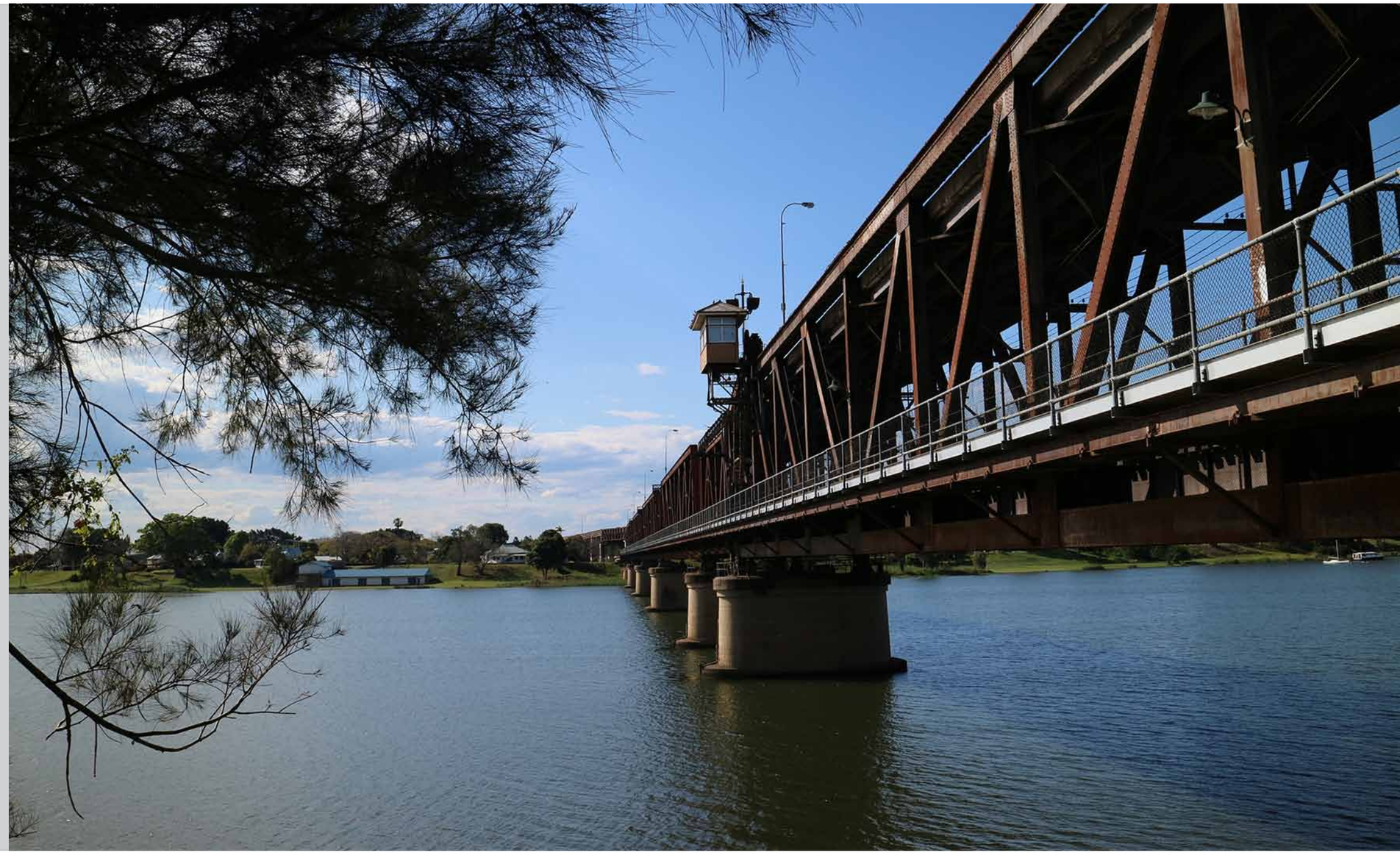
Grafton



URBAN DESIGN AND LANDSCAPE MANAGEMENT PLAN

Additional Crossing of the Clarence River at Grafton

November 2016

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Conformance with Conditions of Approval

Items to be addressed in the UDLMP from an environmental perspective - Minister's Conditions of Approval

ID	Condition Requirement	Document reference
Urban design and landscape		
CoA D42	The Proponent shall prepare and implement an Urban Design and Landscape Management Plan prior to the commencement of permanent built works and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape and design for the SSI. The Plan shall be prepared in accordance with the Roads and Maritime Services urban design and visual guidelines, and the design principles and revegetation guidelines outlined in the EIS. The Plan shall be prepared by an appropriately qualified expert in consultation with EPA, including the Heritage Division, Council and community, and submitted to the Secretary for approval. The Plan shall include, but not necessarily be limited to: (a) identification of design principles and standards based on - (i) local environmental values, (ii) heritage values, (iii) urban design context, (iv) sustainable design and maintenance, (v) community amenity and privacy, (vi) relevant design standards and guidelines including "Crime Prevention Through Environmental Design Principles", and (vii) the urban design objectives outlined in the EIS Technical Paper Urban Design and Landscape Concept Report;	Chapter 3, Design objectives, Key Principles & Strategic Plan Chapter 4, Design Analysis and Strategies Chapter 5, Urban & Concept Design. Chapter 6, Landscape Design & Implementation Chapter 8, Heritage Interpretation Plan
	(b) details on the location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where possible). Details of species to be replanted/revegetated shall be provided in a Revegetation Strategy, including their appropriateness to the area and habitat for threatened species;	Appendix B- Landscape Planting Plans Chapter 6, Landscape Design & Implementation
	(c) a description of locations along the corridor directly or indirectly impacted by the construction of the SSI (e.g. temporary ancillary facilities, access tracks, etc.) and details of the strategies to progressively rehabilitate regenerate and/or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration;	Refer to Section 6.11 Restoration of Compounds and Ancillary Facility Sites; and 6.12 Landscape Management.
	(d) appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts;	Chapter 5, Urban & Landscape Concept Plan, including Figure 5-32
	(e) appropriate landscape treatments on flood levees to ensure the structural integrity of the levees is not compromised;	All flood levels will be either turfed (urban areas) or hydroseeded as itemised in the landscape plans for South Grafton (Appendix B) to re-establish the existing grass cover. The design documentation of levees will be captured in the detail design plans and specifications.
	(f) strategies for progressive landscaping of environmental controls (such as erosion and sedimentation controls, drainage controls);	Refer to Chapter 6.0, Landscape Design & implementation, and note vegetated swales, hydroseeding and hydromulching, and jute mesh application. Refer also to CFFMP.
	(g) responsibilities for maintaining landscaping treatments and areas of regeneration and revegetation;	Refer to Section 6.12 Landscape Management.
	(h) location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, fencing, materials and signs;	Chapter 5 of the UDLMP GB-RF-01 package, Signage, LIne-marking, Road Furniture
	(i) a lighting plan lighting (with lighting in accordance with AS/NZS 1158 Lighting for Roads and Public Spaces series as relevant and AS 4282-1997 Control of the Obtrusive Effect of Outdoor Lighting) including lighting designs	Refer to Section 4.11 Lighting and Fig. 5-49 and Fig. 5-50 and to GB-LT-01 package (Street lighting package)
	(j) an assessment of the visual screening effects of existing vegetation and the proposed landscaping and built elements. Where properties have been identified as likely to experience high visual impact as a result of the SSI and high residual impacts are likely to remain, the Proponent shall, in consultation with affected landowners, identify opportunities for providing at-property landscaping to further screen views of the SSI. Where agreed with the landowner, these measures shall be implemented during construction of the SSI;	Section 4.7 Noise Barriers and Headlight Glare in UDLMP Chapter 5, UDLMP Landscape Planting Plans, Appendix B
	(k) graphics such as sections, perspective views and sketches for key elements of the SSI, including, but not limited to built elements of the SSI;	Section 4.7 Noise Barriers and Headlight Glare in UDLMP
	(l) final design details of the proposed external materials and finishes for the bridge and noise barriers, including schedules and a sample board of materials and colours;	Section 5.5 Urban Design Finishes.
	(m) monitoring and maintenance procedures for the built elements, including performance indicators, responsibilities, timing and duration; and	Refer to Appendix C, Structural Maintenance Diary.
	(n) evidence of consultation with EPA, Council and community on the proposed urban design and landscape measures prior to finalisation of the Plan. Note: • The Urban Design and Landscape Plan shall be consistent with any revegetation and biodiversity offsets established for the SSI under the conditions of this approval.	Refer to minutes of meeting held on 21 July, 2016 in Grafton. Refer to FH minutes

Table 0-1: : Conformance with Volume II Urban Design requirements as per the Request for Tender

Items to be addressed in the UDLMP from an environmental perspective - Environmental management measures

ID	Environmental management measure	Timing	Document reference
Non-Aboriginal heritage			
EMM NH2	Heritage considerations will be incorporated into the urban design and landscape objectives developed for the project. These features will be refined further during detailed design development for the project.	Detailed design	Chapter 8, UDLMP, Heritage Interpretation Plan
Visual amenity, built form and urban design			
EMM V1	Detailed design will investigate opportunities to: Refine car parking arrangements on the southern side of Pound Street	Detailed design	Due to unavailability of property acquisition this has not been possible. Restricted street trees due to carpark requirements and narrow verge. Refer to Chapter 5.
	Adjust the kerbline along Pound Street between Clarence Street and Villiers Street. This would enable extra tree planting on both sides of the street and the removal of proposed parallel parking on the southern side. This would improve the visual and pedestrian amenity, reduce the scale of the street and reduce the encroachment of works in TAFE land		Kerbline adjusted, see above.
	Reduce the batter steepness around the water detention basin to avoid the need for fencing		Basin improved- refer Section 5.3, Precinct 2- Greaves Street
	Reduce the construction boundary to reduce impacts on Pound Street and Greaves Street		Efforts have been made to minimise impacts to these areas, especially with the improved design for Greaves St.
	Refine the drainage detention basin design in Grafton to minimise its visual impact		Basin improved- refer Section 5.3, Precinct 2- Greaves Street
	Incorporate Crime Prevention Through Environmental Design principles into the project where required.		CPTED has been considered with the design. Refer to Chapter 5.
EMM V2	During detailed design, the pier designs will be developed to further reinforce the complementary relationship between the proposed bridge piers and the piers on the existing bridge. In particular, the option of tapering the piers at their long elevation will be considered.	Detailed design	The pier design is discussed in Chapter 4, Sections 4.2 and 4.3.
	In addition, opportunities will be considered to further streamline the appearance of the bridge, including: Aligning the edges of the piers with the outside faces of the girders		The appearance of the bridge has been further refined, including aligning the edges of the piers with the outside faces of the girders. Refer to Section 5.4.
	Investigating monolithic construction as an alternative to the current pier design		Piers will be of a monolithic construction.
	Ensure the proposed bridge soffit appears as a series of continuous curves with a segmented appearance to be avoided		A segmented appearance has been avoided. Refer Section 4.3.
	Incorporate Crime Prevention Through Environmental Design principles into the project where required.		CPTED has been considered with the design. Refer to Chapter 5.
EMM V3	Detailed design will consider: • Flattening the fill embankments to the bridge approach road to better integrate it with the surrounding flat rural landscape.	Detailed design	Batters were not possible to flatten due to material constraints.
	Opportunities to enhance the location's role as the ~~southern arrival point to South Grafton and Grafton~~		Strong landscape design ~~concept reflecting native~~ trees to mark the new entry is illustrated on the Urban Design Plans in Chapter 5 and Appendix B, Planting Plans, Section 5.5 Southern Gateway, and Section 5.6 -. Refer to integrated Urban Design Plans in Chapter 5, Section 5.6, and Section 4.11 that demonstrate the improved pedestrian and cyclist provisions
	• Incorporating safe and efficient bicycle access on the Iolanthe Street / Pacific Highway / Through Street roundabout and the Gwydir Highway / Pacific Highway roundabout to allow a connection to the regional Coastline Cycleway route on the Pacific Highway		

ID	Environmental management measure	Timing	Document reference
EMM V4	Consideration should be given to undertaking an arborist assessment to inform the design development and optimum levee alignment. Where the levee has existing structures (eg a building) a specific levee raising design will be required. Where feasible and reasonable, the design will: • Investigate opportunities to avoid changes to the existing structure (eg minor realignment of the levee crest) • Keep changes to the existing structure to a minimum • Identify a construction method that will keep the structure operational while construction work is being carried out (subject to safety considerations). Roads and Maritime will consult with the infrastructure owners during detailed design. For heritage listed items, the design will seek to avoid or minimise the need to modify the structure and investigate non-intrusive options to achieve the required levee level. Levee raising materials and finishes will be sympathetic to minimise impact on the significance of the heritage item.	Detailed design Construction management	An arborist will be employed to assess any existing trees within proximity to new levee, to ensure adequate soil depths, minimal impacts to tree root systems, as well as the longevity of the trees. Refer to DPE approval: *"The Department notes Roads and Maritime Services advice that the proposed landscape treatment of the levee upgrade works is grass seeding in rural areas and grass turf in residential areas. The landscape treatment has been discussed with affected property owners and included in the Property Adjustment Works. A copy of the Property Adjustments will be submitted to the Department under condition D24, prior to their implementation. The Department is satisfied that the submission of the Urban Design and Landscape Plan by 31 March 2017 will not affect the landscape treatment of the levee upgrade works, and will be well in advance of the construction of the permanent built works for the* bridge and approach roads."*

ID	Environmental management measure	Timing	Document reference
EMM V5	Detailed design and documentation drawings will define the extent of all construction activity, including temporary work, to protect the area during construction. Construction facilities will be contained within the construction work zone and occupy the minimum area practicable for the intended use. Suitable barriers will be erected to screen views from nearby areas. Work sites will be returned to at least their pre-construction state once work is complete, or progressively reinstated throughout the construction process, where possible. Pollution and dust emissions will be minimised and monitored throughout the construction period (refer to Section 8.12). Footpaths affected by construction activities will be diverted or re-routed.	Detailed design	Refer to: Safety in Design Register CEMP CAQMP Detailed Design; CTAMP Sec. 7.7.1 CFFMP Ancillary Facility Assessment; as required
	Trees to be retained within construction facilities areas will be identified, protected and maintained. Temporary lighting will be screened or diverted to reduce unnecessary light spill. Material used for temporary land reclamation will be removed once construction is complete.	Detailed design Construction management	Refer to: Safety in Design Register CEMP CAQMP Detailed Design; CTAMP Sec. 7.7.1 CFFMP Anxiliary Facility Assessment; as required
Socio-economic, property and land use			
EMM SE5	Roads and Maritime and the construction contractor will minimise impacts, where feasible and reasonable, on existing character trees, including figs and jacarandas. Visual impacts and mitigation measures are outlined in Section 8.8 of the EIS.	Detailed design	Key existing trees to be protected and retained are indicated on the Urban Design Plans. In detail design this xref will be incorporated into engineering plans.

Table 0-2: Conformance with Volume II Urban Design requirements as per the Request for Tender

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Executive Summary

In accordance with the Minister's Conditions of Approval, this Urban Design and Landscape Management Plan (UDLMP) report includes tables that outline document references for each requirement, the proposed Urban and Landscape Design concept for the Additional Crossing of the Clarence River at Grafton, in addition with the following revisions since the EIS in planning and design :

- revised and improved outcome for Greaves Street precinct since the EIS;
- incorporation of the Skink Habitat (to reflect the requirements of the Three-toed Snake Tooth Skink Construction Management Plan) requirements in Grafton (north) ;
- incorporation of the CFFMP (Construction Flora and Fauna Management Plan) requirements, where applicable; and
- incorporation of the Heritage Interpretation Plan.

The above outcomes have been developed from a thorough analysis of the project /landscape context, community aspirations, land use and client's brief. The report outlines the urban and landscape design principles adopted in the design of the river crossing, and demonstrates how the concept designs and strategies proposed provide a design that is highly integrated with the existing site/community context through providing:

- a considered response to the existing built and natural landscape characters of Grafton and South Grafton.
- a sympathetic design response to the existing heritage listed truss bridge and the various associated infrastructure elements.
- an understanding of Council's intent for the future of Grafton (through its published documents) and ensuring that the design responses help achieve this desired future character.

The proposed road corridor traverses through distinctly different environments that influence the character of the Project and the experience of it. Five design precincts are identified within North and South Grafton. These are defined by landform, vegetation, land use, topography, built form among other physical attributed. The approach to the design of the highway and of its various natural and built elements respond to the varying character of these five Design Precincts. These are:

- Precinct 1: Pound & Clarence Streets
- Precinct 2: Greaves Street
- Precinct 3: Bridge over Clarence River
- Precinct 4: Southern Approach
- Precinct 5: Iolanthe Street/ Pacific Highway

Fig. 0-1: Design Precincts of the Project

Key

- Precinct 1: Pound and Clarence Streets
- Precinct 2: Greaves Street
- Precinct 3: Bridge over Clarence River
- Precinct 4: Southern Approach
- Precinct 5: Iolanthe Street/ Pacific Highway

Key strategies adopted in the proposal to achieve the project objectives are:

- A sense of arrival and departure to the town is created by feature gateway plantings, that clearly distinguish between the entrance and roads leading to Bent Street/ and the old heritage bridge, (with Jacarandas) with the new approach, flavoured with indigenous tall, evergreen trees to lead to the new bridge- the new approach to town.
- The design of the new bridge over Clarence River is simple and elegant with due consideration to the heritage listed bridge as the primary visual focus.
- The noise/ privacy/ anti glare screen is designed to be unobtrusive as possible for motorists as well as local residents.
- The new truss bridge heralds the entry into Grafton/ Pound Street similar to the role played by the existing truss bridge over Gwydir Highway.
- Key visual corridors to the hinterland and existing bridge are retained with sensitive planting that creates an interplay between masses and voids in the landscape.
- Landform is integrated through careful landscape strategies with the surrounding flat floodplain.
- Reinforcing the indigenous riparian forest tree planting in the new open space corridor, that links the river to the town.
- Creating strong streetscapes to reinforce the garden city of Grafton and clarifying the importance of Jacarandas in old/ heritage areas, and new indigenous street trees in new, or rejuvenated streets.
- Integrating sustainable landscapes that display low maintenance, whole of life strategies.
- Applying water sensitive design to streetscapes, parks and open spaces to assist with flood prevention and also to improve water quality and add value for the community.
- Provide opportunity for working with the community to integrate art/heritage interpretation, and gateway accents in detail design.

Fig. 0-2: Urban Design and Landscape Strategy Plan - 1 of 2

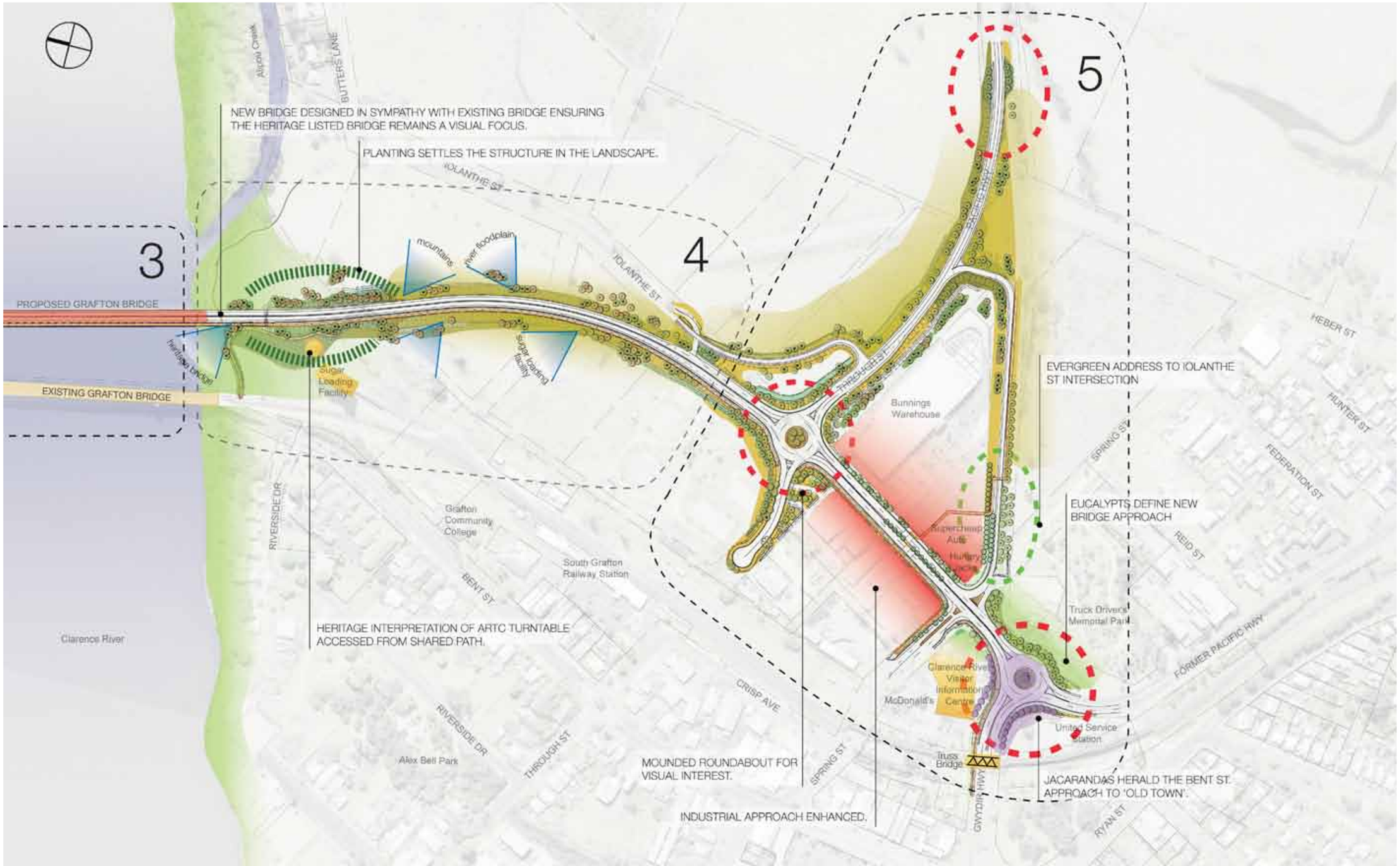


Fig. 0-3: Urban Design and Landscape Strategy Plan - 2 of 2

Fig. 0-4: View of the Additional Bridge over Clarence River at Grafton - looking south west

The following key principles have been adopted in the design of the Additional Bridge over Clarence River at Grafton:

- Grafton town and its immediate local area, both north and south, has a predominance of existing infrastructure. It is considered important that the new structure is sympathetic to the existing heritage listed bridge and associated structures as well as the semi-rural landscape setting of the project.
- The main bridge elements have a simple design with a smooth finish and clean lines producing an elegant outcome. All bridge elements including piers and parapets as well as associated noisewall and retaining wall are fully integrated in the design.

Bridge form:

- The bridge is comprised of 9 spans with 5 piers in the river and 3 piers on land.
- The simple and elegant form of the parabolic bridge structure, as per the EIS concept design, is maintained in the proposed tender design (river crossing section) to ensure that the design is complementary to the existing infrastructure. The end spans are maintained as Super-Ts to achieve a greater clearance at Clarence Street.
- The design of the piers have rounded ends and tapers in the end elevation responding to the rounded end and tapered form of the existing bridge piers.

Relationship to existing bridge:

- The horizontal position of the additional river crossing has been maintained below the existing heritage listed bridge and the soffit of the box girder is approximately in line with the soffit of the existing truss.
- The location of the new piers are in line with the positioning of the piers on the existing bridge as per the Concept Design.

Key features of the bridge are:

1. Introduction

1.1 Background

The project is located at Grafton in the Clarence Valley local government area, on the NSW North Coast, about 600km north of Sydney. The existing crossing of the Clarence River at Grafton has substantial structural, capacity, and safety problems. The Roads and Maritime Services (RMS) is undertaking the upgrade of the crossing through the provision of an additional bridge over the Clarence River connecting north and south Grafton.

The project follows the alignment of a preferred option set out by RMS in April 2013. The northern extent of the project is located at the junction of Pound and Villiers Street in Grafton. The southern extent of the project area is located at the intersection of Bent Street and the Gwydir Highway in South Grafton. The proposed bridge will be positioned approximately 70m downstream of the existing bridge.

1.2 Scope and Purpose of the Report

The purpose of this report is to describe the Urban Design and Landscape Management Plan for the project, its relationship to its context and how the proposed solutions respond to the specific requirements of the context and the community.

The urban and landscape design takes as its starting point the Concept Design as presented in the EIS Appendix J - Technical Paper Urban Design and Landscape Concept Report and the Scope of Works and Technical Criteria Appendix 15.

The Design complies with the Minister's Conditions of Approval, as set out in Table 1-1.

1.3 Project Objectives

The existing bridge crossing the Clarence River is the only crossing between Grafton and South Grafton. The bridge is already operating at capacity during peak hours and projected traffic growth will worsen congestion problems. The bridge design also constrains traffic due to the bottle necks and kinks in the design, both of which contribute to congestion and road safety issues when crossing the river.

The purpose of the project is to address short-term and long-term transport needs within Grafton and South Grafton. The project objectives and associated supporting objectives are listed below (Source: Environmental Impact Statement, RMS, 2014, P 22-23).

Enhance road safety for all road users over the length of the project

- Reduce the potential for road crashes and injuries on the bridge and approaches, including any intersections and connecting roads
- Provide safe facilities for pedestrians and cyclists.
- Improve traffic efficiency between and within Grafton and South Grafton
- Provide efficient access for a second crossing of the Clarence River and for the State road network
- Provide a traffic management network that reduces delays between Grafton and South Grafton in peak periods to an acceptable level of service for 30 years after opening
- Provide adequate vertical clearance for heavy vehicles
- Consider demand management strategies to minimise delays to local and through traffic.

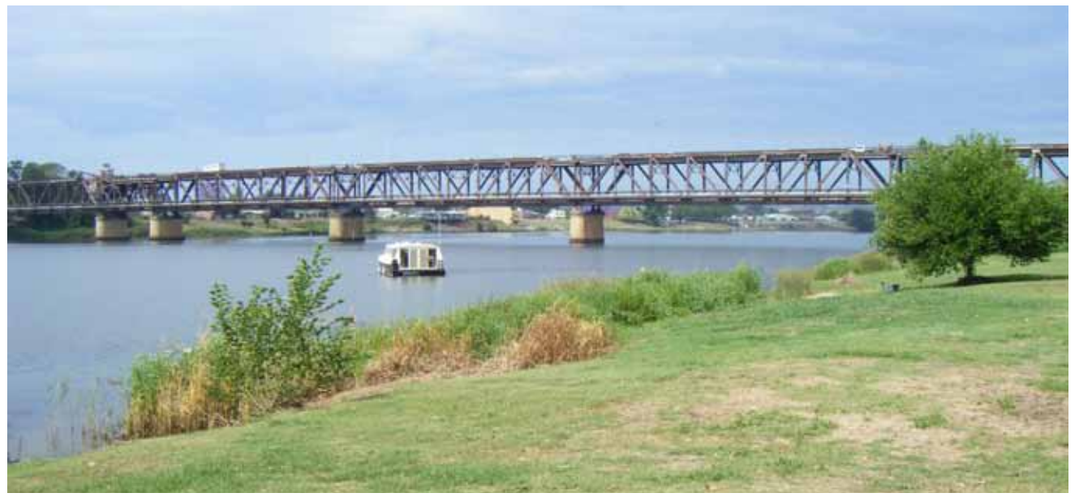


Fig. 1-1: View of the existing bridge looking south west

Fig. 1-2: View travelling north on existing bridge

Support regional and local economic development

- Provide transport solutions that complement existing and future land uses and support development opportunities
- Provide improved opportunities for economic and tourist development for Grafton
- Provide for commercial transport including B-doubles where required
- Provide flood immunity for the bridge for a one in 100-year flood event, and for the approach roads for a one in 20-year flood event, where economically justified
- Provide navigational clearance from the additional crossing for river users.
- Involve all stakeholders and consider their interests
- Develop solutions that consider community expectations for the project
- Satisfy the technical and procedural requirements of Roads and Maritime with respect to the planning and design of the project
- Integrate input from the community into the development of the project through the implementation of a comprehensive program of community consultation and participation.

