22. Conclusions and Recommendations

Northern Link

Phase 2 – Detailed Feasibility Study

EIS CHAPTER 22

CONCLUSIONS AND RECOMMENDATIONS

■ September 2008

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22. Conclusions and Recommendations

This chapter addresses Section 7 of the Terms of Reference (ToR). Its purpose is to provide a balanced overview of the Project and its impacts and benefits, together with any recommendations considered necessary as a result of the environmental impact assessment process. The chapter outlines the approach proposed to be taken in project implementation through reference to the draft Outline Environmental Management Plans and through the mitigation measures proposed to address the predicted impacts and optimise where possible the predicted benefits, as measures seeking to ensure the Project contributes to ecologically sustainable development.

22.1 Overview

With the declaration of Northern Link as a significant project, the Coordinator-General determined that an Environmental Impact Statement (EIS) was required to describe the scope of the Project, to identify the potential benefits and impacts, and to describe the mitigation measures required to address such impacts. The Coordinator-General established and released ToR for the assessment of Northern Link in April 2008.

The investigations for the development of the Northern Link design and for the preparation of the EIS, have extended beyond the matters raised in the ToR to include matters raised during the preliminary consultation process and during the design development phase.

The conclusions drawn from the design studies and the EIS relate to:

- the strategic need, or rationale, for Northern Link within Brisbane's road network;
- the potential benefits and impacts of Northern Link upon the environment of the study corridor, and beyond in some circumstances, in both its construction or delivery and its operation;
- the scope of community and stakeholder interests in Northern Link; and
- the range of mitigation measures available to address community issues.

22.2 Rationale for Northern Link

Sustained population growth and economic development in SEQ over the last two decades or more has led to a strengthening of the SEQ Regional Plan from an advisory document to a statutory instrument. The Queensland Government has implemented this change in approach to planning for and managing the effects of growth and demand for infrastructure and essential services.

One outcome of this growth is the continued increase in travel demand across the SEQ Region, and within key local government areas. Brisbane will accommodate nearly 18% of regional population growth, in the period 2006 – 2026. As Brisbane is and will remain the principal centre for business activities, high-level services and employment in the region, it will continue to be the focus for growth in travel demand. Such significant growth in population and employment would lead to a sustained growth rate in trip making at an average of 1.6% per annum through to 2026. This would be an increase in over 2,000,000 total weekday person trips compared to 2007.

Over the past 15 years there has been a concerted effort to increase significantly the use of public and active transport. The current rate of patronage growth for weekday trips in the region is around 7.7% per annum[1]. Despite this substantial growth in public transport usage the majority of trips in the Brisbane Metropolitan Area are made by private and commercial vehicles.

The SEQ Regional Plan, and the South East Infrastructure Plan and Program present the Queensland Government's framework for sustainable growth management. A key aspect of the suite of infrastructure identified is the on-going augmentation of the road transport network.

The key deficiencies of the current road network are related to gaps in the strategic network, system performance, the ability to cater for growth in travel, low and unreliable travel times and a lack of route choice and flexibility. The gaps in the strategic transport network principally affect east-west transport efficiency, safety and reliability. There are network gaps between the western and northern approaches to Brisbane, and a direct, high quality connection between the west and the ATC (North), which includes Brisbane Airport, is missing from the current network structure.

The traffic congestion that currently exists on the road network is forecast to deteriorate further over time. This will have a range of consequences such as:

- congested arterial roads resulting in excessive and unreliable travel times;
- increased and unreliable bus journey times;
- increased time for the road network to recover from an incident;
- constrained local accessibility such as banned turns and one-way systems, to cater for regional radial traffic;
- the diversion of trips to the local road network;
- inappropriate vehicles types (freight) using inner urban roads;
- a lack of road space for local functions such as parking, loading, public transport; and
- increased reliance on signalised intersections resulting in significant delay during congested times, in particular for local traffic.

Increased travel demands in future years will create significant additional pressure in the metropolitan area transport network. The consequences of the road network deficiencies will worsen such that peak period journey travel times are forecast to increase compared to the current level. For example, without Northern Link, but with enhanced mode share to public transport, traffic conditions on the Milton Road, Coronation Drive and Moggill Road corridors are forecast to deteriorate over time. Traffic volume growth to 2026 is forecast to be almost 30% on Milton Road and 15% on Coronation Drive.

Northern Link would address strategic transport needs by:

- supporting the preferred future development pattern, population and employment growth of SEQ in accordance with the SEQ Regional Plan by improving connectivity and transport system capacity to cater for major growth areas (eg: Western Corridor) and economic activity centres (eg: CBD, Toowong, Indooroopilly, and ATC;

[1] Queensland Government, 2007e, *TransLink Network Plan*, Brisbane.

- improving east-west transport efficiency (eg: Western Corridor and western suburbs to ATC, the CBD and the regional roads in northern suburbs);
- improving freight distribution by completing an alternative, motorway-standard corridor for long distance freight from the south-west to the CBD, ATC and north Brisbane; and
- providing additional public transport capacity, and facilitating enhanced public transport capacity within existing corridors such as Coronation Drive and Milton Road.

