CrossRiver**Rail**

25. Conclusions and Recommendations

Cross River Rail

CHAPTER 25

CONCLUSIONS AND RECOMMENDATIONS

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25 Conclusions and recommendations

25.1 Overview

This chapter addresses Section 9 of the Terms of Reference (ToR). Its purpose is to present the conclusions and recommendations with respect to the Project based on the studies presented, the proposed environmental management measures and conformity of the Project with legislative and policy requirements.

It provides an analysis of the overall impacts, both beneficial and adverse, of the Project from a life-of-project perspective, taking into consideration the scale, intensity, duration and frequency of the impacts to demonstrate a balance between environment integrity, social development and economic development.

The conclusions drawn from the reference design and the EIS provided in this chapter relate to:

- the strategic need for Cross River Rail to address existing constraints and to respond to patronage growth on the South East Queensland passenger rail network
- the potential benefits and impacts of Cross River Rail on the environment of the study corridor, in both its construction and operation
- the scope of community and stakeholder interest in Cross River Rail
- the range of mitigation measures available to address community and stakeholder issues.

25.2 Rationale for Cross River Rail

25.2.1 Population growth

The population of the South East Queensland region has grown rapidly for several decades and is expected to continue with the population forecast to increase from 2.8 million people in 2006 to 4.4 million in 2031 and to 6 million in 2056 (DIP, 2009). Brisbane's CBD will continue to serve as the primary employment hub for the South East Queensland region.

As the regional and urban populations continue to grow, with corresponding growth in employment, the demand for intra-regional travel will also increase. While all modes of transport will need to develop additional capacity to support this growth in travel demand, public transport and particularly rail provides a sustainable solution for employment based-travel, with the Brisbane Central Business District (CBD) and regional centres as key destinations.

Population and employment growth is expected to result in an increase in transport demand from 6.7 million person trips in 2009 to 9.3 million in 2031. The increase in public transport trips is forecast to grow from 546,000 trips in 2009 to almost 1.1 million trips in 2031. This represents an increase in public transport trips of nearly 97% between 2009 and 2031, more than double the rate of growth in total trips.

The proportion of trips by public transport is predicted to increase from 8.1% in 2009 to 12.1% in 2031. This compares to a mode share target of 14% by 2031 sought by the draft *Connecting SEQ 2031* transport strategy. A significant on-going investment in rail and bus infrastructure is required to accommodate this growth and change in mode share.

25.2.2 Constraints on the transport network

By 2031, the growth in rail travel is expected to lead to a doubling of passenger movements in the morning peak through most inner city and CBD stations. However, the capacity of Central Station is limited and not expected to be able to accommodate projected passenger demand safely and efficiently beyond 2020.

Key constraints on the inner city section of the network will also affect the ability to meet projected growth in train volumes particularly from the south and west, over the Brisbane River which is limited to the single rail crossing on the Merivale Bridge.

At the same time, demand for rail freight services is expected to double by 2020 (Queensland Transport, 2008), in response to population growth and economic development. The efficient movement of freight is essential for economic growth. However, the lack of a dedicated freight track between Salisbury and Park Road requires the sharing of tracks for passenger and freight services, with the passenger scheduling bias constraining the movement of freight to the Port of Brisbane by rail, particularly in peaks. This sharing of track for freight and passenger services also impedes the improvement of passenger train frequencies on the Gold Coast line off-peak.

Without Cross River Rail, the ability to increase rail freight services and provide a regular 15 minute frequency for off-peak passenger services is constrained by infrastructure limitations. Additional rail capacity would be required within the inner city, specifically to relieve the congestion developing around the Merivale Bridge over the Brisbane River. An additional north-south river crossing for rail would be needed by 2020. Furthermore, additional rail infrastructure particularly between Park Road and Salisbury is required to avoid major shortfalls in rail freight paths to meet demand which would have significant, far-reaching consequences for the regional economy as access to the Port of Brisbane becomes constrained, and freight movements transition to road transport.

At the same time, the bus network is expected to experience higher levels of demand with congestion worsening on several routes causing delays and reliability concerns. Some bus corridors, such as the South East Busway, are already approaching saturation in peak periods.

On the road network, growth in vehicle trips will slow as congestion limits additional trips from occurring. While recent road infrastructure projects have provided additional cross-river capacity bypassing the CBD, the radial arterial roads remain congested in peak periods, with consequential effects on travel time reliability, travel time, road user costs and crash rates, for both private vehicles and public transport (bus).

25.2.3 Sustainable and efficient transport and land use

Sustainable and efficient transport infrastructure is critical to the prosperity and functioning of Brisbane. Cross River Rail would provide a high quality rail service to meet forecast travel demand, rather than default to road transport and the private motor vehicle.

Cross River Rail would deliver mode shift towards public transport through increasing capacity on the inner-city rail network and supporting increased population growth and economic activity within inner city areas. The Project will also increase the efficiency of rail freight by improving freight movement capacity through Brisbane.

