



Transport
Roads & Maritime
Services



Additional crossing of the Clarence River at Grafton

Route Options Development Report
Technical Paper – Landscape and Urban
Character

SEPTEMBER 2012



MAIN ROAD 83 SUMMERLAND WAY
ADDITIONAL CROSSING OF THE CLARENCE RIVER AT
GRAFTON
ROUTE OPTIONS DEVELOPMENT REPORT
TECHNICAL PAPER: **LANDSCAPE AND URBAN CHARACTER**



PREPARED BY **SPACKMAN MOSSOP MICHAELS** FOR ARUP ON BEHALF OF RMS
AUGUST 2012

Main Road 83 Summerland Way
Additional crossing of the Clarence River at Grafton
Route Options Development Report - Landscape and urban Character
Final v1
Report issued August 2012

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This report is intended to be viewed as a double sided document. Orientation should be landscape and double sided printing should be along short-end spine of the document.

Proper viewing and printing of this document will ensure that information is conveyed in its intended clear and logical format.

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I INTRODUCTION



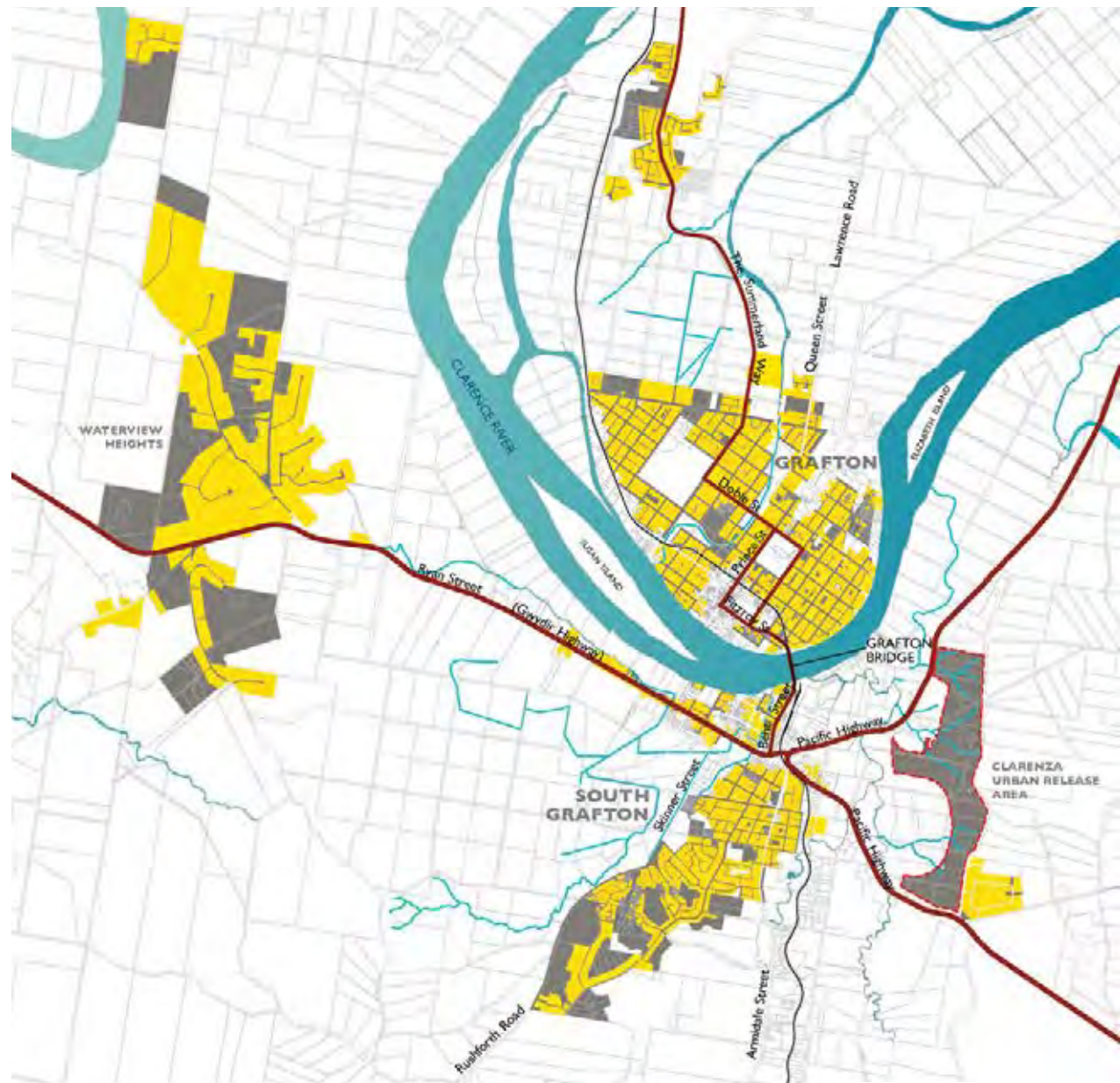
Aerial view of the Clarence River and Grafton Bridge, looking west toward Susan Island (Source: Arup 2010).

I.1 INTRODUCTION

PREAMBLE

Grafton is a major regional centre situated on the Clarence River in the north coast of New South Wales. The Clarence River passes through the centre of the city, dividing Grafton into two separate urban areas that are linked by a single bridge crossing. Grafton Bridge currently provides the only rail, motor vehicle, pedestrian and cyclist connection between Grafton (north of the river) and South Grafton, for local and regional travellers alike. The existing bridge has limited capacity to meet the demands of the large volumes of road traffic that cross it during peak times. It is likely that this demand will increase over time due to the future urban growth that is envisaged for Grafton as part of the Clarence Valley Council's (CVC) regional urban planning strategies. As such, the NSW Roads and Maritime Services, RMS (formerly Roads and Traffic Authority) has identified a need to provide an additional bridge crossing in Grafton.

This urban design strategy report has been prepared by Spackman Mossop Michaels for Arup, on behalf of RMS, to assist in the selection of a preferred location for a future additional crossing of the Clarence River in Grafton. The purpose of the urban design strategy is to provide the framework for evaluating—from a landscape and urban design perspective—proposed options for the location and design of a new bridge, as well as any associated approach routes to the new bridge. The urban design strategy forms the basis of the overall landscape and urban design study for an additional bridge crossing for Grafton. The strategy identifies a series of urban design goals, and related design principles, that will guide the concept landscape and urban design proposal for a new bridge crossing.



- EXISTING RESIDENTIAL LAND USE
- POTENTIAL FUTURE RESIDENTIAL LAND USE

FUTURE URBAN GROWTH OF GRAFTON



Source: Clarence Valley Local Environmental Plan 2011 (CVLEP 2011).

PROJECT PURPOSE

The project purpose is to identify an additional crossing of the Clarence River at Grafton to address short-term and long-term transport needs.

PROJECT OBJECTIVES

The project objectives have been used to determine the feasibility of the options generated by the community and will be used to address the short-list of route options. The project objectives are:

- Enhance road safety for all road users over the length of the project.
- Improve traffic efficiency between and within Grafton and South Grafton.
- Support regional and local economic development.
- Involve all stakeholders and consider their interests.
- Provide value for money.
- Minimise impact on the environment.

STUDY METHOD

The preparation of this report has involved:

- Analysis of the existing site conditions, through on-site investigations and desktop review of current background studies.
- Identification of the key landscape and urban design values of Grafton.
- Identification of the primary landscape and urban design issues that could affect the design of the new bridge and its approach routes.
- Identification of landscape and urban design opportunities that could arise from the introduction of an additional bridge crossing in Grafton.
- Formulation of landscape and urban design goals, and associated design principles, to inform the design and selection of a preferred additional crossing and approach routes.
- Conduct an assessment of the six short-listed route options to determine the strengths and weakness of each route. This assessment also identified design opportunities or challenges that should be considered and incorporated as appropriate.

This landscape and urban character technical paper was based on the current preliminary concept design for the bridge, which may be refined with further development of the selected option during the detailed design of the preferred route. The work undertaken combines information provided by RMS, Arup, field investigations and other sources, and is reasonable for a comparative assessment of the preliminary concept design for six short-listed route options.



BACKGROUND

RMS is currently undertaking investigations to identify an additional crossing of the Clarence River at Grafton to address short-term and long-term transport needs.

The design for the existing bridge over the Clarence River at Grafton commenced in 1915. It comprised a moveable span railway bridge with allowance for pedestrian use. Later in 1922, vehicular traffic was incorporated into the design. The bridge was opened to traffic in 1932.

Since the early 1970s there have been various discussions and studies into a second crossing of the Clarence River near Grafton. In 1977, the NSW Department of Main Roads (DMR, now Roads and Maritime Services) identified that a new bridge should align along Bent Street and Fitzroy Street. It was recognised at that time that the second river crossing proposal was not of immediate priority, but rather a long-term project.

Over the last 10 years, Roads and Maritime Services (RMS) has carried out a number of studies to identify areas that would be suitable for a second crossing of the Clarence River at Grafton. The most recent comprehensive RMS study was undertaken between 2003 and 2004. It consisted of a feasibility study (February 2003) followed by an environmental overview (January 2004) and a corridor evaluation workshop (April 2004). These studies identified that the most suitable location for a new crossing of the Clarence River would be near the existing Grafton bridge. However, a preferred route was not selected at that time and it was recognised that further investigations were needed to determine a preferred route.

Funding availability for the proposal became an issue in 2005 and, as a result, investigations into a second crossing of the Clarence River were placed on hold.

In 2009, in response to increasing traffic congestion in Grafton and South Grafton and operational safety issues with the existing bridge, RMS recommended further investigations. These consisted of a revised traffic analysis that compared previous traffic modelling with updated traffic information. This was undertaken to understand the existing transport demands and traffic patterns within Grafton and the surrounding region. The December 2009 traffic study confirmed that a new bridge, close to the existing bridge, would cater for the traffic needs in the local area.

In February 2010 RMS displayed four preliminary route options for community comment. These preliminary route options were developed based on traffic modelling only and were all in the vicinity of the existing bridge. This display also defined a study area for this investigation.

In December 2010 RMS released a community update announcing a revised process for the identification and preservation of a route for a second crossing. As part of this revised process, a series of public surveys, community forums and meetings with residents and community groups have been held and various studies and project documents released for public viewing and comment.

In June 2011, RMS released the Feasibility Assessment Report, which describes the assessment undertaken by RMS on the 41 route suggestions identified by the community following the announcement of the revised process in December 2010. The report identifies 25 preliminary options within five

strategic corridors to go forward for further engineering and environmental investigation.

Between June 2011 and January 2012, RMS carried out investigations in the Grafton area and surrounds to identify constraints relevant to an additional crossing of the Clarence River. The outcomes of these investigations, community comment and a community and stakeholder evaluation workshop provided the inputs to the selection of the short-list of options.

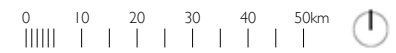
In January 2012, six route options to be investigated further as part of the process to identify a location for the crossing were announced. The short-listed options were identified in the *Preliminary Route Options Report – Final* (RMS, January 2012) which also provided details of the technical investigations undertaken on the 25 preliminary options and the process to select the short-listed route options.

This technical paper builds upon this previous body of work and is an attachment to the *Route Options Development Report*. It will be used to define the existing landscape and urban design values and constraints in the Grafton area that may affect the proposed six route options.

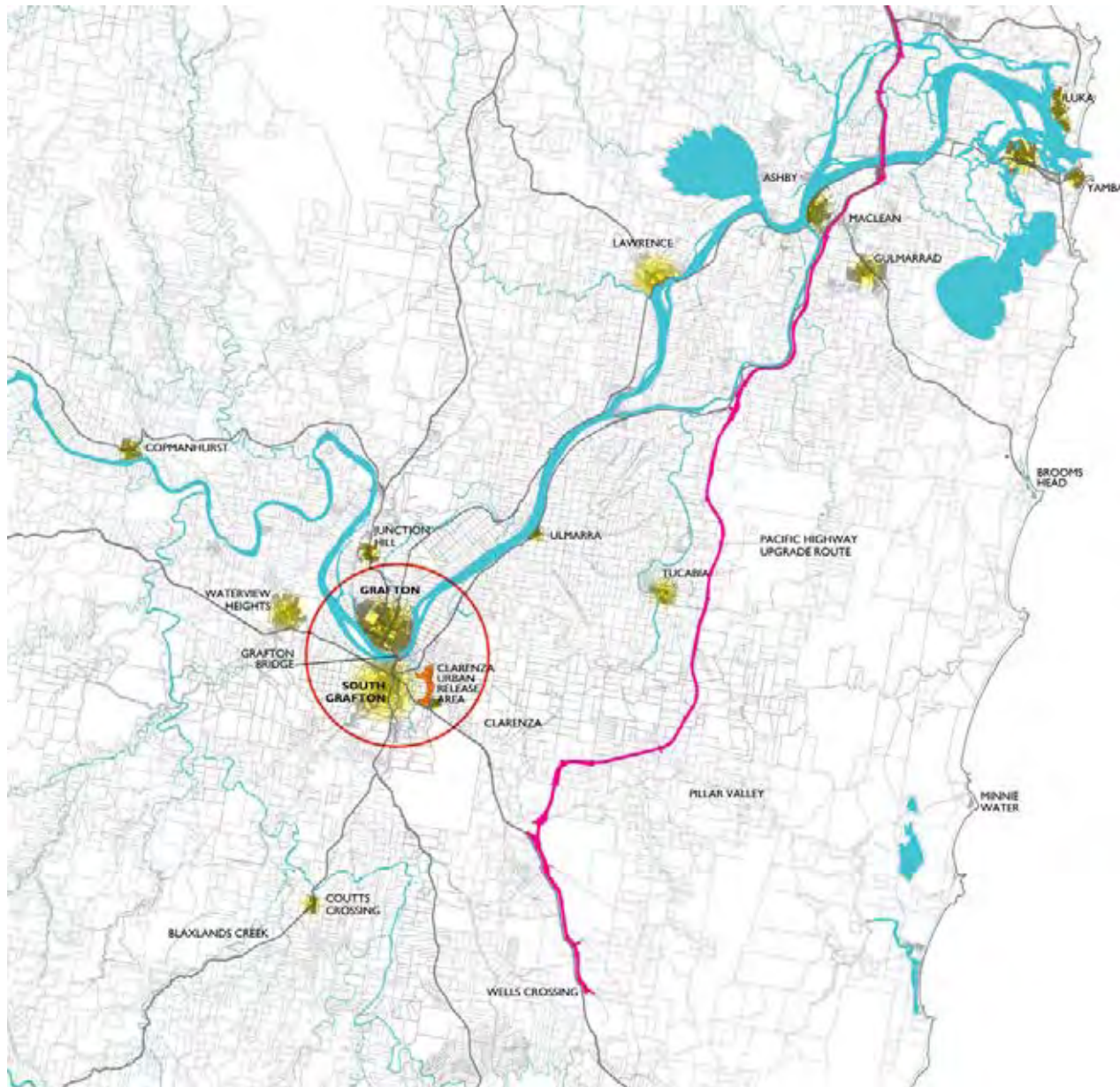
2 THE EXISTING SITUATION



REGIONAL CONTEXT



Source: Clarence Valley Council



2.1 REGIONAL CONTEXT

LOCATION

The City of Grafton is situated on the northern New South Wales coastal plain, within the Clarence Valley local government area. It is located on the banks of the Clarence River, approximately 36.5km inland from the coast and 65.5km from the river's mouth at Yamba. Grafton is the major urban centre for the region, being the primary focus of commercial, industrial, institutional and administrative activities in a predominantly rural part of the north coast.

URBAN SETTLEMENTS



Source: Clarence Valley Council and RMS

TRANSPORT

Being a regional centre, Grafton is well serviced by transport infrastructure. It is situated at the junction of the Pacific Highway and the Gwydir Highway, both of which are National Highway routes. The planned long-term upgrade route for the Pacific Highway between Wells Crossing and Iluka Road will run from the Glenugie State Forest north to Tyndale, completely bypassing Grafton.

The Summerland Way, a State Route, runs north from the Gwydir Highway and Pacific Highway, across the Grafton Bridge, through Grafton and onward to Woodenbong in Queensland. The Summerland Way is promoted as a tourist drive that provides a 'quieter, scenic alternative' to the Pacific Highway route between Brisbane and Coffs Harbour.

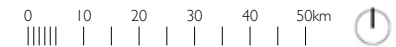
Due to the local topography and the relationship of the railway bridges to the local road network, heavy vehicles do not utilise the Prince Street section of the Summerland Way in Grafton. Instead, there is a heavy vehicle diversion route along Villiers Street to connect with the Dobie Street section of the State Route.

Grafton is also located on the North Coast railway line, the main passenger and freight rail connection between NSW and Queensland. Grafton Bridge currently provides the only major crossing of the Clarence River for both the railway line and the Summerland Way.

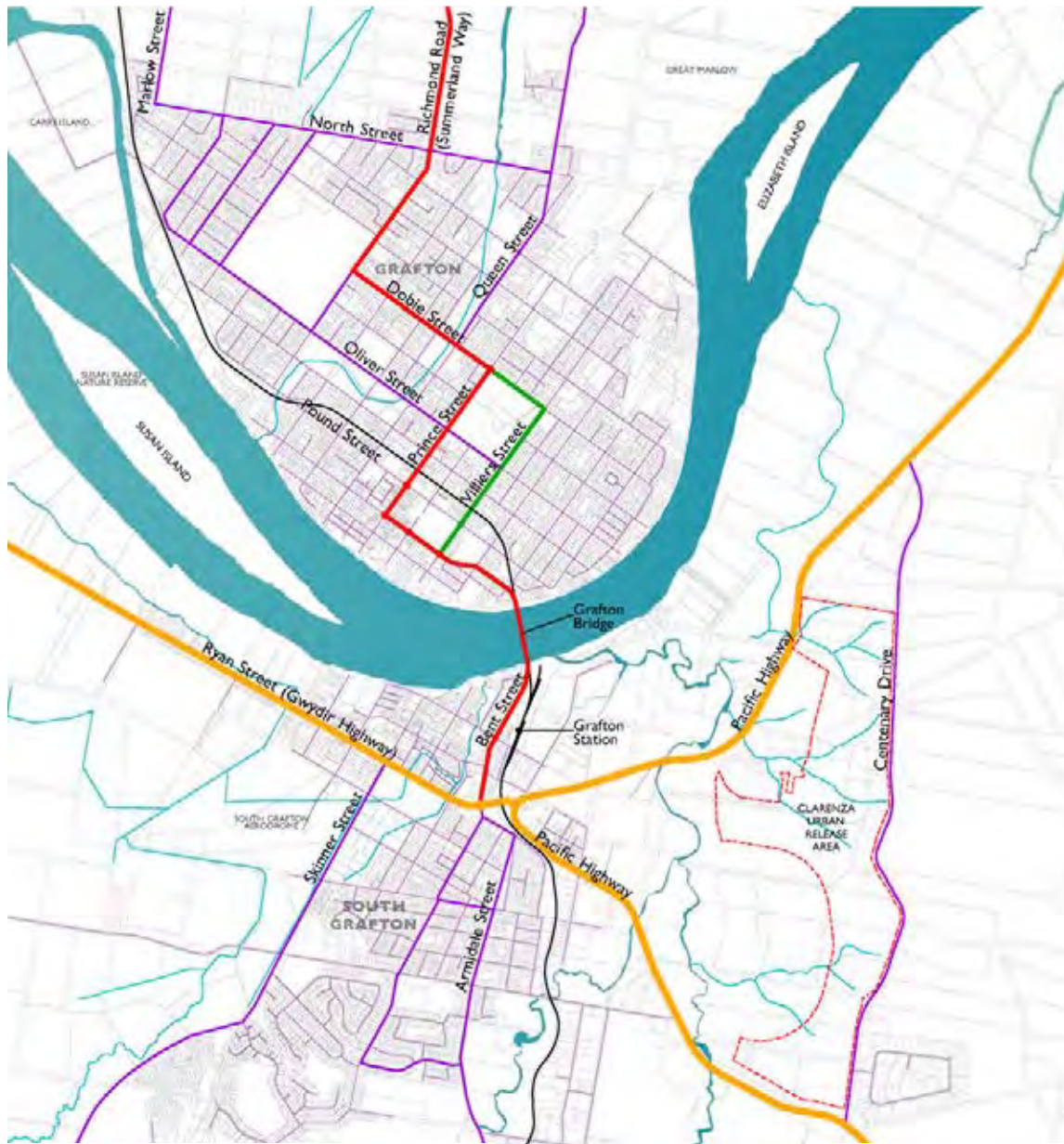
- NATIONAL HIGHWAY
- STATE ROUTE
- RAILWAY LINE
- NATIONAL PARK
NATURE RESERVE
- STATE FOREST



REGIONAL TRANSPORT NETWORK



Source: RMS



LOCAL TRANSPORT NETWORK

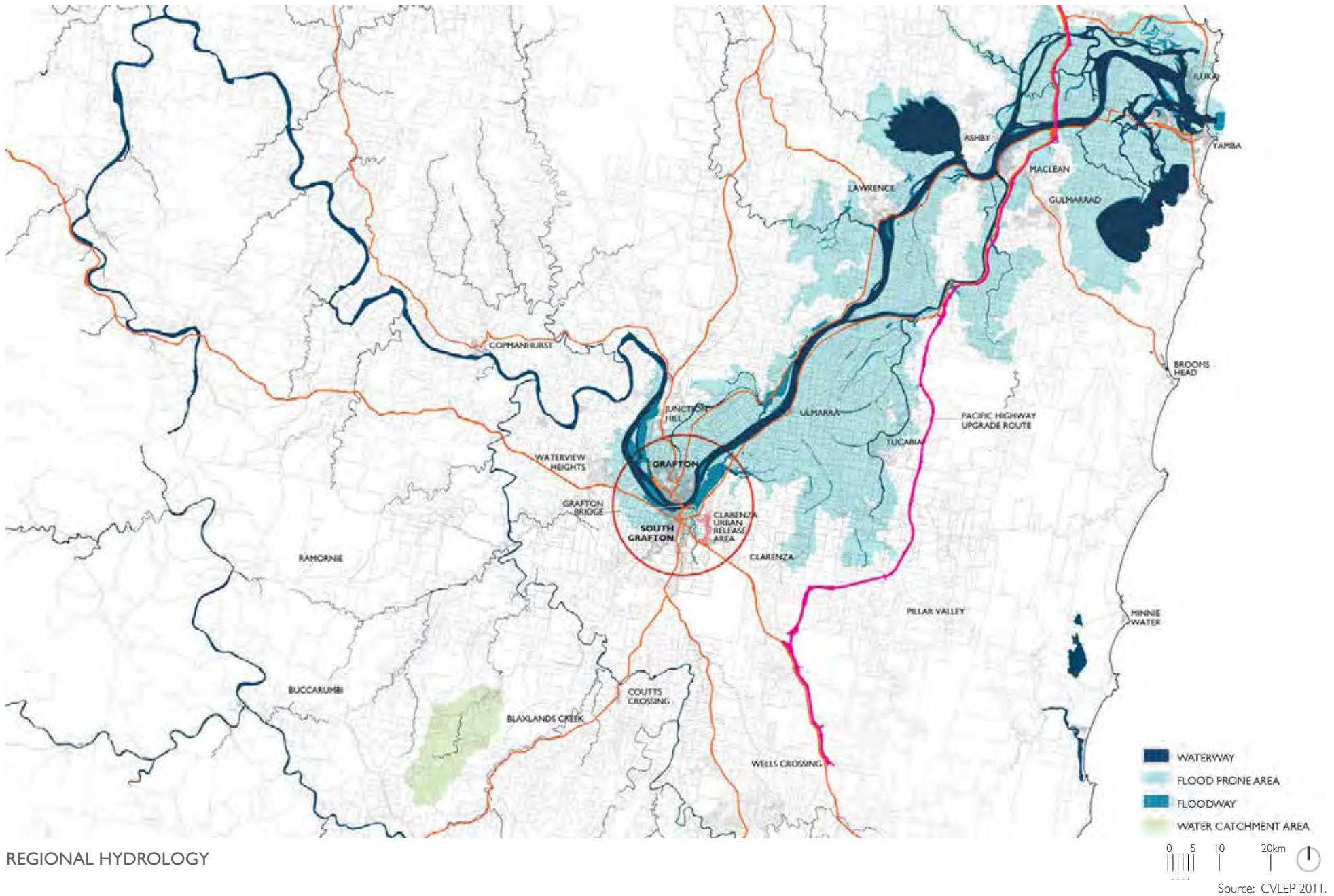


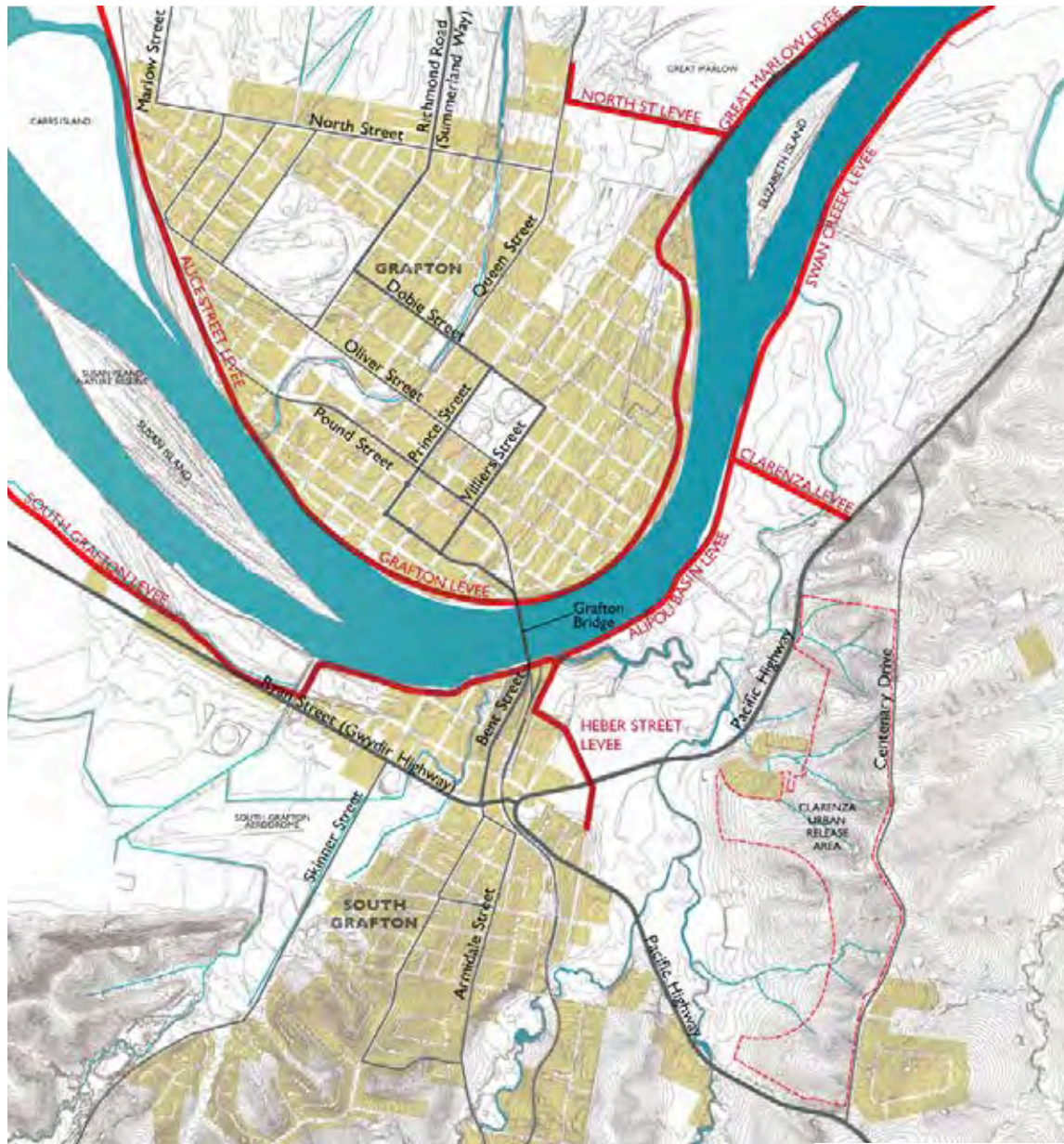
Source: RMS



Above: Road and rail approaches to Grafton Bridge at South Grafton
 (1) Bent Street, (2) North Coast railway, (3) Gwydir Highway, (4) Pacific Highway

- NATIONAL HIGHWAY
- STATE ROUTE
- HEAVY VEHICLE DIVERSION ROUTE
- MAJOR LOCAL ROUTE
- LOCAL ROAD
- RAILWAY





GRAFTON LEVEE SYSTEM

Source: Maps of Grafton and South Grafton Levee System from CVC website.