Northern Link would address local transport needs by:

- providing a high quality route for express bus services between the western suburbs and the CBD, and improving public transport efficiency on major surface bus routes;
- removing through-traffic from Coronation Drive, Milton Road and Moggill Road which pass through major commercial and residential areas, and consequently relieving rat-running pressures from local roads; and
- providing an alternative higher order freight route to inappropriate routes through local areas, and so removing freight movements from surface traffic routes.

22.3 Project Objectives

The objectives for Northern Link, consistent with transport planning at the Commonwealth, State and local levels, are:

- **Transport network**
  - To improve east-west cross-city movement of people and freight.
  - To address deficiencies in the national freight network to improve freight distribution in and around Brisbane.
  - To provide opportunities for additional public transport capacity.
- **Environment**
  - To protect and, where possible, enhance the environment.
- **Social**
  - To assist development of a sustainable urban environment for inner-western suburbs.
- **Value for money**
  - To deliver value-for-money over whole of project life.
- **Timeliness**
  - To deliver Northern Link by June 2013.

22.4 Sustainability

In addition to these functional objectives, development of the Northern Link concept has been influenced by community inputs, technical inputs and a commitment to pursuing sustainability in all feasible aspects of Project construction and operations. Brisbane City Council has established a Corporate Vision for the future of Brisbane through *Our Shared Vision – Living in Brisbane 2026*[2]. The vision is supported by a Sustainability Policy which provides Brisbane-specific guidance for achieving sustainability outcomes through the implementation of Northern Link. The four focus areas identified in this policy are listed below:

[2] Brisbane City Council, 2006, *Our Shared Vision – Living in Brisbane 2026*, Council, Brisbane

- *Resource efficiency*: saving energy and water and reducing waste;
- *Sustainable places and urban form*: improving Brisbane's built environment, especially the interactions between land use, transport and the environment;
- *Biodiversity conservation*: protecting and enhancing biodiversity, natural areas and waterways; and
- *Health and well-being*: developing a city where our people and communities enjoy physical, mental and social well-being.

22.4.1 Sustainability Framework for Northern Link

Table 22-1 provides a sustainability framework for identifying relevant strategic and project specific areas for the development of sustainability measures. The framework provides the basis for a structured approach for integrating Council's Vision and Sustainability Policy into the proposed Northern Link Project, as well measuring the achievement of sustainability outcomes.

Table 22-1 Sustainability Framework and Northern Link

KEY INDICATORS	SUB-CATEGORIES	PROJECT PHASE#			
		Plan	Design	Const.	Ops.
STRATEGIC	***(how the project contributes to)***				
Resource efficiency	Regional/city freight movement	✓	✓		✓
	Regional/city transport network	✓	✓		✓
Sustainable places and urban form	Urban form, design, mixed use/TOD, connectivity	✓	✓		✓
	Public transport movement	✓	✓	✓	✓
Biodiversity conservation	Regional/city green corridors/spaces/waterways	✓	✓	✓	✓
Health and well-being	Amenity and community character	✓	✓	✓	✓
	Public spaces/facilities	✓	✓	✓	✓
PROJECT SPECIFIC	***(how the project addresses)***				
Economic					
Direct Cost	Construction, life cycle	✓	✓		✓
Indirect cost	Community, natural environment	✓	✓		✓
Environmental					
Land use	Project footprint	✓	✓	✓	✓
	Adjoining properties	✓	✓	✓	✓
Water	Impact/mitigation – water cycle	✓	✓	✓	✓
	Water capture/reuse	✓	✓	✓	✓
Air	Quality impact/mitigation	✓	✓	✓	✓
	Ventilation outlet	✓	✓	✓	✓
Noise	Impact/mitigation	✓	✓	✓	✓
Ecology	Impact/mitigation	✓	✓	✓	
	Replacement/enhancement of habitat	✓	✓	✓	
Visual	Impact/mitigation/enhancement	✓	✓	✓	
Waste management	Extent of waste created		✓	✓	
	Reuse		✓	✓	
Social					
Social uses	Impact/mitigation/enhanced access or protection	✓	✓		
Public access and physical activity	Connectivity to employment, services and PT options changed access to open space and parks	✓	✓		✓
Public engagement	Perception	✓	✓	✓	✓
	Involvement and satisfaction with outcomes	✓	✓		

KEY INDICATORS	SUB-CATEGORIES	PROJECT PHASE#			
		Plan	Design	Const.	Ops.
Resource utilisation					
Site access	Construction equipment, workforce, waste, material	✓	✓	✓	
Resource availability	Material, equipment, workforce	✓	✓	✓	
Material type		✓	✓	✓	
Reusability	Reusability of moulds, formwork	✓	✓	✓	
Quality assurance	Ease of quality control	✓	✓	✓	
Health and safety					
Occupational		✓	✓	✓	✓
Public	Pedestrian, vehicular and open space safety	✓	✓	✓	✓
Project administration					
Project requirements (EIS, contract)	Inclusion of sustainability-related clauses	✓	✓		
Procurement method	Assessment against sustainability	✓	✓		

Table Notes:
This table has been created from a range of sources including Brisbane City Council Corporate Sustainability Policy, Kumaraswamy, 2004, Wong, 2003 and SKM 2007.
[#] Project Planning and Feasibility Assessment have been combined into 'Planning' and 'Decommissioning' has not been included at this time.