Specifically, the Project will:

- provide capacity to address growth in travel demand arising from population growth and economic activity, particularly for the Brisbane inner city and CBD. Cross River Rail would cater for additional demand of 66,000 passengers per day in 2031

- support the trend towards rail transport for both passenger services, through increased frequency of services for suburban and main line sectors. Cross River Rail would provide for 134% growth in public transport kilometres by 2031 and would assist in increasing public transport mode share to 12.1% over the same period
- enhance service efficiencies for both the main line and suburban sectors through the separation of operations by establishing new sectors, and the provision of additional, separate stabling facilities so that trains would not have to cross over main line tracks to access stable yards, causing delays to both suburban and main line services
- relieve demand pressure on other modes (bus, private vehicle) and networks (roads) with capacity and congestion challenges
- relieve demand conflicts between passenger and freight rail services, particularly from the south and west to the Port of Brisbane, allowing sufficient capacity to meet forecast demand for freight rail services. Road freight routes through established urban areas would not have to accept additional heavy vehicle traffic to cater for freight transport demand
- relieve congestion-related pressures on passenger rail services, such as journey times and service reliability, passenger crowding and station capacity at Central Station. Waiting times would be reduced progressively from 2021 to 2031. Over the same period, crowding levels would be relieved substantially, with a predicted 54% reduction in 2021 and 49% reduction in 2031
- enhance accessibility to the Brisbane CBD and designated growth centres by providing an additional 52 trains into the CBD in the morning peak period in 2031.

Without the Project, progressively declining levels of rail service, including high levels of train crowding on the long-distance commuting trains and increasing train unreliability would result. Rail commuters would be forced to take off-peak trains, use alternative transport or change trip making decisions.

Cross River Rail would also support the transport outcomes in the SEQ Regional Plan by fostering a compact urban form and connecting communities. The Project would support forecast growth in population and employment in planned extra-CBD centres, with a high quality integrated public transport (rail) service.

Cross River Rail would influence transport choices, mobility patterns, access and connectivity, land use and economic development for decades, and for future generations. Planned, designed and delivered with sustainability in mind, the Project would enhance its contribution to the economic, environmental and social well-being and prosperity of neighbourhoods across Brisbane and the wider region.

Specifically, the Project will:

- support and implement the intentions of the SEQ Regional Plan for an efficient urban form in which an integrated, high capacity public transport system supports designated growth areas at Bowen Hills, Woolloongabba, Dutton Park/Boggo Road andYeerongpilly
- support the on-going role of the Brisbane CBD as the primary centre in South East Queensland, through the provision of additional capacity in the passenger rail network
- support continued population growth and economic development in South East Queensland through the provision of high capacity public transport to key locations, including Bowen Hills, Brisbane CBD – Roma Street and Albert Street, Woolloongabba, Dutton Park/Boggo Road
- provide high quality public transport with minimal disruption to surface land use patterns or land use planning intentions by delivering the infrastructure and stations underground and confining the surface infrastructure to the rail corridor where practicable

- support existing employment and activity centres through the provision of high frequency, high capacity public transport at the Royal Brisbane and Women's Hospital campus and RNA Showgrounds at Bowen Hills, Brisbane CBD, The Gabba Stadium and Mater Hospital at Woolloongabba, the Boggo Road Urban Village including the Ecosciences Precinct and the Princess Alexandra Hospital at Dutton Park.

25.2.4 Economic justification

In terms of economic benefits, the Project will:

- deliver significant transport benefits for passenger and freight rail services, including travel time savings, on-time reliability, access to freight train paths for service reliability, travel time and operating cost savings for road users
- deliver indirect economic benefits through increased accessibility across the transport network in South East Queensland and increased efficiency of movement in and around the region and the Brisbane metropolitan area
- deliver employment benefits directly and indirectly through the construction phase, as well as through the operational life of the Project
- deliver a range of wider economic benefits, in terms of land use, productivity and amenity
- deliver economic benefits in excess of $9 billion, well in excess of costs, thereby creating a Benefit Cost Ratio (BCR) of 1.42, or 1.63 if wider economic benefits are accounted for.

25.3 Project objectives

Cross River Rail would meet the objective of improving rail services in South East Queensland by increasing the capacity of the inner city rail system so that more train services can operate, more often, across the South East Queensland rail network. The Project is also intended to improve rail access to key inner city destinations and promote a sustainable South East Queensland by reducing car dependency, traffic congestion and pollution, supporting economic growth and helping the region develop in a way that maintains the lifestyle of residents.

The over-arching objectives of Cross River Rail aim to achieve the following economic, social and environmental outcomes:

- Economic
  - freight and business traffic can move efficiently and effectively
  - transport investment and land use patterns maximise the efficiency of the system, with a focus on getting the best out of the network
  - travel times are reliable and the cost of congestion is not a significant impediment to economic prosperity
  - the transport system has alternative routes available when major incidents or events occur and the vulnerability to reduced supply of oil is minimised
- Social
  - the transport system contributes to making the region a better place to be and enhances amenity in South East Queensland communities
  - people can easily access goods, services, facilities and jobs, with many residents having these available locally or able to easily access them without using a car
  - people feel safe and secure using the transport system and there is a steady reduction in the occurrence of crashes on the road and rail network

- Environmental
  - greenhouse gas and other environmental emissions are reduced by increasing public and active transport use, reducing overall transport demand, using transport more efficiently and increasing the proportion of fuel-efficient and alternative fuel vehicles in the fleet.

25.4 Project impacts and mitigation – construction phase

In its construction, Cross River Rail would present a massive transport infrastructure undertaking extending across and beneath a large part of the inner suburbs of Brisbane, including the Brisbane CBD. While the scale and intensity of the construction undertaking is significant on a national scale, the impacts would be of limited duration, ie 5.5 years, compared with the operational benefits.