HYDROLOGY

Grafton is located in the lower reaches of the Clarence River catchment, within the Clarence Valley—one of the largest coastal floodplains in the country. Most of the city is situated within Council’s flood planning area (*Clarence Valley Local Environmental Plan 2011, CVLEP 2011*) and the only part of the township that is not part of the floodplain is the southern approach to Grafton Bridge, along Bent Street. Due to the large size of the river catchment upstream of Grafton (approximately 19,800m²), flooding is a major concern for the city. A series of levee banks has been constructed over time to protect both Grafton and South Grafton from the regular flooding of the Clarence River. These levee banks are a distinctive characteristic of the Clarence riverfront in Grafton and South Grafton.

2001 flood in Grafton (source: CVC website)



Grafton levee

- BUILT UP AREAS
- CLARENZA URBAN RELEASE AREA
- INDEX CONTOURS: 5m
- INTERMEDIATE CONTOURS: 1m
- LEVEE

2.2 HISTORICAL CONTEXT

European settlement of the Grafton area dates from the 1830s, with the arrival of timber-getters attracted by the plenitude of valuable timber, particularly cedar, in the region. Subsequently, the land was used for predominantly agricultural and pastoral purposes, including farming (particularly sugarcane), dairying and grazing.

The establishment of a village in Grafton in the 1850s was initially facilitated by the development of wharves in the area to transport goods from the rural hinterland to the coast. Wharves and a shipyard had been established in what is now the Grafton riverfront by the early 1840s. Shipbuilding continued to be the major local industry until the end of the century, when the railways became the primary means of internal goods transport.

Grafton expanded rapidly in the 1860s and 1870s, aided by its strategic location on the main coastal road, the break-up of large pastoral properties and the discovery of gold nearby. The town soon became the major urban settlement on the Clarence River and the commercial focus for an extensive agricultural and pastoral district. Grafton was proclaimed a city in 1885, and in 1897 South Grafton became a separate municipality. The two towns were not amalgamated until 1957.

The existing Grafton Bridge was completed and opened to traffic in 1932. Prior to this, Grafton and South Grafton were connected by a punt service across the Clarence River.



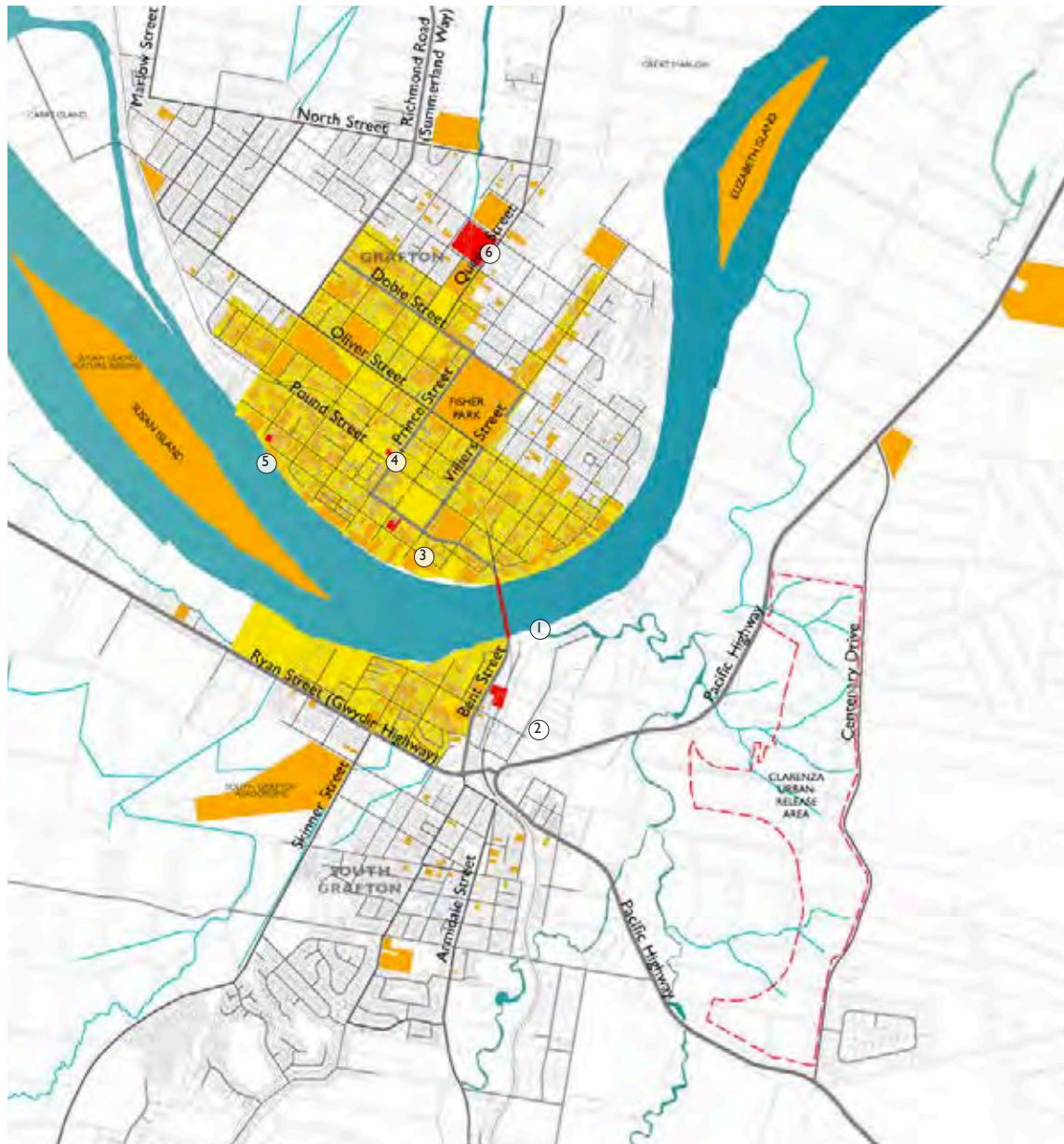
Top left: Punt service on the Clarence River at Grafton (photo: John Henry Harvey; image held at State Library of Victoria)

Left: View along Prince Street to the Clarence River; c.1940 (source: Clarence River Historical Society, published in: Clarence Valley Council 2007, *A thematic History of the City of Grafton*)



Top: View of Grafton Bridge with the bascule span open. (Source: Clarence Valley Council 2007, *A thematic History of the City of Grafton*)

Above: Aerial view of Grafton, 1946 (source: National Archives of Australia: A1200, L6168)



HERITAGE LISTED ITEMS



Source: CVLEP 2011.

2.3 HERITAGE LISTED ITEMS

The *Grafton Local Environment Plan 1988* lists a number of heritage items within Grafton and South Grafton, including all heritage items listed on the State Heritage Register; (SHR) a number of items that are listed on the *North Coast Regional Environmental Plan (REP)*, and the majority of items proposed for listing by the *Community Based Heritage Study* (Gardiner 2010). On the recommendation of the *Community Based Heritage Study*, the heritage conservation area listed in the LEP (1988) was substantially modified in June 2011. It is now divided into the Grafton and South Grafton Urban Conservation Areas, and its boundaries have been considerably expanded in Grafton and less so in South Grafton. This has been updated based on the recently adopted CVLEP 2011.

The adjacent map shows the heritage items and heritage conservation areas listed under the current *Grafton Local Environment Plan 1988*, including those listed on the State Heritage Register. Grafton Bridge is one of the items listed on the SHR. It is a steel truss structure with a bascule span that would lift to allow river traffic to pass below. The bascule span is no longer in use. The double-deck road/rail design of Grafton Bridge is one of its key distinguishing characteristics, and it is the only one of its type in NSW.

Detailed discussion of the heritage issues is provided in the separate specialist *Non-Aboriginal Heritage Technical Paper* (Biosis 2012) that forms part of the *Route Options Development Report* for this project.

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> ■ STATE SIGNIFICANT HERITAGE ITEM ■ LOCALLY SIGNIFICANT HERITAGE ITEM ■ HERITAGE CONSERVATION AREAS | <p>STATE SIGNIFICANCE HERITAGE ITEMS</p> <ol style="list-style-type: none"> 1. GRAFTON BRIDGE 2. GRAFTON CITY RAILWAY STATION GROUP 3. CATHEDRAL CHURCH OF CHRIST THE KING 4. SARATON THEATRE 5. 'ARCOLA' GROUP 6. GRAFTON GAOL |
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1954 AERIAL PHOTOGRAPH
(source: NSW Land & Property Information)

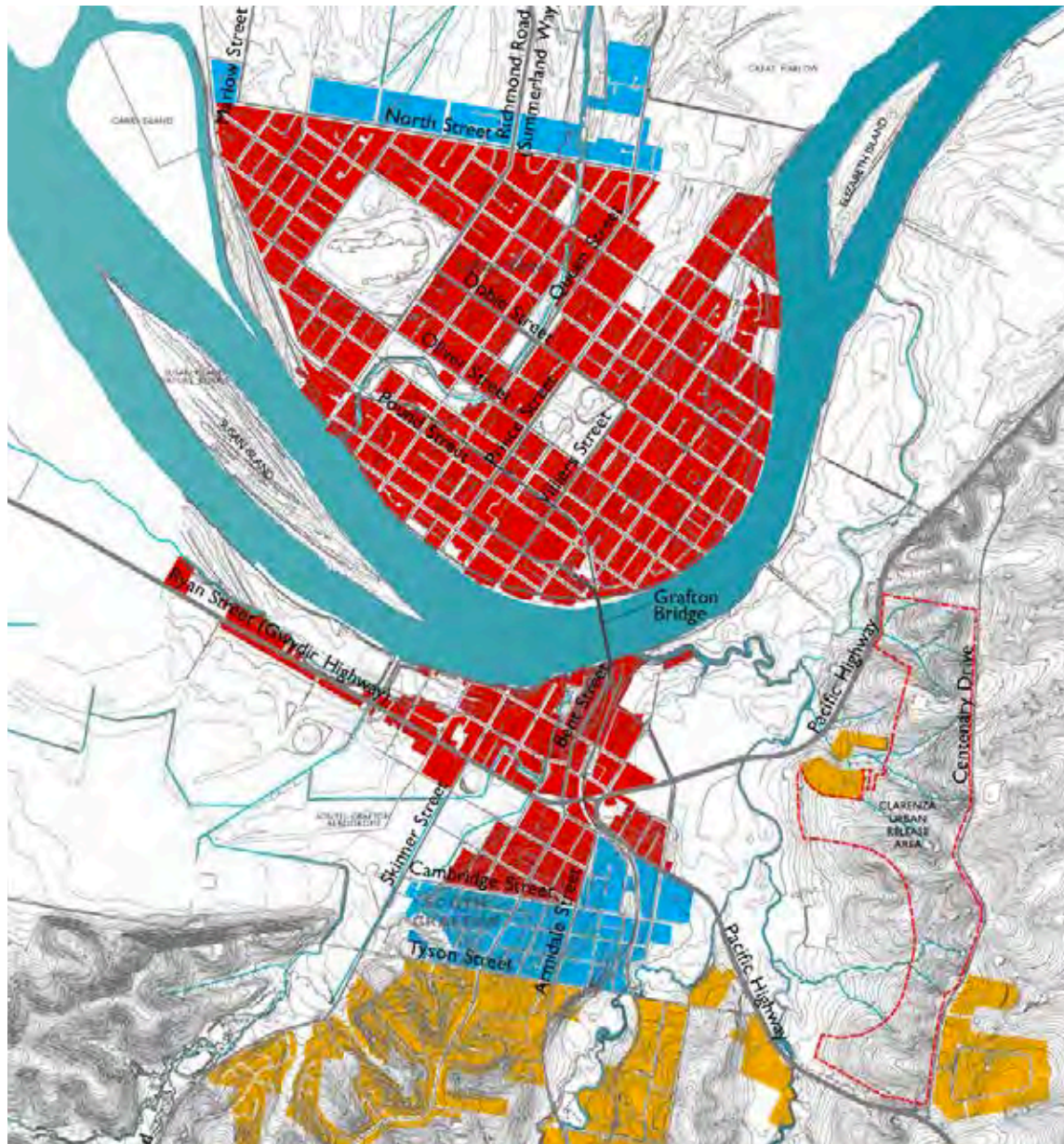
URBAN GROWTH OF GRAFTON



1978 AERIAL PHOTOGRAPH
(source: NSW Land & Property Information)



2010 AERIAL PHOTOGRAPH
(source: NSW Land & Property Information)



URBAN PATTERNS



Source: CVLEP 2011.

2.4 URBAN FORM

The two original urban settlements of Grafton and South Grafton are located on either side of the Clarence River, on the floodplain immediately adjacent to the river. The two towns were laid out with a regular square grid pattern of streets. However, although the proportions of the Grafton and South Grafton grids are essentially identical, their orientations differ slightly.

North of the river, the grid is a defining characteristic of the urban experience. With few exceptions, the urban area of Grafton conforms to the historical grid. Where the geometry of the grid is interrupted, for example at the road and rail viaduct approaches to the bridge, the effect is immediately apparent and is perceived in dramatic contrast to the uniform regularity of the grid.

South of the river, the historical grid is much less prevalent. Only the older parts of South Grafton, those areas closest to the river, are laid out on the original grid. The historical grid terminates at Cambridge Street, which cuts across the old grid and establishes a new, less regular, street grid to its south. South of Tyson Street, the grid geometry disappears altogether as the newer areas of South Grafton extend onto higher ground and an irregular street pattern of looping roads and cul-de-sacs prevails. While the Gwydir Highway conforms to the local urban patterns, being aligned with the historical grid, the other regional infrastructural elements in south Grafton—the railway line, the Pacific Highway and Bent Street (Summerland Way)—have their own individual geometries that cut across the local grain.

- ORIGINAL (HISTORICAL) GRID
- LATER URBAN GRID
- IRREGULAR DEVELOPMENT PATTERN ON HIGHER GROUND
- CLARENZA URBAN RELEASE AREA
- INDEX CONTOURS: 5m
- INTERMEDIATE CONTOURS: 1m

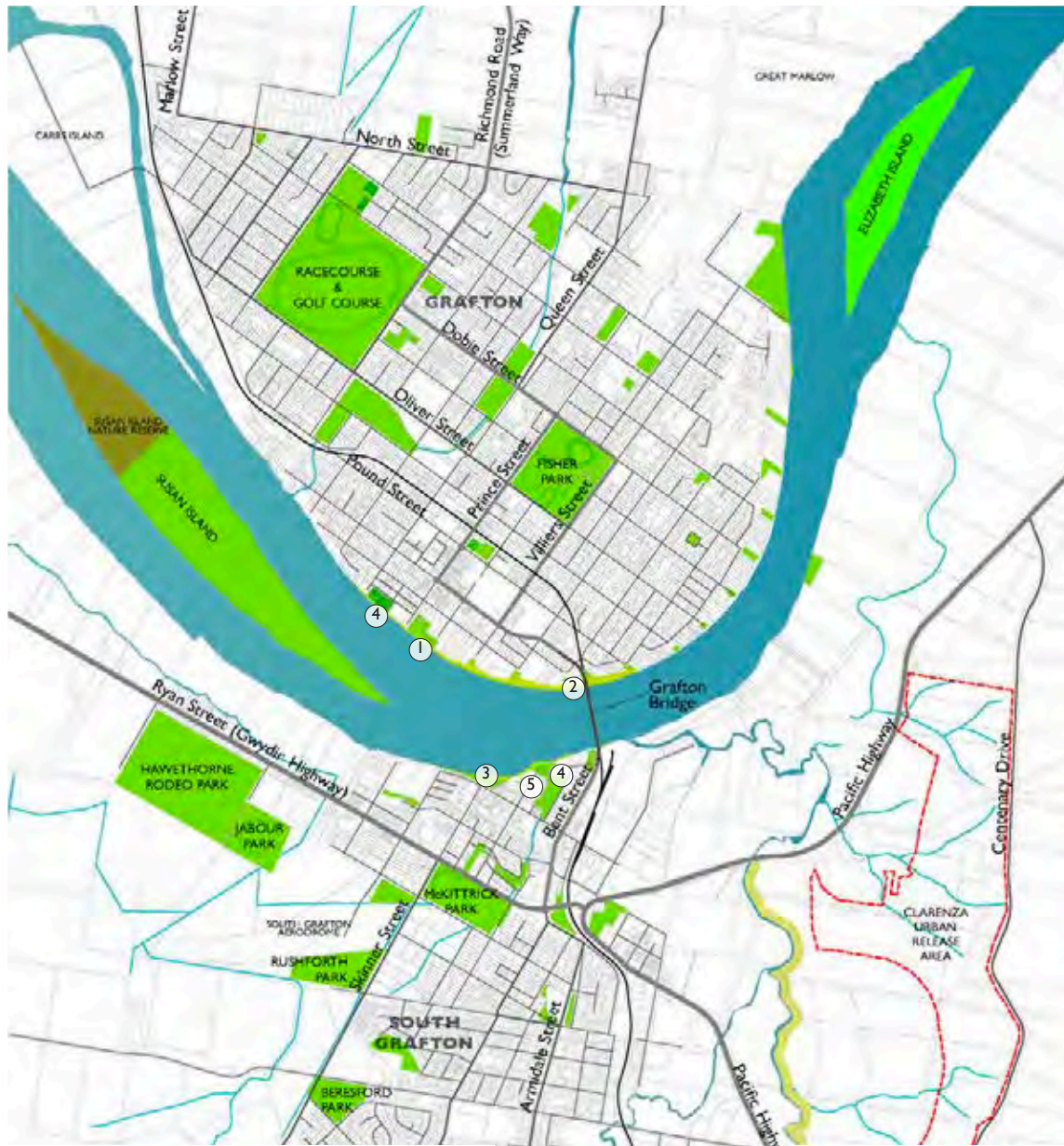
2.5 TWO TOWN CENTRES

North of the river, Grafton has a clearly defined urban core with the primary commercial activities centred along the traditional main street of Prince Street. Running perpendicular to Prince Street, Victoria Street is Grafton's civic street, where much of the town's administrative and institutional activities are concentrated. Highway-related businesses are located along Fitzroy Street, which also runs perpendicular to Prince Street to bring traffic (and hence passing trade) off the bridge in to the main commercial street. While the recently developed Grafton Shopping World, located on Fitzroy Street, has shifted some of the commercial and retail focus away from the 'main street' environment (Prince Street) to an internalised shopping mall, its close proximity to Prince Street has helped to keep the town centre intact.

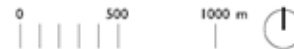
South of the river, South Grafton also has a historical main street—Skinner Street. Like Prince Street north of the river, Skinner Street provides a strong, direct, connection to the river and public open spaces along the foreshore. However, in contrast to the cohesive town centre north of the river, South Grafton's town centre has been fractured by successive developments that have eroded the commercial—and hence to a certain extent, civic—relevance of the historical main street. The siting of the current bridge crossing outside of town had the effect of disconnecting South Grafton's main street from the regional transport network. This is likely to have contributed, at least in part, to the gradual decline of South Grafton's town centre. While Fitzroy Street brings traffic off the bridge directly into Prince Street in Grafton, its counterpart in South Grafton—Bent Street—parallels Skinner Street and allows potential passing trade to bypass the main street. The subsequent development of highway commercial and retail businesses—as well as light industrial activities—along Bent Street and the Pacific Highway has shifted South Grafton's commercial focus from the historical main street to the highway environment.



Source: SMM 2012



OPEN SPACE & RECREATION



Source: CVLEP 2011.

2.6 OPEN SPACE AND RECREATION

Both Grafton and South Grafton are well served by recreational public open spaces. In addition to their public parks, both town centres are directly connected to the Clarence River and the recreational opportunities it affords. The primary public riverfront spaces on both sides of the river are located between the existing bridge and Susan Island, and this section of the river is highly valued as the focus of water-based recreational activities and public events.

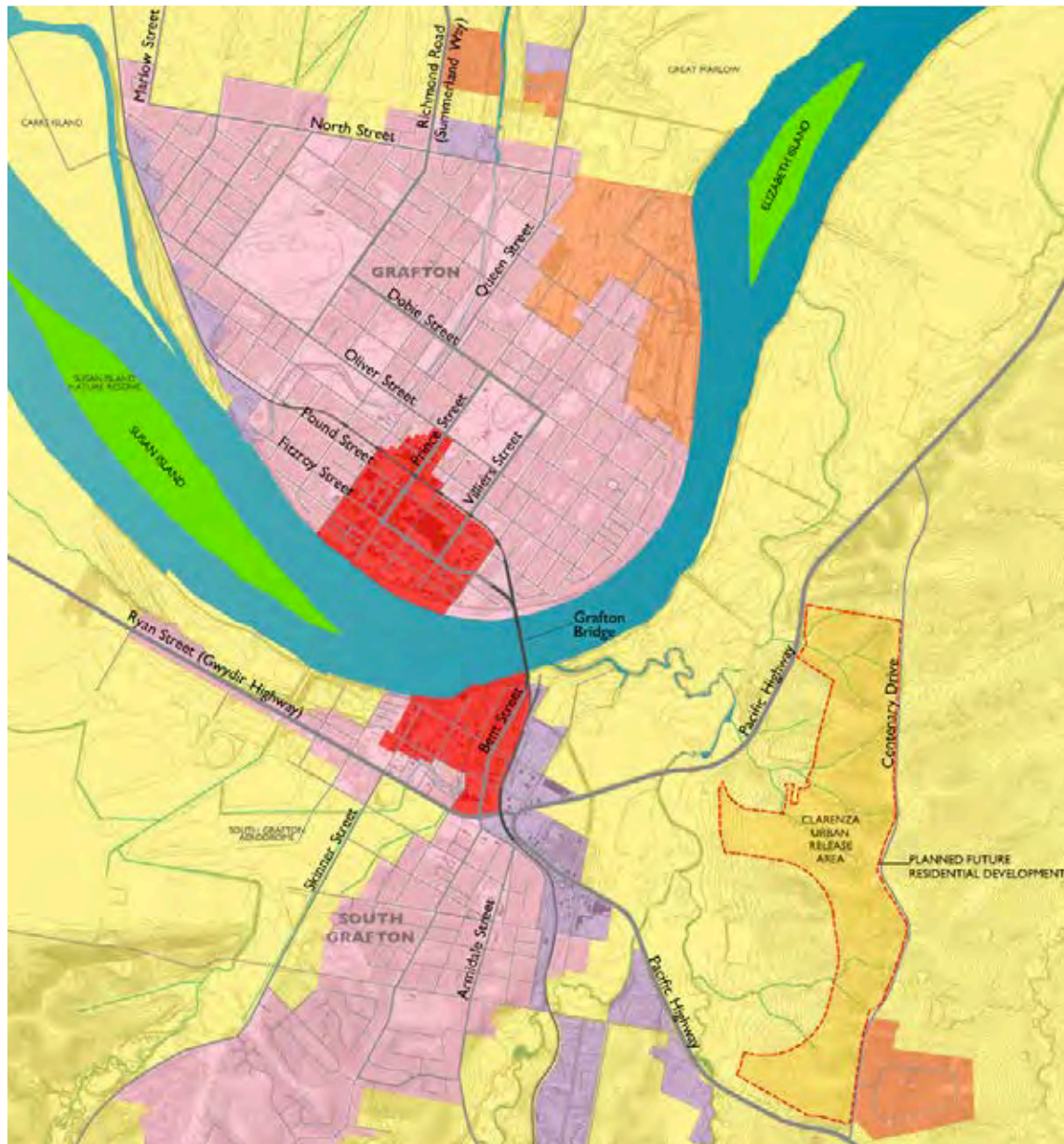
The public waterfront on the southern side of the river includes the wharf at Skinner Street, and the bowling club and Ex-Servicemen's Club at Wharf Street. The public waterfront on the northern side of the river incorporates a number of recreational facilities, including a jetty, boat ramp and rowing club at Prince Street and the sailing club at Fitzroy Street. This part of the riverfront also includes a substantial amount of privately-owned land, situated between residential and church properties along Victoria Street and the river. Council's *Grafton Waterfront Precinct Masterplan* (March 2011) aims to develop continuous public access along the foreshore between Clarence Street and Queen Street, to improve the public recreational amenity of this stretch of the river.