22.4.2 Sustainability Measures

Specific sustainability measures that have been applied in the development and refinement of the Reference Project have included:

- how the design process is undertaken:
  - minimise paper use and only use recycled paper;
  - coordinate and manage site visits and travel by Project Team to minimise emissions;
- achieving efficient transport network and traffic movement outcomes through the location and design of connections to surface roads;
- options for accommodating express bus movements;
- the capture of stormwater for use during construction;
- the reuse of tunnel spoil; and
- sustainable urban regeneration and mitigation initiatives.

It is the Proponent's intention to include sustainability measures in the Project procurement phase and throughout the detailed design, construction and operation of the Project. Specific sustainability measures that have been currently identified for inclusion into the next phase of project design and delivery following the evaluation of the EIS would include:

- maintaining construction equipment and haul trucks in good working order so fuel efficiency of equipment is maximised;
- vehicle management systems to reduce waiting e.g. spoil haulage;
- use of appropriately sized equipment for construction activities;
- minimising waste from construction, including reuse of tunnel spoil as a valuable resource;
- using low intensity lighting throughout the length of the tunnel without compromising user safety;
- energy efficient and effective lighting, fans and traffic management systems;

- automatic control of light intensity in the portal region as varying with ambient light conditions on the surface;
- ventilation system design which utilises the piston effect of traffic movement through the tunnels and with demand management of the ventilation system where ventilation (and associated electricity use) can be increased or decreased as necessary based on in-tunnel concentrations of air pollutants or in the event of fire or emergency situations.
- low energy design of project buildings;
- water sensitive construction practices; and
- sustainability objectives in urban design, landscape treatments and urban mitigation;

22.5 Economic Implications

As a key strategic element in the road network, Northern Link would link a number of designated economic activity centres and employment nodes. Employment growth to 2026 for the Brisbane CBD and for the ATC is strong, leading to anticipated levels of 190,000 jobs and 80,000 jobs respectively. Investment in infrastructure and business in these major centres also is predicted to be strong. For example, the Brisbane Airport is expected to attract more than $2 billion in infrastructure investment and $2 billion in business development over the next 10 years.

The Western Corridor, supported by the SEQ Regional Plan as the focus for much of the regional population growth, already accommodates 16,000 small businesses, with more than 30 businesses with an annual turnover in the range of $50 million to $200 million. As a major new urban growth area likely to double, or more, its current population in the next 20 years, the Western Corridor requires the creation of a large number of jobs, through economic growth and investments in infrastructure and services. Aerospace, freight, training and education have been identified as industries with high growth potential due to the proximity to Amberley airbase and existing campuses.

At the local level, employment and business activity on a regional or metropolitan scale is concentrated in centres as listed below.

- Milton – commercial and business centre, including major activities such as the Milton Brewery and Suncorp Stadium.
- Auchenflower – including the Wesley Hospital.
- Toowong – including regional commercial and profession services, shopping, entertainment and leisure facilities.
- St Lucia – the University of Queensland and CSIRO.
- Kelvin Grove – Queensland University of Technology and Kelvin Grove Urban Village.
- Herston – Royal Brisbane Hospital.

Consistent with the strategic directions of the SEQ Regional Plan, City Plan and the Transport Plan for Brisbane, Northern Link would benefit and support economic activity and employment in each of these centres either directly or indirectly by relieving traffic flows on congested arterial routes such as Coronation Drive and Milton Road. Enhanced accessibility between employment centres and residential dormitories is critical to sustainable economic growth in each of these centres. Each of these centres is expected to grow in terms of output and employment over the period to 2026 and will rely upon an upgraded transport system, in which enhanced road capacity and enhanced public transport capacity are both important.

The economic benefits of Northern Link can also be quantified in terms of travel time benefits, reductions in vehicle operating costs, improved road safety both within the Project and on benefiting surface roads, and improved environmental conditions (eg: reduced air pollution and traffic noise, reduced greenhouse gases, enhanced urban amenity). With a risk-adjusted capital cost of $2,755 million and an operating cost of $1,627 million over the 45 year period of the franchise, Northern Link would have a net present value of $549.9 million or a benefit cost ratio of 1.2, based on a discount rate of 6.0%. **Table 22-2** presents a summary of the benefit cost assessment for Northern Link.

Table 22-2 Northern Link Benefit Cost Assessment

Output	Value
Present Value of Costs (PVC)	$2,311.1 m
Present Value of Benefits (PVB)	$2,861.0 m
Net Present Value (NPV)	$549.9 m
Benefit Cost Ratio (BCR)	**1.2**

Table Note: BCR derived from discount rate of 6% with risk-adjusted (P50) CAPEX and OPEX.

Northern Link is estimated to generate in excess of $11 billion worth of undiscounted economic benefits over the life of the Project in terms of travel time savings, vehicle operating costs, road safety savings and environmental savings. Other non-monetised benefits include some public transport travel time and waiting savings, some bus fleet operational efficiencies, land value capture along the corridor and a number of other secondary benefits that would serve to improve the benefits of the Project. Under the modelling assumptions that have been adopted, there is an acceptable economic justification to proceed with Northern Link.