The construction impacts anticipated with the delivery of Cross River Rail would be most obvious in the vicinity of the worksites, and less obvious along the alignment of the tunnelling works, the materials supply lines, the spoil placement sites and the haulage routes. The major worksites include:

- Yeerongpilly – for the establishment of tunnelling activities including the assembly of two tunnel boring machines (TBMs) for the drive of two parallel tunnels through to Woolloongabba and support of surface works at the Yeerongpilly Station
- Woolloongabba – for the establishment of tunnelling activities including the assembly and launch of two TBMs for the drive of two parallel tunnels through to Victoria Park and construction of the Woolloongabba Station
- Albert Street – consisting of two shafts and supporting worksite for the construction of the underground station and receipt of the TBMs passing through from Woolloongabba to Victoria Park
- Roma Street – consisting of three shafts for the construction of the underground platform and pedestrian concourse linking back to the existing station.

The key findings with regards to the anticipated Project impacts are summarised as follows:

- impacts generally would be temporary and finite, ie less than five years duration, and would be confined mostly to the locality of the worksites
- impacts would be greatest in the vicinity of the major worksites at Yeerongpilly, Woolloongabba, Albert Street and Roma Street
- wider ranging impacts such as construction transport reduce in intensity rapidly with distance from the major worksites
- impacts from tunnel construction, such as ground-borne noise and vibration, would last for approximately five to seven days for each TBM passby, except for tunnelling under the CBD, where each passby would take longer, eg seven to ten days.

Implementation of the mitigation measures, in combination with advance and on-going consultation with potentially affected owners and occupants of properties would address most, if not all impacts.

25.4.1 Construction traffic

Construction activities would have potential impacts on the strategic road network, eg haulage routes, and the local road network, eg in the vicinity of worksites. Each of the major worksites, ie Yeerongpilly, Boggo Road, Woolloongabba, Albert Street and Roma Street, would require changes to local traffic arrangements to function effectively. Specific construction traffic management plans would provide measures to mitigate the effects of construction traffic. Management plans would address safety aspects, the movement of pedestrians and cyclists around worksites, the relocation of bus stops and taxi ranks where required, and measures to mitigate the effects of lane closures if and when they might be required.

Construction workforce car parking

The provision of car parking for the construction workforce engaged at each worksite would include a combination of on-site parking and overflow parking supported by shuttle services to worksites where parking capacity is constrained. For some sites, such as the Yeerongpilly worksite, implementation of a car parking management scheme would address community concerns about parking overflow in local streets. Inner CBD worksites would have limited workforce parking, however public transport access is readily available to these sites, similar to other CBD construction sites.

Construction haulage routes

Construction haulage routes have been identified to minimise the impact of truck operations from the proposed works. The key haul routes for worksites south of the Brisbane River include a combination of Ipswich Road and Ipswich Motorway. For spoil haulage, the route would continue to Swanbank via the Cunningham Highway to Redbank Plains Road and then Swanbank Coal Road. Apart from Ipswich Road and Swanbank Coal Road, all other roads are State-controlled roads. The key haulage routes for worksites north of the Brisbane River include the Riverside Expressway for Albert Street and a combination of the Inner City Bypass, Hale Street to Milton Road and the Centenary Motorway, before joining the Ipswich Motorway and onwards to the spoil placement site at Swanbank.

The assessment shows that peak hour haulage operations have a minimal and insignificant impact on base case peak traffic operation. Consequently, no restriction to trucking operations during the peak traffic periods is warranted.

Impacts at worksites

Specific mitigation measures have been proposed for each worksite where the impacts are considered to be significant. Overall, the impacts of construction are considered to be acceptable, with minimum changes to existing traffic conditions.

In addition to specific mitigation measures, strategic whole-of-project mitigation measures to manage traffic safety and network impacts are required and have been proposed. These macro-level measures would address the methods for traffic management, stakeholder consultation and communications with road users. The combination of whole-of-project and specific worksite management measures proposed would minimise construction impacts on existing traffic conditions and provide a feasible way to manage the construction traffic impacts of the Project.

25.4.2 Construction noise and vibration

During construction, activities likely to generate significant noise include the demolition of existing buildings, excavation using rockbreakers and other construction plant, earthworks, removal of spoil and station construction.

Underground construction

TBMs and roadheaders would operate underground over a 24-hour period, including a daily maintenance period when operations would cease temporarily. It is also anticipated that night-time construction works would be required at most worksites at some stage. The modelling undertaken for tunnel construction works indicate the vibration goals would be satisfied for avoiding damage to both residential and heritage buildings. Some exceedances of the night-time residential vibration goal (sleep preservation) are predicted, however these exceedances would be of short duration (five to seven days), correlating with the ‘passby’ of each TBM. At the same time, potential short term annoyance due to infrasound (dBG) and low frequency noise (LpA,LF) associated with driven tunnelling works may also occur. To mitigate the potential for low frequency noise impacts, the noise and vibration management plan would include public information on tunnelling progress and subsequent likely (temporary) exposure periods.

Mitigation measures proposed at both the major Woolloongabba and Yeerongpilly worksites include the use of high performance acoustic enclosures and hoarding (with low noise generating ventilation systems) and using the quietest mobile plant available. With these mitigation measures combined with careful worksite management, construction works at Woolloongabba would generally achieve the environmental objectives and satisfy the noise criteria. Additional mitigation measures may have to be developed for the initial works, such as piling, which include early consultations with nearby residences.

The predicted construction noise levels for Roma Street Station works would exceed the noise goals for only a small number of sensitive buildings during the daytime and night-time period. The predicted construction noise levels indicate that with mitigation, such as a 6 m high hoarding around each site, night-time construction noise levels would be within 1 dBA of the sleep disturbance noise goal. The predicted construction noise for these premises would be unlikely to interfere with sleep.

