of material available from the Kew bypass is required for construction of the remaining lengths of the Kew section as well as for the other sections. Early construction of just the Kew bypass would result in the need to stockpile and double-handle about 350,000 m<sup>3</sup> of material.
- An approximate earthworks balance has been achieved for the Johns River section and for the Lake section.
- There is a shortage of about 130,000 m<sup>3</sup> of general fill for the Herons Creek section.
- The embankments across the Camden Haven floodplain and the southern approach embankment to the Stewarts River bridge would require a significant period for settlement prior to construction of pavements. It has been estimated that the embankments for the Camden Haven River bridge would settle by up to 0.6 m during consolidation due to the nature of the soft or loose alluvial deposits. Depending on the method of construction adopted and time constraints, it could take up to 4½ years to achieve 90% consolidation for the embankment on the south side of the Camden Haven River. For this reason, construction of the embankments would need to be carried out with sufficient lead-time to allow for consolidation prior to bridge and pavement construction. Early construction of these embankments would maximise the settlement time available. The period needed for embankment consolidation could be reduced by measures such as surcharging and improved drainage under the embankment.
- Settlement of the embankments at Stewarts River is not expected to be as significant (0.3 m consolidation), and would have a lesser impact on construction staging.
- In terms of safety and amenity, the sections that would benefit most from earlier construction are the Kew and Johns River bypasses and associated interchanges.
- Where possible, dual carriageway sections should be provided in continuous lengths, avoiding short sections of single carriageway between completed dual carriageway sections. The duplication at the northern end of the project is already in place and it is anticipated that the Coopernook to Moorland section would be complete prior to commencement of construction of the Proposal.
- It is assumed that land acquisition would proceed following approval of the Proposal and that the acquisition process would not influence the order of construction.
- It has been assumed that the availability of funding would not be a constraint and that a relatively short construction period, estimated at 3 to 3½ years minimum, could therefore be achieved.
- While there are two existing bridges that are identified for replacement, structural assessment indicates that replacement is not urgent and therefore does not influence construction staging.
- Haulage would have an impact on local roads. It would include the transfer of fill material between sections as well as the delivery of construction materials such as pavement materials, asphalt, and concrete. Particularly, where significant volumes of fill material need to be transferred between sections, this transfer should not coincide with peaks in delivery of construction materials. Haulage should also take into account peak travel hours and times, particularly during school and public holiday periods, to minimise the potential for delays on the highway to the travelling public.
- In order to maximise the return on the investment, it is preferable that completed sections be opened to traffic as soon as possible. This means that any individual construction stage should begin and end at locations where connection back into the highway network existing at the time could be safely achieved and with a minimum of temporary works required. Generally the tie-in would require a transition between the new dual carriageway highway and the existing single carriageway. The safety of the

horizontal and vertical alignment of the temporary connections is particularly important in this case because the connections may be required to operate for a period of two years or more. Other issues that should be considered in determining preferable section limits for the transitions are:

- one carriageway of the newly completed works should approximately match to the existing carriageway both horizontally and vertically
- there should be no intersections or local access points in the vicinity of the tie-in
- tie-ins on sharp horizontal or vertical curves should be avoided.

The construction staging of the Proposal has been reviewed based on the above criteria and one option for construction would be to adopt two stages as described below. It should be noted, however, that the way in which the Proposal might be staged would depend on the availability of funding, emerging accident history and other issues that at the time may demonstrate a need to develop staging to satisfy specific requirements.

- **Stage 1 – Johns River, Kew, and Herons Creek sections**

This stage would include the Kew bypass, the Herons Creek section and the Johns River bypass. It would include construction of the embankments across the Camden Haven floodplain and the southern approach embankment to the Stewarts River bridge, but would not include pavement construction on these embankments. There would be an approximate overall balance of earthworks for Stage 1, with the excess of material in the Kew section balancing shortages in the other sections, primarily the Herons Creek section. This stage would include the Herons Creek bridges, the Ocean Drive bridge, and the Stewarts River Road bridge. It would exclude the major bridges across the Stewarts River and the Camden Haven River, since these should be constructed after the approach embankments have settled. The length of construction in Stage 1 would be about 12 km of completed pavement plus about 1 km of embankment in soft soil areas.

- **Stage 2 - Lake section**

This stage would cover the remaining section between Johns River and Kew, including construction of the Stewarts River bridge, Stony Creek bridges, Rossglen railway bridge and the Camden Haven bridge. It would also include construction of pavements on the embankments across the Camden Haven floodplain and the southern approach embankment to the Stewarts River bridge. There would be an approximate overall balance of earthworks for Stage 2. The length of construction in Stage 2 would be about 10 km including the major bridges and construction of pavements on embankments in soft soil areas.

Within each stage it would be preferable to concentrate resources on convenient sub-sections that could be completed and opened to traffic separately. This process would also help ensure that disruption to traffic at any one time would be restricted in extent. Suggested sub-sections within each stage are defined below, in the proposed order of construction:

- **Stage 1 – Johns River, Kew, and Herons Creek sections**

- Embankments across the Camden Haven floodplain (Stations 12300 to 12600 and Stations 12800 to 13500) using fill material sourced from cuttings in Kew.
- Johns River section, which has an approximate earthworks balance. It would include the bridge and interchange at Stewarts River Road. At the southern end, the duplication would match to the Coopernook to Moorland section, which should be completed before this construction commences. At the north end, the new southbound carriageway of the bypass would be connected to the existing highway at Station 3800. A temporary dual to single carriageway transition would be constructed between Stations 3400 and 3700. The northbound embankment earthworks would be constructed through to the proposed abutment at Station 3940 but northbound pavement would be constructed to Station 3700 only.

- Herons Creek section using fill material sourced from cuttings in Kew. It would include the three bridges at Herons Creek. At the northern end the duplication would match to the existing dual carriageway north of Bobs Creek Road. At the southern end, a temporary connection would be made to the existing carriageway at about Station 17100. A temporary single to dual carriageway transition could be constructed between Stations 17100 and 17400 so that the Herons Creek section could be opened to traffic prior to construction of the Kew bypass.
- Completion of Kew bypass, including the bridge and interchange at Ocean Drive and the access roads at Weeroona Place, Sunnyvale Road and the 'Glenhaven' property south of Kew. At the southern end, a temporary single carriageway to dual carriageway transition would be constructed between Stations 13300 and 13600. At the northern end, the bypass would be connected to the completed Herons Creek section at Station 17100.
- **Stage 2 - Lake section**
  - Lake section south. It is proposed to construct the southern section first because the settlement period required for the soft soils at the Stewarts River is shorter than at the Camden Haven River. This section would include construction of the Stewarts River bridge and completion of the pavements on the south approach embankment. It also includes construction of retaining walls in the section just to the north of the Stewarts River and opposite the Middle Brother National Park. At the southern end, the duplication would match to the completed section of the Johns River bypass at Station 3700. At the northern end, the upgraded southbound carriageway of the bypass would be connected to the existing highway at about Station 9800. A temporary dual to single carriageway transition would be constructed between Stations 9800 and 10100.
  - Lake section north. This would be the last section constructed in order to provide as long a period as possible for settlement of soft soils under the Camden Haven floodplain embankments. This section would include construction of the railway bridge at Rossglen and the Camden Haven River bridge, as well as completion of the pavements on the approach embankments to this bridge. At the southern end, the duplication would match to the completed Lake south section at Station 9800. At the northern end, the section would include pavement construction through to the completed Kew section pavement at Station 13600.

### 7.2.3 Construction packaging

Adoption of a single construction contract for Stage 1 and another single contract for Stage 2 would result in two large contracts but their size is not excessive considering recent practice in the construction industry. Each stage would require two to three years to construct. The advantage of single contracts for each stage is that efficiencies in construction could be achieved and the earthmoving process could be optimised with a minimum of stockpiling and double-handling. It would also be easier to ensure that disruption to traffic at any one time would be restricted in extent.

Should circumstances at the time require, however, it would be possible to split Stage 1 and/or Stage 2 into sub-sections. The sub-sections could correspond to the four Stage 1 sub-sections and the two Stage 2 sub-sections listed above. Careful documentation would be required if smaller contract packages were adopted since it would be necessary to ensure that disruption to through traffic at any one time is controlled and that possible conflicts arising from having different contractors on site at the same time are addressed. While it would be feasible to sub-divide Stage 1 and Stage 2 into smaller contracts, the basic order of works as described in Section 7.2.2 should be retained. The construction staging methodology has been developed based on the two major packages shown. The same methodology would work if the packages were sub-divided, even if the various sub-sections were built by different contractors rather than under the one contract.

The exact construction packaging, as with the construction staging described in Section 7.2.2, would depend on other issues such as the availability of funding and the concurrent workload in the construction industry.

#### 7.2.4 Traffic impacts during construction

There are no appropriate alternate temporary routes to the existing highway that could be used during construction. Provision for highway traffic therefore needs to be considered in the construction staging and construction methodology for all sections of the Proposal.