Public boat launch, Grafton.

- | | | | |
|--|-------------------------------------|--|------------------------------------|
| | RIVERFRONT OPEN SPACE | | |
| | ZONED PUBLIC OPEN SPACE | | |
| | RE1 PUBLIC RECREATION | | WATERFRONT RECREATIONAL FACILITIES |
| | RE2 PRIVATE RECREATION | | 1. ROWING CLUB |
| | E1 NATIONAL PARKS & NATURE RESERVES | | 2. SAILING CLUB |
| | E2 ENVIRONMENTAL CONSERVATION | | 3. SKINNER STREET WHARF |
| | E3 ENVIRONMENTAL MANAGEMENT | | 4. BOWLING CLUB |
| | | | 5. EX-SERVICEMEN'S CLUB |

3 LANDSCAPE AND URBAN VALUES



LOCAL CHARACTER

Source: SMM 2012

3.1 EXISTING LANDSCAPE CHARACTER

There are a number of distinct landscape character types in Grafton, each distinguished by its particular combination of land use, topography and built form. The relationship between these landscape character types is an important aspect of the urban experience of the town.

Based on site assessment and desktop review, the primary landscape character types in Grafton are:

- The two town centres of Grafton and South Grafton, which form the civic and commercial urban cores on either side of the river.
- The established residential areas immediately connected to the town centres, with housing stock of varying ages.
- Newly developing residential areas on the outskirts of town, and the Clarenza Urban Release Area (as defined by CVLEP 2011).
- Industrial areas, generally situated along primary regional transport routes and on the outskirts of town.
- The rural hinterland, consisting of low-lying river floodplain and rolling hills, with intermittent buildings in the landscape.
- Elizabeth Island and Susan Island, two large undeveloped islands in the river, which are significant landmarks for the town.
- The Clarence River itself.



3.2 TOWN CENTRE CHARACTER

GRAFTON AND SOUTH GRAFTON

A defining characteristic of the two town centres of Grafton and South Grafton is their physical separation by the Clarence River. As previously discussed, both town centres were originally laid out on a square grid, with strong connections between the main commercial streets and the river itself. The relationships between Clarence River, the urban form created by the grid and the transport infrastructure of highway and railway have established the key distinguishing features of the urban landscape character of the town centres. These are:

- The experience of infrastructure in the town centres.
- The wide gracious streets in the town centres.
- The town centres' connection to the Clarence River.



Top images: Grafton town centre.
Above and right: South Grafton town centre.



Road viaduct, Grafton.



Railway viaduct, Grafton with road viaduct & Grafton Bridge beyond.



Railway bridge over local road, Grafton.



Railway embankment, Grafton.



INFRASTRUCTURAL ELEMENTS



Source: CVC & SMM 2012

THE EXPERIENCE OF INFRASTRUCTURE

The prevalence of transport infrastructure elements in the urban landscape is a defining aspect of the city's urban character. This is particularly the case north of the river in Grafton, where the low-lying land at the river's edge has necessitated the use of viaduct (bridge) structures to elevate both the road and railway approaches to Grafton. The long viaduct structures at the river's edge are a distinctive and memorable part of Grafton's urban landscape.

The corridor of elevated railway between Bacon Street and Pound Street is also a distinctive characteristic of Grafton's urban landscape. The railway line is elevated on a high embankment that parallels the street grid, forming a physical barrier that generally defines the extent of Grafton's commercial core. Where the railway embankment intersects the local street grid, railway bridges provide permeability for vehicular and pedestrian movement below. These railway bridges are a distinctive component of the experience of Grafton's local streets, creating memorable thresholds between the town centre and the outlying residential areas.

While the visual and physical presence of transport infrastructure is a dominant quality of Grafton's urban character north of the river, it is not a defining characteristic of South Grafton. This is because, unlike the area north of the river, the topography in South Grafton has enabled both Bent Street and the railway line to remain on natural ground as they approach the bridge crossing. The only piece of elevated infrastructure in South Grafton is the curving railway viaduct over the Gwydir Highway, which creates a memorable landmark at the highway entry to town.

VIADUCTS & BRIDGES



Railway viaduct, South Grafton.

WIDE, GRACIOUS STREETS

The two town centres at Grafton and South Grafton have a distinctive character that has been directly influenced by the proportions of the historical urban grid. The historical grid has created the wide, generously scaled, light-filled streets and the long avenue vistas that characterise the urban experience of the town centres. Extensive avenue tree plantings enhance the landscape character of the streets and are highly valued aspects of the town centres' urban character.

Integral to Grafton's identity as a genteel provincial centre are its wide, gracious tree-lined streets. Grafton's Jacaranda Festival, held annually in late spring, centres on the visual spectacle provided by hundreds of jacaranda street trees (*Jacaranda mimosifolia*) in full bloom. Inaugurated in 1935, Grafton's festival is the country's longest-running floral festival, and is a source of great civic pride for the city. Although Grafton is renowned as the 'Jacaranda City', the jacarandas are primarily concentrated along Pound Street, Turf Street, Dobie Street and a short section of Prince Street. Grafton's other streets are lined with many other types of trees, predominantly tropical or sub-tropical species, that make a significant contribution to the stately character of the city's streets. Of particular note are the large fig trees found in and around the civic centre (Victoria Street), and the fig avenue in Breimba Street.

While the character of South Grafton's streets does not figure as prominently in the popular perception of the city, the streets in the town centre nonetheless possess a genteel character, lined with trees and Victorian buildings, that are similar to that of Grafton's streets.



WIDE, GRACIOUS STREETS AT THE TWO TOWN CENTRES

- STREET TREES
- PUBLIC PARKS
- RIVERFRONT PUBLIC SPACE



Source: CVC & SMM 2012



Victoria Street, Grafton



Skinner Street, South Grafton



Fig-lined avenue at Breimba Street, Grafton



'MAIN STREET' CONNECTIONS TO THE CLARENCE RIVER

Source: CVC & SMM 2012

CONNECTION TO THE CLARENCE RIVER

The strong connection between the main streets and the riverfront is a distinguishing characteristic of both Grafton and South Grafton's town centres. Both Prince Street and Skinner Street lead directly to the primary riverfront public spaces on either side of the Clarence River. Skinner Street also leads directly to the section of the river between Susan Island and Grafton Bridge, which is the primary recreational and special event space for the city.

East (downstream) of Grafton Bridge, the relationship between the city and the river has a much less public focus. Residential properties occupy much of the river's northern frontage and public access is limited to the ends of the streets that lead down to the river. On the southern side of the river, the area east of the bridge is occupied by private agricultural land.



Clarence riverfront at Prince Street, Grafton.



Clarence riverfront at Skinner Street, South Grafton.

3.3 ESTABLISHED RESIDENTIAL AREAS

The established urban residential areas of Grafton and South Grafton are directly connected to the two town centres. The urban and landscape character of these areas is defined by the pattern of the street layouts and the combination of building types, planting and road formation that make up the streetscapes.

As previously discussed in section 2.4 – Urban form, the residential areas of Grafton are laid out according to the historical grid, while the established residential areas of South Grafton were laid out in three clearly distinguishable patterns: the older areas closer to the town centre conform to the original grid, a second grid defines the area south of Cambridge Street, while the newer areas south of Tyson Street have an irregular street pattern of looping roads and cul-de-sacs.

The housing stock in the established residential areas vary in age, with the older homes generally located closest to the town centres, and the post-war and later homes generally located further north and south of the two town centres. The established residential areas are also generally characterised by established gardens, with front gardens visible to the street. The streets themselves generally have sealed roads with unformed edges (no kerbs) and wide grassy verges. Many are lined with mature street trees.

The overriding character of this landscape type is that of informal streets with established houses and gardens, which is in keeping with the urban character of a genteel provincial town.



Images below:
Representative residential buildings in established residential areas in Grafton and South Grafton



Images right:
Representative streetscapes in established residential areas in Grafton and South Grafton

3.4 NEWLY DEVELOPING RESIDENTIAL AREAS

On the outer edges of the established residential areas, more recent residential developments can be found. These newly developing residential areas are currently primarily concentrated in the north-east of Grafton. The Clarenza Urban Release Area, as described in the CVLEP 2011, will bring a substantial amount of new residential development to the east of South Grafton.

The character of the newly developing residential areas is distinguished by large houses that occupy much of their residential blocks, with small gardens that are often surrounded by high fences. The streets are typically laid out in looping patterns with cul-de-sacs, and the roads are sealed and typically edged with roll-top kerbs. The streetscapes are often dominated by the high, solid front fences to the houses, which creates a strong sense of separation between the houses and the street. This character is markedly different to the more informal character found in the established residential areas of Grafton and South Grafton, and is more typical of the more anonymous suburban areas found in other regional towns and cities.



This page:
Newly developing residential areas in Grafton

3.5 INDUSTRIAL AREAS

The primary areas of industrial activity in Grafton and South Grafton are generally concentrated around the regional road and rail corridors. The character of these areas is distinguished by large industrial buildings, often surrounded by large open yards. The large scale of the buildings and their associated yards is in marked contrast to the surrounding smaller-scaled residential and commercial areas of Grafton and South Grafton.

The character of the industrial buildings vary, with the newer industrial buildings typically being “big box” warehouse developments that are designed to be flexible and accommodate a range of different uses. As such, they tend to be visually homogeneous and somewhat anonymous. The older industrial buildings tend to be use-specific. As such, they tend to have a more distinctive architecture that in some cases, for example the sugar mill at South Grafton, have become prominent landmarks for the town.



Left: Sugar mill, South Grafton
Images below: Representative examples of industrial developments in Grafton and South Grafton.



3.6 THE RURAL HINTERLAND



View from elevated land along Centenary Drive, across the agricultural floodplain to the newly developing residential areas along Grafton's riverfront.

The urban areas of Grafton and South Grafton are surrounded by agricultural areas that comprise the city's rural hinterland. This landscape type has two distinctive characters—the flat open country on the floodplain immediately south of the Clarence River, which is visually exposed and connected to the river; and rolling hills as the land rises further to the south, which have a more enclosed character with long-range views to the river and town.

The rural hinterland is distinguished by the geometric layout of the agricultural fields, which establishes a regular pattern across the landscape irrespective of topography. The geometry of the property boundaries is clearly visible in the landscape through the long straight roads, the fence lines and lines of trees that follow the patterns of land division.



View from elevated land along Centenary Drive, across the agricultural floodplain to Grafton Bridge.

3.7 THE RIVER ISLANDS

Susan Island and Elizabeth Island are two large, elongated lozenge shaped islands in the Clarence River. Both islands generally have an open, undeveloped, character with scattered trees in grass. The western end of Susan Island is differentiated by dense tree cover and is a designated nature reserve under the CVLEP 2011.

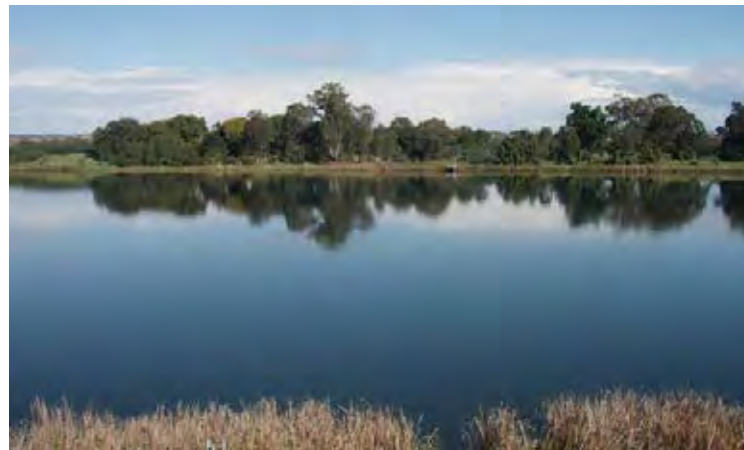
The two islands are not generally perceived as distinct islands due to their large size and their location at either side of a sharp curve in the Clarence River. Due to the geometry of the river, views to the islands from the surrounding river banks are generally oblique and are dominated by the backdrop of the wider landscape, which the islands tend to visually merge into. Similarly, the view from Grafton Bridge to Susan Island is oblique and the island visually merges with the surrounding landscape. Elizabeth Island is not visible from Grafton Bridge due to the geometry of the river.

Nonetheless, the two river islands are important components of the landscape setting for the city, and figure prominently in the popular perception of the character of the river. Due to its proximity to the two town centres, Susan Island provides a distinctive landmark at the towns' riverfronts. It forms the western boundary of the primary river recreation space for the two towns, while also being a popular public recreation space itself.

The key views of Susan Island are from the public riverfront at South Grafton, where the island can be clearly seen to be distinct from the surrounding riverbanks. The views to Susan Island from the public waterfront in Grafton are primarily perpendicular from the shore, or at an acute angle from the shore. As such the island tends to visually merge with the wider landscape background, and appears to be a part of the opposite shore.



Above:
View to Susan Island from South Grafton's public waterfront. The island is clearly distinct from the surrounding river banks.



Left:
View to Susan Island from the public waterfront near Queen Street, Grafton. The island appears to visually merge with the wider landscape.

3.8 THE CLARENCE RIVER

The Clarence River is the defining landscape feature for the city and, as previously discussed in section 2.2 – Historical context, it was the fundamental reason for the establishment of the city in this location.

The river is the dominant visual element in the local landscape. It has a distinctive character that is defined by its wide sweeping form as it winds across the flat river plain. The flat, open, topography of the local area reinforces the visual prominence of the river and its important role as the visual focus and landscape point of reference for the locality. As the only structure that crosses the river in the locality, the landmark quality of Grafton Bridge is accentuated by the exposed visual character of the river and its setting.

The river's edge is defined by the high levee banks that protect Grafton and South Grafton from periodic flooding of the river. The character of the river's edge varies throughout the study area. Between Grafton Bridge and Susan Island, boat sheds, launches, wharves and pontoons have been developed along the riverfront at both Grafton and South Grafton, which support the public recreation focus along this stretch of the river. Future implementation of Council's *Grafton Waterfront Precinct Masterplan* (Mar 2011) will see further development of this riverfront area for public recreation. East of Grafton Bridge, the riverfront has two distinct characters. The southern riverfront is defined by the open character of the agricultural floodplain, which consists of fields and scattered trees. The northern riverfront has a more developed character, with houses and gardens built along the top of the levee bank, and private moorings on the river. The concept plan for the *Masterplan* is included in Appendix A.



Agricultural floodplain along the southern riverfront east of Grafton Bridge



The public riverfront at Grafton, west of Grafton Bridge.



The public riverfront at South Grafton, west of Grafton Bridge.



Private residential properties front the northern riverfront east of Grafton Bridge.

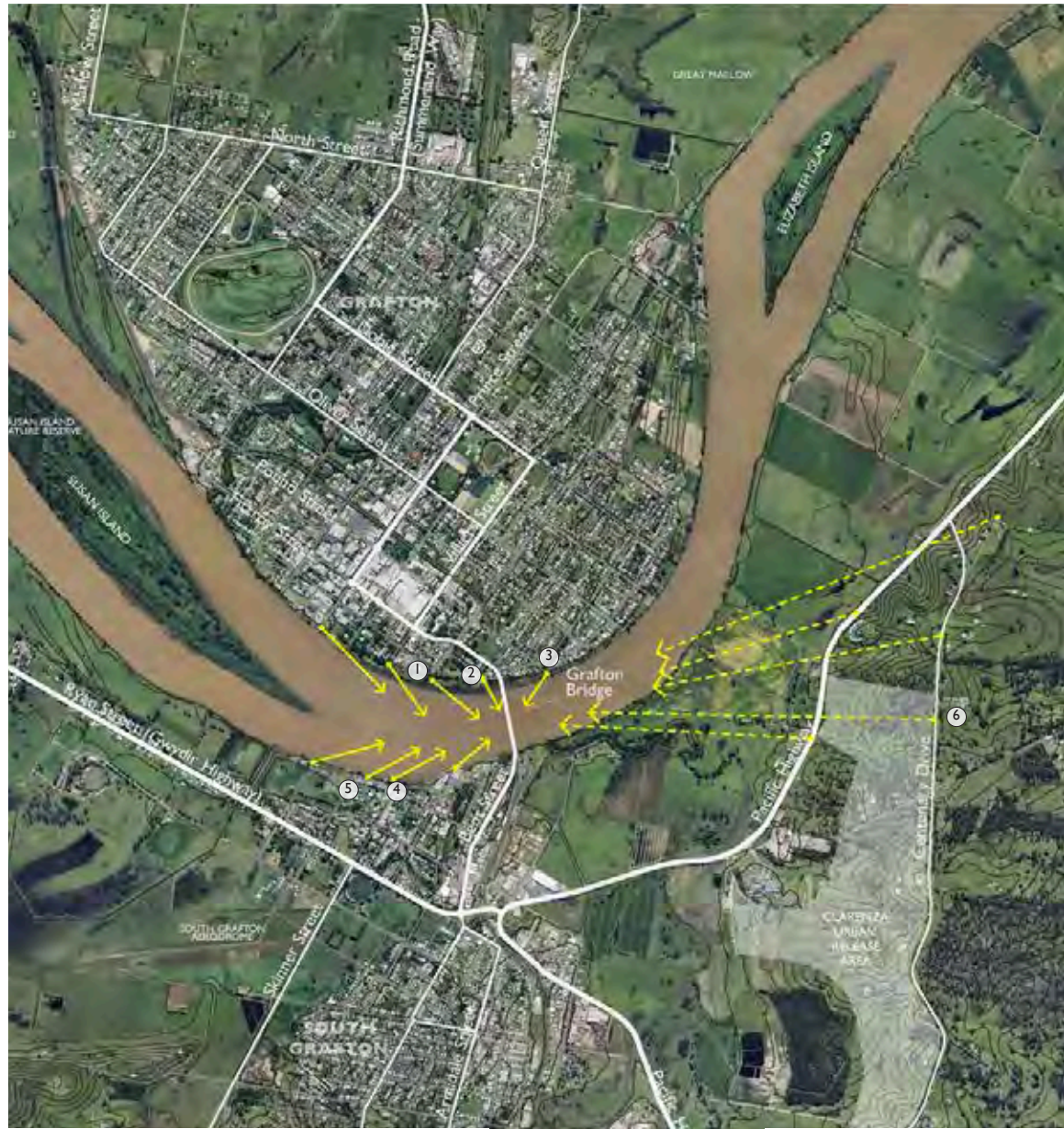
3.9 THE VISUAL SETTING OF THE EXISTING BRIDGE

VIEWS TO GRAFTON BRIDGE

The visual relationship between Grafton and the Clarence River is fundamental to the urban experience of the town. As the dominant visual feature on the river, Grafton Bridge is a key urban landmark that contributes significantly to the identity of the town. There are two primary types of views to the bridge: proximate views from the riverfront public spaces at Grafton and South Grafton, and long range views from elevated vantage points throughout the district, primarily south of the river.

VIEWS FROM GRAFTON BRIDGE

The views of the town from the bridge are also an important component of the urban experience of Grafton, providing a strong visual sense of the relationship between the town and the river. The best views from the bridge are from the two pedestrian and cyclist paths, located at the rail deck level on either side of the bridge. The views from the train are partially screened by the bridge's steel truss, and the motorists' views from the road deck level are partially obscured by the bridge parapet.



IEWS OF THE BRIDGE



Source: SMM 2012



View eastward along the Clarence River from Grafton Bridge

 PROXIMATE VIEWS TO BRIDGE
 LONG-RANGE VIEWS TO BRIDGE



1 View from Grafton levee



2 View from Fitzroy Street, at sailing club



3 View from Girl Guide Park



4 View from end of Skinner Street



5 View from Through Street



6 View from Centenary Drive, Clarenza

4 LANDSCAPE AND URBAN DESIGN ISSUES

4.1 LANDSCAPE AND URBAN DESIGN ISSUES



Aerial view from Grafton, across the Clarence River to South Grafton (source: Arup 2010).

A new crossing of the Clarence River would need to include approach roads to the new bridge from Grafton and South Grafton, as well as the design of the bridge itself. The location of the new bridge over the river would affect the possible routes for the approach roads and their relationship to the existing urban fabric—the physical structure and experience of the local streets.

This section discusses the key landscape and urban design factors that are likely to affect, or be affected by, the location of a new crossing and its approach roads in Grafton and South Grafton. The urban structure of Grafton, bisected by the Clarence River, is clearly comprised of three distinct precincts—Grafton, South Grafton and the river itself. The precincts will be discussed separately, as each presents particular landscape and urban issues in addition to those that affect the city as a whole.

The key issues discussed in this chapter are:

- City-wide issues
 - Topography and flood.
 - Dispersed activity generators.
 - Pedestrian and cyclist connectivity.
 - Historical urban fabric.
- The Clarence River
 - Visual relationship between the new bridge and the existing bridge.
 - Position of the new bridge in relation to the existing bridge.
 - Potential impact on the recreational amenity of the Clarence River.
- Grafton
 - The need for elevated infrastructure.
 - Relationship between the new approach road and the local street grid.
- South Grafton
 - Location of the approach road.
 - Utilising Bent Street.
 - Approach road to the east of Bent Street.
 - Approach road to the west of Bent Street.

4.2 CITY-WIDE ISSUES

TOPOGRAPHY AND FLOOD

The interrelationship between the flood regime of the Clarence River and the existing topography on either side of the river is a key landscape constraint that will determine the physical outcomes for a new bridge and its approach roads.

The design of a new bridge would need to address both maritime navigational requirements and provide immunity from 1 in 100 year flood levels. As such, the soffit (underside) level of any new bridge is to be above the 1 in 100 year ARI flood event to ensure that it would be trafficable during major flood events. The highest recorded flood level in Grafton was 7.834m AHD in 1890, and the most recent flood in January 2011 reached 7.61m AHD. During the 2001 flood, the Clarence River reached 7.70m AHD in Grafton.



Flood sign, South Grafton

The generally low-lying topography on either side of the river means that any approach roads to a new bridge would most likely need to be elevated above the existing ground in order to connect with the new bridge's road level. The likely issues arising from this requirement are discussed in more detail in relation to each precinct.