Provide value for money

- Achieve a good benefit-cost ratio
- Develop a strategy to integrate future upgrades into the project.

Minimise impact on the environment

- Minimise the impact on the social and economic environment, including property impacts
- Minimise the impact on residential amenity, including noise, vibration, air quality, etc
- Minimise the impact on heritage
- Minimise the impact on the natural environment
- Provide a project that fits sensitively into the built, natural and community context
- Minimise flooding impact caused by the project."

1.4 Structure of the Report

The report has been structured to clearly identify design responses and strategies and show compliance with both the scope of work and the conditions of approval requirements.

Chapter 1: Introduction – introduces the project, outlines the scope and provides a background of the work undertaken to date.

Chapter 2: Contextual Analysis - provides a brief contextual analysis focusing on urban design relevant issues.

Chapter 3: Urban and Landscape Design Objectives, Key Principles and Strategy Plan – identifies the design objectives, key principles for the project as outlined in the EIS and presents the Strategy Plan.

Chapter 4: Design Analysis and Strategies – presents the design analysis, detailed principles and strategies adopted in the design approach to the additional crossing in general, and the various urban design and landscape elements in particular.

Chapter 5: Urban and Landscape Design – presents the concept urban and landscape design including the design of the bridge. This chapter also presents the design revisions to improve the Greaves Street Precinct, and to include habitat requirements for the Three-toed Snake Tooth Skink.

Chapter 6: Landscape Design Details – presents the landscape details proposed.

Chapter 7: Urban Design Finishes – presents the Urban Design Finishes Schedule.

Chapter 8: Heritage Interpretation Plan.- illustrates the integration of heritage interpretation throughout the urban and landscape design.

This is followed by the References and Appendices.

2. Contextual Analysis

The EIS Appendix J - Technical Paper Urban Design and Landscape Concept Report (2014) provides a comprehensive analysis of the project context. It broadly describes the range of urban and rural elements that make up the Grafton area and that contribute to its unique identity and character. In this Chapter, we summarise the key issues highlighted in the EIS contextual analysis and provide additional description only where greater detail is required for this stage of the work.

2.1 Summary Contextual Analysis EIS - Appendix J

Key issues as highlighted in the report are:

2.1.1 Regional and Local Context

Grafton City is located in NSW northern coastal region (Figure 2-1). Grafton is a leading city within the area as three roads of regional significance converge on the city. This is the main crossing point of the Clarence River within the Clarence Valley, and the point where the North Coast Rail line crosses the river. The rail line is the primary north-south rail line in NSW, linking Brisbane and Sydney. The Summerland Way crosses the Clarence River at Grafton and continues north to Casino. The Pacific and Gwydir Highways pass through South Grafton.

The town centres of the city of Grafton are bisected by the Clarence River. Grafton lies north of the river and South Grafton is located south of the river.

2.1.2 Transport

Grafton is a major regional centre, and as such, is well connected to the regional road and rail transport routes (Figure 2-2). Princes Highway and Gwydir Highway provides access from Coffs Harbour and Ballina; and Moree and Glen Innes, respectively and the North Coast Railway provides access to the city. The rail line is the primary connection for passengers and freight between Queensland and NSW. The Summerland way, considered a scenic alternative to

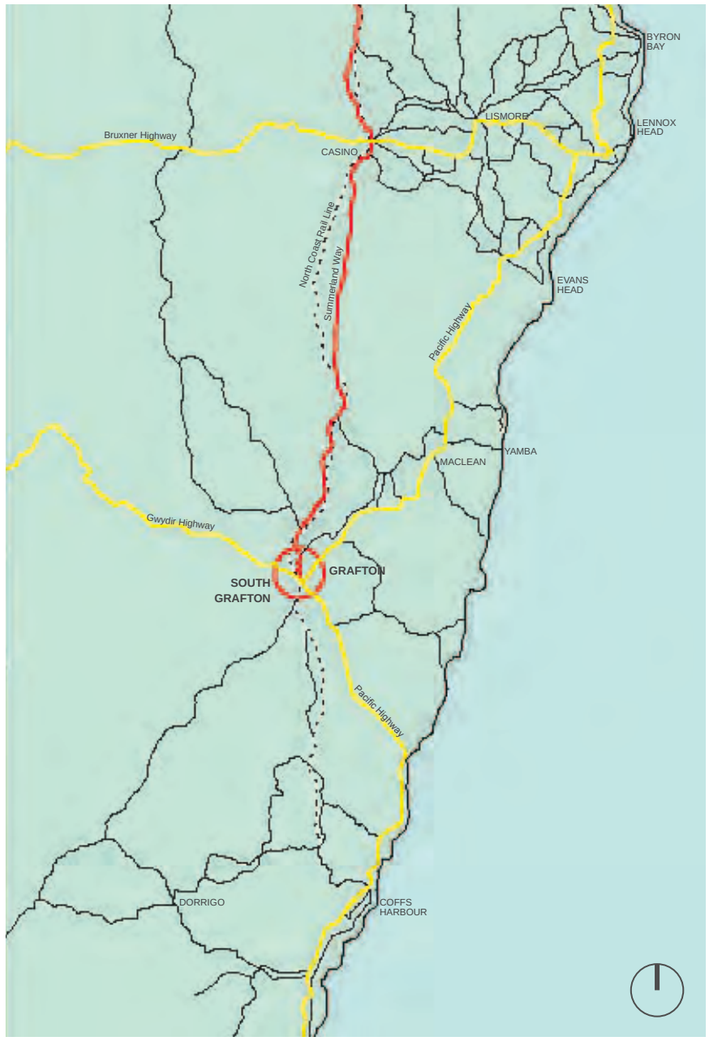


Fig. 2-1: Regional context (NTS)

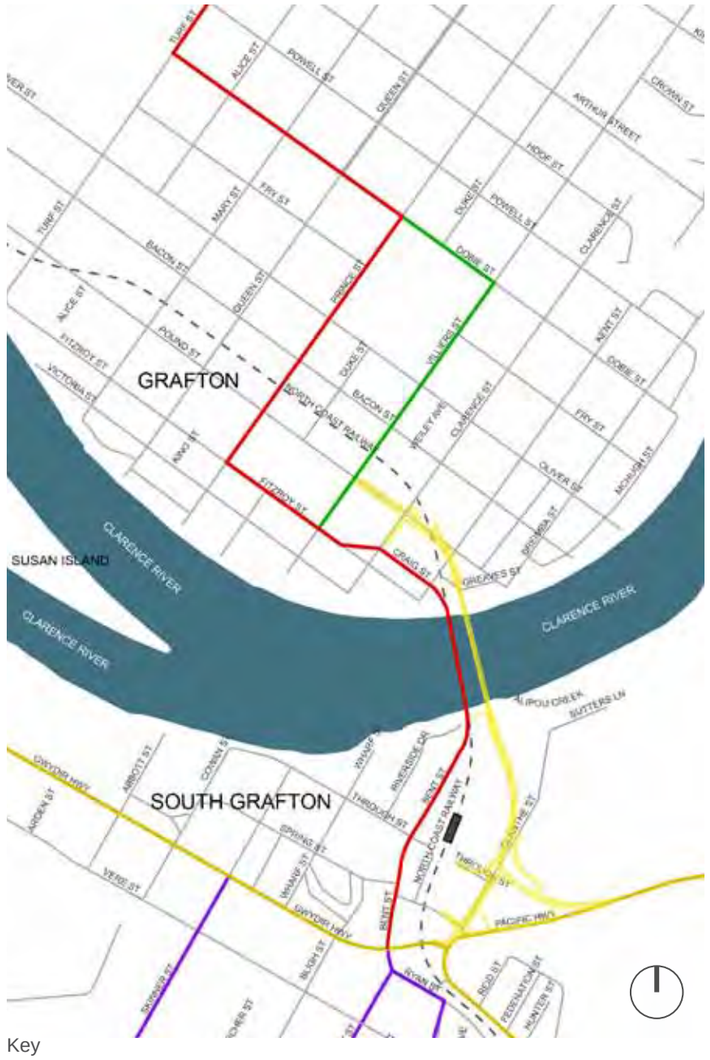


Fig. 2-2: Local context with road network (NTS)

(Information sourced from Additional Crossing of the Clarence River at Grafton Urban Design and Landscape Concept Report)

Pacific Highway, also crosses the city. Heavy vehicles do not use a section of Summerland Way that runs through the town and instead use a heavy vehicle diversion route along Villiers Street.

2.1.3 Hydrology

The Clarence Valley is one of the most extensive coastal flood plains in Australia (Figure 2-6). Grafton is significantly affected by the periodical flooding experienced in the region and has a history of major flooding events affecting both town centres. To alleviate the threat of flooding, a series of high levees have been erected, protecting the town centres from potential floods.

2.1.4 Historical Context

European settlement in the Grafton regions began in the 1830s and Grafton Bridge was opened to the public in 1932, connecting the two town centres (Figure 2-3). Grafton and South Grafton are divided into two Urban Conservation Areas and contain a number of State Heritage Register items as well as numerous locally significant heritage items. Grafton Bridge is a State Heritage listed item.

Chapter 8, Heritage Interpretation Plan illustrates how the proposal has been enriched through integrating key elements of both Aboriginal and non-Aboriginal heritage from both within, or in the vicinity of the project proposal, into the scheme.

2.1.5 Clarence River and the Crossing

The Clarence River is the most significant natural feature within the Clarence Valley. The river has had a lasting influence on the city of Grafton in relation to trade and periodic flooding. The river is characterised by its wide banks and exaggerated bends. Due to the region's prevalence to flooding, levees are situated on either side of the river and give a clear articulation to the waterfront open space. The concept plan for the Waterfront Precinct Master Plan (2011; Clarence Valley Council) seeks to exploit this open space to achieve a better connection to the waterfront.

The existing bridge is an iconic structure that is pivotal to Grafton's image as a 'River City' (Figure 2-4). Grafton Bridge, built in 1932, is a double deck bascule steel truss bridge that spans 457 metres including approach roads. As a result of the low topography of the area, the bridge is accessed through approach roads either side of the river. The bridge is a state heritage item and is the only point of crossing the Clarence River for the region

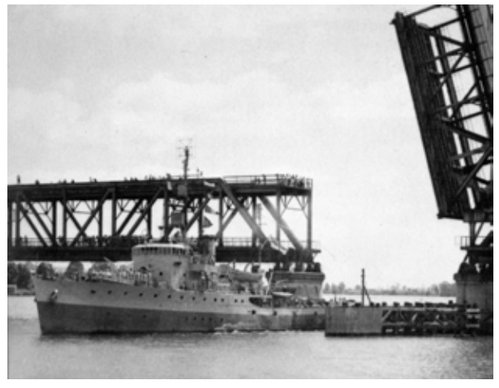


Fig. 2-3: Clarence Bridge Bascule Span, 1950s.

(Source: http://clarencevalleytoday.blogspot.com.au/2012/07/grafton-bridge-bascule-span.html)

Fig. 2-4: Clarence River Flood 2001

(Source: Clarence Valley Council: 2001 Flood Photos)

Fig. 2-5: Clarence Bridge

(Source: Fairfax Newspapers - Aerial view of the opening of Grafton Clarence River Bridge, Grafton)

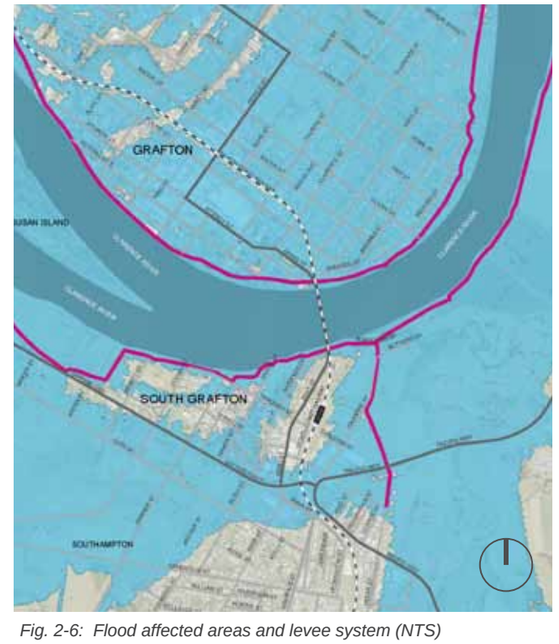


Fig. 2-6: Flood affected areas and levee system (NTS)

(Information sourced from Clarence Valley Council LEP Flooding 2011)

2.1.6. Urban Form and Land Uses

The historic settlements of Grafton and South Grafton are laid out in a regular grid of streets. Grafton town centre is the primary retail and commercial centre of the city, focused on the traditional main street of Prince Street. South Grafton's retail and commercial activities are centred on Skinner Street (Figure 2-7). Both retail streets connect the town centres to the river waterfront. The separation of the two town centres is a significant characteristic of the town. This, along with the experience of infrastructure and the jacaranda-lined streetscapes, define the city character.

Key land uses are:

Residential: Outside of Grafton and South Grafton town centres is a well-established urban residential core (Figure 2-7). The historic street layout along this zone, with mature fig and jacaranda trees, defines the streetscape character of the city.

Industrial: Industrial uses have a historical significance within Grafton and, as they have in the past, are located along the major road and rail passageways through the city. While recent industrial development has been primarily 'big box' developments and generally homogenous within the urban fabric, the long term industrial developments such as the sugar mill and other specialised uses are more synonymous within the city landscape, becoming landmarks within the city.

Open Space and Recreation: The town centres of Grafton and South Grafton provide a number of areas of open space and recreation through public parks as well as the Clarence River waterfront. The local parks cater for both active and passive recreation. The open space on the waterfront is focused upstream of the existing Grafton Bridge where it provides key public recreational opportunities including active recreation in rowing, sailing, and bowling. The Grafton Waterfront Precinct Masterplan (2011; Clarence Valley Council) aims to provide continuous waterfront public access between Queen Street and Clarence Street

Fig. 2-7: Urban Form and Land Uses (NTS)

(Information sourced from Clarence Valley Council LEP Land Zoning 2011)

Key

- Neighbourhood Centre
- Commercial Core
- Business Development
- General Industry
- General Residential
- Large Lot Residential
- Primary Production
- Rural Landscape
- Environmental Management
- Public Recreation
- Private Recreation
- Infrastructure
- Tourist
- Working Waterways
- Project Alignment
- Local Road
- Main Road
- Highway
- North Coast Railway

Legend

1. Grafton Shopping World
2. North Coast TAFE Grafton Campus
3. Clarence Valley Council
4. Grafton High School
5. Grafton Police Station
6. Clarence River Visitor Information Centre
7. Bunnings Grafton

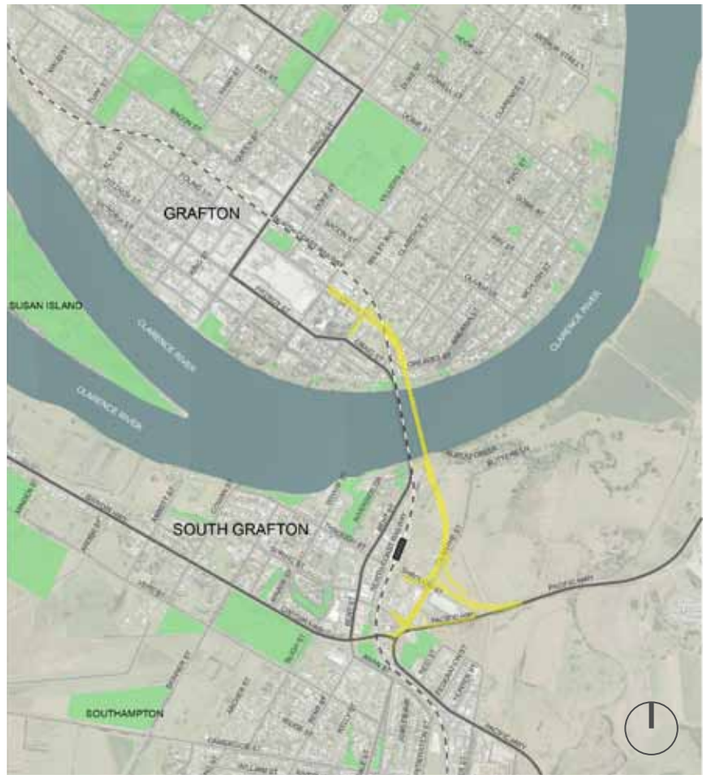


Fig. 2-8: Existing Open space (NTS)

(Information sourced from Clarence Valley Council LEP 2011)

Key

- Open Space
- Clarence River
- Project Alignment
- Local Road
- Main Road
- Highway
- North Coast Railway

2.2 Additional Contextual Analysis

2.2.1 Urban Character

Both town centres have an established urban core with primarily commercial uses present on the historical main streets of Prince Street and Skinner Street. Whilst both main streets have a direct connection to the waterfront, they do not acknowledge the waterfront and the active core of the town is not connected with the water front amenity.

A defining urban characteristic of the city of Grafton is the prevalence of transportation infrastructure throughout the city (Figure 2-11). As a result of the flat topography of Grafton town centre, viaducts and ramps have been used to elevate both the rail and road approaches to the existing bridge. These structures give a distinctive characteristic to the urban landscape and act as landmarks within the urban core.

This is not the case for South Grafton, however, where the elevation of Bent Street and the railway line have provided the opportunity to approach the existing bridge on a natural level. The truss bridge over Gwydir Highway serves as a gateway landmark within South Grafton (Figure 2-12).

Fig. 2-9: Prince Street

Fig. 2-10: Predominance of infrastructure in Grafton

Fig. 2-11: The use of Jacaranda as a street tree

Fig. 2-12: Skinner Street

Fig. 2-13: Truss bridge over Gwydir Highway

Fig. 2-14: Established residential street in Grafton

2.2.2 Heritage

The Heritage Interpretation Strategy in Chapter 8 further illustrates key heritage elements and how these, with their stories have potential to be interwoven into the Urban and Landscape design to enrich the scheme and to provide the community an enriched overall environment.

Aboriginal Heritage: Prior to European settlement the region of Grafton was within the Bunjalung lands and a community of aboriginal people, of whom, some with links to the original inhabitants, still live in Grafton today. The EIS Appendix H archaeological assessment identified one aboriginal site within the project area and one site recorded nearby. The entirety of the Clarence River and Alipou Creek were determined to be aboriginal sites associated with the Golden Eel story (Figure 2-16). “It is known that the Golden Eel site and the formation of the Clarence River are considered to be of high cultural significance to the local Aboriginal people” (EIS Appendix H, P17, RMS, 2014). Two aboriginal sandstone artefacts were located in an area near the entrance of lot 457, Iolanthe Street, South Grafton, and designated Alipou Creek AS1. They are a modified river cobble and a grinding stone.

The Heritage Interpretation Plan further demonstrates the significance of the Aboriginal heritage to the area, and recommends strategies to work alongside the Aboriginal community to further develop the strategy.

Strategies include interpretation signage, heritage trails/artwork/plantings to reinforce and interpret some of their particular heritage significance of the area.

Non - Aboriginal Heritage: Non aboriginal settlement in Grafton began with the timber cutters and settlers of the early 1800s although no buildings of that time have survived today. The town’s significant development came later in the 19th century. Both town centres are dedicated conservation areas with significant heritage items from this time such as residential buildings, and a sugar mill and railway turntable, referring to the established streetscape and character of the town as well as its industrial past.

Grafton

There are many heritage elements in close proximity to the site in Grafton, in particular-

- Grafton Bridge (circa 19320)
- Breimba Street Fig Trees
- “Dunvegan”- TAFE Building (circa 1905-1927)
- Ravenswood- (circ 1860-)
- King George V Plaque
- Old Grafton Viaducts

The design responds to the above by:

- Ensuring views across to the Grafton Bridge from the new alignment are exploited, and the presence of Jacarandas on the Grafton side will be reinforced with this proposal (see Clarence and Pound Streets), and at the entrance to the old bridge/ old town in the vicinity of the Pacific Highway/Gwydir Highway area, South Grafton.
- Ensuring proposed street works do not adversely affect the streetscape in front of both Dunvegan and Ravenswood residences.
- The views from Greaves and Pound Street areas to the Fig trees on Breimba Street are maintained.

South Grafton

There is a rich history of the rail precinct and the relationship to train ferries across the river, and to wharf and heritage ship remains. The 18.3 meter (60 Foot) manual turntable was installed in 1925, at the terminus of the railway line from Maitland. Opening of the double deck rail and road bridge across the Clarence River in 1932 completed the standard rail gauge connection from Sydney to South Brisbane. The turntable is now an isolated component related to the heritage-listed Grafton City Railway Precinct, and the Heritage Interpretation Strategy indicates the potential to interpret the importance of the railway system and river transport to the historical development of Grafton, with major components of which are the bridge and railway and wharf/ship structures surviving within the Precinct.

Fig. 2-15: View of the Clarence River from the existing Grafton Bridge looking north east - identified as being created during Dreamtime

Fig. 2-16: Looking towards Alipou Creek on the southern banks, where part of the Golden Eel site story is linked

Fig. 2-17: The ARTC Turntable

Fig. 2-18: Dunvegan (TAFE building) on Pound Street

Fig. 2-19: Sugar mill in South Grafton

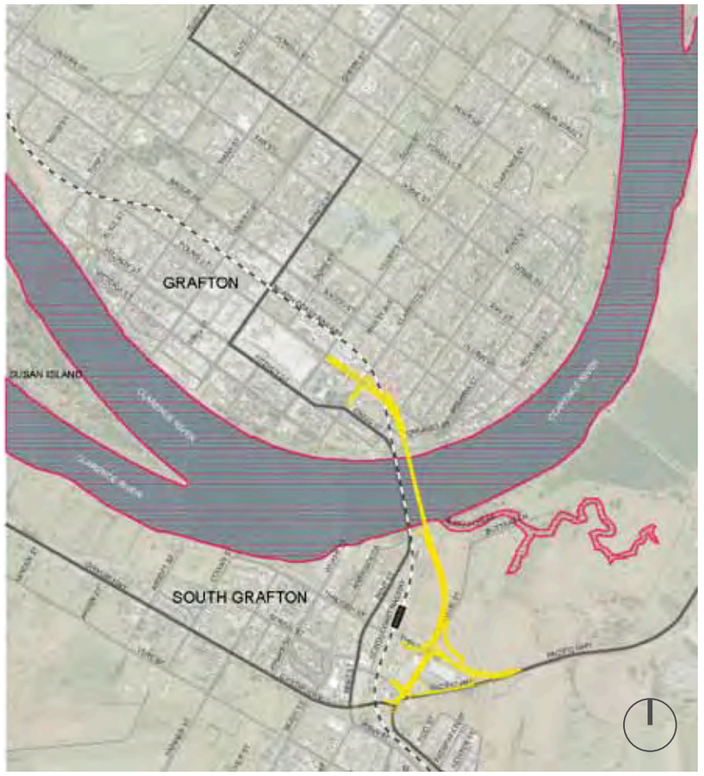


Fig. 2-20: Significant Aboriginal Heritage Sites (NTS)

(Information sourced from the Additional Crossing of the Clarence River at Grafton Urban Design and Landscape Concept Report)

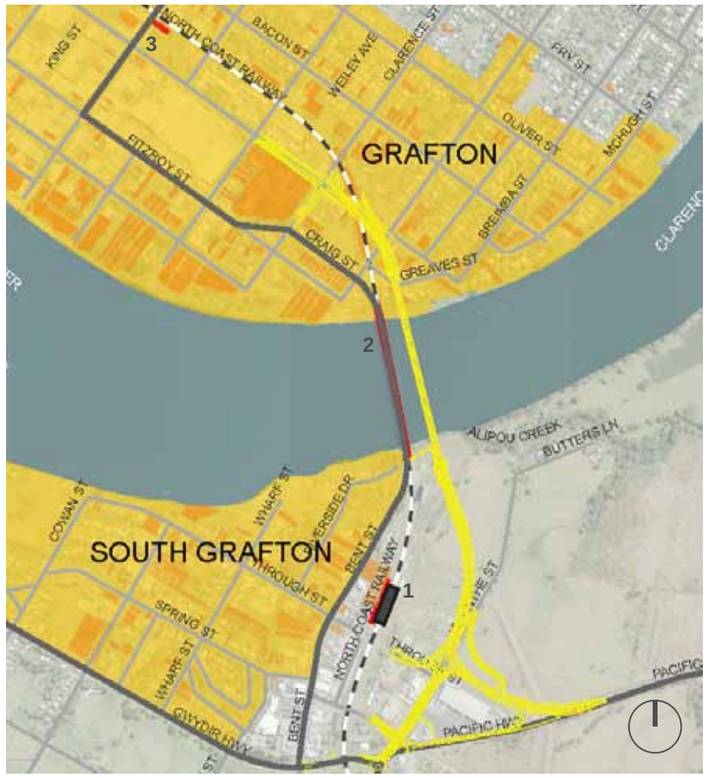


Fig. 2-21: Non Aboriginal Heritage (NTS)

(Information sourced from the Additional Crossing of the Clarence River at Grafton Urban Design and Landscape Concept Report)

2.2.3 Bridge over Clarence River at Grafton

A key feature of the experience of Grafton town centre is the relationship it has to the Clarence River. The state heritage listed bridge and the river are key identity markers for both Grafton and South Grafton (Figure 2-22). At present, the bridge is the only road and rail connection between the two town centres with a unique double deck steel truss. The bridge's bascule span is no longer in operation.

The bridge is approximately 396 meters long across the river and is comprised of 6 truss spans (including the bascule span). The concrete piers have a distinct rounded end shape with a cornice detail at the top. The piers are also tapered at 1:24 degrees outwards to the base on all four sides. The approaches to the river bridge and the railway viaduct continue to dominate the landscape of Grafton and South Grafton. The arched structures of the railway viaduct are a key visual feature through the town centre of Grafton.

Fig. 2-22: Existing truss bridge over the Clarence River

Fig. 2-23: Existing bridge piers

Fig. 2-24: Drivers view from existing bridge looking south

Fig. 2-25: View east from pedestrian walkway

Fig. 2-26: Walkway beneath existing bridge

2.2.4 Streetscape

A clear relationship can be seen between the scale of the historic urban layout of Grafton and its streetscape character. The broad streets, lined with mature fig trees, are a remnant of past town planning.

The retail and commercial town centres have formal streetscapes consistent with their location within the street hierarchy. Outside of the urban core, the streetscapes are informal in character with few providing kerbed edges, defined footpaths or formal parking.

The mature Fig and Jacaranda trees present throughout the city are implicit in the city character. Grafton's Jacaranda Festival, held annually in early November celebrates the visual spectacle provided by hundreds of in bloom Jacaranda trees. These trees are synonymous with the character and identity of the older parts of Grafton, with Pound Street being known in the past as "Jacaranda Avenue."

Clarence Valley Urban Tree Management Strategy identifies the need for formal heritage avenues of similar species with the urban forest concept. The balance of style is in debate, particularly with climate change and site constraints, and the impact of water sensitive design on species selection. Council support water sensitive design for new streets as it becomes increasingly important to minimise drought stress on street plantings and mitigate the effects of flood events. This project provides an ideal opportunity to put this new vision into effect.

