11. Sustainability in Project design and delivery

11.1 Introduction to sustainability

Sustainability is a process of social, economic and environmental concerns combined to maintain a high quality of life for current and future generations. The term 'sustainable development' was introduced by the World Commission on Environment and Development in 1987. As part of a global commitment adopted by more than 178 governments around the world at the United Nations Conference on Environment and Development (UNCED 1992), *Agenda 21* identified key areas for action. The *National Strategy for Ecological Sustainable Development* (NSESD) (Department of the Environment and Heritage 1992) addresses some of these key areas and defines ecologically sustainable development (ESD) as:

> using, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased.

The concept of ESD ensures that environmental and social considerations are taken into account in decision-making processes. This will guarantee that current and future generations will enjoy an environment that functions as well as, or better than, the environment they inherit.

The core objectives of the NSESD are to:

- enhance individual and community well-being and welfare by following a path of economic development that safeguards the welfare of future generations
- provide for equity within and between generations
- protect biological diversity and maintain essential ecological processes and life-support systems.

After the establishment of NSESD in Australia, the *Protection of the Environment Administration Act 1991* was introduced by the NSW Government to promote ESD in NSW. In addition, the Act defined ESD by four principles:

- The precautionary principle — where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for not implementing mitigation measures or strategies to avoid potential impacts.
- Inter-generational equity — the present generation should ensure that the health, diversity and productivity of the environment are equal to, or better for, the future generations.
- Conservation of biological diversity and ecological integrity — preserving this diversity and integrity requires that ecosystems, species and genetic diversity within species are maintained.
- Improved valuation and pricing of environmental resources — this principle establishes the need to determine economic values for services provided by the natural environment, such as the atmosphere's ability to receive gaseous emissions, cultural values and visual amenity.

The definition of ESD is also referred to in the *Environmental Planning and Assessment Act 1979* (EP&A Act) and *Protection of the Environment Administration Act 1999* (PEA Act). The PEA Act includes principles of ESD and the requirement for these principles to be considered in environmental and economic decision-making processes.

11.2 TIDC commitment to sustainability

Transport Infrastructure Development Corporation of NSW (TIDC) operates with an Environmental Policy that aims to safeguard environmental and community assets within the corporation's care, and to seek innovative solutions to reduce the footprint of the corporation's activities.

This policy reflects TIDC's ongoing commitment in the delivery of transport products that:

- sustain the health, diversity and productivity of the environment for future generations
- comply with all applicable environmental laws, regulations and statutory obligations
- maintain an environmental management system (EMS) modelled on international requirements that are integrated into the corporation's business activities
- develop responses to the challenges of climate change, resource conservation and greenhouse gas emissions
- involve working effectively with stakeholders to maximise opportunities and add value to local communities.

To achieve these objectives, TIDC is committed to adopting environmentally sustainable development practices throughout the lifespan of their projects, including the Quakers Hill to Vineyard Rail Duplication. The education and training of employees and subcontractors ensures that staff meet their environmental responsibilities and have full environmental awareness within the organisation. Sustainability assessment and reporting is a tool that helps TIDC deliver on its corporate Environment Policy and to identify sustainability outcomes more specifically. TIDC aims to develop a culture of environmental excellence and leadership in the delivery of environmentally sound infrastructure projects. By demanding high standards from contractors and suppliers, TIDC uses market presence to continuously improve the environmental credentials of the entire infrastructure sector.

11.3 Application of ESD principles to the Project

11.3.1 Sustainability framework for the Project

A thorough assessment of opportunities to improve the overall sustainability of the Project through design, construction and operation has been undertaken, and is reported in Table 11-1. The initiatives outlined in the table would continue to be pursued, referenced and regularly reviewed and updated through all stages of the Project, including detailed design, construction and operation.

Ten sustainability themes have been addressed in this assessment:

- Governance
- Community and stakeholder involvement
- Community benefit
- Adaptation to climate change
- Greenhouse gas emissions
- Energy
- Resource minimisation and recycling
- Water
- Biodiversity
- Economic viability.