Construction of the Johns River bypass and Kew bypass could generally proceed free of traffic but a significant part of the Proposal would involve duplication alongside the existing highway. Generally the horizontal alignment of the existing highway has been adopted as the approximate alignment of one carriageway of the upgraded highway and the proposed median width is 11 m. In this situation the new carriageway could be constructed with little impact on existing traffic. Once the new carriageway is complete, traffic would be transferred to the new carriageway while the existing carriageway was upgraded.

However, there are a number of locations where one carriageway would not be clearly separate from the existing highway and construction activities would be required in close proximity to existing highway traffic.

Locations where work would necessarily be carried out in close proximity to the existing highway are:

- at the tie-ins at either end of the Johns River and Kew bypasses
- along the Lake section just north of the Stewarts River bridge (Stations 4300 to 5000) where split level carriageways, narrow median and retaining walls are proposed
- along the Lake section through Middle Brother National Park where a narrow median and retaining wall are proposed
- where the Johns River and Kew bypasses connect to the existing highway
- at the connections to the existing dual carriageways north of Herons Creek and south of Johns River where the Cooperook to Moorland duplication is expected to be complete
- at locations where the new carriageway switches from one side of the existing carriageway to the other side:
  - around Station 200 where the new carriageway would shift from the eastern side to the western side of the existing carriageway
  - around Station 13200 where the new carriageway would shift from the western side to the eastern side of the existing carriageway
  - between Stations 17000 and 18500 where the new carriageways straddle the existing highway in order to avoid existing fibre optic cables on both sides of the existing highway
  - around Station 21000 where the new carriageway would shift from the eastern side to the western side of the present carriageway.

In addition to speed restrictions and traffic controls, night work could be required for short periods at the above locations where the proposed new carriageway conflicts with the existing highway. Night work may be necessary to allow smooth transitions to be constructed and traffic diversions to be installed while minimising traffic impacts. Detailed arrangements for works in these areas would be developed during detail design. Refer to Section 6.19 for further description of detailed design requirements.

## 7.2.5 Construction of the major bridges

Major bridges are required across the Stewarts River (new bridge 304 m) and across the Camden Haven River (new bridge 174 m). The northern span of the Stewarts River bridge crosses the river itself, but the piers are all located within the floodplain rather than in the river. The Camden Haven River bridge would have five piers, all of which would be located within the river.

Construction of new bridge structures may result in adverse impacts on local waterways traversed by the Proposal, particularly in terms of water quality and degradation of aquatic biota. Potential impacts may include:

- increased sediment and contaminant loadings to waterways, resulting from disturbance of stream beds
- physical alteration or removal of aquatic habitat
- impediment to fish passage
- afflux and constriction of flood waters due to physical obstruction.

These potential impacts and related mitigation measures are addressed, as appropriate, in Chapters 8, 9 and 11. Other construction issues are described in the following sections.

Construction of the of the 304 m bridge over the Stewarts River and 174 m bridge over the Camden Haven River requires methods that would reduce the extent of and potential for adverse impacts and that incorporate appropriate mitigation measures and design treatments.

A feasible method of construction has been developed for these bridges (as described below) but detailed construction methods would be developed and finalised by the construction contractor(s) in consultation with the RTA. The method of construction described below is not intended to be prescriptive but is presented to allow a realistic assessment of the likely nature and extent of impacts during construction. The construction contractor(s) may adopt alternative construction methods provided that the level of impact during construction is not substantially different from the impact of the method presented below. This requirement would be reflected in the CEMP and contract conditions for the project.

### Construction of the bridge over the Stewarts River

There will be no pier construction in the Stewarts River waterway itself as the bridge has been designed to span the river. Appropriate erosion and sediment control measures would be required to prevent sediment-laden runoff from entering the river, but the riverbed should not be disturbed by construction activities.

It is proposed that the piers and abutments for the new bridge would be supported on driven steel or concrete piles and founded on rock at about 15 m below AHD. Excavation for pile caps may expose ASS/PASS. Management measures for ASS/PASS are discussed in Section 8.5.2.

### Construction of the bridge over the Camden Haven River

It is anticipated that construction of the foundations in the waterway of this river would be carried out using a barge-mounted pile-driving rig. For the piers adjacent to the banks, other methods such as the construction of rock support pads would be considered subject to demonstration of acceptable environmental management and mitigation measures. Driven hollow steel tubes or driven concrete piles are suggested for the piling as disturbance to ASS/PASS and the riverbed during construction is less than for other pile systems involving bored cast in-situ concrete piles. The rig would install the steel tube or precast concrete pile by vibrating the piles through the marine silts and sediments.

Following the vibration, the steel tubes or concrete piles would be driven, using a piling rig to the required load capacity. The piles would be founded on bedrock at approximately 25 m below AHD. Inclined piles would be installed to transfer horizontal forces to the substrates.

For steel tubes, the top 7 m of the piles would be concrete filled after all of the piles in the pile groups are installed.

The pile cap would be formed up around the piles using the piles to support the formwork. The bottom of each pile cap would be just below the low tide water level - the pile cap would extend out of the water for approximately 1.25 m to match the existing pile caps.

Concrete for the construction of the pile caps, piers and headstocks to support the bridge beams could be provided by barge using skips. Erection of the precast beams for spans above water could also take place using barges. A barge-mounted crane would lift the precast beams from a storage area (probably on the north bank of the Camden Haven River), transport them to the appropriate span, and lift them into position.

Clearing of riparian vegetation communities along the riverbank for construction access would be restricted to the extent reasonably possible for construction of the bridge. This vegetation helps to consolidate the riverbank habitat and provide scour protection. Some removal of riparian vegetation would be required during construction for vehicle/boat access and the preparation of the bridge abutments. Sediment fences would be deployed around areas of excavated or stripped land and sediment curtains would be installed in the vicinity of any minor works disturbing the river banks. A revegetation program would be initiated at each new bridge crossing once all construction is complete to help maintain natural scour protection.

In adopting driven steel tube piles, it is anticipated that there would be minimal disturbance to the riverbed during construction of the piles, pile caps and piers for the Camden Haven River bridge. The use of a sediment curtain or similar containment device agreed by the DPI and DIPNR would be suitable because of the silty sand particle size of the riverbed deposits. The construction contractor(s) would be required to ensure that relevant water quality levels were maintained during bridge pile construction.

The construction contractor(s) would also be required to ensure that there was no spillage into the river of concrete during transport or pouring into the pile tube or pile cap. This could be achieved by extending the formwork above the top of the pour to reduce the risk of spillage.

### 7.2.6 Removal of old bridge piers in Camden Haven River

Both NSW Waterways and DPI (Fisheries) advised that the remaining pylons of the former bridge across the Camden Haven River, just downstream of the existing bridge, should be removed. Accordingly, this EIS assesses removal of the former piers, including the other underwater debris that remains. Further details of the debris are provided in Section 6.5.3.

Methods of removing the disused piers and rubble have been investigated considering the disturbance the operation could cause and potential methods to mitigate these impacts.

Based on these investigations, a methodology reflecting best practice has been developed and described below, aimed at reducing disturbance of river sediments while removing the bulk of the non-natural structures in the riverbed. The methodology described is not intended as prescriptive, rather to evaluate the extent of impacts that removal might cause and methods of mitigating those impacts.

The main potential environmental effect would be the increase in turbidity caused by disturbing the layer of silt that overlies the debris piles and surrounds the remains of the pier structures. A second potential impact would be the further disturbance to the riverbed caused by dropping cut sections of the pier columns on the riverbed. A possible method of removal of disused piers and rubble is summarised below.

- In order to reduce the disturbance of fine sediments, the required machinery (12.2 m steel pontoon barges with machinery such as grab, saw cutter, crane) would be positioned near the rubble pile or pier. A silt curtain would then be positioned surrounding the perimeter of the working area and then anchored to the riverbed. In all locations, operations to remove pier columns or clear rubble would take place entirely

within the area isolated by the silt curtain. Rubble would be removed to the level of the riverbed using a crane mounted on the barge. The barge would transport the rubble to a ramp on the southern riverbank. From there the rubble would be off-loaded for appropriate land disposal. To the extent possible, increases in turbidity would be contained within the small area of the silt curtain. Suspended sediments would be allowed to settle to the riverbed before removal of the silt curtain following completion of works at that location.