Fig. 2-27: Pound Street streetscape, prior to the Fig trees being removed

Fig. 2-30: Clarence Street streetscape

Fig. 2-28: Roundabout on Villiers Street

Fig. 2-31: Spring Street streetscape

Fig. 2-29: Clarence Street streetscape

Fig. 2-32: Kent Street streetscape

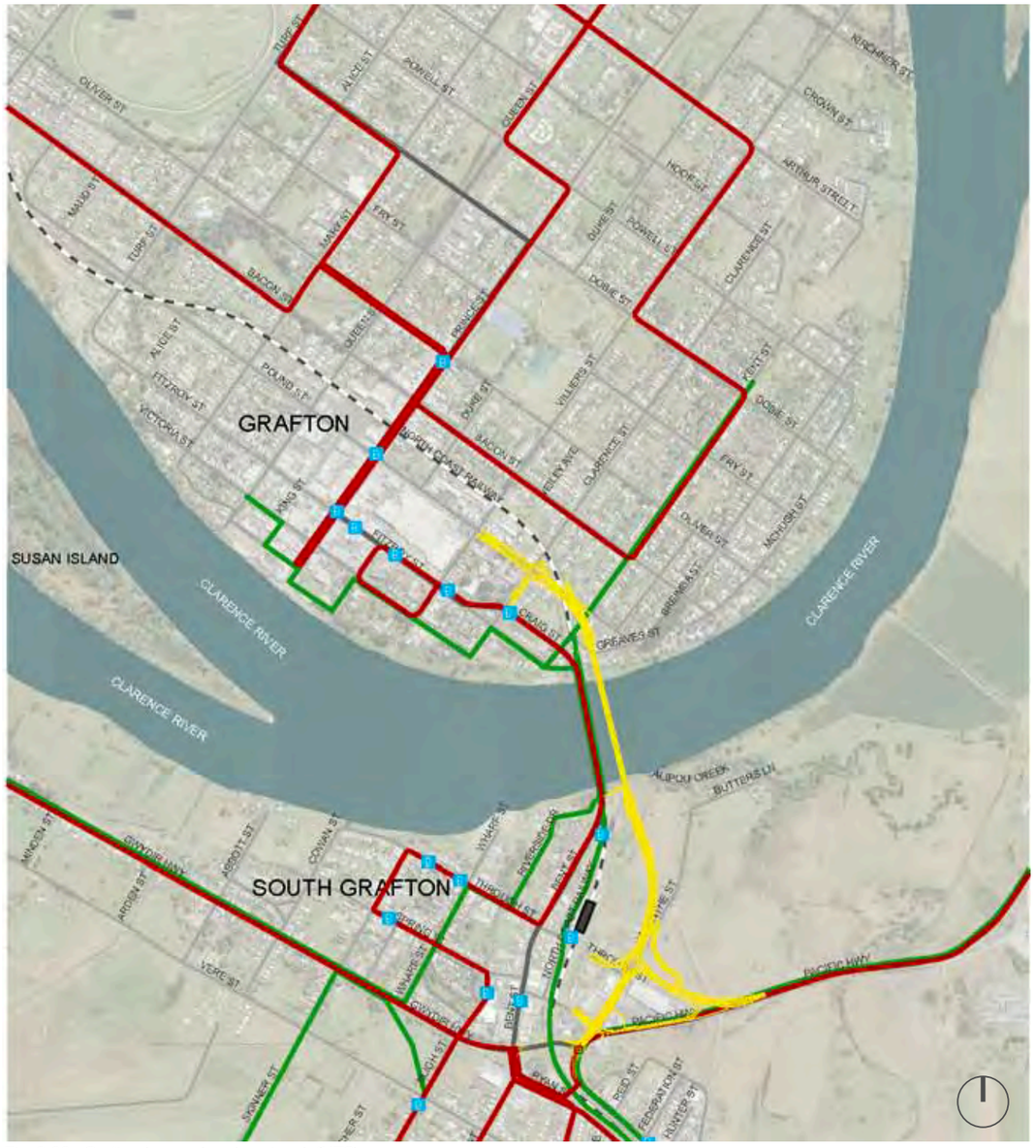
2.2.5 Pedestrian and Cycle Paths

There are wide footpaths provided in the urban core of both Grafton and South Grafton primarily along the retail and commercial streets. There is no signalised traffic control for vehicles or pedestrians in Grafton. The most common traffic management control, apart from give way and stop controls, is the roundabout, which vary in scale across the city. Outside of the urban centres, however, there are few dedicated pathways and pedestrians commonly walk on the roads edge.

Similarly there are few dedicated cycle networks in the Grafton region (Figure 2-33). The existing Grafton Bridge is currently the only pedestrian and cycle route that crosses the Clarence River. The shared paths on either side of the bridge form part of the NSW Coastline Cycleway.

2.2.6 Public Transport

The Countrylink rail and bus network provide the bulk of the public transport services for Grafton and the Clarence Valley region. The Brisbane to Sydney rail line runs through Grafton, stopping at Grafton rail station located in South Grafton. The Countrylink bus services link up with this rail network. The Countrylink transport network is extended locally through a number of local bus networks and school buses (Figure 2-33). Community transport services serve people with disabilities, although with limited funding, these services are less frequent. Accessible taxi services operate in both Grafton and South Grafton.



Key

- Railway Station
- Bus Stop
- Bus Route
- RMS Regional Coastline Cycle Routes
- Project Alignment
- Local Road
- Main Road
- Highway
- North Coast Railway

Fig. 2-33: Grafton bus and cycle network (NTS)
(Bus Route information sourced from https://www.busways.com.au/region/grafton)
(Bus Stop information sourced from Google Maps)
(Cycle Route information sourced from Clarence Valley Council, 2008, Pedestrian Access and Mobility Plan)

2.2.7 Key Views and Vistas

Key views identified are (Figure 2-37):

1) On approach to South Grafton from Moree and Glen Innes on the Gwydir Highway, and from Ballina and Coffs Harbour on the Pacific Highway,
2) Approach to the bridge crossing from the north and south.
3) View out to the river from the bridge crossings and views to the heritage listed bridge from the new highway.
4) Views of the new bridge from the heritage listed bridge – railway, motorway and pedestrian and cycle paths.
5) Views of the two bridge crossings from the river way, and adjacent small public open spaces on the north and south river banks.
6) Views of the bridge crossing from the pedestrian and cycle networks.
7) Views from the new alignment to the rural landscape and distant mountain range to the south.
8) Views from the new embankment to the Sugar Loading Facility.

Fig. 2-34: Approach to South Grafton from Moree and Glen Innes

Fig. 2-35: View to both bridges from river bank on North Grafton

Fig. 2-36: View to sugar mill and rail precinct

Fig. 2-37: Significant Views and Vistas (NTS)

Key

- View Point
- Town Entries
- Project Alignment
- Clarence River
- Local Road
- Main Road
- Highway
- North Coast Railway

2.2.8 Vegetation Patterns

Grafton is a heavily built up area, devoid of much of the original vegetation that clad the landscape. As the Biosis Flora and Fauna Assessment (EIS) noted, the soil landscape type throughout is Clarence-Richmond alluvial plains.

Soils throughout the area are heavily disturbed through industrial, agricultural, urban land uses, and constructed levees. The area is subject to flooding and there is little intact vegetation remaining, apart from a few isolated patches of native vegetation, typical of the vegetation of Lower Clarence.

As mentioned in the Clarence City Council "Open Space for Grafton City" report, there is a need to create more native vegetation corridors. This project provides opportunity for that, especially in the space between the river and Pound Street.

The key vegetation association that should be reinforced, where space and conditions permit, to promote biodiversity is the Riparian Forest- Sub-tropical coastal floodplain forest (EEC)

2.2.9 Open Space Strategy

The summary of the significance of the Clarence River Way Masterplan is mentioned elsewhere. This project offers opportunity to Council to greatly improve the open space between the river and the town.

Whilst the design shows an intent, we are aware of the principles as set out in the Riverside Recreation and Riparian Vegetation Strategy (2008), which was developed by Clarence Valley Council to better provide for the recreational use and protection of natural vegetation on Council managed riverside parks and reserves upstream of Grafton. This report included the establishment of a Project Steering Committee with representatives from the Clarence Valley Council, Department of Environment, Climate Change and Water; and NSW Land and Property Management Authority.

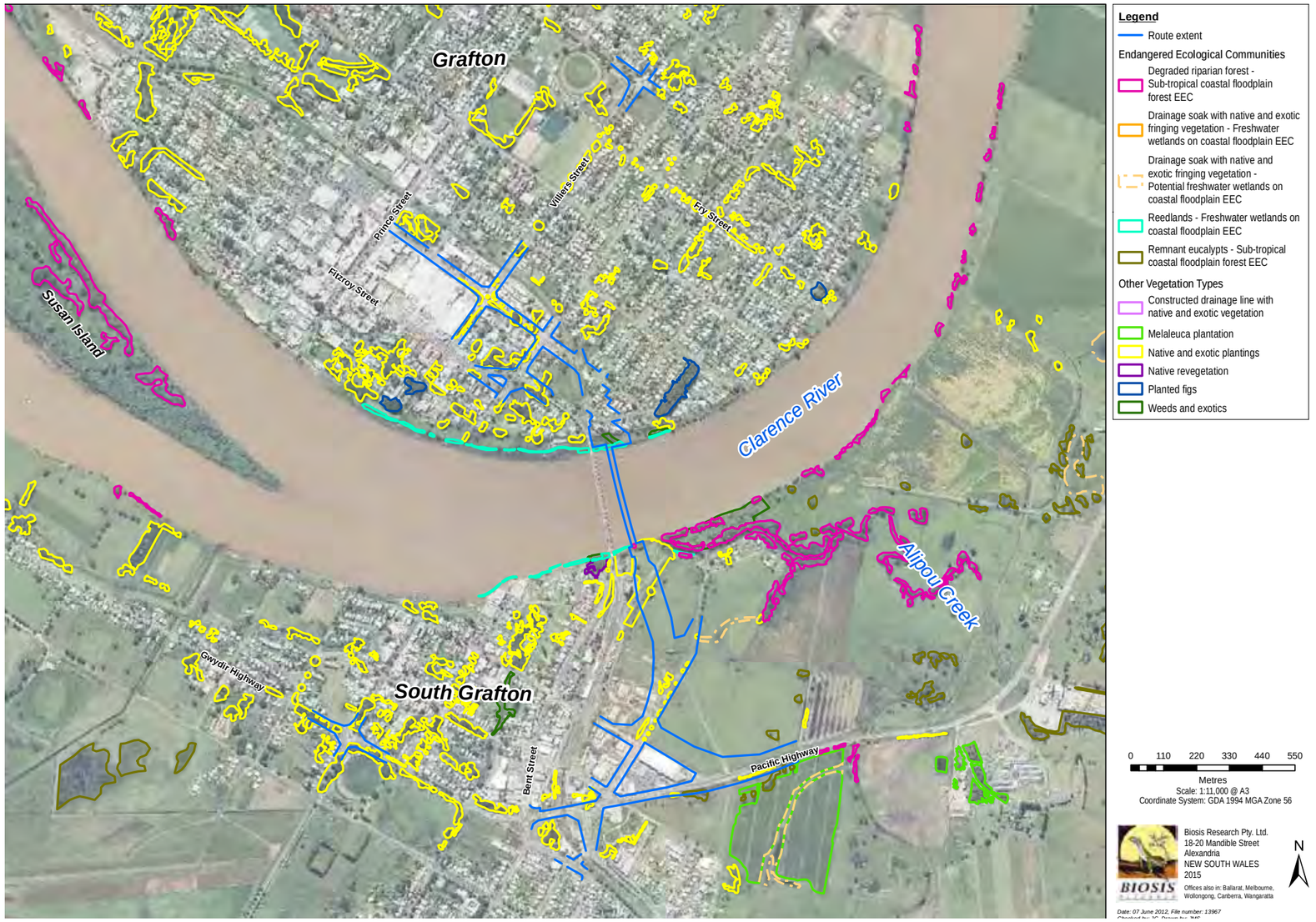


Fig. 2-38: Grafton vegetation patterns.

(Source: Biosis map figure 9: Vegetation Mapping, April 2012

This strategy was designed to complement existing, and future plans of management in managing recreation needs and impacts. It is one of many tools to assist Council in preserving the natural and cultural values of riverside parks and reserves. The strategy adopts an integrated land management approach to balance often competing values of conservation, cultural heritage protection and recreation provision.

This strategy strongly supports the Clarence River Way Masterplan through better physical access and interpretive stories about the river whilst being mindful of the need to protect and enhance riparian vegetation. It encourages a coordinated approach to planning and management activities associated with the Clarence River and its tributaries. This will be achieved primarily by upgrading reserves so that they are more clearly identifiable as public open space and installing infrastructure to protect native vegetation and support riverside recreational pursuits. Specific key issues are the vegetation management initiatives required to protect and restore riparian vegetation communities and the designation and regulation of reserves available to the public for specific recreational activities.

The core design principles proposed in this report include:

- Conservation of natural and cultural values
- Integrated planning
- Recreation based on identified needs and demand
- Consultation with the community and user groups
- Economic evaluation

It is the above principles that would be translated into the long the future design for the new open space corridors that will improve links between the river and the town.

2.3 Clarence River Way Master Plan

The Clarence River Way Master Plan (2009), outlines an objective to 'reposition Grafton as a 'river city' tourist destination' within a wider masterplan for the broader Clarence Valley region (Figure 2-39). The master plan looks to place Grafton as a tourist hub around the concept of a 'River city'.

The River Way Master Plan considers Grafton to have great potential as a hub of tourism for the region. Grafton's historic identity as a trading capitol, its central placement within the region and its high level of connectivity to the region are specified as reasons to support this. The master plan recognises Grafton's identity as the 'Jacaranda City' but alludes to the point that this is a draw for tourism for a minimal portion of the year. The river would be a year round asset that is currently underexploited. The utilisation of the Clarence river waterfront would help fashion Grafton as 'an alternate destination to the beach/port experience of Yamba'.

The master plan outlines ten priorities for repositioning

Key

1) Reorient the city to the river, including both Grafton and South Grafton.

2) Simplify decision making and create a sense of arrival, gateway statement and enhance first impressions of Grafton from the pacific highway.

3) Improve the cityscape through investment in a main street programme for the CBD, but primarily Prince Street for its waterfront linkage and Fitzroy Street for its gateway arrival first impressions.

4) Promote the development of a waterfront precinct adjacent the town centre. Focus on the redevelopment and vitalisation of the core river edge from Queen Street to under the Grafton Bridge.

5) Improve the presentation of retail and commercial areas for tourism.

6) Encourage extended trading hours for restaurants and cafes.

7) Facilitate investment in new infrastructure and improve accommodation presentation levels to meet expectations of target markets.

8) Investigate options for development of the State Rail Authority land on the rivers edge on both sides of the river as public parkland.

9) Through negotiation with private land holders investigate options to provide safe public waterfront access or easements that respects privacy and security.

10) Improve public access to the waterfront through existing public open space.

Grafton as a tourist destination:

The provision of the additional river crossing and the design adopted in the Fulton Hogan tender helps to achieve several of these listed priorities.

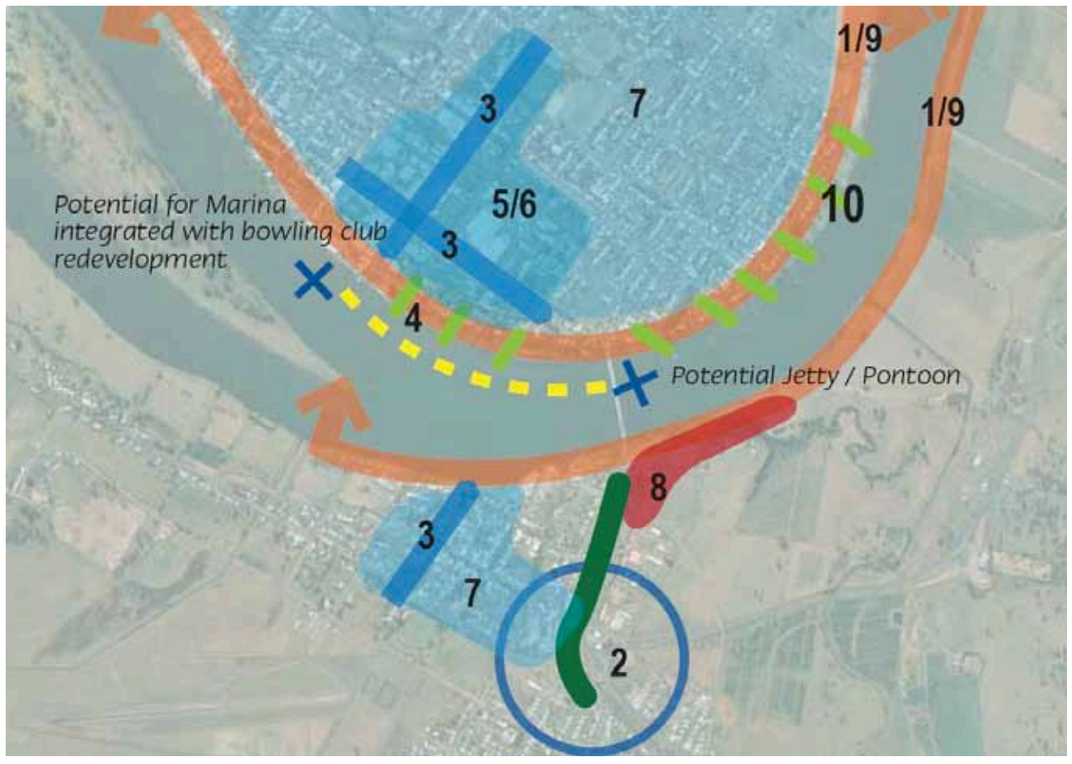


Fig. 2-39: The Clarence River Way Master Plan - Grafton Upgrade Priorities

(Source: Clarence River Way Master Plan: Clarence Valley Council)

3. Design Objectives, Key Principles and Strategy Plan

3.1 Introduction

The design approach taken in the Fulton Hogan tender is to provide a design that is highly integrated with the existing context through:

- a considered response to the existing built and natural landscape characters of Grafton and South Grafton.
- a sympathetic design response to the existing heritage listed truss bridge and the various associated infrastructure elements.
- an understanding of Council's intent for the future of Grafton (through its published documents) and ensuring that the design responses help achieve this desired future character.

The proposed road corridor traverses through distinctly different environments that influence the character of the Project and the experience of it. Five design precincts are identified within North and South Grafton. These are defined by landform, vegetation, land use, topography, built form among other physical attributed.The approach to the design of the highway and of its various natural and built elements respond to the varying character of these five Design Precincts (Figure 3-1). These are:

Precinct 1: Pound & Clarence Streets

Precinct 2: Greaves Street

Precinct 3: Bridge over Clarence River

Precinct 4: Southern Approach

Precinct 5: Iolanthe Street/ Pacific Highway

Key

- Precinct 1: Pound and Clarence Streets
- Precinct 2: Greaves Street
- Precinct 3: Bridge over Clarence River
- Precinct 4: Southern Approach
- Precinct 5: Iolanthe Street/ Pacific Highway
- Project Alignment
- Clarence River
- Local Road
- Main Road
- Highway
- North Coast Railway

Fig. 3-1: Design Precincts of the Project

3.2 Urban and Landscape Design Objectives and Key Principles

EIS Appendix J – Urban Design and Landscape Concept (2014; Spackman Mossop Michaels; page 43) outlines objectives and principles for the project. These objectives and principles address the desired future landscape and urban design character of the area as outlined in the Director General's environmental assessment requirements and Clarence Valley Council documents. The report states that a key consideration in the development of the objectives and principles have been the heritage and cultural values of the existing bridge.

The objectives as stated in this document are:

"Objective 1: To achieve a project that fits sensitively with the existing qualities and characteristics of Grafton, South Grafton and it's Clarence River setting."

Design Principles:

- Protect and integrate the river environment including foreshore areas, into the overall project design.
- Maintain important recognisable views of the river, foreshore areas and townscape, in particularly those views to and from the existing bridge
- Design the project to fit in naturally with the local topography and river setting.
- Design major project elements like earthworks, embankments, and mounding to fit into its setting and reduce its visual and physical obtrusiveness.
- Integrate natural patterns and ecology into the design of the project, protect creeks, retain physical continuity of natural systems, and use natural characteristics in the project's landscape design.
- Minimise the intrusion of project related elements on the local landscape, such as lighting, barriers, fencing and flood control elements.

"Objective 2: To maintain the integrity of the existing urban character, particularly the physical and visual experience of the streetscape and street grid."

Design Principles:

- Protect the built fabric and streetscape quality of the existing neighbourhoods by integrating the project into the existing character of Grafton and South Grafton.
- Retain the existing urban character of the neighbourhood areas, for example by minimising the removal of street trees that provide a sense of place.
- Minimise the effects of fragmentation on neighbourhoods and precinct areas.
- Minimise the effects on the general form of the existing grid and urban settlement patterns.

"Objective 3: To protect the integrity of the heritage and cultural values of the Grafton area."

Design Principles:

- Minimise the impact of the project on State and locally listed Aboriginal and non-Aboriginal sites, buildings and precincts and their contribution to the setting and character of the area.
- Respect and incorporate places and sites of Aboriginal value in the overall project design.
- Minimise impacts to heritage listed tree species and cultural plantings.
- Retain the cultural qualities and identity of Grafton through sensitive design.

"Objective 4: To protect the integrity of the existing State Heritage listed Bridge as the pre-eminent structure in its setting."

Design Principles:

- Design the proposed bridge to minimise the loss of views towards to the existing bridge.
- Create a new landmark crossing over the river at Grafton through a complementary relationship of the proposed bridge with the old bridge having regard to form, scale and function.
- Design the proposed bridge to have a contemporary form and scale that complements the existing bridge and allows it to take visual precedence:
- Design all of the proposed bridge elements as part of unified bridge architecture, minimising the bulk and massing of the bridge elements.
- Design the soffit of the proposed bridge to create a visually attractive form, particularly in areas that will be highly visible to the public.
- Design the shared path on the bridge to maximise the visual experience for pedestrians and cyclists, and consider a sequence of events such as stopping points to improve users experience.
- Design all lighting and signage on the proposed bridge to be unobtrusive against the existing bridge and in the landscape.
- Minimise over-shadowing and over-looking from the proposed bridge structure and viaducts on adjoining residential areas

"Objective 5: To achieve an integrated road design form and character that blends with the adjoining areas."

Design Principles:

- Minimise the potential visual and physical barrier effect of the approach roads by maintaining cross connections for local traffic, public transport, cyclists and pedestrians.
- Minimising the footprint and scale of the approach roads and intersections.
- Minimise the size of intersections between the approach roads and the existing local roads.
- Integrate and coordinate the approach road elements with adjoining road elements and structures.
- Minimise the height and extent of noise walls, retaining walls and embankments along the approach roads.
- Maximise the opportunities to rehabilitate the streetscapes impacted by the proposed approach roads.

"Objective 6: To contribute to the accessibility and connectivity into and through Grafton and surrounding areas."

Design Principles:

- Retain permeability of movement through areas by maintaining the continuity of the street grid and laneway systems.
- Improve connectivity around and through the project area for all modes of transport and user groups.
- Maximise safe pedestrian and bicycle crossings on streets and at intersections that are attractive, easy to use and minimise crossing distances.
- Integrate the pedestrian and cycle path of the proposed bridge as a continuous system with the Clarence Valley Council's existing and future planned network in Grafton and South Grafton.
- Improve connectivity to existing and potential future riverfront public recreation spaces.
- Provide attractive, safe and accessible undercroft areas adjacent to the abutments for potential future foreshore and local pedestrian and cycle access.

"Objective 7: To create a project that facilitates future urban development and revitalisation along and surrounding the project area."

Design Principles:

- Design the proposed bridge and associated infrastructure so that it can support future development and revitalisation of surrounding retail, commercial, industrial, recreational and educational areas.
- Work with Council to facilitate the consolidation of residual land parcels into sufficiently useable areas that can be redeveloped appropriately, consistent with surrounding land uses.
- Consider the potential for new uses of residual and underutilised areas impacted by the project.
- Provide suitable streetscape design that will facilitate new public and private related land uses.

"Objective 8: To enhance the quality and value of the public domain along and surrounding the project area."

Design Principles:

- Minimise negative physical impacts on public, open space, the river and other foreshore areas adjacent to the bridge and on the existing activities.
- Design the project to accommodate potential new uses and improvements in existing and new public domain spaces along the river foreshore.
- Design the project to ensure that the spaces under and around the bridge and viaducts are appropriately integrated into the public domain.
- Design the project to create town entry treatments that are attractive and inviting.
- Design the project to ensure good surveillance for pedestrians and cyclists on and around the bridge and its approach roads.

These objectives and design principles have been adopted in the design development of the Fulton Hogan design.

3.3 Key Reference Documents

This UDLMP has been prepared in accordance with the RMS Urban Design and visual guidelines, and the design principles and revegetation guidelines outlined in Appendix J of the EIS.

In addition, the following design guideline documents were used as guidance through the design process. :

RMS Publications

- Beyond the Pavement - RTA Urban Design Policy, Procedures and Design Principles, August 2009
- Landscape Guideline: Landscape design and Maintenance Guidelines to Improve the Quality, Safety and Cost Effectiveness of Road Corridor Planting and Seeding, April 2008
- Bridge Aesthetics, July 2012
- Noise Wall Design Guideline, February 2007
- Road Design Guide
- Designing to Minimise Vandalism (Final Draft), November 2008

Clarence Valley Council Publications

- Riverside Recreation and Riparian Vegetation Strategy , 2008
- Clarence Valley Urban Tree Management Strategy, 2015
- Clarence River Way Masterplan, River Masterplan, 2009
- Clarence Valley Community Land, Crown Reserves and other Public Places Generic Plan of Management, 2014-2023.
- POM Clarence Coast Reserves Management Strategy, 2008
- Clarence Valley Open space Strategic Plan, May 2012.
- An Open Space Plan for Grafton City, October 2003.
- Some of Grafton City's Noteworthy Trees, September, 2004, LDouglas.
- Grafton Heritage Tree Survey, J.Wrigley, 1991

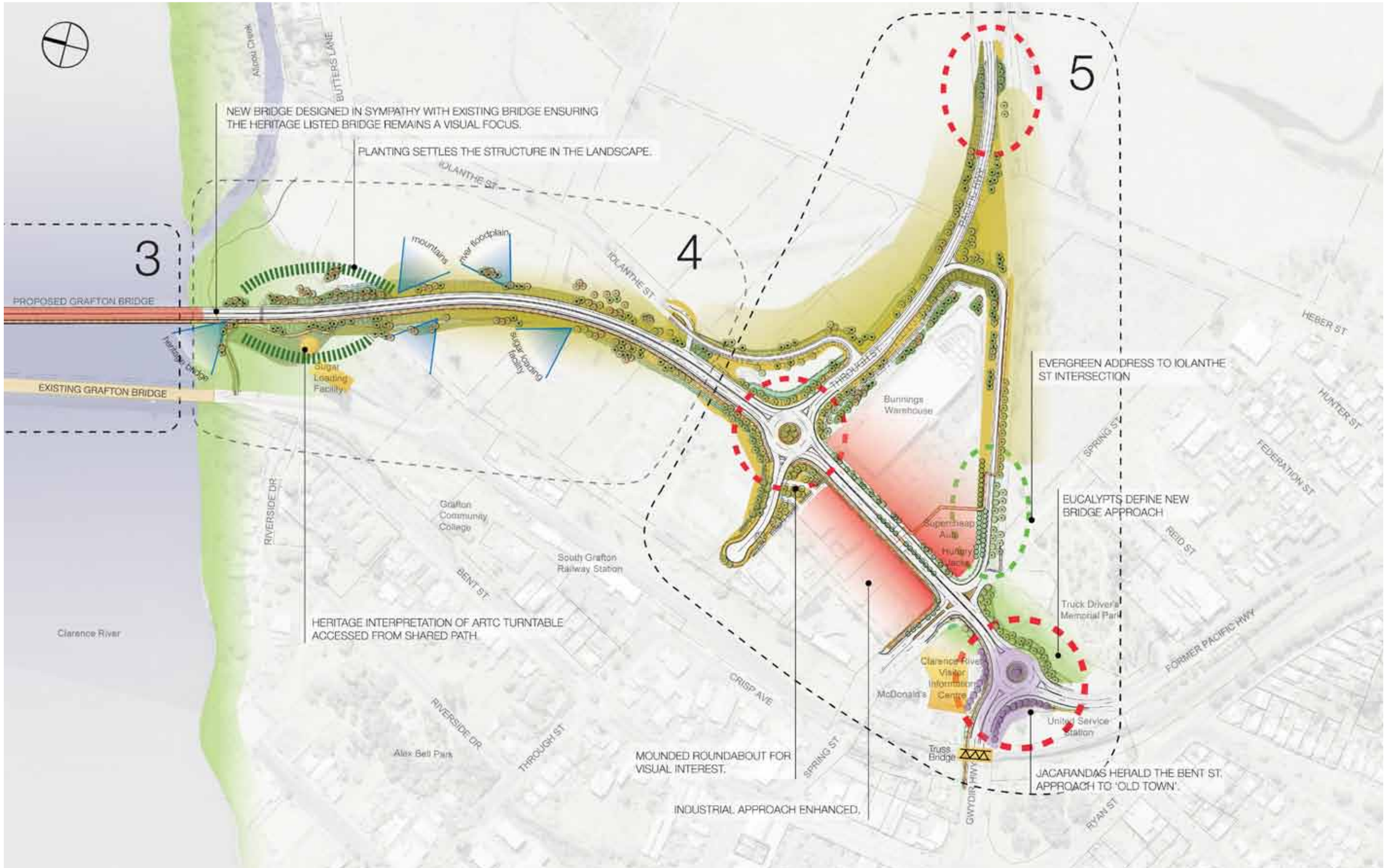
3.4 Urban Design and Landscape Strategy

This section describes the strategies adopted in the design and the reasoning for the approach taken.