Table 11-1 Sustainability framework for the Project

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
Governance	Implement good project governance	Maximise beneficial outcomes through effective and efficient project management Highlight corporate social responsibility Demonstrate international best practice and previous TIDC experience from other projects	These process-oriented objectives have influenced the development of the proposal: ▪ involvement of TIDC's sustainability champion ▪ involvement of a Project sustainability champion ▪ sustainability auditing and performance assessment ▪ appropriate studies and risk assessments ▪ project sustainability charter and framework ▪ integration of sustainability champions into the Project design process ▪ reviews of good TIDC and international practice.	▪ ongoing sustainability auditing and performance assessment ▪ implementation of a sustainability awards scheme ▪ addressing identified gaps in existing studies and risk assessments ▪ conducting sustainability training for the benefit of construction contractors ▪ establishing sustainability targets for construction and operation of the project during the detailed design stage ▪ including sustainability in relevant procurement documentation (e.g. invitations to tender, tender assessment criteria etc) ▪ taking sustainability into account in the specification and procurement of materials ▪ incorporating relevant sustainability initiatives into the project EMS (or Sustainability Management System (SMS)).
Community and stakeholder involvement	Effectively engage community and stakeholders with design development and increase awareness of facilities to maximise patronage	Actively engage the local community in the development of the project to maximise patronage	These process-oriented objectives have influenced the development of the proposal: ▪ TIDC Public Affairs Manager ▪ consultation specialists within the Project team ▪ preparation of a Community Involvement Plan (and sustainability Community Engagement Plan) ▪ stakeholder meetings ▪ government agency briefings ▪ council workshops	▪ continued involvement of the TIDC Public Affairs Manager ▪ continued involvement of project team consultation specialists ▪ ongoing consultation with the local community to monitor construction impacts ▪ ongoing survey of community members on what would encourage them to use the station and to walk/cycle or catch public transport to the station.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ community information sessions ▪ information brochures and newsletters ▪ advertisements ▪ Project information line ▪ website ▪ posters ▪ records of feedback and how feedback has been addressed through the design process ▪ evaluation of community satisfaction with the community involvement process.	
Community benefit	Facilitate healthy living	Maximise opportunities for active and healthy living for rail patrons Maximise opportunities for healthy living for construction workers Minimise nuisance impacts on the local community	*All* ▪ a range of measures have been incorporated to encourage people to walk and cycle to the station (see Sustainability Principle — Maximise access and connectivity below) ▪ proposed noise mitigation measures draw on innovative solutions representing best practice focused on at source mitigation measures. *Stations* ▪ exterior lighting is to be fitted to meet spill lighting and obtrusive lighting requirements so as to minimise potential light pollution impacts. *Civil works* ▪ visual impacts would be minimised through ▪ landscaping integrated with existing and future adjoining landscapes to enhance the visual impact of the Project	*Stations* ▪ consideration would be given to the health impacts of materials and surface treatments and coatings at the next stage of design. *Civil works* ▪ the uncertain or unknown uses of land adjacent to the rail corridor (and their future noise sensitivity) currently constrains options for exploring potential 'combined responses' to noise mitigation with the project (i.e. achieving a reasonable balance between noise mitigation within the corridor and optimal land use planning outside the corridor). This issue would be investigated further depending on the availability of detailed precinct plans from the Growth Centres Commission (GCC).