- Following removal of existing rubble in the vicinity of the disused lift span piers, the pier and diaphragm visible above the waterline would be secured in a vertical position by a braced frame supported between two barges. The pier section would then be saw cut below the diaphragm but above water level. The cutting would be done during low tide. The minimum depth of cutting would be to that required to cut the reinforcing cage; the tension caused by the barges lifting with the tide should be sufficient to sever the remaining unreinforced concrete. The detached pier columns would then be transported to the ramp on the southern bank where they would be off-loaded for demolition and appropriate disposal on land. This methodology avoids the additional disturbance of allowing the cut section to drop into the riverbed, then causing further disturbance in retrieving it.
- The second stage of the demolition would be aimed at removing the remaining sections of the lift span pier stubs to below the level of the riverbed. The top of the remaining structure (pier column stubs) would be at the low tide level. A barge would be used to place an open steel caisson over the stub of the pier column, forming a seal on top of the 3.58 m diameter pilecap and extending to 0.3 m above the high tide level. The diameter of the steel caisson would be about 3.4 m, providing sufficient workspace between it and the pier. The silt would be removed from the base of the caisson, which would then be sealed and the work area within it would be dewatered. Slurry water from the dewatering procedure would be contained on the barge and disposed of on land after treatment. The pier column stub would be cut approximately 0.5 m above the base of the pilecap, or about 0.5 m below bed level. The column stub would be removed using a crane on the barge and transported to the southern bank for appropriate disposal on land. No silt curtain would be required for this stage of the works, as the disturbance due to cutting would be confined within the steel caisson, and silty water would be contained on the barge prior to land disposal after treatment.

The methodology described above has been developed to demonstrate a feasible method for removal of the old bridge piers and most of the underwater debris while largely containing any disturbed sediment and controlling turbidity increases in the river within acceptable limits. Alternative methods of removal of the bridge piers and debris would not be precluded subject to similar control of disturbed sediment and turbidity being achieved.

## 7.2.7 Construction adjacent to Main Northern Railway line

### Description of works required

The Main Northern Railway line extends for the full length of the Proposal. However, the proposed highway upgrade is close to the existing railway only through the Lake section and at one isolated location south of Johns River township. While relocation of the railway would not be required, there are several locations where acquisition of part of the existing rail reservation would be required and/or works would be required in close proximity to the existing railway line. These locations are shown on Figure 6-1A and 6-1C to 6-1H and include the following:

- Station 1000–1200: At this location the existing highway would be retained as the southbound on-ramp allowing southbound traffic from Johns River to rejoin the upgraded highway. The proposed works would be only marginally closer to the existing railway and acquisition of rail land would not be required.

- Station 4350–4650: Acquisition of part of the rail reservation would be required over a length of about 300 m on the north side of the Stewarts River and construction of a retaining wall would be required between the southbound carriageway and the railway from Station 4450 to Station 4550.
- Station 4850–5150: Acquisition of part of the rail reservation would be required over a length of about 300 m immediately to the south of Salvation Bridge to accommodate the construction of a highway fill batter as well as a proposed sedimentation basin.
- Station 6400–6650: Minor acquisition of part of the rail reservation would be required over a length of about 250 m opposite Algona Road to accommodate earthworks adjacent to the railway.
- Station 7000–7600: Minor acquisition of part of the rail reservation would be required over a length of about 600 m opposite Middle Brother National Park to accommodate earthworks as well as construction of a proposed retaining wall between the southbound carriageway and the railway over a 150 m long section from Stations 7400 to 7550.
- Station 7900–8100: Minor acquisition of part of the rail reservation would be required to accommodate earthworks over a length of about 200 m opposite Haydons Road.
- Station 8400–8850: Acquisition of a triangle of railway land on the north side of the existing Watson Taylor Road would be required to accommodate the realignment of Watson Taylor Road as well as construction of sedimentation basins on either side of Stony Creek.
- Station 10100–10600: Minor acquisition of part of the rail reservation would be required over a length of about 500 m opposite the realigned Charles Yard Road intersection for construction of sedimentation basins.
- Station 10950–11300: Minor acquisition of part of the rail reservation would be required over a length of about 350 m opposite the proposed northbound rest area near Ross Glen Road, although the proposed works would be only marginally closer to the existing railway.
- Culverts under rail at Stations 6010, 10710 and 11370: There are three existing culverts under the railway line immediately downstream of the upgraded highway in the Lake section that appear to be undersized. Upgrading of rail culverts at Stations 6010, 10710 and 11370 would be required as noted in Table 6-4, although the deficiency is independent of the highway upgrade and no specific allowance for these works has been included in the cost estimates.
- Construction of bridge above railway at Ross Glen: The existing three-span 9.2 m wide by 42.3 m long bridge (spans of 12.4 m, 17.5 m and 12.4 m) above the railway at Ross Glen would be retained and converted to one-way, two lane operation for the southbound carriageway. A new three span 42.5 m bridge with a similar span layout would be constructed above the railway on the west side of the existing bridge for the northbound carriageway.
- Fencing: RailCorp has previously noted that there is no existing fence between the road and rail in some parts of the Lake section. Installation of fencing is proposed as part of the highway upgrade. Allowance would be made for gates where necessary.

### Construction methods

The works described above could be carried out without significant disruption to existing rail services. Detailed proposals for working adjacent to and within the rail corridor would be developed in consultation with Railcorp during the detail design phase of the project.

All works within the rail corridor would be required to comply with Railcorp requirements. Any short-term track possessions would require development and approval of a track possession plan in accordance with Railcorp's requirements.

## 7.3 Construction resources

### 7.3.1 General fill and select fill materials

Material from excavations would be variable in quality but it is anticipated that, provided suitable methods of excavation are used, sufficient quantities of material won from excavations would be available and suitable for use in embankments as general fill and also as select fill for the top 0.3 m of embankments. Lower quality material could be used for landscape fill and noise mounds and in the lower layers of embankments.

### 7.3.2 Other materials

Sand and aggregates would be required for the highway pavement sub-base course and, depending on the choice between rigid or flexible pavement in the detailed design stage, for the overlying pavement asphalt layers or concrete base. Sand, aggregates, and gravel would also be required for other pavements including local roads and ramps, as well as for drainage layers, bedding sand, erosion protection, gabions, and select fill if sufficient material is not available from excavations.

Requirements for materials will also depend on the final design and the extent of use of pre-cast components for bridges and structures but indicative quantities for major items (excluding precast concrete components) are given in Table 7-1.

**Table 7-1 Aggregate and cement requirements**

Purpose	Type	Tonnes required (t)
Major bridges	Coarse aggregate	5,000
	Fine aggregate	2,500
	Cement	1,800
Minor structures	Coarse aggregate	2,800
	Fine aggregate	1,400
	Cement	1,000
Highway pavement - rigid pavement option	Coarse aggregate	250,000
	Fine aggregate	125,000
	Cement	80,000
Highway pavement - flexible pavement option	Asphaltic concrete	200,000
	Base course (lean mix)	280,000
	Cement (for lean mix)	12,000
Other pavement	Asphaltic concrete	30,000
	Base course (lean mix)	25,000
	Cement (for lean mix)	2,000

Cement quantities are substantial but would be readily available from industry sources.

Information provided by the DPI indicates that there are five industrial mineral borrow areas or quarries within or near the project that would be potential sources of pavement materials and coarse aggregates. Table 7-2 summarises the details and locations of these quarries. Further information is provided in Section 2.6 of Working Paper No. 8. Currently, the Boral Quarry at Johns River is the only one in operation. The approved extraction limit of this quarry is 180,000 tonnes per year but annual tonnage varies from 180,000 to 280,000 tonnes with special approval.

Outside the study area, Pacific Blue Metal operates a quarry at Possum Brush, about 40 km south of Moorland, producing about 220,000 tonnes per year. There is also a Readymix quarry at Jandra in the same vicinity, producing about 200,000 tonnes per year.

**Table 7-2 Existing aggregate borrow pits**

Name and location	Operator and operational status	Product/material
Taylor's Pit, Ocean Drive, Kew	Hurd Haulage Pty Ltd - not operated. Hastings Council proposes to develop this site as a waste transfer station	Road materials/conglomerate
Bethesda Quarry, off Bethesda Road, Kew	NSW Roads and Traffic Authority - not operated	Road materials/shale
Rossglen	State Rail Authority of NSW - not operated	Railway ballast/granite
Stony Creek Road, Middle Brother State Forest	State Forests of NSW - not operated	Road materials/granite
Johns River	Boral Resources Pty Ltd - in operation	Hard rock aggregate/granite

The total tonnage of coarse aggregates for on-site batched concrete, asphaltic concrete and pavements required for the full length of the highway upgrade could be up to 350,000 tonnes depending on the type of pavement adopted. It is anticipated that pavement and bridge construction would be spread over two to three years approximately, so requirements could be up to 150,000 tonnes per year. There is the potential, therefore, for much of the pavement materials and coarse aggregates required for the Proposal to be sourced from the Johns River quarry, although it may need to be supplemented from quarries further to the south.

Depending again on the pavement type and extent of usage of precast concrete, sand (fine aggregates) would be required for on-site batched concrete, lean mix and asphaltic concrete. Requirements could total up to 180,000 tonnes of clean, durable sand with a low alkali/silica reaction. No sand deposits sufficient for use have been identified in the vicinity of the Proposal and, as a result, sand would have to be imported.

## 7.4 Ancillary construction facilities

### 7.4.1 Range of facilities and activities

In addition to the physical footprint of the permanent works for the Proposal as described in Chapter 6, the construction contractor(s) would require temporary access to land to accommodate a range of construction-related facilities and activities. These would include some or all of the following:

- site compounds for offices and storage of plant and equipment
- batch plants - potentially both concrete and asphalt, depending on the type of pavement adopted
- crushing plants
- stockpile areas
- spoil disposal areas.