The predicted noise levels for site establishment works, including demolition of the existing buildings at the two Albert Street Station sites indicate the noise goals for the environmental objectives would be exceeded, at the nearest residential buildings, for daytime and night-time construction works. Mitigation measures, such as controls on hours of work would be required at these locations, in consultation with property owners.

The predicted noise levels for site establishment works at the Boggo Road Station worksite would exceed the noise goal for daytime works at the nearest residential receivers in Rawnsley Street. Mitigation measures at Boggo Road include restrictions on working hours during the initial stages of shaft excavation, together with a high performance acoustic enclosure.

The predicted noise levels for some elements of construction at the ventilation and emergency access building site at Fairfield would exceed the daytime construction noise goals for those sensitive receptors closest to the worksite. Consultations with potentially affected people prior to construction would assist in identifying options for mitigating noise impacts.

Portal construction

The predicted noise levels for construction works at the northern portal site indicate the potential for small exceedances of the relevant noise goals, due to the separation distances between the worksite and residences. Installation of a 6 m high noise barrier around the worksite would achieve the environmental objectives and satisfy the noise goals at all sensitive receivers except for the Centenary Aquatic Centre and the nearest Gregory Terrace residences. Impacts to these receivers would be managed through use of quietest available construction plant and effective consultation with potentially affected receivers. As excavation works progress deeper into the portal structure, noise levels would diminish at the residential properties on Gregory Terrace to meet the construction noise goals.

At the southern portal site, noise levels for short-term site establishment (including demolition) works are predicted to exceed the daytime noise goals. The predicted noise levels for spoil removal along Station Road during TBM operation indicate noise exceedances during the night-time period at the nearest residential receivers. Mitigation measures would include the retention of some existing industrial buildings, acoustic enclosures, managing the work hours and consultation with residents. With mitigation measures in place combined with careful management of all heavy vehicle movements, the noise goals would be achieved at the southern portal site. The exceptions would be for the initial demolition works and work requiring possessions of the live rail corridor in the vicinity of the southern portal. For these activities, consultations with potentially affected residents would be required to determine suitable mitigation measures.

Surface works

High noise levels may result from the Project track work as it occurs over short distances. In addition to limiting, where practicable, the duration of track construction works near sensitive receivers, mitigation measures would be applied, consistent with the measures listed in Queensland Rail's Code of Practice.

Construction traffic

The preferred spoil haulage routes are confined mostly to major roads. Local roads would be used for spoil haulage only if designated in an approved construction traffic management plan. Noise impacts of spoil traffic on spoil routes that pass residential receivers have been assessed as negligible.

Construction noise and vibration management

A range of noise and vibration mitigation measures would be developed in consultation with DERM and other stakeholders and implemented prior to construction. Construction noise and vibration monitoring procedures would be developed to assist in planning the excavation and construction works. Monitoring would be particularly important where work activities are within 100 m of residential properties or other noise sensitive receivers and in locations where predictive modelling indicates a potential for exceedances of either the noise or vibration goals. Pre-condition surveys would be required for buildings and heritage places in vibration sensitive zones prior to commencement of construction.

25.4.3 Air quality impacts during construction

Air quality

The potential for dust nuisance during construction would arise with the establishment of each worksite, through demolition and site clearance and the operation of plant and equipment, as well as the removal of excavated material (spoil) from tunnelling activities. A construction dust monitoring plan would be prepared as part of the Construction EMP. The Construction EMP would specify measures for avoiding and managing nuisance dust impacts and controlling exhaust emissions from fixed or stationery plant and equipment with diesel motors. Regular air quality monitoring at the nearest sensitive receptors to the worksites and locations representative of the worksites would be required to assess compliance with appropriate criteria.

25.4.4 Socio-economic impacts

Social

While the Project would provide many community benefits at the State, regional and local levels, its construction would have some impacts on the surrounding residents and communities. Adverse community and social impacts can result from "construction fatigue", that is ongoing exposure to a range of other large infrastructure and land development projects in the study corridor. Likely social impacts to the community in the vicinity of construction worksites can result from the influx of construction workers and related parking concerns, changes to local access routes, as well as the scale, intensity and duration of construction, including concerns over dust, noise and vibration impacts. These impacts have the potential to alter the existing amenity of the local areas, the amenity of the local parks and reserves, community health and safety, pedestrian and cycle movements, and community cohesion.

A range of mitigation measures have been developed in **Chapter 24 Draft Outline EMP**, and would be refined during detailed design and construction planning. One of the key mitigation measures would be the provision of timely and clear information (in appropriate languages and using a range of mediums) about the Project works and support to residents. This would reduce stress and anxiety levels, and increase local safety in areas around the worksites.

Land use

Overall, the Project would require the acquisition of approximately 411 properties, including private, State and Council owned land, either by way of surface acquisition or by volumetric acquisition. Of these, some 108 properties would be required for surface works, including worksites, stations and ancillary infrastructure, mostly in the southern parts of the study corridor. In addition, volumetric acquisition would be required on a further 303 properties. Volumetric acquisition of titles required for the Project would be located mainly within the central section of the study corridor. Residential properties would be most affected by volumetric acquisition.

Upon completion of the Project works, land required for worksites would be rehabilitated and would be available for redevelopment, subject to conventional planning and development assessment procedures.