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ retaining walls designed to be unobtrusive and simple and integrate with surrounding structures and landscapes; where possible they would be screened by existing or new vegetation ▪ an Environmental Management Plan (EMP) would be prepared to address dust, noise and vibration impacts during construction.	
	Maximise access and connectivity	Increase access to places, jobs, services and friends and family Increase access for people with disabilities Increase confidence in schedules and travel times	*Stations* ▪ Schofields and Vineyard stations would be located within new town centres and would seek to maximise access to surrounding land uses ▪ Schofields and Vineyard stations would be designed to accommodate future pedestrian and cyclist provisions (i.e. the Project proposes to provide bike lockers at the stations) ▪ Riverstone Station Platform 2 would be widened and the entire station regraded to meet *Disability Discrimination Act 1992* requirements ▪ bus interchange facilities, kiss-and-ride and commuter parking, would form integral components of the new stations which would be designed to allow smooth transitions to rail from other modes of transport. *Civil works* ▪ the replacement of level crossings with pedestrian footbridges at Quakers Hill, Schofields and Riverstone would provide safer access across the rail corridor. *Rail systems* ▪ track design would be optimised to minimise travel times and improve ride comfort	*Stations* ▪ Consideration would be given to incorporating Sustainability-promoting Interpretation (SPI) units at the bus interchanges and within the town centres (integrated with bus information) to provide up-to-date travel information and promote use of rail and buses. *Civil works* ▪ consideration would be given to working collaboratively with key stakeholder organisations (e.g. GCC, Blacktown City Council and RailCorp) to provide a footpath and cycleway alongside the rail corridor to improve pedestrian and cyclist access between stations ▪ consideration would be given to working collaboratively with key stakeholder organisations (e.g. GCC, Blacktown City Council and RailCorp) to provide a footpath on the western side of the rail corridor to connect the southern end of Bridge Street with the new Schofields Station.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ opportunities for incorporation of back-up signalling facilities would be identified to minimise delays when potential failures occur.	
	Promote culture, diversity and heritage	Protect and enhance Indigenous heritage in collaboration with traditional owners Protect and enhance non-Indigenous heritage Reflect, respond to and promote cultural diversity Enhance local social identity	*All* ▪ significant features of Indigenous heritage have been identified in collaboration with relevant Indigenous groups and addressed in the design process ▪ prior to commencement of construction, Indigenous heritage surveys would be undertaken and appropriate mitigation measures implemented ▪ features of non-Indigenous heritage have been identified (e.g. Riverstone Station and the rail corridor). No significant direct impact is expected. *Stations* ▪ Public art would be incorporated within the stations to promote culture, diversity and heritage. ▪ The heritage significance of Riverstone Station would be maintained by sympathetic design.	*All* ▪ consideration would be given to engaging in further discussions with key stakeholder organisations regarding public art initiatives.
	Maximise safety and comfort	Create a safe travel environment Create a comfortable travel environment	*All* ▪ a range of safety in design measures would be incorporated including provision of maintenance accesses and walkways, guardrails, use of anti-graffiti protection and use of security fencing and security communication facilities (e.g. local area networks (LAN), signal post phones etc). *Stations* ▪ the new stations would be designed with clear unambiguous circulation, good sightlines for arriving and departing passengers and open view access to promote easy access and safety	*All* ▪ a Safety Assurance Report would be developed during the detailed design and construction stages of the Project. *Stations* ▪ further measures for incorporating passive design measures to facilitate daylighting and natural ventilation (particularly in back of house areas) would be investigated as part of the design.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ signage and way-finding would be incorporated to reinforce the intuitive way-finding design of the stations, for example signage directing users to bus stops, kiss-and-rides, cycle facilities, emergency exits and passenger information screens ▪ design for day-lighting and natural ventilation would be incorporated and would contribute to customer comfort ▪ acoustic aluminium soffit lining panels would be incorporated under platform canopies to minimise noise nuisance to station users. ▪ Crime prevention through environmental design principles would be applied, so that the station designs would include clear open planning, views from staff facilities over the concourses, day lighting and artificial lighting, CCTV coverage throughout the stations and interchanges, gates and fences at platform ends, and help points on platforms and concourses. *Civil works* ▪ a range of measures would be incorporated to enable safe access and maintenance throughout the rail corridor (e.g. safe access tracks, anti-graffiti protective treatments etc) ▪ landscaping would be designed to optimise the rail users experience through providing both visual buffers as well as views out of the rail corridor ▪ shaded areas would be provided at each construction site for the health and comfort of workers. *Rail systems* ▪ signalling equipment would be positioned to	