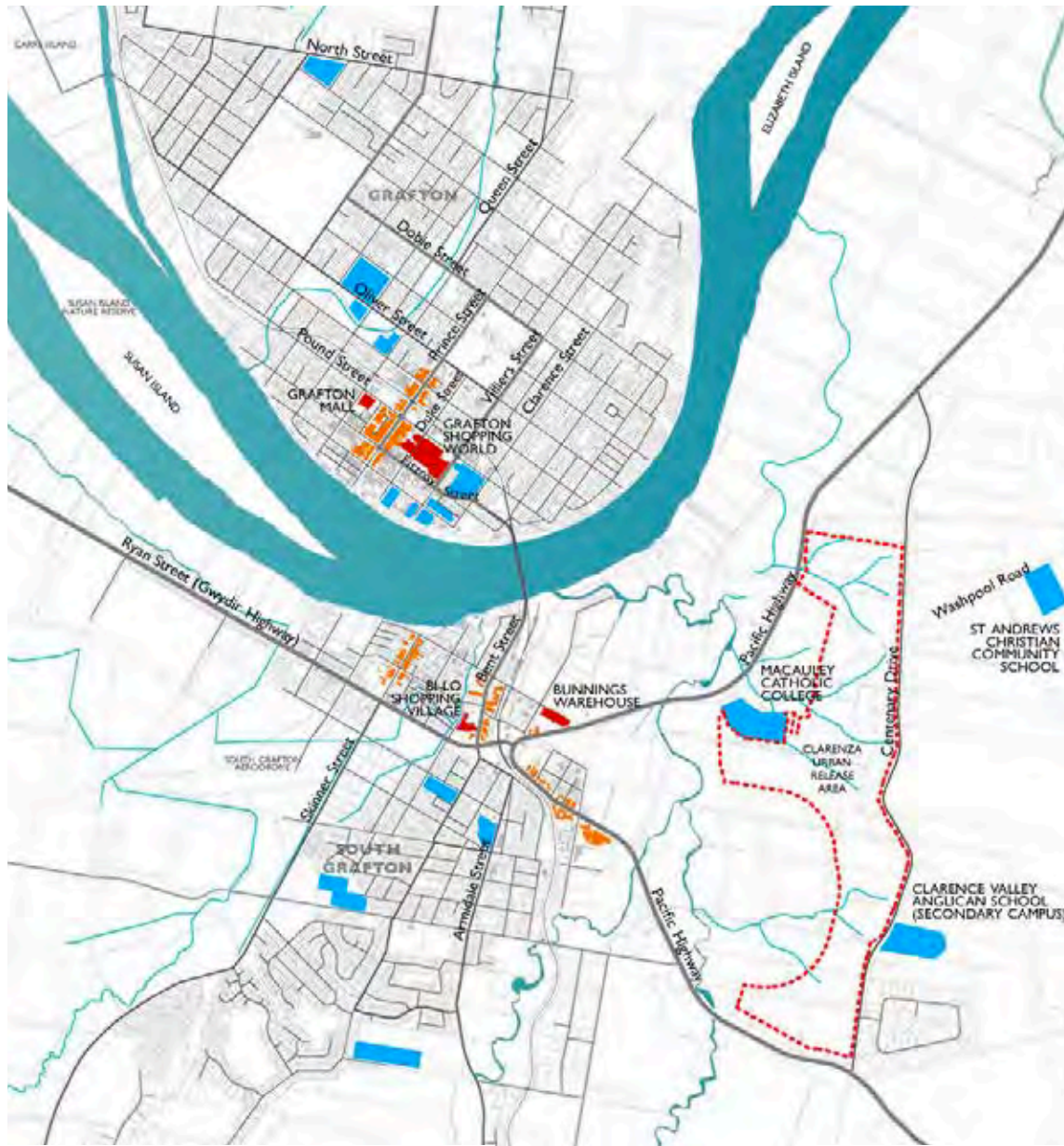
- CLARENCE RIVER
- EXTENT OF 100 YEAR ARI FLOOD (Lower Clarence River Flood Study Review, Clarence Valley Council 2004)
- CLARENZA URBAN RELEASE AREA
- INDEX CONTOURS: 5m
- INTERMEDIATE CONTOURS: 1m



FLOOD AFFECTED AREAS



Source: CVLEP 2011



ACTIVITY GENERATORS

Source: CVC & SMM 2012

DISPERSED ACTIVITY GENERATORS

The location of major commercial activity attractors on both sides of the river—particularly Grafton Shopping World to the north of the river; and bulky goods retailers such as Bunnings Warehouse to the south of the river—has resulted in dispersed urban activity and generation of substantial vehicular traffic across the existing Grafton Bridge. Additionally, the development of large school campuses at the newly developing urban release area at Clarenza also generates substantial vehicular traffic across the bridge on school days.

RMS's 2011 *Heavy Vehicle Study* found that 97% of the traffic currently using Grafton Bridge is local traffic, with an origin and/or destination in Grafton or South Grafton. The other 3% of vehicles comprises regional traffic passing through to other destinations.

The predominantly local nature of the traffic using the current bridge, and presumably any future bridge, should be taken into account when determining the route of the new river crossing. Particular consideration should be given to the new route's relationship to the town centres and network of local streets in both Grafton and South Grafton.

PEDESTRIAN AND CYCLIST CONNECTIVITY






The existing Grafton Bridge currently provides the only pedestrian and cyclist connection between Grafton and South Grafton. The location of the bridge outside of the town centres reinforces the sense of separation between Grafton and South Grafton's town centres, particularly for pedestrians and cyclists.

The most direct route between Skinner Street, South Grafton's main street, and the bridge is approximately 1000m. Based on an average pedestrian walking speed of 4km per hour, this would be about a 15 minute walk. In Grafton, the most direct route between Prince Street and the bridge is approximately 970m — close to 15 minutes' walk. Including the bridge, the most direct route between the main streets is about 2.3km, about a 35 minute walk.

Pedestrian and cyclist access across the Clarence River is currently provided by the shared paths on either side of Grafton Bridge. In South Grafton, a shared pedestrian and cyclist path continues along the western side of the railway corridor and terminates at the railway station. There are currently no formal provisions for pedestrians and cyclists between South Grafton and Clarenza. The *Clarenza Cycleways Option Study (2012)* recommends the development of a new shared pedestrian and cyclist path between South Grafton and Clarenza. The recommended route would start at the end of the existing shared path at the railway station, travel to the Pacific Highway via Crisp Avenue and Spring Street, cross the Highway and South Grafton levee and then continue on to Hennessey Drive in Clarenza along the southern side of the Highway.



Shared path on Grafton Bridge

-  MAIN (COMMERCIAL) STREET
-  CONNECTION TO RIVER
-  PEDESTRIAN ROUTE BETWEEN MAIN STREET AND BRIDGE
-  EXISTING SHARED PEDESTRIAN AND CYCLIST ROUTE ACROSS BRIDGE
-  PROPOSED SHARED PEDESTRIAN AND CYCLIST ROUTE TO CLARENZA



PEDESTRIAN & CYCLIST CONNECTIVITY

Source: CVLEP 2011 & SMM 2012

4.3 THE CLARENCE RIVER



VISUAL RELATIONSHIP BETWEEN A NEW BRIDGE AND THE EXISTING BRIDGE

The visual dominance of the existing bridge on the wide, flat, river floodplain—especially when viewed from key vantage points in Grafton and South Grafton—is an essential component of the city's urban identity. As such, a key consideration for the design of a new bridge would be its visual relationship to the existing bridge, and this relationship would be governed by the two bridges' physical proximity to one another.

The closer a new bridge is located to the existing bridge, the more closely related the two bridges should be in terms of scale and proportion, in order to ensure that the new bridge does not adversely affect the character of the existing bridge in its setting. If a new bridge is located further away from the existing bridge, it would be perceived as its own separate entity and, as such, could potentially have its own distinct visual expression.

POSITION OF A NEW BRIDGE IN RELATION TO THE EXISTING BRIDGE

The primary public viewing points to the existing bridge are from the public riverfront spaces to its west. As such, the western elevation of the bridge is more sensitive to visual changes than its eastern elevation, which is viewed primarily from private residences and agricultural land.

Top right:
View of Grafton Bridge from the east,
at Girl Guide Park.

Right:
View of Grafton Bridge from the west,
at Skinner Street wharf.

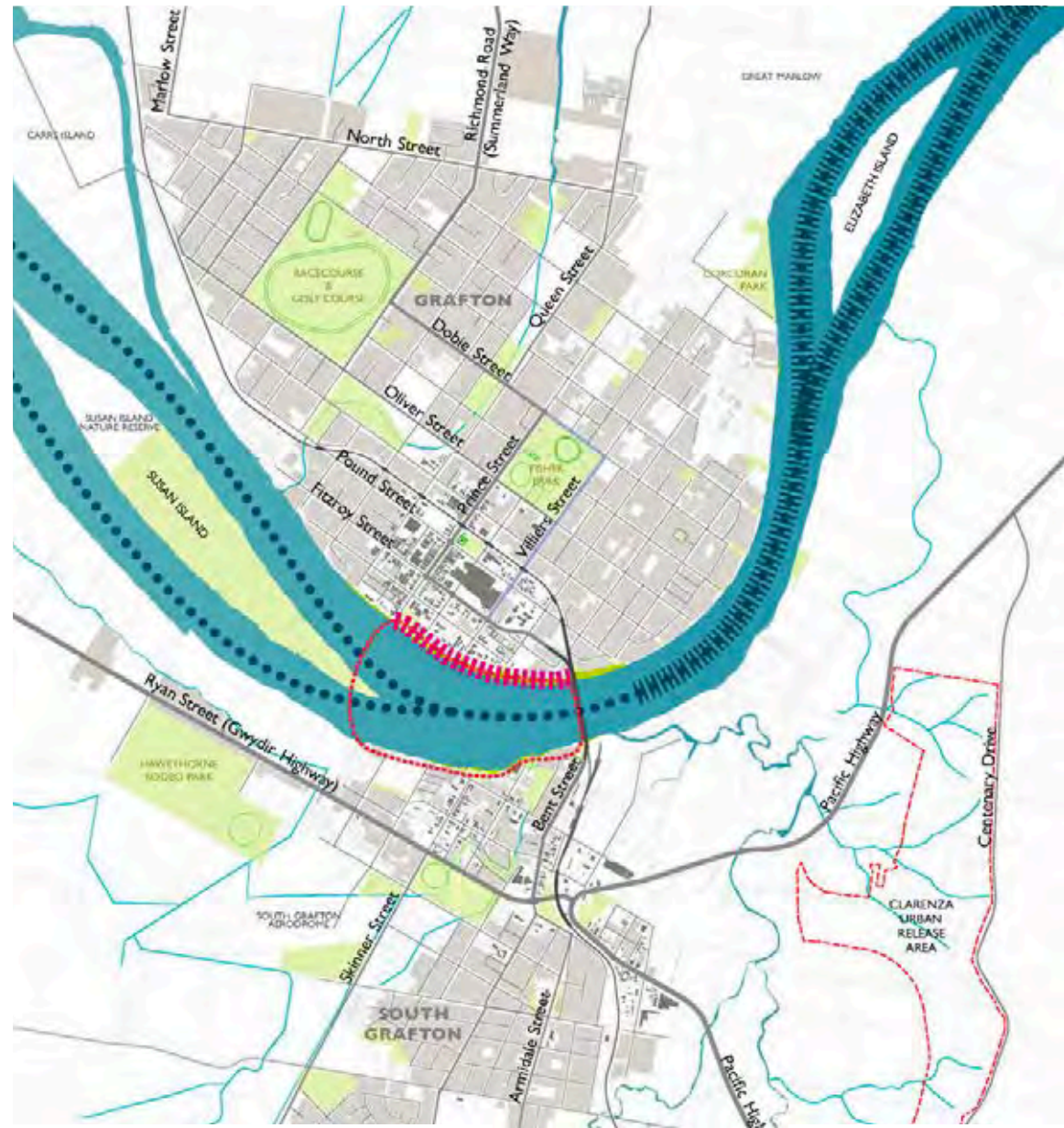
POTENTIAL IMPACT ON THE RECREATIONAL AMENITY OF THE CLARENCE RIVER

The development of a new bridge could potentially affect the recreational amenity of the river, regardless of which side of the existing bridge it is to be located.

To the west of the existing bridge, the stretch of river up to Susan Island is the primary location for river-related town festivals and sporting events. Activities include: water skiing, including the famous Bridge to Bridge Ski Race held annually in October; rowing, including the Clarence Schools Head of the River Regatta; wakeboarding; dragon boat racing; sailing; and fishing. Furthermore, Council's *Grafton Waterfront Precinct Masterplan* (Mar 2011) aims to further develop the public recreational amenity of the riverfront between the existing bridge and Susan Island. The concept plan for the *Masterplan* is included in Appendix A.

The recreational amenity of the river to the east of the existing bridge has a more private focus, with the residential properties fronting the river having moorings along the northern banks. Due to current navigational clearances, boats with a total height greater than 8.5m, are limited to the stretch of river east (downstream) of the existing bridge. If the current recreational amenity of this stretch of the river is to be maintained, the height of any new bridge in this area would need to allow for the passage of boats, which NSW Maritime indicate is 9.1m above Mean High Water Springs upstream of Pound Street and 17m above Mean High Water Springs downstream of Pound Street.

- PUBLIC PARK
- GRAFTON WATERFRONT PRECINCT
- PRIMARY RIVER RECREATION SPACE
- NSW MARITIME NAVIGABLE CHANNEL
- EXTENT OF RIVER NAVIGABLE BY BOATS WITH A TOTAL HEIGHT GREATER THAN 8.5m



PRIMARY RIVER RECREATION SPACE



Source: CVLEP 2011, NSW Maritime & Grafton Waterfront Precinct Masterplan (Mar 2011).

4.4 GRAFTON



Aerial view of Grafton, showing existing road and rail viaducts over low-lying land (source: Arup 2010).

THE NEED FOR ELEVATED INFRASTRUCTURE

Topographic constraints are a major physical factor in the selection of a preferred route alignment north of the river. This is because the existing landform adjacent to the river is uniformly low-lying. As such, the level difference between the required bridge height (due to flooding and navigational requirements) and the existing ground would necessitate any approach road to an additional bridge to be elevated.

The likely options for elevating an approach road would be bridge structure (viaduct), retaining wall or embankment. Elevating an approach road on viaduct creates the potential for a complementary relationship with the existing language of infrastructure elements in Grafton—in particular the road and rail viaduct approaches to the existing bridge. However, depending on the length of elevated road required, the viaduct option may be cost-prohibitive. Retaining walls and embankments would be more cost-effective than viaducts, but would form large solid structures that would have a significant visual and physical impact on the urban character of Grafton. In particular, retaining walls would introduce a new language of major structures in the town. Both retaining walls and embankments are visually and physically less permeable than viaducts, creating visually divisive elements in the town's urban fabric.

Furthermore, depending on their location, any new elevated roads in Grafton would most likely be on viaduct due to flooding impacts and the need to allow for the dispersal of flood water.

RELATIONSHIP BETWEEN THE NEW APPROACH ROAD AND THE LOCAL STREET GRID

Depending on the location of a new bridge crossing, the approach road may need to cut across the local street grid in order to connect back into Grafton's road network. The potential consequences of cutting across the grid include: impact on existing properties, which may need to be resumed; the creation of awkwardly shaped remnant blocks; and the introduction of larger-scaled intersections where the new road meets the grid at an angle. These types of changes would have a direct impact on the character of the neighbourhoods immediately adjacent to the river that are likely to be affected by a new approach road. The extent of the disruption to the street grid would depend on the location of an additional bridge crossing, and where the approach road can connect back into the existing road network.



Left: Relationship of the existing approach road viaduct and railway viaduct to the local street grid in Grafton (Source: Arup 2010).



Right: View south along Bent Street.

Left: Approach to existing bridge along Bent Street, South Grafton (Source: Arup 2010).

4.5 SOUTH GRAFTON

LOCATION OF THE APPROACH ROAD

The location of an approach road to an additional bridge crossing has the potential to have a significant impact on the civic and commercial functions of South Grafton's town centre. Currently, the approach to Grafton Bridge is along Bent Street. Running parallel to Skinner Street, Bent Street allows traffic and passing trade to very effectively bypass South Grafton's traditional centre. This has contributed to the declining commercial relevance and civic profile of South Grafton's town centre in relation to Grafton's town centre. Depending on the location of an additional bridge crossing, there are three likely scenarios for the location of the approach road through South Grafton: utilising the existing approach route of Bent Street; or utilising a new approach route either to the east or west of Bent Street.

UTILISING BENT STREET

The advantage of Bent Street as the approach road to any bridge crossing is that it follows a natural ridge of elevated land, which eliminates the need to artificially elevate the approach road to meet the required level of the bridge crossing. However, this option would need to consider the impact of placing additional traffic onto Bent Street, which already experiences problems with traffic congestion. Furthermore, utilising Bent Street as the approach road for both bridges would only reinforce the isolated, 'offline', nature of Skinner Street and South Grafton's town centre.



APPROACH ROAD TO THE EAST OF BENT STREET

If an additional bridge were to be located to the east of the existing bridge, there is an opportunity to provide a separate new approach road to the east of the railway line.

An advantage of this option is that it would provide an alternative route in South Grafton for traffic wishing to cross the river, thereby relieving some of the existing pressures on Bent Street. Furthermore, the route of the new approach road would be through a light industrial area (immediately east of Bent Street), or the agricultural floodplain, which stretches east from the industrial area to downstream of Elizabeth Island. The landscape and urban character of these areas is less likely to be adversely affected by the introduction of new through traffic than the areas in and around South Grafton's town centre. Any new approach road and bridge to the east of the existing bridge would also provide a more direct river crossing for the future constituents of the Clarenza Urban Release Area, located to the east of South Grafton.

One disadvantage of an approach road to the east of the railway line is that it would be located on the low-lying river floodplain, which would require it to be elevated to both meet the required bridge level and ensure that it is trafficable during flood periods. The bridge may also need to be further elevated to ensure minimum maritime navigational clearance is maintained along this stretch of the river.

In particular, any new approach road located to the east of Bent Street would divert passing traffic and trade even further away from South Grafton's town centre, and this would most likely exacerbate the current problem of the town centre's low commercial and civic profile.



Above: Aerial photograph showing agricultural floodplain and light industry to the east of Bent Street, South Grafton. The town centre west of Bent Street is in the background (Source: Arup 2010).



Above: Aerial photograph showing South Grafton's town centre to the west of Bent Street. The light industrial area and agricultural floodplain east of Bent Street is in the background (Source: Arup 2010).

APPROACH ROAD TO THE WEST OF BENT STREET

Conversely, providing a separate new approach road to the west of Bent Street could assist in revitalising South Grafton's town centre, as it would bring passing traffic closer to Skinner Street. This could potentially increase Skinner Street's commercial exposure and consequently, its civic relevance. This option would also relieve some of the existing pressures on Bent Street by providing an alternative route in South Grafton for traffic wishing to cross the river:

The potential benefits for South Grafton's civic and commercial profile would be greater if the new approach road were located close to the existing town centre. The potential benefit would be less if the approach road were situated further west of the town centre (toward Susan Island), as passing traffic would bypass the town centre.

As the land to the west of Bent Street is low-lying, any approach road would need to be elevated above existing ground in order to meet the required bridge crossing level. An elevated road would introduce a substantial change to South Grafton's urban character, as there are presently no such elevated structures in the vicinity of the town centre and riverfront in South Grafton.

5 A UNIQUE OPPORTUNITY



Aerial view from South Grafton across the Clarence River to Grafton (Source: Arup 2010).

The provision of an additional bridge crossing at Grafton has the potential to do more than just improve the flow of vehicular traffic across the river. A new bridge crossing of the Clarence River presents a unique opportunity to direct the future urban growth of the City of Grafton.

The location of the existing bridge has caused the Summerland Way to bypass South Grafton, which has contributed, at least in part, to a decline in South Grafton's civic and commercial prominence in relation to Grafton, which remains connected to the regional route. This problem could potentially be redressed through the strategic siting of the additional crossing and its approach road closer to South Grafton's town centre.

The long distances from the current bridge to the two town centres has resulted in long, indirect, pedestrian and cyclist connections between South Grafton and Grafton, which reinforces the sense of separation between the two towns. Here again, the location of an additional crossing and its approaches has the potential to significantly improve the physical, visual and experiential connection between the two town centres.

The potential exists with the siting of the new river crossing, to influence the future development of greater Grafton, where urban consolidation can strengthen existing patterns of urban form, improve infrastructure efficiencies and avoid the potential of strip development around the city's margins.

Opportunities also exist for improved foreshore recreational access and activities along the river, depending on the route option location and its proximity to existing public land. The potential to build upon Council's current plans for increased foreshore open space needs to be factored into route option decision making.

A significant piece of infrastructure such as a new river crossing is a defining moment in the development of any city and the potential for Grafton to benefit from a wide range of citywide improvements should be a central component in the selection of the next Clarence River crossing.

6 LANDSCAPE AND URBAN DESIGN GOALS

6.1 LANDSCAPE AND URBAN DESIGN GOALS

A set of key landscape and urban design goals, and related design principles, has been identified to guide the identification of a preferred location for a new bridge and its approach roads. These goals are based on an understanding of the key existing landscape and urban values of the area, the likely landscape and urban design issues that could affect, or be affected by, a new bridge crossing, and the unique opportunity that a new bridge crossing presents in shaping the urban future of Grafton.

Visual Integrity of Existing Bridge

Goal: *To maintain the visual integrity of the existing bridge in its setting.*

Design principles:

- Maintain important and recognisable views from and to the existing and new bridges of Grafton and South Grafton.
- Ensure the new bridge has a complementary scale and form, that still allows the existing bridge to take visual precedence. Strategies include:
 - Aligning the new bridge deck with the lower (railway) deck of the existing bridge.
 - Minimising the visual depth of the superstructure on the new bridge, to allow the steel truss structure of the existing bridge to maintain its visual dominance.
 - Aligning any piers on the new bridge with the piers of the existing bridge.
- Consider the potential for the new bridge to have an independent visual expression (form and scale) from the existing bridge and the potential to become a landmark in its own right, if located away from the existing bridge.

Compatibility with the Surrounding Built Environment

Goal: *To establish a complementary relationship between the new bridge approaches and the existing infrastructural elements in Grafton and South Grafton.*

Design principles:

- Utilise the existing topography and landforms wherever possible to reduce the need to artificially elevate the approach roads.
- Minimise the potential visual and physical barrier effect of the approach roads by maintaining cross connections for local traffic, transport, cyclists and pedestrians.
- Minimise the height and extent of retaining walls and embankments.

Integrity of Existing Landscape and Street Pattern

Goal: *To maintain the integrity of the existing urban character and rural landscapes, particularly the physical and visual experience of the historical street grid.*

Design principles:

- Minimise the street scale and form of the new bridge approach roads.
- Retain the existing landscape character of the area, including minimising the removal of trees.
- Minimise the size of intersections between the approach roads and the existing local roads.
- Maintain the general form of the existing urban patterns and integrate the geometry of any new approach roads within the existing road reserves.

Urban Connectivity

Goal: *To improve accessibility for local traffic and public transport and in particular connectivity for pedestrians and cyclists between Grafton and South Grafton.*

Design principles:

- Minimise the travel distance and times between town centres for all modes of users.
- Improve connectivity and connection opportunities for local traffic and public transport.
- Improve connectivity and connection opportunities for pedestrian and cycle networks.
- Improve connectivity to existing and proposed riverfront public recreation spaces.

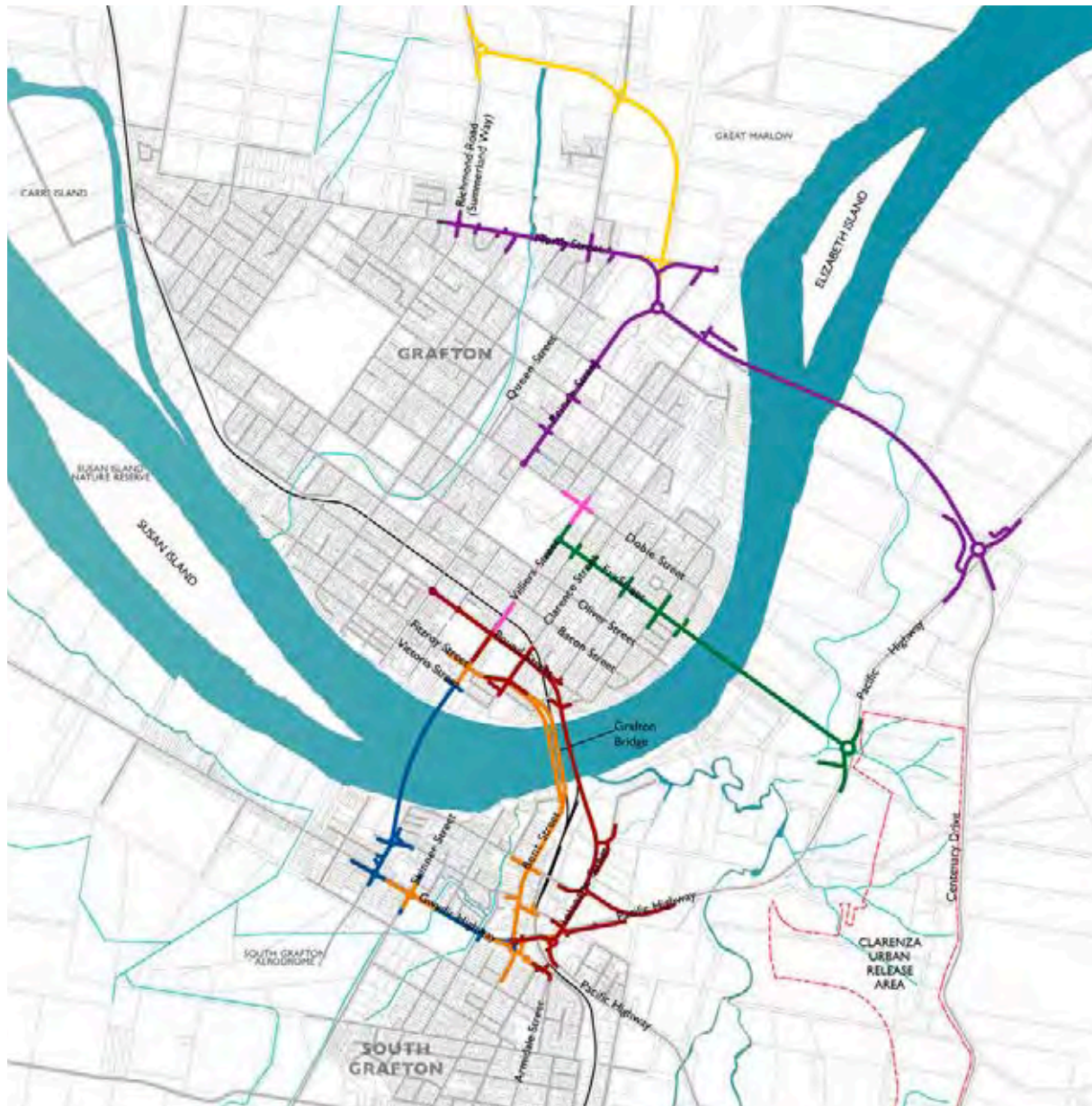
Continued Urban Development

Goal: *To assist in maintaining the integrity of the existing patterns of urban settlement and facilitate future urban development.*

Design principles:

- Provide more direct connections for local trips and destinations beyond Grafton and South Grafton town centres.
- Minimise the effects of fragmentation on neighbourhoods or precinct areas.
- Integrate the new bridge into urban environment so it can support future development and revitalisation of existing areas (retail, commercial, industrial, recreation, education, etc.).
- Minimise the creation of new main street environments and strip development that does not support or connect to the town centres of Grafton and South Grafton.

