

Options Report
Replacement of McCabe's Bridge, Doon Doon

February 2018

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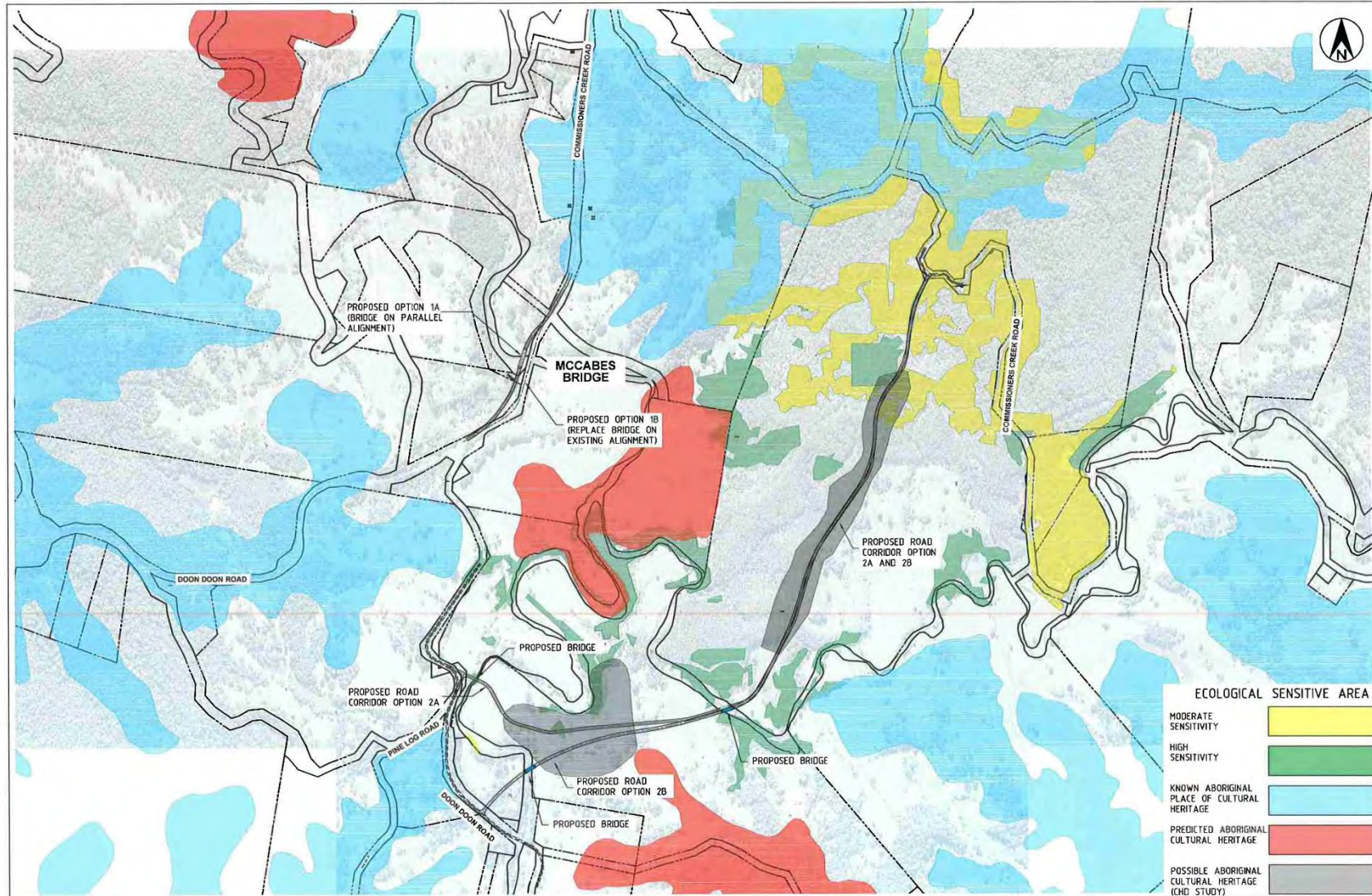


Executive Summary

Tweed Shire Council is currently undertaking investigations and community consultation to identify the preferred option to provide access to residents east of McCabe's Bridge when Clarrie Hall Dam is raised. This report identifies the options and documents engineering, environmental and cost details for each option. A summary of the Options investigated is presented below.

Options	1a. New bridge on a parallel alignment to the existing bridge	1b. New bridge on the same alignment as the existing bridge	2a. New link road between Doon Doon Road and Commissioners Creek Road	2b. New link road between Doon Doon Road and Commissioners Creek Road
Assessment Criteria				
Cost	\$6.0 million	\$6.2 million	\$7.1 million	\$7.0 million
Engineering	New bridge and road approaches west (downstream) of existing bridge. Bridge construction includes 3 x 16 metre spans and 700 metres roadworks.	Temporary vehicle access diversion road required during bridge re-construction. New bridge construction includes 3 x 16 metre spans and 700 metres roadworks.	2.4 km roadworks and 2 bridges of 20 metre span. New intersections at Doon Doon Road and Commissioners Creek Road. Major cross drainage structures.	2.2 km roadworks and 2 bridges of 20 metre span. New intersections at Doon Doon Road and Commissioners Creek Road. Major cross drainage structures.
Flora and fauna	Least impact of all options. Limited impacts to threatened species habitats. Standard construction management measures required to manage impacts to waterways and adjacent land.	Similar impacts to Option 1a although with an increased risk of erosion and sedimentation of waterway from extended duration of a temporary diversion access.	Clearing of vegetation mapped as 'highly ecologically sensitive land'. Potential impacts to threatened flora and fauna habitats requiring detailed ecological survey and assessment.	Clearing of vegetation mapped as 'highly ecologically sensitive land'. Potential impacts to threatened flora and fauna habitats requiring detailed ecological survey and assessment. Modified alignment intercepts potential impacts to mapped Koala habitat.
Air and Noise	Standard construction measures required to manage impacts to air quality and to limit noise impacts on adjacent residences.	Standard construction measures required to manage impacts to air quality and to limit noise impacts on adjacent residences.	Standard construction measures required to address air quality impacts. Construction and operational noise-modelling required to assess new road developments.	Standard construction measures required to address air quality impacts. Construction and operational noise-modelling required to assess new road developments.

Visual impacts	Impacts to closest neighbours will remain low due to sufficient separation distances and partial vegetation screening.	Impacts to closest neighbours will remain low due to sufficient separation distances and partial vegetation screening.	Low impact on visual amenity.	Low impact on visual amenity.
Aboriginal cultural heritage	No impacts on known or predictive Aboriginal cultural heritage.	No impacts on known or predictive Aboriginal cultural heritage.	Presence of known and predictive Aboriginal cultural heritage areas associated with the alignment requiring detailed Aboriginal cultural heritage assessment.	Presence of known and predictive Aboriginal cultural heritage areas associated with the alignment requiring detailed Aboriginal cultural heritage assessment.
Environmental approvals and permits	Best option in respect of gaining NSW and Commonwealth planning approval and compliance with NSW Fisheries permit requirements.	Second best option in respect of gaining NSW and Commonwealth planning approval. However, additional mitigation and construction management actions required to comply with NSW Fisheries requirements.	This option would result in a greater environmental impact and risk to obtaining NSW and Commonwealth planning approvals compared to Option 1 due to clearing of highly ecologically sensitive land, impacts to waterways, and potential to Aboriginal objects.	This option would similarly result in a greater environmental impact and risk to obtaining NSW and Commonwealth planning approvals compared to Option 1 due to clearing of highly ecologically sensitive land, impacts to waterways, and potential to Aboriginal objects.



ECOLOGICAL SENSITIVE AREA

- MODERATE SENSITIVITY
- HIGH SENSITIVITY
- KNOWN ABORIGINAL PLACE OF CULTURAL HERITAGE
- PREDICTED ABORIGINAL CULTURAL HERITAGE
- POSSIBLE ABORIGINAL CULTURAL HERITAGE (CHD STUDY)

**PRELIMINARY
NOT FOR CONSTRUCTION**

SCALE: A1 SHEET 1:3000, A3 SHEET 1:10,000
0 50 100 200 300 400 500m
DESIGN UNIT
COUNCIL OFFICES TUMBULOGUM ROAD, MURWILLUMBAH NSW 2484.
PHONE 02 66702400 FAX 02 66727513 WEBSITE www.tweed.nsw.gov.au
DESIGNED 777 77.77.16 DATE 77.77.16
DRAWN J.M.M. 77.77.16 COORDS ADOPTED PM 77777
CHECKED 777 77.77.16 EASTING 887777.777
HORIZONTAL DATUM MGA1 NORTHING 887777.777
VERTICAL DATUM AHD R.L. 7.777

PROJECT: WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT	PROJECT NUMBER: WAT70-1
PLAN TITLE: OPTIONS SITE PLAN	DRAWING NUMBER WAT70-1-01 ISSUE A

A	ORIGINAL ISSUE	J.M.M.	7.7.7	77.77.16
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE

HEAD FILE No: G:_XXX\DESIGN PROJECTS\WAT70\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BA01.dwg

Introduction

Tweed Shire Council has adopted the raising of the wall of Clarrie Hall Dam as its preferred option to secure the water supply for the Tweed Shire. Additional water storage is required due to predicted reduced water yields in the future due to the effects of climate change and also to allow for population growth.

The raising of the dam wall will set the dam spillway at RL70.0, compared to the existing level of RL61.5. This will result in McCabe's Bridge, which lies on Commissioners Creek Road, being inundated as its current deck level is approximately RL66.5.

The Design Unit of Tweed Shire Council was commissioned by the Water and Wastewater Unit to prepare an options report on how access can be provided to 39 residential properties, east of McCabe's Bridge, once Clarrie Hall Dam has been raised.

At a stakeholder information session at Crams Farm on 21 June 2017 five options, including 'do nothing', were presented. As a result of the discussion on those options, Council Officers were directed to investigate to a greater level of detail two options and prepare a report for further community consideration. Each of these two options has been further broken into two sub-options, which are the subject of this report:

Option 1

A new bridge on a parallel or existing alignment to replace the existing McCabe's bridge. This was presented as Option 3 at the meeting of 21 June 2017 and more design detail was requested, including finalising the road alignment either side of the bridge where it ties back into the existing Commissioners Creek Road.

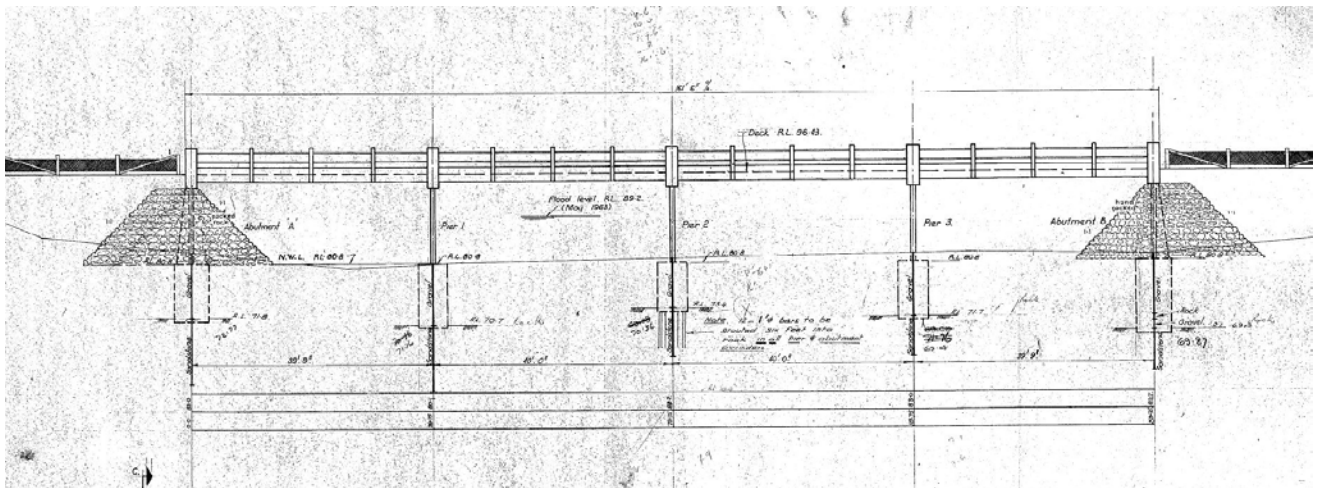
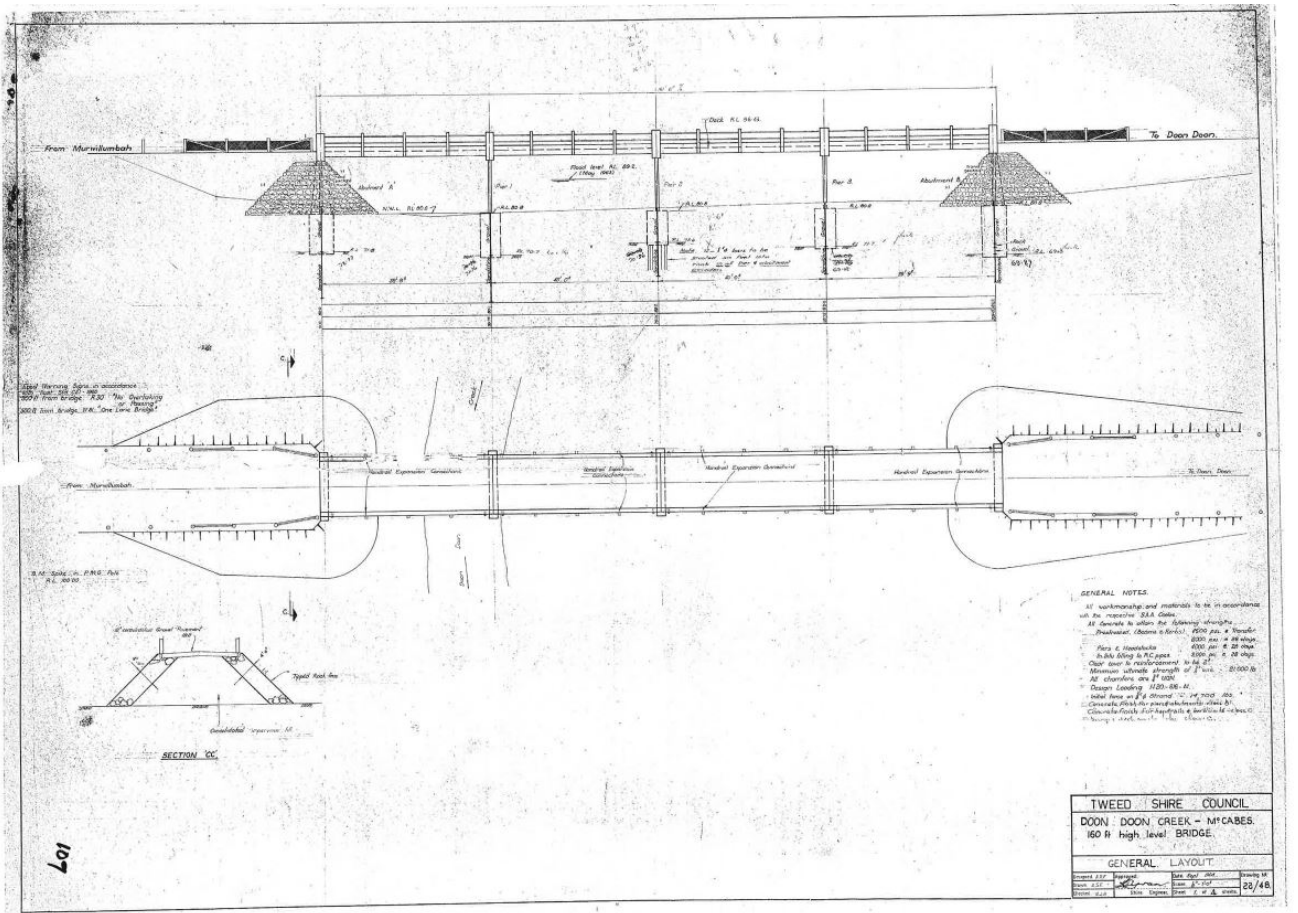
In this report, a new bridge on a parallel alignment is designated as Option 1a and a new bridge on the existing alignment is Option 1b.

Option 2

Construct a new link road between Commissioners Creek Road and Doon Doon Road contained within lands acquired by Council as part of the Clarrie Hall Dam raising process. This option was not investigated as part of the original options report, but was suggested by local residents at the Stakeholder Information Session.

The concept design process has identified two preferred link road connection locations at Doon Doon Road, being 100 metres north of Pine Log Road, designated as Option 2a, and 400 metres south of Pine Log Road, designated as Option 2b.

This report aims to describe engineering, cost and environmental considerations associated with the options, including their respective advantages and disadvantages. Any final option would be subject to an environmental impact assessment and approval in accordance with the NSW Environmental Planning and Assessment Act 1979.



Original Design Drawings of Existing McCabe's Bridge

OPTION 1 - Build a new bridge either on a parallel or existing bridge alignment at a higher level

Engineering considerations

In this report, the engineering and environmental considerations for the replacement of McCabe's Bridge are similar for the parallel and existing alignment options, the major differences being the quality of the side track and the amount of traffic control required during construction for each option. Accordingly, most sections are relevant to both options, 1a and 1b, and are treated as such in this report.

Refer Appendix A for concept design drawings of Options 1a and 1b.

Bridge Alignment

1a. Parallel alignment

The parallel alignment is located on the western side of the existing McCabe's Bridge, as on this side, the new bridge would be able to be constructed within the existing road reserve or areas acquired for Clarrie Hall Dam.