Actual requirements for these facilities and activities would depend on the construction contractor(s), the final design, and the staging and work methods adopted for construction. To ensure a comprehensive appreciation of the overall impacts of the construction of the Proposal, investigations have been undertaken:

- to identify sufficient suitable areas for each possible ancillary construction facility or activity
- to assess likely environmental impacts of siting these facilities and activities in nominated locations within the project area and whether these impacts could be avoided or reduced
- to present appropriate mitigation measures for any residual impacts.

At the time of construction, the construction contractor(s) would be able to select available sites for ancillary facilities from those identified for each type of activity according to the final design, staging and proposed work methods.

#### 7.4.2 Identification of suitable sites for construction facilities and activities

Identification of suitable areas for ancillary facilities and activities has been based on typical area requirements for projects on a similar scale, combined with appreciation of the study area and the environmental issues identified during project development and the preparation of this EIS. Environmental and construction related criteria for each type of construction related facility have been developed and are identified in Table 7-3.

A further description of each type of construction-related facility and activity is provided in Sections 7.4.4 to 7.4.9.

**Table 7-3 Locational criteria for ancillary construction facilities**

Locational criteria	Site compound	Batching plant	Crushing plant	Stockpile area	Spoil disposal area
<b>Environmental criteria</b>					
100 m or more from waterways and SEPP 14 wetlands	✓	✓	✓	✓	✓
Not in protected conservation areas, e.g. Middle Brother National Park	✓✓	✓✓	✓✓	✓✓	✓✓
Low conservation significance for flora, fauna and cultural heritage	✓	✓	✓	✓	✓
No substantial clearing of native vegetation required, or is located where future clearing is required for permanent project works	✓✓	✓✓	✓✓	✓✓	✓✓
Around 200m or more from dwellings or other uses that may be adversely affected by operational noise or other impacts of the plant	✓✓	✓✓	✓✓	✓	✓
<b>Construction requirements</b>					
Easy and safe access to the main road network	✓✓	✓✓	✓✓	✓	✓
Directly adjacent to the upgrade route	✓✓	✓✓	✓✓	✓✓	✓✓
Relatively level ground but elevated or sloped to assist drainage and allow containment and treatment of runoff	✓	✓	✓	✓	✓
Minimum area preferred (indicative)	2-3 ha	1 ha	3 ha	3 ha	Variable
Electricity and phone services available or can be provided without adverse environmental impacts	✓	✓	✓	Not relevant	Not relevant
Preferably within existing road reservation or within areas to be acquired by the RTA	✓✓	✓✓	✓	✓	✓
At least one site within each likely major construction stage/package	✓✓	✓✓	✓✓	As required	As required
Easily accessible supply of water of appropriate quality	✓	✓✓	✓✓	Not relevant	Not relevant
Adjacent/close to concrete batching plant and/or asphalt batching plant	Not relevant	Not relevant	✓✓	Not relevant	Not relevant
✓✓ Site compliance highly desirable or essential ✓ Site compliance desirable – some flexibility possible depending on particular location and design response					

Using these criteria, a number of potentially suitable sites for ancillary construction facilities and activities have been identified. The potential sites identified are shown in Figure 7-1A and in Figure 7-1B while descriptions of the characteristics of each site are summarised in Table 7-4.

At the time of construction, the construction contractor(s) would be able to select available sites for ancillary facilities from those identified in Figure 7-1A, Figure 7-1B and Table 7-4 for each type of activity according to the final design, staging and proposed work methods. However, some of the sites identified are on private land, and any use by the construction contractor(s) of these sites would be subject to prior negotiation and agreement between the parties.

Usage would also be subject to suitable access arrangements and appropriate environmental controls as described in Section 7.4.3.

While a number of suitable sites have been nominated in Figure 7-1A, Figure 7-1B and Table 7-4, the construction contractor(s) would have the option of using other areas within or outside the footprint of the permanent works for the Proposal, subject to satisfying the relevant locational criteria and implementing appropriate environmental mitigation measures such as those described in Table 7-4. For example:

- depending on the staging of works, land which is within the footprint of the permanent works, and which would ultimately be cleared in accordance with the project design, may offer opportunities for construction related activities
- there may also be other areas within or outside the road corridor that would be suitable as sites for ancillary facilities.

If the construction contractor(s) identifies a potential ancillary construction site in addition to those assessed in this EIS, a separate environmental impact assessment process may need to be undertaken for that additional site.

Appropriate mitigation measures would be required at all sites used for ancillary construction activities. Further details of potential environmental and appropriate mitigation measures are provided Section 7.4.3 below.



J:\80213\ArcGIS\Layouts\ Figure 7-1A Ancillary Construction Sites.mxd

- Proposed route alignment
- Main Northern Railway
- Existing highway
- Distributor and local roads
- Waterways
- Water bodies
- SEPP 14 Wetlands
- State Forests
- National Parks
- Cadastral boundary
- Electricity easement
- Gazetted subdivision
- Potential ancillary construction facility sites
















**Figure 7-1A** Potential sites for ancillary construction activities

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- |                                                                                       |                             |                                                                                       |                                                 |
|---------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------|
|  | Proposed route alignment    |  | State Forests                                   |
|  | Main Northern Railway       |  | National Parks                                  |
|  | Existing highway            |  | Cadastral boundary                              |
|  | Distributor and local roads |  | Electricity easement                            |
|  | Waterways                   |  | Gazetted subdivision                            |
|  | Water bodies                |  | Potential ancillary construction facility sites |
|  | SEPP 14 Wetlands            |                                                                                       |                                                 |



**Figure 7-1B** Potential sites for ancillary construction activities

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Table 7-4 Potential sites for ancillary construction activities

Site location (Station)	Prop. Ref No.	Potential area	Comments	Suitability* potential				
				1	2	3	4	5
<b>Johns River section</b>								
150-350	4	Western side of highway Up to 3 ha	Cleared, private land, 2 nearby houses. Power and phone available.	✓	x	x	x	x
1600-1900	12	Southern area of property 4 ha	Semi-treed private land, has been used for agricultural activities, 1 house 150 m+ to the north.	✓	✓	✓	✓	✓
2340-2550	16	East of bypass 1.6 ha	RTA owned. Flat and cleared private land (includes house). Close to tavern and occupied house (Property 17). Potential for site compound for bridge works.	✓	x	x	x	x
2600-3300	21/24	West of highway, north of Stewarts River Road junction 4 ha	Generally cleared private land, subdivision approved on Property 21, no houses very close, north of drainage line (Washtub Creek tributary).	✓	x	x	✓	x
3400-3600	28	South of Bulleys Road, west of bypass 3 ha	Private land, flat and cleared, access from Bulleys Road, one house north of Bulleys Road.	✓	x	x	✓	x
4000-4125	-	Within road reserve south of Stewarts River on western side of upgrade Up to 1.6 ha in road reserve including eastwards under existing bridge (could expand onto private property westwards)	Cleared but subject to flooding. Actively farmed land adjacent on north and south (Farming activities also use road reserve). In vicinity of PAD site (subject to further investigation at time of construction). May be useful for bridge construction.	✓	x	x	x	x
4200-4230	-	Road and rail reserves under and adjacent to north side of Stewarts River bridge Up to 1 ha	Accessible from old highway on northern side of the river. May be useful for bridge construction.	✓	x	x	✓	x
Adjacent to project area between old highway and Stewarts River	34	Quarry and land adjacent to quarry, owned by Boral 1 ha	Operating quarry – potential to use crushing plant and locate batching plant. Access from Bulleys Road to highway and southern side of bridge. Access to northern side of bridge along former highway route. May assist with construction of wall north of Stewarts River.	x	✓	✓	✓	x
<b>Lake section</b>								
4700-5100	35	East of highway and railway, within rail reservation 1+ ha	Access over wooden bridge (load restrictions), cleared land, close to Stewarts River and 1 house.	✓	x	x	x	x
5500-5600	40	West of highway Up to 2 ha	Private land. Access off Middle Brother Road. 1 house within 100 m. South of Passionfruit Gully.	✓	x	x	✓	x
*	1	Site compound	✓	Suitable				
	2	Batching plant – concrete or asphalt	x	Unsuitable				
	3	Crushing plant						
	4	Stockpile area						
	5	Spoil disposal area						