7 ROUTE OPTIONS ASSESSMENT



SHORT-LIST OF ROUTE OPTIONS

0 500 1000 m

Source: Arup (Revision 5)

7.1 ROUTE OPTIONS DESCRIPTION AND SETTING

Working with the community, RMS has developed a short-list of six route options for further investigation. Community comment, a community and stakeholder workshop (November 2011), and technical investigations helped to identify the short-list of options which are described as follows.

GENERAL DESIGN FEATURES

Engineering design features that are common to all of the route options include:

- Posted speed limit for approach roads would be 60 km/h within urban areas and 80 km/h outside urban areas.
- Traffic lanes width would be minimum 3.5 metres.
- Pedestrian / cyclist shared path width would be 3 metres.
- Bridge structural elements would be designed and detailed for a design life of at least 100 years.
- Waterway structures must be of sufficient height to maintain acceptable freeboard during a 100 year Average Recurrence Interval (ARI) design flood event.
- Bridge approach embankments and viaducts must be flood immune during a 100 year ARI design flood event.
- Main roads accessing the bridge approaches must be flood immune during a 20 year ARI design flood event.
- Design mitigation measures would be implemented to maintain the current level of flood immunity during a 20 year ARI design flood event.



OPTION E – ROUTE DESCRIPTION

Option E consists of a new bridge approximately 830 metres west (upstream) of the existing bridge and it is also southeast (downstream) of Susan Island. It would connect to the Gwydir Highway at Cowan Street in South Grafton and to Villiers Street in Grafton. The option would extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle height.

The current bridge design would be approximately 620 metres long, 15.9 metres wide and have a horizontal curve across the Clarence River. The bridge would be constructed from South Grafton using two methods, incremental launching for the longer spans and prestressed beam and slab for the shorter spans. The river crossing section would have 13 span sections. There would also be a roughly 65 metre long approach viaduct with two spans on the Grafton side. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 9.1 metres.

The bridge and approach roads would include one northbound lane and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the eastern (downstream) side of the bridge for pedestrians and cyclists. The existing bridge would remain with one northbound lane and one southbound lane.

OPTION E – ROUTE SETTING

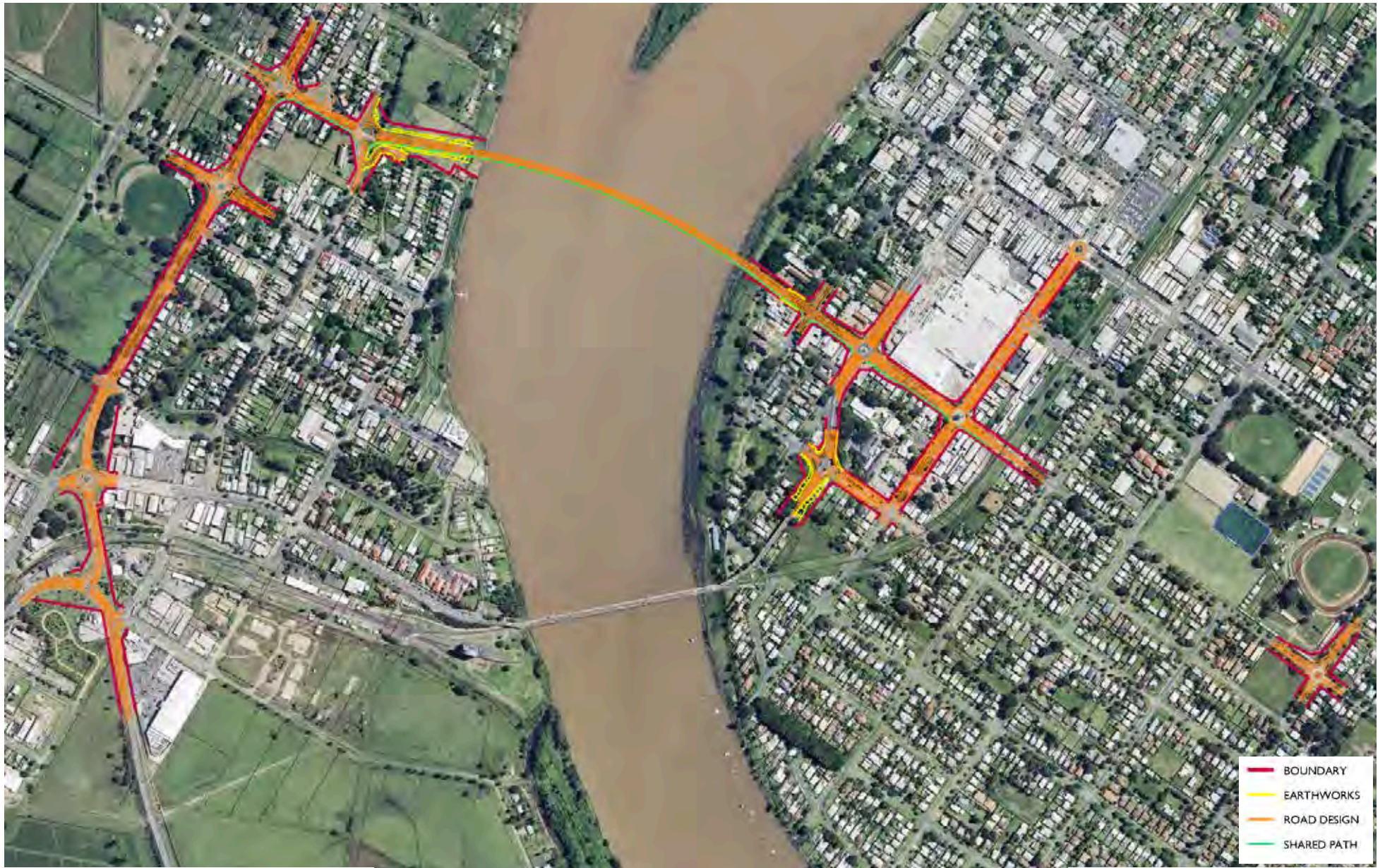
South Bank – South Grafton

- Landform of the area is relatively flat and somewhat elevated relative to the river, rising to the crest of the levee bank before sloping steeply down to the water.
- Vegetation in the area consists of grazing paddocks with trees limited to a riparian corridor that is in alignment with Spring Street.
- Land uses are generally residential with some undeveloped areas used for grazing animals, which are zoned for general industrial use just west of the proposed crossing.
- Settlement pattern of the area consists of established single-family detached dwellings along a standard grid pattern with some areas that remain undeveloped.
- Landscape character is suburban and consists of moderately sized streets, scattered street trees and limited pedestrian paths.

North Bank – Grafton

- Landform of the area consists of a more gently sloping riverbank rising up to a level area above the high watermark, with no prominent levee in the area (levee is built into the landscape).
- Vegetation consists of groupings of trees and grassy areas along the river foreshore and well established street trees along Victoria and Villiers Streets.
- Land uses are a mix of residential, commercial, retail businesses, and an educational institution.
- Settlement patterns are along a regular urban grid pattern.
- Landscape character of the area is urban historic with well established street trees throughout the area and a range of attractive heritage buildings.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION E

Source: Arup (Revision 6)

OPTION A – ROUTE DESCRIPTION

Option A consists of a new bridge parallel, approximately 40 metres west (upstream) of the existing bridge and connects to the existing road network on Bent Street in South Grafton and on Fitzroy Street in Grafton. The option would extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle height.

The current bridge design would be approximately 470 metres long, 17.7 metres wide and be perpendicular to the Clarence River. The bridge would be constructed using a combination of balanced cantilever spans across the river and prestressed beam and slab construction methods for the viaduct. The river crossing section would have seven span sections. There would also be a roughly 145 metre long approach viaduct with five spans on the Grafton side. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 9.1 metres.

The bridge and approach roads would include two northbound lanes and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the western (upstream) side of the bridge for pedestrians and cyclists. The existing bridge would become a one-lane southbound bridge, with adjustments to line marking to reduce the severity of the sharp bends.

OPTION A – ROUTE SETTING

South Bank – South Grafton

- Landform of the area is elevated well above the floodplain and river with a high point located at the Bent Street and Riverside Drive intersection, before sloping steeply down to the water.
- Vegetation is generally limited along most of Bent Street. There is a well established linear park, Earle Page Park, at Bent Street and Riverside Drive. The riverbank also supports a well established stand of thick riverine trees and shrubs.
- Land uses are a mix of industrial and commercial businesses with residential dwellings mostly occurring on the western side of Bent Street.
- Settlement patterns of the area consist of established single-family detached homes and small/medium businesses along a standard grid pattern.
- Landscape character in this area is a mixed urban form which relates to the surrounding uses and the area is generally open and exposed; providing views of the river and its floodplain.

North Bank – Grafton

- Landform of the area consists of a flat to gently sloping riverbank leading up to a level area above the high watermark, with no distinct levee.
- Vegetation consists of well established street trees and well maintained residential landscapes.
- Land uses are mainly residential with a medical centre and recreation facilities in the adjoining area as well as a mix of residential, commercial, retail businesses, and an educational institution.
- Settlement patterns are small single-family residential dwellings along a relatively regular urban grid pattern.
- Landscape character in this area has a strong suburban character with wide streets, verges with large street trees and footpaths.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION A

Source: Arup (Revision 6)

OPTION C – ROUTE DESCRIPTION

Option C consists of a new bridge approximately 70 metres east (downstream) of the existing bridge. It would connect to the Pacific Highway at Iolanthe Street in South Grafton and to Pound Street in Grafton. In South Grafton, Option C crosses an abandoned rail spur and would include a new intersection with the Pacific Highway southwest of Bunnings Warehouse. To accommodate heavy vehicle clearance in Grafton, the new northern approach along Pound Street would be lowered beneath the existing railway viaduct, between Kent Street and Clarence Street, in addition to lowering Villiers Street beneath the existing railway viaduct between Pound and Bacon Streets. Greaves Street would also be lowered to provide four metres clearance beneath the new viaduct.

The current bridge design would be approximately 460 metres long, 15.9 metres wide and be perpendicular to the Clarence River. The bridge would be constructed using a combination of balanced cantilever spans across the river and prestressed beam and slab construction methods for the viaduct. The river crossing section would have seven span sections. There would also be approach viaducts on either side of the bridge, which are both roughly 60 metres long (120 metres combined) with two spans on the South Grafton side, and two spans on the Grafton side. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 9.1 metres.

The bridge and approach roads would include one northbound lane and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the western (upstream) side of the bridge for pedestrians and cyclists. The existing bridge would remain with one northbound lane and one southbound lane.

OPTION C – ROUTE SETTING

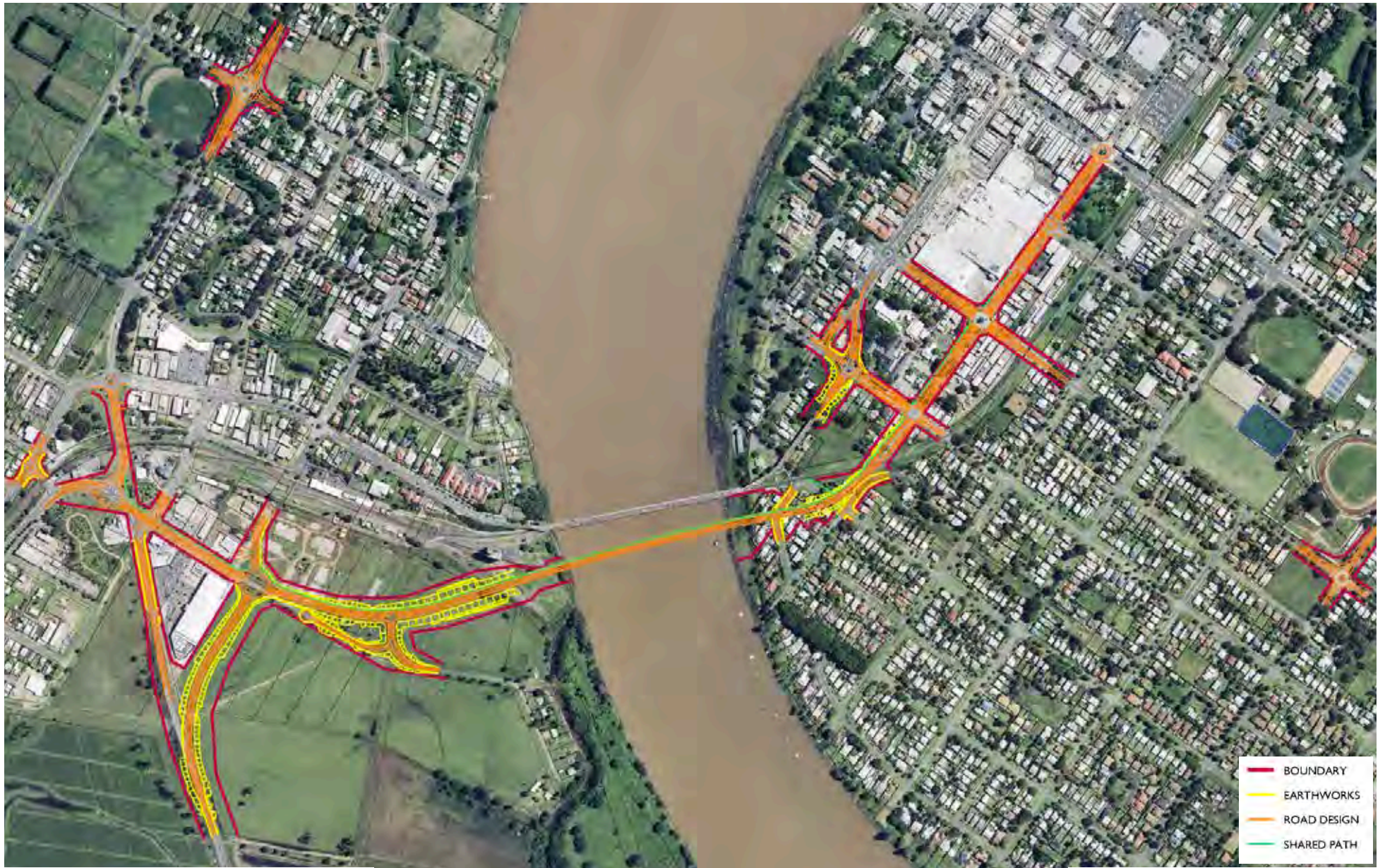
South Bank – South Grafton

- Landform of the area is low-lying and flat, extending to a steep riverbank edge.
- Vegetation in the area ranges from agricultural pasture grasses to weed infested (ruderal grass) areas in the more industrially developed areas.
- Land uses in the area are a mix of industrial, bulky goods retail with agriculture closer to the river.
- Settlement pattern is consistent with large grid patterns for industrial and agricultural production.
- Landscape character in this area is characterised by an open and generally exposed landscape.

North Bank – Grafton

- Landform of the area, north of the levee area, is slightly lower than other parts of Grafton and is prone to flooding, particularly along Pound Streets near the rail viaduct. The riverbank itself, is more of a floodplain in this area with a gentle slope down to the river.
- Vegetation in the area consists of street trees and maintained residential landscapes. Along the riverbank there are highly maintained open space areas with diverse plantings in lawn areas.
- Land uses are low density residential.
- Settlement patterns are single-family residential dwellings along a regular urban grid pattern.
- Landscape character in this area has a well maintained suburban character with wide streets and grassed swales and verges with numerous mature street trees.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION C

Source: Arup (Revision 6)

OPTION 11 – ROUTE DESCRIPTION

Option 11 consists of a new bridge approximately 1100 metres northeast (downstream) of the existing bridge and would provide a connection between the Pacific Highway, northeast of McClaers Lane, and Fry Street in Grafton. This option would also include an upgrade of Fry Street to enable it to cater for future traffic volumes. Additionally, the option would extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle height.

The current bridge design would be approximately 390 metres long, 15.9 metres wide and be perpendicular to the Clarence River. It would be constructed using incremental launching for the river crossing and prestressed beam and slab construction for the viaduct in South Grafton. The river crossing section would have eight span sections. There would also be a roughly 340 metre long approach viaduct with 10 spans across the floodplain on the South Grafton side. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 17 metres. In addition to these structures, an additional roughly 110 metre long, viaduct would be required to cross a small creek on the South Grafton side, near the Pacific Highway.

The bridge and approach roads would include one northbound lane and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the western (upstream) side of the bridge for pedestrians and cyclists. The existing bridge would remain with one northbound lane and one southbound lane.

OPTION 11 – ROUTE SETTING

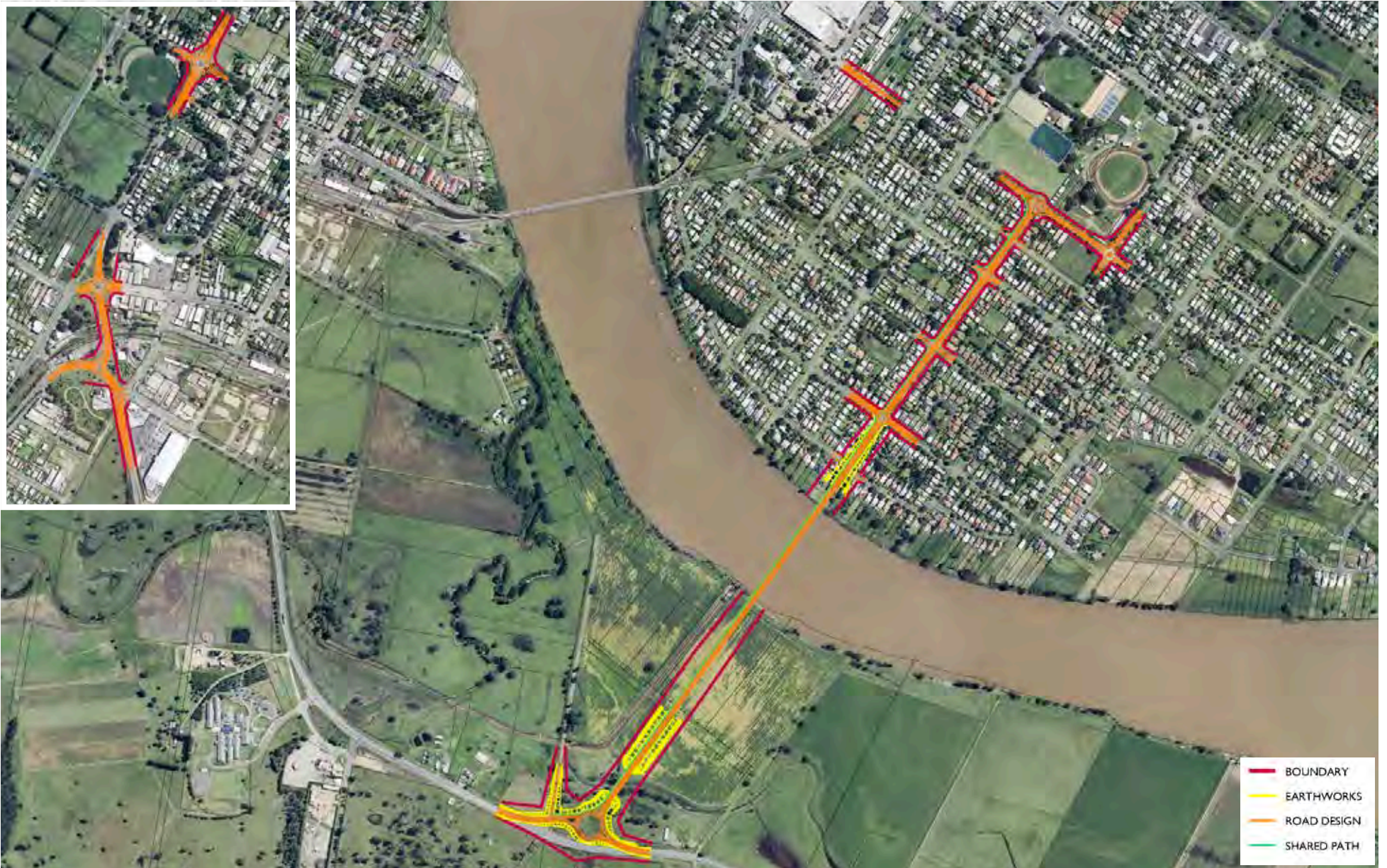
South Bank – South Grafton

- Landform of the area is low-lying and flat floodplain, extending to a steep riverbank edge.
- Vegetation in the area is dominated by agricultural crops and pasture grasses.
- Land uses in the area are entirely agricultural.
- Settlement patterns are consistent with large grid patterns for agricultural production.
- Landscape character in this area is characterised by an open and generally exposed landscape.

North Bank – Grafton

- The riverbank is more of a floodplain in this area with a gentle slope down to the river.
- Vegetation in the area consists of street trees and maintained residential landscapes. Along the riverbank there are highly maintained open space areas with diverse plantings in lawn areas.
- Land uses are low density residential.
- Settlement patterns are single-family residential dwellings along a regular urban grid pattern.
- Landscape character in this area has a well maintained suburban character with wide streets and grassed swales and verges with numerous mature street trees.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION II

Source: Arup (Revision 6)

OPTION 14 – ROUTE DESCRIPTION

Option 14 consists of a new bridge approximately 2700 metres northeast (downstream) of the existing bridge. It would create a new intersection with Centenary Drive and the Pacific Highway in South Grafton and connect to Kirchner Street and North Street in Grafton. Prince Street would also need to be upgraded from Kirchner Street to Dobie Street for heavy vehicle access into central Grafton. Additionally, the option would extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle height.

The current bridge design would be approximately 620 metres long, 16.3 metres wide and be perpendicular to the Clarence River. It would be constructed using incremental launching for the river crossing and prestressed beam and slab construction for the viaduct. The river crossing section would have 12 span sections. There would also be a roughly 780 metre long approach viaduct with 23 spans across the floodplain on the South Grafton side. On the Grafton side, there would be an approximately 135 metre long approach viaduct with four spans. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 17 metres. In addition to these structures, there would also be three other shorter bridges for creek crossings. The total length of viaducts needed for Option 14 is roughly 1070 metres.

The bridge and approach roads would include one northbound lane and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the southern (upstream) side of the bridge for pedestrians and cyclists. The existing bridge would remain as one northbound lane and one southbound lane.

OPTION 14 – ROUTE SETTING

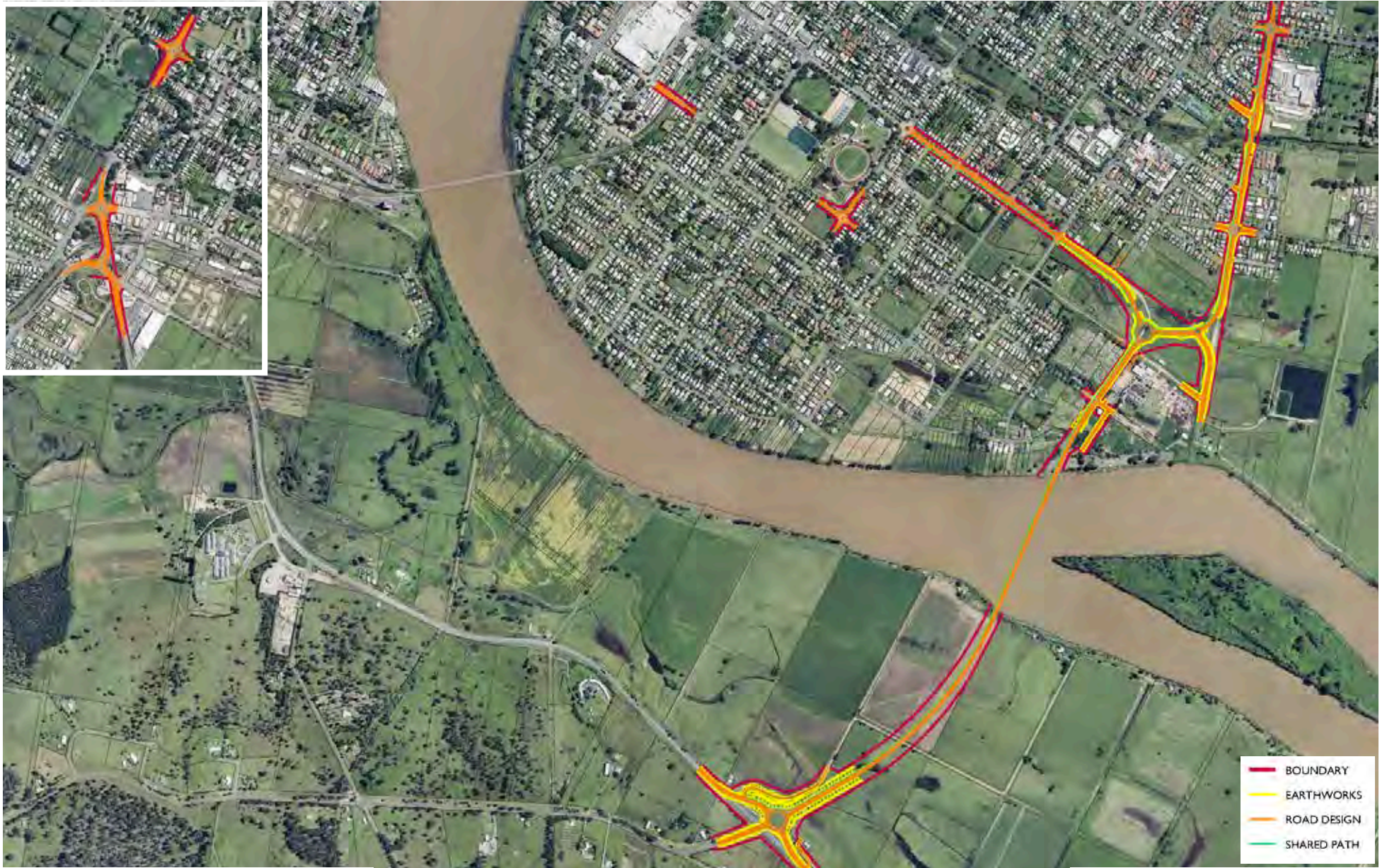
South Bank – South Grafton

- Landform of the area is low-lying and flat floodplain, extending to a steep riverbank edge.
- Vegetation in the area is dominated by agricultural crops and pasture grasses.
- Land uses in the area are entirely agricultural.
- Settlement patterns are consistent with large grid patterns for agricultural production.
- Landscape character in this area is characterised by an open and generally exposed landscape.

