Attachment 6

Statement of Heritage Impacts

Proposed Duplication of the Clarence River Bridge, Grafton

Statement of Heritage Impact

RTA ENVIRONMENTAL TECHNOLOGY

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Document Controls

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Appendix A: Plans of the proposed 2 lane new bridge

Appendix B: Artist's impression of the new bridge

Appendix C: Proposed duplication of the Clarence River Bridge Visual Assessment of Option 2b from downstream, Geolink, 2004

1 Introduction and Background to the Proposal

The Clarence River Bridge links North and South Grafton along Main Road No.83 (the Coffs Harbour to Casino Road). The location of the Bridge is shown on **Figure 1.** The Bridge is a metal truss road and railway bridge with a Rall bascule span opened to traffic in 1932. The Bridge and railway approaches were placed on the Heritage Council of NSW's State Heritage Register (SHR) in 1998. While a curtilage was not established for the Bridge at that time any proposal to develop land in the close vicinity of an item on the SHR requires approval from the Heritage Council in accordance with Section 60 of the NSW *Heritage Act* 1977 as amended before works can be undertaken.

The NSW Roads and Traffic Authority (RTA) is investigating options for the duplication and straightening of the approaches of the Clarence River Bridge at Grafton in order to meet current and future traffic requirements. As the proposed works would involve alteration of a heritage item, a Statement of Heritage Impact (SOHI) is required to determine the potential level of impact upon the Bridge and whether the level of impact is acceptable. This SOHI will form accompanying documentation to the RTA's S60 application to the Heritage Council of NSW. A Conservation Management Plan (CMP) was prepared by Connell Wagner in 1996 and though it deals primarily with the rail element of the Bridge, reference is also made to the road and approaches.

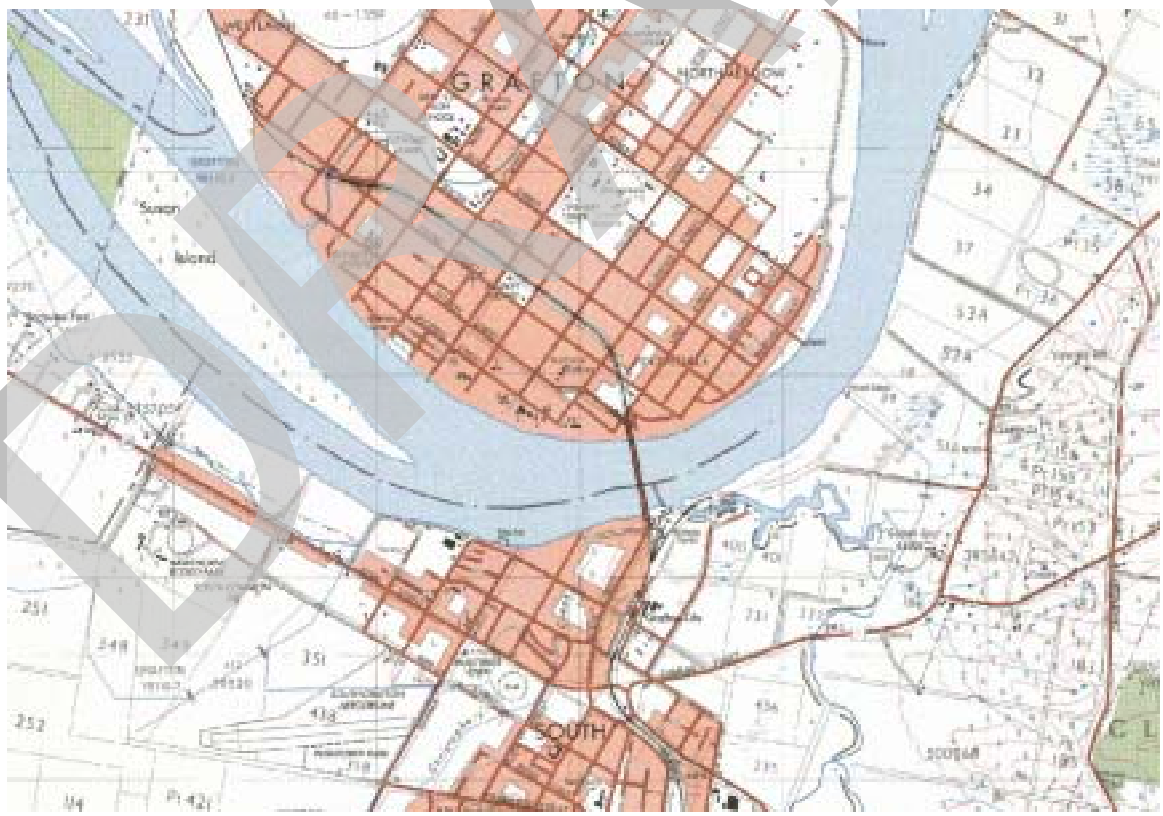


Figure 1: Location of Clarence River Bridge, Grafton (Source: AMG 55 1:25 000. Map extract courtesy of Surveyor General's Department).

2 History and Significance of the Clarence River Bridge

2.1 History of the Grafton Area

The City of Grafton is located on the Clarence River between Brisbane (320 kilometres) and Sydney (695 kilometres). The Indigenous people traditionally occupying the Clarence River Valley are the Bundjalung, their land extending North to Baryulgil, Casino and Evans Head. A smaller group the Yaegl occupied the coastal area where Iluka, Yamba and Maclean now exist, and Southwest of this was Gumba Ynggir land. Early explorers report a high density of Aboriginal occupation of the Northern Rivers especially close to the Coast where they could exploit a rich marine environment in addition to the animals and fruits found in the brushes and grassy plains. Details of the mythological landscape of this environment have been lost as a result of European settlement, however the Grafton region contains many indigenous sites on rock walls and ledges lining creeks, rivers and valleys dated up to 6500 years old (HODUAP, 1996:59).

As it nears the sea, the Clarence River widens and stretches out into bays and inlets, its mouth so large that in 1799 Mathew Flinders after spending the night there named it 'Shoal Bay'. (*Clarence River Historical Society*, 1992: 1) Escaped convict Richard Craig reported a big River and a plenitude of valuable timber in the early 1830s, but the area was not further explored until the late 1830s. In 1839 a Sydney merchant Thomas Small and Henry Gillett organised an expedition inspired by Craig's sighting of 'The Big River', on board the schooner 'Susan', it was the first European vessel to enter the River. Small took up a large parcel of land on Woodford Island to run cattle (HODUAP 1996:64).

Occupation of the area followed immediately and settlers arrived to take advantage of the Rivers' rich alluvial soils and stands of cedar. The forest country around Grafton was deemed suitable for grazing cattle and primitive stations were established in the 1840s. Conflict with the local Bundjalung people inevitably followed settlement. Aboriginal people local to pastoral stations were employed to form a casual labour force, however armed conflict, massacres and disease hastened the decline in the population. Despite this, by the late nineteenth century a substantial population was being 'managed' by the Government and nine reserves had been established. Seeds, tools and rations were provided and Aboriginal men were encouraged to work as stockmen or in fishing and farming (HODUAP, 1996:64).

Cedar getters set up their camps in the late 1830s on the banks of either side of the Clarence at Grafton, which was known as 'The Settlement' from earliest times. The red cedar tree (*Toona australis*) was sought after due to its soft easily worked timber and attractive finish resembling mahogany. The colonists of Sydney and Melbourne had by now decided cedar was the most desirable timber for their building, joinery and furniture both in the colony and for export to England. The manner in which cedar was cut and transported to market heavily influenced the siting of the camps. Cedar was a light timber which could be floated downriver. Cutters working in the rugged upper reaches of the rivers stacked the logs of cedar near the riverbanks. When seasonal floods or high water permitted, the logs

were floated downstream. Cedar camps often formed at the places where the logs were caught and where the dealers came to buy the logs for shipment downriver and on to Sydney. To undertake the shipping of cedar logs to Sydney, many quite substantial vessels came up the northern rivers. Initially they were often met with little in the way of facilities such as docks and repair works but these were gradually developed. The difficulties of navigation on the rivers, still bar bound and with submerged logs, unknown rocks and other debris, coupled with the difficulty of steering sailing vessels upriver with little room for manoeuvre, meant that steam tugboats were vital aids.

Grafton became an established cedar cutter's port from the 1830s and then a major shipbuilding site until the end of the nineteenth century when the railways began to dominate internal trade. A store and shipyard were established on the southern bank in 1839 and a wharf, store and inn adorned the northern bank by the early 1840's. Twenty establishments were listed on the Clarence River in 1841. The district was surveyed in 1843 and a police magistrate appointed in 1846, at which time the population was recorded at 120. A township was laid out in 1849 and named after the Duke of Grafton.