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			minimise risk of vandalism and where possible would be located on maintenance access roads for ease of access for maintenance and safety.	
	Maximise employment and opportunity	Maximise opportunities for training in traditional trades Maximise opportunities for disadvantaged groups Maximise opportunities for small to medium sized businesses to obtain work Source labour and materials locally to promote local employment opportunities	Not addressed at the concept design stage.	*All* ▪ it is anticipated that a number of opportunities for delivering community benefits would be implemented during the construction stage through adoption of appropriate procurement processes (e.g. accessing construction materials locally, promoting apprenticeship schemes etc).
Climate change adaptation	Respond to the effects of climate change, including higher temperatures and more extreme weather events (e.g. strong winds and heavy rainfall)	Maximise environmental comfort for passengers and workers Ensure facilities withstand extreme weather events Ensure landscaping is appropriate to future climate	*All* ▪ landscaping using drought tolerant plant species would help to ensure that landscaping endures despite reductions in annual rainfall. *Stations* ▪ natural ventilation of the concourse would contribute to customer comfort, particularly in response to increases in temperature.	*All* ▪ further flood risk assessment investigations would assess the implications of a 15% increase in catchment run-off as a result of future climate change ▪ further investigations would also involve examining the potential impact of increased wind velocities during extreme storm events particularly with regard to displacement overhead wiring (e.g. a sensitivity analysis to identify the implications of an increase in wind velocities of up to 25%) ▪ design sensitivity to changes in soil moisture resulting from climate change would also be examined further (e.g. predicted increases in evaporation of up to 24% and decreases in annual rainfall of up to 5%) along with the further detailed

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
				geological investigations to examine, for example, implications for civil structures and earthing ▪ plant species selection would include further consideration of wind tolerance. *Stations* ▪ the need for additional design responses to provide protection for rail customers on the stations' platforms and concourses during storm events (e.g. driving rain and wind) would be considered further in the detailed design stage.
Greenhouse gas emissions	Minimise contributions to climate change through reducing the greenhouse gas emissions of the project and increasing patronage	Minimise direct emissions and indirect emissions from consumption of purchased electricity, heat or steam (Scope 1 & 2) Minimise upstream indirect emissions (Scope 3) Minimise downstream indirect emissions and maximise patronage with transit orientated development (Scope 3)	*All* ▪ incorporation of passive design and energy efficiency measures, as described under the theme of 'Energy' below, would reduce greenhouse gas emissions associated with energy production ▪ pre-casting concrete yards may be available close to the proposed station sites. Use of these facilities would reduce the amount of greenhouse gases produced during the transportation of construction materials ▪ recycling of cleared vegetation and use of recycled timber to produce mulch for landscaping would reduce demand for sourcing mulch off-site and from sourcing mulch from other raw materials ▪ landscaping would help to provide a small carbon off-set. *Stations* ▪ measures which would promote walking and cycling to the station as well as travel by bus would reduce emissions associated with rail customers. Further detail on these measures is set out under the theme of 'Community Benefit' above	*All* ▪ a carbon strategy would be prepared for the Project to identify measures for minimising greenhouse gas emissions associated with the project. Further information on the anticipated carbon strategy is provided below under the theme of 'Energy' ▪ the majority of excavated material would be re-used on the project, minimising the need to transport spoil. Currently it is anticipated that there would be some excess spoil which would be utilised on adjacent projects (such as urban development in the North West Growth Centre (NWGC)). Geotechnical surveys would be conducted as part of the detailed design stage to more accurately determine the project's cut and fill balance ▪ provision of small car parks and parking for electric vehicles would be considered as part of the parking strategy for both commuter and staff parking. *Rail systems* ▪ further consideration would be given to investigating the gas agent used in the gaseous fire suppression system to determine potential contributions to