Key strategies adopted in the proposal to achieve the project objectives are (See Figure 3-2):

- A sense of arrival and departure to the town is created by feature gateway plantings, that clearly distinguish between the entrance and roads leading to Bent Street/ and the old heritage bridge, (with Jacarandas) with the new approach, flavoured with indigenous tall, evergreen trees to lead to the new bridge- the new approach to town.
- The design of the new bridge over Clarence River is simple and elegant with due consideration to the heritage listed bridge as the primary visual focus.
- The noise/ privacy/ anti glare screen is designed to be unobtrusive as possible for motorists as well as local residents.
- The new truss bridge heralds the entry into Grafton/ Pound Street similar to the role played by the existing truss bridge over Gwydir Highway.
- Key visual corridors to the hinterland and existing bridge are retained with sensitive planting that creates an interplay between masses and voids in the landscape.
- Landform is integrated through careful landscape strategies with the surrounding flat floodplain.
- Reinforcing the indigenous riparian forest tree planting in the new open space corridor, that links the river to the town.
- Creating strong streetscapes to reinforce the garden city of Grafton and clarifying the importance of Jacarandas in old/ heritage areas, and new indigenous street trees in new, or rejuvenated streets.
- Integrating sustainable landscapes that display low maintenance, whole of life strategies.
- Applying water sensitive design to streetscapes, parks and open spaces to assist with flood prevention and also to improve water quality and add value for the community.
- Provide opportunity for working with the community to integrate art/heritage interpretation, and gateway accents in detail design.

Fig. 3-2: Urban Design and Landscape Strategy Plan


NEW BRIDGE DESIGNED IN SYMPATHY WITH EXISTING BRIDGE ENSURING THE HERITAGE LISTED BRIDGE REMAINS A VISUAL FOCUS.
PLANTING SETTLES THE STRUCTURE IN THE LANDSCAPE.
3
4
5
PROPOSED GRAFTON BRIDGE
EXISTING GRAFTON BRIDGE
Heritage bridge
Sugar Loading Facility
mountains
river floodplain
sugar loading facility
IOLANTHE ST
THROUGH ST
PACIFIC HWY
Burnings Warehouse
EVERGREEN ADDRESS TO IOLANTHE ST INTERSECTION
EUCALYPTS DEFINE NEW BRIDGE APPROACH
HEBER ST
HUNTER ST
SPRING ST
FEDERATION ST
REID ST
Supercheap Auto
Hungry Jacks
Truck Driver's Memorial Park
FORMER PACIFIC HWY
Clarence River Visitor Information Centre
McDonald's
United Service Station
Truss Bridge
GWYDIR HWY
RYAN ST
Allotm Creek
BUTTERS LANE
RIVERSIDE DR
Grafton Community College
South Grafton Railway Station
BENT ST
Clarence River
HERITAGE INTERPRETATION OF ARTC TURNTABLE ACCESSED FROM SHARED PATH
CRISP AVE
RIVERSIDE DR
Alex Bell Park
THROUGH ST
MOUNDED ROUNDABOUT FOR VISUAL INTEREST.
SPRING ST
INDUSTRIAL APPROACH ENHANCED.
JACARANDAS HERALD THE BENT ST. APPROACH TO 'OLD TOWN'.

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4. Design Analysis and Strategies

4.1 Introduction

This Chapter details the design analysis, detailed principles and strategies that have been adopted based on the consideration of the urban design objectives presented in the EA, the Scope of Works, other requirements as set out in the various Appendices, RMS design guideline documents and the requirements of the Three-toed Snake Tooth Skink Construction Management Plan.

The design analysis is also informed by the existing context of the proposal. It describes the design development and logic of the family of elements that that form the Concept Design (as described in the next Chapter) and includes a discussion of natural and built elements.

4.2 Bridges

The design of the bridges on the project follows the guidelines described in the Bridge Aesthetics (RMS, 2013) document.

The following key principles have been adopted in the design of the bridges:

- Grafton town and its immediate local area, both north and south, has a predominance of existing infrastructure (Figure 4-1). It is considered important that the new structures are sympathetic to the existing structures as well as the semi-rural landscape setting of the project.
- The main bridge elements have a simple design with a smooth finish and clean lines producing an elegant outcome. All bridge elements including piers, parapets, headstocks, abutments, transition panels, road traffic barriers and leading edges are fully integrated in the design.

The Project is comprised of two bridges:

- Additional Crossing of the Clarence River adjacent to the existing heritage listed bridge (this includes the bridge over Clarence Street).
- Rail Viaduct Replacement over Pound Street where the existing arched structure is being replaced by a steel truss.

Fig. 4-1: Existing infrastructure in the proposal area

Fig. 4-2: Existing infrastructure in the proposal area

4.3 Additional Crossing of the Clarence River

4.3.1 EIS Concept Design

The concept design presented in Appendix J – Urban Design and Landscape Concept Report is summarised below :

Bridge form:

- The bridge is comprised of 10 spans with 5 piers in the river and 4 piers on land.
- The additional bridge (river crossing section) has a simple and elegant parabolic form that corresponds to the form of the extensive infrastructure related to the bridge and railway viaduct (Figure 4-3). The arched form of the viaduct are highly visible elements through the town. The end spans of the bridge are Super-Ts to achieve a greater clearance at Clarence Street.
- The piers are illustrated as rectangular blades.

Relationship to existing bridge:

- The horizontal position of the additional river crossing corresponds to the existing heritage listed bridge in terms of its elevation - the height of the new bridge does not exceed the height of the existing bridge, and the soffit of the box girder is approximately in line with the soffit of the truss (Figure 4-4). It is noted that the elevation of the bridge is influenced by a variety of other factors in addition to its relationship to the existing bridge.
- The location of the piers correspond to the positioning of the piers on the existing bridge.

Transition piers:

- The design of the transition pier suggested in the Concept Design is that used at Iron Cove Bridge (Figure 4-6).

Abutments:

- The headstocks of the end spans reach the ground due to the low clearance at the abutments.

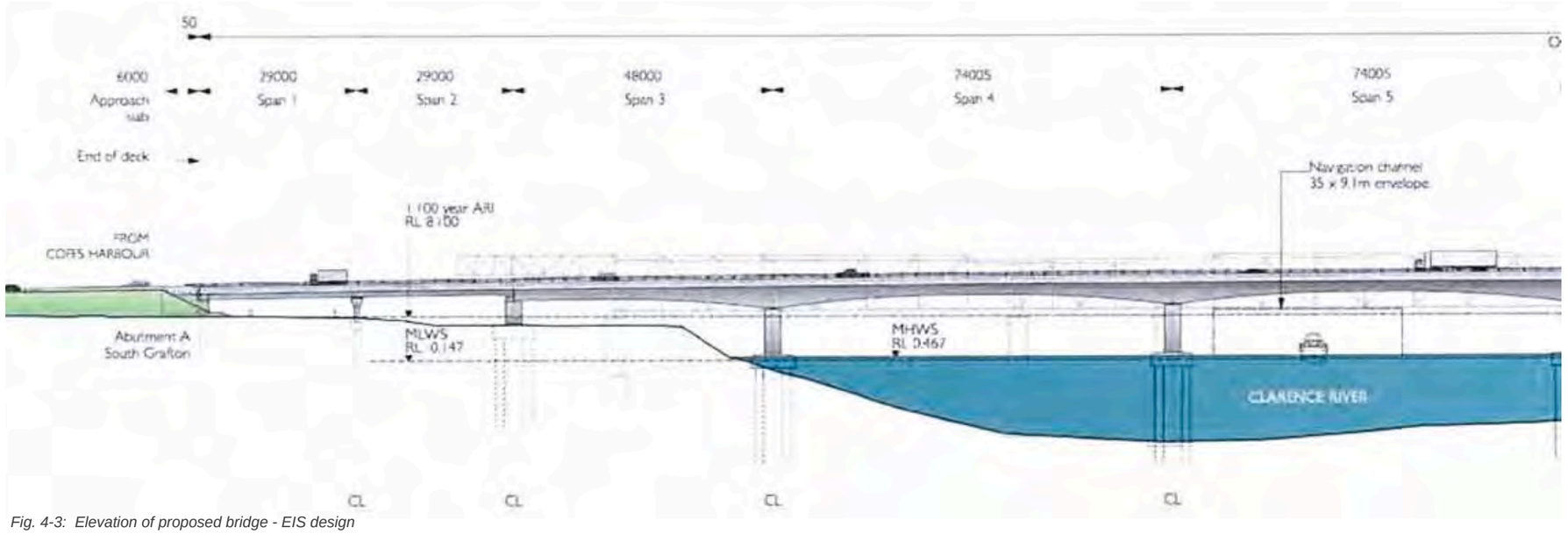


Fig. 4-3: Elevation of proposed bridge - EIS design

(Source: RMS Additional Crossing of the Clarence River at Grafton EIS: Appendix J – August 2014)

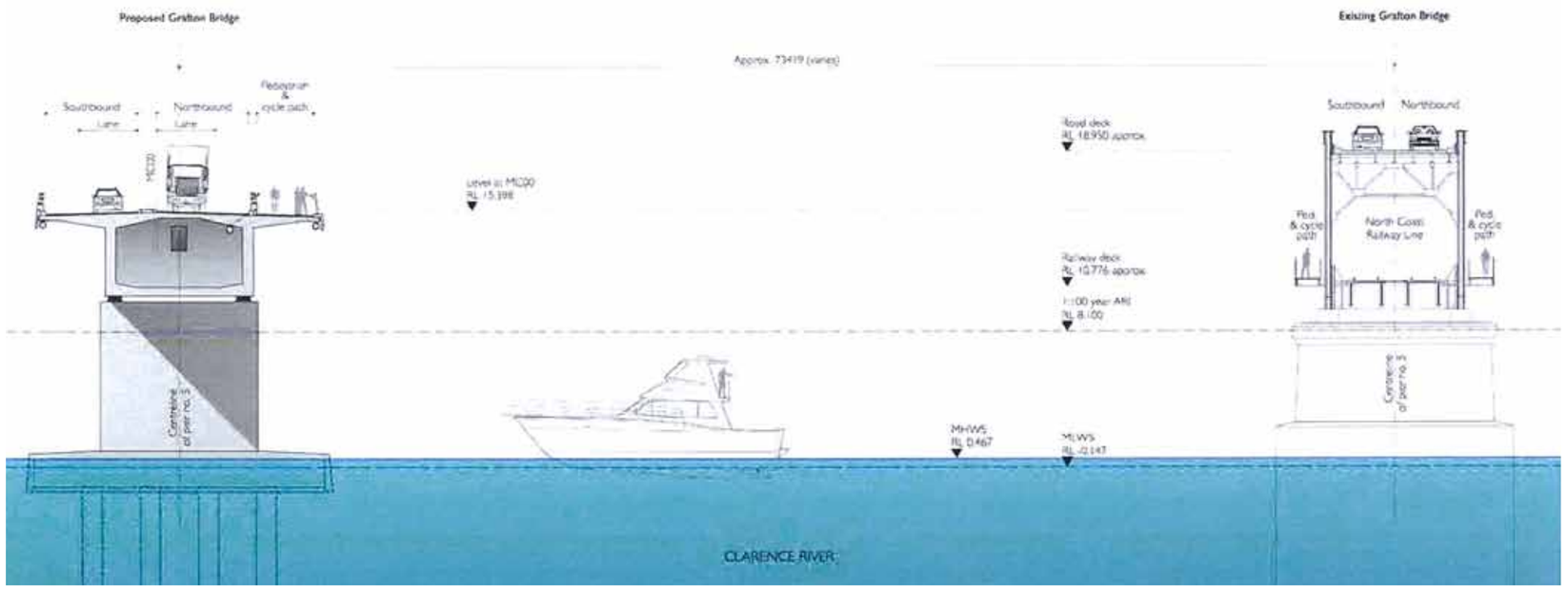
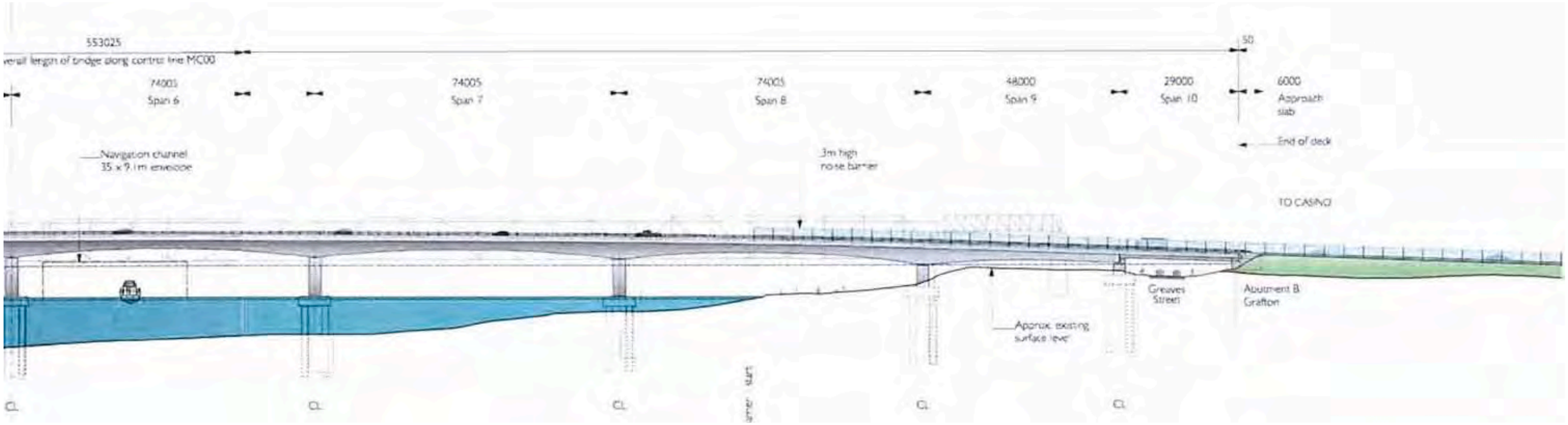


Fig. 4-4: Relationship of new bridge to existing heritage listed bridge - EIS design

(Source: RMS Additional Crossing of the Clarence River at Grafton EIS: Appendix J – August 2014)



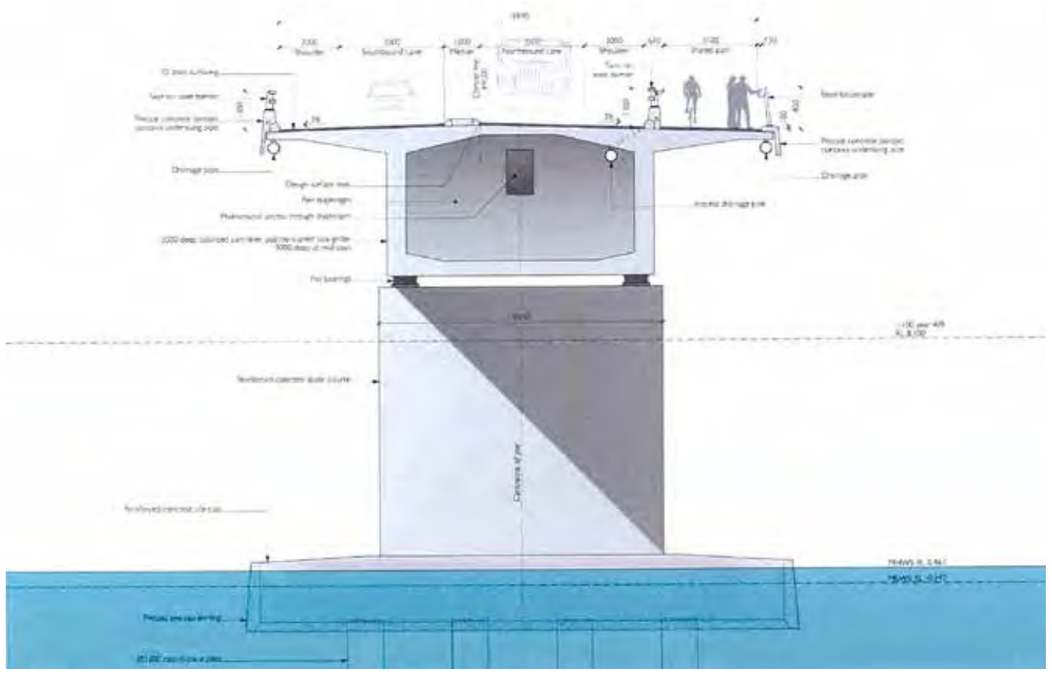


Fig. 4-5: Cross section showing pier design - EIS design

(Source: RMS Additional Crossing of the Clarence River at Grafton EIS: Appendix J – August 2014)

Fig. 4-6: Proposed example of the transition pier - EIS design

(Source: RMS Additional Crossing of the Clarence River at Grafton EIS: Appendix J – August 2014)

Bridge Form Studies

Two main options were considered - a haunched bridge profile as per the EIS Concept Design (Figures 4-7 and 4-8) and a segmented arch that achieves a profile as close as possible to the haunched (Figures 4-9 and 4-10).

Having done extensive three dimensional modelling studies of the two options, it was determined that the parabolic form provided a more elegant outcome in keeping with the project urban design objectives and design principles.

Fig. 4-7: Bridge Form Option - Parabolic

Fig. 4-8: Bridge Form Option - Parabolic

Fig. 4-9: Bridge Form Option - Segmented arch

Fig. 4-10: Bridge Form Option - Segmented arch

Pier Form Studies

Fig. 4-11: Existing bridge pier form

Fig. 4-13: Preferred bridge pier form

Fig. 4-14: Pier form option - rounded ends

Fig. 4-16: Pier form option - rectangular blade with chamfers

Fig. 4-17: Preferred bridge pier form

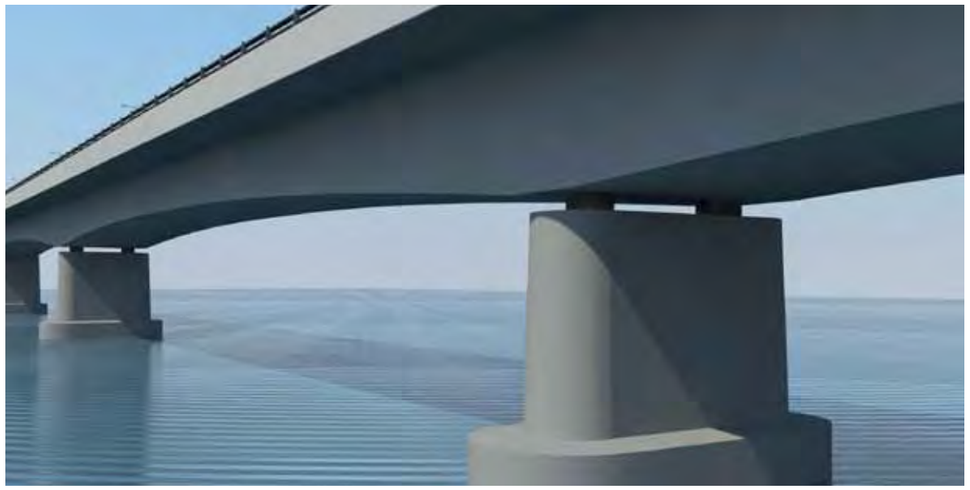


Fig. 4-12: Pier form option - rectangular blade with double chamfers (decreasing width)

Fig. 4-15: Pier form option - rectangular blade with double chamfers (increasing width)

The existing bridge piers have a distinct rounded end shape with a cornice detail at the top. The piers are also tapered at 1:24 outwards to the base on all four sides.(Figure 4-11)

The preferred pier design is a modern expression of the existing bridge pier (Fig. 4-16). Its key features are:

- A blade wall with rounded ends that complement the parabolic profile of the bridge deck.

- 1:12 taper to the end elevation only.

- A skirting provided at the base. No pile caps are required.

4.3.2 Fulton Hogan Design

The design development of the proposed design uses the Concept Design and its design intent, RMS requirements as outlined in the SWTC and subsequent advice received during the positive guidance sessions as a starting point for the design of the bridge and its various elements.

Its key features are:

Bridge form:

- The bridge is comprised of 9 spans with 5 piers in the river and 3 piers on land. One span on the southern side has been removed.

  The simple and elegant form of the parabolic bridge structure is maintained in the proposed design (river crossing section) to ensure that the design is complementary to the existing infrastructure (Figure 4-18). The end spans are maintained as Super-Ts to achieve a greater clearance at Clarence Street.

  The design of the piers have been improved responding to the rounded end and tapered form of the existing bridge piers.

Relationship to existing bridge:

- The horizontal position of the additional river crossing has been maintained below the existing heritage listed bridge and the soffit of the box girder is approximately in line with the soffit of the existing truss.

  The location of the new piers are in line with the positioning of the piers on the existing bridge as per the Concept Design.

Fig. 4-18: Bridge form in elevation - Fulton Hogan design

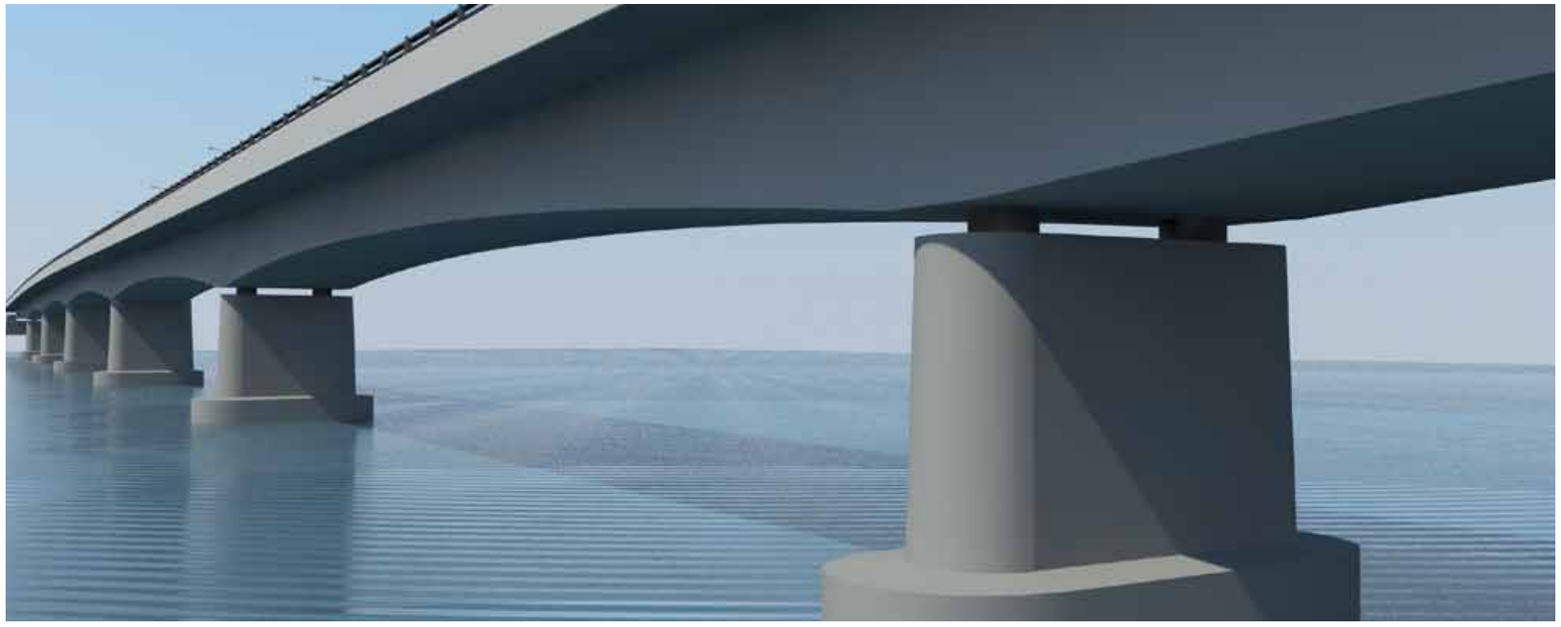


Fig. 4-19: Bridge form - Fulton Hogan design

Shadow Studies

Fig. 4-20: June 21st at 9.00am

Fig. 4-21: December 21st at 9.00am

Fig. 4-22: June 21st at 12.00 noon

Fig. 4-23: December 21st at 12.00 noon

Fig. 4-24: June 21st at 3.00 pm

Fig. 4-25: December 21st at 3.00 pm

Transition piers:

- The design of the transition pier as adopted in the tender design is a blade wall that spans the extent of the Super-T headstock, due to the lower height of the piers. This successfully accommodates the differences in height of the box girder and the Super-T girders and conceals the difference in elevation (Figure 4-26). A headstock style transition pier has not been adopted due to the higher ground levels which provides an awkward shape closer to the ground.

Fig. 4-26: Transition pier example

Abutments:

- The headstocks of the end spans reach the ground due to the low clearance at the abutments.

The following general principles are applied to the design of this bridge:

Bridge Parapets

- Twin steel rail and post system traffic barriers are used to allow through views to the surrounding landscape and to reduce the height of concrete portion of the structure in elevation (Fig. 4-28).
- Bridge parapets are precast units.
- Parapets incorporate a skirt to provide a drip edge and conceal drainage/service pipes.