The major advantages of the parallel bridge alignment compared to constructing on the existing alignment are:

- the existing bridge could be used for access during construction, resulting in minimal disturbance to travel times for residents
- reduced interaction between local traffic and construction activities, and
- reduced traffic control requirements.

Due to the raising of Clarrie Hall Dam there would be a six (6)-metre height differential between the existing bridge deck level and the new bridge. To keep the existing bridge operational during the construction of the embankments required for the new approach road and bridge abutments, a horizontal separation of a minimum of 12 metres is required. This would enable a batter to be constructed from the existing road level up to the new bridge level. By analysing the existing and proposed bridge deck levels the recommended separation presented in this report is around 20 metres. This also helps contain earthworks to approximately the same volumes as building on the current road alignment and allows for the entry and exit curves to the bridge to blend in more appropriately with the existing Commissioners Creek Road alignment.

1b. Existing alignment

To construct a new bridge on the existing alignment a temporary sealed diversion track and a temporary low-level bridge would be required to cross Doon Doon Creek so that access to the east and west of the bridge is maintained during construction. This track would also be utilised by construction traffic to access the creek bed for bridge foundation construction. It is likely that during construction hours, delays may occur as the track would likely be under traffic control. It is also possible that during periods of heavy rain access could be compromised as the temporary bridge would be at a low level and could be inundated.

Private property

No private property acquisition is required as these options will use the existing road reserves and / or land acquired for the dam.

During construction, it is likely that a gang caravan would be located in the road / dam reserve, with possible clearing around the preferred alignment needed for bridge works.

A new higher access from Commissioners Creek Road to 229 Doon Doon Road would be required and would be constructed in conjunction with the southern abutment earthworks. The new driveway would be at a similar level to the new bridge or approximately RL72.6.

Travel times

The travel time to and from the major centres would be unchanged once the new bridge was constructed.

It is likely that travel times would be increased during the construction period as works would be under traffic control. If the existing bridge alignment was maintained for the new bridge, a diversion track (Refer Constructability below) would be used for access during construction and the alignment would be inferior to the existing road alignment.

Road safety

Road safety would be unchanged once construction was completed.

Utilities

A dial-before-you-dig enquiry indicates there are no major utility constraints, but further liaison with utility authorities would be required.

There is a power conduit connected to the existing bridge supplying power to properties either side of the bridge. Telstra cabling also passes along the bridge alignment.

There are power poles along the existing road network, but these would appear to be outside the raised Clarrie Hall Dam impact zone.

Physical constraints

With an existing span of around 50 metres, Doon Doon Creek needs a relatively long bridge with approaches connecting back to road/ground level on each approach. Subject to environmental approval, it is anticipated the current spill-through abutments could be utilised to tie-in the new bridge span to the existing bridge span.

The proposed configuration of the new bridge (subject to detailed design) would be three 16-metre spans with a deck width of 8.2 metres.

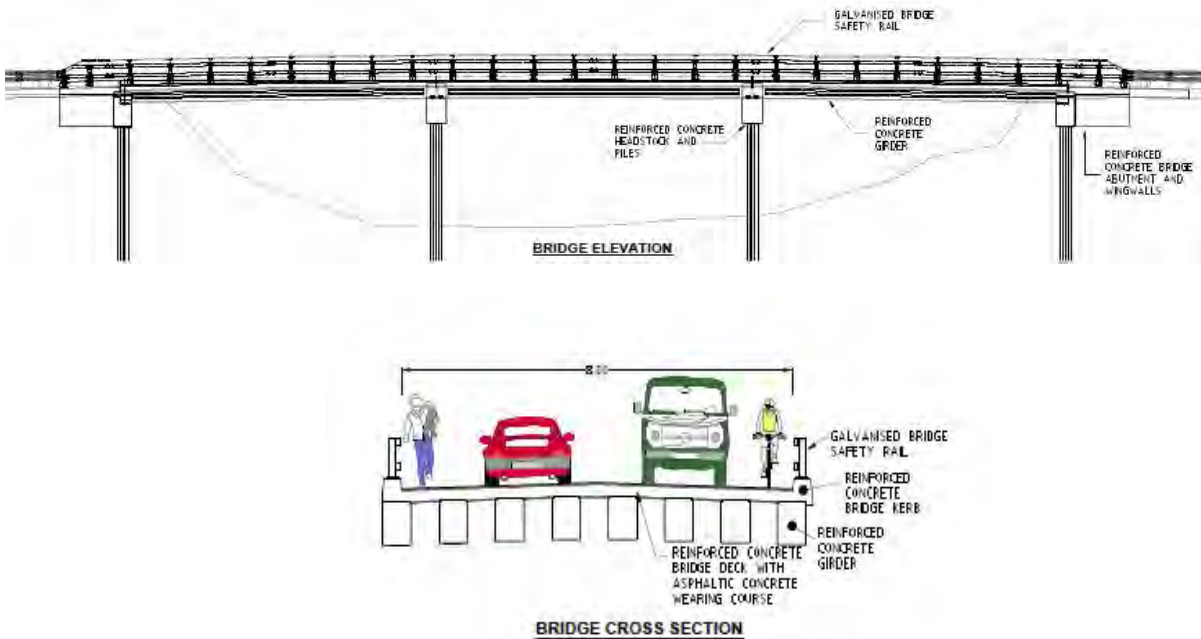
Vertical clearance for creek traffic is not required.

Constructability

Requirements identified for bridge construction include site compound location, maintenance access and craning/piling pads. Further concept design development would address most general construction issues.

Either side of the new bridge, Commissioners Creek Road would have to be raised by six (6) metres to suit the new bridge level. This would result in approximately 700 metres of road reconstruction and the placement of 60,000 cubic metres of fill for road raising and bridge abutments. It is proposed that the fill material would be obtained from inside the dam inundation area close to the bridge site to minimise transport costs. The exact location of the borrow pit has not been identified at this stage and would be subject to environmental approval. The borrow pit may be located to improve the profiling of the inundated land to limit weed growth in the dam.

If Council's current bridge construction methodology was adopted for a replacement bridge, the construction sequence would involve piled foundations tied together with a pile cap. A reinforced concrete blade wall would then extend up to the abutments/headstocks. Prestressed bridge deck units would then be placed and, finally, a reinforced concrete deck would be poured to link the deck units.



Typical Bridge elevation and cross sections

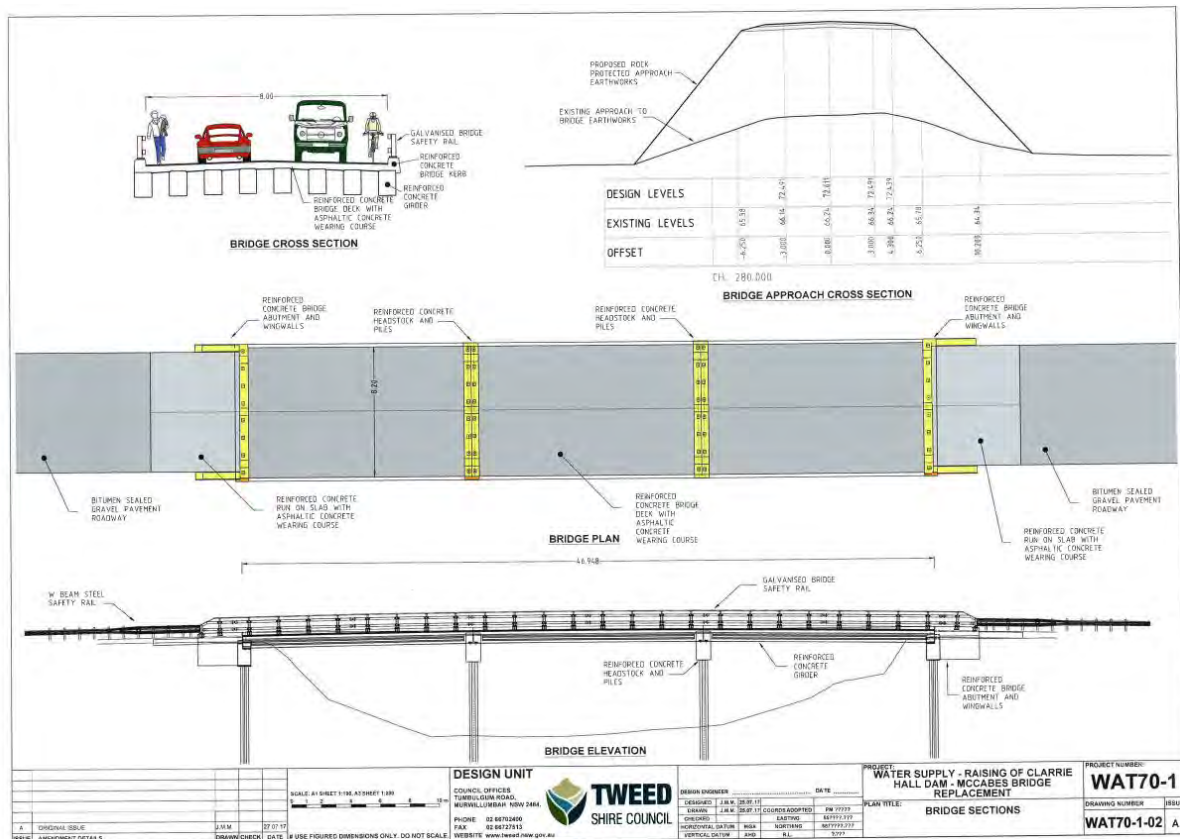
To replace the bridge on the existing alignment, a temporary sealed diversion track and a temporary low-level bridge would be required to cross Doon Doon Creek so that access to the west of the bridge is maintained during construction. This track would also be used by construction traffic to access the creek bed for bridge foundation construction. It is likely that during construction hours, traffic delays may occur as the track would likely be under traffic control. It is also possible that during periods of heavy rain access could be compromised as the temporary bridge would be at a low level and could be inundated.

It is anticipated that the new bridge and approaches would take approximately nine (9) months to complete. If the existing bridge alignment were adopted as the preferred option, the diversion track and low level bridge would operate for almost all of the construction period.

Hydrology

Currently, a finished deck level for the bridge has not been adopted as the final spillway height and width are subject to further modelling. As a guide, based on the bridge construction methodology suggested above and with a clearance below the bridge deck bearings to allow maintenance access, the minimum deck level (without wearing course) would be around R.L.72.6 This would place the deck level above the predicted ARI 100 flood level of R.L.72.50.

It should be noted, that most of the surrounding road network can become impassable in an ARI 10 flood (1 in 10 year flood).



Typical Bridge details

Geotechnical considerations

Drawings of the existing McCabe's Bridge indicate rock levels for bridge foundations to be around three (3) metres below the existing creek bed at its lowest point. As the new bridge will be in close proximity to the existing bridge, it is anticipated that rock levels for foundations will generally be around the same depths as the existing piers. These details will be confirmed by geotechnical testing as part of the detailed design process.

Ancillary issues

Two of the existing culverts east of McCabe's Bridge on Commissioners Creek Road will be inundated once the dam wall is raised. As part of this option, road works may be required at these culverts to maintain access to the residential properties, east of McCabe's Bridge.

Estimated costs

- Option 1a (parallel bridge alignment) - \$6.0 million and
- Option 1b (existing bridge alignment) - \$6.2 million.

The cost is based on a 50-metre-long three (3)-span and eight (8)-metre-wide two-lane bridge and includes:

- 700 metres of roadworks to tie the new higher bridge back into Commissioners Creek Road
- 60,000 cubic metres of fill to raise embankments to the new bridge level
- contingencies of 20 per cent for bridge construction and 10 per cent for road construction
- survey, investigation, environmental approvals and design
- survey set-out and work-as-executed survey and drawings
- wet weather allowance
- traffic control and diversion track construction and demolition, and
- demolition of the existing bridge.

The estimated costs for bridgeworks and roadworks for options 1a and 1b are generally similar. The major difference between 1a and 1b is the level of traffic control and the standard of diversion track required for each option. The parallel alignment allows the existing bridge and road to be used for the majority of the construction period. For a new bridge on the existing alignment, a diversion track and traffic control will be required for the majority of the construction period. To enable a new bridge to be constructed on the existing bridge alignment, the diversion track would be required to be used by both construction vehicles and the general public. This road would have to be designed and constructed to a level commensurate with its intended use. For the parallel alignment, the diversion track would only be used by construction vehicles and could therefore be constructed to a lower standard.

(If a separate pedestrian lane was required for the bridge this would add approximately \$0.8 million to the cost of the project.)

The estimated cost of this option has increased from figures presented at the meeting of 21 June 2017. The original cost estimate was derived using actual construction costs of similar length bridges constructed by Tweed Shire Council. This method provided an indicative broad order cost estimate to allow comparison with other options. The increase in estimated costs reflects additional conceptual design work undertaken for the options presented in this report. The conceptual design provided a more accurate quantification of the works, particularly the amount of earthworks and roadworks involved in constructing the new bridge and matching back into Commissioners Creek Road on either side of the bridge. This allowed a more detailed estimate to be derived using an elemental format. As well, items for the demolition of McCabe's Bridge and construction/demolition of a side track and traffic control were not included in the original estimate.

It should be noted that as more detailed information is gathered (eg survey, environmental, geotechnical, etc.) the cost estimate will evolve further. As well, depending when a new bridge is constructed, impacts such as inflation and wage growth would need to be taken into account.

Ongoing maintenance

The new bridge would be designed to have a life of 100 years and there would be ongoing maintenance savings from a new bridge compared to the current bridge, which is approximately 50 years old.

Environmental considerations

Catchment description

McCabe's Bridge is located within the Doon Doon sub-catchment of the Tweed River catchment. The majority of Doon Doon sub-catchment is made up of rural and agricultural land uses (>70% land zone 1a Rural) and sclerophyll open forest and sub-tropical rainforest bushland (TSC GIS Enlighten, 2013). The Doon Doon sub-catchment incorporates parts of Nightcap National Park in the south-west and Mount Jerusalem in the east and south. The future land use intent for the catchment is consistent with the current use, with the Tweed LEP 2014 mapping the majority of Doon Doon catchment Rural Landscape (RU2) zone.

The climate is sub-tropical, characterised by warm temperatures and high rainfall. The average annual temperature in Murwillumbah is a minimum of 14.5⁰C and maximum of 25.8⁰C (BoM, 2015). Tweed has an average rainfall of 1605 millimetres per year (BoM, 2015).

Flora

Vegetation in the proximity of McCabe's Bridge has been mapped as 'substantially cleared', according to the Tweed Vegetation Mapping strategy (Kingston 2004). A patch of vegetation mapped as Tallwood open forest occurs in association with the southern road alignment for Option 1a, however, surveys associated with the Clarrie Hall Dam raising proposal noted this vegetation was highly disturbed from cattle and weeds. Road verges in the subject area are identified as Low Conservation Value in the Tweed Shire Council Roadside Vegetation Management Plan (2013).

Cleared areas adjacent to McCabe's Bridge are predominantly pasture for cattle grazing and are vegetated with a mixture of exotic and native grasses and herbs and isolated paddock trees and/or narrow riparian strips of regrowth vegetation.

A likelihood of occurrence assessment for threatened flora species associated with the proposed Clarrie Hall Dam raising study found 11 threatened species likely to occur in the broader area. These species are typically associated with warm temperate/subtropical and/or dry rainforest or wet sclerophyll forest, mostly associated with basalt-derived soils. Given the highly cleared and disturbed nature of the vegetation associated with McCabe's Bridge, these species would have a low likelihood of occurrence associated with the subject site. Notwithstanding this, targeted threatened species surveys would be required to confirm the presence of threatened flora species associated with this option.

There are no mapped endangered ecological communities associated with the temporary access alignment. The presence of threatened plants would need to be confirmed from site assessments, although given the area is cleared and disturbed from cattle grazing, threatened plants would be unlikely to occur directly upstream or downstream of the existing bridge alignment.

Fauna

A search of the NSW Bionet and Commonwealth Protected Matters threatened species databases, and discussions with Birdlife Northern Rivers for the purpose of identifying potential species, suggested that 61 threatened fauna species may occur in the broader area. However, many of these species are associated with forested habitats. Nonetheless, a number of threatened and protected species may still be associated with the subject site including threatened insectivorous bats potentially roosting and breeding under McCabe's Bridge and other stream dependent species, such as the Platypus, which has been observed at McCabe's Bridge. Targeted site assessments would be required to confirm the presence of threatened species and their habitats at the subject site.

Soils and hydrology

The subject site consists of level to undulating narrow floodplains supporting alluvial soils bordered by erosional landscapes (as per the Soil Landscapes of the Murwillumbah Tweed Heads 1:100,000 sheet; Morand 1996). The geology is quaternary sediments consisting of river gavel, alluvium, sand and clay. The soil landscape type at McCabe's Bridge is Terania (Te) bordered by Kunghur (ku)

type. Limitations at the site are flooding, streambank erosion, seasonal waterlogging and mass movement (Morand 1996).

Of significance to water quality is the high average runoff rates from the catchment (Water Futures & City Water Technology, 2010). These rates are due to steep ranges in the upper catchment and short stream lengths in the lower catchment (HWA, 2006). In combination, the topographical features of the catchment can give rise to peak flows which can carry high levels of runoff contaminants, such as pathogens and particles, quickly into waterways (Water Futures & City Water Technology, 2010).

Air and noise

Air quality is likely to be very high given the vegetated nature of the broader area, with limited commercial or industrial land use activities in the area. Similarly, background noise levels would be low and associated with occasional traffic movements and rural activities. No power boats are permitted on Clarrie Hall Dam and, consequently, noise associated with this activity is not relevant.