22.6 Project Impacts and Mitigations – Construction Phase

Northern Link would have a range of environmental and community impacts during its construction phase. Such impacts would vary in their duration and intensity along the study corridor, but mostly would be confined to the immediate locality of the Project works. Most construction impacts would be of a temporary nature, even though some of them may be present for the duration of the 3.5 year construction period. Other impacts, mostly relating to land use and property aspects, would be long-term.

22.6.1 Construction and Worksites

Northern Link is a major infrastructure project involving a scale of construction activity not previously encountered in the study corridor. Construction impacts could include:

- diminished air quality due to exposed earth surfaces in the worksites, the operation of earth-moving equipment, and the loading and haulage of spoil;
- noise and vibration due to both surface and sub-surface construction techniques such as drilling and blasting, rock-breaking, cut and cover works, or tunnelling either by roadheader or tunnel boring machine;
- reduced surface water quality due to the escape of drainage waters contaminated with sediments or other entrained material, and possible drawdown of groundwater in some areas of alluvium;
- loss of vegetation, including some significant trees in Kelvin Grove; and
- possible risk of impacts on places of cultural heritage significance, such as Toowong Cemetery.

To respond to and manage effectively these and the other potential impacts arising from construction of Northern Link, a draft outline Environmental Management Plan (EMP) for the construction phase has been proposed in this EIS. The outline EMP presents a performance-based approach in which environmental

objectives are proposed. These objectives, supported by recommended performance criteria, are relevant to maintaining reasonable conditions and quality of life for nearby residents and businesses.

The construction of Northern Link would entail the establishment of worksites at the Western Freeway, Toowong, Kelvin Grove and a temporary work area within the ICB corridor. While the worksite at the Western Freeway and the area in the ICB corridor are within public land, the worksites at Toowong and Kelvin Grove would require the acquisition of private land. These latter sites would be situated in close proximity to residential dwellings and would require a high standard of site management to avoid, or to mitigate and manage construction impacts.

Acoustically-lined and ventilated enclosures or sheds would be erected over the portals to each of the tunnels at the Western Freeway, Toowong and Kelvin Grove to manage noise and dust impacts from tunnel construction and spoil handling and loading. All spoil handling and loading into trucks or the conveyor system at the Western Freeway would occur within these enclosures or sheds. The conveyor to the quarry would also have an acoustic enclosure throughout its course. The worksheds would be large and bulky in character, and would impact a temporary impact on the visual amenity of near neighbours. Night lighting on these sheds and the worksites would need to be directional and would need to comply with the requirements for managing light spill intrusion on near neighbours.

The movement of vehicles, including spoil haulage trucks, and other construction plant and equipment would need to be managed effectively to achieve the environmental objectives for construction noise and air quality. The haulage routes for the removal of spoil would generally follow the motorway network and the arterial road network where there is no ready access to a motorway. To reduce the impact of spoil haulage by up to 65,000 truck loads, a spoil conveyor system servicing the TBMs at the Western Freeway worksite is proposed, discharging spoil to the adjacent Mt Coot-tha Quarry for stockpiling and re-use, both in Project works and other applications.

Following construction, each of the worksites would be rehabilitated and landscaped to complement the locality. The Western Freeway worksite would complement the Brisbane Botanic Gardens. The Toowong worksite would be developed as an attractive landscaped buffer to mitigate the visual impacts of the elevated road structures above Milton Road and the road traffic noise from the ramps into and out of the Toowong connections. The Kelvin Grove worksite lends itself to re-use for some form of active use, combined with an area adjacent to the Kelvin Grove Road and Hale Street connections being more suitable for landscaped buffer. The ICB connection would be provided with architectural treatments which complement or are consistent with the transport infrastructure theme in this corridor. The ICB landscaped area on the corner of Kelvin Grove Road would be reinstated with landscaping and urban design treatments.

22.6.2 Construction Traffic and Access

The movement of construction traffic in and around worksites is of concern to people living in the vicinity of each worksite. The indicative access arrangement for each worksite is intended to reduce the potential for conflict with both local traffic and general traffic using the arterial road network. The EIS recommends the preparation of detailed construction traffic management plans and construction vehicle management plans to address and manage the likely implications of construction traffic.

A key consideration will be the maintenance of traffic flows past each of the worksites during construction and during peak traffic periods. Further, the management of construction traffic to nominated routes for spoil haulage would aid in reducing haulage impacts upon the road network as well as near neighbours. A key management measure would be to limit the use of these nominated spoil haulage routes to nominated hours – typically 6.30am Monday until 6.30pm Saturday, with there being no haulage on Sundays or public holidays.

Considering the location of each of the worksites within the arterial road network, the movement of construction traffic is within the function and the capacity of these roads.

22.6.3 Construction Air Quality

The potential for dust nuisance during construction would arise with the establishment of each worksite, through the clearing and reforming land, removing or demolishing buildings, the operation of plant and equipment for earthworks, and the handling and loading of construction spoil. The draft Outline EMP proposes criteria for managing dustfall at nearby locations, as well as proposing mitigation measures to avoid, or minimise or manage dust nuisance. Considering the proximity of dwellings to both the Toowong and Kelvin Grove worksites, there is an increased awareness of the importance of effective site management for dust control.