Grafton was well placed to serve the pastoral population of the 1840s. By 1842 most of the cedar getters had moved North to the Richmond district which was also opening up to the pastoral expansion. Following this the relatively small and scattered pastoral occupation suffered economic depression and pastoralists turned to preserving and exporting their cattle. Tallow, hides, bones and horns were boiled down and exported as were salted sides of beef. Live cattle was shipped to Sydney or sold to stock new inland runs. A meat preserving works was opened in Grafton in 1840 (HODUAP, 1996:65)

Land was opened to agriculturalists in the 1850s along the rivers in densely forested country rejected by pastoralists. Small farms were sold on the Clarence from 1854 until the Land Alienation Act of 1861 opened crown lands to 'free settlement' (HODUAP, 1996:61). With the opening up of the land old cedar ports like Grafton were revived and shipping services grew more frequent to serve farmers growing perishable produce. (HODUAP, 1996: 61) At first it was hoped that the Clarence would be the 'wheat bowl of NSW' but rains in the 1860s brought rust and maize became the mainstay. Maize was in overproduction and prices were low, the search for a new staple in the region met with limited success until sugar. Sugar cane was the only tropical crop to prove successful, and many small mills were built, the largest at Ulmarra. The industry became fully established when the Colonial Sugar Refining Company built Southgate, Chatsworth and the Harwood mills by 1870 (HODUAP, 1996: 65).

Most of the smaller sugar mills were hard hit in the 1880s when the price of sugar slumped and CSR, with its larger resources, was better able to weather the difficulty. However, with the sensitive climactic requirements of sugar cane and the deliberate location policy decisions of the CSR Company, many areas of the Northern Rivers were no longer regarded as viable for economic sugar cane production. By 1891 only 9 mills remained, the largest and most efficient were located at Broadwater, Rous and Alstonville. Then in the 1890s sugar cane was heavily infested with gumming disease and dairying was taken up as an alternative (HODUAP, 1996: 62).

When paspalum grass was introduced for fodder in the northern coastlands in the mid-1890s the dairy industry thrived. The settlers who proved the viability of dairying on the Northern Rivers were mainly men from the south coast dairy region. By the 1880s most of the suitable land on the south coast had been taken up and younger sons and tenant farmers who hoped to buy their own freehold and maintain their own dairy farm had few alternatives but to seek land elsewhere. Many went to the Northern Rivers. When taking up land on the Northern Rivers, these farmers sought basalt soils similar to those that they had found to be suitable for dairying on the south coast. With them the farmers took a familiarity with the latest technology, particularly mechanical cream separation, and a readiness to associate with other farmers in co-operative ventures for mutual benefit. Initially butter factories were established in the area later becoming creameries, with central factories emerging at Ulmarra and Grafton which reinforced their urban status (HODUAP, 1996:65).

In Grafton a school had opened in 1852 and the first Anglican Church in 1854. The population had grown to 1069 by 1856. Grafton benefited both from its location on the main coastal road to the north and from gold discoveries on the upper Clarence River and was growing as a town becoming a municipality in 1859. Building works boomed from this time including a courthouse (1846 and 1880), post office (1878), cathedral (1884) and the gaol (1891-30). In the 1860s work on the entrance to the River began to improve its navigation, and the telegraph was connected to the main Australian system at Tenterfield in 1882. (HODUAP, 1996:65) Grafton was becoming the urban centre of the North Coast and was declared a city in 1885, by which time its population had surpassed 4000.

The railway reached North Grafton linking it to Brisbane in 1905 with South Grafton linked to Sydney in 1923. By the late 1920s the volume of both road and rail traffic proved that the steam ferry service was insufficient. Long delays were experienced, particularly when manoeuvring the trains across the river and the construction of a Bridge had to proceed urgently. Construction provided stable employment for willing men for four years during the 'Great Depression' and The Clarence River Bridge was finally opened in 1932 to road and rail traffic, completing the rail line between Sydney and Brisbane without a change of trains. The importance of shipping to the area was a major consideration in the location and design of the Bridge with its unique bascule (lifting) span. However, a decline in the use of the Clarence as a major shipping route led to the Maritime Services Board's decision to close the bascule span in 1968. The Bridge retains an important role for the present community of Grafton both in a functional sense and as a reminder of the history of the area as it represents the linking of Grafton and South Grafton which had traditionally been two separate communities.

2.2 History of Lift Span Bridges in NSW

The history of opening span bridges in NSW is closely linked to the economic rivalries of NSW, Victoria and South Australia in the final decades of the 19th century. Prior to 1850, the western region of NSW was thinly populated, the majority of inhabitants being settlers who managed vast sheep runs. The costs associated with transportation of the wool clip overland to Sydney were very high, but was made economically viable by the even higher prices fine Australian wool fetched on the world markets at that time. Following the gold rushes of the 1850s and the establishment of the *Crown Lands Alienation Act 1861*, more people began to settle in the west and southwest of NSW. The increased population of these areas led to demands for better river crossings of the major inland rivers, particularly the Murray and Murrumbidgee.

The majority of early bridges were preceded by punts, which although better than having to ford a river, still had problems in terms of their low capacity, slow operation, and the monopoly held by most operators which led to many disputes over excessive charges. On the majority of crossings, a simple bridge was the answer, but on the navigable stretches of rivers such as the Paterson, Murrumbidgee, Darling and Clarence, provision had to be made to allow free passage of river traffic. Opening span bridges were the answer. Five types of opening span bridges were built in NSW prior to 1915, these being:

1. Pontoon or floating bridges – a series of pontoons or barges moored end to end with allowance for one or two units to be floated clear to allow passage of river traffic.
2. Sliding, traversing, draw or retractable bridges – the opening span as a counter-balance portion, projecting over the fixed part of the bridge, with the whole unit sliding horizontally on a system of rails and rollers.
3. Swing or pivoting bridges – these bridges rotate or pivot horizontally about a vertical axis. Symmetrical swing bridges provide an opening on each side of the central pivot, which balances the structure. In cases where a single-opening span is used, some form of short counterbalance is built on the other side.
4. Bascule bridges – also known as draw bridges. The moving span is hinged at one end and swinging from the horizontal into a near-vertical position.
5. Lift bridges – the moveable portion remains horizontal and is lifted vertically. The amount of headroom available is determined by the variations between water levels and the heights of the lift towers. Water traffic beneath these bridges is restricted to low-masted craft, barges and tugs (Fraser, 1985: 71-4).

During the colonial period, the costs of a high-level bridge with long approach spans was prohibitively expensive, thus low-level crossings of navigable rivers were required. Factors which determined the selection of what type of moveable span bridge should be built in a given location were:

- Volume of water-borne traffic;
- Speed of operation, and
- The height of vessels and the variations in water levels.

In NSW four regions existed in which these factors combined to create justification for opening span bridges, these being Sydney Harbour, the North Coast rivers, South Coast Inlets and the inland river system of the Darling, Murray and Murrumbidgee. Sydney Harbour and the North Coast had to cater for the large boats and sea-going vessels that traveled large distances upstream from the river entrances, so bridges of the first four types were required, in order to provide clearance for masted vessels. For the inland rivers, the majority of craft were paddle steamers and loaded barges. These craft were not tall (maximum height approximately seven metres) and could pass under most bridges when water levels were low. However, during high water periods, particularly floods, additional headroom was required, and this could easily be provided by a lift span over the main channel. Hence the majority of bridges on the Murray/Darling river system are lift bridges (Fraser, 1985:74).

The first bascule bridges built in NSW were designed by J.A. McDonald between 1891 and 1895. These were timber structures operated by ropes leading over and down a timber tower, with sectional counterweights and were located on the Belmore River near Kempsey, at the Camden Haven River near Ross Glen, over Shea's Creek at Mascot and over Kinchela Creek also near Kempsey. The towers lacked stiffness; this could have been provided in later designs, but other methods of operation were preferred for later bridges.

Designs from 1902 to 1926, known as the "Coraki" type, were adapted from an American design and were part of the changeover to American bridge technology around 1900. These had steel girders with timber decks, and were rope operated with counter-weights rolling down a curved track designed so as to maintain continuous balance during lifting. The towers were sometimes timber, sometimes steel; the track supports formed a substantial tracing truss for each tower. The surviving examples of this type of bascule bridge are at Coraki and Maclean on the far North Coast and the 1985:80) 1922 bridge over the Murrumbidgee River near Carrathool (**Figure 2**) (Fraser, 1985:80).

Figure 2: View of Carrathool Bridge detailing the bascule lift span.

The major type in use between 1927 and 1936 was the "Strauss" bascule with four bridges

were built to this design in which the balance is maintained by a parallelogram of links between the end of the span and the counterweight. The first of these was the road and rail bridge at Menindee, the central lifting span enabling large vessels to pass up and down the Darling (**Figure 3**). However, this proved prone to mechanical troubles and it frequently took six men 45 minutes to raise or lower the span. The counterweight and towers were removed in 1970 to give sufficient clearance for trains carrying semi-trailers between Parkes and Western Australia (DMR, 1977:4). The bridges at Menindee (1919) (**Figure 3**), Narooma (1931) and Coopernook (1933) are examples of two forms of "Strauss" bascule.