The nearest properties that may notice changes in air quality and noise levels would be those properties located in close proximity to McCabe's Bridge including:

- Lot 1//816505, no. 571 Doon Doon Road, and
- Lot 1//877100, no. 60 Commissioners Creek Road.

Air quality impacts could be managed and mitigated using standard construction mitigation measures.

The demolition and reconstruction of McCabe's Bridge is likely to take up to nine (9) months and consequently, in accordance with the NSW EPA Interim Construction Noise Guideline, a quantitative noise assessment would be required including development of a construction noise management plan to manage noise impacts on nearby properties.

Visual amenity

McCabe's Bridge is located within a rural setting characterised by rural roads and residences, and a mosaic of cleared and vegetated lands and escarpments associated with Mount Jerusalem and the Nightcap ranges.

The closest residences with views to McCabe's Bridge are Lot 1//816505, No. 571 Doon Doon Road (referred to as visual receptor (VR) 1) and Lot 1//877100, No. 60 Commissioners Creek Road (VR2). Both residences are located generally between RL80 and RL90. Views from a third residence to the proposed bridge upgrade alignment, located at Lot 2//838936, No. 511 Doon Doon Road (approx. RL 90), are likely to be obstructed by existing dense vegetation.



Location of two properties with existing views to McCabe's Bridge (VR1 = Lot1//816505; VR2 = Lot1//877100)

A preliminary assessment of the two nearest properties, VR1 and VR2, is presented in Appendix C. These 'representative viewpoints' were assessed in terms of the nature of change and the magnitude of change and the preliminary assessment found there to be low impact.

Contaminated land use

A review of Council's contaminated land database did not detect any known contamination at the subject site. Further, there are no registered cattle dip sites in or adjacent to McCabe's Bridge. Given the area is used for agriculture, final alignments would have to be field validated for signs of contamination, such as chemical drums associated with cattle yards and old sheds.

Heritage

Non-Aboriginal heritage:

- McCabe's Bridge is not listed as a heritage item in Schedule 5 of the Tweed Local Environment plan (2014), and
- there were no heritage items listed in association with McCabe's Bridge on the State Heritage Register.

Aboriginal heritage:

- a search for Aboriginal places on the State Heritage Register did not find any items associated with McCabe's Bridge
- there are no known or predictive Aboriginal sites or places located in or directly adjacent to McCabe's Bridge, according to the Tweed Shire Aboriginal Cultural Heritage Mapping layer
- an Aboriginal Heritage Information Management Search (AHIMS) search based on a 200-metre buffer from McCabe's Bridge did not find any Aboriginal site or places, and
- recent cultural heritage site investigations associated with the raising of Clarrie Hall Dam did not record any known sites in association with the raised bridge options including road alignments (pers. Comm. TBLALC).

Notwithstanding this, a preliminary cultural heritage assessment would be required to assess risk associated with impacting Aboriginal cultural heritage.

Other hazards

Other known hazards associated with the subject site include bushfire prone land and flooding hazard. These hazards would require further assessment and mitigation as part of the environmental assessment for the proposal although would be addressed using standard construction mitigation measures.

OPTION 2 - New link road between Commissioners Creek Road and Doon Doon Road

Engineering considerations

In this report, the engineering and environmental considerations for a new link road are similar for Options 2a and 2b. Accordingly, most sections are relevant to both options and are treated as such in this report.

Option description

The option involves construction of a new link road connecting Commissioners Creek Road and Doon Doon Road. Two alignments have been investigated and are designated 2a and 2b. Both alignments will require 20-metre span bridges to cross Doon Doon Creek and Commissioners Creek respectively.

Alignment 2a

Alignment 2a commences approximately 100 metres north of Pine Log Road where the road would cross Doon Doon Creek via a 20-metre span bridge and generally run in an easterly direction for one (1) kilometre. The road would then cross Commissioners Creek via a second 20-metre span bridge and continue in a north-easterly direction until it meets Commissioners Creek Road, approximately 400 metres south of the Lone Pine Road intersection. New intersections would be required at Doon Doon Road and Commissioners Creek Road respectively.

The major advantage of this option compared to 2b below, is that it would result in a slightly (30 seconds) shorter travel time. However, it should be noted that at the Doon Doon Road end, the proposed alignment crosses over land owned by Department of Primary Industries and a small area of private property.

Alignment 2b

Alignment 2b commences approximately 400 metres south of Pine Log Road and initially runs in a north-easterly direction requiring a 20-metre span bridge over Doon Doon Creek. After approximately 700 metres, this alignment joins into alignment 2a just before the Commissioners Creek bridge. As with Option 2a, new intersections would be required at Doon Doon Road and Commissioners Creek Road respectively.

Although about 200 metres shorter than Option 2a, Option 2b traverses lands entirely owned by Tweed Shire Council and is further away from the Pine Log Road intersection, allowing a better intersection with Doon Doon Road.

Alignment

Both options would be designed for an 80kmh design speed, which would be superior to the existing section of Commissioners Creek Road from the start of the new road to Doon Doon Road. Road gradients would be designed in accordance with Tweed Shire Council's Road Design Specification.

As well, a section of Doon Doon Road and Commissioners Creek Road near to the proposed intersections would be brought up to a similar standard as the new link road.

Private property

For Option 2a, negotiations for the purchase of land from DPI and a private land owner would be required. Due to the small areas needed for the road, these should not be seen as constraints to on this option.

No private property acquisition is required for Option 2b as this option will use the existing road reserves and / or land acquired for the dam.

During construction, it is likely that a gang caravan would be located on the land acquired for the dam.

To gain access to 269 Doon Doon Road, a 300-metre section of Commissioners Creek Road as well as a 50-metre section of the existing driveway would need to be raised to RL72.5.

As well, it would be necessary to close Commissioners Creek Road at either side of the existing bridge and provide turn around areas for garbage trucks.

Travel times

The travel times to and from the major centres would be marginally increased for the new link road. The following increases are anticipated for properties along Commissioners Creek Road.

Travel From	Travel To	Increased Travel Time for Option 2a
Commissioners Creek Road, south and east of the new link road.	Intersection Commissioners Creek Road and Doon Doon Road	1 minute
Lone Pine Road	Intersection Commissioners Creek Road and Doon Doon Road	3 minutes
Crams Farm	Intersection Commissioners Creek Road and Doon Doon Road	4 minutes
McCabe's Bridge	Intersection Commissioners Creek Road and Doon Doon Road	5 minutes

Note: Add approximately 30 seconds to travel times for Option 2b.

Road safety

Road safety would be marginally improved once construction was completed. The new link road would be a superior alignment (80kmh speed regime) compared to the existing Commissioners Creek Road from McCabe's Bridge to the start of the new link road.

Utilities

A dial-before-you-dig enquiry indicates there are no major utility constraints but further liaison with utility authorities would be required.

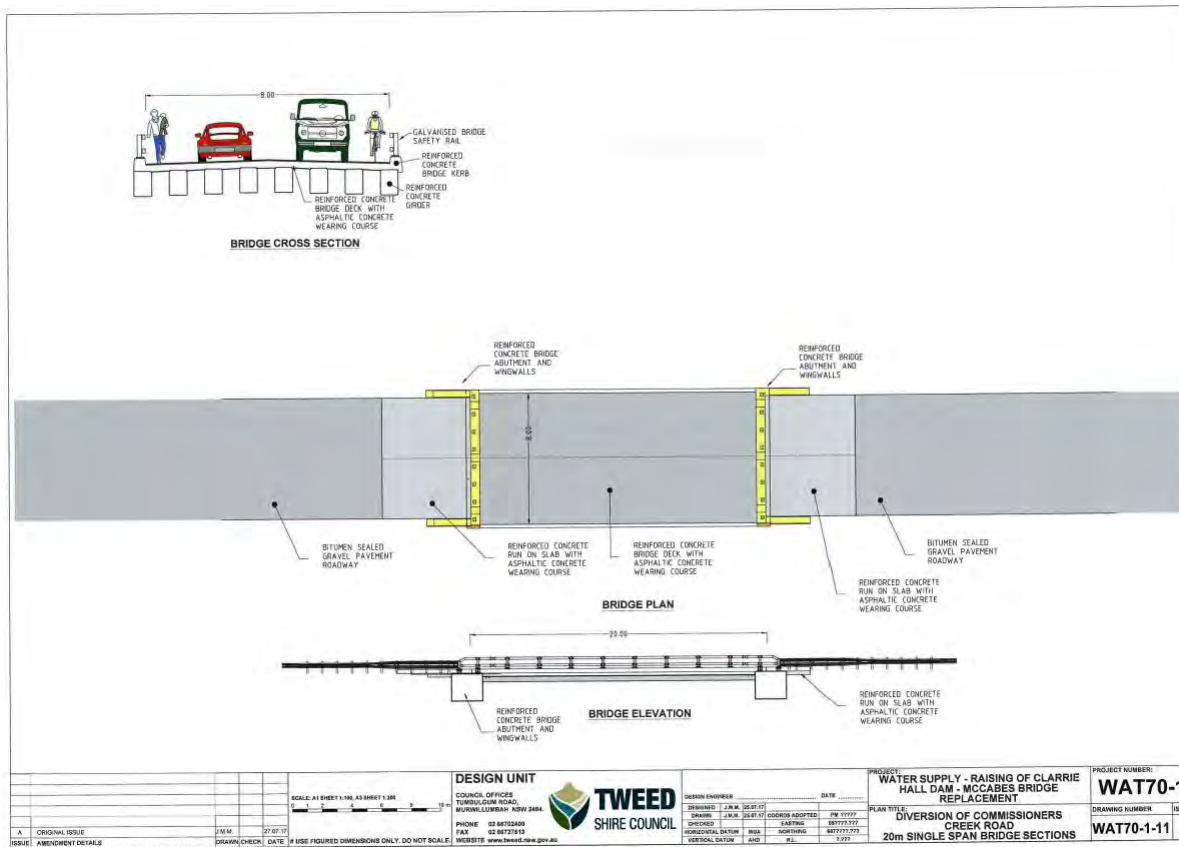
There is underground Telstra cabling, which would pass under the link road.

Conduits that pass along McCabe's bridge would need to be catered for once the bridge was demolished.

Physical constraints

Both alignments pass over Doon Doon Creek and Commissioners Creek, which necessitates the construction of two 20-metre span bridges. Vertical clearance for creek traffic is not required.

The link roads traverse relatively steep topography. To keep the road gradients within Tweed Shire Council's design limits, some large cuttings of up to five (5) metres deep may be required. Material from the cuttings would be used as filling in gullies, so that no material would need to be removed from the construction zone.



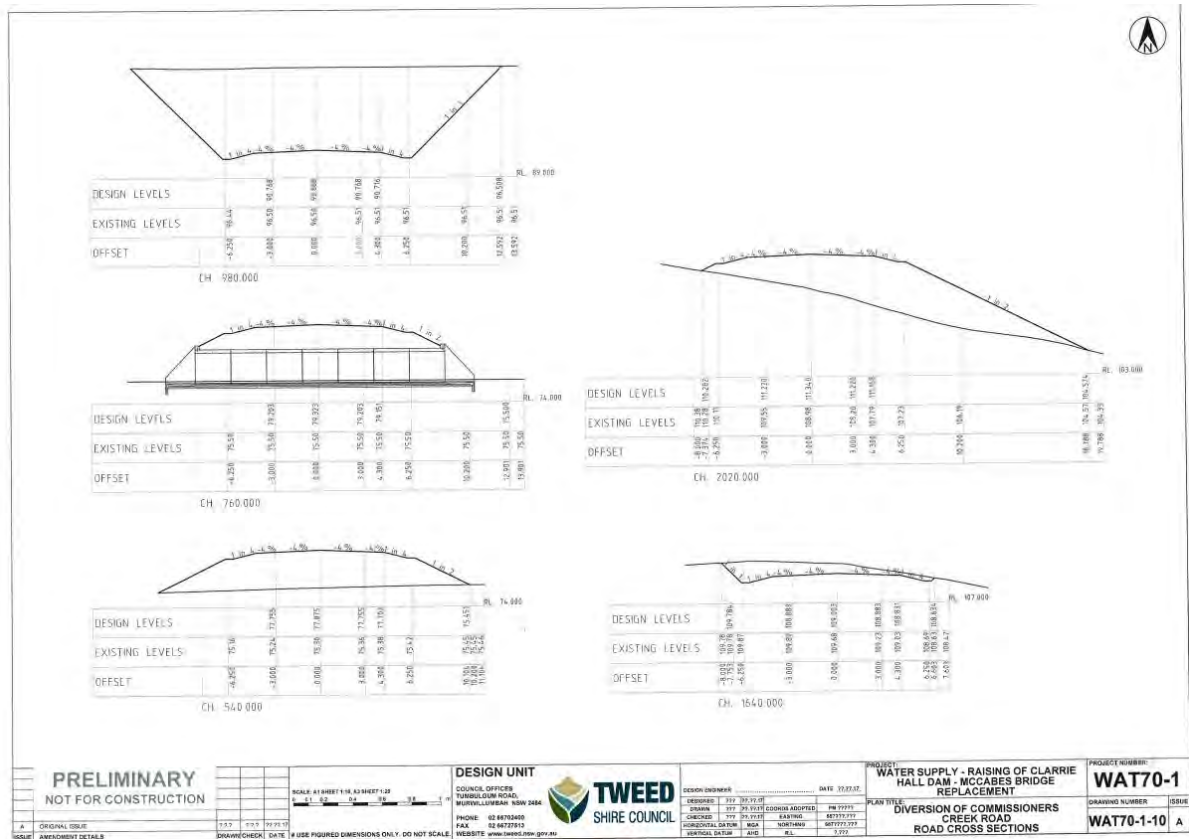
Typical Bridge Details

Constructability

Requirements identified for the road and bridge construction include site compound location, maintenance access and craning/piling pads. Further concept design development would address most general construction issues.

A temporary construction track to the bed of Doon Doon Creek would be required to assist in the demolition of McCabe's Bridge. However, it is likely that the new link road would be completed and open to traffic prior to demolition occurring, so there would be no need for the construction track to be used by residents.

For both options, the new link road would be around 2.7 kilometres in length and would result in approximately 60,000 cubic metres of earthworks. The road design would be undertaken to enable materials from road cuttings (30,000 cubic metres) to be used for filling gullies and bridge abutments (30,000 cubic metres), so that no materials would be removed from the construction zone.



Example Road Cross Sections showing deep cuts and filling that would be required to construct the link road.

If Council's current bridge construction methodology was adopted for the new bridges, the construction sequence would involve piled foundations for the bridge abutments tied together with a pile cap. Both bridges would be approximately 20-metre span and so no piers would be required. Prestressed bridge deck units would then be placed and, finally, a reinforced concrete deck would be poured to link the deck units.

It is anticipated that the new bridges and link road would take approximately nine (9) months to complete.

Hydrology

Currently, a finished deck level for the bridges has not been adopted as the final road height would be subject to further modelling to ensure balanced cut and fill volumes. As a guide, the deck levels of the bridges, based on the concept alignment included in this study, place both bridges above RL77.0, which is above the predicted ARI 100 flood level of the Clarrie Hall Dam spillway of R.L.72.50.

It should be noted that most of the surrounding road network can become impassable in an ARI 10 flood.

Survey, associated hydrological assessment and culvert design for road-cross drainage over existing gullies has not been undertaken and consequently, the sizes of drainage structures are not known. This assessment would form part of the detailed road design if this becomes the preferred option.

Geotechnical considerations

No geotechnical testing has been carried out on the alternative road alignment. This testing will be necessary for the detailed design of bridge foundations and also to confirm cutting and filling batter slope angles. Anecdotal evidence from local residents indicates that rock may be present only one (1) to two (2) metres below current surface levels where the alignment passes along or through ridge lines. If rock is present, this would need to be confirmed by rigorous geotechnical testing along the

alignment, which would also confirm the strength of any rock and detail construction methods and machinery that may be required.

Ancillary issues

By closing sections of Commissioners Creek Road around McCabe's Bridge and opening a new link road, some street addresses may be affected.

Estimated cost

- The estimated cost of Option 2a is \$7.1 million
- The estimated cost of Option 2b is \$7.0 million

The cost is based on two 20-metre span eight (8) metre-wide two-lane bridges and includes:

- 2.4 kilometres (2a) and 2.2 kilometres (2b) of roadworks to tie Commissioners Creek Road to Doon Doon Road
- 60,000 earthworks cut to fill, including allowance for rock excavation
- high level access to properties near McCabe's Bridge and garbage turn-around area
- new intersections at Commissioners Creek Road and Doon Doon Road
- contingencies of 20 per cent for bridge construction and 10 per cent for road construction
- survey, investigation, environmental approvals and design
- survey set-out and work-as-executed surveys and drawings
- wet weather allowance
- traffic control (only required during intersection works), and
- McCabe's Bridge demolition.

Ongoing maintenance

The new bridges would be designed to have a life of 100 years and there would be ongoing maintenance savings from the new bridge compared to the current bridge.

The link road would involve approximately two (2) kilometres of extra road length compared to the current road alignment and so Council's overall maintenance responsibility would be increased for this option.

Alternative alignments

Aside from Options 2a and 2b, a number of alternative alignments were investigated as part of the link road assessment. The alignments described in this report were chosen because:

- they did not require (large) purchases of additional private land acquisition over what has already been arranged with no purchases for Option 2b and only minimal purchases for Option 2a
- they maintained a suitable (minimum 50 metre) buffer to existing dwellings
- they followed (generally) cleared areas, minimising vegetation clearing, and
- they provided for bends and gradients that allowed an 80kmh design speed, which would improve safety and minimise increases in travel times.