Indigenous cultural heritage

All work would conform to the requirements of the *Aboriginal Cultural Heritage Act 2003* and the principles of the Burra Charter. A Cultural Heritage Management Plan would be required between the Proponent and both Aboriginal Traditional Owner parties.

Non-Indigenous cultural heritage

Cross River Rail would directly impact on a number of heritage places including the RNA Showgrounds, Victoria Park, Boggo Road Gaol, and Roma Street, Rocklea and Salisbury stations. Sub-surface works also have the potential to impact on a number of heritage registered places from noise, vibration and settlement associated with tunnel construction. Where the potential for archaeological places or artefacts exists, the discovery of any important historical archaeological place or artefact must be reported to the Department of Environment and Resource Management (DERM).

Where Project works would impact on heritage-listed structures, a full photographic and descriptive report would be prepared prior to construction. Works would be conducted in accordance with cultural heritage management plans.

Economic impacts

Cross River Rail would require the acquisition of residential and commercial premises to accommodate the portals, stations and connections with the existing surface network. In addition to the direct financial costs associated with the property acquisitions, there would be economic costs in terms of businesses and jobs potentially lost during the course of displacement. In the locality of the acquisitions there would also be a loss in the availability of residential accommodation. Notable acquisitions include the Albert Street area, where 19 existing businesses supporting approximately 70 to 100 employees would be displaced, and the section from Yeerongpilly to Salisbury where 104 residential dwellings and over 100 businesses supporting 480 to 600 employees would be displaced.

25.4.5 Other potential environmental impacts

Flooding

Flood modelling was undertaken to assess potential impacts on the flood behaviour of watercourses from the construction of the Project. Key issues include:

- a bund is proposed at the Yeerongpilly (Station Road) worksite on the Moolabin Creek floodplain to prevent floodwater from entering in a 1 in 20 AEP local creek flood event. Changes to flood levels in a 1 in 5 AEP flood event are expected to be negligible (less than 0.01 m). In a 1 in 20 AEP flood event, changes in flood levels are expected to be in the order of 0.04 m, while potential changes to flood levels in adjoining areas would be in the order of 0.09 m in a 1 in 100 AEP flood event. The bund would be removed following the completion of construction.

- for both construction and operation, flood levels in Rocky Waterholes Creek are predicted to increase by up to 0.04 m at Muriel Avenue for a 1 in 100 AEP flood event. The climate change scenario anticipates a change of approximately 0.03 m. The Project is not expected to increase flood levels on private property in this area for the 1 in 100 AEP or result in noticeable changes to flood velocities in the creek.

Flood mitigation measures which would apply to the Project include:

- culverts required to be extended to accommodate Project infrastructure and a wider rail corridor to be designed to ensure no increase in upstream flood levels
- construction worksites located in the floodplain to be either bunded or filled to a height above the 1 in 20 AEP flood level plus 300 mm, or protected by a bund on that level.

Groundwater

Groundwater inflows during the construction phase will be managed using engineering solutions (ie waterproof lining, specified grouting criteria etc). Impacts resulting from groundwater inflows into the tunnel during construction are considered to be less than that expected during the operational phase of the Project. Given the short timeframe of the construction period, any impacts are expected to be short term. Groundwater monitoring would be required to inform the detailed design and would be maintained during construction to address issues pertaining to drawdown and quality.

Surface water

The construction phase would require water to be used for a range of activities, including the operation of the TBMs, the wash down of vehicles and equipment, the production of grout and shotcrete, and dust suppression on surface work areas. Any water to be discharged from construction areas and worksites has the potential to impact on nearby waterways if not appropriately managed. Appropriate measures for the collection, treatment and disposal of groundwater entering a worksite would be required.

At worksites with extensive earthworks or in areas in close proximity to watercourses, more extensive site drainage and stormwater management measures would be required to achieve water quality objectives. A soil erosion and sediment control management plan would be prepared and implemented for each worksite, to avoid or minimise the transfer of sediment or other pollutants from construction activities to waterways or drainage lines. A water quality monitoring programme would be in place prior to construction, to ensure compliance with water quality objectives and manage potential impacts on surface water quality.

Soils and geology

With tunnel construction, there is a potential risk of geology and soil impacts due to settlement resulting from tunnel excavation/construction. The potential risk for such impacts is considered to be low, having regard to the design and construction methods proposed for the mainline tunnels, the cross passages and the underground stations.

The potential for widespread disturbance of ASS sediments as a consequence of Cross River Rail construction is also considered to be low and manageable. Field investigations would be required to support detailed design, to confirm the presence/absence and status of ASS and manage the potential impacts on both surface water and groundwater.

Further sampling and geotechnical analysis would be undertaken as part of detailed design and construction planning to assess the physical and chemical conditions of surface and subsurface soils likely to be encountered during construction. A monitoring program during construction would address both ground movement and groundwater inflow to tunnel works and station excavations.

Land contamination

The potential for land contamination to occur during construction would be greatest where surface soils would be disturbed, such as at the worksites. Construction activities, such as shafts for underground stations and ventilation, tunnel dive structures and portals, mostly occur within rail corridors or in areas where contaminated land might be present.

Detailed investigations would be carried out prior to the commencement of the Project works in accordance with the Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland and the National Environment Protection (Assessment of Site Contamination) Measure. In accordance with the *Environmental Protection Act 1994* (EP Act), a DERM disposal permit would also be required for the removal and disposal of contaminated soil from land which is recorded on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) to an off-site location.