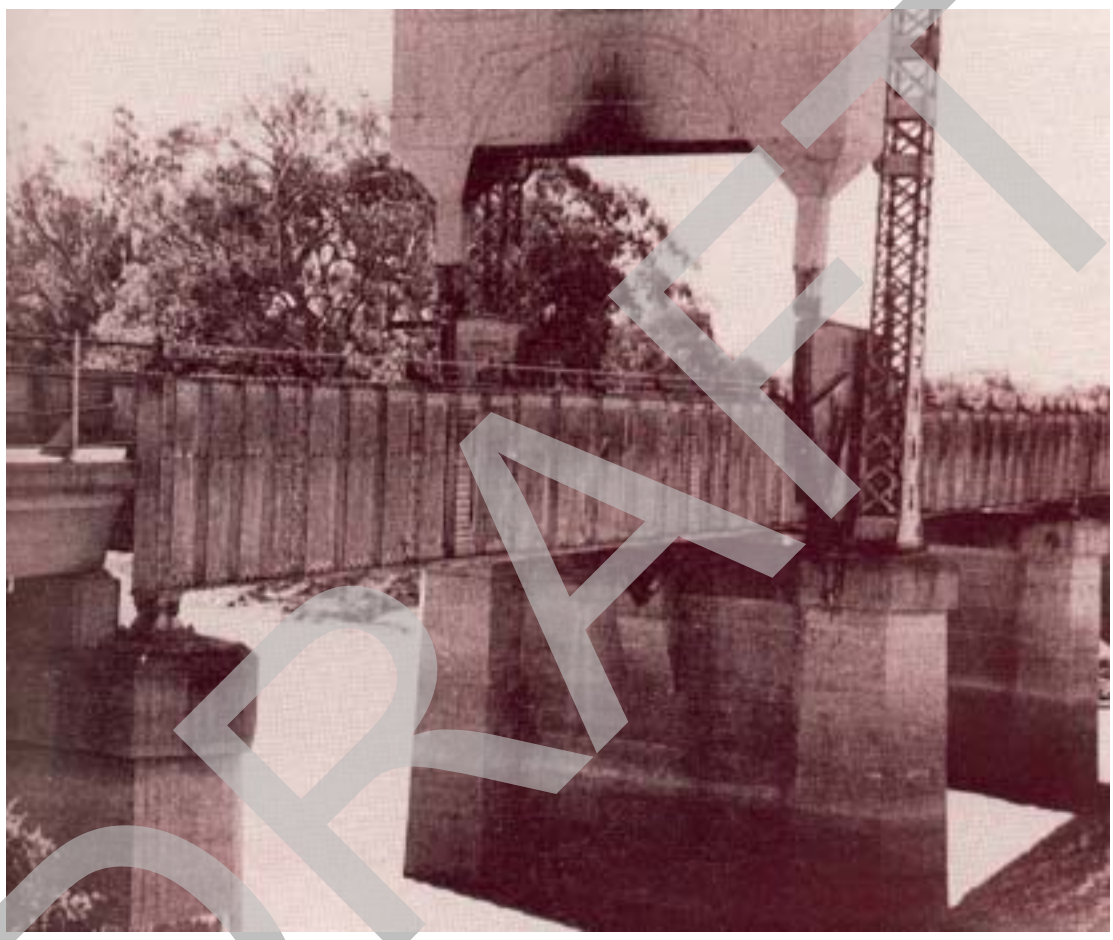


Figure 3: View of the Menindee Bridge in 1958 showing the concrete counterweight and the associated towers that have since been removed (DMR, 1977:7).

The Lansdowne River Bridge at Coopernook built in 1933 is in many respects identical to the Narooma Bridge. One significant difference is that a petrol engine was fitted to the Bridge at the time of its construction in a purpose built engine room on account of the relatively frequent opening required.

The Barney's Point Bridge over the Tweed River (1936) was the last "Strauss" bascule to be built in NSW (**Figure 4**). This was replaced with a modern six-lane bridge but the bascule span was given to the Richmond Valley Council which is reusing it in conjunction with new concrete spans to bridge the Richmond River south of Ballina.

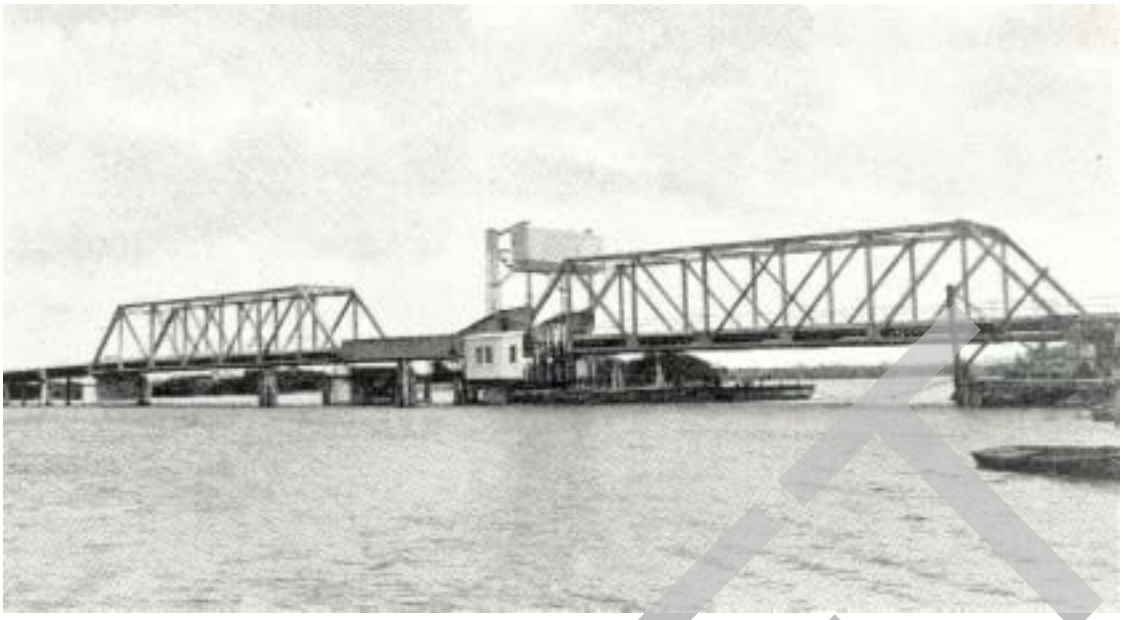


Figure 4: View of Barney's Pont Bridge looking west (DMR, 1953:89).

The bridge over the Clarence River at Grafton built in 1932 has road and railway decks superimposed (**Figure 5**). It is a "Rall" bascule moving back on a track as well as rotating towards the vertical position.

Figure 5: View of the unique double-deck rail-road bridge over the Clarence River at the time of opening in 1932 (DMR, 1976:170).

The opening spans in the Spit Bridge, Mosman and Swansea Bridge, Lake Macquarie work on the principle of a simple lever rotating about a fixed axis; the counterweight is below deck level, an advantage where appearance is concerned. The Swansea Bridge has two leaves meeting at the centre (**Figure 6**), locked together when closed (DMR, 1953:40).

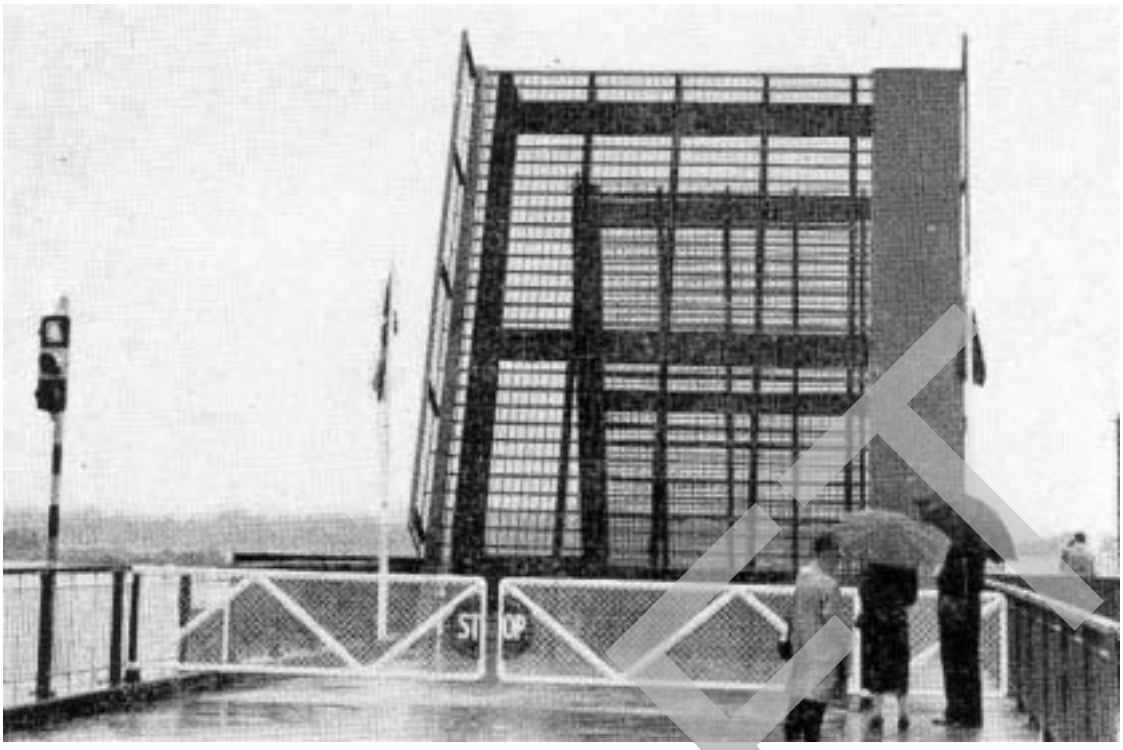


Figure 6: View of Swansea Bridge in 1955 showing the steel grid deck in the open position.