All other alignments were inferior on at least one of the points raised above and so were not assessed in detail.

Environmental considerations

Catchment description

Option 2 is located within the Doon Doon sub-catchment of the Tweed River catchment. The majority of Doon Doon sub-catchment is made up of rural and agricultural land uses (>70% land zone 1a Rural) and sclerophyll open forest and sub-tropical rainforest bushland (TSC GIS Weave, 2017). The Doon Doon sub-catchment incorporates parts of Nightcap National Park in the south-west and Mount Jerusalem in the east and south. The future land use intent for the catchment is consistent with the current use, with the Tweed LEP 2014 mapping the majority of Doon Doon catchment Rural Landscape (RU2) zone.

The climate is sub-tropical, characterised by warm temperatures and high rainfall. The average annual temperature in Murwillumbah is a minimum of 14.5⁰C and maximum of 25.8⁰C (BoM, 2015). Tweed has an average rainfall of 1605 millimetres per year (BoM, 2015).

Flora

Option 2a transverses in metres and percentage: 1644 metres (73%) of substantially cleared land, 228 metres (10%) of unspecified plantation, 191 metres (8%) of unassessed forest, 128 metres (6%) of brush box open forest, 40 metres (2%) of flooded gum open forest and 31 metres (1%) of grey ironbark/white mahogany/grey gum open forest complex. Vegetation types are based on classification by Kingston et al., (2004) and would require field validation.

The alternative connection to Doon Doon Road proposed in Option 2b is approximately 540-metres long before reconnecting with the combined Option 2 alignment. This alternative connection is partly overcleared land except between Doon Doon Road and Doon Doon Creek, where the alignment will intercept riparian vegetation including flooded gum open forest (mapped by Kingston et al., 2004). This community is also classified as secondary koala habitat according to Kingston et al., 2004.

Cleared areas are predominantly pasture that is grazed by cattle, with much of the forested areas classified as disturbed mature forest. None of the proposed footprint crosses key habitat. However, 290 metres of road goes through land classified by Kingston et al., (2004) as moderately ecologically sensitive land and 39 metres crosses highly ecologically sensitive land. Option 2b would intercept an additional 50 metres of high ecological sensitivity land.

A likelihood of occurrence assessment for threatened flora species associated with the proposed Clarrie Hall Dam raising study found 11 threatened species likely to occur in the broader area. These species are typically associated with warm temperate/subtropical and/or dry rainforest or wet sclerophyll forest, mostly associated with basalt-derived soils. Given that the proposed road would travel through 390 metres of native forest, ground surveys would be required to assess occupancy and impact on threatened plant species.

(All estimates for the flora section relate only to the section of road yet to be constructed.)

Fauna

A search of the NSW Bionet and Commonwealth Protected Matters threatened species databases, and discussions with Birdlife Northern Rivers for the purpose of identifying potential species, suggested that 61 threatened fauna species may occur in the broader area. Recent fieldwork in land parcels that the proposed works travel through and surrounding land, identified 25 threatened animal species. Hence, it is probable that threatened species' habitat will be disturbed by the proposed works. Targeted and general surveys around the riparian areas and forested areas in close proximity to the footprint would need to occur to assess the impact on threatened fauna. The cleared areas away from Doon Doon Creek are unlikely to provide habitat for threatened fauna, except for some threatened microbat species.

Edge effects is a term applied where two contrasting habitats suddenly converge without natural graduation and often relates to human-made edges which are inimical to most species, except those with excellent dispersal, invading and colonising abilities. These species then encroach on interior habitats reducing the integrity and biological values of an area. At present, edge associated effects

are considered to exist in most areas within the upper Doon Doon catchment through past road construction and land clearing and management of land for grazing and other rural land uses. Consequently, it is likely that edge effects, and other ecological processes such as habitat fragmentation and barriers to fauna movement, are already prevalent to varying degrees within all habitats associated with the area. The introduction of a new road for Option 2 would introduce and/or exacerbate new ecological processes to adjacent lands, such as the creation of fauna movement barriers for those species reluctant to cross roads, road-related fauna mortality, new predator pathways, road runoff to adjacent aquatic habitats and other hazards, such as roadside weeds and fire risk.

Soils and hydrology

Soil types have been classified by Morand (1996). The proposed footprint travels through alluvial landscapes, specifically Terania soil, which is made up of river gravel, alluvium, sand and clay. This alluvial landscape is located near the most-western proposed waterway crossing for both Option 2a and Option 2b. The remaining soil type is classified as Kunghur, an erosional soil type found in undulating and rolling hills. It comprises of sandy clay on top of ridges, sandy clay loam, sandy clay and yellowish brown mottled clay on the higher slopes and sandy clay, sandy clay loam and red massive clay on the lower slopes. Geology is Quaternary at the first proposed creek crossing and Jurassic for the remaining area. Soil limitations (those that restrict development) of the Terania soil are flooding, stream bank erosion, seasonal waterlogging and mass movement of soil. Limitations of the Kunghur soil are steep slopes, rocky outcrops, rock fall hazard, mass movement, shallow soil, waterlogging, non-cohesive soils and water erosion.

Of significance to water quality is the high average runoff rates from the catchment (Water Futures & City Water Technology, 2010). These rates are due to steep ranges in the upper catchment and short stream lengths in the lower catchment (HWA, 2006). In combination, the topographical features of the catchment can give rise to peak flows which can carry high levels of runoff contaminants, such as pathogens and particles, quickly into waterways (Water Futures & City Water Technology, 2010).

Air and noise

Air quality is likely to be very high given the vegetated nature of the broader area, with limited commercial or industrial land use activities in the area. Similarly, background noise levels would be low and associated with occasional traffic movements and rural activities. No power boats are permitted on Clarrie Hall Dam and, consequently, noise associated with this activity is not relevant. Sensitive receivers associated with changes in air quality and noise levels would be those properties closest to the alignment. However, most properties associated with Option 2a and Option 2b have been purchased by Tweed Shire Council and associated dwellings proposed for removal. The next closest property potentially affected by air and noise associated with construction works would be at number 637 Doon Doon Road (Lot 3//605354). The greatest area of potential impact would be associated with the connection point to Doon Doon Road for Option 2a, which is approximately 150 metres from the dwelling. Existing screening vegetation could buffer some effects of noise and air impacts although further assessment would be required to determine the extent of these impacts.

Construction noise

The NSW EPA Interim Construction Noise Guideline (ICNG) identifies that both qualitative and quantitative noise assessments can be undertaken for infrastructure construction works. The choice of assessment method is not dependent on what time of day the works are proposed to take place, instead it relates to the proposed duration of the works. Construction of new public infrastructure generally warrants a quantitative assessment as the works often occur for longer periods of time (> 3 weeks) and can involve lots of equipment and/or stages of work.

The quantitative assessment method involves predicting noise levels and comparing them with the levels specified in the ICNG. Guidance noise levels are given for airborne noise at sensitive land uses, ground-borne noise and sleep disturbance. Vibration is not covered in this Guideline. The

noise levels specified within the ICNG are important indicators for construction managers to avoid or minimise noise that, if not considered, could delay construction work.

Operational noise

The NSW EPA Environmental Criteria for Road Traffic Noise (ECRTN) provides a framework that guides the consideration and management of traffic noise issues associated with new road developments. The framework embodies a non-mandatory performance-based approach. The criteria are applied as targets, but recognise that there will be situations where planning strategies are not feasible.

Table 1 of the ECRTN sets out the criteria to be applied to particular types of road and land uses. The values presented in the tables are intended to preserve amenity appropriate to the land use. Within Table 1, traffic noise on a new local road corridor within a rural area is not to exceed 50dB(A) during daytime and 45dB(A) during night periods and should not increase existing noise levels by more than 0.5dB(A).

Considering the above information, it would appear that construction and operational noise modelling would be required as a component of the environmental assessment for Option 2.

Visual amenity

The proposed alignment mostly transverses undulating and rolling hills from an altitude of 70-130 metres and a slope ranging from 0-32^o, with an average of 12^o. The alignment is located within a rural landscape characterised by cleared grazing land, native plantation and remnant forests, occasional rural residences and a mosaic of cleared and vegetated hills and escarpments associated with Mount Jerusalem and the Nightcap ranges.

The magnitude of change associated with existing viewpoints to this option has not been modelled. Notwithstanding this, it is likely that the construction of a new 2.2-kilometre road alignment, including two bridges and cut and fill earthworks, could introduce adverse impacts on a number of existing viewpoints. The magnitude of this change would depend on the proximity of properties with lines of sight. Impacts to most existing residences have been mitigated through property acquisition associated with the Clarrie Hall Dam raising proposal. Visual impacts (and other construction and operation-related impacts) to at least one residence located adjacent to the connection point on Doon Doon Road Option 2a would require further assessment. In general, however, rural roads once constructed may not necessarily result in significant adverse visual impacts where these are located many hundreds of metres away from existing residences.

Contaminated land use

A review of Council's contaminated land database did not detect any known contamination at the subject site. Further, there are no registered cattle dip sites located in or directly adjacent the proposed footprint. One dip site (Fogarty's Dip) is located on the opposite side of Doon Doon Road, south of the Option 2b connection point to Doon Doon Road. No works would be in the vicinity of this dip site. Given the area is used for agriculture, final alignments would have to be field validated for signs of contamination, such as chemical drums associated with cattle yards and old sheds.

Heritage

There were no non-Aboriginal heritage items listed within 10 kilometres of the proposed footprint listed on the State Heritage Register.

An Aboriginal Heritage Information Management Search (AHIMS) detected three known Aboriginal sites within 350 metres of the proposed new road alignment. These sites are clumped north of the construction start point on Doon Doon Road, on Doon Doon Creek. In addition, recent Aboriginal cultural heritage assessments for the Clarrie Hall Dam raising proposal suggested a high likelihood of encountering Aboriginal sites in and adjacent the Option 2 alignment. In particular, the ridgeline extending from Commissioners Creek Road to Commissioners Creek was identified as having possible Aboriginal sites. Considering that the proposed footprint crosses similar terrain to the known Aboriginal site locations (low-lying land on Doon Doon Creek) and is also located along a ridgeline considered to have a high probability of Aboriginal site presence, a comprehensive cultural

heritage assessment would be required if Option 2 was progressed to the preferred option. This would require a cultural heritage assessment in accordance with the Aboriginal cultural heritage consultation requirements for proponents (2010) including engaging a cultural heritage consultant, registered Aboriginal parties and the preparation of a cultural heritage assessment report.

Other hazards

Other known hazards associated with the subject site include bushfire prone land and flooding close to watercourses.

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Demolition of existing McCabe's Bridge

Demolition of the existing bridge is a common element required for all options presented in this report.

For Option 1a, the existing bridge would remain operational for most of the construction period. Local traffic would be using the new bridge prior to the demolition of the existing bridge.

For Option 1b, the timing of the demolition would begin early during construction, so use of a diversion track would be required for most of the road and bridge construction period.

For Option 2a and 2b, the new road and bridges would be built on land acquired for the dam and so the existing Commissioners Creek Road and McCabe's Bridge could remain operational until the new road was opened.

The method of demolition will be determined by demolition experts. It is envisaged that removal of the existing bridge would begin with removal of the road surfacing followed by removal of the safety barriers. To remove the deck units, the Macalloy bars, which tie the deck units together, would have to be cut and it may then be possible to remove the individual deck units with a crane.

The number of piers to be removed is unknown. As the creek is not navigable and the piers are around four metres below the spillway or dam full level, an argument could be mounted that they be left in place. Alternatively, they could be cut to an appropriate level or explosive charges could be used to create a plane of weakness so they could then be removed.



Existing McCabes Bridge

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Options assessment summary

OPTION	ASSESSMENT
<p>1a. Construct a new bridge on a parallel alignment to the existing bridge</p>	<p>Engineering</p> <p>The new higher bridge would be reconstructed on a parallel alignment west of the existing bridge. This would enable the majority of the bridge and road works to be undertaken without requiring traffic to use diversion tracks. A temporary access track and waterway crossing would be required for construction traffic and would remain in operation for the full construction period (up to nine months).</p> <p>This option would require major earthworks including a borrow pit (location yet to be determined) to provide filling material in the vicinity of the bridge. All other materials including road gravel, sealing and concrete for bridge construction would have to be transported into the area.</p> <p>Once completed travel times would not be changed compared to existing.</p> <p>Estimated cost \$6.0 million.</p> <p>Environmental</p> <p>The construction of a new bridge on a parallel alignment is considered to have the least environmental impact and risk of all options assessed. This is because the new bridge and road alignment primarily occur in previously disturbed land, and existing traffic can be maintained across McCabe's bridge during the construction period removing the requirement for a temporary access across Doon Doon Creek. This is important as flash-flooding often results in temporary access tracks and associated construction materials being washed into waterways resulting in degradation of the waterway and extra costs and delays to maintain access.</p> <p>This preliminary assessment found that there are no mapped endangered ecological communities associated with Option 1a and a low likelihood of encountering threatened plants; although targeted searches would still be required.</p> <p>Demolition of McCabe's Bridge would result in the potential loss of threatened insectivorous bat-roosting habitat from under the bridge. However, impacts to roosting bats could be mitigated through the establishment of artificial roosting habitats into the new bridge design. This has been used on other Council bridges in the shire.</p> <p>The potential for visual impacts from constructing a new bridge is likely for at least one adjacent residence, although this preliminary assessment suggests these impacts will remain low as the new bridge option is approximately 250 metres away from this residence and partially obstructed by vegetation. Additional vegetation screen-planting to obstruct views could be proposed to minimise the nature and magnitude of change of this visual impact.</p> <p>This option is unlikely to impact significantly on heritage, contaminated land, air and noise amenity or other hazards. Standard construction management measures would be required to control offsite impacts. These would be managed through the preparation of construction environmental management plans and sub-plans.</p> <p>Works in the bed and banks of a creek would require approval from NSW Fisheries.</p>
<p>1b. Construct a new bridge on the same alignment as the existing bridge</p>	<p>Engineering</p> <p>The new higher bridge would be reconstructed on a similar alignment to the existing bridge. This would necessitate a temporary side track to maintain access and would include temporary bridge/culverts laid in the base of Doon Doon Creek to provide access during low flows. The temporary access track and waterway crossing would remain in operation for the full construction period (up to nine months).</p> <p>This option would require major earthworks including a borrow pit (location yet to be determined) to provide filling material in the vicinity of the bridge. All other materials</p>

OPTION	ASSESSMENT
	<p>including road gravel, sealing and concrete for bridge construction would have to be transported into the area.</p> <p>Once completed, travel times would not be changed compared to existing.</p> <p>Estimated cost \$6.2 million.</p> <p>Environmental</p> <p>The environmental impacts of Option 1b are similar to Option 1a except for the following:</p> <ul style="list-style-type: none"> • Demolition of the existing McCabe's Bridge would displace any roosting threatened insectivorous bats for an extended period of time while the new bridge is constructed. This could affect roosting and breeding habitat given the new bridge could take approximately nine (9) months to construct. In contrast, Option 1a would maintain bat-roosting habitats throughout the entire construction period. • A temporary access road to maintain public access would be subject to flash-flooding and periodic inundation and subsequent loss of road materials to the waterway. • The construction of a new raised bridge option in the current alignment would result in the new bridge being slightly closer to two adjacent residences.
<p>2a. New link road between Doon Doon Road and Commissioners Creek Road</p>	<p>Engineering</p> <p>This option would consist of a link road off Doon Doon Road approximately 100 metres north of Pine Log Road and connecting to Commissioners Creek Road approximately 400 metres south of the Lone Pine Road intersection. Two new bridges (20-metre span) would be required as well as a number of major culverts to provide for cross-drainage. Survey and associated hydrological assessment for culvert design has not been undertaken and consequently, the sizes of drainage structures are not known.</p> <p>To comply with Tweed Shire Council design road gradients, cut and fill earthworks would be required. In some sections, this is anticipated to be substantial (up to five (5) metre cuts). The new link road, as noted, is 2.4-kilometres long and would result in approximately 60,000 cubic metres of earthworks. Geotechnical testing will be carried out to determine rock levels and strength along the proposed alignment to determine earthworks machinery and methodology. Construction of the link road is anticipated to take approximately nine (9) months to complete.</p> <p>Travel times may be increased up to five (5) minutes compared to existing.</p> <p>Estimated cost \$7.1 million.</p> <p>Environmental assessment</p> <p>This option would result in a greater environmental impact and risk to obtaining planning approval compared to Option 1 due to clearing of highly ecologically sensitive land, impacts to waterways, and potential for harm to Aboriginal objects.</p> <p>As a result, this option would require substantially more environmental assessment given that a new road corridor would require greater levels of earthworks and could result in new fauna movement barriers for those species reluctant to cross roads, road-related fauna mortality, new predator pathways, road-runoff to adjacent aquatic habitats and create or exacerbate biological edge effects, including the spread of weeds into adjacent bushland.</p> <p>Given that the proposed road would travel through 390 metres of native forest, ground surveys would be required to assess occupancy and impact on threatened plant species. Similarly, recent fieldwork in the broader area for the Clarrie Hall Dam raising proposal identified 25 threatened fauna species. Hence, it is probable that threatened species' habitat could be disturbed by the proposed works. As a consequence, fauna surveys (including targeted threatened species surveys) associated with the proposed alignment would be required to assess impacts on</p>