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ provision of the kiss-and-ride and park and ride facilities would encourage a more sustainable switch from road-based transport to rail travel ▪ pre-casting yards for concrete may be available close to the proposed station sites. Use of these facilities would reduce the amount of carbon produced during the transportation of materials.	greenhouse gas emissions, as well as ozone depletion.
Energy	Minimise energy demand, increase efficiency and maximise use of clean energy sources	Increase energy efficiency from business as usual base Reduce energy demand from business as usual Use clean energy sources	*Stations* ▪ passive design measures would be incorporated into the design to minimise energy demand. The architectural design would expose the platform levels of the stations to as much daylight as possible, particularly around the stairs. At the same time the concourse level would have good daylight exposure to the east and would generally provide good levels of daylight while being shaded for most of the day. Where possible ventilation would be provided within back of house and office spaces by natural means using fixed openings or operable windows. Thermal insulation of all hot water pipes would also minimise heat loss as well as avoiding heating occupied spaces ▪ energy efficient appliances would be incorporated, mainly including fluorescent luminaries. A lighting control system would be incorporated to optimise the amount of lighting when it is used. This would be achieved via movement sensors for back of house areas. Exhaust systems would also be interlocked to light switches for afterhours operation *Rail systems* ▪ lighting control would be provided using a Building Management System/SCADA system. Zoned lighting control using a combination of PE cell and time clock inputs would be used in conjunction with	*All* ▪ a carbon strategy would be prepared for the project to identify measures for minimising greenhouse gas emissions. The strategy would incorporate calculations of energy demand for two options ▪ a base case option using RailCorp's standard user requirements ▪ a concept design option with measures for minimising energy demand ▪ recommendations on further approaches to reducing energy demand from the project would also be considered in the preparation of the carbon strategy with an aim of reducing energy demand to 25% less than the base case. The carbon strategy would incorporate estimates of the energy/carbon payback periods for the concept design (i.e. embodied energy versus carbon savings over the life of the design). These energy studies would also provide information on savings verses costs (capital or running) of incorporating demand reduction measures ▪ further consideration would be given to incorporating energy metering and voltage correction at the stations with a view to preparing an energy metering strategy and monitoring station energy demand

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			the lighting control system to ensure efficiency in power usage. Local switches and movement sensors would be incorporated into back of house areas to minimise energy wastage ▪ external lighting would use energy efficient long life lamps with fittings selected to limit spill lighting and obtrusive lighting. ▪ electrical metering would be incorporated at new stations to enable monitoring of energy use and opportunities for continual improvement. ▪ a Building Management System would be proposed to monitor building systems such as air-conditioning and communications room temperatures and could be used to manage energy consumption. ▪ natural or mechanical ventilation systems would be used to provide and maintain airflow within some enclosed spaces. Where possible ventilation would be provided by natural means using fixed openings or operable windows. Where this cannot be accomplished fresh air supply to the majority of back of house rooms would be provided by a common fan and filter arrangement. Air conditioning and mechanical ventilation systems would be operated automatically under the control of a digital control system and monitored by the management control system.	*Each of the proposals set out below would also be addressed through the Project carbon strategy.* *Stations* ▪ further investigations would be conducted into opportunities to provide natural ventilation of occupied areas whilst maintaining security requirements. Consideration would also be given to utilising package air conditioning systems where economy cycle can be incorporated (e.g. where the ambient air can be directly introduced into the air conditioned spaces without additional cooling when the ambient air temperature is within design criteria temperatures). Alternative approaches to space heating would also be considered further such as solar thermal space heating ▪ provision for skylights into the back of house areas and office areas would be considered further ▪ consideration would be given to incorporating solar panels at three locations: ‣ roof of the concourse ‣ roof of the platform canopy ‣ side of embankments ‣ if these were implemented there would be discrete photovoltaic panels mounted on the roof producing energy in parallel with mains power. Consideration would also be given to modifying the staging of construction to accommodate installation of solar photovoltaic cells for the provision of power for some portion of construction (e.g. lighting) ‣ provision of parking for electric vehicles which would charge while parked at the stations