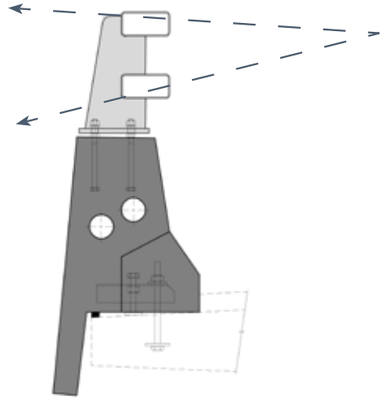


Fig. 4-27: Typical section - Bridge parapet

Abutment Finish

- All spill through bridge abutments are finished as rock pitched/ or rock armoured depending on the location. The rock would be sourced from local quarries.

Lighting on Bridges

- Road lighting on the bridge decks is provided on the western side of the bridge over and across the shared path. The light posts are fixed to an elegant concrete support fixed to the side of the bridge parapet.

4.4 Rail Viaduct Replacement over Pound Street

4.4.1 EIS Concept Design

The concept design presented in Appendix J – Urban Design and Landscape Concept Report is summarised below:

Truss form:

- The truss form proposed in the concept design is comprised of verticals at approximately 3 meters spans with diagonals in between them. There is a high density of steel members which allow for limited through views only.

End piers:

- The proposed end piers carrying the steel truss, are blade walls that sit directly in front of the existing rounded end shaped abutment walls.

4.4.2 Fulton Hogan Design

The proposed design takes the EIS Concept Design and its design intent, RMS requirements as a starting point for the design refinement of the bridge and its various elements.

Its key features are:

- **Truss form:** The truss form has been simplified by increasing the distance between the verticals to 5 meter spans and placing diagonals in one direction only for each half of the bridge. Due to the reduced number of steel members the visual mass is reduced and greater through views are achieved (Figure 4-29). The concrete elements will be coloured to achieve a close integration with the existing structures.
- **End piers:** The placement of the end piers are constrained by the existing bridge abutment pile caps underground and construction sequencing requirements to enable the bridge to be constructed within the rail possession timing allowing for continued railway operations.

The proposed end piers carrying the steel truss are rectangular columns that are located away from the existing abutments, thereby maintaining the visibility and the integrity of the existing structures. The front edge of the pier is tapered to reflect the architectural language of the abutment.

The pile caps required for the piers cannot be buried underground due to existing footings. Therefore localised earth mounding is used to conceal the pile caps.

The bridges are illustrated within their respective contexts in Chapter 5. Refer to Chapter 7 -Urban Design Schedule of Finishes, for details on finishes.

Fig. 4-29: Existing Pound Street bridge form, looking west towards town

Fig. 4-28: View of proposed Pound Street bridge looking east

4.5 Entrance Strategies

We propose a suite of town entry statements to signal the entry into South Grafton and Grafton. The sequence of town entry experiences on approach to South Grafton and Grafton are described below:

1) Appropriate advance notice road signage located at specified distances from the entry into towns.

2) Legible, strong landscape treatments at the two interchanges in South Grafton, as outlined further in the Design Concept section. Design creates clear visual cues for entering either old town/old bridge, or the new approach to the new bridge. Changing tree canopy character and reinforcing evergreen, natives for new roadways and bridge approaches, compared to the deciduous Jacaranda for the old routes.

3) Mounding of the roundabouts to create visual interest, and during detail design, work alongside Council and the community to incorporate an integrated art/heritage gateway elements, as appropriate for the South Grafton entry points.

4) Entry into Grafton is signalled by the crossing of the river with expansive views to the west and of the heritage listed bridge to the east.

5) In the evenings the lighting on the bridge and approach roads will add to the experience of entering the towns.

6) As the motorists descend the bridge the sweeping form of the alignment is accentuated by the transparent noise wall on the west side along the southbound lane and views beyond of the hinterland.

7) The new approach in to town along Pound Street commences as the motorists pass the new rail viaduct replacement over Pound Street.

8) Approaching Pound Street from the new bridge, one will experience a transition through an avenue of Jacarandas to reinforce the existing character to the east, prior to entering the transformed streetscape of Pound Street with its lush, gracious avenue of Australian Teak trees which will complement the future CBD character of the area.

4.6 Streetscape Strategies

Key actions arising from Clarence Valley's Urban Tree Management Strategy include:

- Limit same species avenues to where they are essential such as historic precincts, higher hierarchy streets
- Design road and nature strip widths to accommodate trees in scale with the proposed development applicable to Pound Street with the future CBD zoning;
- Consider permeable paving treatments and structural soils in civic areas;
- Design streetscape for adequate soil volumes;
- Minimise conflicts between services and trees.

These principles have been adopted in our design and are addressed in Chapter 5 - Urban and Landscape Design section of this report.

Fig. 4-30: Jacarandas and native evergreen trees are used to signal major interchanges

Fig. 4-31: The two truss bridges are important town entry statements in South Grafton and Grafton

4.7 Noise Barriers and Headlight Screens

There is one noise barrier on the project on the approach to the new bridge over Clarence River (on the southbound) that is required to be a total height of 3000mm. Due to its elevated position and the proximity to dwellings, this wall is required to perform the role of a noise barrier, privacy screen as well as block headlight glare onto surrounding residences.

The design of this noise barrier has taken into consideration the following:

1) Views: Due to the elevated level of the bridge approach, going up to a height of approximately 4.5 meters, motorists approaching and leaving Grafton will have expansive views out to the hinterland. It is desirable to maintain these long distance views.
2) Privacy: Several residential properties in the proximity of the bridge will be subject to reduced levels of privacy due to potential overlooking of motorists.
3) Headlight glare: Adjacent residential properties will also be subject to headlight glare and the design of the barrier would need to provide mitigation.
4) Visual impact of noise wall: Since the noise wall can be a dominant feature in the sightline of motorists on approach to, and departure from, Grafton, as well as from the general surroundings, the visual impact of the structure and its role needs to be determined, i.e. does it need to be a visual feature or should it be as unobtrusive as possible?
5) The design needs to be respectful of the semi-rural nature of Grafton and the heritage structures existing in the landscape environment. In addition, the adjacent landscaped open space; the at-times colourful Jacarandas; and the expansive views of the river and hinterland as the elevation increases all provide visual interest and diversity which would be detracted from if the noise wall were to be a feature. Therefore, the Fulton Hogan design for the noise wall takes the approach that the noise wall be as visually unobtrusive as possible, given the multiple roles required of the wall.

Key

- Affected Residential Properties to be Developed
- Affected Residential Housing
- Critical Views
- Section Lines

Fig. 4-32: Analysis of views onto private dwellings

4.7.1 View Analysis

The need to maintain long distance views; and the need to protect residences from glare and provide privacy, call for a potentially conflicting design solution i.e. transparent panels vs. opaque panels. The following section describes the analysis undertaken to determine the height and extent of the opaque and transparent panels (Fig. 4-37 and 4-40).

4.7.2 Headlight Glare Analysis

A separate glare analysis has been undertaken by Fulton Hogan and it has been confirmed that a 1300 mm high barrier is required along the entire length of the noise wall to protect residences from headlight glare.

As the height of the road increases leading up to the bridge, the impact on residences in terms of privacy reduces but a glare screen is required for the length of the wall. Therefore a translucent (but not transparent) screen is provided at the bottom of the panel (on a concrete barrier) up to a total height of 1300 mm, with the top panel being transparent to a height of 1700mm. Additional landscape screening is provided at the lower end of the wall to properties closest to the highway to ensure their privacy and protection from head light glare.

Fig. 4-33: Typical dwelling near proposed area.

Fig. 4-35: Typical dwelling near proposed area.

Fig. 4-36: Typical dwelling near proposed area.

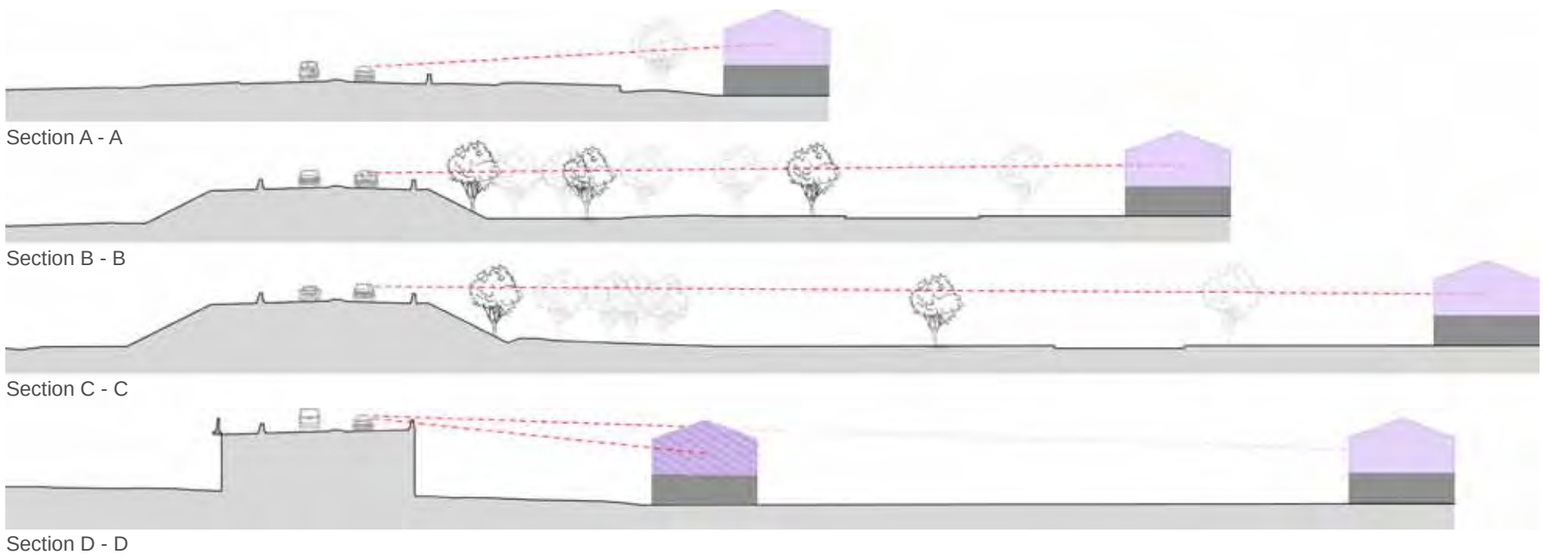


Fig. 4-34: View analysis

Note: The height of the typical dwelling used for the assessment is assumed to include a 2.5 - 3.0m generally non-habitable lower level reflecting the typical house design of the area due to the land being flood prone.

4.7.3 Materials Selection

A key design objective in the design of the noise wall was to make it as unobtrusive as possible. To achieve this objective, clear transparent panels with anti-bird strike lines have been selected for the top of wall (1700mm in height) to allow through views to the landscape.

The bottom section of the wall sits on top of a F-type concrete barrier. There are several options for this material that are opaque or translucent.

The selected material is of the same type as the top panel i.e. acrylic, but is translucent (and not transparent). The product also prevents headlight glare. A frosted-white colour has been selected to ensure low visibility of the structure. Due to its height being the same height as the bridge barrier, for part of its length, it sits behind the bridge twin rail.

Fig. 4-37: Transparent panels

Fig. 4-39: Opaque and transparent panels

Fig. 4-38: Translucent panels - colour

Fig. 4-40: Translucent panels - frosted

4.8 Feature Panel

In the area south of the pier against Greaves Street, there is minimum head room under the bridge (underside of the box girder), varying in height from 1.4 metres to 2.3 metres, over a length of 37 metres, at the interface with the levy.

It is recommended that this low void be closed off by a feature panel, to limit access into this space.

The screen is composed of perforated metal panels with different apertures. The upper section will use larger apertures and the panels be painted in a burnt red colour. The wider apertures are intended as a graffiti deterrent. The base of the screen is set back to create an overlapping effect and will use a denser panel with smaller apertures. These panels will be painted in a mid-warm grey.

Square hollow steel posts will be expressed along the lower portion and will also be painted in a mid-warm grey colour.

Inspiration for Materials

Figures 4.42 and 4.45 reflect the industrial character of the existing old Grafton Bridge. The existing character of the rusty steel, and metal guided the design resolution and colour selection.

The intent of using perforated metal is to reflect the rusty steel colour of the old bridge.

The eastern side of the screen will be provided with a large opening that interfaces with the secure land area dedicated for the generator space. This will allow maintenance access for bridge inspections.

Further context of the screen element is illustrated in Chapter 5.

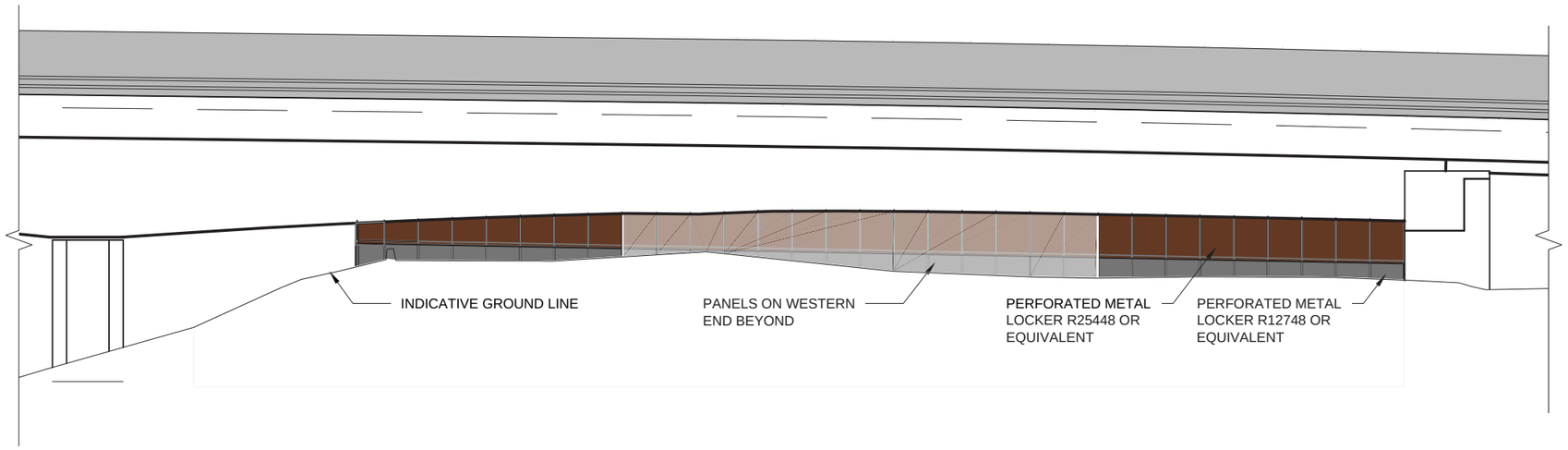


Fig. 4-41: Eastern elevation of the northern abutment. Scale 1:200

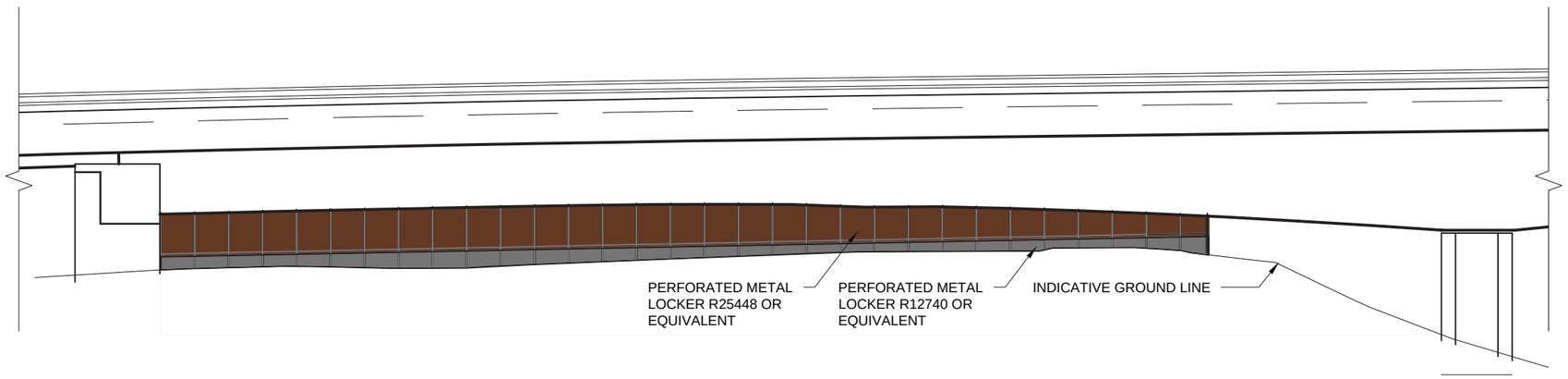


Fig. 4-42: Western elevation of the northern abutment. Scale 1:200

Fig. 4-43: View looking north from South Grafton under the existing bridge.

Fig. 4-44: View of the existing bridge and railway viaduct on North Grafton side.

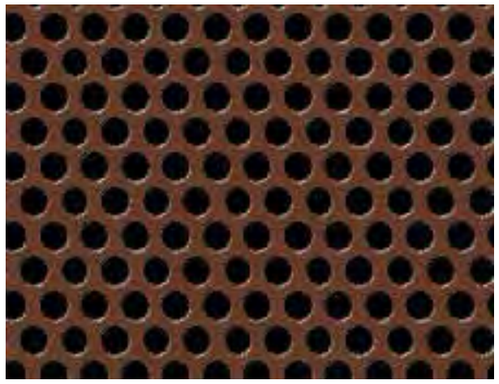


Fig. 4-45: Indicative colour sample of the upper section of the screen.

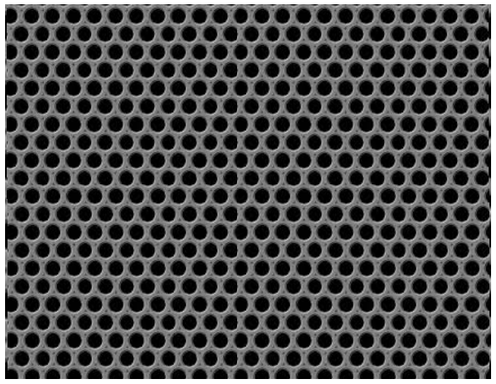


Fig. 4-46: Indicative colour sample of the lower section of the screen.

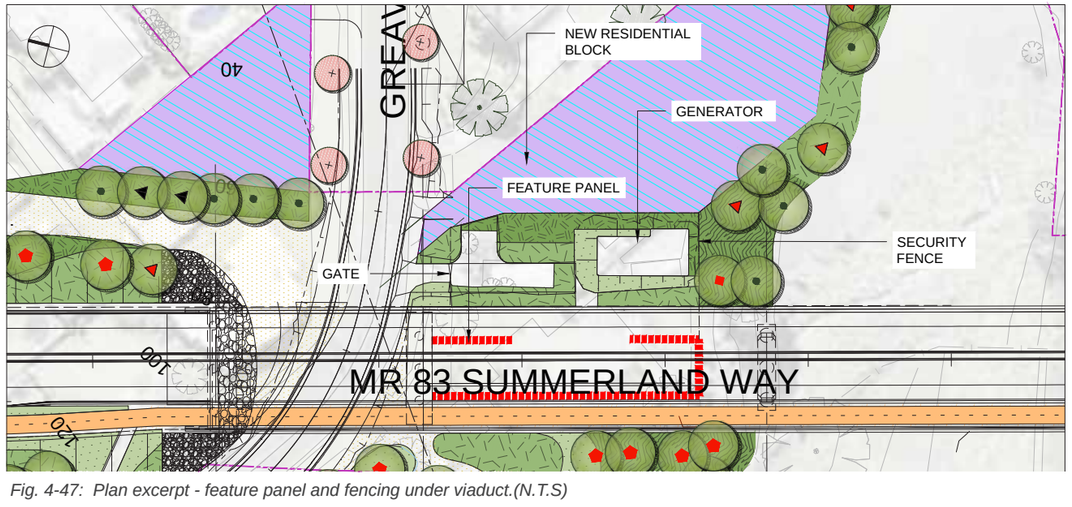


Fig. 4-47: Plan excerpt - feature panel and fencing under viaduct.(N.T.S)

Fig. 4-48: Showing landscape strategies to provide visual mitigation on the east side and also provide skink habitat plantings.

4.9 Earthworks, Landform and Slope Stabilisation

The main earthworks are the new approach to the new bridge, upon raised embankments, both sides of the river. The strategy is to minimise the visual impact of such earthworks within the flat, floodplain setting. Earthshaping varies from 4:1 to 2: 1 batters, and landscape strategies have been applied to integrate the batters into the surrounding landscape.

Slope stabilisation measures are not proposed, as the steepest batters are 2:1, with the majority of the batters being grassed. Refer to section 6-1 for more detailed information on treatment of batters.

4.10 Pedestrian and Cyclist Provisions

Pedestrian and/ or cyclist facilities will be provided as follows:

- A shared path is provided along the extent of the project.
- The new shared path connects with the existing NSW Coastline Cycleway on both the southern and northern sides.

The design of the new shared path has considered Crime Prevention Through Environmental Design (CPTED) principles and guidelines, as far as possible. The shared path along Iolanthe Street in South Grafton is particularly isolated due to the lack of active land uses in the area. Therefore the cycleway is retained at the same elevation as the road to maintain passive surveillance from the road. It is envisaged that in the future this area will be developed.

On north Grafton side of the river, the existing footpaths are continued to extend to the town, and also to proposed heritage interpretation deck.

There are many paths already under the viaduct and the spaces are enlivened with high quality art/graffiti on the piers. These spaces, according to the local community apparently are not considered unsafe.

The EIS shared path design ran up and down the embankment on the northern side of the river, and this has now been improved.

The revised scheme as illustrated in this report includes an at grade shared path running parallel to the existing railway viaduct in the Greaves Street precinct. A set of stairs down the embankment has been included to provide access from the shared path on the bridge/ embankment to Greaves Street.

This improved scheme will improve visual surveillance of the area.

4.11 Lighting

Lighting is provided as required by the brief on the entire extent of the proposal. The design of lighting ensures that light spillage into residential properties and other sensitive areas is minimised. The management of light on the bridge entering Grafton is important in both establishing legibility of the town from the highway and minimising impacts on the adjoining community. The lighting design package is GB-LT-01. Refer to Figure 5-49 and Figure 5-50 that illustrate the main lighting on the bridge.

4.12 Signage

Signage plays an important role in the functioning of the highway, providing early warning for exits to town centres and connections to the local road network. Signage will be rationalised and considered in a holistic manner in relation to views, structures and landscape. Signs will generally be not located freestanding above the horizon line and planting would be used as a means of providing a backdrop to signage where possible. Refer to GB-RF- Signage, Linemarking and Road Furniture package for further details.

4.13 Water Sensitive Design Opportunities

Given Grafton's flooding history, and in line with their Urban Tree Management Strategy that promotes application of water sensitive design, there are initiatives presented in the design that integrate swales, rain gardens and infiltration areas into the project to demonstrate the project's commitment to environmental and sustainable outcomes. These initiatives are demonstrated across each section of the project, as illustrated in "Chapter 5 - Urban Design Concept Plan" and "Chapter 6 - Landscape Design and Implementation".

Fig. 4-49: Rain gardens with slotted kerb, at Leppington Station, constructed 2015 (design by KI Studio)

4.14 Fencing

Three fence types are proposed along the project:

- 1.2 metre high stockproof fence located on the southern side of the project along Through Street, Summerland Way and Pacific Highway.\
- 1.8 metre high security fence located along the southern bridge approach and at the new car park in Pound Street.
- 1.8 metre high timber paling fence for the new private property boundaries facing the open space, between Greaves Street and Pound Street; and to define the future possible redevelopment block along Pound Street.

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5. Urban and Landscape Concept Design

5.1 The Fulton Hogan Design

The integrated urban and landscape design is presented within this Chapter. The narrative is presented based on the five identified Design Precincts. These are:

- Precinct 1: Pound & Clarence Streets
- Precinct 2: Greaves Street
- Precinct 3: Bridge over Clarence River
- Precinct 4: Southern Approach
- Precinct 5: Iolanthe Street/ Pacific Highway

5.2 Precinct 1 - Pound & Clarence Streets

5.2.1 Pound Street

Major changes to Pound Street will occur with the new project, with the street becoming the key entry into Grafton CBD. To describe the design proposal we have divide Pound Street into two sections:

- Pound Street- Villiers to Clarence
- Pound Street- Clarence to the viaduct

Major streetscape transformation will occur with the widening of the road, requiring removal of the large, mature and dominating Fig trees, that formed a strong green buffer to views, east and west along Pound Street, framing the old viaduct from the view looking west.

Whilst the fig trees created a strong presence, and provide much needed shade, they have been a maintenance issue for Council, given their sheer size and proportions.

Pound Street between Villiers Street and Clarence Street:

Design responses to the existing situation

- Replace a strong, tree lined streetscape

Fig. 5-1: Mature fig trees(prior to removal) in Pound Street,

Fig trees, with massive trunks created dense shade and great presence. The fig trees presented strong green, high backdrop to views along Pound Street, in both directions. With the heritage viaduct to the south, it will be important to replicate an evergreen street scale to provide a visual background to views looking east and west.

Fig. 5-2: Fig trees, Pound Street

The Fig trees (prior to removal) framed views along Pound Street. The design needs to address this with careful selection of a new street tree.

- Create strong intersections

There is a strong accent and formal entrance at the Pound Street/Villiers Street intersection, with predominantly exotic character, with Umbrella palms, a mixture of low scale deciduous trees, and formal box hedging framing the paths.

Fig. 5-3: Accent roundabout

Colourful, low pink flowering ground cover in the roundabout, contrasts with the bright green foliage of the formal hedging on the verges.

Fig. 5-4: Box Hedging, Villiers Street

Formal low box hedging, with palms within the spaces creates formal entrance to Pound Street.

It is not intended to continue this formal intersection character of exotic plants to the southern inter section on Clarence Street, but rather to apply a structured indigenous planting design using native plants, mainly as rain gardens.

- Pound Street as future CBD

As the street will undergo major transformation, the large scale, huge Ficus and Camphor trees will be removed, leaving an open street, with low scale commercial mixed development on the northern verge, and the TAFE property along the southern verge, with a few older double storey houses (two heritage listed) , all part of the CBD zoning. Commercial places with wide concrete driveways and predominance of vehicles, on north verge, and The North Coast TAFE campus occupying most of southern verge.

- Commercial character of north verge

The existing commercial properties front the existing footpath to the west, whilst to the east, a few smaller scale houses are developed into commercial premises.

Fig. 5-5: Wide concrete driveways

Wide concrete driveways, high wire fencing, and predominance of vehicles, on the northern verge.

The design responds to the existing situation by providing a consistent, 1800mm wide path against the boundary, which also maximises soft landscape to the kerb.

Fig. 5-6: Paving to property boundary

Note the presence of paving to the property boundary, under the eaves. (Photo taken prior to Fig tree removals.)

Fig. 5-7: Existing boundary shrubs

Existing shrubs along the boundary, and cottage with picket fencing beyond the driveway.

- South verge- respect the heritage qualities of the streetscape.

A more open landscape character predominates along the southern verge, with the open space of the North Coast TAFE campus occupying most of southern verge, and heritage property framing the street view to the east, and another high quality two storey residence framing the intersection with Villiers Street.

Fig. 5-8: Dunvegan street front (prior to Fig tree removals)

Looking east in front of Dunvegan, with the picket fence and turf strip.

Fig. 5-9: View of Dunvegan (prior to Fig Tree removals)

View looking directly across the street from Dunvegan, the heritage listed property, -a pleasantly proportioned dwelling with strong presence in the street.

There is opportunity for the existing grassed swales to change into rain gardens, with tighter proportions, that also irrigate the street trees.

The design responds to the above conditions and moves the path away from sensitive heritage frontages or existing tree locations.