OPTION	ASSESSMENT
	<p>threatened fauna.</p> <p>Additional studies and assessments required for the development of a new road proposal would include:</p> <ul style="list-style-type: none"> • an ecological assessment including threatened flora and fauna surveys, • visual impact assessment to determine existing viewpoints and assessment of the nature and magnitude of change in views as a result of a new road within the landscape • construction and operational noise-modelling associated with new road developments • an Aboriginal cultural heritage assessment in accordance with the Aboriginal cultural heritage consultation requirements for proponents (OEH, 2010), and • construction environmental management plans and sub-plans to manage cut and fill earthworks, air and noise impacts and impacts to waterways. <p>Works in the bed and banks of Doon Doon Creek and Commissioners Creek would require approval from NSW Fisheries.</p>
<p>2b. New link road between Doon Doon Road and Commissioners Creek Road</p>	<p>Engineering</p> <p>This option would consist of a link road off Doon Doon Road approximately 400 metres south of Pine Log Road and connecting to Commissioners Creek Road approximately 400 metres south of the Lone Pine Road intersection. Two new bridges (20-metre span) would be required as well as a number of major culverts to provide for cross-drainage. Survey and associated hydrological assessment for culvert design has not been undertaken and consequently, the sizes of drainage structures are not known.</p> <p>To comply with Tweed Shire Council design road gradients, cut and fill earthworks would be required. In some sections, this is anticipated to be substantial (up to five (5) metre cuts). The new link road, as noted, is 2.2-kilometres long and would result in approximately 60,000 cubic metres of earthworks. Geotechnical testing will be carried out to determine rock levels and strength along the proposed alignment to determine earthworks machinery and methodology. Construction of the link road is anticipated to take approximately nine (9) months to complete.</p> <p>Travel times may be increased up to approximately 5 minutes compared to existing.</p> <p>Estimated cost \$7.0 million.</p> <p>Environmental assessment</p> <p>As for 2a, this option would result in a greater environmental impact and risk to obtaining planning approval compared to Option 1 due to clearing of highly ecologically sensitive land, impacts to waterways and potential for harm to Aboriginal objects.</p> <p>As a result, this option would require substantially more environmental assessment, given that a new road corridor would require greater levels of earthworks and could result in new fauna movement barriers for those species reluctant to cross roads, road-related fauna mortality, new predator pathways, road-runoff to adjacent aquatic habitats and create or exacerbate biological edge effects, including the spread of weeds into adjacent bushland. In addition, Option 2b would impact on potential koala habitat and highly ecologically sensitive riparian vegetation.</p> <p>Given that the proposed road would travel through 390 metres of native forest, ground surveys would be required to assess occupancy and impact on threatened plant species. Similarly, recent fieldwork in the broader area for the Clarrie Hall Dam raising proposal identified 25 threatened fauna species. Hence, it is probable that threatened species' habitat could be disturbed by the proposed works. As a consequence, fauna surveys (including targeted threatened species surveys) associated with the proposed alignment would be required to assess impacts on threatened fauna.</p>

OPTION	ASSESSMENT
	<p data-bbox="416 203 1433 264">Additional studies and assessments required for the development of a new road proposal would include:</p> <ul data-bbox="416 264 1433 577" style="list-style-type: none"><li data-bbox="416 264 1433 297">• an ecological assessment including threatened flora and fauna surveys<li data-bbox="416 297 1433 387">• visual impact assessment to determine existing viewpoints and assessment of the nature and magnitude of change in views as a result of a new road within the landscape<li data-bbox="416 387 1433 454">• construction and operational noise-modelling associated with new road developments<li data-bbox="416 454 1433 521">• an Aboriginal cultural heritage assessment in accordance with the Aboriginal cultural heritage consultation requirements for proponents (OEH, 2010), and<li data-bbox="416 521 1433 577">• construction environmental management plans and sub-plans to manage cut and fill earthworks, air and noise impacts and impacts to waterways. <p data-bbox="416 607 1433 667">Works in the bed and banks of Doon Doon Creek and Commissioners Creek would require approval from NSW Fisheries.</p>

Appendix A: McCabe's Bridge Options Concept Plans

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Appendix B: Preliminary visual impact assessment

Assessment of impacts on visual amenity aim to:

- describe the existing visibility from a range of visual receptors (typically these are residences)
- identify potential impacts and mitigation methods to minimise potential adverse visual effects, and
- evaluate how a proposal is likely to affect the existing visual values of the site by assessing a number of viewpoints that represent the existing visibility of the study area.

These 'representative viewpoints' are then assessed in terms of the nature of change (adverse, neutral or beneficial), magnitude of change (minor, moderate, major) and, then, consideration of whether these effects have a significant impact.

A preliminary assessment of the two nearest properties, VR1 and VR2, is discussed in Table 1 with the aid of an ESRI-based 3D model using 2007 LIDAR data and photo imaging software. Existing views from McCabe's Bridge towards VR1 and VR2 are presented below and a modelled view from VR1 is presented in Appendix B. A visual model was not prepared for VR2 as existing vegetation obstructed line of sight views.



Existing view from McCabe's Bridge to VR1



Existing views from McCabe's Bridge to VR2

Table 1: Preliminary visual impact assessment, McCabe's Bridge parallel alignment option

Impact assessment	Visual Receptor 1 (Lot1//816505)	Visual Receptor 2 (Lot1//877100)
Existing viewpoint (refer Figures for viewpoint location)	Unobstructed to partially obstructed views to McCabe's Bridge. Partial obstruction as a result of existing scattered trees on northern side of residence.	Partial to highly obstructed views to McCabe's bridge from existing vegetation.
Nature of change (e.g. adverse, neutral or beneficial)	<p>The nature of the change in view type from raising the existing bridge is considered to be low given that:</p> <ol style="list-style-type: none"> 1. there is already a bridge associated with the existing view 2. the distance to the new bridge option is largely unchanged albeit slightly further away being located on the downstream (western side) of the existing bridge (approx. 250 metres away) and 3. the existing and new bridge view would remain partially obstructed by vegetation (when viewed from the dwelling). <p>It is important to note that the foreground and distant views would be transformed from an area mostly dominated by grazing land and patches of bushland to a foreground landscape with greater areas of waterway. Standing dead trees from inundation would be present for a period of time after raising the dam.</p>	<p>The nature of the change in view type from raising the existing bridge is predicted to have a low adverse impact given that:</p> <ol style="list-style-type: none"> 1. the view to both the existing and raised bridge option is partially to fully obstructed by existing vegetation depending on viewpoints, (therefore no photomontage has been produced for VR2) and 2. the primary view points from the dwelling are not towards the existing bridge and /or are obstructed by farm infrastructure. <p>It is noted that: The exact locations of trees were not surveyed and consequently, flooded vegetation could 'open up' views depending on viewpoints.</p> <p>The view to the new bridge option is slightly further away from the existing bridge (approx. 170 metres from VR2).</p>
Magnitude of change (e.g. minor, moderate, major)	The magnitude of the change in view is likely to be moderate due to the conversion or cleared grazing land to waterway – rather than the presence of a raised bridge option.	The magnitude of the change in view is likely to be low due primarily to views being obstructed by vegetation, and the main viewpoints from the property may be obstructed by existing sheds. More generally, the magnitude of change in views will be influenced by the conversion of cleared grazing land to waterway.
Impact summary	In regards to impacts on views from constructing a new bridge, this preliminary assessment suggests these impacts will remain low as the new bridge option is approx. 250 metres from VR1 and partially obstructed by vegetation. The view types within the landscape would be modified by the greater presence of waterway although view changes of this nature are unlikely to have a negative impact on visual amenity.	The visual impact of a raised bridge option is considered to have low impact on views from VR2. The distance to the raised bridge is still substantial (approx. 170 metres) and therefore not imposing on views. Vegetation screening (such as riparian bank revegetation) could mitigate visual impacts if flooded vegetation 'opens up' views. As for VR1, the view types within the landscape would be modified by the greater presence of waterway although views changes of this nature are unlikely to have a negative impact on visual amenity.

Photomontage – Visual Receptor 1



Existing view from VR1 to McCabe's Bridge



Modelled view from VR1 to McCabe's Bridge post dam wall raising / new bridge



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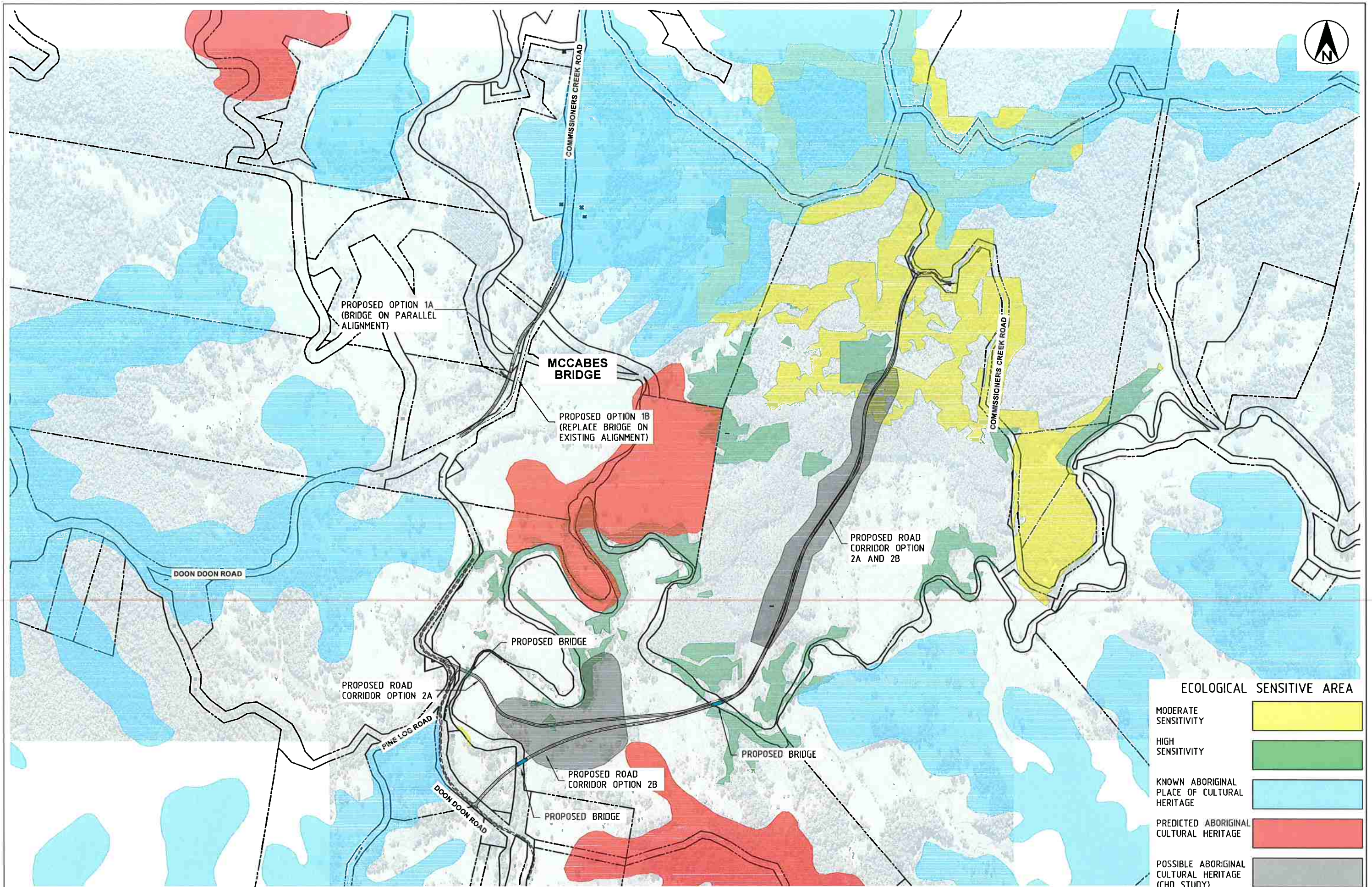
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ECOLOGICAL SENSITIVE AREA

- MODERATE SENSITIVITY
- HIGH SENSITIVITY
- KNOWN ABORIGINAL PLACE OF CULTURAL HERITAGE
- PREDICTED ABORIGINAL CULTURAL HERITAGE
- POSSIBLE ABORIGINAL CULTURAL HERITAGE (CHD STUDY)

PRELIMINARY
NOT FOR CONSTRUCTION

A	ORIGINAL ISSUE	J.M.M.	???	??-??-15
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE

SCALE: A1 SHEET 1:5000, A3 SHEET 1:10,000
0 50 100 200 300 400 500m

USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

DESIGN ENGINEER	DATE	??-??-15
DESIGNED	???	??-??-15
DRAWN	J.M.M.	??-??-15
CHECKED	???	??-??-15
HORIZONTAL DATUM	MGA	NORTHING
VERTICAL DATUM	AHD	R.L.

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
OPTIONS SITE PLAN

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER
WAT70-1-01

ISSUE
A

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



A	ORIGINAL ISSUE	J.M.M.	25.07.17
ISSUE	AMENDMENT DETAILS	DRAWN/CHECK	DATE

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000
 0 10 20 40 60 80 100m
 # USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

DESIGN UNIT
 COUNCIL OFFICES
 TUMBULGUM ROAD,
 MURWILLUMBAH NSW 2484.
 PHONE 02 66702400
 FAX 02 66727613
 WEBSITE www.tweed.nsw.gov.au



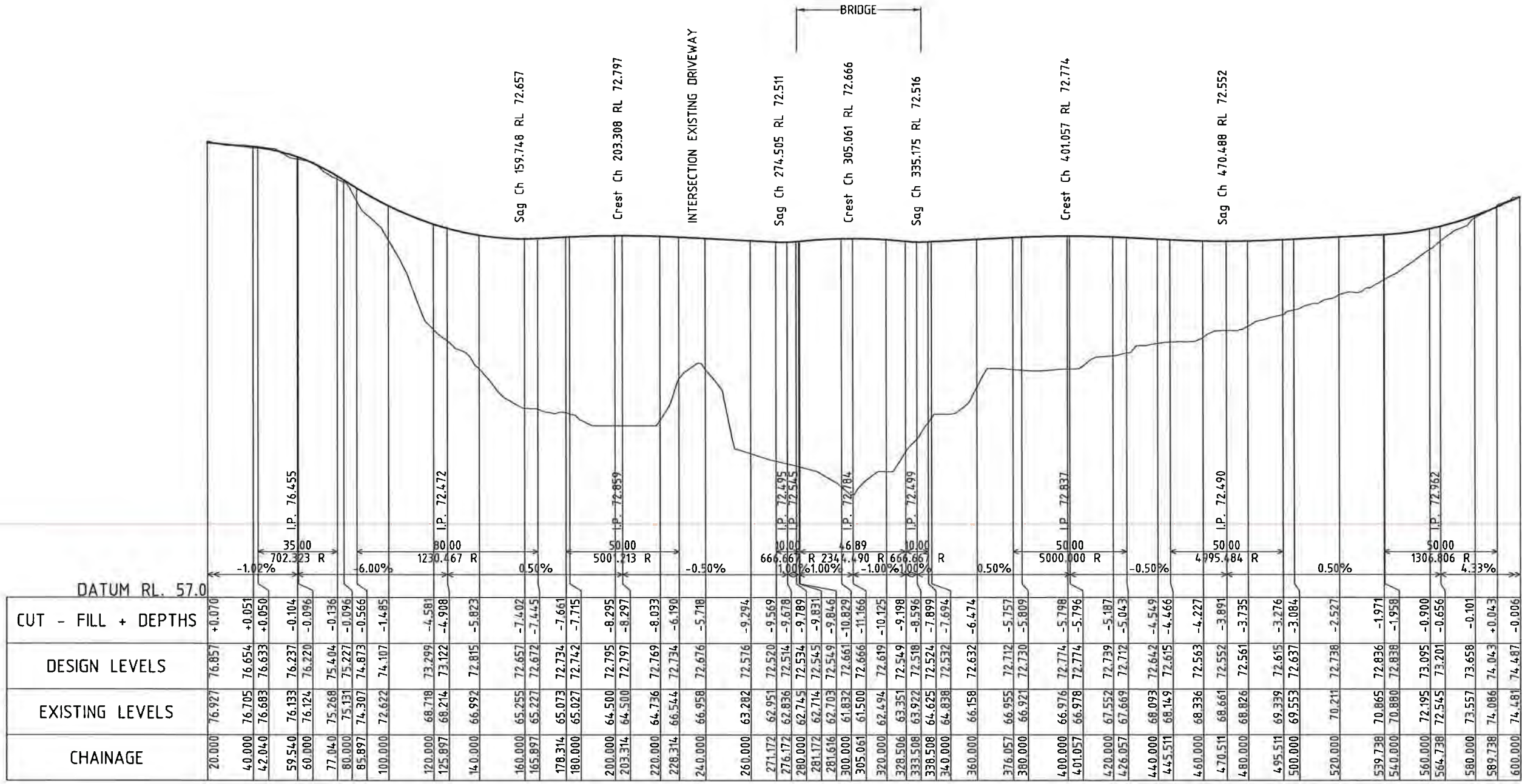
DESIGNED	J.M.M.	25.07.17	DATE
DRAWN	J.M.M.	25.07.17	COORDS ADOPTED	PM ?????
CHECKED	J.M.M.	25.07.17	EASTING	587777.777
HORIZONTAL DATUM	MGA	NORTHING	687777.777	
VERTICAL DATUM	AHD	R.L.	7.777	

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
PROPOSAL TO REPLACE EXISTING BRIDGE ON A PARALLEL ALIGNMENT OPTION 1A

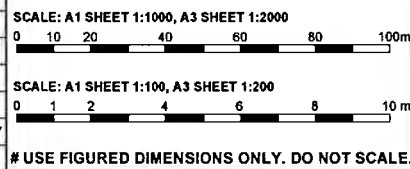
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DRAWING NUMBER	WAT70-1-02
ISSUE	A