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
				(powered by solar photovoltaic cells) would also be considered further. *Civil works* ▪ consideration would be given to incorporating solar photovoltaic cells on structures, particularly noise walls, within the rail corridor. *Rail systems* ▪ LAN systems requirements for the collation of energy consumption and production data (particularly production from renewable and low carbon sources) would be investigated further.
Resource minimisation / recycling	Maximise efficiency of resource use over the project lifecycle	Minimise construction volumes Use and source materials efficiently Where materials are required, maximise use of reused and recycled materials Where materials are required and reuse of materials or recycled materials are not available, maximise use of renewable materials from sustainable sources and minimise use of non-renewable materials	*All* ▪ the use of pre-fabrication and pre-cast construction techniques would reduce the quantity of materials used in construction. Precast concrete mixes can also be designed to include fly ash and recycled aggregates to reduce consumption of raw materials ▪ mulch would be derived from vegetation cleared during construction while additional mulch, if required, would be obtained from recycled waste timber ▪ low gradient batters should help to reduce soil erosion ▪ topsoil would be ameliorated and reused on-site. *Stations* ▪ concourse level balustrades and glazed screens would have recycled hardwood handrails.	*All* ▪ benchmarks would be developed for the quantity of recycled material to be used (e.g. for concrete, steel, rubber etc) ▪ further investigation would be conducted into opportunities for using pre-cast and prefabrication construction techniques ▪ opportunities for minimising the embodied energy of construction materials would be investigated further during the detailed design phase ▪ the majority of excavated material would be re-used on the project where feasible, minimising the need to transport spoil. Geotechnical surveys would be conducted as part of the detailed design phase to more accurately determine the Project's cut and fill balance.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
		Reduce waste generation and recycle all waste and spoil whilst minimising greenhouse gas emissions Design for end of life Avoid production of hazardous waste Minimise land take Maximise opportunities for recycling by passengers and workers	*Civil works* ▪ planting medium would be existing topsoil ameliorated on site ▪ hazardous waste segregation and storage would be provided at each construction site.	*Rail systems* ▪ investigations would be undertaken into the impacts of using PVC plastics for conduits with consideration given to alternative products.
Water and flooding	Manage water to maximise its beneficial use	Reduce demand on potable water supply Increase efficiency in water use Reclaim and reuse wastewater Maximise reuse of infiltration and stormwater Manage aquifer interference to protect connected ecosystems	*All* ▪ a total water cycle management approach would be adopted including: ‣ consideration of water sources — minimising the use of portable water and optimising water harvesting ‣ water use — re-use and recycling of water. *Stations* ▪ stormwater from the concourse roof and platform canopies at the new stations would be stored in rain water tanks located within the platform structure.	*All* ▪ consideration would be given to harvesting water for landscaping, earthworks and re-use during construction. This may require the establishment of water retention facilities early to use in construction (e.g. along the railway line, at the stations etc). *Rail systems* ▪ collection and re-use of water from testing of fire extinguishing systems would also be considered further.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
		Manage aquifer interference to protect water rights for existing groundwater users	This would be re-used for toilet flushing , irrigation and station wash down and in future could be connected to any suburban grey water system should one be developed. Rainwater harvesting tanks would be sized to meet catchment area rainfall and predicted water use ▪ AAAA rated sanitary fixtures and fittings would be used ▪ low water reliant plants would be used in landscaping. *Civil works* ▪ measures would be incorporated to prevent contaminants from the rail entering the local stormwater system and/or waterways ▪ water sensitive design measures would be implemented. For example, grassed swales would be used wherever possible to reduce the impact of run-off pollutants and sediment deposits and on-site detention would be used where possible to reduce downstream stormwater flow impacts. Detention basins would be designed to sit comfortably in the landscape (e.g use of organic shapes) and would be planted with endemic macrophytic species) ▪ silt collection pits would be provided for access tracks to assist in the removal of pollutants from runoff ▪ use of mulch on landscaping areas would reduce demand for watering ▪ the EMP would be prepared to address water discharges to groundwater and creeks. *Rail systems*	