7 Construction issues

Site location (Station)	Prop. Ref No.	Potential area	Comments	Suitability* potential				
				1	2	3	4	5
5900-6900	-	East side of highway and railway 5+ ha	Private land, cleared, access by rail level crossing, flat land near railway, low-lying to the east. Drains to Watson Taylor Lake, no houses nearby.	✓	x	x	✓	x
8200 - 8550	53/57	Immediately north and south of Watson Taylor Road on east side of existing highway to railway line 1 ha	Within rail reservation. Northern side of Watson Taylors Road is cleared, previously used for stockpile site.	✓	x	x	✓	x
8600-8750	59	South of Stony Creek, west side of road reserve 1.5 ha	Private land, cleared, visible from residence on Property 59. Useful for bridge construction.	✓	x	x	✓	x
8800-8900	61	Near site of new bridge over Stony Creek, western side of road reserve 1.5 ha	Private land, cleared, visible from residence on Property 59. Possible site compound for bridge construction.	✓	x	x	✓	x
8900-9400	-	Road reserve area to east of existing highway and west of railway line 1.5 ha cleared (3.0 ha total)	Some land cleared, previously used as an RTA stockpile site. North of Stony Creek (8770- 8790).	✓	✓	✓	✓	✓
10500-10900	-	Road reserve and adjacent land to the east of railway 5 ha	Private land, cleared, level crossing 400 m to the north. House to the south.	✓	x	x	✓	x
10700-11000	-	Road reserve area of proposed northbound rest area (not big enough for construction facilities)	Possible staging issue depending on timing requirements for new rest area, some clearing required in any case for roadworks and rest area.					
11000-11600	-	East of highway and railway 5+ ha	Private airfield land to south of house, access by level crossing, low-lying.	✓	x	x	✓	x
12450-12600	67/68	Southern side of Camden Haven River adjacent to area of proposed fill 2.5 ha	Private land on both sides of highway. Possible construction area for bridge on southern side of river. Road reserve itself not cleared and not wide enough for bridge works.	✓	x	x	✓	✓
12800-12900	71	Area within road reserve immediately north of Camden Haven River bounded by Sunnyvale Road on eastern side of existing highway 0.5 ha	Close to SEPP 14 wetland and Camden Haven River. Close to new bridge but on wrong side of highway and vertical clearance under existing bridge is restricted. Within existing road reserve. Not cleared but existing vegetation of limited value. Telstra fibre optic cable crosses area.	✓	x	x	✓	x
12800-12900	74	Land to east of highway Up to 1 ha	Private land (was old highway reserve). Close to SEPP 14 wetland. Flat and cleared but flood prone.	✓	x	x	✓	x
*	1	Site compound	✓	Suitable				
	2	Batching plant – concrete or asphalt	x	Unsuitable				
	3	Crushing plant						
	4	Stockpile area						
	5	Spoil disposal area						

Site location (Station)	Prop. Ref No.	Potential area	Comments	Suitability* potential				
				1	2	3	4	5
<b>Kew section</b>								
13500-13800	75	Western side of highway 4 ha	Part road reserve and adjacent private land. Flat and cleared. Heritage site A14 at St 13950. In the vicinity of PAD site (subject to further investigation during construction).	✓	✓	✓	✓	✓
13600-13900	76	East side of highway in front paddock 1.5 ha	Private land under transmission line. Flat and generally cleared.	✓	✓	✓	✓	✓
14400-14500	79	Eastern side of highway	Private land. Flat and generally cleared. North of sedimentation basin.	✓	x	x	✓	x
14900	85	Bunyah Aboriginal Land Council land on eastern side of bypass 1 ha	Previously used as a quarry. Regrowth vegetation. Adjacent residences in Glen Haven Drive. Fairly flat. Restricted access to alignment once cutting constructed.	✓	x	x	✓	x
15300	91	Property and house west of bypass 0.5 ha	RTA owned. Close to residential development in Glen Haven Drive and Kew township, access via former highway near Police Station	✓	x	x	✓	x
15800-900	99	Northeast of Ocean Drive 2.5 ha	Hastings Council land, former quarry site, availability may depend on timing of Council's plans for Waste Transfer Station on the site, suitable for batching plant and/or crushing plant.	✓	✓	✓	✓	✓
16350-16650	101	Western side of upgrade south of Weeroona Place 5+ ha	Some area within road reserve, most on private property. Mostly cleared land, except northern end. Drains into Golf Course.	✓	x	x	✓	✓
16800-17000	105	Western side of upgrade north of Weeroona Place 2 ha	Private land adjacent to project area. Cleared. Close to 1 house.	✓	x	x	✓	x
17400-17600	-	Former tip site on Herons Creek Road 1.5 ha	Hastings Council-owned land. Regrowth, access via Herons Creek Road. No houses close. Potential contamination issues arising from prior use of the site as a rubbish tip would require investigation.	✓	✓	✓	✓	✓
<b>Herons Creek section</b>								
18800-19000	111/112	Egbert Egg Farm front paddock and on eastern side of existing highway 2 ha	Private land adjacent to project area. Cleared area south of houses and hatcheries.	✓	x	x	✓	x
19550-19650	117	West of highway, north of Walkers Creek 3 ha	Private land. Cleared and flat. Adjacent to Walkers Creek.	✓	✓	✓	✓	✓
*	1	Site compound	✓	Suitable				
	2	Batching plant – concrete or asphalt	x	Unsuitable				
	3	Crushing plant						
	4	Stockpile area						
	5	Spoil disposal area						

Site location (Station)	Prop. Ref No.	Potential area	Comments	Suitability* potential				
				1	2	3	4	5
20300-20450	123	Land to east of highway 1.5 ha	Property to be acquired by the RTA. Semi-cleared land	✓	×	×	✓	×
20950-21100	129	West of highway 1.5 ha	Boral Mill land in area used for timber storage, generally cleared, access from Herons Creek Road.	✓	✓	✓	✓	✓
21150-21450	131	Western side near Herons Creek and floodway – site of new bridges 1.5 ha	Property to be acquired by the RTA Access from Herons Creek Road and the highway. Close to new bridges. PAD site in vicinity (subject to further investigation during construction).	✓	✓	✓	✓	✓
* 1 Site compound				✓	Suitable			
2 Batching plant – concrete or asphalt				×	Unsuitable			
3 Crushing plant								
4 Stockpile area								
5 Spoil disposal area								

### 7.4.3 Potential environmental impacts and mitigation measures

For each type of ancillary construction activity the potential environmental impacts and related mitigation measures have been identified and are summarised in Table 7-5.

The construction contractor(s) would be required to address the potential environmental impacts and develop appropriate mitigation measures for each ancillary construction facility in the Construction Environmental Management Plan (CEMP). This would be prepared by the selected construction contractor(s) for implementation throughout construction. Further details are provided in Section 7.7.

Further descriptions of each type of construction-related facility/activity and appropriate mitigation measures are provided in Sections 7.4.4 to 7.4.9.

### 7.4.4 Site compounds

The construction contractor(s) would require site compounds for offices, workforce facilities, and storage areas for plant and construction materials. Given that the Proposal may be constructed in several stages (see Section 7.2.2), the construction contractor(s) may require one or more site compounds for each construction stage/package. If the compounds are located close to the new bridge structures required for the Stewarts and Camden Haven Rivers, they could also function as compounds for construction of these bridges. Otherwise, separate compounds would be required near each bridge site.

The construction compounds would require about 2 to 3 ha of land and would be fenced for security and safety purposes. Initial site works for the compounds would involve site clearing and installation of appropriate environmental controls. Hard-standing areas would be provided for parking, storage, access roads, and site sheds.

Potential impacts of site compounds would include lighting, noise, visual, traffic, waste, odours and contamination. Potential environmental impacts and related mitigation measures for construction compounds are summarised in Table 7-5. Environmental management of ancillary construction facilities should be included in the CEMP.