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT - FILL + DEPTHS
20.000	76.927	76.857	+0.070
40.000	76.705	76.654	+0.051
42.040	76.683	76.633	+0.050
59.540	76.133	76.237	-0.104
60.000	76.124	76.220	-0.096
77.040	75.268	75.404	-0.136
80.000	75.131	75.221	-0.096
85.897	74.307	74.873	-0.566
100.000	72.622	74.107	-1.485
120.000	68.718	73.299	-4.581
125.897	68.214	73.122	-4.908
140.000	66.992	72.815	-5.823
160.000	65.255	72.657	-7.402
165.897	65.227	72.672	-7.445
178.314	65.073	72.734	-7.661
180.000	65.027	72.742	-7.715
200.000	64.500	72.795	-8.295
203.314	64.500	72.797	-8.297
220.000	64.736	72.769	-8.033
228.314	66.544	72.734	-6.190
240.000	66.958	72.676	-5.718
260.000	63.282	72.576	-9.294
271.172	62.951	72.520	-9.569
276.172	62.836	72.514	-9.678
280.000	62.745	72.534	-9.789
281.172	62.714	72.545	-9.831
281.616	62.703	72.549	-9.846
300.000	61.832	72.661	-10.829
305.061	61.500	72.666	-11.166
320.000	62.494	72.619	-10.125
328.506	63.351	72.549	-9.198
333.508	63.922	72.518	-8.596
338.508	64.625	72.524	-7.899
340.000	64.838	72.532	-7.694
360.000	66.158	72.632	-6.474
376.057	66.955	72.712	-5.757
380.000	66.921	72.730	-5.809
400.000	66.976	72.774	-5.798
401.057	66.978	72.774	-5.796
420.000	67.552	72.739	-5.187
426.057	67.669	72.712	-5.043
440.000	68.093	72.642	-4.549
445.511	68.149	72.615	-4.466
460.000	68.336	72.563	-4.227
470.511	68.661	72.552	-3.891
480.000	68.826	72.561	-3.735
495.511	69.339	72.615	-3.276
500.000	69.553	72.637	-3.084
520.000	70.211	72.738	-2.527
539.738	70.865	72.836	-1.971
540.000	70.880	72.838	-1.958
560.000	72.195	73.095	-0.900
564.738	72.545	73.201	-0.656
580.000	73.557	73.658	-0.101
589.738	74.086	74.043	+0.043
600.000	74.481	74.487	-0.006

PRELIMINARY
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 MURWILLUMBAH NSW 2484.
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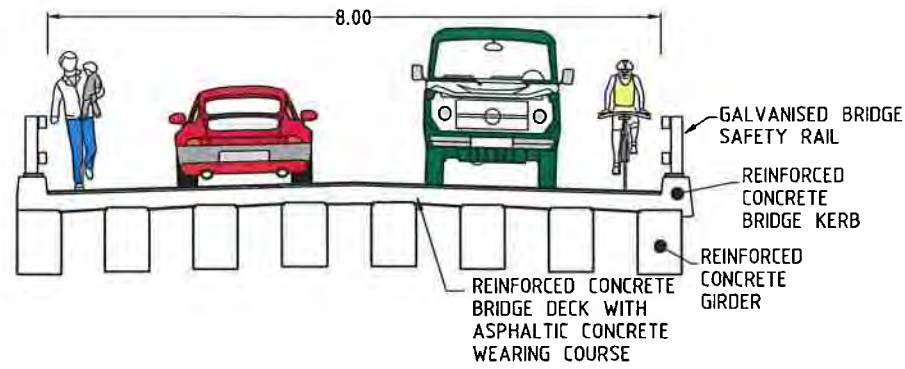
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CHECKED	???	77.77.17	EASTING	557777.???
HORIZONTAL DATUM	MGA	NORTHING	687777.???	
VERTICAL DATUM	AHD	R.L.	7.???	

PROJECT:
**WATER SUPPLY - RAISING OF CLARRIE
 HALL DAM - MCCABES BRIDGE
 REPLACEMENT**

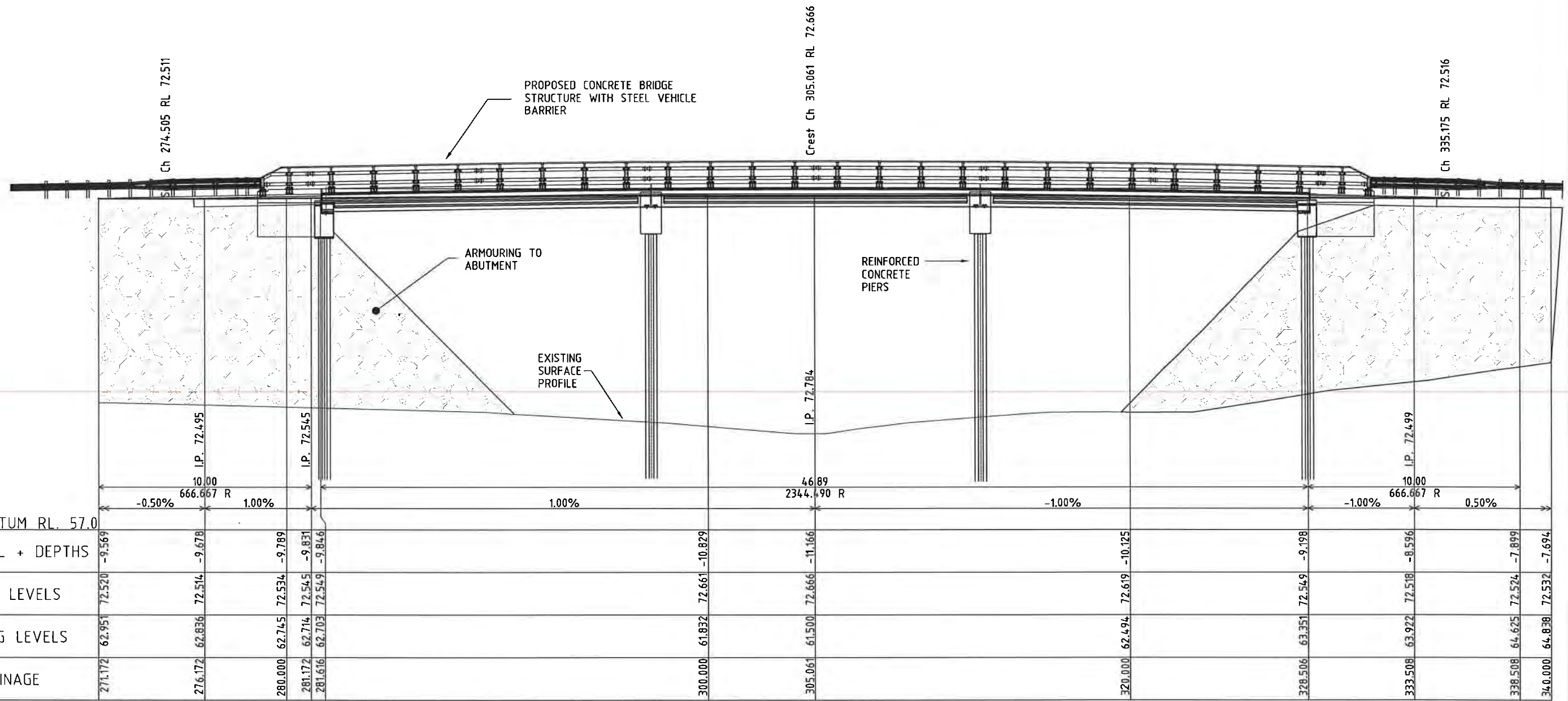
PLAN TITLE:
**PARALLEL BRIDGE ALIGNMENT
 ROAD LONGITUDINAL SECTION
 OPTION 1A**

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER	ISSUE
WAT70-1-03	A



BRIDGE CROSS SECTION



BRIDGE LONGITUDINAL SECTION

	271.172	276.172	280.000	281.172	281.616	300.000	305.061	320.000	328.506	333.508	338.508	340.000
CUT - FILL + DEPTHS	-9.569	-9.678	-9.789	-9.831	-9.846	-10.829	-11.166	-10.125	-9.198	-8.596	-7.899	-7.694
DESIGN LEVELS	72.520	72.514	72.534	72.545	72.549	72.661	72.666	72.619	72.549	72.518	72.524	72.532
EXISTING LEVELS	62.951	62.836	62.745	62.714	62.703	61.832	61.500	62.494	63.351	63.922	64.625	64.838
CHAINAGE	271.172	276.172	280.000	281.172	281.616	300.000	305.061	320.000	328.506	333.508	338.508	340.000

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SCALE: A1 SHEET 1:100, A3 SHEET 1:200
0 1 2 4 6 8 10 m

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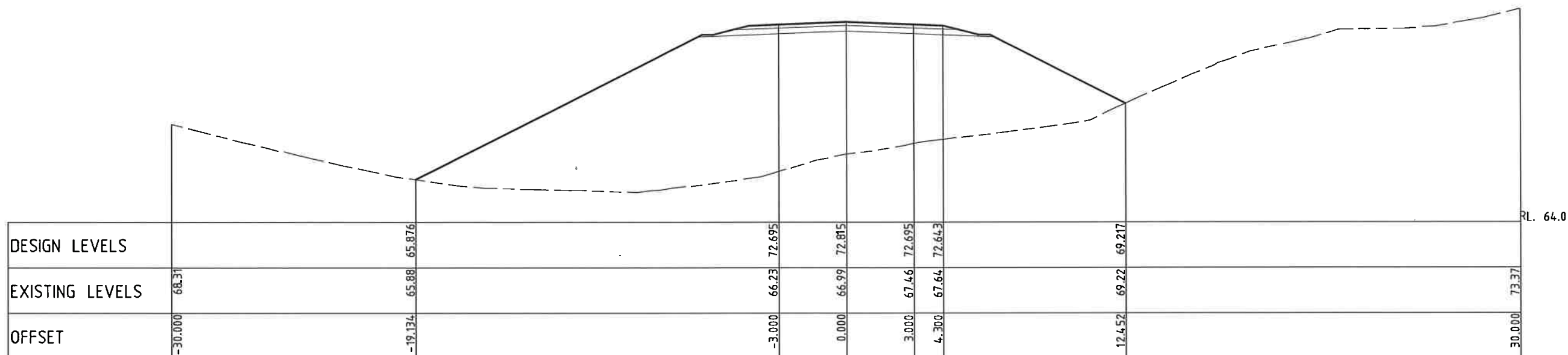
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CHECKED	???	???.???.17	NORTHING	687777.???
HORIZONTAL DATUM	MGA			???
VERTICAL DATUM	AHD			???

PROJECT:
**WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT**

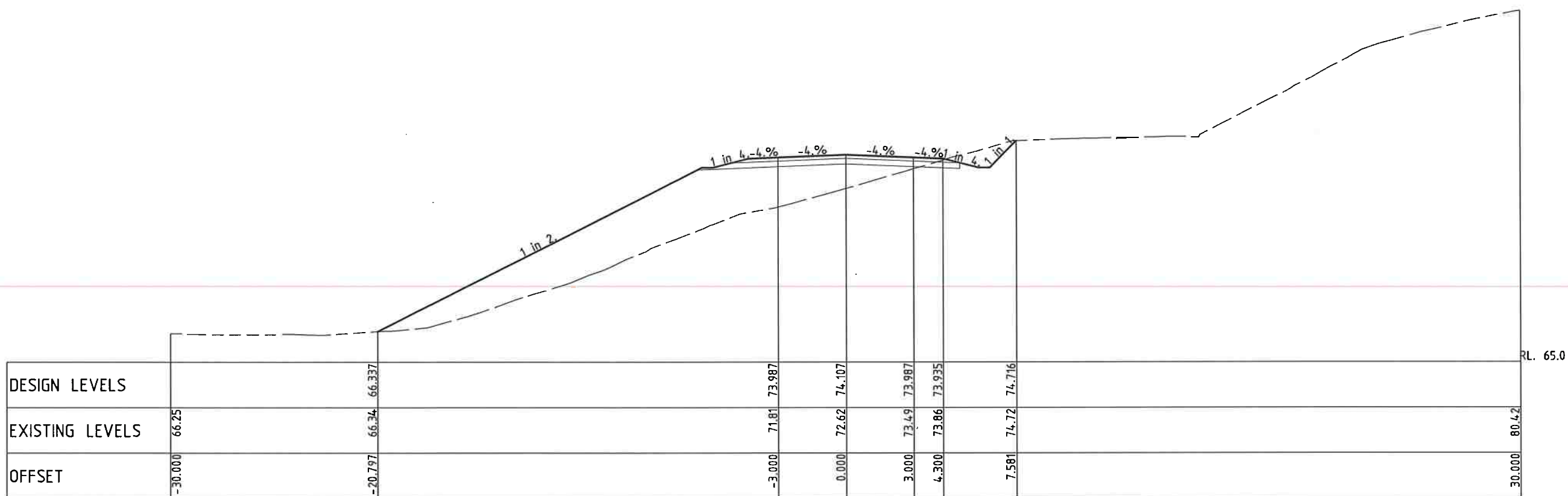
PLAN TITLE:
**PARALLEL BRIDGE ALIGNMENT
BRIDGE SECTIONS SECTION
OPTION 1A AND 1B**

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER
WAT70-1-04
ISSUE
A



Ch. 140.0



Ch. 100.0

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DESIGNED	J.M.M.	18.10.17	DATE	
DRAWN	J.M.M.	18.10.17	COORDS ADOPTED	PM ?????
CHECKED			EASTING	557777.777
HORIZONTAL DATUM	MGA		NORTHING	687777.777
VERTICAL DATUM	AHD		R.L.	7.777

PROJECT:
**WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT**

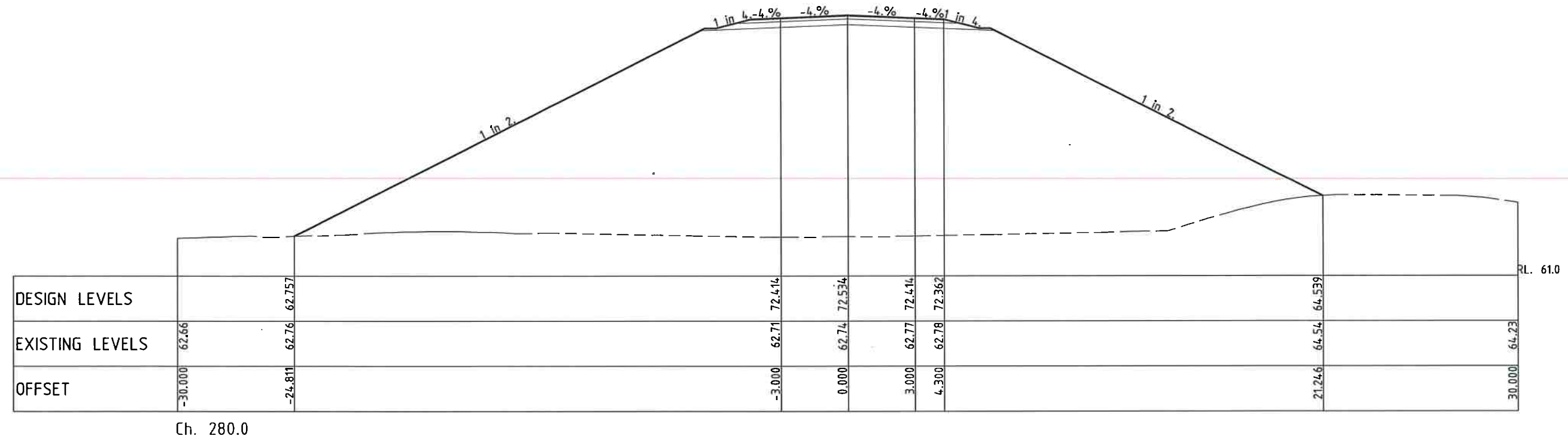
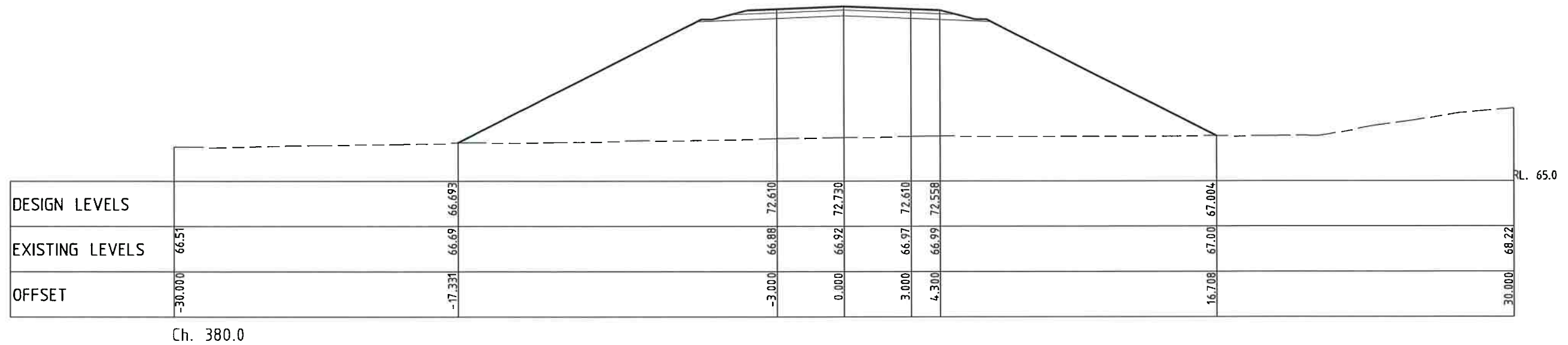
PLAN TITLE:
**PROPOSAL TO REPLACE EXISTING
BRIDGE ON A PARALLEL ALIGNMENT
OPTION 1A - ROAD CROSS SECTIONS**