Fig. 5-10: Villiers Street intersection

This older two storey residence frames the intersection with Villiers Street, and the hedging creates a soft, green edge to the streetscape. There is also a mature Liquidamber close to the boundary, which will require attention during construction to ensure no root damage occurs.

Fig. 5-11: Southern verge hedging

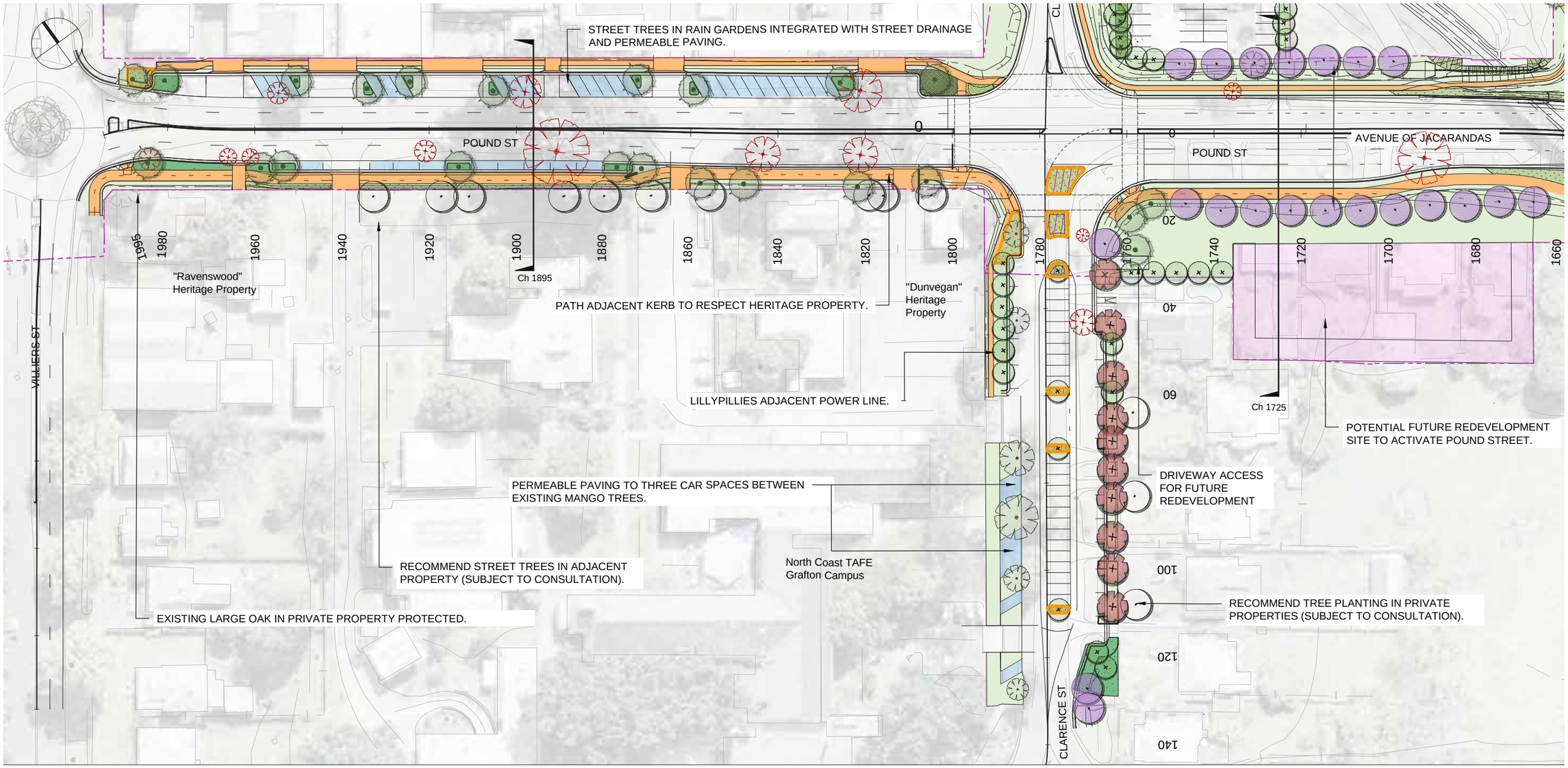
Hedging defines the streetscape on the south verge, adjacent Villiers Street. Intersection.

Landscape Design Concept

The Fulton Hogan design respects the need for a strong streetscape, and reflects a rejuvenated tree lined street that will enhance the existing situation, provide shade for street users, and also integrate water sensitive design as a key feature.

Key design elements of the scheme include:

- Planting of evergreen trees- Australian Teak, *Flindersia australis* to replace the Fig trees.This species has already been trialled by Clarence Valley Council and is being proposed as a street tree for new plantings.
- Accents of frangible, lighter trees where space is limited.
- Where possible, incorporation of rain gardens, connected with underground pipes, to slow down the rainwater, clean it and infiltrate it into the ground, as well as irrigating the adjacent new tree plantings. Water sensitive design integrated with the streetscape and pavement design. Combination of car wheel stops and angled slotted kerb will allow water to enter the rain garden/infiltration areas.
- Services aligned under the shared path or other paved areas, to free up permeable soil landscape space for street trees.
- Low textured plantings of native tussock and grasses to add textural interest and to complement the water sensitive design requirements.
- Retention of turf strips beside boundaries only where applicable- for example in front of the heritage double storey building – “Dunvegan”- TAFE building (circa 1905-1927); on the northern verge, beside the low timber picket fence, and beside “Ravenswood” on the west corner of the street, where any disturbance to the adjacent large tree roots of the tree within private property should be avoided.
- Introduction of a wider path on the north verge, to meet existing conditions where pavement continues to the property boundary, and overhangs exist.



LEGEND

EXISTING ELEMENTS

- TREES PROTECTED & RETAINED
- TREES REMOVED
- PROPERTY BOUNDARY
- FENCE

PLANTING & SEEDING

- TURF
- NATIVE GRASSES
- LOW NATIVE SHRUBS
- RAIN GARDENS
- FEATURE PLANTING AREAS

SPOT PLANTING

- *EVERGREEN* (35L)
- *EVERGREEN* (5L)
- *JACARANDA* (35L)
- *STENOCARPUS* (35L)
- *FRANGIBLE SMALL TREE*

INCIDENTAL WORKS

PAVEMENTS

- GREY OXIDE, BRUSHED CONCRETE SHARED PATH
- GREY OXIDE, BRUSHED CONCRETE FOOTPATH
- PERMEABLE PAVING

WALLS & EDGING

- TRANSPARENT / TRANSLUCENT NOISE WALL
- TYPE F BARRIER

OTHER

- PROPERTY ACQUISITION

Fig. 5-12: Urban and Landscape Design Plan (Sheet 1) - Pound and Clarence Streets Design Precinct (Scale: 1:2000)

- Jacarandas to accent the ends of the street and to transition back into Villiers and Clarence streets, and to “mark” the viaduct.

During detail design, assessment of the adequacy of the proposed the tree pit areas will be undertaken to ensure they are large enough for longevity of the trees.

Future Redevelopment

One large parcel of land has been allocated for potential future redevelopment (See Figure 5-12). The potential future use should be determined in consultation with Council given the changing character and land use zoning of the area.

Fig. 5-13: Cross section at Pound Street - Ch 1895 (Scale 1:250)

Pound Street - from Clarence to the Viaduct:

Design responses to the existing situation

- Reinforce existing Jacarandas

Street tree plantings of Jacarandas, with some voids, and some younger trees. The Jacarandas were planted along this street many years ago, and disturbances to the regular spacing are evident.

Fig. 5-14: Pound Street looking east

Views from Pound Street looking east clearly identify the Jacarandas with the old viaduct and Pound street east, and the strong high evergreen backdrop formed by the Fig trees along Briemba Street. (photo taken prior to their removal)

Low density housing, some of which on both verges will be removed with the new works.

Above ground power lines on the north side of the road limit street tree plantings.

Landscape Design Concept

Key design elements include:

- Strong avenue of Jacarandas, from Clarence Street to the viaduct to mark the heritage nature of East Pound Street, and to reinforce Pound street as "*Jacaranda Avenue*"
- Tree planting to the claimed open space, east of Clarence Street on the southern verge
- Integration with the pedestrian desire lines from Pound Street east under the viaduct- to link with the footpath on the north verge, and shared path on the south verge to link to the new Pound street approach to the bridge.
- Links to the new open space with the new shared path along the southern verge to improve pedestrian/ cycle connectivity.

5.2.2 Clarence Street

Design responses to the existing situation

Clarence Street is being widened, requiring tree removal and major changes to this local streetscape. The design proposal attempt to ameliorate the changes as far as possible by maximising tree retention and ensuring a lush planting scheme in the remaining spaces.

Fig. 5-15: Low scale street

Gardens of low scale, with palms, small scaled trees, mainly in private properties, along the eastern edge. Low scale picket fences dominate, with turfed grass swales within streetscape, and random, informal car parking. Street verge services and spatial limits.

Fig. 5-16: Retention of Mango trees`

The key element of this street is the group of three mature Mango trees within the west verge. These are retained with the design, with three car parks allowed between the main trees. Permeable paving is proposed between the trees to limit interference to root zones.

Existing Streetscape

A local street with low scale residential on the east, and the North Coast TAFE campus on the west.

Fig. 5-17: Above ground power limits street trees

Small scale trees exist within the TAFE campus that will provide some visual relief to the proposed car parking additions. As the above ground power lines limit any additional tall tree planting along this verge, a frangible small scaled tree- *Szygium leuhmannii,* Lillypilly is proposed.

Fig. 5-18: Visual cue to Jacarandas marking old route to town

Looking south along Clarence Street the Jacarandas along Summerland Way, mark the existing route to town, across the old bridge. The design reinforces Jacarandas at the intersection where space permits.

Landscape Design Concept

Key design elements include:

- Retention of the three mature Mango trees to the south west verge, with allowance for 3 cars parked between them, with 1500mm clearance.
- Introduction of frangible tree planting (*Szygium luehmanni* dominant) to the side and rear perimeter of the new car park area , amidst small shrubs and a blanket of native tussocks and groundcovers .
- Reinforcement of the existing tree species- *Stenocarpus sinatus* on the east verge.
- Permeable paving to the car park spaces between both new street trees and raingardens along Pound Street. Due to excavation required for this, this approach is not intended to areas around existing trees in Clarence Street. The advantages of this approach are improved water quality, and slowing down of stormwater during storm events; minimising impacts to existing trees especially the Mango trees in Clarence street; maximising irrigation to new and existing tree roots, thereby maximising successful growth of trees; and visually articulating the difference between pavements for parked cars and moving cars, thereby adding richness to the streetscape design and increasing legibility and CPTED.

Fig. 5-20: Permeable Paving will be used in areas adjacent existing trees, such as against the Mango trees in Clarence Street

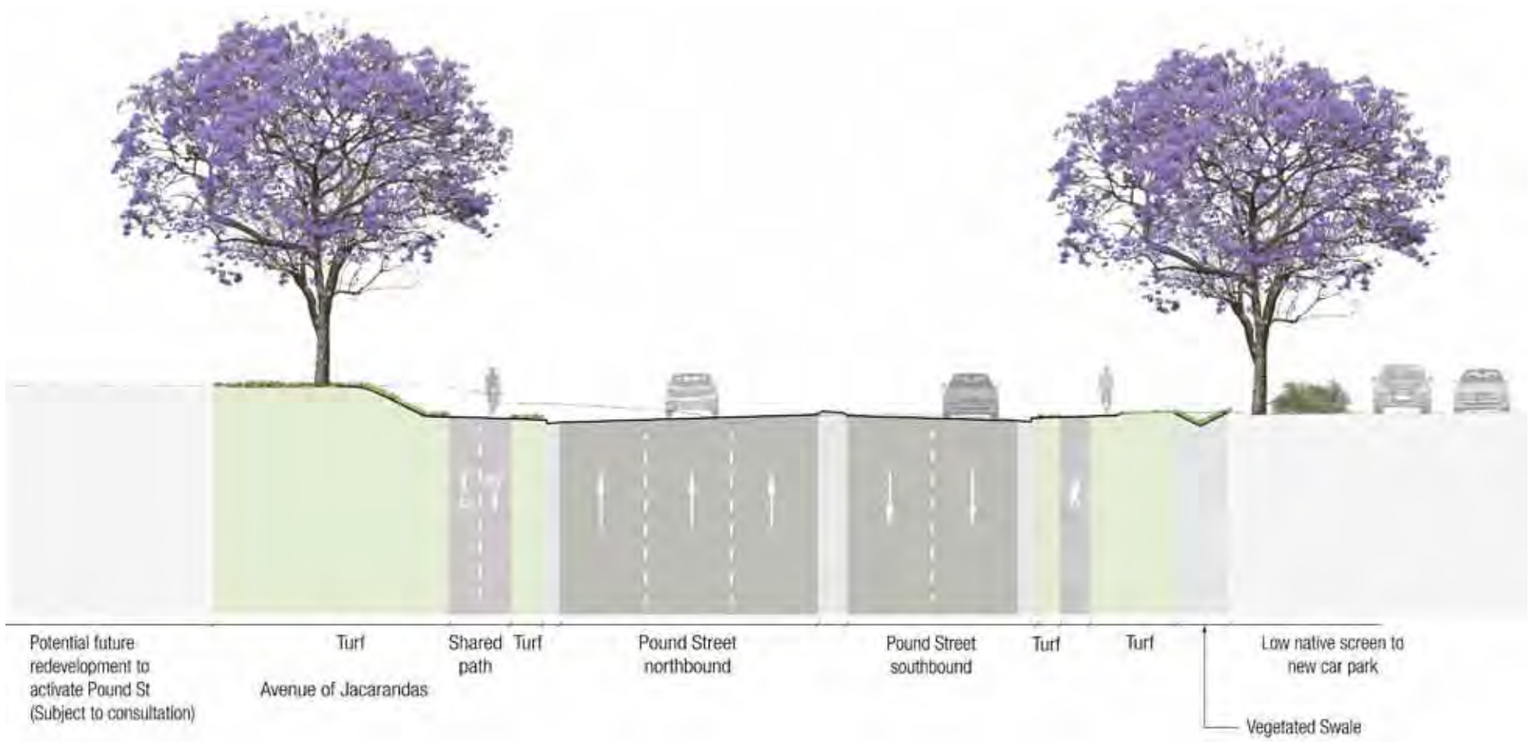


Fig. 5-19: Cross section at Pound Street - Ch 1725 (Scale 1:250)

5.3 Precinct 2 - Greaves Street

With the new embankment and bridge entry to Grafton occupying the central part of this precinct, there will be major changes to the spatial quality and existing streetscapes of this area. Key changes include the removal of Kent Street south and a central section of Pound Street , removal of houses, lowering of Greaves Street and the introduction of high earth embankments and a bridge form into the space between the river and Pound Street.

The opportunities to create an improved open space system are expressed in the design, which maximises open space areas and provides an improved, clear, legible open space network to connect the river to this section of North Grafton.

In addition the landscape plan will enhance the skink habitat requirements.

Design responses to the existing situation

Fig. 5-21: Maximise spatial flow of open space beyond the project boundary

The open space east of the North Coast Railway line, owned by NCRL provides added value to the project. There is a strong open space flow to this boundary, marked by plantings of Acacias and other indigenous species.

The community currently utilise this strip as access to Pound Street- pedestrians and cyclists.

The design recognises this potential, and maximises the openness of the park space.

The design option addresses improved opportunities within this zone.

Fig. 5-22: Reinforce visual cues of Jacarandas

Looking south along Clarence Street the Jacarandas along Summerland Way, mark the existing route to town, across the old bridge. The design reinforces Jacarandas at the intersection where space permits.

Fig. 5-23: Respect the residential street amenity

Greaves Street is a low scale residential street, with open character, devoid of street trees, yet with prominent views to the existing railway viaduct. Grassed swales occur on both sides of the street, and car parking occurs on street verges.

Impacts to these residents will be mitigated with the proposed design which promotes additional screen plantings and an improved open space system.

Fig. 5-24: Improve connectivity, maximise permeability

There are many existing paths and cycle ways that will be integrated with the project. They include pathways under the railway viaduct, paths in open space leading to the old bridge, and paths leading along the levee to the riverside open space network.

Fig. 5-25: Provide low scale trees where above ground power limits street trees

Small scale trees exist within the TAFE campus that will provide some visual relief to the proposed car parking additions. As the above ground power lines limit any additional tall tree planting along this verge, a frangible small scaled tree- *Szygium leuhmannii,* Lillypilly is proposed.

Fig. 5-26: Articulate and reinforce the heritage association of Jacarandas with the viaducts/old town/old bridge

There is a clear relationship between Jacarandas and the older part of Grafton, the viaducts, the old bridge, Summerland Way entrance etc. This zone needs to reflect this association and keep views open in and around the existing viaducts.

Fig. 5-27: Public Art

Note the public art of high value occurring on the railway viaduct pylons.

Fig. 5-28: Adjacent Open Space

Looking through to the adjacent open space from under the North Coast Railway Bridge to the existing trees within the proposed open space/park corridor (south of Greaves Street.) Care will be taken to maximise tree retention to ensure there is existing structure to the open space.

Fig. 5-29: Existing footpaths

Existing footpath leading to the old bridge will be retained. The design connects with these paths and extends them into the newly created parkland.

Fig. 5-30: Existing Connection

Existing connection between footpath on Greaves Street side of the North Coast Railway, and the existing heritage bridge path extension, under the viaduct.

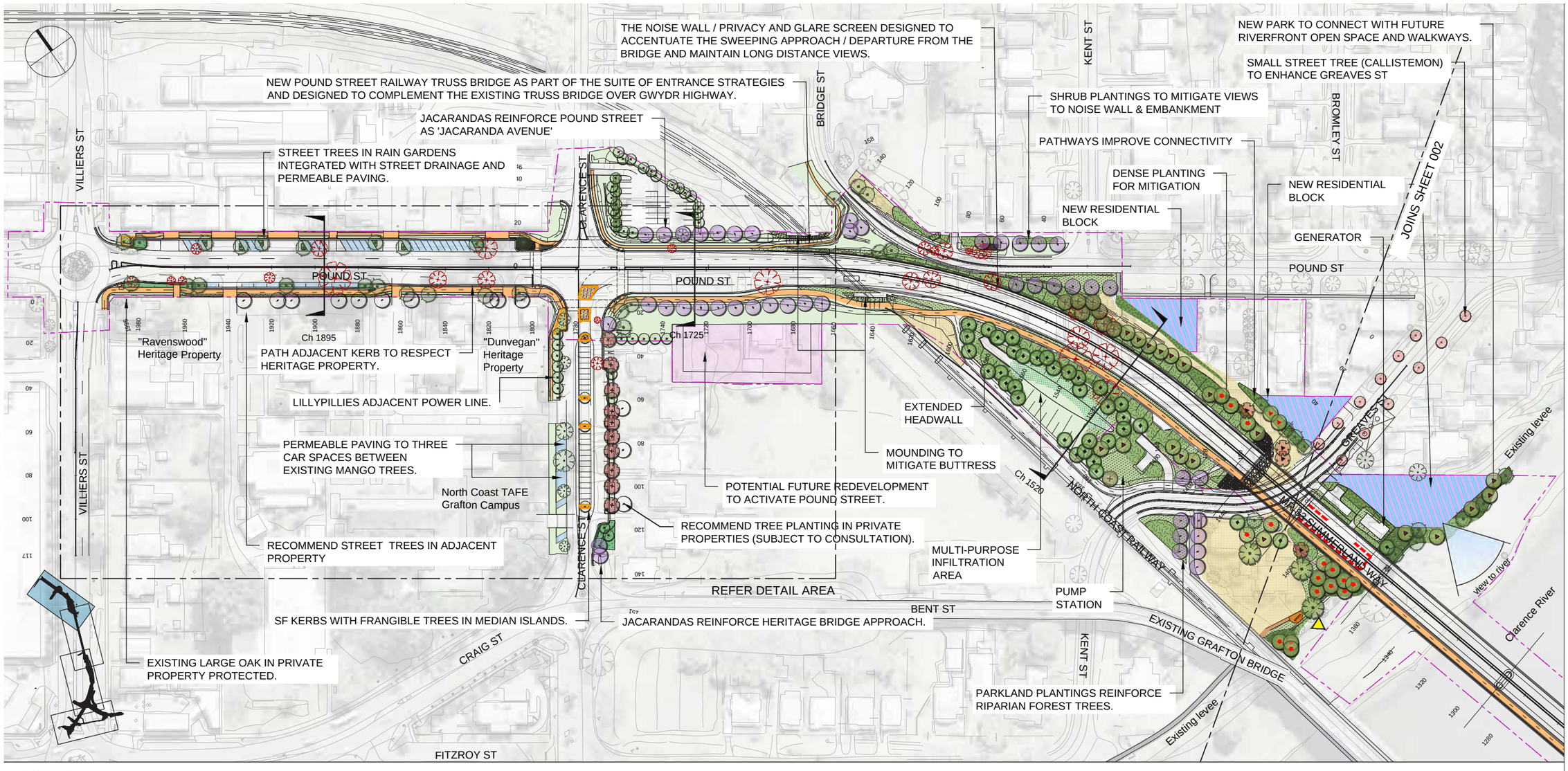
Fig. 5-31: Existing fig tree (prior to removal)

The existing fig trees and camphor tree along Pound Street will be removed due to the proposed roadworks. New plantings of evergreen, indigenous trees will be planted to mitigate the loss of greening to this section of Pound Street.

Landscape Design Concept

Key design elements include:

- Creating a fluid, generous open space corridor to link the Clarence River to North Grafton.
- Reinforcing the original vegetation patterns of this area- Subtropical Coastal Floodplain Forest- as per Clarence Valley Council Biodiversity and Open Space Strategy policy documents.
- Satisfying the requirements as per the CoA for the new plantings to provide skink habitat, and to maximise connectivity of the habitat.
- Providing the core tree planting, for consultation with Council during detail design- to maintain a predominantly open landscape character of trees in grassland.
- Maximisation of open vistas through the viaduct and views along Pound Street, given the proposed new earth shaping. The spaces need to be kept open, and not cluttered.
- Reinforcement of street trees of Jacarandas to fill existing voids to strengthen the streetscape, where above ground power lines permit.
- Maximising retention of existing Jacarandas as they provide markers in the landscape.
- Planting of low and high shrubs in areas for mitigating the new earth forms, high embankments and noise walls.
- Incorporation of water sensitive design elements such as vegetated swales, infiltration areas and skink habitat/ low native grasses edge to the large infiltration area.
- Improvement of the previous EIS design for the infiltration/detention area which included a fenced perimeter. The improved design removes this requirement by having shallower grades and a larger area.
- “Providing the core tree planting species to reflect Grafton’s key traditional street and park tree plantings – i.e. Fig trees, and Jacarandas, as feature copses within the parkland to add variety and richness.
- Enhance safety and improve visual surveillance As there is a perceived issue of loitering around the viaducts, we have addressed this issue by keeping the landscape space open wherever applicable. The design options (1A and 1B) improve visual surveillance by introducing a shared path through the area to enliven the space.



LEGEND

EXISTING ELEMENTS
- TREES PROTECTED & RETAINED
- TREES REMOVED
- PROPERTY BOUNDARY
- FENCE
- FOOTPATH

PLANTING & SEEDING
- TURF
- HYDROSEEDING/ HYDROMULCHING - DRYLAND GRASS
- HYDROSEEDING/ HYDROMULCHING - PASTURE GRASS
- NATIVE GRASSES
- INFILTRATION / NATIVE PLANTINGS
- HIGH NATIVE SHRUBS
- LOW NATIVE SHRUBS
- MIXED CANOPY
- FEATURE PLANTING AREAS
- RIPARIAN PLANTING

SPOT PLANTING
- *EVERGREEN (35L)*
- *EVERGREEN (5L)*
- *JACARANDA (35L)*
- *ILLAWARRA FLAME TREE*
- *FIG TREE*
- *FRANGIBLE SMALL TREE*

WATER SENSITIVE DESIGN
- SWALE
- RAIN GARDEN
- INFILTRATION
- SPILL CONTAINMENT BASIN
- VEGETATED SWALE

INCIDENTAL WORKS
PAVEMENTS
- GREY OXIDE, BRUSHED CONCRETE SHARED PATH
- GREY OXIDE, BRUSHED CONCRETE FOOTPATH
- INTERPRETATION SIGNAGE OPPORTUNITY

WALLS & EDGING
- CONCRETE RETAINING WALL
- TRANSPARENT / TRANSLUCENT NOISE WALL
- TYPE F BARRIER
- THRIE BEAM BARRIER
- WIRE ROPE BARRIER
- PEDESTRIAN FENCE

OTHER
- PROPERTY ACQUISITION

Fig. 5-32: Urban and Landscape Design Plan (Sheet 2) - Greaves Street Design Precinct (Scale: 1:2000)

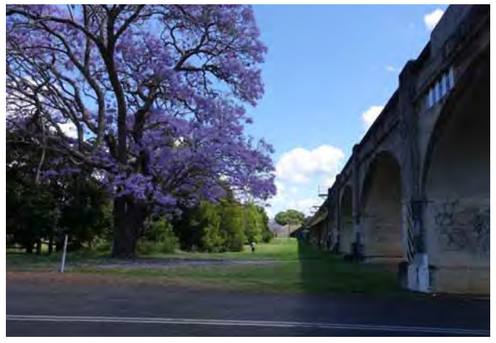


Fig. 5-34: Open Space between Greaves and Pound Street

This generous open space is used as the main track from Greaves Street west to Pound Street.

Fig. 5-35: View South along Kent Street

Looking south along existing Kent Street which will be proposed parkland with the project. It is important that the feeling of open parkland is maintained, especially around the viaducts, where the Jacaranda's presence is strong.

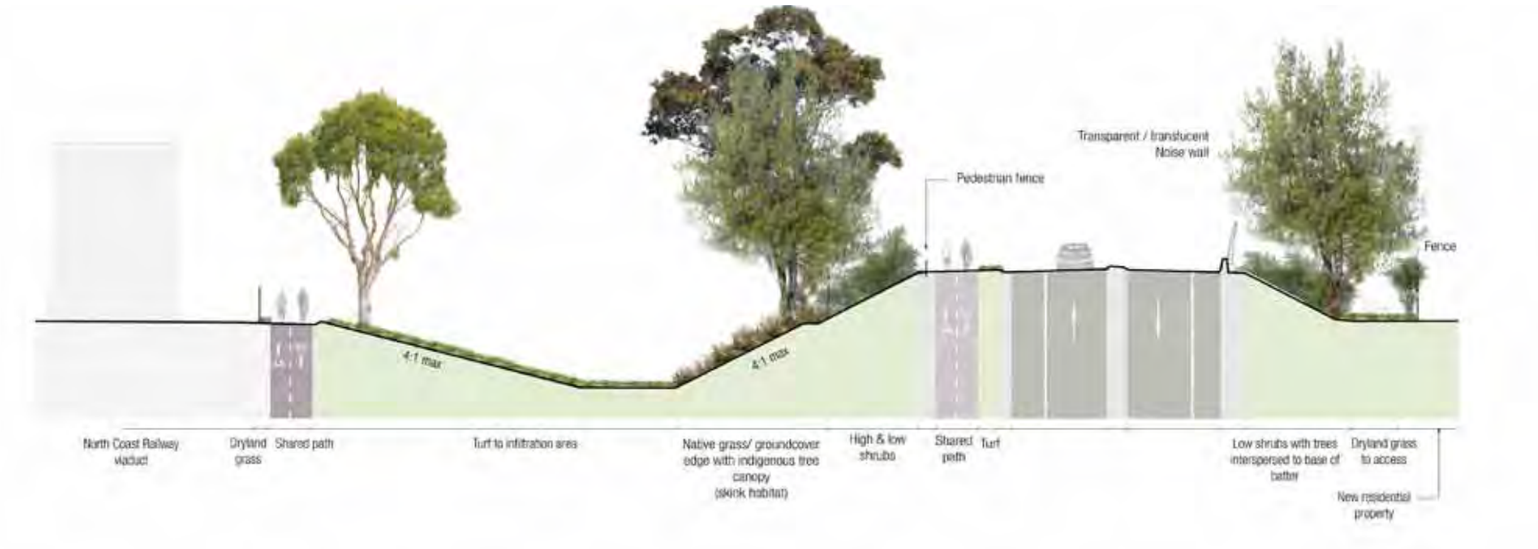


Fig. 5-33: Section through detention area at chainage 1520 indicating integration of grassing and planting to infiltration area, as well as dense screening to the eastern corridor

Improved Greaves Street Precinct Plan

A meeting was held in Grafton on 21st July, 2016 with Greg Nash, RMS, Brendon Johnson, (FH) and Judy van Gelderen (KI Studio), followed by another meeting in the day with representatives from Clarence River Valley Council- David Lawrence and David Sutton to discuss opportunities for the Greaves Street precinct. The following design changes were discussed and agreed upon in principle:

Key design elements:

1. Deleting the SUP that went up and down the bank; and substituting with a path running on level ground from Greaves St to meet Pound Street, inside the RMS property boundary.