**Table 7-5 Ancillary construction facilities - potential environmental impacts and mitigation measures**

Likely environmental impacts	Mitigation measures	Ancillary facility*				
		1	2	3	4	5
Soil erosion and sedimentation of water bodies	Reduce area of disturbance to vegetation and topsoil.	✓	✓	✓	✓	✓
Contaminated runoff adversely affecting water quality	Divert clean runoff around the site.	✓	✓	✓	✓	✓
	Install environmental controls downstream of disturbed areas and before discharge into watercourses.	✓	✓	✓	✓	✓
	Provide properly drained hardstand or similar to reduce infiltration to and contamination of soil and groundwater.	✓	✓	✓	×	×
	Contain and monitor run-off from batch plants (including pH)	×	✓	✓	×	×
	Bund fuel and chemical storage areas in accordance with DEC requirements, e.g. 100% storage capacity	✓	✓	✓	×	×
	Treat runoff from fuel storage and vehicle wash down areas prior to discharge from site.	✓	✓	✓	×	×
	Prompt removal or clean-up of spillages of materials.	✓	✓	✓	×	×
Fumes from batch plants or crushing plants	Regularly maintain and service all operational plant and equipment to ensure optimum performance and reduce the potential for emissions.	×	✓	✓	×	×
Dust generation or vehicle emissions adversely affecting air quality	Water unsealed areas such as haul roads during weather conditions conducive to dust generation.	✓	✓	✓	✓	✓
	Undertake regular maintenance of vehicles and machinery to ensure efficient operation.	✓	✓	✓	✓	✓
Traffic impacts	Set haul routes to reduce disturbance	✓	✓	✓	✓	✓
Vehicle and equipment noise	Ensure safe access and egress for construction vehicles	✓	✓	✓	✓	✓
	Comply with relevant DEC noise requirements.	✓	✓	✓	×	×
	Regularly monitor noise levels.	✓	✓	✓	×	×
	Undertake regular maintenance of vehicles and machinery to ensure efficient operation.	✓	✓	✓	×	×
Waste	If required, installation of temporary noise mitigation measures at nearby residences.	✓	✓	✓	×	×
	Good site housekeeping to prevent littering.	✓	✓	✓	×	×
	Reduce amount of waste generated	✓	✓	✓	×	×
	Segregate waste streams for recycling or disposal at an approved facility.	✓	✓	✓	×	×
Impacts on visual quality	Remove liquid and solid waste by tanker or truck for disposal at an approved facility.	✓	✓	✓	×	×
	Consider installation of colour coordinated shade cloth on perimeter fencing to reduce visual impact.	✓	✓	✓	×	×
Impacts on flora and fauna	If site is particularly visible from key viewing points, consider supplementary planting (indigenous species) external to perimeter fence.	✓	✓	✓	✓	✓
	Reduce area to be cleared.	✓	✓	✓	✓	✓
	Prior to clearing, inspect areas to be cleared for presence of native fauna.	✓	✓	✓	✓	✓
	Install fauna provisions as soon as possible	✓	✓	✓	×	×
	Revegetate sites on completion of construction.	✓	✓	✓	✓	✓
* 1	Site compound	✓			Required	
2	Batching plant – concrete or asphaltic concrete	×			Not required	
3	Crushing plant					
4	Stockpile area					
5	Spoil disposal area					

### 7.4.5 Concrete batching plants

Construction of the new bridge structures over the Stewarts and Camden Haven Rivers together with the minor bridges and structures would require about 5,500 m<sup>3</sup> of concrete to be placed in-situ over a period of up to two years. If a rigid pavement were adopted for the full length of the Proposal (with overlays in areas where low noise pavement is required), an additional 190,000 m<sup>3</sup> of concrete (assuming 250 mm thick un-reinforced base over a 150 mm lean mix sub-base) would be required over a period of around two to three years. Even if a flexible asphaltic concrete type pavement is adopted, the concrete requirements for the bridges alone are such that establishment of one or more concrete batching plants is likely to be cost-effective. The size of the two major structures as well as the other new bridges in the Lake section (i.e. Passionfruit Gully and Stony Creek) and at Herons Creek suggests that two or three concrete batching plants would be required. Potential sites for concrete batching plants have been identified at the southern end (adjacent to the Stewarts River), in the middle (adjacent to or north of the Camden Haven River) and at the north end (north of Herons Creek Road on the west side of the highway).

Concrete batching plants could have a schematic configuration similar to that shown in Figure 7-2. Concrete aggregates and sand would be stockpiled on site and transferred by front-end loaders to aggregate bins. A conveyor would transfer aggregates to a surge bin and then to a mixer where water, cement and admixtures would be added. Trucks would be loaded directly from the drum mixer. Temporary buildings for staff amenities, offices and quality assurance control would also be required.

Potential environmental impacts and related mitigation measures for concrete batching plants are summarised in Table 7-5.

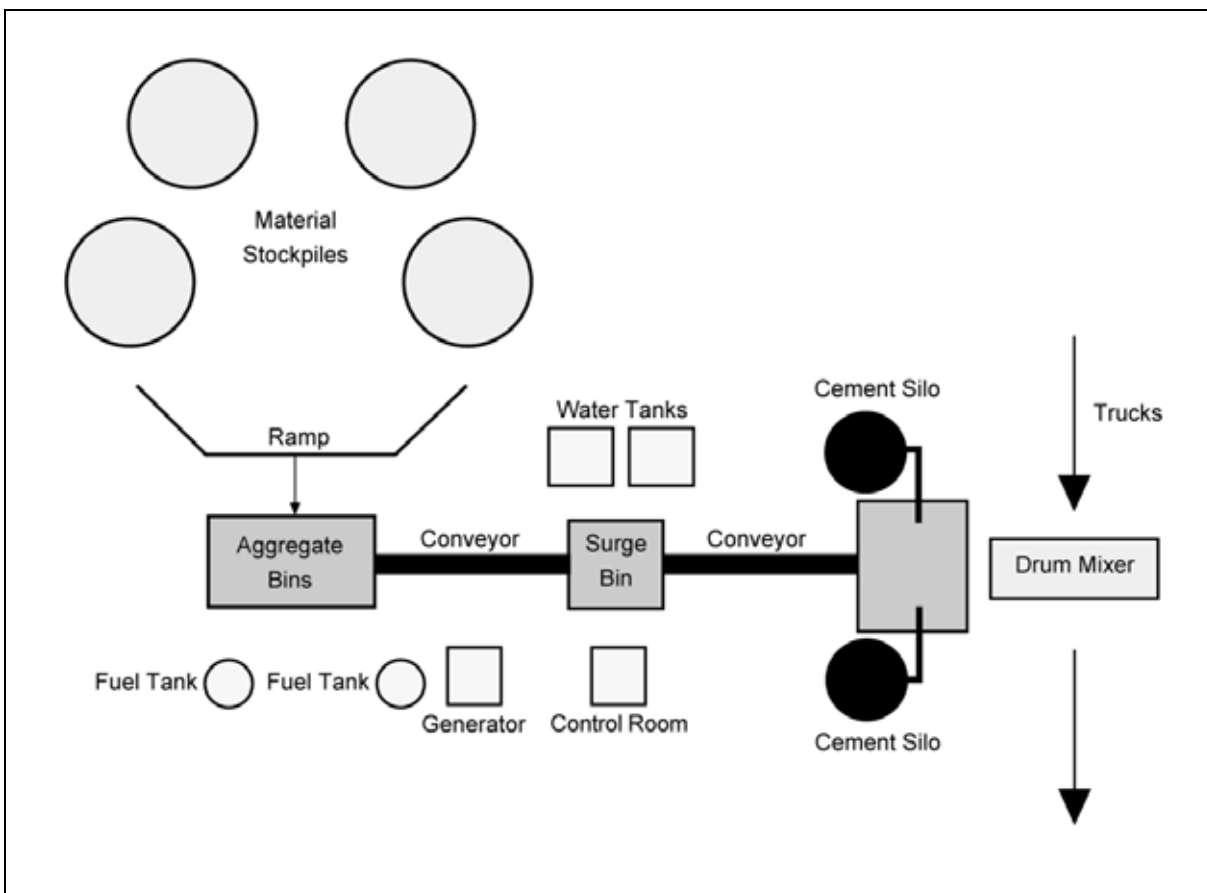


Figure 7-2 Concrete batching plant

### 7.4.6 Asphalt batching plants

Adoption of a flexible pavement for the Proposal would require about 230,000 tonnes of asphaltic concrete (assuming 175 mm thickness and including local roads) to be placed over a period of about two to three years. In the interests of allowing greater flexibility in the design and construction process, suitable sites for such plants have been identified in each of the four major sections of the Proposal.

Asphalt batching plants could have a schematic configuration similar to that shown in Figure 7-3. Aggregates would be stockpiled on site and transferred by front-end loaders to aggregate bins. Filler would be stored in silos and bitumen in a large capacity tank. A conveyor would transfer aggregates to a mixing drum where filler and bitumen would be added. Fuel tanks would supply fuel to the plant, generators and burners. Asphaltic concrete would be loaded onto trucks from the mixing drum. Temporary buildings for staff amenities, offices and quality assurance control would also be required.

Potential environmental impacts and related mitigation measures for asphalt batching plants are summarised in Table 7-5.