While dust management practices are well developed and understood, the avoidance of dust nuisance requires on-going, careful management, supported by a monitoring program and a reporting program. Where monitoring, or complaints, indicate the environmental objectives were not being achieved, the construction EMP requires preparation of an incident report and a corrective action report as part of a process to avoid further exceedances.

There would be two ventilation outlets constructed for Northern Link. One would be situated within the Western Freeway worksite on land adjacent to the Brisbane Botanic Gardens. It would stand as part of the structure for the ventilation station. The other would be constructed on land within the Victoria Park golf course. The ventilation station for the northern ventilation outlet would be constructed on land adjacent to the ICB and the Inner Northern Busway. Each of these facilities would be designed and constructed to achieve their function of dispersing vitiated air from the tunnel system. Due to their scale, each facility would also require design and siting treatments to mitigate their potential visual impact.

22.6.4 Construction Noise and Vibration

The construction of the Northern Link tunnels would entail the removal of large quantities of hard rock by a variety of methods, each of which has the potential to generate noise and vibration. As the depth of each tunnel to the surface increases, the potential for noise or vibration to be detected by people on the surface diminishes. Surface works likely to generate noise or vibration, such as construction of the transitions and cut and cover tunnels, would require some form of physical intervention, such as noise barriers, to reduce the impact upon people nearby.

The study corridor is characterised mostly by residential buildings in the ‘timber and tin’ architectural vernacular. While these buildings are more flexible than some other structures and therefore less affected by vibrations, they are also more susceptible to noise from surface works. Also, the presence of some places of cultural heritage significance, such as the Toowong Cemetery, above the tunnels, would require careful management to either avoid, or minimise the risk of damage.

The draft outline EMP (Construction) proposes a range of guides for noise and vibration for works to achieve the environmental objectives, which would enable people to maintain a reasonable daily pattern of life within an acceptable acoustic environment. Other guides are provided to reduce the risk of damage to buildings and the disruption to the operation of sensitive equipment, such as computers and medical equipment. The draft outline EMP also proposes a monitoring regime in combination with early and on-going consultation with people as construction progresses. An effective and accessible complaints and reporting system would also be established as part of the construction method.

Finally, the draft outline EMP requires a building condition survey to be conducted, in advance of and following construction works along the route to identify the extent of damage caused by construction due to vibration, or settlement. The construction contractor would be obliged to repair and make good all damage caused.

22.6.5 Groundwater Movement and Settlement

The environmental studies undertaken for Northern Link indicate the likely presence of groundwater in a number of locations and at different depths. It is likely that groundwater would be intercepted by construction works establishing the western transition structures in shallow aquifers adjacent to the Brisbane Botanic Gardens and the Toowong Cemetery. There may also be a potential to intercept groundwater in the mid-sections near Paddington, where the tunnel alignments come close to the surface drainage lines. Groundwater may be intercepted in other locations along the route, where faulting or fractures in the rock. Generally, the construction depths between the tunnel portals would reduce the potential for groundwater drawdown.

The drawdown of groundwater into Northern Link has been modelled and is predicted to occur slowly over more than 100 years. The rate of flow into the Northern Link tunnels through the hard bedrock conditions is slow to very slow, allowing consideration of construction without the need for waterproof lining, or 'tanking'. Drainage systems to minimise and manage groundwater inflow would be required for the sections of tunnel through the shallow aquifer at Mt Coot-tha.

The environmental studies did not detect any groundwater-dependent ecosystems. Considering the depth of the tunnel construction in hard competent rock, the potential to intercept surface aquifers supporting groundwater-dependent ecosystems was determined to be very low.

The extent of settlement likely to be caused by tunnel construction, either through groundwater drawdown or construction activity, is predicted to be small and unlikely to affect structures, including swimming pools, on the surface. As this is an issue of some concern to the communities living above the tunnel routes, monitoring and management of groundwater drawdown and settlement would be required through implementation of the construction EMP.

22.6.6 Cultural Heritage

The indigenous cultural heritage values of the study corridor have been identified by studies undertaken by representatives of the traditional owners with an interest in the area, namely the Jagera People and the Turrbal People. The traditional owners have an interest in maintaining the heritage values of places of significance to them and would welcome the opportunity to become involved in the construction phase of Northern Link, both to ensure such values are not impacted, but also as advisors to facilitate better recognition of their heritage in Northern Link.

Northern Link would pass beneath some of the older, more established suburbs in Brisbane in which are located places of cultural heritage significance on either the State or local level. Some places of State cultural heritage include Brisbane Forest Park and the Toowong Cemetery at the western end of the study corridor, and St Brigid's Church at Red Hill and Gona Barracks at the northern end of the study corridor. There are also areas of character housing and demolition control within the study corridor. While the reference project has minimised the extent of land required for the worksites, some buildings within these precincts would be removed or demolished.

While this EIS has identified places of cultural heritage significance, the construction of Northern Link would need to be planned and implemented carefully to avoid, or minimise and mitigate the effects on such places. Detailed design in combination with predictive modelling of the potential vibration and settlement effects would be required in advance of the works, to enable the environmental objectives to be achieved.

Approval of the detailed works would be required, in some circumstances, to meet the requirements of legislation (Integrated Planning Act) before the commencement of such works. Such approvals would be sought once detailed design has provided sufficient information to support an application.