(following discussion regarding the difficulty in gaining permission from the NSW State Rail for the path to be put into their property- which would likely cause time delays to the project)

2. Develop the concept of introducing additional housing blocks, to recreate the Greaves Street housing precinct, and make a safer street, rather than having such a large area of open space. (as shown in the EIS/ reference design.)

3. Create a dense planted edge (east of bridge between narrowed space between bridge and building blocks) to contain the bridge and also provide TTSTS habitat with the goal to provide interpretation for it(funds permitting).

4. Remove previous path connections shown to connect into the river open space system at a high level, running from the new bridge to the east along the river bank, as that is causing problems with existing residents, and it may be 20 years before that pathway/ circulation is actually realised.

5. Relocation of the stormwater generator from the open space between the two bridges, to the area east of the new bridge, accessed off Greaves Street.

6. Thinning of tall planting proposed along the river bank to allow views through from residential areas.

Fig. 5-36: Previous EIS Urban and Landscape Design Plan (Spackman Michaels Mossop) - Greaves Street area

Since that meeting, we have further developed the scheme as shown in Fgure 5-37.

Key elements include:

- Introduction of **three new residential blocks** to create safer streets- for Greaves Street and Pound Street;
- New SUP (shared user path) running north/south within the boundary, west of the infiltration area and parallel to the Railway Viaduct;
- **New set of stairs** running from the shared path on the bridge/embankment to link down to Greaves Street;
- **Revised, extended, infiltration area,** with gentler side slopes as shown in the section, now unfenced, and better integrated with the adjoining landscape;
- **Improved culvert design adjacent** the area in close proximity to the SUP;
- **Relocation of the pump station** to the south and east, enabling better integration with the landscape, set back from the batter, and planted around to the south;
- **Revised access to the pump station,** location to minimise pavement and to safely cross the SUP;
- **Relocated generator** from the open space west of the bridge to the eastern section as shown, to maximise use of the otherwise “left over” space. The generator structure fence aligns with the southern end of the infill and a security fence will enclose the area to the north and south, leaving a void for maintenance access under the bridge, with gates provided where shown;
- **Perforated metal/ infill panelling** to the low headroom areas under the bridge (as illustrated in section 4.8); and
- **Relocated water pipes from the pump station to the river** to maximise landscape treatment, and new residential blocks.

Generator Space

To the east of the bridge, the relocated generator will accommodate the space, and be fenced with security fencing, north and south to meet the adjacent building block paling fencing.

The void in between the infill panels will be left open for maintenance access under the bridge.

Setbacks from Water Pipes

Minimum setbacks from the water pipes have been achieved:

- 7.5M from piers
- 5m, or 3m where shown from pipes to property boundary.

There currently is a pinch point at the first new block to the east of the pier where the pipe offset would be set back 3 metres.

Fig. 5-37: Revised Greaves Street Precinct plan showing additional housing blocks, infill to under bridge and relocation of pump station and generator to improve overall outcome.

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Skink Management Plan

Figure 5-38 illustrates a Skink Habitat strategy plan that responds to the Skink Management Plan. The areas correspond to the revised landscape design that incorporates more areas of mulched planting beds, and ensures more continuity across the various sites. Most of the areas are on level ground, or at the base of batters where more moist habitats could develop.

The infiltration area provides an ideal opportunity to develop habitat for the skink, and the planting design has been amended to suit this habitat requirement.

Key elements include:

- indigenous low shrubs and native grasses, species are illustrated in Chapter 6 or the report
- above canopy of shade trees- species as illustrated in Chapter 6 or the report; and
- mulch thickness of 75mm depth.

In relation to the areas of existing skink habitat vegetation, care will be taken during construction to ensure minimal impacts to these zones.

Fig. 5-38: Skink Habitat Plan

Bridge over Pound Street- Railway Viaduct Replacement

The precinct commences with the new bridge over Pound Street – the Rail Viaduct Replacement. The existing arched structure is being demolished and replaced with a steel truss bridge similar in design to the exiting truss bridge over the Gwydir Highway.

Thie new bridge will be a visual marker as one enters Pound Street and will be part of the suite of gateway experiences.

The existing bridge abutment structures are to remain in place (Figure 5-39), with the new structure being supported by rectangular piers in front of the existing abutment (Figure 5-39). This will ensure that views through to the existing bridge are maintained.

Fig. 5-39: Elevation - Railway Viaduct Replacement at Pound Street (Scale 1:200)

Fig. 5-40: View of existing Pound Street viaduct

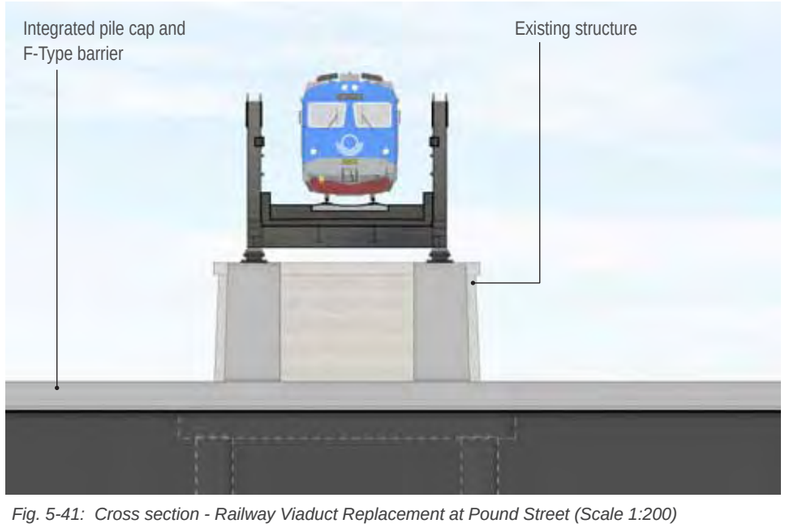


Fig. 5-41: Cross section - Railway Viaduct Replacement at Pound Street (Scale 1:200)

Fig. 5-42: View of the Railway Viaduct Replacement at Pound Street looking east

Noise Wall

The proposed noise wall commences at chainage 1680 near Pound Street and continues to chainage 1340 on the bridge. The noise wall is fixed to an 820 mm high F-type barrier and transitions to the bridge barrier on the bridge.

View, privacy and headlight glare analysis have been undertaken to assess the level of impact on adjacent existing residences from the new section of road linking the additional river crossing to Pound Street (See Chapter 4 – Design Analysis and Strategies). As this wall is required to address privacy and headlight glare as well as noise, transparent panels are used on the top 1700 mm allowing long distance views to the landscape, with translucent panels used at the bottom 480 mm ensuring that views to nearby dwellings are blocked.

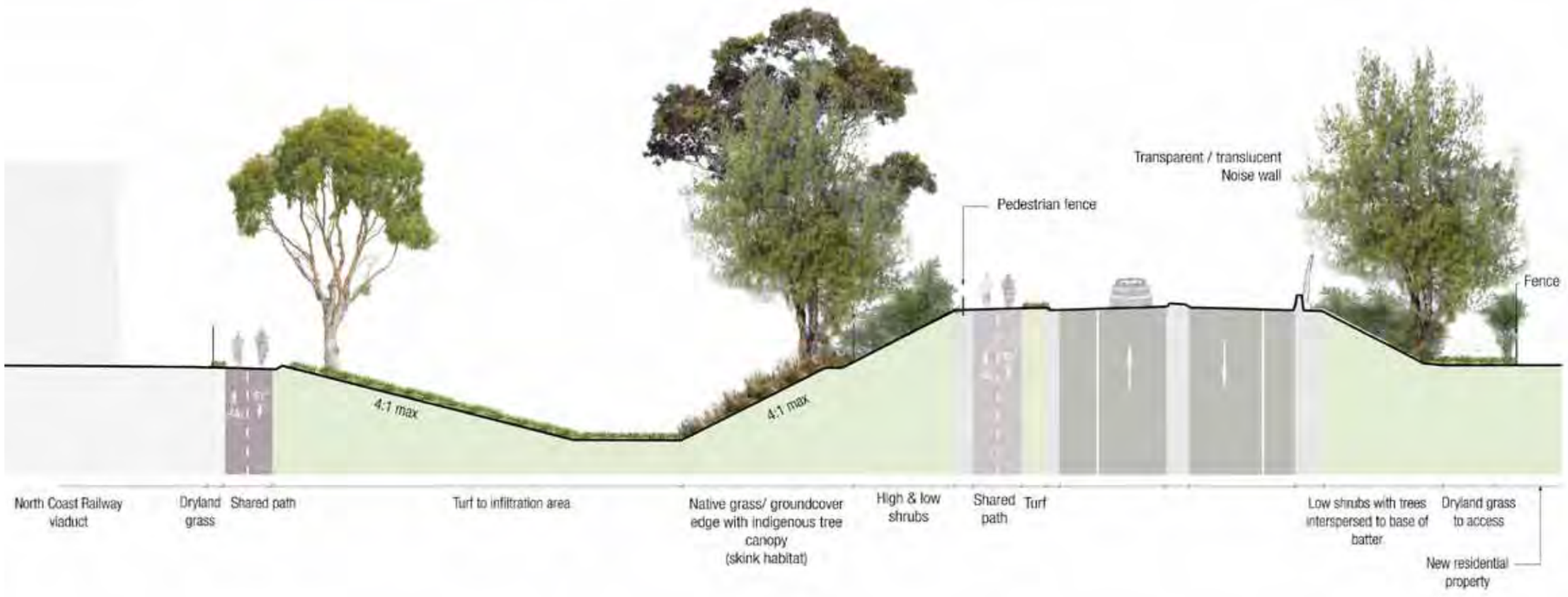


Fig. 5-44: Cross section at Greaves Street Ch 1520 (Scale 1:250)

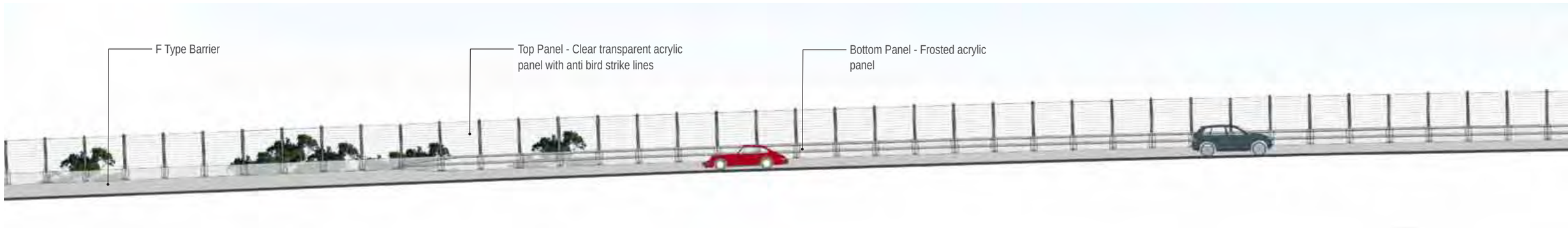


Fig. 5-43: Noise Wall - Elevation (Scale 1:200)

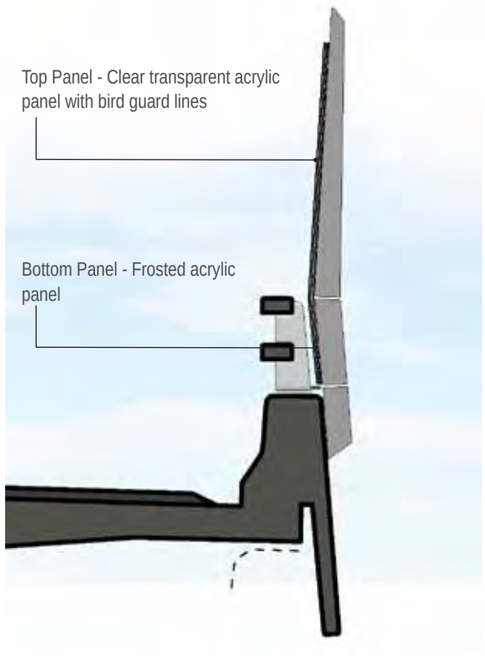
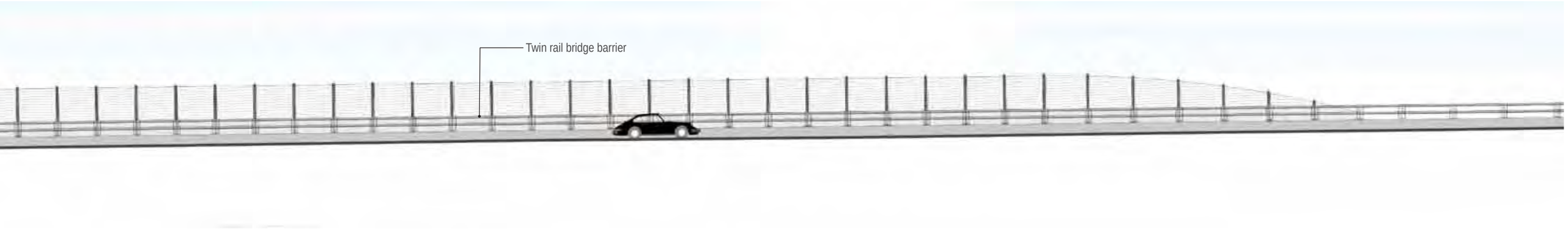


Fig. 5-45: Noise Wall - Cross section (Scale 1:10)



5.4 Precinct 3 - The Bridge

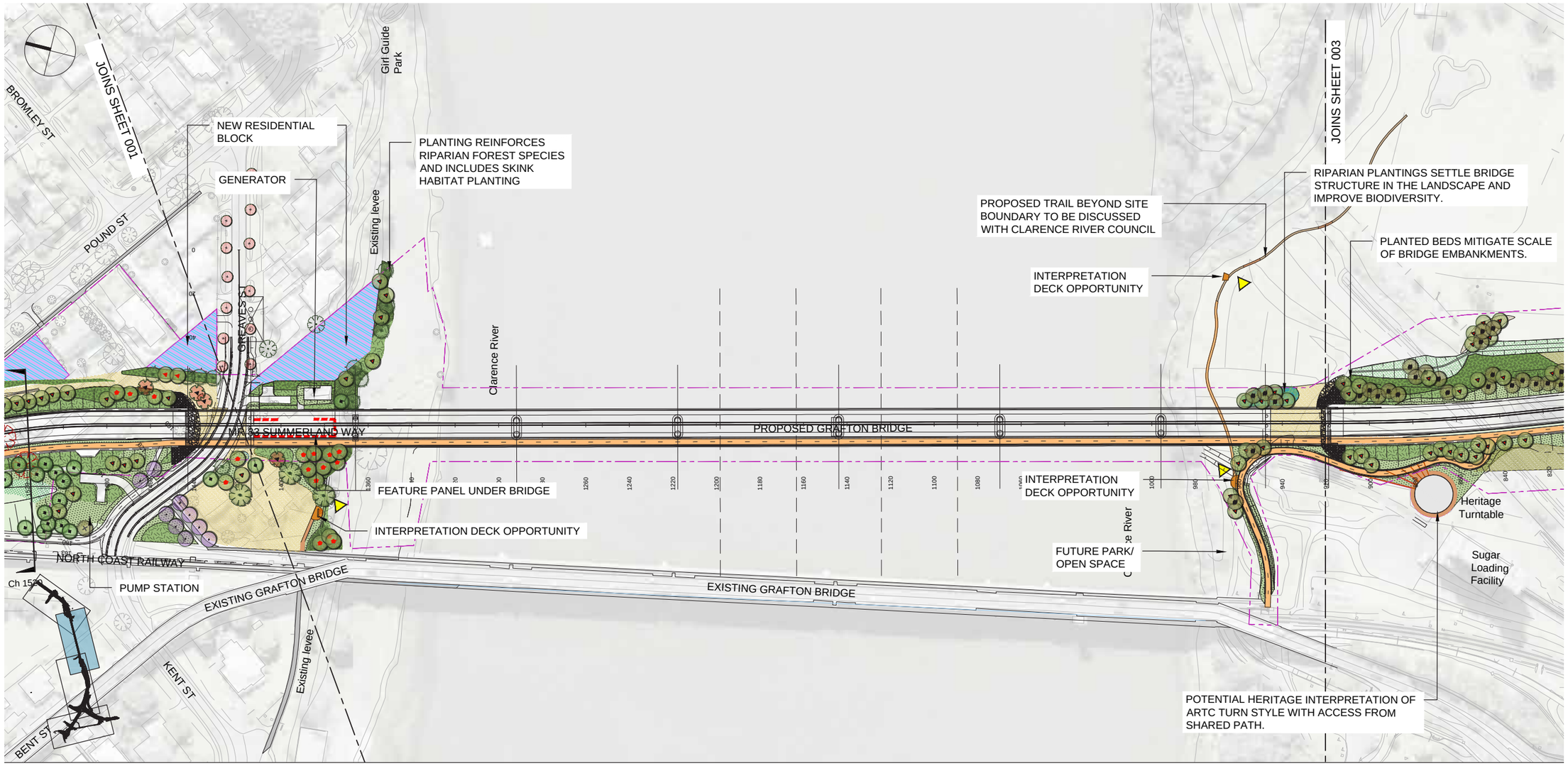
The additional bridge over Clarence River at Grafton is designed to achieve a simple and elegant form to ensure that the existing heritage listed bridge remains a primary visual focus. It is located approximately 70 meters downstream to the east of the existing truss bridge. Both the new and the existing bridges have a straight horizontal alignment. The northern and southern approaches to the additional bridge take on a gentle curve as they tie-in to the existing fabric of the towns, dramatising the experience of approaching and departing the bridge. In Grafton this is further accentuated by the noise wall on the north eastern side of the bridge.

Views to the existing bridge from the approaches on the additional bridge have been preserved through the careful siting of trees. The view of the driver is framed by closely spaced clusters of trees on the embankments at the start of the northern and southern approaches contrasting with the expansive views to the river, existing bridge and the hinterland as they approach the bridge.

Landscape Design Concept

- Planting design to settle the bridge into the floodplain setting on South Grafton side, by providing low dense shrubs to the embankment, with dense trees within.
- Planting clusters to frame the views to the old bridge and the river, from both sides of the Clarence River.
- Planting to reinforce the Subtropical coastal floodplain species (EEC) on the river bank areas.
- Planting of Jacarandas to reinforce the cultural landscape/presence of the existing Grafton Bridge.
- Integrating the Heritage Interpretation strategy (refer Chapter 8)

Fig. 5-46: View looking east from the existing bridge



LEGEND

EXISTING ELEMENTS
- TREES PROTECTED & RETAINED
- TREES REMOVED
- PROPERTY BOUNDARY
- FENCE
- FOOTPATH

PLANTING & SEEDING
- TURF
- HYDROSEEDING/ HYDROMULCHING - DRYLAND GRASS
- HYDROSEEDING/ HYDROMULCHING - PASTURE GRASS
- NATIVE GRASSES
- INFILTRATION / NATIVE PLANTINGS
- HIGH NATIVE SHRUBS
- LOW NATIVE SHRUBS
- MIXED CANOPY
- FEATURE PLANTING AREAS
- RIPARIAN PLANTING

SPOT PLANTING
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- *EVERGREEN (5L)*
- *JACARANDA* (35L)
- *ILLAWARRA FLAME TREE*
- *FIG TREE*
- *FRANGIBLE SMALL TREE*

WATER SENSITIVE DESIGN
- SWALE
- RAIN GARDEN
- INFILTRATION
- SPILL CONTAINMENT BASIN
- VEGETATED SWALE

INCIDENTAL WORKS
PAVEMENTS
- GREY OXIDE, BRUSHED CONCRETE SHARED PATH
- GREY OXIDE, BRUSHED CONCRETE FOOTPATH
- INTERPRETATION SIGNAGE OPPORTUNITY

WALLS & EDGING
- CONCRETE RETAINING WALL
- TRANSPARENT / TRANSLUCENT NOISE WALL
- TYPE F BARRIER
- THRIE BEAM BARRIER
- WIRE ROPE BARRIER
- PEDESTRIAN FENCE

OTHER
- PROPERTY ACQUISITION

Fig. 5-47: Urban and landscape Design Plan (Sheet 3) - Bridge over Clarence River Design Precinct (Scale: 1:2000)

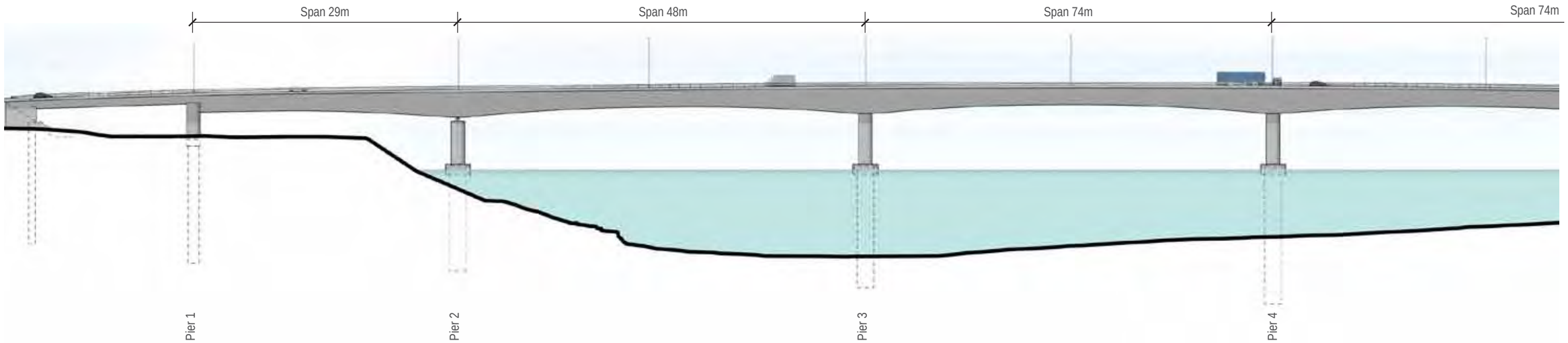

Fig. 5-48: Additional bridge over Clarence River at Grafton - Elevation (Scale 1:750)

The central spans across the river are a box girder with a parabolic form in elevation, with the two end spans being constructed of Super-T girders to achieve greater clearance over Greaves Street. A shared path is provided on the bridge linking to shared paths on Pound Street and Iolanthe Streets in the north and south respectively. Lighting is provided on the western side of the bridge.

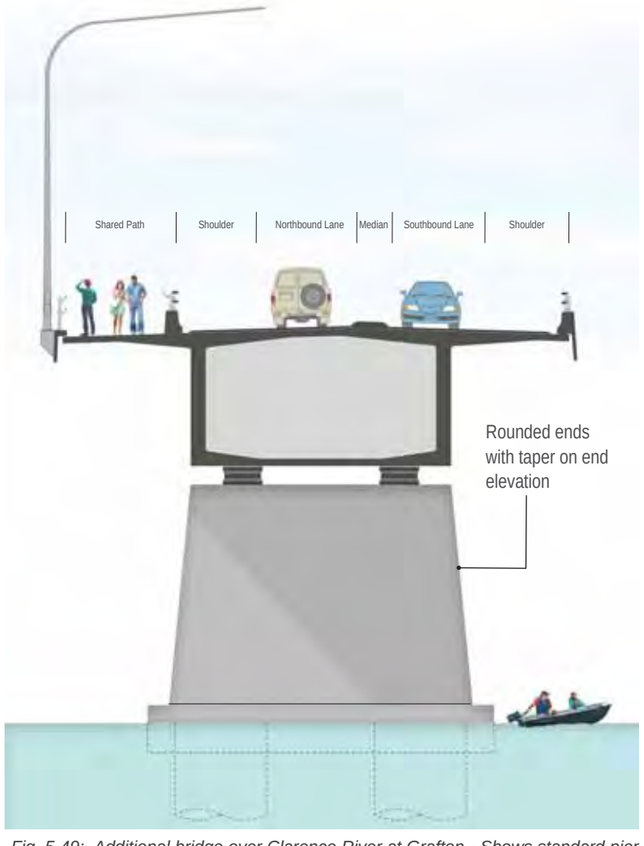

Fig. 5-49: Additional bridge over Clarence River at Grafton - Shows standard pier type (Scale 1:200)

Fig. 5-50: Additional bridge over Clarence River at Grafton - Shows integral pier type for the two most central spans (Scale 1:200)

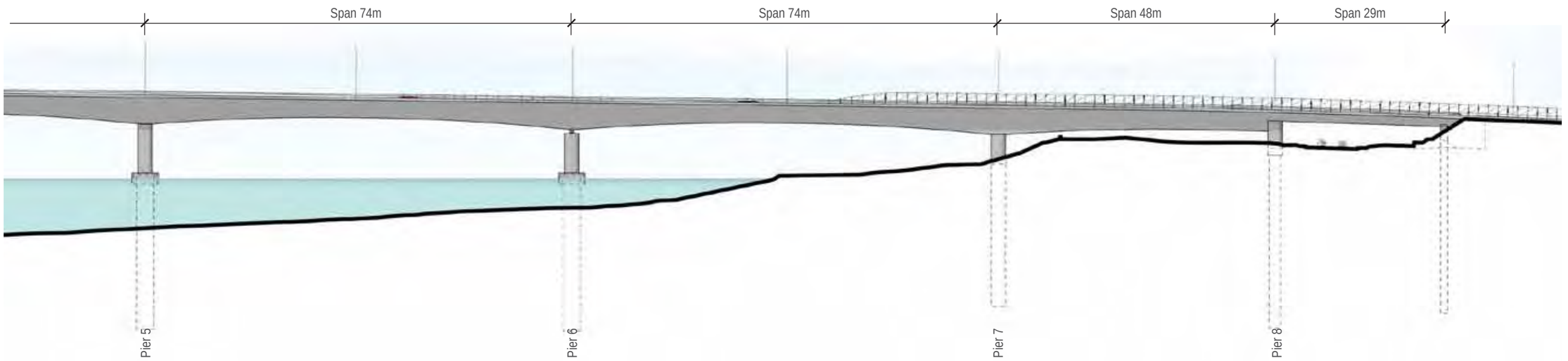

Fig. 5-51: View of the additional bridge over Clarence River at Grafton looking south west

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The transition piers are blades that are tapered inwards in the end elevation. Due to the depth of the box girder and height of bearings, it is not possible to reduce the bulk of the blade.