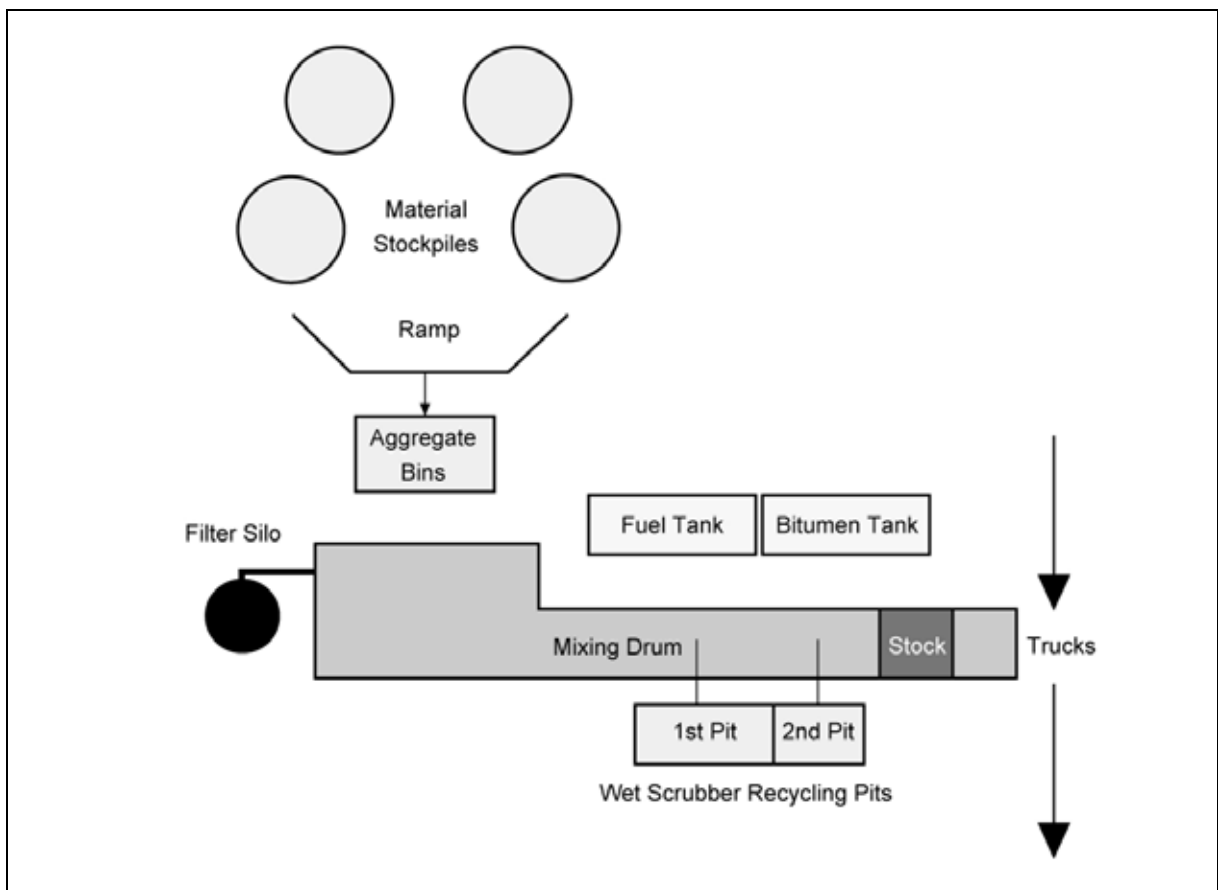


Figure 7-3 Asphalt batching plant

### 7.4.7 Crushing plants

The major cuttings in the vicinity of Ocean Drive in the Kew section of the Proposal would generally require excavations in medium to high strength rock. According to the geotechnical investigations carried out in 2001, blasting is likely to be required, followed by crushing as necessary to reduce the rock to sizes suitable for placement in fill embankments, including select fill and pavement materials (see Working Paper No. 8).

The excavations in the Kew section would require removal of about 520,000 m<sup>3</sup> of material, of which about 350,000 m<sup>3</sup> would be rock. Given the significant volumes of rock material to be excavated and reused elsewhere on the project, it is likely that the construction contractor(s) would want to establish a crushing plant in this vicinity for efficiency of operations, including a reduction in haulage. The former quarry on the north side of Ocean Drive would be a potential site subject to Council plans for a waste transfer facility on the site. Table 7-4 includes a number of other potential crushing plant sites within the Kew section.

Substantial excavation volumes would also be required in the Johns River section (about 200,000 m<sup>3</sup>) and in the Lake section (about 290,000 m<sup>3</sup>), of which about 180,000 m<sup>3</sup> would be low to medium strength rock. Depending on the methods of excavation adopted by the construction contractor(s) and the intended usage of the material, it is possible that a crushing plant site could be required in the southern half of the project. One option is that the construction contractor(s) could negotiate with Boral Quarry to use its existing crushing plant adjacent to the Stewarts River, otherwise a number of other potential sites for crushing plants have been identified in Table 7-4.

The crushing plant area should also include areas for stockpiling of material. The stockpiling requirements would again depend on the construction staging and construction contractor(s)' work methods but assuming conservatively that all rock would be crushed and that storage would be required for 30% of the rock cut volume on each side of the river, the crushing plant sites should each contain sufficient area for stockpiling of about 100,000 m<sup>3</sup> north of the Camden Haven River and about 50,000 m<sup>3</sup> within the southern half of the project. This would require a stockpile area of about 3.5 ha (total site area of 4 ha) north of the Camden Haven River and about half that for the southern half of the project.

The assessment in Table 7-4 has identified suitable crushing plant sites with sufficient area to accommodate these requirements.

The crushing plant could potentially produce aggregates for concrete and/or asphalt as well. Should the construction contractor(s) adopt this option, the crushing plants should preferably be located adjacent or as near as possible to concrete or asphalt batch plants to reduce truck traffic on public roads.

Potential environmental impacts and related mitigation measures for crushing plants are summarised in Table 7-5.

### 7.4.8 Stockpile sites

The profile of the proposed highway upgrade has been adjusted to achieve an approximate balance of material overall but there would be a surplus of material from the Kew section and a shortage for the Herons Creek section. The construction packaging and staging proposed in Section 7.2 has been arranged to the extent possible to reduce haulage of material and allow material to be moved directly from cut areas and placed in fill areas or spoil disposal areas without the need for stockpiling and the resultant double-handling.

It is likely however that there would be a requirement for stockpiling of general fill material outside of the crushing plant areas, and for temporary storage of select material, rock or other imported materials consistent with construction requirements on other sections of the project. It is estimated that there could be a requirement to stockpile up to about 150,000 m<sup>3</sup> of excavated material during the project. As a result of this possible requirement and

assuming a maximum height of 3 m, stockpile areas of up to 5 ha in total may be required for stockpiling of general fill within the study area.

In addition, areas would be required for the stockpiling of topsoil materials from cut and fill areas prior to placement on medians, embankment slopes, and flatter cut batters. It is estimated that about 200,000 m<sup>3</sup> of topsoil would be stripped and stockpiled over the full length of the project. Assuming a maximum stockpile height of about 3 m, up to approximately 2 ha would be required within each of the four major sections.

Hence the total area required for stockpiling could be up to about 12 ha. The analysis in Table 7-4 has identified suitable stockpile sites with a total area of 14 ha and therefore adequate for anticipated stockpile requirements.

The nominated stockpile areas would also be suitable for the temporary storage of other materials such as unsuitable material, topsoil, and cleared vegetation to be used for sediment control as described in Section 9.3.2.

The construction contractor(s) would be required to protect stockpiles of erodible material such as topsoil against erosion by mulching or other means. Potential environmental impacts and related mitigation measures for stockpile sites are summarised in Table 7-5.

#### 7.4.9 Spoil disposal areas

It is proposed that most of the excess of fill material from the Kew section would be utilised on the remaining sections of the Proposal but it is likely that there would be a relatively small volume of excess material that would require spoil disposal areas. It is also possible that, depending on construction staging, excess fill material used to surcharge the embankments in soft soil areas would also require later removal to spoil disposal areas. In addition, disposal of ASS/PASS and material from cuttings classed as unsuitable for use in embankments would be required.

Based on the concept design and the preliminary geotechnical investigations, the volume of excess material would be about 60,000 m<sup>3</sup>, mainly comprising unsuitable material. During the detail design stage when additional geotechnical testing would be carried out, the volume of excess material could be further reduced. Design refinements could include minor adjustments to the highway profile and utilising material unsuitable for the highway embankment for non-critical areas such as the earthen noise mounds or as surcharge material on embankments above soft soils.

However, depending on the staging of construction, methods of construction of embankments in soft soil areas and the resulting consolidation periods required, it is possible even after design refinement that up to about 50,000 m<sup>3</sup> of surcharge material may need to be disposed of in spoil disposal areas. Placement of spoil would be subject to meeting the landscape and urban design objectives in Section 6.14. Table 7-4 identifies potential spoil disposal areas totalling about 30 ha, which would be adequate for the disposal of excess material.

ASS/PASS would generally not be removed as part of any bulk excavations. However, small volumes may be excavated in isolated areas for drainage works, construction of sedimentation basins, and construction of bridge abutments. Any excavated ASS/PASS would be buried below the water table or treated and tested prior to placement in fill (see Chapter 8).

Potential environmental impacts and related mitigation measures for spoil disposal areas are summarised in Table 7-5.

## 7.5 Waste management

### 7.5.1 Waste management and minimisation

Waste management would have a high priority during construction of the Proposal, consistent with the objectives of the *Waste Avoidance and Resource Recovery Act 2001* and the *Waste Avoidance and Resource Recovery Strategy 2003* (NSW DEC 2003a). The current strategy for this Act sets the following targets:

- to maintain the level of total waste generated for the next five years
- to increase the recovery and utilisation of materials from construction and demolition from 65% to 76%
- to reduce the total volume and tonnage of litter reported annually.

The selected construction contractor(s) would be required to include in the CEMP a Waste Management Plan that would set out objectives for minimising and managing waste during construction, and provide guidelines for managing waste, implementing re-use and recycling programs, and disposing appropriately of other non-reusable waste.