25.5 Project impacts and mitigation – operations phase

The operational impacts generated by Cross River Rail are predicted to be mostly beneficial over the 100 year design life of the Project. The Project benefits accrue for both local and regional communities and populations.

The main adverse impacts would be limited to local areas and would include:

- increased pedestrian movements in the vicinity of Albert Street Station requiring changes to the existing footpath configuration and consequential changes to the existing streetscape and amenity. A similar impact would arise with pedestrian movements at Roma Street Station
- increased commuter traffic around the new station at Yeerongpilly and changes in local access arrangements at Salisbury
- increased surface rail corridor noise in several locations south of Yeerongpilly, eg Rocklea, Salisbury, for which noise barriers have been designed (as far as practicable) at these locations to comply with Queensland Rail's operational planning levels
- the siting of some Project infrastructure in particular locations, such as the ventilation and emergency access building in Fairfield.

Overall:

- impacts would be mostly beneficial and would extend well beyond the study corridor to the greater Brisbane metropolitan area and the wider South East Queensland region
- the localities around the stations would benefit over the long term through a greatly enhanced transport service and accessibility to both metropolitan and regional facilities and services
- benefits would accrue over the long term, ie greater than 10 years, and would bring about inter-generation change to land use, transport of people, particularly commuters and would support more sustainable population growth and economic development in South East Queensland
- benefits would be optimised by supporting the effects of Cross River Rail through on-going integrated land use and transport planning and disciplined development management
- potential localised impacts on some properties adjacent to the surface stations and adjacent to the surface rail corridor south of Park Road would be reduced, if not avoided, through detailed design, in response to the environmental design principals in this EIS. Such impacts would include the potential for noise break-out from public address systems, commuter traffic and parking near stations.

25.5.1 Local traffic impacts

The provision of additional rail capacity and faster more frequent train services will lead to greater demand for kiss ‘n’ ride and park ‘n’ ride access to stations within the study corridor, with minor increases in local traffic generation. At all stations within the study corridor, there is sufficient existing or proposed capacity to accommodate expected kiss ‘n’ ride demands.

At some stations, such as Albion and Wooloowin, parking demand is already in excess of supply and Cross River Rail is not expected to significantly change this. However, at Yeerongpilly, additional commuter parking demand created by Cross River Rail would need to be managed through the introduction of a permanent weekday controlled parking area, whereby all day parking is restricted for non-resident vehicles.

Changes to the local road network required at Roma Street and Albert Street in the CBD to accommodate widened footways and additional pedestrian infrastructure would have minor and acceptable impacts to traffic delays and queuing.

Permanent changes to the road network around Rocklea as a result of the closure of Beaudesert Road (service road) level crossing, including signalisation of the intersections on alternative access routes would result in minor, acceptable increases in delay for through traffic while benefiting (ie reducing delays) for local traffic.

25.5.2 Noise and vibration impacts

Ground-borne noise and vibration

The ground-borne noise modelling and predictions show that the selection of appropriate trackforms would achieve compliance with the ground-borne noise goals at all sensitive receivers.

The predicted ground-borne vibration levels during operation are below the residential vibration goal at the nearest sensitive locations. Ground-borne vibration levels from train pass-bys are unlikely to be perceptible within nearby buildings. The predicted ground-borne vibration levels also comply with the instrument-specific vibration criteria given for the electron microscope at the Ecosciences precinct.

Airborne noise

In the southern section, some sensitive locations are predicted to exceed Queensland Rail’s operational rail noise criteria. Consequently, noise barriers have been designed for these locations at Salisbury, Rocklea and Yeronga to achieve compliance with Queensland Rail’s operational rail noise criteria. The noise barriers at Rocklea and Yeronga would be up to 5 m in height, whilst the noise barrier at Salisbury would vary between 5 m to 7 m in height.

Changes in freight and passenger train numbers on existing surface tracks between the portals in Yeerongpilly and Victoria Park would lead to negligible predicted increases in noise from surface rail traffic. The maximum noise level during train passbys will not change due to the change in passenger and freight train numbers. There would only be a change to the number of train passby events. Over time, it is likely that the maximum noise levels from train passbys would be reduced as new generation rollingstock are progressively introduced into operation.

25.5.3 Socio-economic impacts

Social impacts

Cross River Rail would support the achievement of the transport and transit outcomes in the SEQ Regional Plan by fostering compact urban form and connecting communities. The Project supports a sustainable approach to population growth, and the on-going role and function of the Brisbane CBD as the primary centre for commerce and employment in Queensland. Future, sustainable population and employment growth in these areas would benefit from high quality public transport connections offered by the Project.

Services and infrastructure delivered by the Project would meet the needs of people with mobility and sensory difficulties, such as older people and people with disabilities as per the *Disability Discrimination Act 1992*.

While the Project would provide many community benefits at the State, regional and local levels, its operation would have some impacts on the surrounding residents and communities. That is, while communities close to new stations, new structures and renewed stations would generally benefit from the enhanced accessibility provided by the Project, they would also experience some changes to local road access and to stations and the loss of some parkland, especially in Victoria Park and Roma Street. However, new open space provided by the Project at the Albert Street Station plaza, the Gabba Station plaza and a riparian corridor within the Yeerongpilly worksite would provide important social benefits for local communities.

Economic impacts

The provision of improved inner city public transport is expected to provide substantial broader economic benefits to industry and the broader community in Brisbane and South East Queensland. At a discount rate of 7%, the economic analysis indicated a positive economic return for Cross River Rail with a net present value (NPV) of $2.3 billion and a Benefit Cost Ratio (BCR) of 1.42. The BCR increases to 1.63 when the wider economic impacts for the Project are included. The main contributor to the wider economic impacts is agglomeration benefits, with the remainder largely accounted for by labour supply effects.