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER	ISSUE
WAT70-1-05	A

A	ORIGINAL ISSUE	J.M.M.	W.A.B.	18.10.17
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE

ACAD FILE No: G:\AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_05-A_08-A_07-A.dwg



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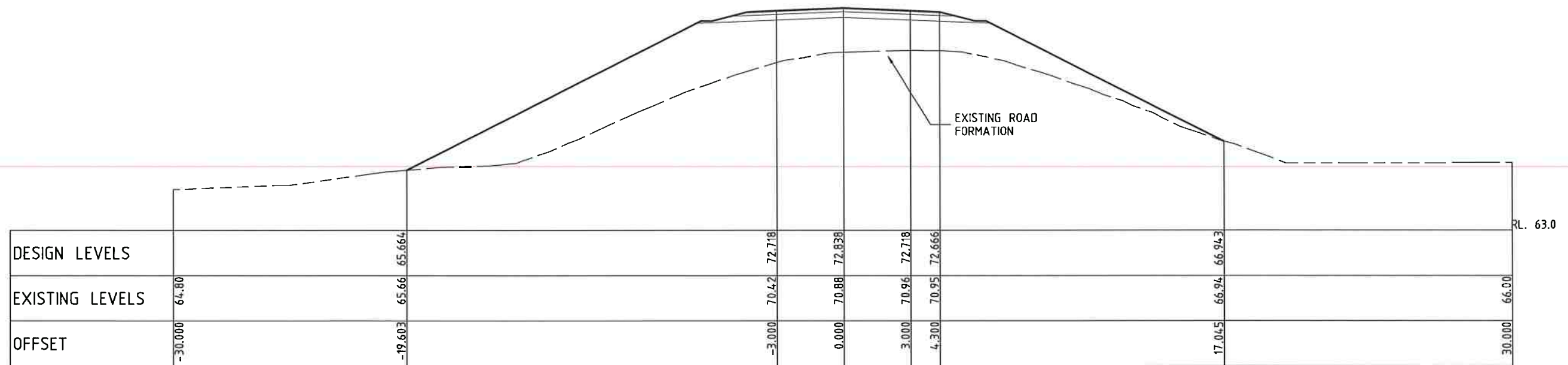


DESIGNED	J.M.M.	18.10.17	DATE
DRAWN	J.M.M.	18.10.17	COORDS ADOPTED	PM ?????
CHECKED			EASTING	557777.777
HORIZONTAL DATUM	MGA		NORTHING	687777.777
VERTICAL DATUM	AHD		R.L.	7.777

PROJECT:
**WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT**

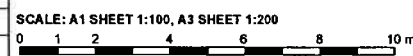
PLAN TITLE:
**PROPOSAL TO REPLACE EXISTING
BRIDGE ON A PARALLEL ALIGNMENT
OPTION 1A - ROAD CROSS SECTIONS**

PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-06
ISSUE	A



Ch. 540.0

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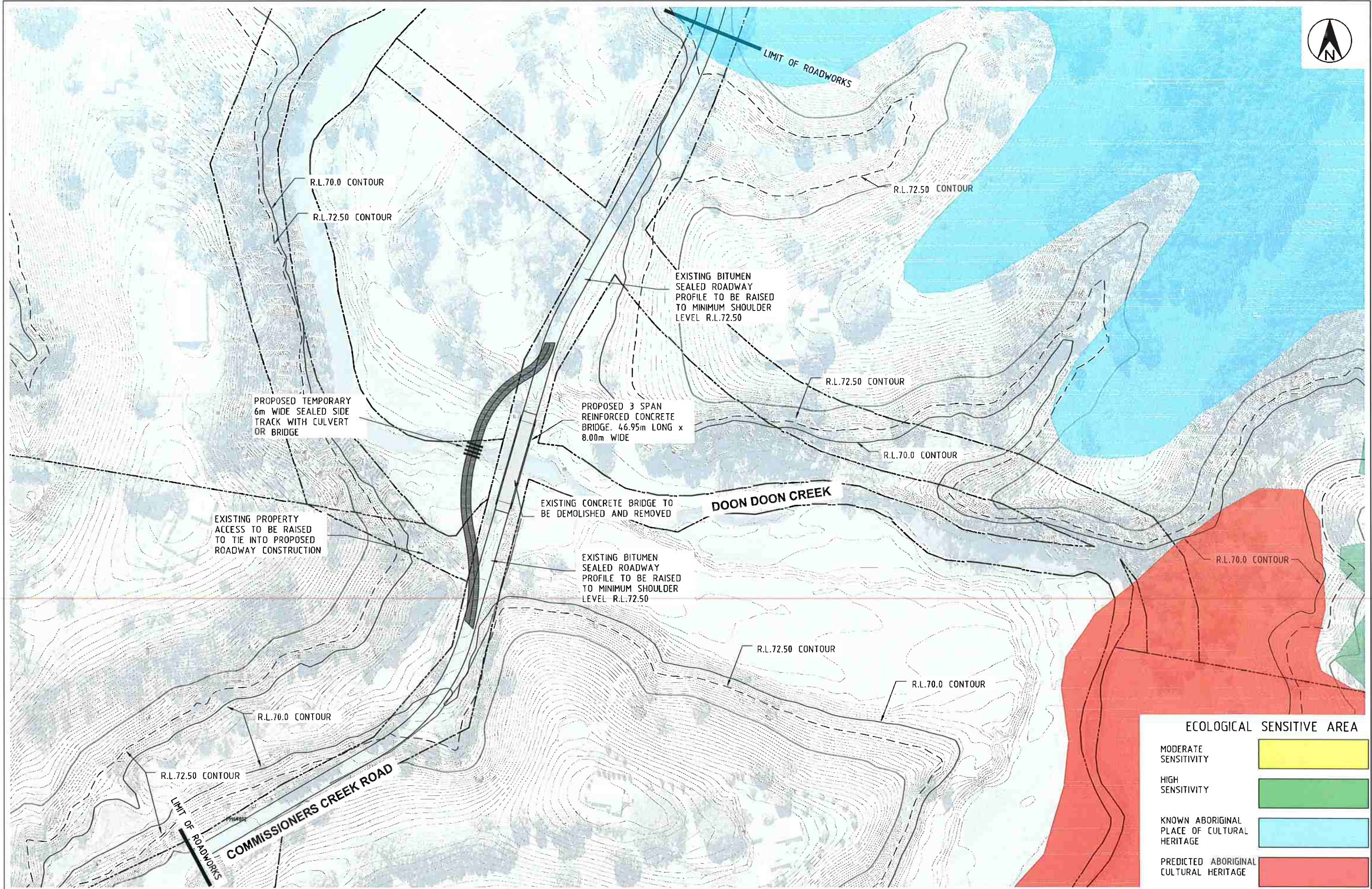
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CHECKED			NORTHING	687777.777
HORIZONTAL DATUM	MGA		R.L.	?.???
VERTICAL DATUM	AHD			

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT
PLAN TITLE:
PROPOSAL TO REPLACE EXISTING
BRIDGE ON A PARALLEL ALIGNMENT
OPTION 1A - ROAD CROSS SECTIONS

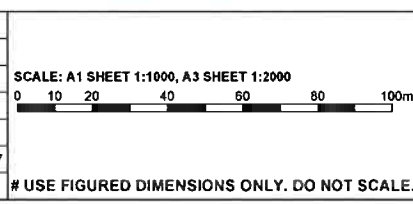
PROJECT NUMBER:
WAT70-1
DRAWING NUMBER
WAT70-1-07
ISSUE
A

A	ORIGINAL ISSUE	J.M.M.	W.A.B.	18.10.17
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE

ACAD FILE No: G:\AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_05-A_06-A_07-A.dwg



A	ORIGINAL ISSUE	J.M.M.	25.07.17
ISSUE	AMENDMENT DETAILS	DRAWN/CHECK	DATE



DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

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FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

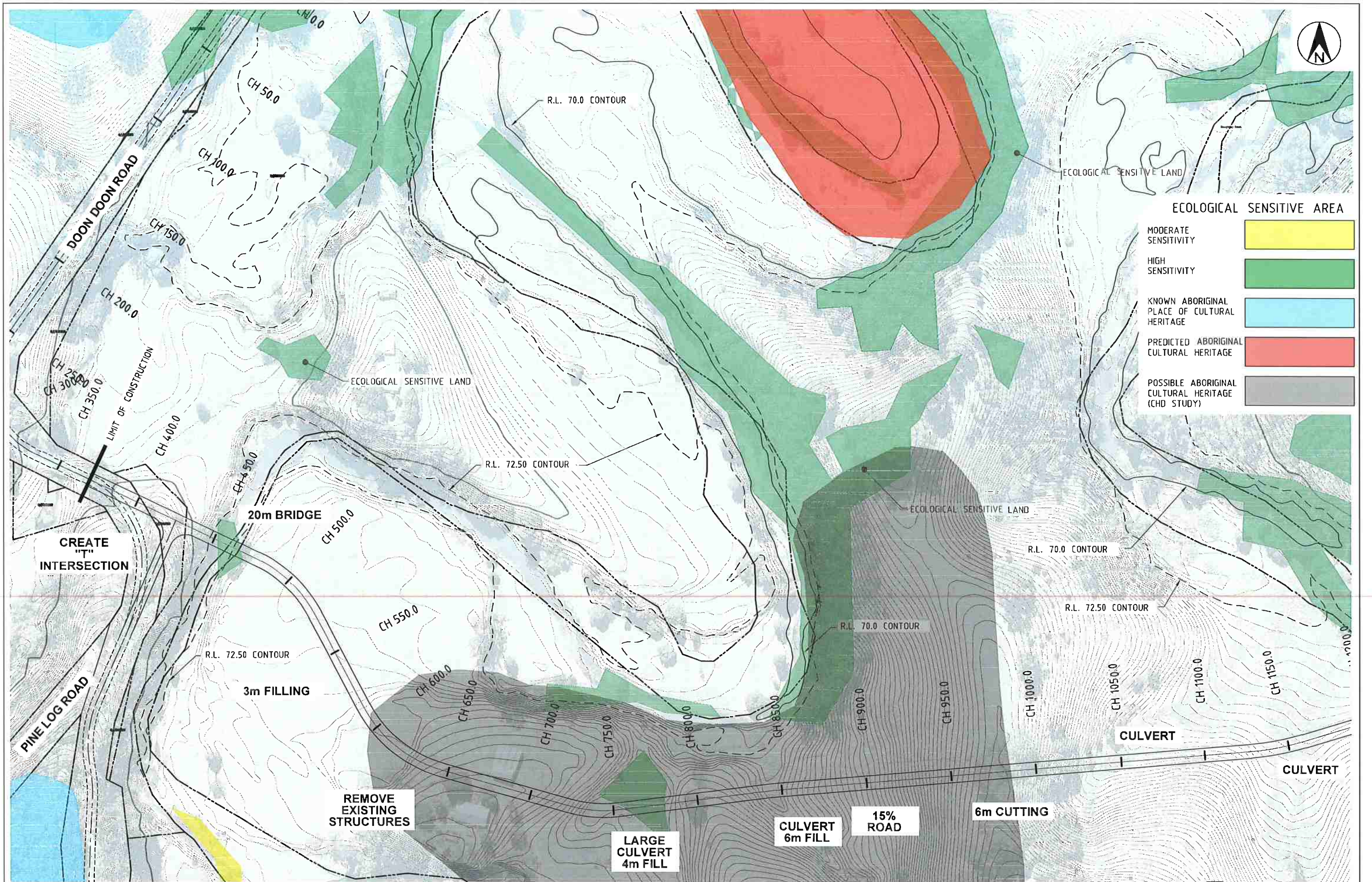
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DESIGNED	J.M.M. 25.07.17	COORDS ADOPTED	PM ?????
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CHECKED		NORTHING	687777.777
HORIZONTAL DATUM	MGA	R.L.	7.???
VERTICAL DATUM	AHD		

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
PROPOSAL TO REPLACE EXISTING BRIDGE ON EXISTING ALIGNMENT OPTION 1B

PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-08
ISSUE	A

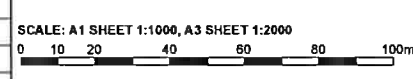
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ECOLOGICAL SENSITIVE AREA

- MODERATE SENSITIVITY
- HIGH SENSITIVITY
- KNOWN ABORIGINAL PLACE OF CULTURAL HERITAGE
- PREDICTED ABORIGINAL CULTURAL HERITAGE
- POSSIBLE ABORIGINAL CULTURAL HERITAGE (CHD STUDY)

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DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGN ENGINEER	DATE 27.07.15
DESIGNED ??? 77.77.15	COORDS ADOPTED PM 77777
DRAWN ??? 77.77.15	EASTING 557777.777
CHECKED ??? 77.77.15	NORTHING 687777.777
HORIZONTAL DATUM MGA	R.L. 7.777
VERTICAL DATUM AHD	

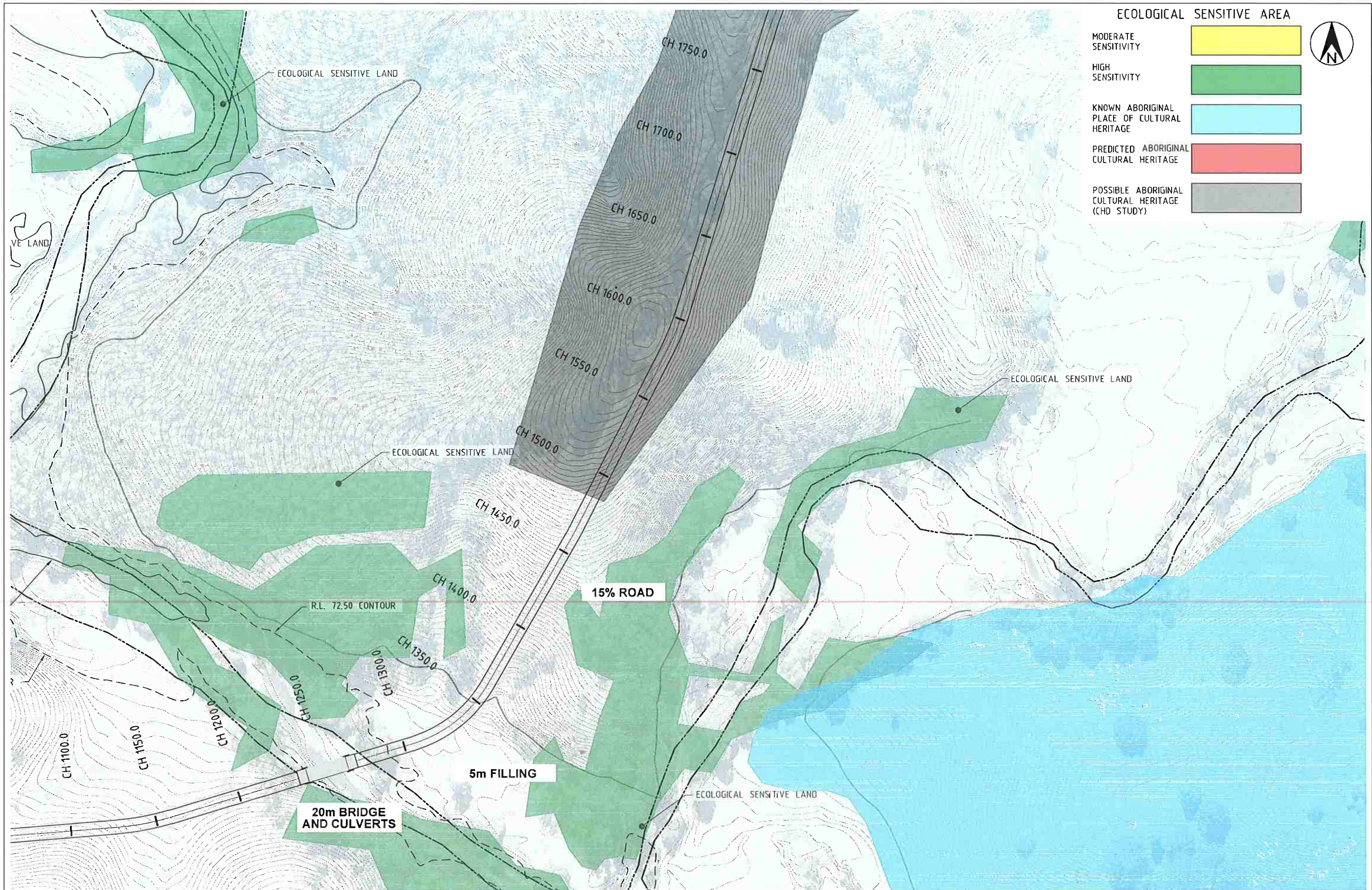
PROJECT: WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE: DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - OPTION 2A

PROJECT NUMBER: **WAT70-1**

DRAWING NUMBER: **WAT70-1-09**
ISSUE: **A**

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



PRELIMINARY
NOT FOR CONSTRUCTION

ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE
A	ORIGINAL ISSUE	J.M.M.	???	??.??.15

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000
0 10 20 40 60 80 100m

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGNED	???	??.??.15	COORDS ADOPTED	PM 77777
DRAWN	J.M.M.	??.??.15	EASTING	557777.???
CHECKED	???	??.??.15	NORTHING	687777.???
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VERTICAL DATUM	AHD			