In the 1950s bascule and lift spans were the two options used by the DMR to meet requirements on main roads. The bascule was preferred to the vertical lift span due to its generally superior appearance, especially if there was room for the counterweight below the deck. The vertical clearance of a bascule span is unlimited. However, unless rock was present the foundations were costly because the counterweight was two or three times as heavy as the moving span. Vertical lift spans were the preferred type where foundation conditions were not especially favourable, and this was a frequent condition on New South Wales' coastal rivers (DMR, 1953:40). All movable span bridges constructed in this state are described in **Table 1**. Listings relate to the State Heritage Register (SHR) and RTAs Heritage Register (S.170).

Table 1: List of all movable span bridges constructed in NSW.

	Name	Description	Listings	Date	Status
1.	Richmond River at Wardell	SH10			Demolished
2.	Murray River at Mildura	SH14			Demolished. Remnants only
3.	Martins Bridge	SH10			Permanently closed
4.	Balranald	Lift		1881	Demolished
5.	Gladesville	Swing		1881	Demolished
6.	Darling River at North Bourke	Lift	Bourke Council LEP	1883	Permanently closed
7.	Lismore	Sliding		1884	Demolished

	Name	Description	Listings	Date	Status
8.	Coopernook	Sliding		1884	Demolished
9.	East Gosford	Sliding		1884	Demolished
10	Lane Cove River	Swing		1885	Demolished
11	Brewarrina Bridge, Barwon River (BN 4854)	Lift	Brewarrina Council LEP	1888	Permanently closed
12	Gladstone	Bascule		1891	Demolished
13	Camden Haven	Bascule		1891	Demolished
14	Coldstream	Swing		1892	Demolished
15	Mulwala	Lift		1892	Demolished
16	Darling River at Wentworth	SH22		1893	Replaced in 1969
17	Kinchela	Bascule		1893	Demolished
18	Tocumwal	Lift	SHR, S.170	1895	Currently locked but still operable
19	Shea's Creek, Canal Road, St. Peters	Bascule: span length 43ft £3,494		1895	Demolished in 1937
20	Darling River at Wilcannia	Lift		1896	Demolished.
21	Murray River, Swan Hill (BN 3215)	Lift	SHR, S.170	1896	Currently locked but still operable
22	Dunmore Bridge, Paterson River (BN 1683)	Lift	SHR, S.170	1899	Permanently closed
23	Ballina	Lift		1900	Demolished
24	Glebe Island Bridge (BN 61)	Swing Bridge MR165	SHR, S.170	1901	Operational
25	Tweed River, Murwillumbah	Lift		1901	Demolished
26	Cobram Bridge, Murray River at Barooga (BN 3247)	Lift		1902	Currently locked but still operable
27	Telegraph Point	Bascule		1902	Demolished
28	Pyrmont Bridge	Swing Bridge	S.170	1902	Pedestrian use only
29	Coraki Bridge, Richmond River (BN 2462)	Bascule, curved path counterweight	SHR, S.170	1903	Currently locked but still operable
30	Hinton Bridge, Paterson River (BN 1482)	Lift	SHR, S.170	1904	Permanently closed
31	Koondrook Bridge, Murray River at Barham (BN 3256)	Lift	SHR, S.170	1905	Operational
32	Murrumbidgee River at Darlington Point (BN 182)	Bascule, curved path counterweight		1905	Replaced 1978

	Name	Description	Listings	Date	Status
		with deBurgh trusses			
33	Macfarlane Bridge, Clarence River (BN 2537)	Bascule, curved path counterweight		1906	Currently locked but still operable
34	Clarence River at Maclean	Bascule		1906	Replaced in 1966
35	Swansea	Bascule		1909	Replaced 1955
36	Wakool River at Kyalite (BN 1126)	Bascule		1912	Replaced 1981
37	Carrathool Bridge, Murrumbidgee River (BN 3248)	Bascule, curved path counterweight	SHR, S.170	1922	Currently locked but still operable
38	Murray River, Tooleybuc (BN 3244)	Lift	SHR, S.170	1925	Currently locked but still operable
39	Murray River at Robinvale, Mildura (BN 5187)	Lift		1925	Currently locked but still operable
40	Darling River, Menindee	"Strauss" Bascule. Also carries rail.		1927	Permanently closed. Counterweight and towers removed in 1970
41	Abbotsford Bridge, Curlwaa (BN 5149)	Lift		1928	Operational (manual)
42	Narooma, Wagonga Inlet (BN 5972)	"Strauss" Bascule	S.170	1931	Operational
43	Clarence River at Grafton (BN 2322)	"Rall" Bascule. Also carries rail.	S.170	1932	Permanently closed
44	Landsdowne River, Coopernook (BN 1805)	"Strauss" Bascule	Taree Council LEP	1934	Permanently closed
45	Clarence River, Mororo (BN 2154)	Lift, SH10. £26,000.		1935	Permanently closed
46	Ryde Bridge, Parramatta River (BN 437)	Lift		1935	Demolished
47	Barneys Point Bridge, Tweed River	"Strauss" Bascule		1936	Replaced 1999 see entry 59
48	Terranora Inlet, Boyds Bay	Lift. SH10		1937	Currently locked but still operable
49	Murray River at Nyah (BN 3377)	Lift		1941	Currently locked but still operable
50	Murray River at Gonn Crossing (BN 3375)	Lift		1941	Currently locked but still operable
51	Hexham, Hunter Bridge (BN 1378)	Lift	Newcastle Council LEP	1952	Operational
52	Swansea Bridge, Lake	Bascule		1955	Replaced 1989

	Name	Description	Listings	Date	Status
	Macquarie (BN 1365)				
53	Clyde River, Batemans Bay	Lift		1956	Operational
54	Spit Bridge, Middle Harbour (BN 50)	Bascule	S.170	1958	Operational
55	Clarence River, Harwood (BN 2151)	Lift		1966	Operational
56	Clarence River at Maclean	Lift		1966	Permanently closed
57	Darling River, Wentworth (BN 5130)	Lift		1969	Operational
58	Swansea Bridge, Lake Macquarie (BN 7828)	Bascule		1989	Operational
59	Broadwater Bridge, Richmond River	Bascule from Barneys Point Bridge reused in conjunction with a modern concrete bridge		2000	Permanently closed

2.3 History of the Clarence River Bridge

Construction on the Clarence River Bridge began in 1926 and was completed in 1932 linking North and South Grafton. From the earliest days of settlement residents canvassed for a bridge across the river to link the two sides of town and to replace the various forms of river transport being used (*Clarence River Historical Society*, 1992:1)

Preliminary designs for a crossing of the Clarence River were initiated in 1910 and in 1913 a report was prepared by the Public Works Committee regarding the construction of a bridge across the River. The volume of road and rail transport had been increasing and by 1905 the railway had reached the river at North Grafton. (*Clarence River Historical Society*, 1992:79) In 1924 the NSW Railways leased the *Swallow* and later the *Induna*, remodelled ferries, to carry passengers and train carriages across the river.

An Act authorising the construction of the Grafton to South Grafton railway received vice-regal assent in December 1915 and plans for a rail bridge with a double line of railway and a footway with a movable span allowing a clear channel for the passage of vessels along the river.

By 1922 the Minister for Works asked the Railway Commission to include vehicle traffic in the Bridge design in addition to rail and pedestrian traffic. The officials of the Works Department and the Railway Construction Branch decided that plans should be made for a Bridge unique to the Commonwealth. The design was drawn by Mr Wickham, chief engineer of the Railway Construction Branch, and provided for a double-deck bridge. A number of alternatives were considered, however the final concept provided for road and rail traffic on

two separate levels using a rare "Rall" type bascule span to accommodate the double-deck structure. Also due to the low clearance of the bridge, the lower level being about 8m above high water level, the bascule span was required to lift to allow the large river vessels to pass (Connell Wagner, 1996:17).

Two routes were considered for the location of the Bridge - Susan Island and Wilson's Hill. Despite opposition from many members of the community, Wilson's Hill, the narrowest section of river at Grafton, was chosen as the preferred route primarily due to a lower construction cost.