The largest component of benefit is perceived benefits to public transport users (time savings, improved amenity from reduced crowding) which accounts for 39% of benefits. The next largest component is travel time and cost savings to private transport users who gain from the reduction in road congestion, leading to higher commuting speeds and reduced operating costs.

In addition to passenger-related travel benefits, Cross River Rail would also deliver benefits to rail freight by moving passenger trains (Gold Coast and Beenleigh) to Cross River Rail tracks and ‘freeing-up’ dedicated rail freight paths between Acacia Ridge and the Port of Brisbane. This would allow more intermodal freight to be transported by rail rather than by road, as under existing conditions. Consequently, there would be operating cost, externality and crash cost and road decongestion benefits.

Land use impacts

At the completion of Ekka Station, the RNA Showgrounds facilities affected by the Project works would be rehabilitated for subsequent use consistent with the Master Plan. The design reflects the intentions of the RNA Showgrounds Master Plan.

Within the Brisbane CBD, land use impacts would be primarily commercial, with impacts also on residential and open space uses. The Project would result in the permanent loss of 22 retail businesses for the establishment of Albert Street station accesses. The subsequent redevelopment opportunities including retail facilities around the proposed civic space at the Albert Street Station access would assist in offsetting the loss of CBD retail space.

The proposed Roma Street and Albert Street stations, with the enhanced accessibility to these parts of the CBD, would support and stimulate changes to the density and mix of nearby land uses. An intensification of both commercial and residential uses around both Roma Street Station and Albert Street Station should be expected as a consequence of Cross River Rail.

At Woolloongabba, State land adjacent to the proposed station is proposed for redevelopment. This would support major events at the Gabba, and the planned urban rejuvenation in the surrounding precincts.

Cross River Rail would also support Boggo Road Urban Village as a highly accessible, high density, mixed use precinct. Such enhanced accessibility would stimulate further residential and commercial activities in the precinct. The connections between the University of Queensland and the Ecosciences Precinct would be strengthened as a consequence of Cross River Rail.

Yeerongpilly would be affected by surface land acquisitions for permanent works, which include a new rail station and road realignments. These requirements would result in the loss of residential and industrial land. However, the Project would support the rejuvenation of areas surrounding the new rail station, including the future Yeerongpilly transit oriented development (TOD) and provides enhanced access to the Queensland Tennis Centre with more services able to stop at the expanded station.

25.5.4 Groundwater impacts

The potential for groundwater drawdown with Cross River Rail would be created by the main tunnels, the cross-passages and the underground stations. Groundwater level drawdown has been predicted using modelling studies for one year, five years and ten years following tunnel construction. The risk of groundwater drawdown to the main tunnels will be minimised by adopting a construction method which uses a reinforced, waterproof lining. The predicted inflow of groundwater with this system of construction is low and less than 1 litre per second. This inflow is sufficiently small enough to be considered to represent a ‘dry’ tunnel.

Groundwater modelling shows that the potential for groundwater drawdown is greatest at the underground stations at Albert Street and Roma Street in the CBD, at Woolloongabba and at the ventilation and emergency access shaft at Fairfield. The extent of drawdown is not expected to exceed 5 m over the first 10 years post construction.

With the cross-passages, the method of construction will also act as effective mitigation to groundwater inflow. It would include the installation of a waterproof membrane behind a concrete lining. For the underground stations and the ventilation and emergency access shaft, the proposed construction method includes ‘cut-off’ walls or sheets to intercept and contain groundwater in the shallow aquifers. This approach is considered to be effective and practicable for the circumstances of each structure.

25.6 Cumulative impacts

The cumulative impacts of the Project with respect to other current or planned developments have been considered with reference to the South East Queensland Infrastructure Plan and Program, draft *Connecting SEQ 2031*, Brisbane City Council Planning and Development, master plans, the Urban Land Development Authority, Department of Public Works, the Department of Infrastructure and Planning and the Department of Transport and Main Roads.

Projects that could potentially increase construction impacts on the community are Legacy Way, urban development areas at Bowen Hills (including RNA Showgrounds) and Woolloongabba, Yeerongpilly TOD and Boggo Road Urban Village. There would be varying potential for cumulative construction impacts to arise with some of these projects.

While the indicative program identifies a number of projects with overlapping construction timeframes, none of these projects is sufficiently advanced in its planning and detailed design to compare specific aspects of construction.

Overall, the cumulative effect of Bowen Hills Urban Development Area (including RNA Showgrounds), Woolloongabba UDA, Boggo Road Urban Village and Yeerongpilly TOD and Cross River Rail would have a positive, long-term effect on the local and broader community through the provision of accessible and robust public transport systems that are integrated with urban development. Cross River Rail would facilitate and support redevelopment in these locations through a planned and coordinated integrated transport framework.

25.7 Environmental management and sustainability

Cross River Rail, as a major transport project requiring a significant construction effort, must be able to demonstrate that it has been planned and designed in a way which maximises sustainability and efficiency and that it can be delivered and operated in a way which is sensitive to environment values.

Apart from being a public transport project which, by its very nature, tend to support more sustainable settlement and travel patterns, the design of Cross River Rail has considered and incorporated a range of specific initiatives which will lead to sustainable and efficient outcomes.