North Bank – Grafton

- Landform of the area is at a slightly lower elevation than Grafton with some areas subject to flooding. The riverbank is more of a floodplain in this area with a gentle slope on the riverbank.
- Vegetation in the area consists of sporadic street trees and residential landscapes. Along the river edge the vegetation is consistent with a parkland setting.
- Settlement patterns are large single-family residential dwellings to the south with a larger rural grid pattern to the north.
- Land uses are public parklands, Council works depot, low density residential and rural residential and agricultural areas.
- Landscape character in this area is rural and open with wide streets that have limited pedestrian facilities.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION 14

Source: Arup (Revision 6)

OPTION 15 – ROUTE DESCRIPTION

Option 15 consists of a new bridge approximately 2700 metres northeast (downstream) of the existing bridge. It would create a new intersection with Centenary Drive and the Pacific Highway in South Grafton and connect to Kirchner Street and North Street in Grafton. Prince Street would also need to be upgraded from Kirchner Street to Dobie Street for heavy vehicle access into central Grafton. Additionally, the option would extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle height.

The current bridge design would be approximately 620 metres long, 16.3 metres wide and be perpendicular to the Clarence River. It would be constructed using incremental launching for the river crossing and prestressed beam and slab construction for the viaduct. The river crossing section would have 12 span sections. There would also be a roughly 780 metre long approach viaduct with 23 spans across the floodplain on the South Grafton side. On the Grafton side, there would be an approximately 135 metre long approach viaduct with four spans. The navigable channel beneath the bridge would have two clear channels, both 35 metres wide, and a minimum vertical clearance of 17 metres. In addition to these structures, there would also be three other shorter bridges for creek crossings. The total length of viaducts needed for Option 15 is roughly 1130 metres.

The bridge and approach roads would include one northbound lane and one southbound lane for vehicles and a 3.1 metre wide shared pathway on the southern (upstream) side of the bridge for pedestrians and cyclists. The existing bridge would remain as one northbound lane and one southbound lane.

OPTION 15 – ROUTE SETTING

South Bank – South Grafton

- Landform of the area is low-lying and flat floodplain, extending to a steep riverbank edge.
- Vegetation in the area is dominated by agricultural crops and pasture grasses.
- Land uses in the area are entirely agricultural.
- Settlement patterns are consistent with large grid patterns for agricultural production.
- Landscape character in this area is characterised by an open and generally exposed landscape.

North Bank – Grafton

- Landform of the area is at a slightly lower elevation than Grafton with some areas subject to flooding. The riverbank is more of a floodplain in this area with a gentle slope on the riverbank.
- Vegetation in the area consists of sporadic street trees and residential landscapes. Along the river edge the vegetation is consistent with a parkland setting.
- Settlement patterns are large single-family residential dwellings to the south with a larger rural grid pattern to the north.
- Land uses are public parklands, Council works depot, low density residential and rural residential and agricultural areas.
- Landscape character in this area is rural and open with wide streets that have limited pedestrian facilities.

Refer to Appendix 2 of the Route Options Development Report, Vol.1 for additional detailed plans.



ROUTE OPTION 15

Source: Arup (Revision 6)

7.2 ROUTE OPTIONS VISUAL OBSERVATIONS ASSESSMENT

As the dominant visual feature on the river, Grafton Bridge is the key urban landmark that defines the visual relationship between Grafton and the Clarence River. The viewpoints identified provide an understanding of how views will be affected by a new crossing and if the new bridge will either enhance or detract from the setting of the existing bridge. These viewpoints also highlight the wide range of view locations that could be affected throughout the area. Generally, the viewpoints observed for the route options are broken into the three following types:

- Proximate Bridge Views - Illustrate how a new crossing located close to the existing Grafton Bridge could impact the visual experience of the area.
- Long-Range & Other Option Views - Illustrate how a new crossing will affect the distinctive visual form of the existing bridge. They also identify if a new crossing can have its own independent character or if it will have other impacts on adjacent areas.
- Urban Views - Illustrate how road upgrades and new approach roads for the new crossing will impact the urban character of different parts of Grafton and South Grafton.

The visual expression of the bridge options in their settings is important for the assessment of each of the route options. The views on the adjoining map identify the range of locations from which the existing bridge and the options are visible. Images from these viewpoints are used to analyse the character of each option in the following section.



OBSERVED VIEWS



Source: SMM 2012

7.3 ROUTE OPTIONS CHARACTER ASSESSMENT

CHARACTER ASSESSMENT

The following character assessment identifies how each option will affect the visual, landscape and urban character of the area. The table, on the left, provides a summary of the major characteristics related to each option.

The character assessment includes a series of images that illustrate key aspects of each location and a sense of the current level of development and use. The assessment for each option has been organised into the following groups:

- Strengths
- Opportunities
- Weaknesses
- Challenges

This character assessment is intended to provide a contextual understanding for the qualitative assessment of each option in the Indicators Assessment (the next section).

Overview of visual, landscape and urban design characteristics	Option E	Option A	Option C	Option 11	Option 14	Option 15
Option specific characteristics						
Height of new bridge crossing (m) <i>Notes: Measured from the high water mark (R.L. 0.416m) to the finished road surface. Existing bridge crossing at rail level is 10.4 m.</i>	16.6	14.5	13.8	20.7	23.3	23.3
Approximate length of new bridge (m) <i>Notes: Measured from south shore abutment to north shore abutment</i>	620	470	460	390	620	620
Approximate length of new viaduct spans (m) <i>Notes: Includes minor waterway crossing structures where required.</i>	65	145	120	450	1070	1130
Approximate length of new approach roads (m)	265	290	1315	760	1635	5980
Approximate distance from existing bridge along the river (m)	800	40	70	1200	2700	2700
Transport related characteristics						
Approximate driving distance between town centres (km) <i>Distance from South Grafton (Skinner/Spring St) to Grafton (Fitzroy/Prince St)</i>	1.7 km	2.6 km	3.8 km	6.6 km	9.4 km	9.4 km
Number of new signalised intersections	2	4	2	0	0	0
Number of new large scale roundabouts	0	2	2	1	2	4
Number of new roundabouts or intersections *	5	2	5	6	15	8
Number of upgraded roundabouts or intersections	9	7	7	6	11	12
Urban environment related characteristics						
Number of residential, commercial and rural lots that are directly affected **	36	67	48	31	24	26
Number of buildings, including dwellings and ancillary structures, that are physically impacted ***	9	25	25	18	6	8

Note: All information based on Revision 6 plans, long sections, and measurements provided by ARUP.

* Identifies locations where new traffic control features will be needed beyond upgrades that maintain existing controls.

** Identifies the number of legal lots that overlap with the indicative road boundary for each of the options. These figures do not combine lots into single properties under the same ownership. Some level of acquisition may be required.

*** Identifies the number of building structures that will be physically impacted by the road design and associated earthworks (not based on indicative road boundary overlap). In some cases, more than one structure may be located on a single legal lot.

OPTION E – ROUTE CHARACTER ASSESSMENT

Strengths

- Most direct connections between town centres.
- Maintains important and recognisable views to and from the existing bridge.
- Requires no improvements along Bent street.
- Requires minimal improvements at the Bent/Ryan Street roundabout.
- Provides a natural gateway opportunity coming into South Grafton town centre.
- Utilises existing urban patterns and land forms.
- Direct connection into Villiers Street, which is the existing heavy vehicle route.
- Reduces congestion on existing bridge by spreading river crossing traffic movements between two separate locations in close proximity to both town centres.
- Minimises road closures and through connections for all transport mode users.
- Does not require the new bridge form to be consistent with the existing bridge, due to its distance from the existing bridge.
- Shortest overall option length, including the bridge and associated viaducts and road works.
- Bridge is able to be constructed without impairing the current traffic movements across the river.

Weaknesses

- Fragments a large parcel of land in South Grafton for the bridge abutment.
- May impact established trees along sections of the Gwydir Highway.
- Impacts large fig tree at Villiers/Victoria Street intersection.
- May result in increased traffic along Gwydir Highway between Bent and Cowan Streets.
- Changes access and through connections along Victoria Street.
- Bridge located within the Clarence River recreation area, which may impact on water based recreation.

Opportunities

- Ability to improve local roads in South Grafton.
- Potential to use the undeveloped land adjacent to the southern abutment as an easy construction compound/staging location should additional land be needed during construction.
- Potential to improve underutilised surrounding land areas.
- Potential to improve foreshore on southern bank and connect to Grafton foreshore improvements.
- Potential to create a 2.5-3km pedestrian/cycle loop along the foreshore between the two town centres.
- Potential to redevelop the site of the Clarence Regional Library Headquarters location.
- Potential to revitalise Skinner Street commercial centre – economically/culturally/socially.
- Potential to provide a signalised intersection like the one being proposed for Villiers/Fitzroy Streets since the Gwydir Highway and Cowan Street roundabout may impact surrounding business.
- Potential to reuse the heritage buildings along foreshore at Villiers/Victoria Streets.
- Potential to design a bridge that can have its own visual expression as it is distant from the existing bridge.

Challenges

- Narrow landing area on northern bank at Villiers Street.
- Protecting curtilages of historic structures on northern bank.
- Maintaining water recreation uses.
- Tree removals along Villiers Street and the Gwydir Highway.
- Access to properties fronting the widened roads along Villiers Street.



Area along Grafton foreshore where Option E would connect to Villiers Street



View west along South Grafton foreshore where Option E would connect



Intersection of Cowan/Spring Street; opportunity for street improvements



South Grafton town centre



Location of proposed bridge abutment; potential for improved land utilisation



View west from existing bridge toward location of Option E alignment

OPTION A – ROUTE CHARACTER ASSESSMENT

Strengths

- Utilises existing road corridors in South Grafton.
- Easy orientation for visitors, one entry point.
- Generally utilises existing urban patterns and land forms.
- Minimises road closures and through connections for all transport mode users.

Weaknesses

- Impedes recognisable views of the existing bridge from surrounding upstream land area.
- Road deck of the new bridge does not align with the railway deck of the existing bridge.
- Reduces or eliminates parking for commercial businesses along the east side of Bent Street.
- Impacts or requires the acquisition of commercial businesses along Bent Street.
- Requires acquisition and demolition of some dwellings along Fitzroy Street.
- Does not utilise existing road corridors in Grafton (along Fitzroy Street only).
- Requires major upgrades along Bent Street.
- May impact established trees along sections of the Gwydir Highway.
- Requires modification and upgrades to intersections along Villiers Street.
- Impacts on the neighbourhood and attractive streetscape character along Fitzroy Street.
- Concentrates all the traffic movements into one corridor which may increase congestion over time.
- Bridge is not able to be constructed without impairing the current traffic movements, particularly in Grafton.

Opportunities

- Close proximity of the two bridges requires one set of shared paths, located on the outside portions of the bridge crossing and approach road.
- Direct connections to cycleway along Victoria Street.
- Potential to redevelop the residual land along the north side of Fitzroy Street as a linear park or for business/commercial uses.

Challenges

- Bringing the approach road along Bent Street down (from just south of Riverside Drive) to the rail bridge level, without creating visual impact to surrounding neighbourhoods and while maintaining acceptable gradients for pedestrian and cycle paths.
- Maintaining the character of the existing bridge with a new bridge in such close proximity.
- No opportunity for the new bridge to establish an independent visual expression due to its close proximity to the existing bridge.
- Ensuring adequate driveway access for residents along the west side of Bent Street.
- Lining up the new bridge piers with the existing bridge from a visual point of view due to the difference number of piers on each bridge, as well as the effect of perspective that makes it impossible to line up all of the piers from any one viewpoint.
- Retaining bus stops along Bent Street.
- No clear location for a construction compound/staging location should additional land be needed during construction.
- Providing adequate pedestrian and cycle access around enlarged roundabouts and with the development of major five-armed roundabout at Bent Street.
- Retaining the park amenity in Earle Page Park.



View along Bent Street north from Through Street roundabout



Bus stop location along Bent Street just before Grafton Bridge



View of proposed abutment location in South Grafton



View of proposed abutment location in Grafton



Neighbourhood character along Fitzroy Street



View of the existing viaduct network in Grafton that would be adjacent to Option A



View from upstream of the Grafton Bridge where Option A alignment would cross the Clarence River

OPTION C – ROUTE CHARACTER ASSESSMENT

Strengths

- Requires no improvements along Bent street.
- Reduces congestion on existing bridge by spreading river crossing traffic movements between two separate locations in close proximity to both town centres.

Weaknesses

- Impedes recognisable views of the existing bridge from surrounding downstream land area.
- Requires acquisition and demolition of several dwellings in Grafton.
- Sterilises a substantial portion of land in Grafton along Kent, Pound and Greaves Streets, under and around the new viaduct.
- Results in substantial fragmentation of the local neighbourhood in Grafton.
- Does not utilise the existing road corridors in Grafton or South Grafton.
- May impact established trees along sections of the Gwydir Highway.
- Does not utilise existing urban patterns and land forms.
- Increases barriers and road closures for through connections and local users in Grafton.
- Requires modification and upgrades to intersections along Villiers Street.
- Increased flooding potential and on-going maintenance for the new (lowered) crossing under the railway viaduct on Pound Street.
- Pedestrian and cycle routes passes through an industrial area (South Grafton) that has a very exposed environment with a lack of amenity and public safety elements.
- Will require public safety improvements (most specifically pedestrian) in the newly sterilised areas amongst the viaducts in Grafton.
- Bridge is not able to be constructed without impairing the current traffic movements in Grafton in the vicinity of Greaves and Pound Streets.

Opportunities

- Potential to use the undeveloped land along Iolanthe Street as an easy construction compound/ staging location should additional land be needed during construction.

Challenges

- Lining up the new bridge piers with the existing bridge from a visual point of view due to the difference number of piers on each bridge, as well as the effect of perspective that makes it impossible to line up all of the piers from any one viewpoint.
- No opportunity for the new bridge to establish an independent visual expression due to its close proximity to the existing bridge.
- Increased the amount of sterilised land in the Grafton area, in addition to the areas already sterilised by the existing railway crossing.
- Providing adequate security and safety within these sterilised areas under the two bridge and rail crossings.
- Providing adequate buffers for the remaining properties along Greaves and Pound Streets.
- Minimising the impact from vehicular headlights on the Grafton riverfront properties while crossing northbound.
- Providing adequate pedestrian and cycle access around enlarged roundabouts.
- Providing adequate drainage on Pound Street to address potential flooding impacts.



View of Grafton foreshore amenity where Option C alignment and abutment would be located



View of proposed abutment location near and Alipou Creek in South Grafton



View along Greaves Street heading towards the river



Neighbourhood setting along Pound Street



View of the existing viaduct network in Grafton



Downstream view of the Grafton Bridge where Option C alignment would cross the Clarence River

OPTION 11 – ROUTE CHARACTER ASSESSMENT

Strengths

- Requires no improvements along Bent street.
- Generally consistent with land patterns on South Grafton side of the river.
- Aligns with existing grid pattern on Grafton side of the river.
- Does not require the new bridge form to be consistent with the existing bridge.
- Requires minimal improvements at the Bent/Ryan Street roundabout.
- Maintains important and recognisable views to and from the existing bridge.
- Bridge is able to be constructed without impairing the current traffic movements across the river.

Weaknesses

- Requires over 400m of viaduct in an open and exposed floodplain.
- Requires a substantial amount of fill embankments for the new roundabout, which is located in a gully, on the Pacific Highway.
- May impact established trees along sections of the Gwydir Highway.
- Requires the removal of the boat launch facility at Fry Street.
- Results in a T-intersection at Villiers and Fry Street adjacent to Fisher Park.
- Results in substantial fragmentation of the local neighbourhood in Grafton.
- Closes off at least two residential through streets and intersections on Fry Street.
- Heavier traffic volumes and vehicle sizes will have a major impact on the local neighbourhood setting in this area of Grafton.
- Breaks up the foreshore connectivity of maintained landscapes along the Grafton foreshore.
- Creates a bypass of the Grafton and South Grafton town centres, which potentially reduces economic activity in those areas.
- Increases travel distances for local trips between Grafton and South Grafton.
- Increased potential for “rat-running” along side streets for vehicles trying to get back to the Grafton town centre.
- Increased impact on residential area from freight movement along Fry Street going to both the Grafton CBD and through to the Summerland Way.
- Pedestrian/cycleway route does not link into a network on the southern bank but ends in open farmland on the Pacific Highway.
- Does not substantially reduce congestion on existing bridge generated by local trips between South Grafton and Grafton.
- Does not substantially reduce congestion on existing bridge generated by heavy vehicle deliveries to the Grafton town centre.

Opportunities

- Potential to design a bridge that can have its own visual expression as it is distant from the existing bridge.
- Provides a link between existing residential neighbourhoods in Grafton with the future residential neighbourhoods in Clarenza urban release area.

Challenges

- Providing adequate buffers for the remaining properties along Fry Street.
- Minimising the impact from vehicular headlights on the Grafton riverfront properties while crossing northbound.
- Potential to create traffic conflicts between users and heavy vehicles through traffic along local residential roads.
- Identifying a site for a replacement boat launch facility for the one removed at Fry Street.
- Providing effective measures to reduce “rat-running” potential in side streets.
- Integrating the existing suburban pattern of no kerbs, gutters or footpaths in the surrounding areas with upgrades along the new route.
- Providing adequate pedestrian and cycle access around enlarged roundabouts and connecting to appropriate destinations.
- No clear location for a construction compound/staging location should additional land be needed during construction.
- Reducing the high visual impact on surrounding area due to the height of new bridge and the need for a 17 metre vertical clearance over the river.



View of the proposed roundabout location adjacent to Pacific Highway



View of proposed bridge abutment location on the South Grafton foreshore



View along Fry Street from the proposed bridge landing towards Villiers Street



Recreational amenity provided by the Fry St. boat ramp at the Option 11 location



Streetscape and neighbourhood character on streets adjacent to Fry Street.



View of the Grafton foreshore and bridge abutment location for the Option 11 alignment crossing of the Clarence River

OPTION 14 – ROUTE CHARACTER ASSESSMENT

Strengths

- Requires no improvements along Bent street.
- Provides a Grafton town centre bypass for vehicles making through trips.
- Relatively consistent with land patterns on Grafton side of the river.
- Does not require the new bridge form to be consistent with the existing bridge, due to its distance from the existing bridge.
- Requires minimal improvements at the Bent/Ryan Street roundabout.
- Bridge is able to be constructed without impairing the current traffic movements across the river.

Weaknesses

- Requires a long bridge crossing in addition to a viaduct (over 750m in length) over the open and exposed southern floodplain.
- May impact established trees along sections of the Gwydir Highway.
- Does not utilise existing urban patterns or land forms, resulting in substantial fragmentation.
- Impact on residential area from freight and vehicle movement back to the Grafton town centre.
- Requires a substantial amount of fill for the new roundabout on the Pacific Highway connecting to Centenary Drive.
- Increases barriers and road closures for through connections and local users, creating long straight road corridors that are not consistent with the existing surrounding suburban residential development.
- Requires the removal of a boat launch and jetty facility at Corcoran Park.
- Substantial impact on the Corcoran Park facilities and recreational amenity.
- Closes off some local residential through streets.
- Increased potential for “rat-running” along side streets for vehicles trying to get back to the Grafton town centre.
- Creates a bypass of the Grafton and South Grafton town centres, which potentially reduces economic activity in those areas.
- Increases travel distances for local trips between Grafton and South Grafton
- Pedestrian/cycleway route does not link into a network on the southern bank but ends in open farmland on the Pacific Highway.
- Does not substantially reduce congestion on existing bridge generated by local trips between South Grafton and Grafton.
- Does not substantially reduce congestion on existing bridge generated by heavy vehicle deliveries to the Grafton town centre.

Opportunities

- Potential to design a bridge that can have its own visual expression as it is distant from the existing bridge.

Challenges

- Providing adequate buffers for the remaining properties along Kirchner, Prince and North Streets.
- Minimising the impact from vehicular headlights on the Grafton riverfront properties while crossing northbound.
- Potential to create traffic conflicts between users and heavy vehicles through traffic along local residential roads.
- Identifying a site for a replacement boat launch facility for the one removed at Corcoran Park.
- Providing effective measures to reduce “rat-running” potential in side streets.
- Integrating the existing suburban pattern of no kerbs, gutters or footpaths in the surrounding areas with upgrades along the new route.
- Providing adequate pedestrian and cycle access around enlarged roundabouts and connecting to appropriate destinations.
- No clear location for a construction compound/staging location should additional land be needed during construction.
- Reducing the high visual impact on surrounding area due to the height of new bridge and the need for a 17 metre vertical clearance over the river.



View of Corcoran Park boat launch and jetty where the new bridge abutment would be established



View of proposed bridge abutment location on the South Grafton foreshore



Residential neighbourhood directly adjacent Corcoran Park



View along Prince Street heading southwest



Location of the new proposed Kirchner/Prince Streets roundabout



View from Clarenza along the floodplain where the proposed bridge and viaduct for Options 14 and 15 alignments would be located

OPTION 15 – ROUTE CHARACTER ASSESSMENT

Strengths

- Requires no improvements along Bent street.
- Provides a Grafton town centre bypass for vehicles making through trips.
- Does not require the new bridge form to be consistent with the existing bridge, due to its distance from the existing bridge.
- Requires minimal improvements at the Bent/Ryan Street roundabout.
- Bridge is able to be constructed without impairing the current traffic movements across the river.

Weaknesses

- Requires a long bridge crossing in addition to a viaduct (over 750m in length) over the open and exposed southern floodplain.
- May impact established trees along sections of the Gwydir Highway.
- Does not utilise existing urban patterns or land forms, resulting in substantial fragmentation.
- Impact on residential area from freight and vehicle movement back to the Grafton town centre.
- Requires a substantial amount of fill for the new roundabout on the Pacific Highway connecting to Centenary Drive.
- Increases barriers and road closures for through connections and local users, creating long straight road corridors that are not consistent with the existing surrounding suburban residential development.
- Requires the removal of a boat launch and jetty facility at Corcoran Park.
- Substantial impact on the Corcoran Park facilities and recreational amenity.
- Closes off some local residential through streets.
- Increased potential for “rat-running” along side streets for vehicles trying to get back to the Grafton town centre.
- Creates a bypass of the Grafton and South Grafton town centres, which potentially reduces economic activity in those areas.
- Increases travel distances for local trips between Grafton and South Grafton.
- Pedestrian/cycleway route does not link into a network on the southern bank but ends in open farmland on the Pacific Highway.
- Does not substantially reduce congestion on existing bridge generated by local trips between South Grafton and Grafton.
- Does not substantially reduce congestion on existing bridge generated by heavy vehicle deliveries to the Grafton town centre.

Opportunities

- Potential to design a bridge that can have its own visual expression as it is distant from the existing bridge.

Challenges

- Providing adequate buffers for the remaining properties along Kirchner, Prince and North Streets.
- Minimising the impact from vehicular headlights on the Grafton riverfront properties while crossing northbound.
- Potential to create traffic conflicts between users and heavy vehicles through traffic along local residential roads.
- Identifying a site for a replacement boat launch facility for the one removed at Corcoran Park.
- Providing effective measures to reduce “rat-running” potential in side streets.
- Integrating the existing suburban pattern of no kerbs, gutters or footpaths in the surrounding areas with upgrades along the new route.
- Providing adequate pedestrian and cycle access around enlarged roundabouts and connecting to appropriate destinations.
- No clear location for a construction compound/staging location should additional land be needed during construction.
- Reducing the high visual impact on surrounding area due to the height of new bridge and the need for a 17 metre vertical clearance over the river.



Location of the new proposed Grafton-Lawrence Road roundabout for Option 15



View across the Clarence River to the Grafton foreshore area



View of the proposed bridge abutment location at Corcoran Park



Corcoran Park recreational area



View of Clarenza area from Eggin Lane



View from the residential neighbourhood adjacent to Corcoran Park and the proposed abutment location for Options 14 and 15 alignments

7.4 ROUTE OPTIONS SIMILARITIES ASSESSMENT

'ROUTE OPTION SIMILARITIES

While each route option does have unique features to each roadway design, there are some similar features between all routes and shared similarities with other routes that should be recognised and acknowledged early in the assessment process.

Villiers and Dobie Streets

As indicated in the short-list options figure, on page 61, all six options share common designs for two sections of roadway. These common sections are both in Grafton and include the following improvements:

- All options extend along Villiers Street beneath the existing railway viaduct, between Pound and Bacon Streets, where the vertical clearance would be increased for heavy vehicle clearance.
- All options require an intersection improvement for the northwest turning movement from Villiers Street on to Dobie Street. This will have an impact on Fisher Park in order to create a turning lane that can accommodate heavy vehicles.

Skinner Street Intersection

While all options share almost identical roadway boundaries, there are minor differences in the road design for Option E, in the top right figure. While this minor design variation does not result in any changes to overall impacts between options, the difference should be noted. Further investigations will determine which variation is ultimately needed since all options will require an improvement to this intersection to accommodate future traffic volumes heading west toward Waterview Heights.