In March 1926 tenders were invited to undertake Bridge construction with a distinct stipulation that all Australian made materials be used in the Bridge construction where possible. The specification provided that the whole of the metalwork excepting special machine parts was to be fabricated and processed in Australia. Two tenders were received, one from Dorman Long and Company and one from John Grant and Sons. The Railway Department's estimate was less than the tenders received and it decided to carry out a portion of the construction itself, inviting tenders for the sub-structure of the bridge. In 1927 Clyde Engineering Ltd won the contract to manufacture and supply the caisson metalwork and bridge superstructure (*Clarence River Historical Society*, 1992:45). All the steel was made at Clyde and sent to Grafton on railway trucks and the steel for each span was kept separate until ready for assembly.

In 1927 Mr S. D Webb took up duties as resident engineer and initiated preliminary construction work. Tenders were also awarded for the supply of the punts that were used to carry construction plant and to float the steel truss spans of the Bridge into place following their manufacture. The five truss spans (each weighing approximately 500 tonnes) were built on a platform on the South side of the River and then floated out into position on flotation punts controlled by tugs. All the other spans were built on to the Bridge. The founding of the substructure piers built on rock foundation was carried out by means of steel caissons sunk by the pneumatic process. Construction took approximately five years and the final cost of the Bridge was £408,723 (Connell Wagner, 1996:18).

The importance of the Bridge was evident when a large crowd of local residents gathered to watch the Minister for Works and Railways, A. E Buttenshaw, drive the first rivet, on 11 July 1928. The railway was opened on 7 May 1932 and the first train to cross the Bridge was the largest ever run in NSW, driven by the Minister for Transport Mr McGirr. The Bridge completed the last section of the standard gauge rail link between Sydney and Brisbane .The road section was opened, along with the official opening of the Bridge on the 19th July 1932 by the Governor General Sir Isaac Isaacs.

Since that time the Bridge has been used for road, rail and pedestrian transport. The bascule span was closed in 1968 on the proviso that it remains in such a form that it could become operational within two years if required.

2.4 Bridge Description

The superstructure of the Clarence River Bridge is 13.00 metres high and weighs 4,000 tonnes. The principal portion consists of five fixed truss spans and the moving span of the bascule. The spans range in length from 30.50-73.20m. Two 26kW motors, weighing 728 tonnes, operated the bascule span electronically. It weighs 800 tonnes and is carried on two large steel rollers each 1.52m in diameter and 0.60m in width, which rolled on a steel track. The rollers moved away from the opening simultaneously with the upward rotation of the span, so that with the maximum angular movement of 80°, the rollers had moved back a position of 3.84m from their original position. This left an opening of 21.33m with a depth of approximately 12m of water in the channel allowing vessels of up to 2,500 tonnes displacement to pass. The lifting operation occurred 4-5 times per week and took approximately two minutes. The bascule truss, its machinery and half the adjoining fixed truss were originally assembled on land to fully test its operation then dismantled and re-erected in position on two concrete piers (Connell Wagner, 1996:16).

On the truss spans the roadway is of reinforced concrete; on the bascule span the roadway was originally timber (*Main Roads*, 1932:15). The original timber footways on either side of the bridge have been replaced with aluminium decking and chain mesh fencing. The substructure consists of seven concrete piers built in the river channel on a rock foundation. The piers contain a total of 4,766 cubic metres of concrete weighing over 10,000 tonnes. The total length of the bridge is 667.00m including approaches, and it crosses approximately 400m of water (Connell Wagner, 1996:16). The railway track (3.40m above the piers) is carried at the lower level of the trusses, two footways being cantilevered at this level from the trusses on either side, and the roadway deck (8.20m higher than the railway track) is carried a little below the upper chords.

The Southern roadway approach swings to the west of the alignment of the principal spans, and is carried upon a steel truss span of 30.48m, two concrete and steel spans of 12.19m each, and an earth embankment approximately30.5m long and 10.9m wide. The grade of the approach is 4 per cent and it terminates at the northern alignment of Commercial Road. The Northern approach is more extensive as it consists of one 30.48m steel truss span and fourteen steel and concrete spans of 12.80m each. The steel span is skewed to the west of the alignment of the principal spans, and leads to a curve of 85m radius to which the concrete and steel spans conform. The earth embankment of the Western end of the approach is 4.5 per cent (*Main Roads*, 1932:15).

The approaches between Commercial Road, South Grafton, and Clarence Street, Grafton were paved in reinforced concrete, 6.09m wide, as a part of the work of constructing the Bridge.

2.5 Heritage Listings

The statutory listings that are relevant to the proposed works are the SHR, the Grafton City Council Local Environment Plan (LEP) Heritage Schedule and the SRA s.170 Heritage and Conservation Register.

Table 2: Statutory and non-statutory heritage listings.

Heritage Register	Status
Australian Heritage Database (formerly the Register of the National Estate)	Registered
Heritage Council of NSW State Heritage Register	Listed
Clarence Valley Council amalgamation using Grafton City Council Local Environment Plan 1990– Heritage Schedule	Listed
NSW National Trust Register	Listed
State Rail Authority s.170 Heritage and Conservation Register	Listed
RTA s.170 Heritage and Conservation Register	Listed - assessed as being of state significance.

2.5.1 State Heritage Register

The NSW Heritage Office on behalf of the Heritage Council of NSW maintains the State Heritage Register (SHR). The Register is a list of heritage items identified as being of State heritage significance. A listing on the SHR confers the highest level of legislative protection available for heritage items in NSW. As a listing on the SHR confers protection upon a heritage item, there are restrictions on what activities can be carried out on or adjacent to a listed item. These are covered under Section 57 of the NSW *Heritage Act 1977*. Section 57(1) of the Act states that:

When an interim heritage order or listing on the State Heritage Register applies to a place, building, work, relic, movable object, precinct or land, a person, must not do any of the following things except in pursuance of an approval granted by the approval body under Subdivision 1 of Division 3:

(a) demolish the building or work,

(b) damage or despoil the place, precinct or land, or any part of the place, precinct or land,

(c) move, damage or destroy the relic or movable object,

(d) excavate any land for the purpose of exposing or moving the relic

(e) carry out any development in relation to the land on which the building, work or relic is situated, the land that comprises the place, or land within the precinct,

(f) alter the building, work, relic or movable object,

(g) display any notice or advertisement on the place, building, work, relic, moveable object or land, or in the precinct,

(h) *damage or destroy any tree or other vegetation on or remove any tree or other vegetation form the place, precinct or land.*

Approval to conduct works upon an item listed on the SHR (other than routine maintenance) must be sought from the approval body, the Heritage Council of NSW. An application to conduct works upon or modify a SHR listed item can be made under Section 60 of the Act. The only exceptions to this are works covered in a CMP endorsed by the Heritage Council of NSW, or works for which a standard exemption has been granted by the Minister under Section 57(2) of the Act. The RTA is required to obtain a S60 permit from the Heritage Council in order to conduct the works outlined in this SOHI which while not materially affecting the Bridge would fall within the scope of (e) namely development in the vicinity of the Bridge.

2.6 Grafton City Council LEP

The Clarence Bridge is listed on the Heritage Schedule of the Grafton City Council Local Environment Plan (LEP) 1990 which is currently in use by the Clarence Valley Council. Under the heritage provisions of the LEP, development consent must be sought from Council to demolish or alter a heritage item listed on the LEP. As the proposed works would not materially affect the existing bridge or the Grafton Conservation Area located to the northwest of the study area development consent would not be required.

2.7 State Rail Authority s.170 Register

As part owner of the Clarence River Bridge consent from the Australian Rail Track Corporation is required in order to assist in the lodgement of the S60 permit to the Heritage Council. This was obtained on 18/10/04, with the following two conditions of approval:

1. The heritage implications of the proposed road overbridge crossing the North Coast railway line at the northern end of the Clarence River bridge be addressed, and:
2. The height clearance where the proposed road overbridge crosses the North Coast railway line south and north of the Clarence River include a minimum height requirement of 7.1 metres above all sections of the railway line including the Grafton City Viaducts in order to allow for train operations with double stack containers. The Grafton City Viaducts are a series of concrete viaducts and earth embankments carry the railway line from the bridge abutment north and are separately listed in SRA's S.170 Register.

2.8 Heritage Significance

The Clarence River Bridge is considered to be an item of state heritage significance. The item is strongly associated with the development of the Australian rail network with its construction allowing completion of the standard gauge rail link between Sydney and Brisbane. The Bridge has strong aesthetic significance with its distinctive silhouette forming a landmark across the scenic Clarence River.

The Bridge is an important symbol for both the local and regional communities. The Bridge retains an important role for the present day community both in a functional sense and as a strong reminder of the history of the area.

The Bridge exhibits significant technical characteristics. The bascule span of the Bridge is of an unusual type in Australia and is the largest railway bascule span built in Australia. The Bridge is the second to last steel truss rail ridge built in NSW and was constructed at the height of the popularity of this type of bridge. The Bridge is the only one in NSW to carry road and rail traffic on two levels and is unique in that rail signals were originally used to control road traffic. The Bridge has been assessed as being of heritage significance at the **state** level.

3 Proposed Works

3.1 Background to the Proposal

Grafton City Council initiated correspondence to the Department of Main Roads (DMR) regarding a second bridge in 1960 with investigations commencing in the early 1970's. In 1977, the DMR advised that a new bridge location directly upstream had been adopted linking Fitzroy Street, Grafton, to Bent Street, South Grafton. Survey and geotechnical investigations were then undertaken. In 1985, the DMR advised that the new bridge was a long-range Proposal.