22.6.7 Social Impacts

Northern Link would bring about a range of social impacts, both beneficial and adverse. The beneficial impacts would derive from improved accessibility across the city and within the study corridor as traffic congestion is relieved on the key arterials. Rat-running through suburbs to avoid these presently-congested routes would be relieved somewhat as a consequence of the Project. Other beneficial impacts would flow from enhanced access to employment and the opportunity for enhanced public transport in the inner western suburbs.

The potential adverse social impacts of construction would derive from the establishment and operation of worksites, particularly the Toowong worksite and the Kelvin Grove worksite, due to their location in proximity to residential areas. The Western Freeway worksite, if not carefully managed, has the potential to impact on the recreational and scientific values of Brisbane Botanic Gardens. Management of each of the worksites, including the hours of work for outside or above-ground construction activities and the movement of construction vehicles, would need to achieve the environmental objectives and would need to be supported by an effective and accessible complaints and reporting system.

Community feedback received during preliminary consultation for this EIS has indicated a high level of concern for some residents living near the Toowong and Kevin Grove worksites. Such concerns include the scale and proximity of the works to residences, as well as noise, dust, construction traffic and general disruption to community life.

The construction of Northern Link must be planned and delivered in such a way that people can maintain a reasonable quality of life for the duration of the works. This objective might drive a requirement for innovative construction techniques to be employed. Such techniques must be developed in consultation with near-neighbours to address their reasonable and specific concerns about construction impacts.

22.6.8 Land Use and Planning

Construction of Northern Link would bring about some land use changes due to the establishment of the worksites. Such changes are likely to be long-term at Toowong and Kelvin Grove, and temporary in part, at the Western Freeway and the ICB corridor for the ventilation outlets and ventilation stations. It is proposed that the Toowong worksite be developed as a landscaped buffer, whereas it is possible a combination of landscaped buffer and re-use of the Kelvin Grove worksite is possible and a more desirable outcome.

Changes in traffic movements during construction would affect local access to some properties. Careful management and on-going consultation with affected owners and occupants would be required to avoid or minimise and mitigate the impacts of changed access.

22.6.9 Flora and Fauna

In total, the surface construction works would affect a total of approximately 4.8ha of the Brisbane City Council mapped vegetation communities. Approximately 1.6ha of this is mapped as remnant vegetation and approximately 3.2ha being non-remnant vegetation. All of the affected remnant vegetation is in the area of the Western Freeway connection associated with the construction of the ramps, surface road connections and the construction worksite, including the conveyor and ventilation station. The extent of clearing is not considered to be significant in terms of habitat loss, nor would it result in the displacement of species endemic to those small local areas.

There is some potential from construction activities to indirectly impact on local fauna. Most of the fauna likely to occur within the study area are mobile and readily disperse through the urban landscape. Mobile fauna in the immediate vicinity of each worksite, and particularly the Western Freeway worksite, may temporarily move away from the worksites for the duration of the construction activities. There is potential that vehicle strikes with fauna may increase during the operational phase of the project as a result of the additional lanes that fauna must cross.

No impact is indicated on any rare or threatened species of plant or animal.

Significant vegetation affected by the Project and protected under the Brisbane City Council's VPO and also under BCC and State Heritage listings, include the following.

- A Crows Ash (*Flindersia australis)*, located at 575 Milton Road, Toowong. This tree would require removal due to the proposed widening of Milton Road in order to provide for the Toowong connection ramps.
- Two Fig trees within Marshall Park on the western side of Kelvin Grove Road would also be removed for surface road construction.
- Two Fig trees on the western side of McCaskie Park would be affected by the proposed widening of Kelvin Grove Road at this location.

A rehabilitation program would be applied to affected remnant and non-remnant vegetation communities to restore the ecological values of cleared and impacted areas in the long term (from three to five years plus) by replanting with a suite of locally endemic species. Non native species would only be used where the use of these species is consistent with existing landscaping. The loss of significant landscape trees would be mitigated through suitable landscape rehabilitation including seeking the advice of an aborist regarding the potential for transplanting where possible. Generally these species, including Crows Ash, would be included in the planting palette for streetscape and landscape amenity including the planting of super advanced stock of these species.

Several specific fauna management measures would be comprehensively addressed in a Fauna Management EMP such as inspection of construction sites and use of a 'Spotter-catcher' to identify and relocate affected fauna and protection of all native fauna from intentional harm as a result of the construction works or worker actions.

22.6.10 Landscape and Visual

Due to the surrounding topography, the construction works for Northern Link would not impact on the urban landscape or visual amenity much beyond the immediate vicinity of each of the worksites. The construction works would not be visible from many distant vantage points. However, the scale of the works would impact on the urban landscape and the visual amenity in the localities of each of the worksites. The visual impact of the works at the Western Freeway would be contained within the freeway corridor, however, the extent of cutting to provide the additional lanes on either side would be extensive and would require landscape mitigation. Any stabilising works or structures on these roadside cuttings would need to provide for landscaping and urban design treatments if the visual impact is to be mitigated.