### 7.5.2 Recycling of materials during construction

There are four houses, two small span reinforced concrete bridges and the remnants of the old Camden Haven River bridge to be demolished along the Proposal route. Where possible and consistent with other environmental and occupational health and safety requirements, waste materials would be recycled either on-site or through approved off-site recycling programs. Examples of potential opportunities for recycling of materials during construction include:

- tree and plant material generated during initial site clearing - with the exception of certain weeds and invasive plant species, this material would be mulched and used on-site during construction for sediment control as described in Section 9.3.2, and larger logs would be salvaged for a timber mill
- existing houses would be demolished prior to highway construction in such a way that recycling of the building materials would be optimised
- reuse of existing highway - depending on agreements reached with the Hastings and Greater Taree Councils, pavement materials from excess pavement widths on the old highway at Johns River and Kew could be taken up for recycling or reused on site
- rock and soil material found to be unsuitable for construction purposes would be recycled within the project area in batter extensions or other spoil disposal areas as described in Section 7.4.8, subject to meeting the landscape and urban design objectives in Section 6.14
- on-site facilities for sorting of paper, plastic, glass and other waste from site compounds - this waste could be recycled through local council recycling programs
- bridges to be demolished including the Stoney Creek bridge, Herons Creek bridge and the Camden Haven bridge piers would be assessed for the potential for reuse and recycling of materials. The concrete from the bridges and piers could be recycled using the site crushing plant for use as road base for temporary or construction access roads. Other demolition materials from the bridges, such as steel reinforcement, could also be recycled off site.

### 7.5.3 Post construction waste management

Once the proposed highway upgrade is operational, there would be two waste streams, one from maintenance activities and the other from highway users. Maintenance waste such as vegetation pruning would be collected and recycled for mulch within the road reserve or through local council programs. Other maintenance waste such as oils and greases would be disposed of in an approved manner.

Litter from highway users would be collected by the maintenance organisation. Materials such as glass and aluminium cans would be recycled and other material that cannot be readily recycled would be disposed of to appropriately licensed landfills. Rubbish bins would be installed at all rest area locations along the route of the Proposal with the bins emptied on an appropriately regular basis.

## 7.6 Energy statement

An energy statement for the Proposal considers the energy required during the construction of the Proposal as well as the energy (fuel) that would be saved by vehicles travelling along the highway once it becomes operational.

### 7.6.1 Energy required for road construction

Most of the construction work for the Proposal would be undertaken by diesel-powered machinery. However, the range of construction equipment used would be dependent on the construction contractor(s) selected and the actual conditions encountered during construction. The range of construction equipment is likely to include, but would not be limited to:

- light transport vehicles
- graders and scrapers
- bulldozers
- front-end loaders and backhoes
- excavators
- drilling rigs
- compactors and compressors
- water trucks
- materials trucks (highway and off-highway)
- backhoes, paving machines and other heavy weight vehicles
- pile driving rigs - barge-mounted and land-based
- cranes - barge-mounted and land-based
- concrete pumps and air compressors
- concrete and/or asphalt batching plants
- crushing plants.

Given the extent and nature of the Proposal, a large quantity of fuel is likely to be used. Fuel consumption would depend on factors including the age and condition of equipment, the speed of operation, haul lengths, and the site conditions encountered. The volume of fuel used would be generally proportional to the earthworks involved. Fuel would also be consumed in other construction activities such as bridge construction, batching plant operation, pavement laying and landscaping. A conservative estimate of fuel usage is 15 million litres of diesel.

### 7.6.2 Energy considerations during operation

Energy consumption once the Proposal is completed would be by vehicles using the highway and by vehicles and equipment involved in maintenance of the highway. Aggregate energy use would gradually increase in proportion to the overall growth in traffic volumes on the highway but, compared to the do-nothing case, the Proposal has the potential to reduce energy usage through improved vehicle operating conditions and reduced congestion, especially in peak holiday periods. The Proposal length is about 50 m shorter than the existing highway and this would also contribute to a small but positive energy saving.

As part of the analysis of greenhouse emissions in Chapter 12, fuel usage has been estimated for the Proposal and the do-nothing case for a 30-year operation life. Based on Level of Service and travel speed estimations applied to every hour in the 30-year analysis period, fuel usage over the 30-year operating period has been estimated to reduce from 1067 million litres in the do-nothing case to 1039 million litres for the Proposal. This represents an overall fuel saving of about 28 million litres. The rate of improvement increases over time and by the thirtieth year the estimated fuel usage reduces from 57 million litres per year without the upgrade to 46 million litres per year with the upgrade.

Routine maintenance of the proposed highway upgrade would involve several medium sized vehicles and equipment such as tractors and slashers for grass cutting. Maintenance vehicles would also be required for the permanent water quality control ponds. Energy usage by these vehicles and equipment would be insignificant compared to the fuel usage estimated above, although perhaps slightly above the energy consumption required by the existing highway because of the greater area of roadway requiring maintenance.

## 7.7 Environmental management measures

In addition to the Project Environmental Management Plan (PEMP) prepared by the RTA, a CEMP would be prepared by the selected construction contractor(s) for implementation throughout construction. An outline of the matters to be addressed in the CEMP is provided in Chapter 21.

## 7.8 Construction staging, programming and workforce

An indicative program for project implementation is shown in Figure 7-4. It assumes that design and construction would immediately follow on from an early project approval. The decision on the actual program for project implementation will be made following the receipt of project approval and will be dependent on funding and program priorities.

It is currently anticipated that determination of the EIS would be achieved by early 2006. After all project approvals are obtained, it is estimated that a period of about two years would be required for land acquisition concurrent with adjustments being made to public utilities, completion of detail design and investigations, and tendering procedures prior to commencement of construction.

It is likely that a construction period of about three to five years would be required depending on the method of project delivery, funding availability and the construction contractor(s)' work methods. On the assumption that there would be two main construction packages as identified in Section 7.2 and that the project delivery method would be by conventional detail design followed by tendering for construction, an indicative construction schedule has been prepared. Adoption of alternative delivery methods, such as D&C or DCM (refer Section 7.1) would allow an earlier commencement of construction and would also allow a shorter construction period than the five years shown, subject to the availability of appropriate funding levels.

A peak construction workforce of about 200 to 250 people would be anticipated. The average size of the construction workforce on site would be approximately 100 people including management staff and subcontractors. It is expected that employment opportunities would be available for workers in the Greater Taree and Hastings regions.

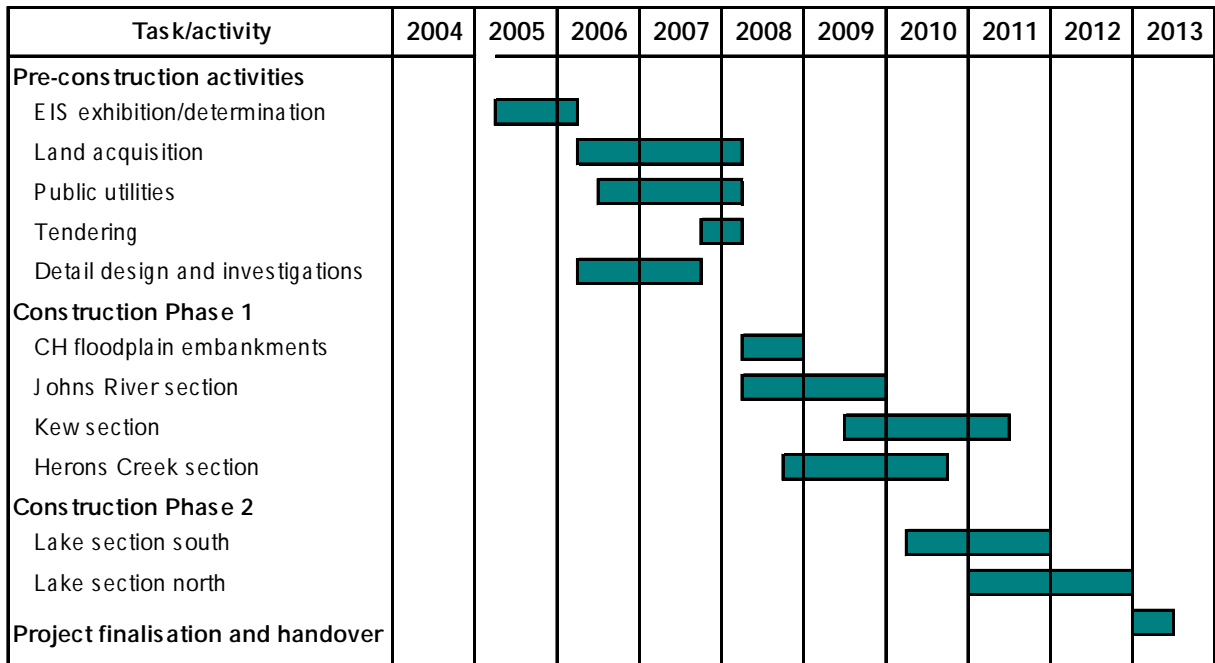


Figure 7-4 Indicative implementation schedule