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			▪ the use of mulch and endemic, drought tolerant species would reduce demand for water for irrigation.	
	Minimise flood risk	Avoid increasing the risk of flooding	*Stations* ▪ the vertical alignment of the stations would respond to flood levels to ensure stations would not be at significant risk of flooding ▪ culverts would be extended or replaced to ensure flood impacts are not exacerbated.	*All* ▪ detailed flood assessments would be undertaken prior to finalising the bridge and culvert designs (to minimise risk of blockage and provide improved ecological outcomes), and would incorporate contemporary run-off data and involve a sensitivity analysis for an increase in catchment run-off of 5% to take account of climate change.
Biodiversity	Improve or maintain biodiversity	Minimise impact on and enhance existing biodiversity systems Deliver offsets / new habitat Minimise habitat for feral animals and weeds Increase connectivity of habitat	*All* ▪ pre-cast construction methods would help minimise the risk of pollution of creeks during construction. *Stations* ▪ landscaping around stations would incorporate trees with understory shrubs. This approach would contribute to the ecological quality of these planted areas. *Civil works* ▪ embankments along the corridor would be planted with native low maintenance, drought tolerant and hardy species to maximise the longevity of landscaping ▪ cut and fill batter slopes would be flattened in the upper sections of cuttings where possible and for the embankments to enable landscaping with a	*All* ▪ further consideration would be given to seed collection and establishment of a propagation nursery to facilitate use of endemic species ▪ opportunities for delivering additional biodiversity benefits would be explored further during the detailed design phase, taking into account potential impacts of the project on areas of less significant ecological value (e.g. potential for biodiversity offsets and enhancement works.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			more diverse range of plants (e.g. groundcovers, shrubs, trees etc) ▪ landscape planting would be informed by the existing Cumberland Plain and Shale Plains Woodland species without attempting to fully recreate this protected habitat which is impractical in the restricted areas available for planting ▪ fully structured planting zones including a combination of native grasses, shrubs, sub-canopy and trees would require little maintenance and would discourage weeds as well as providing a diverse range of habitat opportunities ▪ hydromulching would be carried out using native grass seeds. *Rail systems* ▪ signalling bungalows and cabinets would also be designed to be vermin proof.	
Economic viability	Maximise community benefit in return for investment	Establish self-sustaining management regimes Maximise benefits to local business	*Stations* ▪ the new stations would have similar architectural styles and finishes; this would provide economies in time and cost. For example similar construction systems and structural forms allow the procurement of materials to be streamlined ▪ most mechanical services plant for the new stations would be mounted on the roof of the offices and Back of House support areas. This would afford the plant partial weather protection under the station's main roof canopy as well as good access for maintenance. The material selection for external components would be based on suitability to withstand external conditions ▪ the use of roof trusses in lieu of deep beams would provide continuity to the purlin system, making an	*Stations* ▪ opportunities for incorporating flexible advertising would be investigated during the detailed design stage to provide a revenue stream for the stations.

Sustainability framework			Sustainability measures that would be implemented through the Project	Sustainability measures that would be considered during next stages of design and construction
Sustainability theme	**Core sustainability principle**	**Sustainability objective**		
			economical solution. *Civil works* ▪ whole of life costs for bridge structures would be minimised ▪ improved opportunities for landscaping of batter slopes through use of laid back batters would help to reduce long term maintenance costs of batters ▪ landscape species would be selected for their low maintenance requirements and use of mulch would also reduce landscape maintenance requirements. *Rail systems* ▪ the majority of planting would be sourced from seed collected from the site and a fully structured planting zone, once established and mulched, would require little or no maintenance ensuring a cost effective and low maintenance approach.	
	Maximise opportunities for future growth	Maximise flexibility for the future	*Stations* ▪ concourses would allow non-user movements across the rail tracks connecting potential business on both sides and facilitating development of town centre uses on both sides. *Civil works* ▪ bridge structures would allow for future expansion of roads (e.g. Westminster Street overbridge). *Rail systems* ▪ The Project would permit introduction of alternative technologies and operating practices would be possible in the future, such as automatic train protection and the European train control system.	