The construction works in the ICB corridor would not impact on the landscape values of the corridor. However, care would be required to ensure the landscape values of York's Hollow and Victoria Park were maintained. Site rehabilitation and landscaping would be required to mitigate the visual impact of the northern ventilation station in the ICB corridor, and the construction of the ventilation tunnel to the outlet further north along the ridge.

22.7 Project Impacts and Mitigations – Operations Phase

The operational effects of Northern Link would have both beneficial and adverse outcomes. While on balance the Project would have a strong net benefit for the city, there would be some potential adverse impacts arising from road traffic noise, or, from the barriers required to mitigate road traffic noise to status quo levels.

22.7.1 Urban Design

The widening of Milton Road and of Croydon Street is of concern to some Toowong residents. The future scale of each of these roads would be considerably different to the four-lane roads at present. The combination of the elevated roads, ramp structures and additional traffic lanes in Milton Road between Sylvan Road and Croydon Street is a matter of great concern to local residents and local businesses. The visual impact of the infrastructure in this location would be significant and long-term. While noting that Milton Road is an arterial road with a regional transport function, it is unlikely that the landscaping and urban design treatments proposed for the reference project would succeed in reducing the visual impact on the locality. The visual impact of the infrastructure in this location is exacerbated by the loss of part of Quinn Park and also the proximity of the structures to residences and commercial properties along the southern alignment. Innovation in detailed design would be required to redress these impacts, if at all.

Northern Link would also entail the widening of Kelvin Grove Road between the ICB overpass and Blamey Street to accommodate the Kelvin Grove ramps and the Musk Avenue connection. While Kelvin Grove is presently configured to accommodate seven traffic lanes, the Project would require its widening to include an additional three lanes. The proposed widening is more in context with the setting at Kelvin Grove than the proposed widening of Milton Road. Despite that comparison, Kelvin Grove Road would require careful urban design treatments and landscaping measures to mitigate the visual effects of the additional traffic lanes, the infrastructure connections within the road reserve, the Musk Avenue portal and the noise barriers required to address road traffic noise.

The detailed design process should take into account the proximity of sensitive places, such as residential and some commercial places, adjacent to both Milton Road and Kelvin Grove Road.

The detailed design process should also seek to mitigate the visual impact of the ventilation stations at the Western Freeway and the ICB, through a combination of architectural, urban design and landscape measures.

22.7.2 Local Traffic

From the analysis presented earlier in this summary, Northern Link would achieve its objective of providing a motorway-standard route for cross-city trips. This would relieve traffic congestion on the key arterial roads, such as Milton Road and Coronation Drive, so that presently-congested intersections, such as the Mt Coot-tha roundabout, the Toowong roundabout and the Hale Street – Coronation Drive intersection would operate more freely. A consequential benefit of this redistribution of traffic to the motorway network would be the relief of congestion pressures leading to rat-running in the inner western suburbs.

There would be traffic increases on the road network connecting with Northern Link. For example there would be increases in daily traffic flows on the Western Freeway, Croydon Street and Milton Road west of Croydon Street, and on the ICB. Other roads likely to experience an increase in traffic flows would be Jephson Street and Sylvan Road in Toowong and Kelvin Grove Road north of the connections in Kelvin Grove. These are all arterial or higher function roads. The traffic analysis indicates that each of the following roads in the inner western suburbs would benefit from a reduction in traffic as a consequence of Northern Link:

Milton Road east of Croydon Street, Coronation Drive, High Street, Sherwood Road, Miskin Street, Frederick Street, Jubilee Terrace, Caxton Street, Haigh Road, Stuartholme Road and Morley Street.

The reductions on Coronation Drive and Milton Road would provide opportunities for enhanced levels of service for public transport (bus). Combined with the opportunity to operate express bus services through Northern Link to connect with the Inner Northern Busway at the Normanby busway station, Northern Link would contribute to an overall network and transport improvement in the inner western suburbs.

22.7.3 Traffic Noise

Road traffic noise is one of several adverse outcomes arising from congested or heavily trafficked roads. Increased traffic flows on the motorways and arterial roads connecting with Northern Link would also lead to an increase in traffic noise. However, a doubling in traffic flows usually would lead to an increase in traffic noise of about 3dBA or less. Considering that increases in noise of 2dBA or less are generally not detected by people, the potential impacts for traffic noise intrusion are confined to a number of specific locations.

The traffic noise assessment modelled noise levels and predicted the noise barriers required to mitigate noise to a 'status quo' level[3], as well as to meet the planning guides for local roads established by the Queensland Department of Main Roads. Barrier heights ranging from 5.0m to 8.0m were predicted for some locations (eg: on ICB adjacent to Normanby Terrace, on Valentine Street facing Milton Road). Noise barriers of this scale would present both visual and amenity impacts on nearby properties. Consequently, innovation in detailed design is required to find less intrusive measures to mitigate road traffic noise impacts on these exposed locations.

The noise modelling found there would be a minor reduction in traffic noise levels on those streets experiencing a reduction in daily traffic flows.

22.7.4 Air Quality

Motor vehicle emissions from Brisbane's congested road network are a major source of pollution found in Brisbane's airshed. The air quality implications of motor vehicle emissions generally, and from tunnel ventilation systems specifically, are a matter of community concern. The goals for ambient air quality adopted for Northern Link are more stringent than the standards set in the Environmental Protection Policy (Air), except for carbon monoxide which has been adopted as the Project goal.