The end pier on the existing bridge has a similar form. However, the transition pier on the new bridge is alongside Greaves Street and therefore highly visible to the locals.

Alternatives options should be explored during detailed design, including a textured finish to the pier such as an exposed aggregate finish.

Another suggestion is to use the pier for artwork/ managed graffiti as currently appears to be taking place in this area with the existing bridge/ viaduct structures (Figures 5-50 and 5-51).

Fig. 5-52: End pier (Grafton side) on existing bridge

Fig. 5-54: Managed art / graffiti art on existing viaduct piers

Fig. 5-53: Additional bridge over Clarence River at Grafton - Shows transition pier at Grafton near Greaves Street (Scale: 1:200)

Fig. 5-55: Additional bridge over Clarence River at Grafton - Shows transition pier at South Grafton (Scale: 1:200)`

5.5 Urban Design Finishes

SCHEDULE OF URBAN DESIGN FINISHES ADDITIONAL CROSSING OF THE CLARENCE RIVER AT GRAFTON						OCTOBER 2016		ISSUE 1
CODE	STRUCTURE	FINISH	PROPRIETARY ITEM OR APPROVED EQUIVALENT	CODE/COLOUR OR APPROVED EQUIVALENT	PROPRIETARY SUPPLIER OR APPROVED EQUIVALENT	SAMPLE/TESTING REQUIREMENTS	COMMENTS	REFERENCE IMAGE
ADDITIONAL CROSSING OF THE RIVER								
F1	ABUTMENTS							
	▪ Retaining wall	▪ Masonry Pyrmont blocks	▪ Splitface block with integral colour	▪ Almond 	▪ Boral or equivalent.	▪ Sample to be provided to urban designer for approval of colour and finish.		
	▪ Spill through batter	▪ Rock pitched finish.	▪ N/A	▪ N/A	▪ N/A	▪ Sample to be provided to urban designer for approval of colour and finish	▪ Rock to be sourced locally where possible. ▪ Ensure rock consistent for both abutments.	
F2	ANTI GRAFFITI COATING							
	▪ As per Roads and Maritime Services requirements – piers, wing walls and headstocks accessible to the public.	▪ Anti-graffiti coating as per Roads and Maritime Services requirements. ▪ To be applied to the full height of panels where required.	▪ Sure Seal Graffiti Shield	▪ Should not change colour of concrete when painted.	▪ Sure Seal or equivalent.	▪ Sample to be provided 600 x 600 x 150mm showing half panel applied for approval ▪ VOC test results and environmental certification	▪	
REPLACEMENT OF THE RAILWAY VIADUCT OVER POUND STREET								
F3	TRUSS							
	▪ Steel truss members	▪ Paint on galvanised finish.	▪ Primer: Galvanised Iron primer- Quit Rust Range. ▪ Paint: Micaceous Iron Oxide	▪ Mid Grey 	▪ Dulux Australia or equivalent.	▪ Sample to be provided 200 x 600 x 5mm for approval	▪ Paint system to be obtained by paint supplier. Follow paint supplier instructions in application.	
F4	ANTI GRAFFITI COATING							
	▪ As per Roads and Maritime Services requirements – Piers, wing walls and headstocks accessible to the public.	▪ Anti-graffiti coating as per Roads and Maritime Services requirements. ▪ To be applied to the full height of panels where required.	▪ Sure Seal Graffiti Shield.	▪ Should not change colour of concrete when painted.	▪ Sure Seal or equivalent.	▪ Sample to be provided 600 x 600 x 150mm showing half panel applied for approval ▪ VOC test results and environmental certification		
NOISE WALL/PRIVACY AND GLARE SCREEN								
F5	▪ Noise wall – top panel	▪ Transparent panels with horizontal anti-bird strike lines	▪ PLEXIGLASS SOUNDSTOP XT	▪ Clear	▪ Plastral Plexiglass or equivalent	▪ Sample to be approved by urban designer. Size 400 x 400mm		

Table 5-1: Urban Design Finishes

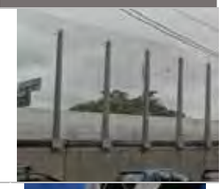
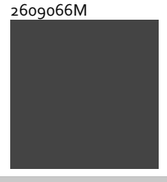
SCHEDULE OF URBAN DESIGN FINISHES ADDITIONAL CROSSING OF THE CLARENCE RIVER AT GRAFTON						OCTOBER 2016		ISSUE 1
CODE	STRUCTURE	FINISH	PROPRIETARY ITEM OR APPROVED EQUIVALENT	CODE/COLOUR OR APPROVED EQUIVALENT	PROPRIETARY SUPPLIER OR APPROVED EQUIVALENT	SAMPLE/TESTING REQUIREMENTS	COMMENTS	REFERENCE IMAGE
F6	▪ Noise wall – bottom panel	▪ Translucent frosted white panel	▪ PLEXIGLASS SOUNDSTOP	▪ 15/0S00 SC	▪ Plastral Plexiglass or equivalent	▪ Sample to be approved by urban designer. Size 400 x 400mm		
F7	▪ Posts	▪ Paint on galvanised finish.	▪ Primer: Galvanised Iron primer- Quit Rust Range. ▪ Paint: Micaceous Iron Oxide	▪ Mid Grey 	▪ Dulux Australia or equivalent.	▪ Sample to be provided 200 x 600 x 5mm for approval	▪ Paint system to be obtained by paint supplier. Follow paint supplier instructions in application.	
SCREEN AT NORTHERN ABUTMENT								
F8	▪ Perforated metal panels ▪ Post	▪ Powdercoat on primer.	▪ Powder coated paint system, matt ▪ Primer: Galvanised Iron primer- Quit Rust Range.	▪ Locker R25448 in Terrain Matt 2608232M  ▪ Posts, Locker R12748 in Monument Matt 2609066M 	▪ Dulux Duralloy or equivalent.	▪ Sample to be approved by urban designer. Size 400 x 400mm	▪ Paint system to be obtained by paint supplier. Follow paint supplier instructions in application.	
HANDRAILS/ CYCLE RAILS/ BALUSTRADES								
F9	▪ Handrails.	▪ Off the shelf products - Galvanised ▪ Custom built - painted at all other locations.	▪ BS25	▪ Galvanised ▪ Painted – Terrain Matt or Mid Grey	▪ Moddex or equivalent	▪ Samples to be approved by the Urban Designer.		
FOOTPATHS, SHARED PATHS AND CYCLE PATHS								
F10	▪ Footpaths, shared paths and cycle paths.	▪ Brushed finish concrete. ▪ Oxide colour pigmentation.	▪ Oxide in concrete.	▪ CCS ONYX 21 @4.15% (min) or greater as per CCS specification in grey cement. 	▪ Concrete Colour Systems or equivalent.	▪ Slip resistance testing as per AS4586 ▪ Provide luminance contrast testing where required		

Table 5-2: Urban Design Finishes

5.6 Precinct 4 - Southern Approach

The approach to the new bridge from south of the Clarence River will herald a new entry into Grafton, very different from the existing. It travels through open rural land, and across a flat, floodplain with scattered trees.

The design integrates long embankments through the floodplain, also integrating with existing levee banks.

The landscape design concept assists in mitigating the new linear, high, earth form into the open landscape through applying a “mass and void” approach that reduces the visual dominance of the long embankments in the broader landscape.

Design responses to the existing situation:

Fig. 5-56: Be sensitive to views from South Grafton

The site is in open, flat floodplain landscape, with a low ridgeline (Bent Street) to the west, where distant housing and Grafton Community College, and the South Grafton Railway Station sit low in the landscape, on the lower ridge area.

Whilst views onto the new structure would be distant, the design would need to mitigate the new engineered forms in the landscape below.

Fig. 5-57: Maximise retention of existing trees

There are existing scattered *Casuarinas* and other trees along the Iolanthe Road, and remnant palms and plantings in the floodplain land to the west of the alignment. Care should be taken to maximise retention of any existing vegetation, as it adds character, provides fauna habitat and provide visual mitigation.

Fig. 5-58: Introduce a landscape of bold scale

View along Iolanthe Street north, looking back to South Grafton - the horizontal forms of the commercial properties sit low in the landscape, yet their massing is large. The design needs to respond to the industrial nature of the built form in this are, by providing a response that complements the large scale of the massing.

Fig. 5-59: Retain and reinforce the rural character of the area

The rural, informal character of this area needs to be retained in the design. There are wide, open spaces along the route and that character should dominate.

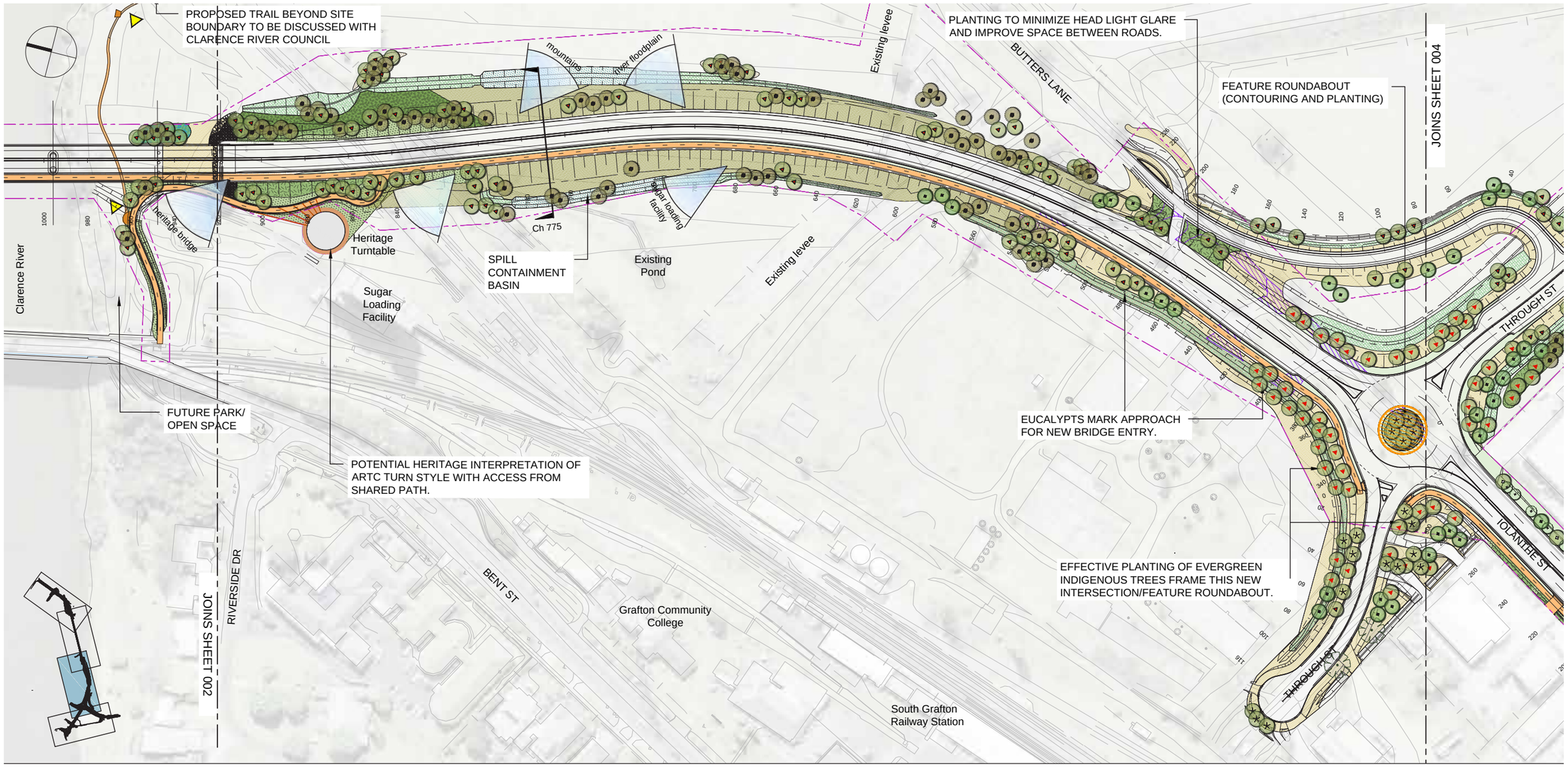
Fig. 5-60: Exploit views to landmarks

From the elevated embankment, there will be great views to key distant landmarks - the existing Sugar Loading Facility, and the old heritage bridge. Both these elements provide legible markers in the landscape.

Landscape Design Concept

Key design elements include:

- Planted batter on the southern embankment closest to the river, to visually settle the structure into the landscape.
- Riparian planting on lower level closest to the river to improve wildlife habitat and reinstate species to reflect the original vegetation community.
- Informal groups of woodland tree species to reinforce the species from the subtropical coastal floodplain forest association of the area, now depleted. Forest Red Gums being the dominant tree species used.
- Dense shrub planting to minimise headlight glare, and improve transition in the narrow space between Iolanthe Street and the new approach road.
- Strong new evergreen (Eucalypt) trees to mark the new gateway to Grafton, reinforcing the original subtropical coastal floodplain forest vegetation association. This will form a strongly defined entrance, different to the Jacaranda streetscape of the older town areas and gateways.
- Gently contoured, raised form to the feature roundabout, which could be a site for future art in public spaces. Dense swards of contrasting native tussocks and grasses to the roundabout, with smaller species within sight line areas.
- Strong evergreen , bold Eucalypt dominant planting- with Casuarinas and Melaleucas to Through Street, where there is space, unimpeded with above ground power lines to cater for the large street trees. This strong planting will greatly assist in creating a bold and evergreen landscape to complement the large, industrial scale buildings in the vicinity.
- an integrated Heritage Interpretation Plan as illustrated in Chapter 8)



LEGEND

EXISTING ELEMENTS
- TREES PROTECTED & RETAINED
- TREES REMOVED
- PROPERTY BOUNDARY
- FENCE
- FOOTPATH

PLANTING & SEEDING
- TURF
- HYDROSEEDING/ HYDROMULCHING - DRYLAND GRASS
- HYDROSEEDING/ HYDROMULCHING - PASTURE GRASS
- NATIVE GRASSES
- INFILTRATION / NATIVE PLANTINGS
- HIGH NATIVE SHRUBS
- LOW NATIVE SHRUBS
- MIXED CANOPY
- FEATURE PLANTING AREAS
- RIPARIAN PLANTING

SPOT PLANTING
- *EVERGREEN (35L)*
- *EVERGREEN (5L)*
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- *ILLAWARRA FLAME TREE*
- *FIG TREE*
- *FRANGIBLE SMALL TREE*

WATER SENSITIVE DESIGN
- SWALE
- RAIN GARDEN
- INFILTRATION
- SPILL CONTAINMENT BASIN
- VEGETATED SWALE

INCIDENTAL WORKS
PAVEMENTS
- GREY OXIDE, BRUSHED CONCRETE SHARED PATH
- GREY OXIDE, BRUSHED CONCRETE FOOTPATH
- INTERPRETATION SIGNAGE OPPORTUNITY

WALLS & EDGING
- CONCRETE RETAINING WALL
- TRANSPARENT / TRANSLUCENT NOISE WALL
- TYPE F BARRIER
- THRIE BEAM BARRIER
- WIRE ROPE BARRIER
- PEDESTRIAN FENCE

OTHER
- PROPERTY ACQUISITION

Fig. 5-61: Urban and Landscape Design Plan (Sheet 4) - Southern Approach Design Precinct (Scale: 1:2000)

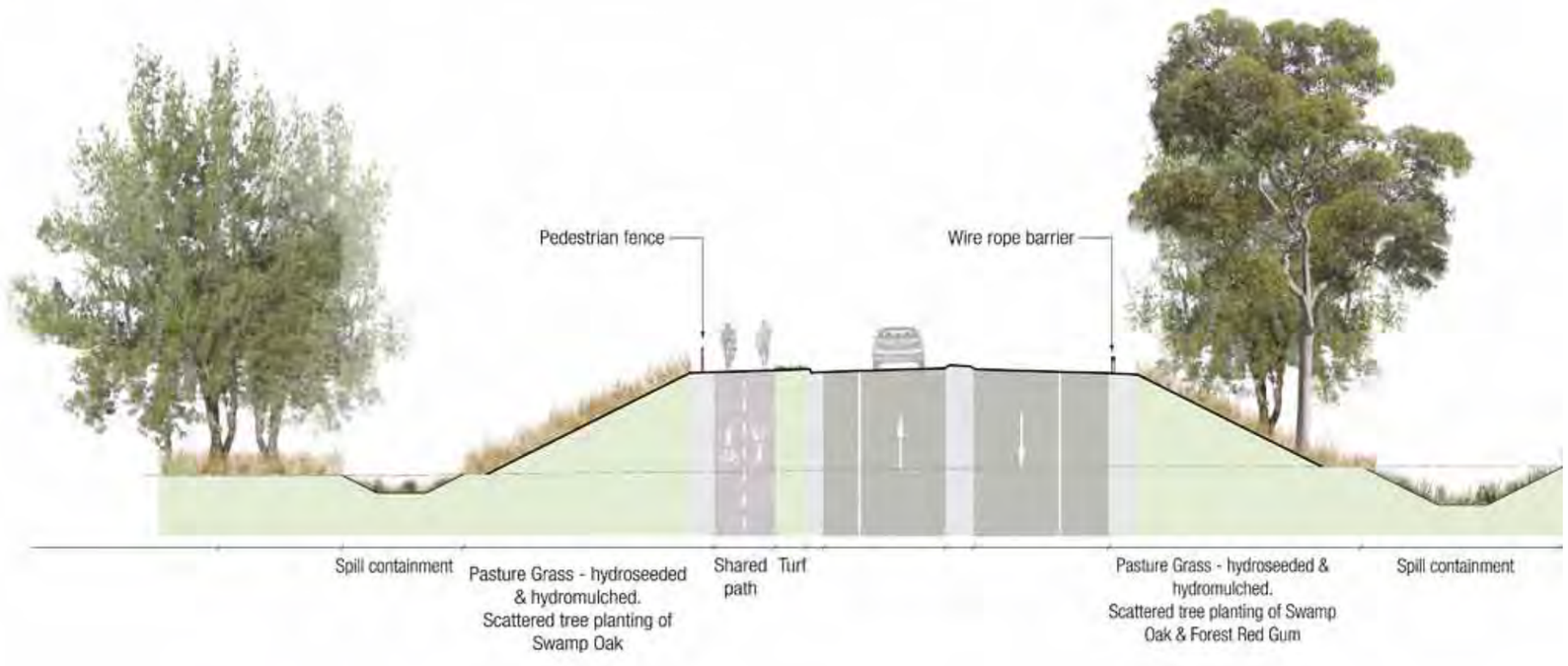


Fig. 5-62: Cross section at southern approach - Ch 775 (Scale 1:250)

ARTC Turntable

Although sitting outside the project boundary, there is an opportunity for the heritage interpretation of the turntable which is now an isolated component related to the heritage-listed Grafton City Railway Precinct. The turntable has potential to showcase the heritage and importance of the railway system to the historical development of Grafton, major components of which are the bridge and other railway structures surviving within the Precinct. Refer to the Heritage Interpretation Strategy illustrated in chapter 8.

Fig. 5-63: Existing ARTC turntable at South Grafton

Fig. 5-64: Conservation and interpretation of a historic turntable in Old Town Folsom, California

5.7 Precinct 5 - Iolanthe Street and Pacific Highway

This area will transform into being the new south Grafton approach to the town and the river, using the new highway, and the older highway. The design needs to be legible and clear in its intent, the planting simple and bold to complement the industrial/commercial character of the area.

Design responses to the existing situation:

Fig. 5-65: Strengthen the indigenous character of the landscape upon arrival

View looking west along the old Pacific Highway- indigenous vegetation contains the edge of the road, and leads the eye to the commercial buildings upon arrival. This vegetation is retained, and the road will be down graded to a more local street- Charles Street, to lead onto Iolanthe Road. This indigenous planting is a good cue for what is required.

Fig. 5-66: Gwydir Highway arrival

Looking south along the Gwydir Highway, the existing Melaleucas form a strong presence upon arrival/departure.

Fig. 5-67: Retain views to open, rural country

Planting to adjacent rural country should be retained and exploited.

Fig. 5-68: Improve streetscape address to the industrial precinct

The journey to the new bridge/ new entry passes this precinct where overhead power lines, large scale industrial buildings, and lack of tree planting exists. This is a real challenge to the project, given the spatial constraints. Wherever possible tree planting has been maximised, given the services and corridor constraints.

Fig. 5-69: Overhead power line restrict street trees

The presence of overhead power lines has been a major constraint for the project, in terms of trying to create an effective streetscape. Unfortunately on the north verge of Iolanthe Street, street trees cannot fit with the services and space constraints.

Fig. 5-70: Integrating street trees and swale

The east verge of Iolanthe Street, there is opportunity to integrate some large scale trees, within the drainage swale in the verge.

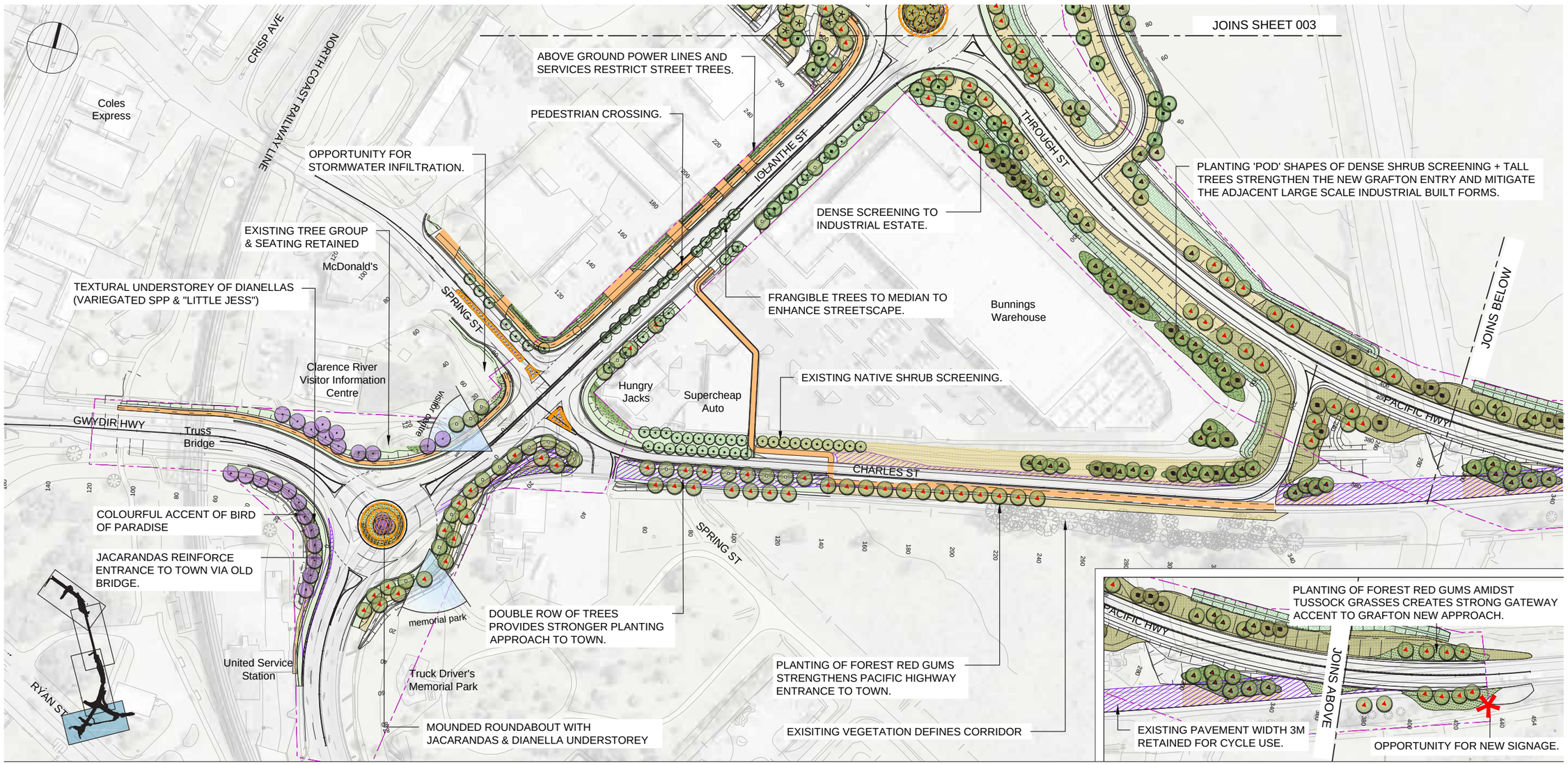
Landscape Design concept

Key design elements include:

- Clear demarcation and wayfinding to define the old town/Bent Street/ old bridge route - with Jacarandas; and the new route with evergreen, tall trees to lead to the river.
- Strong, bold planting theme of indigenous species to complement the large scale massing of the built form of this precinct.
- Simple, bold feature planting at the roundabouts, with gentle raised contouring to create effective accents and entry features. (Refer to Gateway Design Plan)

During detail design these areas could be subject to an integrated art/signage project , in collaboration with Council.

- Introduction of frangible trees (Lillypillys) with a carpet of hardy native grasses and tussocks in the median of Iolanthe street to compensate for the lack of trees on the west verge, and to green the streetscape as much as possible.



LEGEND

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PLANTING & SEEDING
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- HYDROSEEDING/ HYDROMULCHING - PASTURE GRASS
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- INFILTRATION / NATIVE PLANTINGS
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- THRIE BEAM BARRIER
- WIRE ROPE BARRIER
- PEDESTRIAN FENCE

OTHER
- PROPERTY ACQUISITION

Fig. 5-71: Urban and Landscape Design Plan (Sheet 5) - Iolanthe Street/ Pacific Highway Design Precinct (Scale: 1:2000)

Fig. 5-72: Infiltration opportunity

Close to the Visitor Information Centre pond, there is a transition of various storm water pipes and swales. There is potential here for a small infiltration area to clean the water.

Fig. 5-73: Emphasise the old town route.. distinguish the new route

Clear legibility of old/new routes needs to be established with the landscape design. The design proposes Jacarandas to define the route to the old town, across the old bridge via Bent Street ; and evergreen natives to define the route via Iolanthe Street and Pacific Highway to the new bridge.

Fig. 5-74: Retain open views to visitor centre

The view from the new adjacent roads across the pond to the visitor centre need to be kept open. The landscape design responds to this need, and frames the view.

Gwydir/ Iolanthe Street Gateway

With the new road changes and approaches required for the new bridge, this roundabout forms the transition and clue for direction choice for all.

The roundabout needs to clearly identify the route along the old bridge (Jacarandas); with the new evergreen, native clue for the new bridge crossing along Iolanthe Street and beyond.

The proposed treatment for the roundabout gateways are similar, and being in rural setting, concentrate on promoting bold planting designs, relevant to the scale and setting of the area, with the following key design elements:

- Contour mounding to the roundabout to achieve a gentle slope of 1:6, from inside the kerb;
- Simple swathes of complementary grasses, tussocks or ground covers within the sight line areas (maximum 500mm high) ; rising to higher understorey of complementary species (either prostrate Westringias or native tussocks) to the central roundabout areas, where informally grouped semi advanced trees are shown;
- Framing of Bird of Paradise plants under the Jacarandas at the Gwydir/Iolanthe Street Gateway, and adjacent low shrub framing ot the intersection with low, compact Bottlebrush, Paperbark and Waxflower species.
- Understorey of Lomandras and Dianellas (native tussocks) under the Eucalypts.

Fig. 5-75: Gwydir/ Iolanthe Street Gateway Concept Plan (Scale 1:1000)

Fig. 5-76: Iolanthe Street/Pacific Highway Gateway