In 1999, the RTA examined a number of upgrading options for the existing bridge. They were:

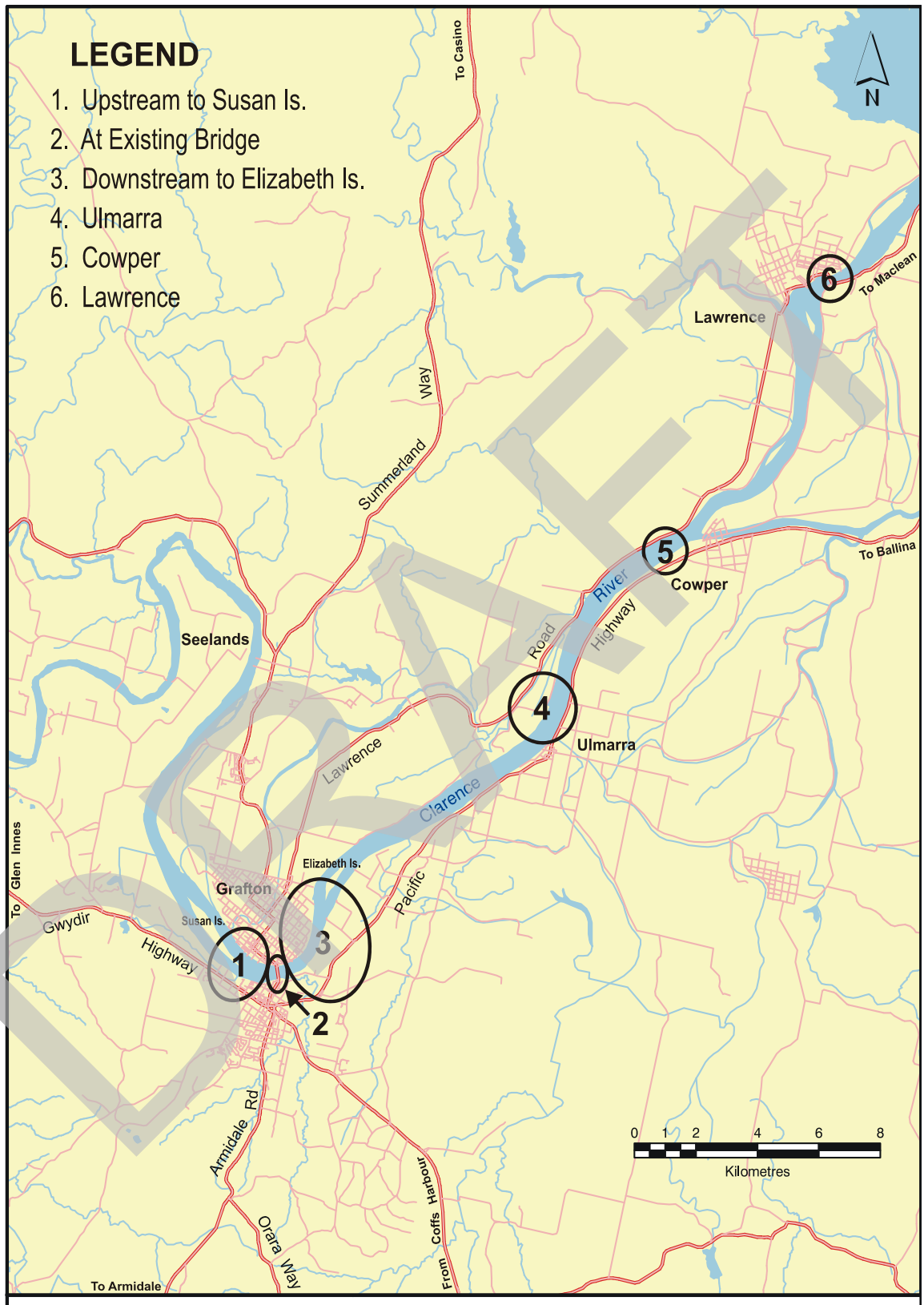
- Do Nothing;
- Minor alterations to the kerbs at the 'kinks';
- Remove the 'kinks';
- Construct one lane on the existing rail bridge on the lower deck;
- Provide two additional travel lanes at the existing rail or road bridge;
- Upgrade the southern approach lanes from the Through Street roundabout; and
- Upgrade the northern approach lanes from the Villiers Street roundabout.

Construction on the northern and southern approaches to the existing bridge was undertaken in 2000 and 2001. This was a cost-effective short-term solution to improve the road capacity at the approaches and reduce the queuing at Villiers Street and Through Street roundabouts.

In 2001, a group of business people formed a committee to campaign for a new bridge at Grafton. In May 2002, the community campaign for an additional crossing of the Clarence River at Grafton commenced. A public meeting held in May 2002 lead the State Government to commission the RTA to undertake a Feasibility Study and determine strategic options for the location of an additional crossing to service Grafton and the surrounding communities.

The Feasibility Study investigated the following locations in a broad study area as shown in **Figure 7**

Figure 7: Feasibility Study Sites



The feasibility study focused on three main areas of investigation, being environment, traffic and community. The conclusions from the study determined that the most feasible location appeared to be in the vicinity of the existing Bridge. The main advantage of this option is that it would maximise the reduction of delays on the existing bridge by transferring fifty per cent of the traffic onto an additional crossing. However, even though this location was feasible any additional crossing was likely to have potentially significant impacts on the community such as traffic, social, noise and aesthetics. More detailed studies would be required at the route selection stage of the project. This would include more specific traffic analysis and noise monitoring in this locality. It would also require continuation of the close consultation with the community to determine the social impact of an additional crossing.

The locations upstream and downstream of the existing bridge also appeared to be feasible as they met all the objectives of the project with the exception of economic comparisons of the benefits to cost. These options had a number of adverse impacts particularly social and environmental impacts and traffic noise. However, they did have a number of benefits as detailed in the study. More detailed investigations would be required at the route selection stage of the project to validate the findings of the feasibility study. Further detailed traffic analysis, noise monitoring, environmental investigations and community consultation would be required to determine the viability of an additional crossing in these locations.

3.2 Route Selection

The route selection commenced in July 2003 following the completion of the feasibility study. The purpose of the project was defined as 'to provide an additional crossing of the Clarence River at Grafton between Susan Island and Elizabeth Island in order to improve road safety, reduce traffic delays and provide improved access for the local and State road network between Grafton and South Grafton.' The "study area" for the purposes of the route selection encompassed the area between Susan Island and Elizabeth Island, and extending into the township of Grafton and South Grafton as far south as the Pacific Highway.

An environmental overview was undertaken of the study area to identify any likely environmental constraints and/or potential issues that would need to be considered as part of the investigations for an additional crossing of the Clarence River at Grafton.
The purpose of the environmental overview was to:

- Identify environmental constraints for the Proposal;
- Identify the impacts of these constraints on each of the crossing localities; and
- Identify potential issues that may require additional investigations, specialist studies, or design considerations for route selection.

3.2.1 Localities Short Listing

Following the environmental overview, seven broad localities were identified within the study area for investigation as part of the route selection study. A description of each option's locality is provided in **Table 3** below. An aerial photograph of the study area showing the proposed Locality options is also provided in **Figure 8**.