The predicted impacts on ambient air quality from the operation of the ventilation outlets for Northern Link would be well below the stringent goals adopted for the Project. Furthermore, the predicted impacts would represent a minor change from the predicted ambient air quality should Northern Link not proceed.

With regards pollution deriving from the surface road network, the predicted changes in traffic as a consequence of the Project, would not lead to significantly increased risk of adverse community health outcomes. Northern Link would lead to more efficient traffic movements in the inner western suburbs, with potential benefits for reduced motor vehicle emissions.

The assessment of potential impacts on air quality included an assessment of the benefits of filtration in the ventilation system. While the filtration system efficiency was found to be high, the beneficial effects of filtering air from the tunnels were overtaken in the dispersion of the outlet emissions in the airshed. There were few discernible changes in ground level concentrations of particulate matter and nitrogen dioxide, for which filtration processes are available.

[3] 'Status quo' traffic noise is defined in Chapter 10 as being the traffic noise levels that would exist in a location in 2024, without Northern Link.

22.7.5 Social and Economic Impacts

Northern Link would have a positive socio-economic effect on Brisbane through improvements it would bring to the city's transport system, and consequential benefits in productivity, road safety, vehicle operating costs and travel time reliability. Northern Link would have a positive economic impact when comparing project costs to project benefits over the 45 year life of the franchise period. Less tangible but still important local benefits would include improved accessibility in the inner western suburbs, improved access to employment and improved public transport in the corridors linking to the CBD.

There would be localised, adverse social consequences arising from the implementation of Northern Link. These would derive primarily from property impacts and the loss of housing in Toowong and Kelvin Grove. Also the impact of local open space at Quinn Park would be significant and long-term. It is unlikely that urban design and landscaping measures on the balance area of Quinn Park would compensate fully for the loss of area. Local residents also are concerned about reduced accessibility across Milton Road to the Toowong State School and to public transport. Pedestrian connections would remain available at the signalised intersection of Croydon Street and Milton Road. While access is already constrained, the widening of Milton Road lends to the perception of diminished accessibility.

It is noted that a number of options to provide grade-separated pedestrian and cycle connections across Milton Road were not pursued due to technical and feasibility issues, including the exacerbation of impacts on near neighbours.

The impacts on the communities of Kelvin Grove would derive from changed access arrangements for residents west of Kelvin Grove Road, due to the closure of access from Victoria Street and the redirection of Westbury Street. This community would become contained by Kelvin Grove Road, Prospect Terrace and Musgrave Road. The Kelvin Grove community east of Kelvin Grove Road would remain largely unaffected by Northern Link with the retention of access to Victoria Park Road from the ICB. Some residents had hoped Victoria Park Road would be closed at the ICB. Pedestrian connectivity southwards towards the Inner Northern Busway would be improved with the widening of the footpath on the eastern side of Kelvin Grove Road.

22.8 Recommendations

Northern Link as described in this EIS meets the needs of the project objectives, particularly in providing for east-west transport efficiency for vehicles and freight with the best balance of environmental impacts. Northern Link would lead to a wide range of transport, socio-economic and community benefits for the City, however, there would also be some likely adverse impacts for local communities residing in close proximity to the Toowong and Kelvin Grove connections.

Having regard to the comprehensive findings of the EIS with regards the benefits and impacts of Northern Link, the following recommendations are made to the Coordinator-General:

Recommendation 1

That Northern Link be approved to proceed subject to:

(i) project development adopting and implementing a sustainability framework consistent with the Brisbane City Council's sustainability policy and with the framework presented in this EIS;

(ii) detailed design embracing an innovative approach in seeking to resolve, to the extent feasible, the potential or predicted impacts of the reference project, particularly with regards the configuration of the local connections at Toowong and Kelvin Grove;

(iii) developing and implementing detailed environmental management plans for the construction and operational phases of the Project, where such plans adopt the environmental objectives and performance criteria where relevant, set out in the draft Outline EMPs presented in this EIS;

(iv) developing and implementing a scheme of effective urban mitigation measures, such as those set out in Chapter 20 of this EIS, intended to address and mitigate the impacts of the Project upon the local communities and to enhance where reasonable and practicable within the scope of the Project, the locality of each of the connections to the surface road network.

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 *City Plan 2000*, the *Integrated Planning Act 1997*, the *Transport Infrastructure Act*, the *Queensland Heritage Act 1992*, and the *Environmental Protection Act 1994*;

(ii) The Brisbane City Council commence an integrated land use and transport planning study for the inner western suburbs, coordinated with current local planning and local growth management strategies, with the purpose of managing land use changes anticipated as a consequence of the implementation of Northern Link; and

(iii) The Queensland Government and the Brisbane City Council investigate measures to coordinate the construction and delivery of Northern Link at the same time as a number of other major projects, including the Hale Street Link, the Western Freeway upgrade, Airport Link, Northern Busway and the Airport Roundabout Upgrade projects.

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

(i) recommend that Northern Link proceed;

(ii) state the conditions for the Project under section 39(1)(a) 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 section 2.6.8 of the *Integrated Planning Act 1997; and*.

(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 Division 8, section 54B of the *State Development and Public Works Organisation Act 1971*.