11.4 Summary and conclusions

11.4.1 Compliance with the four tenets of sustainability

This section describes how the Project has met the four principles of sustainability.

The precautionary principle

The scope and methodology adopted for this Environmental Assessment was derived based on detailed consultation with the relevant government agencies, the community and other stakeholders, and adopts best practice environmental standards wherever practical. The assessment summarised in this document has been prepared for TIDC by environmental specialists and has relied on the best available technical information. The use of this information, coupled with best practice environmental standards, goals and measures, has been relied on in the development of management measures to minimise the risks associated with potential environmental impacts.

This Environmental Assessment proposes measures to assist in the minimisation and prevention of impacts and additional investigations where uncertainty exists or relevant information is not currently available.

Intergenerational equity

TIDC has sought to ensure that any potential long-term effects resulting from the Project are minimised, in order to ensure that future generations have the same (or better) benefits in comparison to those of the present. Rail-related issues that may have long-term implications include energy consumption (including during construction), waste, renewable and non-renewable resource demand, and the provision of economic, social and environmental benefits through improved access to public transport and reduced private vehicle use. The Project would provide support for the planned sustainable land releases in the NWGC by providing a reliable train service to the region during the early master planning and development stages.

Conservation of biological diversity and ecological integrity

The Project has been designed to minimise impacts to flora and fauna where possible and has, therefore, been designed adjacent to or within the existing rail corridor. The new Schofields and Vineyard stations have been located on cleared rural land to avoid extensive impacts to native vegetation. Opportunities to minimise impact on biodiversity would be further explored through detailed design and any vegetation cleared or other habitat loss would be subject to future offset planting through the *Growth Centres Conservation Strategy* (Eco Logical Australia 2007). During the construction stage of the Project, the location of site compounds and other ancillary plant have been planned to avoid impacts to ecologically sensitive areas (refer Chapter 10).

The improved valuation and pricing of environmental issues

It is difficult to place a monetary value on the residual, environmental and social effects of the Project. The value placed on environmental resources within and around the Project is evident in the extent of environmental investigations, planning and design of impact mitigation measures to prevent irreversible damage of those resources. Consideration of environmental issues in the early stages of Project planning, and utilisation of the existing rail corridor where possible, has helped achieve improved consideration of environmental resources by ensuring that these issues were considered in the strategic planning and establishment of the need of the Project.

Once operational, there would be ongoing financial benefits of the Project through enhancement of the local economies serviced by the Project, associated enhancement of land values and a reduction in the cost of private car use as a result of an expected mode shift from private vehicle travel to use of rail transport. The economic viability of businesses located around the stations is expected to be enhanced as a result of increased trade generated by an increase in rail patronage. In addition, the provision of reliable transport nodes close to commercial development zones would improve the accessibility to employment within the NWGC, and thus would aid in achieving sustainable economic growth within the region.

The Project would also have economic benefits to both existing and future communities within the region by increasing the accessibility to a more affordable mode of transport. The provision of additional rail services during the morning and afternoon peak hours, in conjunction with the development of multi-modal transport nodes at stations, would improve transport choice within an area that is already heavily dependent on private vehicles use. The cost of using the rail service is expected to be far cheaper than the cost of using private vehicles. This benefit is likely to increase in future as the cost of fuel and traffic congestion increases.

11.4.2 Summary

The Project is a key factor in the development of sustainable communities in the NWGC. These sustainable communities would rely on transport systems that enable those people, who live, work and play in Sydney's North West region to travel in more sustainable ways.

Throughout development of the Project, a broad range of sustainability principles and objectives have been considered. The initiatives detailed in Table 11-1 would continue to be pursued throughout all stages of the Project. In addition to the continuous assessment against the sustainability principles and objectives, the following steps can be considered during the future stages of the Project:

- maintain a focus on the sustainability goals of the Project
- utilise the mitigation measures detailed in this assessment, particularly during the detailed design and construction phases
- continuously re-evaluate the sustainability measures as new research and information becomes available
- ensure contract and procurement documentation incorporates sustainability themes.