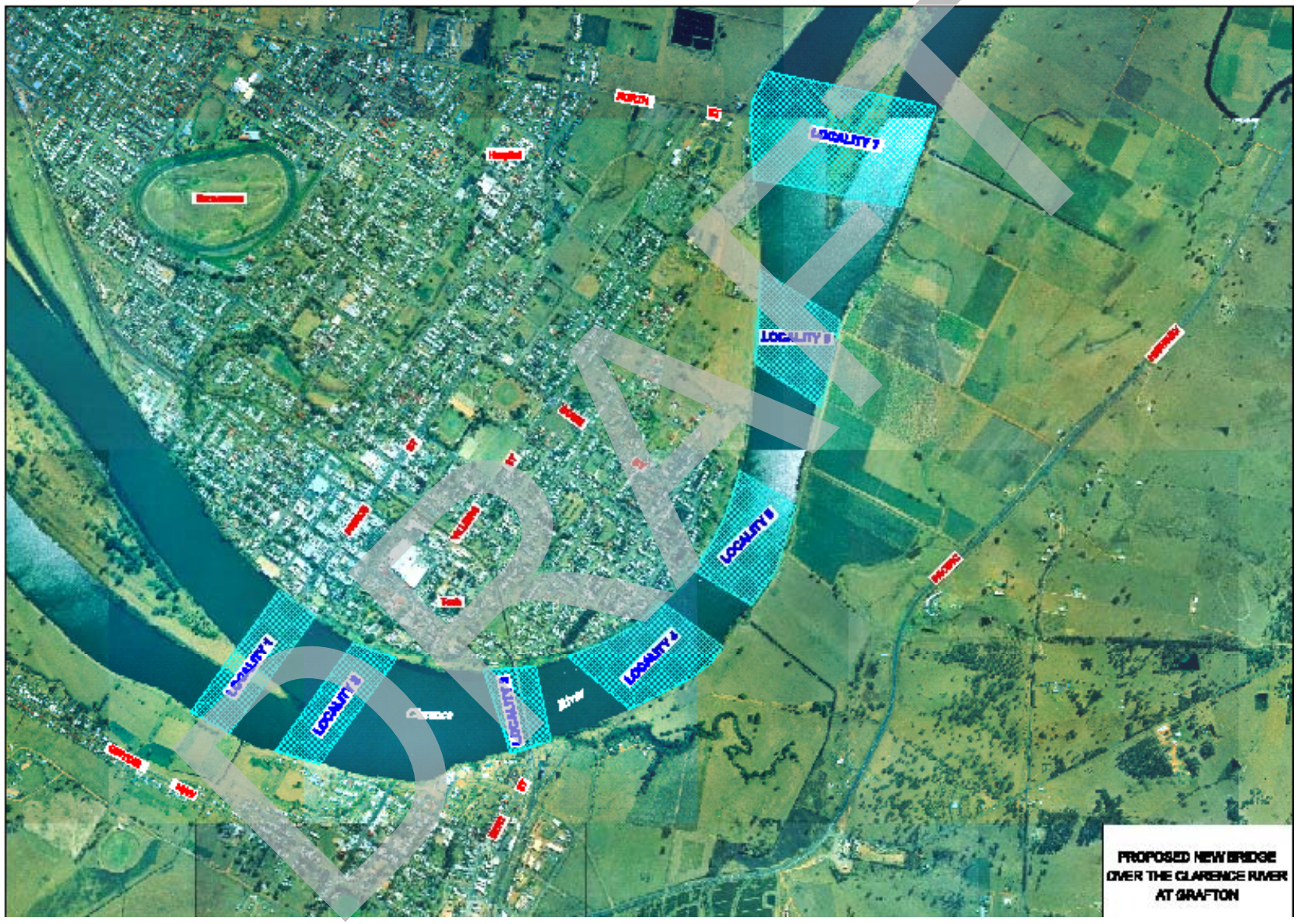
For potential crossings directly adjacent to the existing bridge, a pedestrian cycleway would not be provided, as one has already been provided on the existing bridge. The existing and new crossings would consist of two lanes with a one-way flow. Consequently, the 'kinks' on the existing bridge would be modified to allow the free flow of one lane traffic. For potential crossings downstream or upstream of the existing bridge, a pedestrian cycleway would be considered, with traffic flow on the existing and new crossing two lanes being two-way flow. However, these crossings would not include the modification of the "kinks" on the existing bridge. All crossings would provide two x 3.5m travel lanes with two x 1.0m shoulders.

The Proposal would involve bridge works and road approach works which would connect to the existing road network. Intersection works may be required at these connections. Bridge works associated within an additional crossing would include the construction of road approaches, embankments, bridge abutments, piers, decking etc.

Table 3: A description of the proposed localities

Locality	Origin	Destination
1	From the Gwydir Highway to the Clarence River via rural land, and crossing the river via Susan Island.	Directly onto Prince Street, crossing Victoria Street, and meeting with Fitzroy Street.
2	From the Gwydir Highway along Abbot Street.	Direct onto Villiers Street crossing Victoria Street and meeting with Fitzroy Street.
3	Merge with existing route on Bent Street.	Merge with existing route on Craig Street.
4	From the Pacific Highway to the Clarence River via rural land.	Crossing in the vicinity of Bacon Street and meeting at Villiers Street.
5	From the Pacific Highway to the Clarence River via rural land.	Crossing in the vicinity of Dobie Street and meeting at Villiers Street.
6	From the Pacific Highway to the Clarence River via rural land.	Crossing within the vicinity of Arthur Street and meeting at Turf Street (Summerland Way).
7	From the Pacific Highway in the vicinity of Centenary Drive to the Clarence River via rural land, and crossing the river via Elizabeth Island.	Within the vicinity of North Street and meeting at Turf Street (Summerland Way).

Figure 8: Aerial photograph of the study area with proposed locality options



The Environmental Overview was used as a basis for making a decision on which crossing localities should be further investigated in the route selection stage.

In order to short list those localities worthy of further investigation a Localities Short Listing Workshop was held on 28 November 2003. The short listing of localities workshop was seen as the appropriate strategic tool to bring together some of the key stakeholders involved in the project, to review and assess the localities developed in order to shortlist those that most met the project objectives to proceed further for more detailed investigation. The participants included the RTA project team and representatives from the former Grafton City Council, Copmanhurst Council and Pristine Waters Council. The objective of the workshop was to review and assess the preliminary localities investigated for the project in order to shortlist those worthy of more detailed investigation.

The Feasibility Study stated, *"The most feasible location appears to be in the vicinity of the existing bridge"*. Therefore, as there is an expectation that options adjacent to the existing bridge (locality 3) would be further investigated, it was determined that this locality should be progressed to the next stage of investigation regardless of its merits or deficiencies.

It was also determined that the assessment would be undertaken as a comparison of localities 1, 2, 4, 5, 6 and 7 relative to locality 3 using the project assessment criteria. This would determine which localities should move forward for further investigation. The localities were judged on a qualitative basis by the workshop group in comparison to locality 3 against each criterion.

As a result of undertaking the qualitative assessment of localities, the workshop participants agreed that Localities 1, 4, 5, 6 and 7 be eliminated from further investigations. The workshop agreed that Localities 2 and 3 be moved forward for further investigations.

3.3 Crossing Options Considered

Crossing options were developed within Locality 2 (Villiers Street) and Locality 3 (at the existing bridge) and further investigations were undertaken. The descriptions of the crossing options are outlined below and plans of the crossing options are in **Figure 9**.

Option 1 – Villiers Street/Abbott Street

The limits of this option are from the Gwydir Highway (Ryan Street) at the southern approach to Victoria Street at the northern approach. The crossing would be two lanes, with two way flow. Traffic facilities such as roundabouts would need to be provided at Ryan Street and Victoria Street connections but this would be subject to concept design and community consultation.

Option 2a – At the Existing Bridge (directly upstream)

This option is directly upstream of the existing bridge. The level of the bridge would be at, or just below, the roadway on the existing bridge. The new crossing would be two lanes,

with one way flow and the existing crossing would change to one way flow. This would require modification to the "kinks". The limits of this option are from Bent Street at the southern approach to the existing bridge, opposite the Nursing Home, to the northern approach at Craig Street, opposite KFC. On the southern approach, an additional southbound lane would be provided to allow four lanes (two lanes each way) on this approach.

Option 2b – At the Existing Bridge (directly downstream)

This option is directly downstream of the existing bridge. The level of the bridge would be at, or just above, the roadway on the existing bridge. The new crossing would be two lanes, with one way flow and the existing crossing would change to one way flow. This would require modification to the "kinks". The limits of this option are from Bent Street at the southern approach to the existing bridge, opposite the Nursing Home, to the northern approach at Craig Street, opposite KFC. On the southern approach, an additional southbound lane would be provided to allow four lanes (two lanes each way) on this approach.

An Options Evaluation Workshop was held on 28 and 29 April 2004 with the objective to obtain a common understanding of the project and its objectives, review the work undertaken to date to ensure it met the project objectives, and to recommend a preferred direction, if appropriate, to progress the project to the next stage of development. The workshop participants were the RTA project team, community focus group representatives and government agencies. The workshop was independently facilitated under the principles of Value Management.

The recommendation from the workshop was that Option 2b performed, on balance, better than the other options and it was recommended for further investigation in the next stage of project development.

Figure 9: Crossing Options

3.4 Current Proposal

The recommended proposal is Option 2b, directly downstream of the existing bridge, and a plan and typical cross section is shown in **Appendix A**. The decision to locate the new bridge downstream has also been made in part out of a desire to retain the visual and landmark qualities of the existing bridge, as they are known to the residents of Grafton. The primary viewing catchment of the existing bridge is located to the west (upstream) and this is also the area in which most of the waterborne recreational activity of Grafton takes place.
Option 2b has three different lane configurations available. They are:

- Two lane proposed bridge – requires modification of the "kinks" to allow two lane, one way flow, on the existing bridge and two lane, one way flow on the proposed bridge.
- Three lane proposed bridge – provides one lane northbound flow on the existing bridge, one lane northbound and two lane southbound on the proposed bridge. This would require a kerb on the existing bridge deck to narrow the existing two lanes to one lane and provision of a separate cycleway/pedestrian way.
- Four lane proposed bridge – provides two lanes northbound and two lanes southbound on the proposed bridge and decommissioning of the existing bridge.

The lane configurations would be analysed in detail and a decision made during the next stage of the project, i.e., the concept design and environmental impact assessment stage, and do not form part of this Statement of Heritage Impact.

RTA has extensive experience in the duplication of heritage metal road bridges at major river crossings. Views of three of the more substantial projects are provided below (**Figures 10, 11,** and **12**).