Sustainability measures incorporated in the reference design to date include:

- selection of a long tunnel option as part of the reference design, thereby avoiding the direct impacts of additional rail infrastructure, such as track widening and large scale property acquisition and demolition, on the surface and on inner suburban neighbourhoods
- measures to reduce energy demand and minimise lifecycle energy consumption, eg single track tunnels for ease of construction, reduced gradients for lower energy operations, platform screen doors for safety and station temperature control
- measures to reduce water demand, eg minimising the use of potable water in construction, measures to protect water quality and reducing the risk of flooding, eg tunnel and station design and waterproofing to limit movement of contaminated groundwater
- measures to implement effective waste management beyond regulatory compliance, eg reuse of some excavated material at Clapham Rail Yard and if encountered, remediation of contaminated land on site
- measures to maintain, and where possible, enhance the quality of the built environment through urban design, ie neighbourhood improvements, street widening
- measures to integrate with existing transport nodes, other infrastructure and land use to maximise efficiency in travel, patronage and viability
- measures to enhance health and social well-being and to improve passenger comfort, access to the rail network and station capacity during major events
- measures to enhance safety and security eg Crime Prevention Through Environmental Design (CPTED) measures, compliance with the *Disability Discrimination Act 1992* (DD Act)
- measures that contribute to economic growth in Brisbane and South East Queensland, eg enhanced public transport and accessibility, enhanced capacity for rail freight and integration with land use and redevelopment.

Further sustainability measures to be considered and advanced (where feasible) through the detailed design process include water efficient and energy efficient (renewable energy) alternatives, minimising spoil generation and investigating opportunities for the re-use of spoil in the construction of Cross River Rail.

A draft Outline EMP has been prepared that sets out the Project approach to environmental management. It establishes environmental design principles for the Project and environmental objectives and performance criteria for the construction and operation phases. It also provides outline mitigation measures to maintain the environmental values of the study corridor.

The draft Outline EMP comprises a draft Outline CEMP, which outlines the approach to environmental management for the Project's construction phase, as well as a draft Outline Operations EMP (OEMP), which outlines the approach to environmental management for the Project's operations phase. The draft Outline EMP is intended to guide the development of more detailed EMPs and relevant sub-plans prepared by the Proponent (or its agent or contracted entity), prior to commencement of the Project's construction and operations phases. In preparing the detailed EMPs and sub-plans, the Proponent (or its agent or contracted entity) must consider any conditions imposed by the Coordinator- General as part of the Coordinator-General's Evaluation Report. Any conditions imposed by the Coordinator-General would prevail over any provision in the draft Outline EMP.

25.8 Recommendations

Cross River Rail, as described in this EIS, would meet the objectives of improving rail services by increasing the capacity and efficiency of the inner city rail system, as well as improving rail access to key inner city destinations. The Project would support sustainable population growth and economic development in South East Queensland by extending a high quality, high capacity rail transport system to the Brisbane CBD and designated growth centres in the inner suburbs. Cross River Rail would also free up the surface rail network and so provide enhanced capacity for rail freight accessing the Port of Brisbane and the Acacia Ridge multi-modal freight terminal.

Additional lifestyle benefits Brisbane and South East Queensland residents would derive through enhanced accessibility to high-order facilities and services in the Brisbane CBD and inner suburbs. The Project would alleviate commuter pressure on the road network and the busway network arising from population and employment growth.

While Cross River Rail would lead to a wide range of transport, socio-economic and community benefits for Brisbane, there would be some likely adverse impacts for local communities residing in close proximity to key construction worksites.

Having regard to the findings of the EIS with respect to the benefits and impacts of Cross River Rail, the following recommendations are made to the Coordinator-General:

Recommendation 1

That Cross River Rail should be approved to proceed subject to:

i. project development adopting and implementing a sustainability framework consistent with the Queensland Government's objectives for sustainable development and with the framework presented in the EIS

ii. detailed design embracing an innovative approach in seeking to resolve, to the extent feasible, the potential or predicted impacts of the reference design, particularly with regards to construction impacts on local residents

iii. developing and implementing detailed environmental management plans for the construction and operation phases of the Project, where such plans adopt the principals,objectives and performance criteria, set out in the draft outline EMP presented in the EIS

iv. developing, implementing and maintaining effective mitigation measures to address and mitigate the impacts of the Project on local communities.

Recommendation 2

It is further recommended to the Coordinator-General that:

i. all necessary approvals and permits be obtained for the Project, including, but not limited to, those required under the *Sustainable Planning Act 2009*, the *Transport Infrastructure Act 1994* and related Acts, the *Aboriginal Cultural Heritage Act 2003* and the *Environmental Protection Act 1994*

ii. the Queensland Government investigates measures to coordinate the construction and delivery of Cross River Rail concurrently with a number of other major projects, including Northern Link (Legacy Way), the Boggo Road Urban Village, the Woolloongabba and Bowen Hills UDAs and the Yeerongpilly TOD.

The Coordinator-General is requested to assess this EIS, and in preparing an evaluation report:

i. recommend that Cross River Rail proceed

ii. state the conditions for the Project under section 39 of the State Development and Public Works Organisation Act 1971

iii. recommend under section 43 of the State Development and Public Works Organisation Act 1971, the requirements for inclusion in the designation of the Project corridor or land required for parts of the Project as 'community infrastructure' under the Sustainable Planning Act 2009

iv. where there is no other relevant approval, impose conditions on the Project where identified as relevant environmental mitigation and management measures identified in this EIS, under section 54B of the State Development and Public Works Organisation Act 1971.