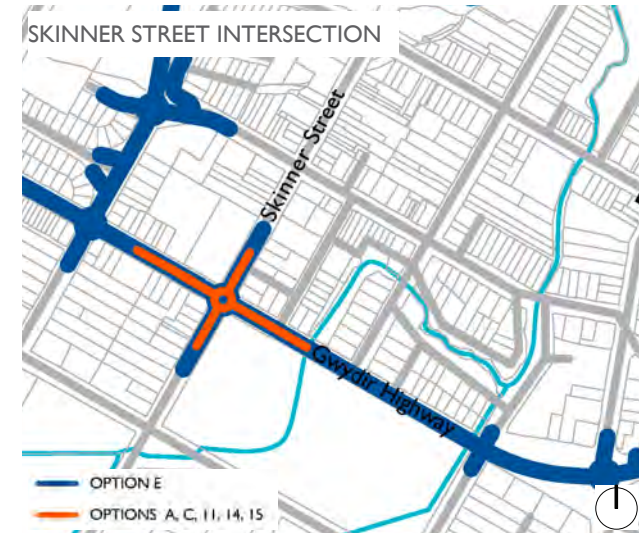


Therefore, this assessment acknowledges the common similarities in this section and the common impacts that will result from the selection of any route options.

Pacific Highway/Bent Street Connection

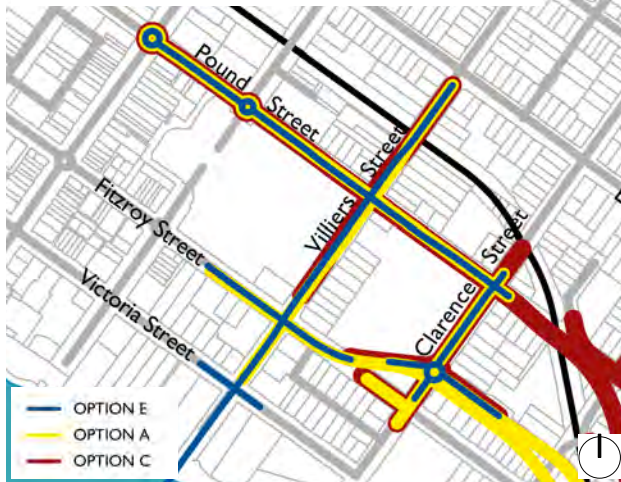
The connection from the Pacific Highway to Bent Street has three main design options depending on the crossing option chosen, in the bottom right figure. Since route Options E, 11, 14 and 15 bypass the Bent Street crossing area entirely, there is reduced need for major improvements to how the connection currently functions. Therefore, these four options can utilise the same design configuration.

Options A and C have crossings that are located in closer proximity to Bent Street and the existing bridge. Since these locations are closer and will have to accommodate different types of traffic flows, route specific designs are required.



Source All: Arup (Revision 6)

GRAFTON TOWN CENTRE ENTRY CORRIDORS

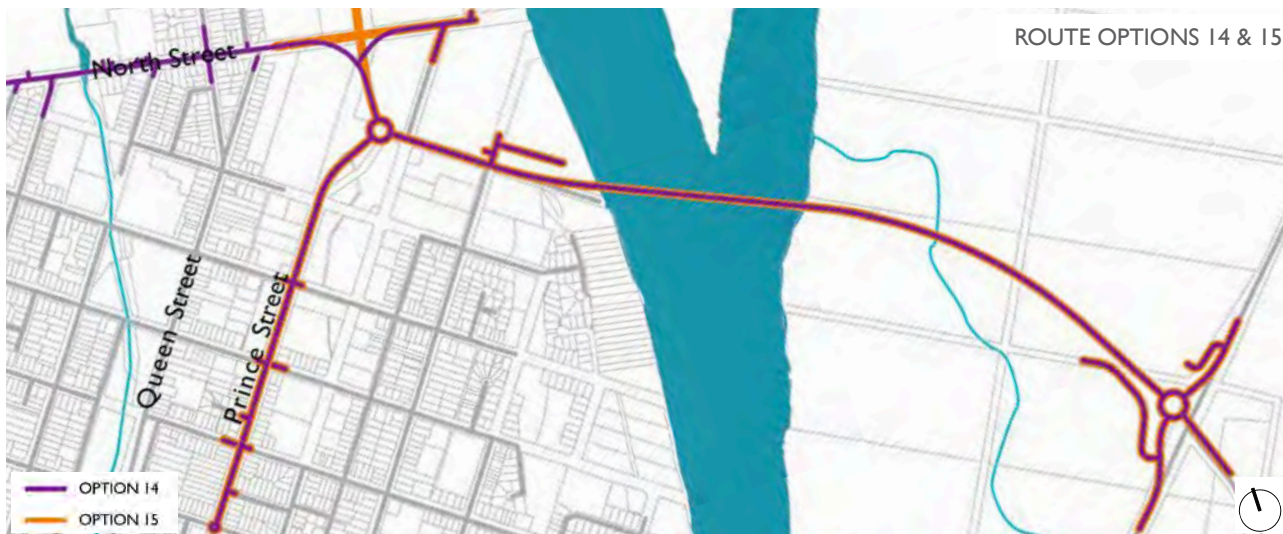


Therefore the options assessment acknowledges the common similarities in Options E, 11, 14 and 15 and these sections will have the same impacts as a result.

Grafton Town Centre Entry Corridors

The Grafton town centre entry corridors are the most complicated portion of the current designs to assess, in the top left figure. Options A, C and E all have certain commonalities and differences within a one city block location, particularly along Villiers Street, Fitzroy Street and Pound Street. As a result this assessment will generally evaluate the route options in this area.

It is anticipated that further investigations will determine which road designs, turning bay, cross walk locations and project boundaries are ultimately needed since all options will require a similar level of overall improvement to accommodate future traffic volumes in this area.



ROUTE OPTIONS 14 & 15

Route Options 14 & 15

Route Options 14 & 15 have the strongest similarities of the six short-listed options, in the bottom left figure. The South Grafton portion of each option is completely identical. Therefore the options assessment acknowledges the common similarities and these sections will have the same impacts for South Grafton as a result.

In Grafton these route options again are identical south of North Street and will have the same impacts as a result. The main variation between these options is as they approach North Street and then connect to Summerland Way. The options assessment will address the similar aspects and highlight the areas where there are differences between the two options.

Source All: Arup (Revision 6)

7.5 ROUTE OPTIONS URBAN CONTEXT ASSESSMENT

URBAN CONTEXT FOR ROUTE OPTIONS

Urban context relates to the structural form and geographic arrangement of the range of land uses occurring within the urban areas of Grafton. These land uses and their locations generate activity which has a direct relationship to the provision of a second crossing of the Clarence River.

Urban context therefore plays an important role in considering the overall functionality of each route option. Overlaying the options with the location of major activity generators on both sides of the river begins to illustrate how traffic patterns and movements will change as a result of the different options. These major activity generators include major retail shopping outlets; office, commercial and industrial businesses; parks and recreation facilities; and schools.

The adjacent urban context map, based on current land use patterns and the CVLEP 2011, clearly shows the commercial/industrial development corridor that extends from Grafton through South Grafton and along the Pacific Highway. This corridor has a significant concentration of these trip generators focused around and near the existing bridge. Future development in South Grafton along the Bent Street/Pacific Highway corridor and adjacent streets, as well as revitalisation efforts in the South Grafton town centre, will continue to create demands for trips near the existing bridge location.

Considering the urban context of the area is particularly relevant since over 97% of all trips have an origin and/or destination in Grafton or South Grafton. Any additional crossing route will need to carefully consider the relationship between the town centres; maintain an acceptable balance between traffic volumes and level of service on local streets; and improve connections for local trips between both Grafton and South Grafton.



URBAN CONTEXT



Source: SMM & Arup (Revision 6)

7.6 ROUTE OPTIONS BRIDGE OPTIONS ASSESSMENT

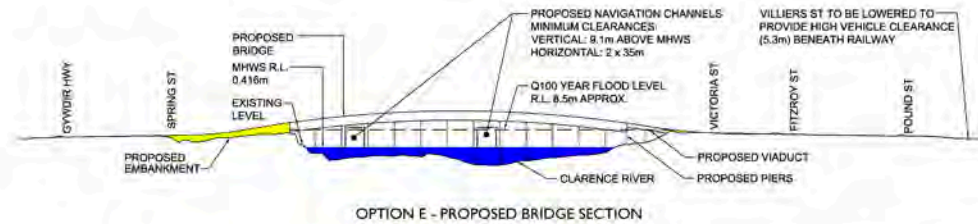
Overview of bridge characteristics	Option E	Option A	Option C	Option 11	Option 14	Option 15
Option specific characteristics						
Bridge type (<i>Incremental Launch IL or Balanced Cantilever BC</i>)	IL	BC	BC	IL	IL	IL
Bridge form	Arch	Flat	Flat	Arch	Arch	Arch
Height of new bridge crossing (m) <i>Notes: Measured from the high water mark (R.L. 0.416m) to the finished road surface. Existing bridge crossing at rail level is 10.4 m.</i>	16.6	14.5	13.8	20.7	23.3	23.3
Number of piers (in the river) <i>Does not include piers for viaducts or other sections of bridge.</i>	12	5	5	6	10	10
Approximate length of new bridge (m) <i>Notes: Measured from south shore abutment to north shore abutment</i>	620	470	460	390	620	620
Length of bridge span crossing the river (m)	49	74.6	74	48.4	53	53
Visual depth of the new bridge section (m) <i>From soffit to top of vehicle barrier.</i>	4.3	5.5	5.2	4.3	4.5	4.5
Width of new bridge (m)	15.9	17.7	15.9	15.9	16.3	16.3
Approximate distance from existing bridge along the river (m)	830	40	70	1100	2700	2700



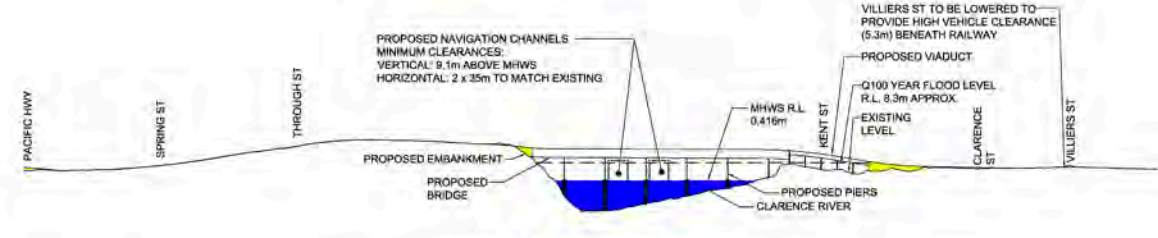
The bridge options for the second crossing of the Clarence River have all been designed in response to the differing characteristics of the locations in which they are sited. Whilst each bridge option has some similarities in terms of the core elements, each bridge has numerous characteristics which differentiate them from each other. Direct comparisons between each of the bridge options will therefore be difficult without making allowances for the individual requirements of each of the locations that determine the form and scale of each option.

Overall, length is the most obvious differentiator for each option however significant differences in the design of the structure such as number and width of spans, clearance above the water and therefore pier heights, as well as box girder and/or Super T depths. Many other elements such as pier and pile cap form, deck soffit design, abutment arrangements, vehicle barriers, lighting and shared path provisions may also vary between options. Additionally, some options have arched deck alignments while others are relatively flat. All of these elements will be assessed for the preferred option and during the subsequent detailed design phase of the project.

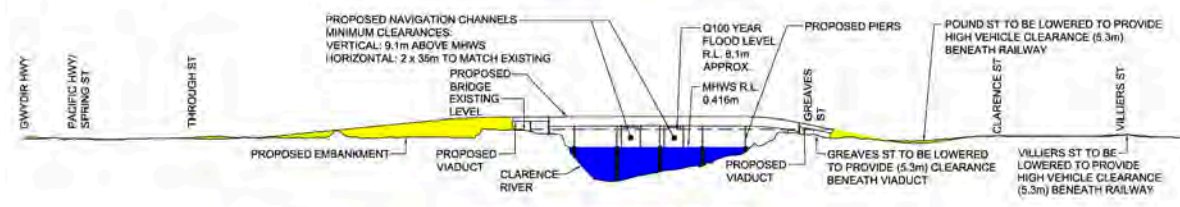
In the urban design assessment for each option in this report, the main consideration has been the relationship of the new bridge option with the existing bridge. The existing bridge has high heritage values and a cultural significance which relates to its identity as a landmark in Grafton. It is therefore an important element against which each option can be assessed.



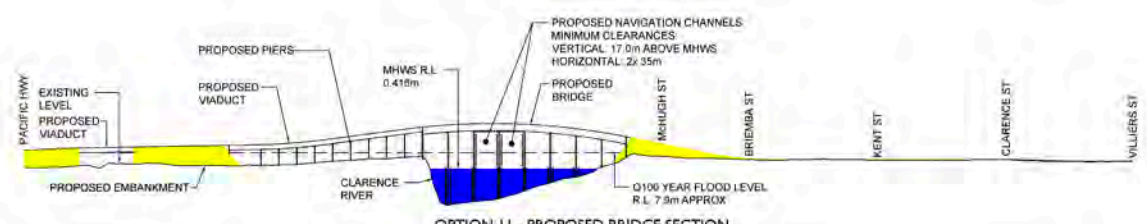
OPTION E - PROPOSED BRIDGE SECTION



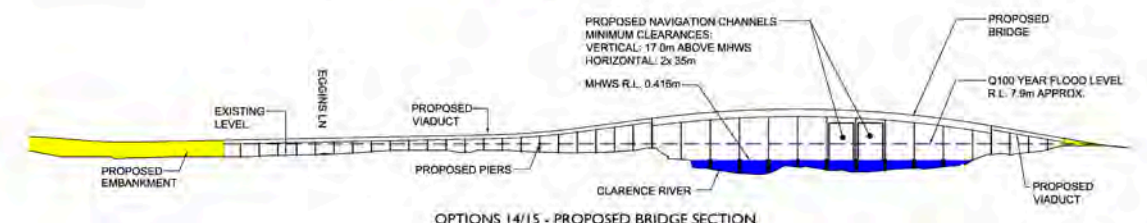
OPTION A - PROPOSED BRIDGE SECTION



OPTION C - PROPOSED BRIDGE SECTION



OPTION 11 - PROPOSED BRIDGE SECTION



OPTIONS 14/15 - PROPOSED BRIDGE SECTION

Note: Q100 Year Flood Levels based on Lower Clarence River Flood Study Review, WBN 2004.

Source: Arup (Revision 6)

Each bridge option has been assessed in the extent to which the new bridge maintains the visual integrity of the existing bridge in its setting.

Options A and C are the closest in proximity of the existing bridge being approximately 40m (upstream) and 70m (downstream) respectively. Although Options A and C have been designed to integrate with the existing structure as much as possible, they will have the greatest impact on its visual integrity. This is mostly due to the proposed bridge deck being aligned in the middle of the steel truss, above the rail deck, of the existing bridge.

Options E and 11 are located at some distance from the existing bridge being approximately 800m (upstream) and 1200m (downstream) respectively. While they are visible from the existing bridge they are likely to have little impact on the existing bridge's visual integrity.

Options 14 and 15 are at a much greater distance from the existing bridge being approximately 2700m downstream and to some degree around the bend of the river. As such, Options 14 and 15 will have no impact on the existing bridge's visual integrity.

Photomontage visualisations for each option from an aerial perspective and a ground level perspective were developed by Arup and are included in Appendix B.

7.7 ROUTE OPTIONS INDICATORS ASSESSMENT



Southern view of the Grafton foreshore amenity from Dobie Street towards Fry Street

INDICATORS ASSESSMENT OF EACH ROUTE

The following is a set of key visual, landscape and urban design indicators, with related descriptions, that have been identified to guide the evaluation of the six route options for an additional crossing of the Clarence River. These indicators are based on an understanding of the key existing visual, landscape and urban values of the area, as well as the likely landscape and urban design issues that could affect, or be affected by, an additional crossing, and the unique opportunity that an additional crossing presents in shaping the urban future of Grafton and South Grafton.

This assessment utilises a qualitative scaling system that allows for a relative assessment of each option rather than a more typical quantitative scaling system. This assessment is followed by a concise narrative summary for each option.

The scale for this assessment is provided below. This method allows factors, described in the section above, to be considered more easily in the individual assessment of each option. It should be noted that neither the table nor narrative assessment provides a comparative analysis or ranking of the six options. A comparative analysis of the options within each indicator is included in the following section.

Indicators assessment scale				
++	+	=	-	--
Strongly Agree	Agree	Neutral No change or difference	Disagree	Strongly Disagree

Indicator	Description	Option E	Option A	Option C	Option 11	Option 14	Option 15
Visual Integrity of Existing Bridge							
Extent to which the new bridge maintains the visual integrity of the existing bridge in its setting.	Ability to maintain important and recognisable views from and to the existing and new bridges of Grafton and South Grafton.	+	--	--	+	=	=
	Ability of the new bridge to have a complementary scale and form, particularly related to aligning the new bridge deck with the lower (railway) deck of the existing bridge, that still allows the existing bridge to take visual precedence.	=	--	--	=	=	=
	Ability of the new bridge to have an independent visual expression (form and scale) from the existing bridge and the potential to become a landmark in its own right.	+	-	-	+	++	++
Compatibility with the Surrounding Built Environment							
Extent to which the new bridge approaches establish a complementary relationship between the existing infrastructural elements in Grafton and South Grafton.	Ability to utilise the existing topography and landforms wherever possible to reduce the need to artificially elevate the approach roads.	+	+	-	-	--	--
	Ability to minimise the potential visual and physical barrier effect of the approach roads by maintaining cross connections for local traffic, transport, cyclists and pedestrians.	+	+	-	-	-	-
Integrity of Existing Landscape and Street Pattern							
Extent to which the new bridge maintains the integrity of the existing urban character and rural landscapes, particularly the physical and visual experience of the historical street grid.	Ability to minimise the street scale and form of the new bridge approach roads.	-	--	--	--	--	--
	Ability to retain the existing landscape character of the area, including minimising the removal of trees.	-	-	--	--	--	--
	Ability to minimise the size of intersections between the approach roads and the existing local roads.	-	--	-	-	--	--
	Ability to generally maintain existing urban patterns and integrate the geometry of any new approach roads within the existing road reserves.	+	=	-	+	-	--
Urban Connectivity							
Extent to which the new bridge improves accessibility for local traffic and public transport and in particular connectivity for pedestrians and cyclists between Grafton and South Grafton.	Ability to minimise the travel distance and times between town centres for all modes of users.	++	=	-	--	--	--
	Ability to improve connectivity and connection opportunities for local traffic and public transport.	++	+	+	-	--	--
	Ability to improve connectivity and connection opportunities for pedestrian and cycle networks.	++	=	-	--	--	--
	Ability to improve connectivity to existing and proposed riverfront public recreation spaces.	++	+	-	--	--	--
Continued Urban Development							
Extent to which the new bridge assists in maintaining the integrity of the existing patterns of urban settlement and facilitate future urban development.	Ability to provide more direct connections for local trips and destinations beyond Grafton and South Grafton town centres.	=	=	=	-	--	--
	Ability to minimise the effects of fragmentation on neighbourhoods or precinct areas.	+	-	--	--	-	-
	Ability to be integrated with or support future development and revitalisation of existing areas (retail, commercial, industrial, recreation, education, etc.).	++	=	+	-	--	--
	Ability to minimise the creation of new main street environments and strip development that does not support or connect to the town centres of Grafton and South Grafton.	+	+	-	-	--	--

Indicator	Description					
	Option E	Option A	Option C	Option I1	Option I4	Option I5
Visual Integrity of Existing Bridge - Extent to which the new bridge maintains the visual integrity of the existing bridge in its setting.	Ability to maintain important and recognisable views from and to the existing and new bridges of Grafton and South Grafton.					
	Maintains the visual integrity of the existing bridge and can be designed to enhance views from a potentially upgraded foreshores and from the new bridge.	Substantially impacts on views to, and visual character of, the existing bridge. Views through the bridge will also be heavily impacted.	Substantially impacts on views to, and visual character of, the existing bridge. Views through the bridge will also be heavily impacted.	Provides adequate distance away to maintain views and provides opportunities for additional view points from the new bridge.	No impact on existing views as it is too far downstream, also does not provide any views of the existing bridge, which is a key feature of the area.	No impact on existing views as it is too far downstream, also does not provide any views of the existing bridge, which is a key feature of the area.
	Ability of the new bridge to have a complementary scale and form, particularly related to aligning the new bridge deck with the lower (railway) deck of the existing bridge, that still allows the existing bridge to take visual precedence.					
	Can be designed to have scale and form that compliments existing bridge, and is far enough away to allow existing bridge to take visual precedence and be seen from the new bridge.	Scale and form does not compliment existing bridge, height of the new bridge will be located across the middle of the existing bridge between the rail deck and road deck.	Scale and form does not compliment existing bridge, height of the new bridge will be located across the middle of the existing bridge between the rail deck and road deck.	Can be designed to have scale and form that compliments existing bridge, and is far enough away to allow existing bridge to take visual precedence and be seen from the new bridge.	No impact on existing views as it is too far downstream, also does not provide any views of the existing bridge, which is a key feature of the area.	No impact on existing views as it is too far downstream, also does not provide any views of the existing bridge, which is a key feature of the area.
	Ability of the new bridge to have an independent visual expression (form and scale) from the existing bridge and the potential to become a landmark in its own right.					
	Distance from existing bridge provides the potential for the new bridge to have its own visual expression and be designed as a complimentary landmark.	Close proximity does not allow the new bridge to have its own visual expression.	Close proximity does not allow the new bridge to have its own visual expression.	Distance from existing bridge provides the potential for the new bridge to have its own visual expression and be designed as a complimentary landmark.	Distance from existing bridge requires that the new bridge be designed to have its own visual expression and its own landmark.	Distance from existing bridge requires that the new bridge be designed to have its own visual expression and its own landmark.
Compatibility with the Surrounding Built Environment - Extent to which the new bridge approaches establish a complementary relationship between the existing infrastructural elements in Grafton and South Grafton.	Ability to utilise the existing topography and landforms wherever possible to reduce the need to artificially elevate the approach roads.					
	Minimal need for viaducts and artificially elevated roadways.	Moderate need for viaducts and artificially elevated roadways on the northern foreshore only.	A major requirement for viaducts and artificially elevated roadways on both sides of the River.	A major requirement for viaducts and artificially elevated roadways on both sides of the River.	Results in extensive need for viaducts and artificially elevated roadways on both sides of the River.	Results in extensive need for viaducts and artificially elevated roadways on both sides of the River.
	Ability to minimise the potential visual and physical barrier effect of the approach roads by maintaining cross connections for local traffic, transport, cyclists and pedestrians.					
Results in minimal physical barriers which would impact some cross connections for vehicular traffic on both sides of the River.	Limited physical barriers which would impact cross connections on both sides of the River particularly at the Bent St and Gwydir Highway roundabout.	Creation of physical barriers that would impact cross connections mostly on the northern foreshore in Grafton.	Results in the creation of physical barriers that would impact cross connections particularly for the length of Fry Street in Grafton.	Results in the creation of physical barriers along Kirchner and Prince Streets that would impact cross connections.	Results in the creation of physical barriers along Kirchner and Prince Streets that would impact cross connections.	

Indicator	Description					
	Option E	Option A	Option C	Option I1	Option I4	Option I5
Integrity of Existing Landscape and Street Pattern - Extent to which the new bridge maintains the integrity of the existing urban character and rural landscapes, particularly the physical and visual experience of the historical street grid.	Ability to minimise the street scale and form of the new bridge approach roads.					
	Widening of streets on both sides of the river will impact on street scale and form.	Widening of streets on both sides of the river will impact on street scale and form plus the viaduct in Grafton is not aligned with the street grid.	Widening of streets on both sides of the river will impact on street scale and form in particular on Pound Street and on Iolanthe Street.	Widening of streets on both sides of the river will impact on street scale and form in particular on Fry Street in Grafton.	Widening of streets on both sides of the river will impact on street scale and form in particular on Kirchner, North and Prince Streets.	Widening of streets on both sides of the river will impact on street scale and form in particular on Kirchner, North and Prince Streets.
	Ability to retain the existing landscape character of the area, including minimising the removal of trees.					
	Moderate impacts on the existing landscape particularly along Villiers Street including the removal of some large Fig Trees.	Major impacts on the existing landscape character on both sides of the river particularly the vegetated southern river bank and the area around Fitzroy Street.	Substantial impacts on the existing landscape character on both sides of the river particularly the Greave and Pound Street area.	Substantial impacts on the existing landscape character on both sides of the river particularly the Fry Street area including some large Fig Trees in the park at the end of Fry Street.	Substantial impacts on the existing landscape character on both sides of the river particularly the southern end of Corcoran Park.	Substantial impacts on the existing landscape character on both sides of the river particularly the southern end of Corcoran Park.
	Ability to minimise the size of intersections between the approach roads and the existing local roads.					
	Some widening of a range of intersections will occur on both sides of the river particularly on Villiers Street.	Requires large scale intersections on the approach roads on both sides of the river, particularly the large roundabout in South Grafton.	Requires large scale intersections on the approach roads on both sides of the river particularly on Iolanthe and Pound Streets.	Requires large scale intersections on the approach roads on both sides of the river particularly the large roundabout adjacent to the Pacific Highway and another two on Villiers Street.	Requires large scale intersections on the approach roads on both sides of the river particularly two large roundabouts, one adjacent to the Pacific Highway and another on Prince Street and two more on Queen and Turf Streets.	Requires large scale intersections on the approach roads on both sides of the river particularly four large roundabouts, one adjacent to the Pacific Highway and another three on Prince Street, Lawrence Road and Summerland Way.
	Ability to generally maintain existing urban patterns and integrate the geometry of any new approach roads within the existing road reserves.					
Consistent with the existing street pattern in Grafton, and generally supports the physical and visual experience of the historical street grid. A short section of approach road (265m) in South Grafton is not aligned with the street grid.	The approach road in South Grafton is mostly aligned with the street grid, however it still impacts on land outside the road reserve. The elevated approach road impacts on the urban pattern between Craig Street and Fitzroy Street.	Urban patterns on both sides of the river are not maintained as neither approach road is aligned with existing road reserves. The northern approach road has a major impact on developed land and structures cutting diagonally across the existing urban form.	The approach road in Grafton is aligned with the street grid, however this option still results in a major impact on developed land and structures expanding outside the road reserves. The southern approach road aligns with the rural landscape pattern.	The southern approach road does not align with the rural landscape pattern, cutting diagonally across the river floodplain. The northern approach roads roughly follow the existing urban patterns although in some areas they expand beyond the existing road reserves.	The southern approach road does not align with the rural landscape pattern, cutting diagonally across the river floodplain. The northern approach roads roughly follow the existing urban patterns until North Street where they expand well beyond the existing road reserves.	