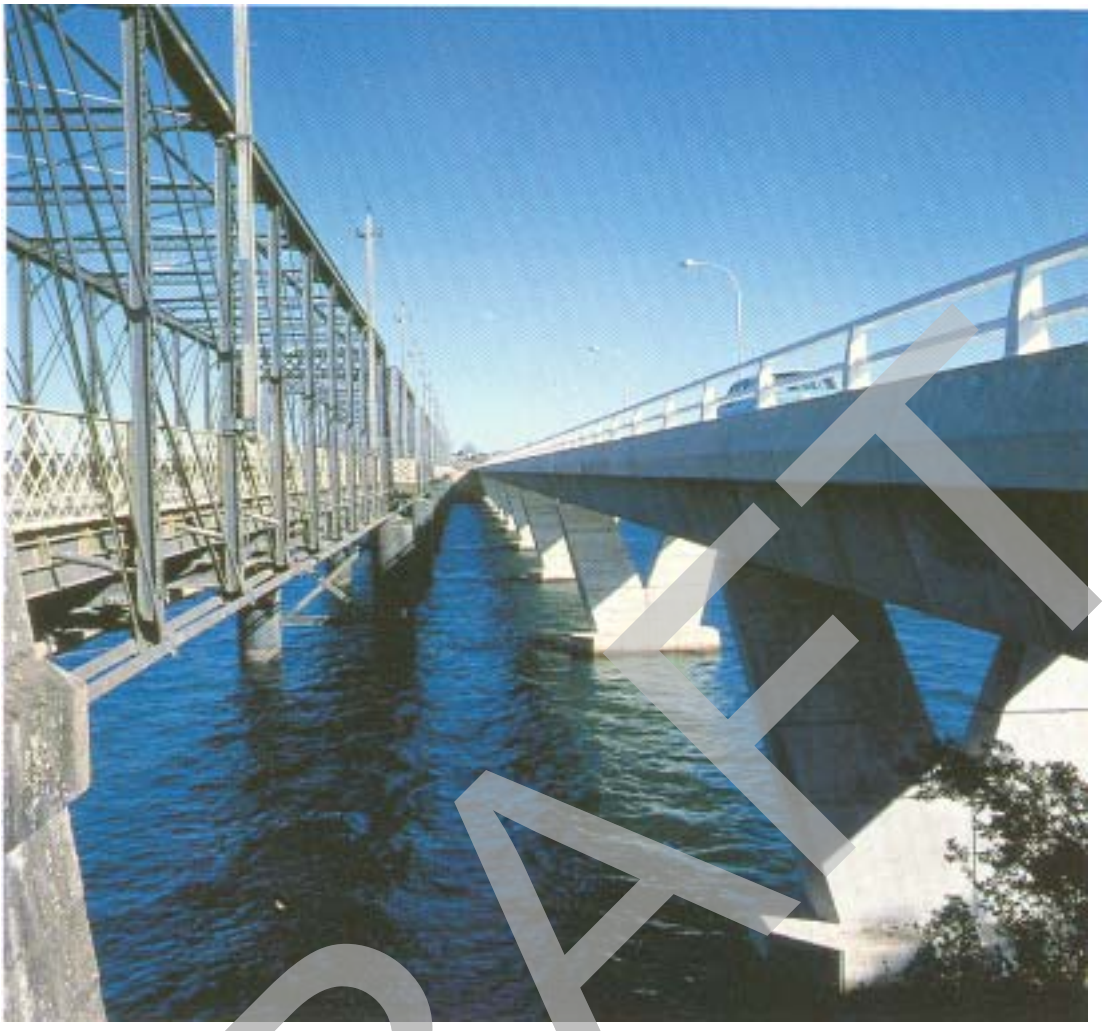


Figure 10: Nowra Bridge over the Shoalhaven River. Built 1880, and duplicated in 1981.

Figure 11: Tom Ugly's Bridge over Georges River, Sylvania. Built 1928, duplicated in 1981.

Figure 12: Peats Ferry Bridge over the Hawkesbury River. Built 1946, duplicated in 1972.

In each of the examples shown the deck of the new bridge is placed at the same or similar height to the existing bridge in order to ensure that the realignment of the approaches back onto the road are kept to a minimum. The new bridge has been designed to achieve the same objectives and a preliminary artist's impression of its appearance alongside the existing bridge looking west is shown in **Appendix B**. One of the significant differences between the Clarence River Bridge and those in **Figures 10, 11** and **12** is the placement of the roadway along the top of the trusses which requires the construction of a bridge of similar size; substantially taller than the other duplicated bridges shown.

3.5 Visual Assessment of the Proposed Duplication

In order to gain a greater appreciation of the likely impacts of the proposal on the existing bridge an independent visual impact assessment of Option 2b from downstream was commissioned and the text of the report is reproduced in full in **Appendix C**. The assessment took into account the impact to the view of the bridge from seven locations downstream in the proximity and came up with recommendations that relate to minimising the visual contrast between the styles and materials of the two bridges. They also relate to trying to lessen the mass of the bridge so that as much as possible of the existing bridge is still visible, particularly the steel trusses against the sky. These recommendations would be considered in more detail in Stage 2 of the Proposal.

4 Statement of Heritage Impact

The following questions are presented in the *NSW Heritage Manual* document "Statements of Heritage Impact" as the minimum response required to properly address proposals on heritage items which would result in the alteration of the item. Both of the lane configurations within Option 2b currently under review would not involve the removal of original bridge fabric (HO/DUAP 1996b).

4.1 What Aspects of the Proposal Respect or Enhance the Heritage Significance of the Bridge and Surrounds?

The Proposal respects the heritage significance of the Clarence River Bridge, as it would not result in the alteration of its form or fabric and would retain its continuity of function as an operating road and rail bridge. The works would be limited to the new bridge alongside, however the 3-lane configuration would require the placing of a kerb barrier on the existing bridge to provide a single lane of traffic flow. This development would serve to enhance the heritage significance of the existing bridge through the responsible treatment of an ageing asset and is predictive in that it looks forward to a time when the existing bridge has traffic removed from the deck

The eventual shift to pedestrian and cycling traffic on to the deck of the bridge would serve to renew interest in some of the technical aspects of the bridge that are not generally appreciated by the travelling public. These include the control box, lifting mechanism and start and end of the bascule span.

Appendix B shows a preliminary artist's impression of a balanced cantilever superstructure, which was used for the purposes of assessing visual impact at the Corridors Evaluation Workshop. The selection of the preferred superstructure design would be confirmed at the Concept Design Stage and the selection process would involve key stakeholders such as NSW Heritage Office, bridge designers, urban designers, community members and NSW Fisheries. The piers would be spaced over the river so as to offer a minimum of interference to river traffic and would be as thin as practicable in keeping with architectural views of bridge aesthetics (DMR, 1987:3). The horizontal separation of the new bridge from the existing bridge is sufficient so as not to crowd it and also to allow travellers to view the existing bridge to best vantage.

The decision to locate the new bridge downstream has also been made in part out of a desire to retain the visual and landmark qualities of the existing bridge, as the residents of Grafton know them. The primary viewing catchment of the existing bridge is located to the west (upstream) and this is also the area in which most of the waterborne recreational activity of Grafton takes place. An additional consideration involved in its location was to avoid the new approach roads from impacting on the Grafton Conservation Area located to the northwest of the study area.

4.2 What Aspects of the Proposal Could Have a Detrimental Effect on

the Heritage Significance of the Bridge and Surrounds?

The impact of the proposal on the heritage significance of the Clarence River Bridge is assessed as being low as the siting and design of the new bridge has taken into account aesthetic considerations. The reduction in future vehicular traffic on the existing bridge would further serve to extend its useable working life.

The new bridge would cross the railway line at the northern end of the Clarence River and pass over the top of the Grafton City Viaducts. This would not in anyway impact on the form or fabric of either of these items. The required height clearance of a minimum of 7.1 metres would be observed at this point and the placement of piers would be set back from this structure so as to further abate any visual impacts.

4.3 Have More Sympathetic Solutions Been Considered and Discounted? Why?

Investigations for the preferred crossing location were extensive and included a number of options in the study area as described in **Section 3**. Consideration has not been given to duplicating the bridge with a metal bridge of similar design. While the construction of metal truss bridges was a relatively standardized approach to river crossings up until the 1950s since that time the use of steel has declined, not because the material is unsuitable, but due to the growing appreciation of the potentialities of reinforced concrete when applied to bridge design. Any attempt to replicate the existing bridge would therefore prove to be a very expensive exercise that would not result in the project objectives being met.

5 Conclusion

The proposal to build a new bridge within the curtilage of the existing bridge has come about after an extensive period of research into all viable options in order to meet the objectives of the project and to significantly reduce the traffic delays at the existing bridge. It is recommended that Option 2b, locating a structure directly downstream of the existing bridge, be submitted to the New South Wales Heritage Office for approval to the location.

If the works proceed, it is recommended that a detailed, archival quality recording of the Bridge be taken as the works progress, to provide a detailed pictorial record of the Bridge prior to the construction of a new bridge. It is recommended that any images taken be placed on the RTA General file for the Bridge.

6 References

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