Indicator	Description					
	Option E	Option A	Option C	Option I1	Option I4	Option I5
Urban Connectivity - Extent to which the new bridge improves accessibility for local traffic and public transport and in particular connectivity for pedestrians and cyclists between Grafton and South Grafton.	Ability to minimise the travel distance and times between town centres for all modes of users.					
	Provides improved connectivity between the town centres by creating a more direct connection between the two centres.	Maintains existing connectivity between the town centres by duplicating the existing bridge crossing.	Does not provide overall improved connectivity between the town centres as it draws traffic movements away for the two town centres.	Substantially reduces connectivity between the town centres being located approximately 1km downstream of the existing bridge.	Substantially reduces connectivity between the town centres being located almost 2.5km downstream of the existing bridge.	Substantially reduces connectivity between the town centres being located almost 2.5km downstream of the existing bridge.
	Ability to improve connectivity and connection opportunities for local traffic and public transport.					
	Strong connections for local traffic and public transport as it provides a direct crossing for local trips close to the two town centres with some separation from the existing bridge crossing. Trips from the new release areas of Waterview Heights would benefit from this option.	Good connections for local traffic and public transport although this bridge option shares the same approach road network with the existing bridge.	Good connections for local traffic and public transport although it is more removed from the town centres.	Reduces connectivity between the town centres, as increased travel distances favour regional traffic rather than local traffic. Trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.	Reduces connectivity between the town centres, as substantially increased travel distances favour regional traffic rather than local traffic. Trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.	Reduces connectivity between the town centres, as substantially increased travel distances favour regional traffic rather than local traffic. Trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.
	Ability to improve connectivity and connection opportunities for pedestrian and cycle networks.					
	Creates new and stronger connections for pedestrians and cyclists being more direct and creating a circular network between the new and existing bridges.	Does not provide any new or improved connections beyond what is currently available on the existing bridge crossing.	Connections are not improved it is more removed from the town centres and the shared path would have poor amenity in the industrial area in South Grafton.	Provides poor connections due to the distance from the town centres and the lack of shared paths on the existing highway in South Grafton.	Provides poor connections due to the distance from the town centres and the lack of shared paths on the existing highway in South Grafton.	Provides poor connections due to the distance from the town centres and the lack of shared paths on the existing highway in South Grafton.
Ability to improve connectivity to existing and proposed riverfront public recreation spaces.						
Provides improved access to both existing and proposed riverfront recreation spaces by creating a circular path system between Grafton and South Grafton.	Provides reasonable access to riverfront recreation spaces although it does not encourage new opportunities along the foreshores.	Does not provide new or additional access to riverfront recreation spaces nor does it encourage new opportunities along the foreshores.	Provides no access to riverfront recreation spaces and removes the boat launch facility at Fry Street.	Provides access to riverfront recreation at Corcoran Park from South Grafton, however it substantially impacts to the park itself.	Provides access to riverfront recreation at Corcoran Park from South Grafton, however it substantially impacts to the park itself.	

Indicator	Description					
	Option E	Option A	Option C	Option 11	Option 14	Option 15
Continued Urban Development - Extent to which the new bridge assists in maintaining the integrity of the existing patterns of urban settlement and facilitate future urban development.	Ability to provide more direct connections for local trips and destinations beyond Grafton and South Grafton town centres.					
	Provides direct connections for local trips in the greater Grafton area.	Close proximity to existing bridge continues to provide same connections for local trips in the greater Grafton area.	Close proximity to existing bridge continues to provide same connections for local trips in the greater Grafton area.	Does not provide direct connections for local trips in the greater Grafton area. Although some trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.	Increased travel distances reduce direct connections for local trips in the greater Grafton area. Although some trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.	Increased travel distances reduce direct connections for local trips in the greater Grafton area. Although some trips to and from the new release areas of Clarenza and Junction Hill could benefit from this option.
	Ability to minimise the effects of fragmentation on neighbourhoods or precinct areas.					
	Does not result in the fragmentation of the existing patterns of urban settlement.	Results in some fragmentation of the existing residential neighbourhoods in Grafton around Fitzroy and Craig Streets.	Results in some fragmentation of the existing residential neighbourhoods in Grafton.	Results in some fragmentation of the existing residential neighbourhoods in Grafton along Fry Street.	Results in the fragmentation of neighbourhood environments in Grafton along Kirchner and North Streets.	Results in the fragmentation of neighbourhood environments in Grafton along Kirchner Street, North Street and the new road to the Summerland Way.
	Ability to be integrated with or support future development and revitalisation of existing areas (retail, commercial, industrial, recreation, education, etc.).					
	Potential to improve future development and revitalisation in existing areas, and has the potential to encourage new economic development and connections between existing town centres.	Continues supporting development patterns and revitalisation in existing areas.	Potential to support industrial area in South Grafton.	Does not support economic development and connections between existing town centres.	Increased travel distances do not support economic development and connections between existing town centres.	Increased travel distances do not support economic development and connections between existing town centres.
	Ability to minimise the creation of new main street environments and strip development that does not support or connect to the town centres of Grafton and South Grafton.					
	Provides additional access along the existing commercial corridor between the town centres on both sides of the river.	Continues supporting the existing development patterns and revitalisation in the area on both sides of the river.	Increases potential for new strip development to occur that will detract from the two town centres.	Increases potential for new strip development to occur that will detract from the two town centres.	Substantially increases potential for new strip development to occur that will detract from the two town centres.	Substantially increases potential for new strip development to occur that will detract from the two town centres.

Indicator	Description					
	Option E	Option A	Option C	Option I1	Option I4	Option I5
Summary	The summary highlights the key features and the ability of each new bridge option to fit into the built and natural context of Grafton and South Grafton and maximise the long term benefit to Grafton and its community.					
	<ul style="list-style-type: none"> • Maintains existing bridge integrity. • Mostly utilises existing road corridors. • Limited new or upgraded infrastructure on approach roads. • Direct and at grade connection into Villiers Street. • Impacts on properties and land uses mostly on Villiers Street. • Direct connections between town centres. • Encourages cohesive development around town centres. • Encourages foreshore recreation access opportunities. 	<ul style="list-style-type: none"> • Impacts substantially on existing bridge integrity. • Mostly utilises existing road corridors. • Impacts on commercial land uses on Bent Street. • Elevated approach road impacts on residential properties and amenity along Fitzroy Street. • No real improvement in town centre connections. • Increases the barrier effect of Bent Street between the town centre and the railway station, industrial and commercial area. • Very large roundabouts in South Grafton impact on pedestrian /cycle movements and town character. 	<ul style="list-style-type: none"> • Impacts substantially on existing bridge integrity. • Requires substantial new approach roads. • Elevated approach road has high impacts on residential properties and local amenity between Greaves Street and Clarence Street. • Limited impact on South Grafton properties and land use. • No improvement in town centre connections. • Encourages development in South Grafton but not close to the town centre. • Poor pedestrian and cycle access between town centres. 	<ul style="list-style-type: none"> • Maintains existing bridge integrity. • Requires substantial new approach roads. • Approach road has high impacts on residential properties and local amenity along Fry Street between the River and Villiers Streets. • Viaduct, fill embankment and large roundabout impact on open floodplain. • Substantial reduces town centre connections. • Fragments existing neighbourhood areas and encourages strip development which impacts on town centre. 	<ul style="list-style-type: none"> • Maintains existing bridge integrity. • Requires extensive new approach roads. • Approach road has high impact on important riverside park and impacts on residential properties and local amenity in northern Grafton. • Large viaduct, fill embankment and large roundabout impact on open floodplain. • Substantially reduces town centre connections. • Fragments existing neighbourhood areas and encourages strip development which impacts on town centre. 	<ul style="list-style-type: none"> • Maintains existing bridge integrity. • Requires extensive new approach roads. • Approach road has high impact on important riverside park and impacts on residential properties and local amenity in northern Grafton. • Large viaduct, fill embankment and large roundabout impact on open floodplain. • Substantially reduces town centre connections. • Fragments existing neighbourhood areas and encourages strip development which impacts on town centres.

COMPARATIVE ASSESSMENT OF ROUTE OPTIONS

As discussed earlier in this report, the proposed new bridge represents a significant piece of infrastructure which, like the existing bridge, will be a defining moment in the future development of Grafton and South Grafton when it is built. Therefore, a comparative assessment that considers how each option will perform in the context of maximising the long-term benefit to the community should be a central component in the selection of the next Clarence River crossing.

This section provides a comparative assessment between the route options based on the same set of key visual, landscape and urban design indicators from the previous section. Unlike the previous assessment which looked at the individual merits of each option against each indicator, this assessment provides a relative comparison of each option in relation to each indicator.

Visual Integrity of Existing Bridge

Option E and Option 11 are the best performing options for maintaining the visual integrity of the existing bridge. These options both maintain important and recognisable views of the bridge as well as provide new opportunities for new viewpoints to be established. Additionally, these options allow for the potential to design a new bridge that has its own independent visual expression.

Option 14 and Option 15 are too far away from the existing bridge to either impact the visual integrity of the existing bridge, or provide opportunities to enhance important and recognisable views. The location of these options allow for the new bridge to have its own independent visual expression.

Option A and Option C are the two poorest performing options for maintaining the visual integrity of the existing bridge. The greatest impact results from the new roadway being located across the middle of the steel truss of the existing bridge, between the rail deck and road deck. The proposed road deck height fails to meet a key urban design principles for bridges located adjacent to the existing bridge. The intent was to design these options so that the road deck of the new bridge would be at the same level as the existing rail deck. It was also intended that the visual depth of the superstructure of the new bridge would not visually intrude on the steel truss of the existing bridge.

Furthermore, pedestrians and cyclists using the path on the existing bridge (adjacent to the new bridge) will primarily see the 5.2m deep side of the new bridge and therefore have a major reduction in views of the river and the surrounding area with both Option A and Option C. Recognisable views towards the existing bridge will be substantially impacted by Option A when looking downstream from either the Grafton or South Grafton foreshore area will impact the view of the existing bridge. In Option C upstream views of the existing bridge will be impacted from the Grafton foreshore and to a much lesser extent, the Clarence urban release area, and at a distance, heading southbound along the Pacific Highway.

Compatibility with the Surrounding Built Environment

Option E and Option A are the best performing options for minimising the need for viaducts and artificially elevated roadways. Option E has the least amount of viaduct of any option. Both of these options also create the least amount of physical barriers that will impact cross connections across all mode user groups.

Option C performs poorer than Options E and A based on the need for viaducts and artificially elevated roadways. This option

also results in the creation of physical barriers in residential neighbourhoods in Grafton around Greave and Pound Streets.

Option 11, Option 14 and Option 15 are the poorest performing options requiring the creation of long sections of viaducts and artificially elevated roadways along an active floodplain and through productive agricultural lands. On the Grafton side of the river, these options also create a number of new physical barriers that would impact cross connections and local traffic patterns in these predominantly residential areas.

Integrity of Existing Landscape and Street Pattern

Under this indicator, all options result in some adverse impact as a result of the new crossing. Of the six options, Option E is the best performing option because it has the least overall impact. Option E is generally consistent with the existing landscape pattern on both sides of the river. While not totally consistent with the historical street grid in South Grafton, this option has the smallest physical footprint and limits the impact to the visual experience of the road user.

Option A and Option C both substantially impact the existing urban character of both Grafton and South Grafton. This is a result of the large scale and form of approach roads, including the viaducts and roundabouts, particularly in South Grafton. Street patterns in Grafton are also not maintained, impacting mostly residential land and structures.

Option 11, Option 14 and Option 15 are the poorest performing options impacting the existing character on both sides of the river through the creation of the large scale approach roads, viaducts and roundabouts. The northern areas of Grafton are particularly impacted by these options as they all have large physical footprints located in predominately residential neighbourhoods.

The visual experience of the road upgrades in these areas is also not consistent with the historical street grid due to the increased scale of the road infrastructure.

Urban Connectivity

Option E is the best performing option in that it provides improved connectivity through the creation of a western connection to the Grafton and South Grafton town centres. This option maximises connections for local traffic, public transport, pedestrians and cyclists by creating a more direct connection between the two town centres because it allows for the creation of a logical loop (or circuit) in the road network. This would assist in distributing the 97% of trips across the existing bridge that are to local destinations. Additionally, this option provides improved access to both existing and proposed riverfront recreation spaces. It also creates an opportunity for connecting the foreshores between Grafton and South Grafton through circular path system

Option A and Option C are fairly neutral in terms of their impact and provide no real overall benefit to the urban connectivity between Grafton and South Grafton. Of the two, Option A is just marginally better than Option C. Both options generally maintain the existing connectivity between the town centres. There is little change in overall connections for local traffic and public transport. Pedestrians and cyclists gain no overall benefits from new connections. These options do maintain access to riverfront recreation spaces in Grafton, although neither encourages new opportunities along the foreshores.

Option 11, Option 14 and Option 15 are the poorest performing options substantially reduce connectivity between the town centres. These options provide the poorest connections for local traffic and public transport. None of these options provide

access to footpaths in South Grafton for either pedestrians and cyclists, leaving them to walk or ride along the shoulder of the Pacific Highway.

Options 11, 14 and 15 have major impacts on access to riverfront recreation. Option 11 removes the small foreshore park and boat launch facility at the end of Fry Street. Options 14 and 15 substantially impacts the setting and amenity of Corcoran Park and remove the main boat launch and jetty.

Options 11, 14 and 15 create bypass of the town centres catering particularly for trips between Clarenza and Junction Hill. However, these options have the highest potential to generate 'rat-runs' off the bypass route through local residential neighbourhoods. This would occur mostly in north Grafton travelling to and from Grafton's town centre. It is also possible that 'rat-runs' could occur along Centenary Drive in Clarenza from through traffic on the Pacific Highway that is trying to avoid the elbow bend through the eastern area of South Grafton.

Continued Urban Development

Option E is the best performing option in that it provides direct connections for local trips in the greater Grafton area and does not result in the fragmentation of the existing patterns of urban settlement. It has potential to improve future urban development and revitalisation efforts through the connections between the town centres. This is due to the creation of a loop network which encompasses the main portion of the commercial/industrial development corridor. Additionally, this option will provide better connectivity to the predominantly residential Waterview Heights area, which has a higher overall development capacity than the Clarenza area.

Option A and Option C would provide direct connections for local trips in the greater Grafton area along the existing commercial/industrial development corridor. However, these options will result in some fragmentation of the existing patterns of urban settlement and remove portions of a residential neighbourhood in Grafton. Option A is slightly better than Option C in terms of fragmentation since the new road alignment will be adjacent to the existing road network and only impact on residential dwellings on one side of Fitzroy Street. Option C will have a more substantial impact, effecting almost an entire block within an established residential neighbourhood.

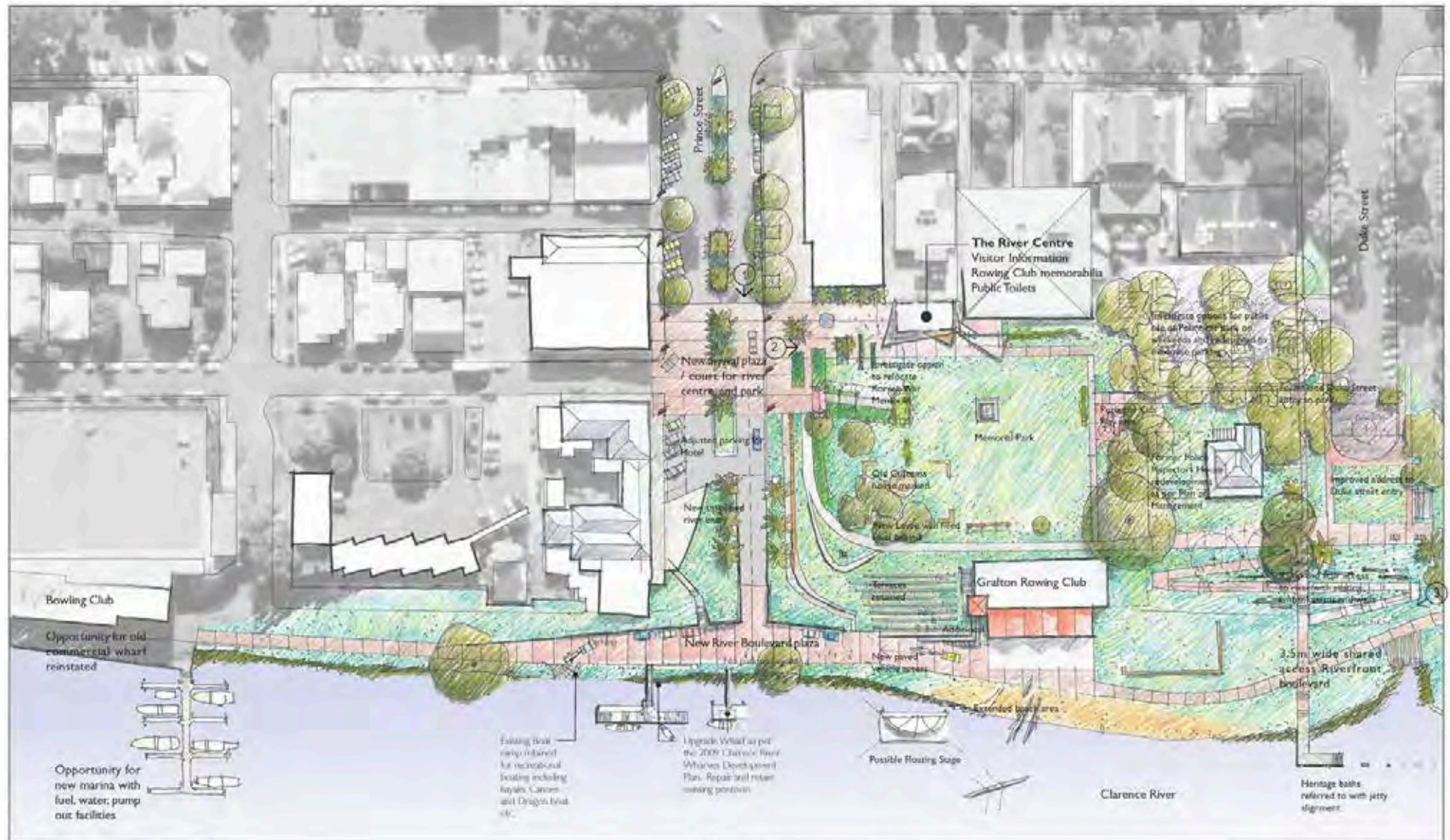
Option A and Option C also have the potential to support economic development and connections between existing town centres in the long-term, however, during construction, businesses in South Grafton will be impacted. This is particularly true in Option A along Bent Street, which will have a major physical impact on commercial properties and will require some form of redevelopment of these effected properties.

Option 11, Option 14 and Option 15 are the poorest performing options as they do not provide direct connections for local trips in the greater Grafton area. All of these options will result in substantial fragmentation of the existing patterns of urban settlement and the continuity of local residential neighbourhoods. These options will also negatively impact future urban development and revitalisation efforts in the central Grafton and South Grafton areas. This is due to the bypass of the town centres creating the real potential to encourage strip development along the new route corridors that will attract development away from the existing town centres.



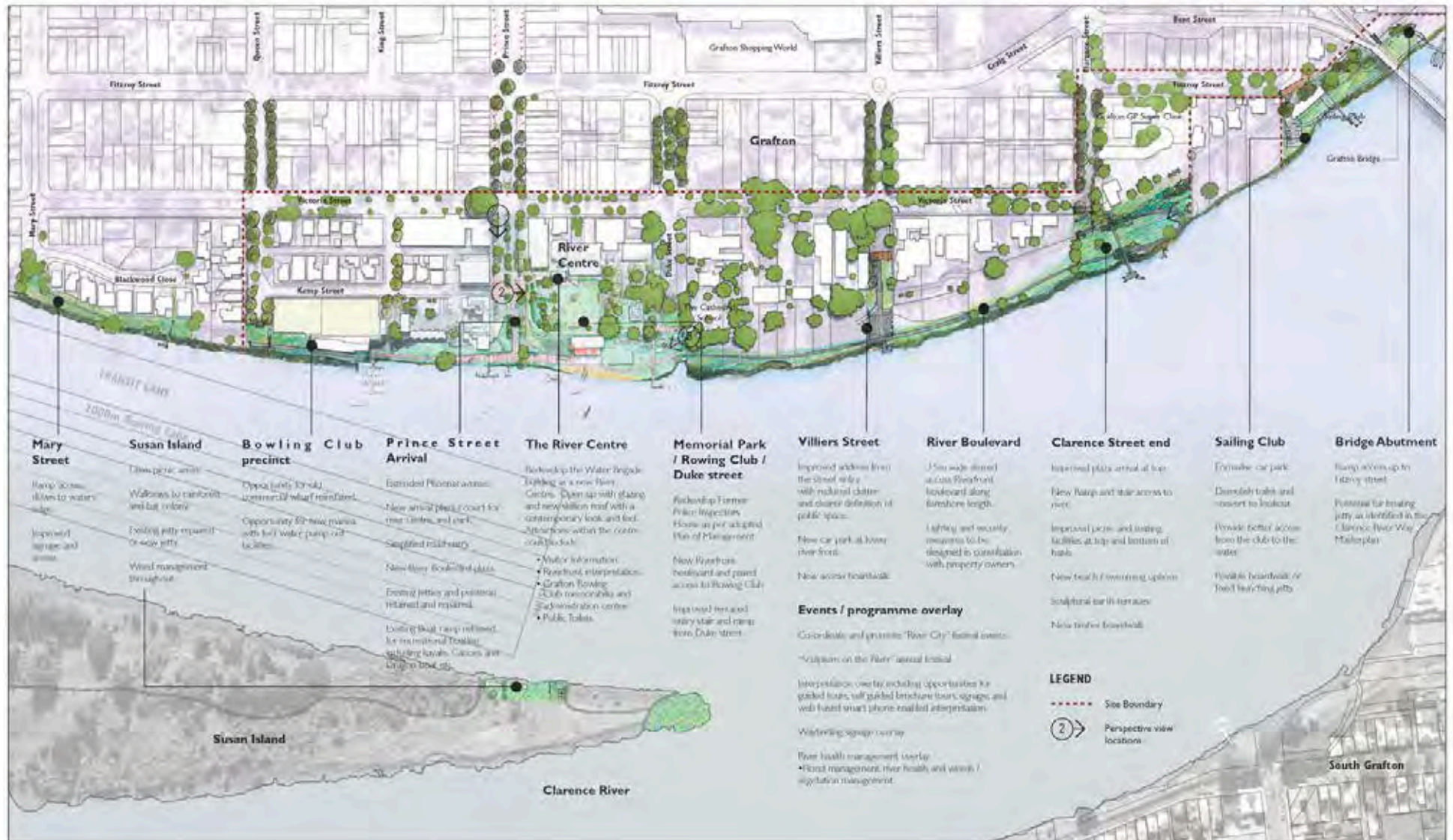
APPENDICES

APPENDIX A - GRAFTON WATERFRONT PRECINCT MASTERPLAN



Source: Clarence Valley Council, March 2011

APPENDIX A - GRAFTON WATERFRONT PRECINCT MASTERPLAN



Source: Clarence Valley Council, March 2011

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION E



AERIAL PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION E



Source: Arup 2012

AERIAL PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION E



GROUND PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION E



Source: Arup 2012

GROUND PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION A



AERIAL PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION A



Source: Arup 2012

AERIAL PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION A



GROUND PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION A



Source: Arup 2012

GROUND PERSPECTIVE - AFTER

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION C



AERIAL PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION C



This artist's impression is for indicative purposes only and provides an indication of the bulk and scale of the current preliminary concept design for the option. The preliminary concept design may be refined with further development of the option.

Source: Arup 2012

AERIAL PERSPECTIVE - AFTER

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION C



GROUND PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION C



Source: Arup 2012

GROUND PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION 11



AERIAL PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION 11



This artist's impression is for indicative purposes only and provides an indication of the bulk and scale of the current preliminary concept design for the option. The preliminary concept design may be refined with further development of the option.

Source: Arup 2012

AERIAL PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION 11



GROUND PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION 11



Source: Arup 2012

GROUND PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION 14/15



AERIAL PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION 14/15



This artist's impression is for indicative purposes only and provides an indication of the bulk and scale of the current preliminary concept design for the option. The preliminary concept design may be refined with further development of the option.

Source: Arup 2012

AERIAL PERSPECTIVE - AFTER

APPENDIX B -
PHOTOMONTAGE VISUALISATION FOR OPTION 14/15



GROUND PERSPECTIVE - BEFORE

APPENDIX B - PHOTOMONTAGE VISUALISATION FOR OPTION 14/15



Source: Arup 2012

GROUND PERSPECTIVE - AFTER

**SPACKMAN
MOSSOP AND
MICHAELS**