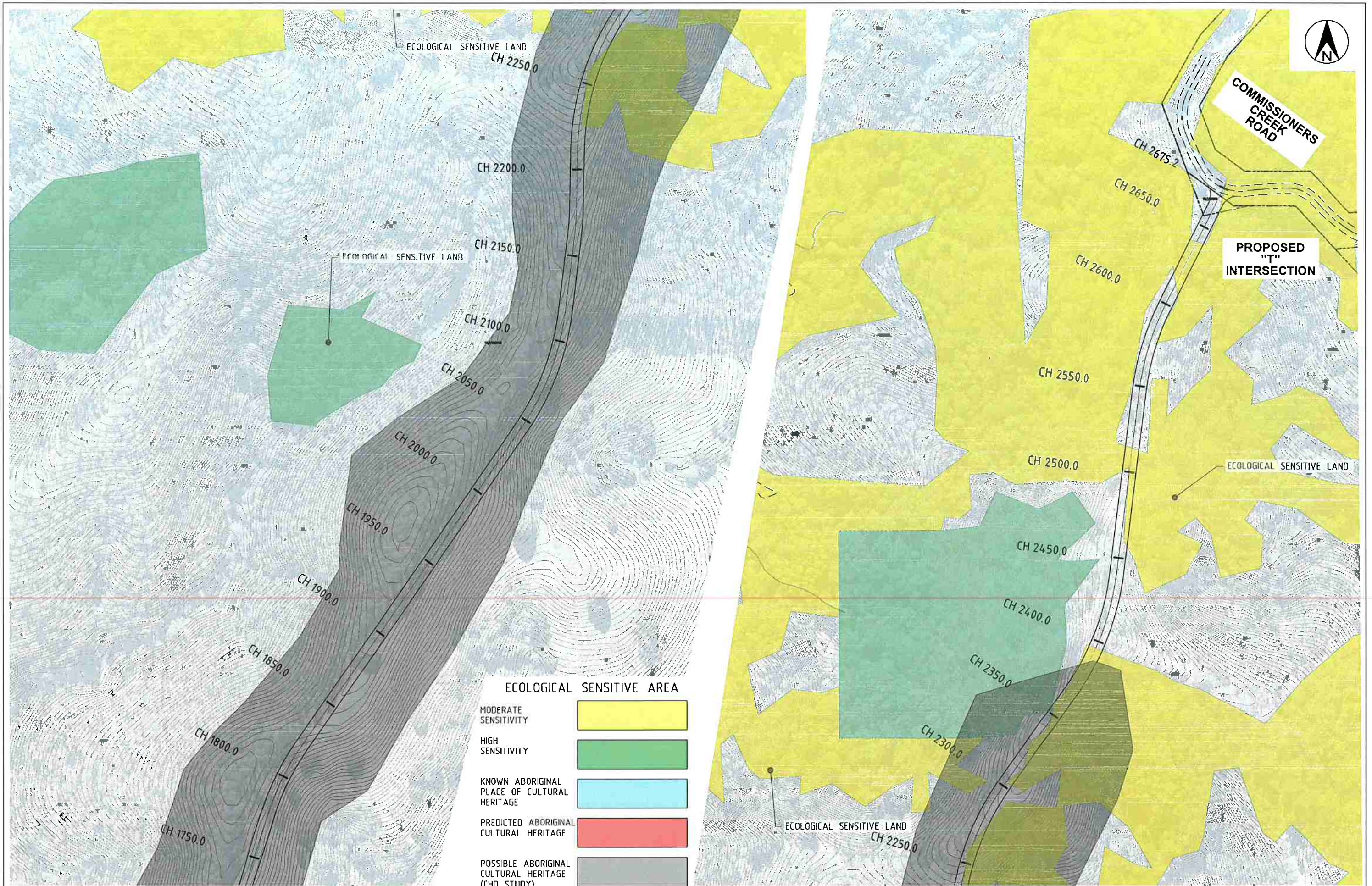
PROJECT: WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE: DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - OPTION 2A

PROJECT NUMBER: **WAT70-1**

DRAWING NUMBER: **WAT70-1-10**
ISSUE: **A**

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



ECOLOGICAL SENSITIVE AREA

- MODERATE SENSITIVITY
- HIGH SENSITIVITY
- KNOWN ABORIGINAL PLACE OF CULTURAL HERITAGE
- PREDICTED ABORIGINAL CULTURAL HERITAGE
- POSSIBLE ABORIGINAL CULTURAL HERITAGE (CHD STUDY)

PRELIMINARY	
NOT FOR CONSTRUCTION	
A	ORIGINAL ISSUE
ISSUE	AMENDMENT DETAILS

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000	0 10 20 40 60 80 100m	
J.M.M.	7.7.7	77.77.15
DRAWN	CHECK	DATE
# USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.		

DESIGN UNIT

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TUMBULGUM ROAD,
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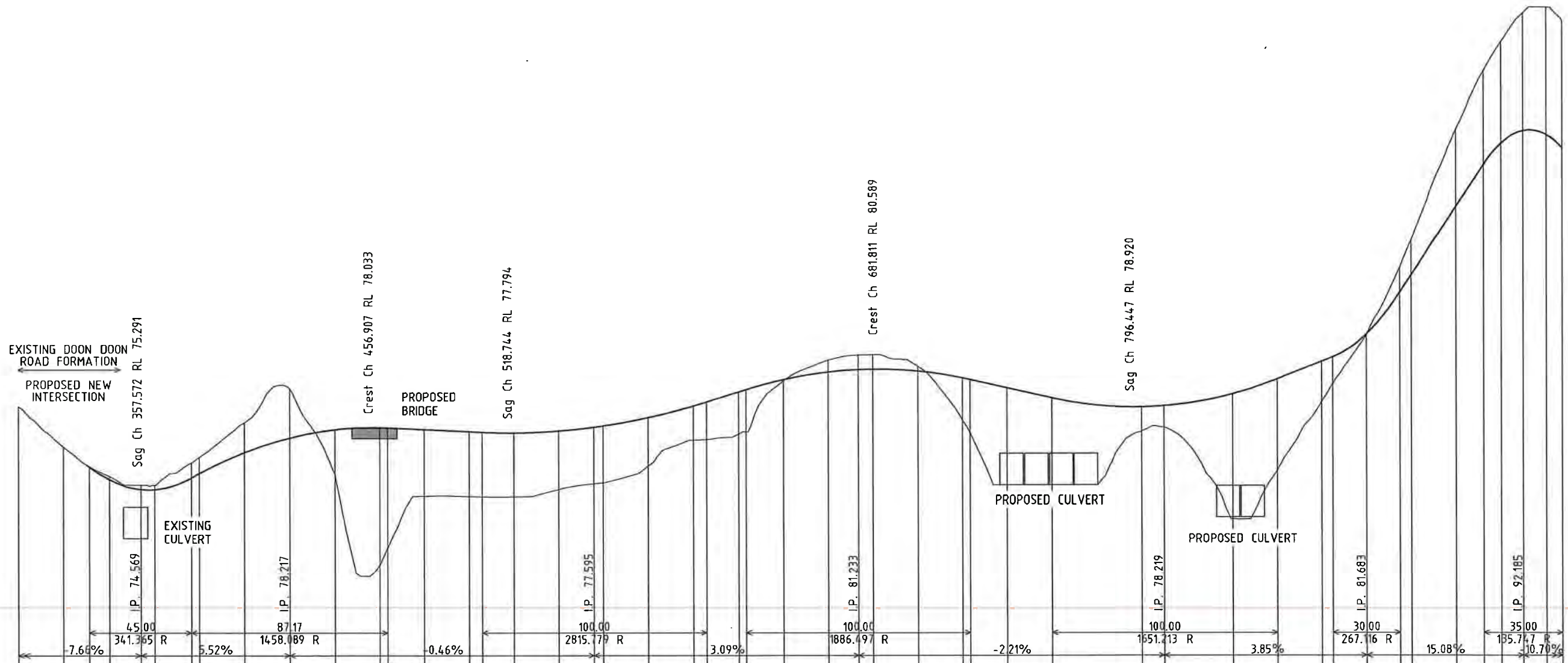
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CHECKED ??? 77.77.15	NORTHING 687777.777
VERTICAL DATUM	AHD R.L. 7.777

PROJECT: WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE: DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - OPTION 2A

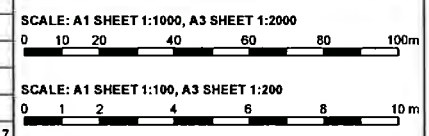
PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-11
ISSUE	A

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT - FILL + DEPTHS
300.000	78.968	78.700	+0.268
320.000	77.179	77.168	+0.011
331.416	76.317	76.293	+0.024
340.000	75.888	75.743	+0.145
353.916	75.507	75.311	+0.196
360.000	75.500	75.300	+0.200
376.416	76.475	75.811	+0.664
380.000	76.715	76.004	+0.711
400.000	78.232	76.922	+1.310
420.000	79.743	77.566	+2.177
440.000	75.988	77.935	-1.947
460.000	71.970	78.029	-6.059
463.583	72.717	78.017	-5.300
480.000	75.013	77.942	-2.929
500.000	74.998	77.851	-2.853
505.852	74.986	77.824	-2.838
520.000	74.987	77.795	-2.808
540.000	75.304	77.875	-2.571
555.852	75.554	78.039	-2.485
560.000	75.596	78.097	-2.501
580.000	76.323	78.461	-2.138
600.000	77.472	78.967	-1.495
605.852	77.495	79.142	-1.647
620.000	77.729	79.579	-1.850
623.451	77.837	79.686	-1.849
640.000	80.065	80.126	-0.061
660.000	80.981	80.463	+0.518
673.451	81.205	80.570	+0.635
680.000	81.216	80.588	+0.628
700.000	80.713	80.501	+0.212
720.000	78.343	80.202	-1.859
723.451	77.791	80.129	-2.338
740.000	75.500	79.764	-4.264
760.000	75.500	79.323	-3.823
800.000	77.850	78.924	-1.074
810.000	78.018	78.976	-0.958
840.000	73.996	79.495	-5.499
860.000	76.132	80.142	-4.011
880.000	79.136	80.913	-1.777
885.000	79.932	81.106	-1.174
900.000	82.068	82.104	-0.036
915.000	85.029	83.945	+1.084
920.000	86.250	84.699	+1.551
940.000	91.110	87.715	+3.395
952.142	93.679	89.546	+4.133
960.000	94.973	90.504	+4.469
969.642	96.237	91.057	+5.180
980.000	96.504	90.888	+5.616
987.142	95.890	90.312	+5.578

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MURWILLUMBAH NSW 2484.
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGN ENGINEER	???	DATE	??,??,17.
DESIGNED	???	COORDS ADOPTED	PM ?????
DRAWN	J.M.M.	EASTING	557777.777
CHECKED	???	NORTHING	687777.777
HORIZONTAL DATUM	MGA	VERTICAL DATUM	AHD
			RL.

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD - ROAD LONGITUDINAL SECTION - OPTION 2A

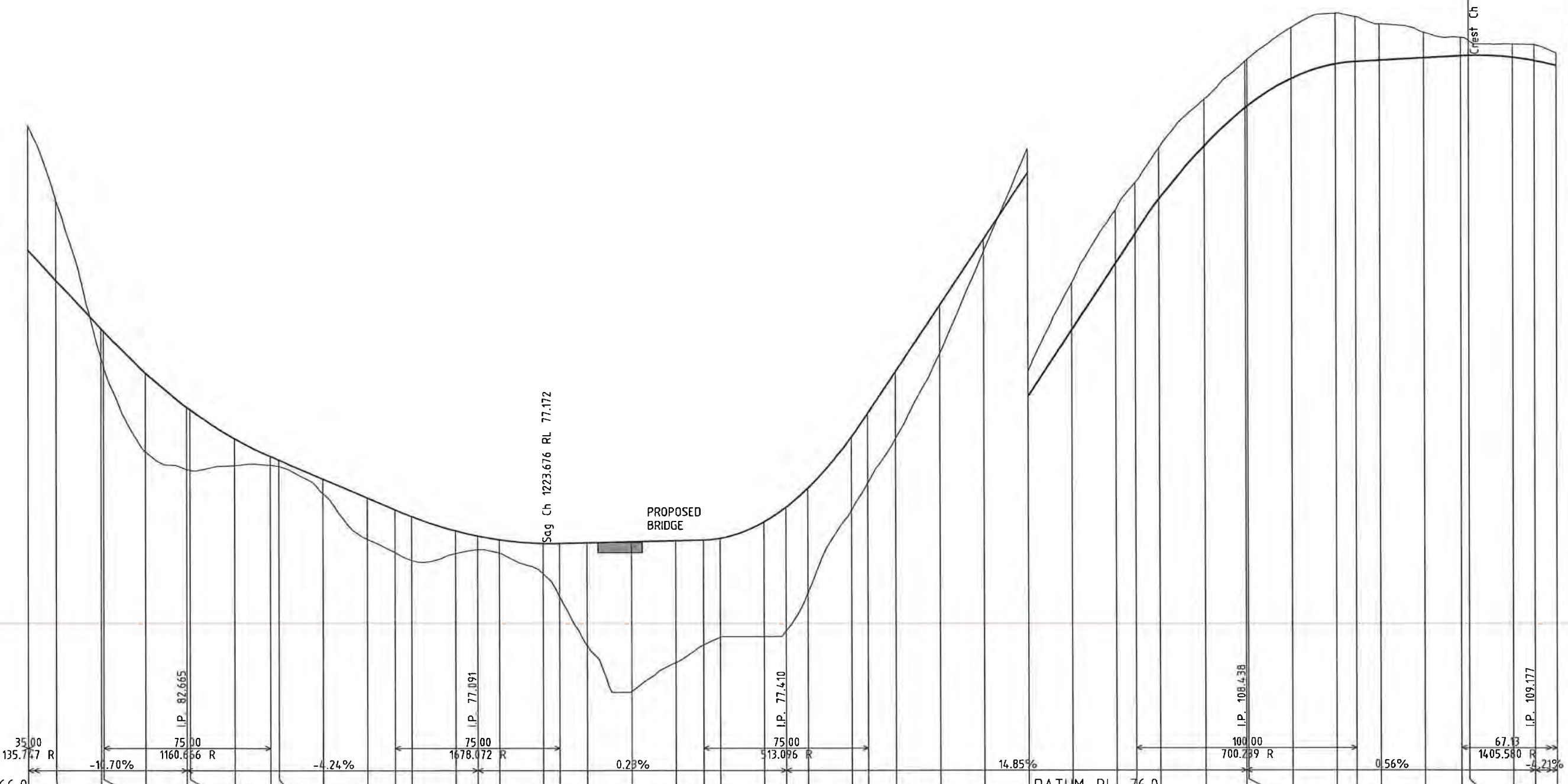
PROJECT NUMBER:
WAT70-1

DRAWING NUMBER
WAT70-1-12

ISSUE
A

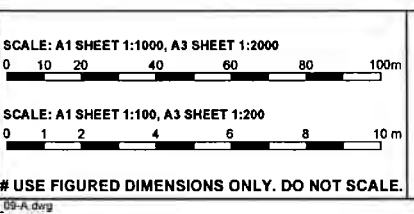


Crest Ch 1644.363 RL 109.010



CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT - FILL + DEPTHS
987.142	95.890	90.312	+5.578
1000.000	92.548	88.936	+3.612
1020.000	85.482	86.795	-1.313
1021.086	85.146	86.679	-1.533
1040.000	81.281	84.808	-3.527
1058.586	80.492	83.271	-2.779
1060.000	80.455	83.166	-2.711
1080.000	80.664	81.868	-1.204
1096.086	80.677	81.074	-0.397
1100.000	80.623	80.908	-0.285
1120.000	79.422	80.060	-0.638
1140.000	77.367	79.212	-1.845
1152.500	76.771	78.682	-1.911
1160.000	76.418	78.380	-1.962
1180.000	76.721	77.740	-1.019
1190.000	76.897	77.510	-0.613
1200.000	76.750	77.339	-0.589
1220.000	75.815	77.176	-1.361
1227.500	74.803	77.176	-2.373
1240.000	72.604	77.205	-4.601
1260.000	70.528	77.251	-6.722
1280.000	71.830	77.296	-5.466
1292.500	72.618	77.325	-4.707
1300.000	72.970	77.396	-4.426
1320.000	72.999	78.124	-5.125
1330.000	73.244	78.780	-5.536
1340.000	74.939	79.631	-4.692
1360.000	78.635	81.918	-3.283
1367.500	79.854	82.977	-3.123
1380.000	81.845	84.833	-2.988
1400.000	85.646	87.802	-2.156
1420.000	90.229	90.771	-0.542
1440.000	94.842	93.740	+1.102
1460.000	98.811	96.709	+2.102
1480.000	102.075	99.678	+2.397
1489.013	103.292	101.015	+2.277
1500.000	104.846	102.560	+2.286
1520.000	107.033	104.930	+2.103
1539.013	108.736	106.653	+2.083
1540.000	108.820	106.728	+2.092
1560.000	110.244	107.955	+2.289
1580.000	110.888	108.611	+2.277
1589.013	110.739	108.720	+2.019
1600.000	110.410	108.782	+1.628
1620.000	110.040	108.895	+1.145
1636.434	109.808	108.988	+0.820
1640.000	109.677	109.003	+0.674
1660.000	109.516	108.923	+0.593
1670.000	109.498	108.776	+0.722
1680.000	109.117	108.558	+0.559

PRELIMINARY			
NOT FOR CONSTRUCTION			
A	ORIGINAL ISSUE	J.M.M.	???.??
ISSUE	AMENDMENT DETAILS	DRAWN/CHECK	DATE



DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

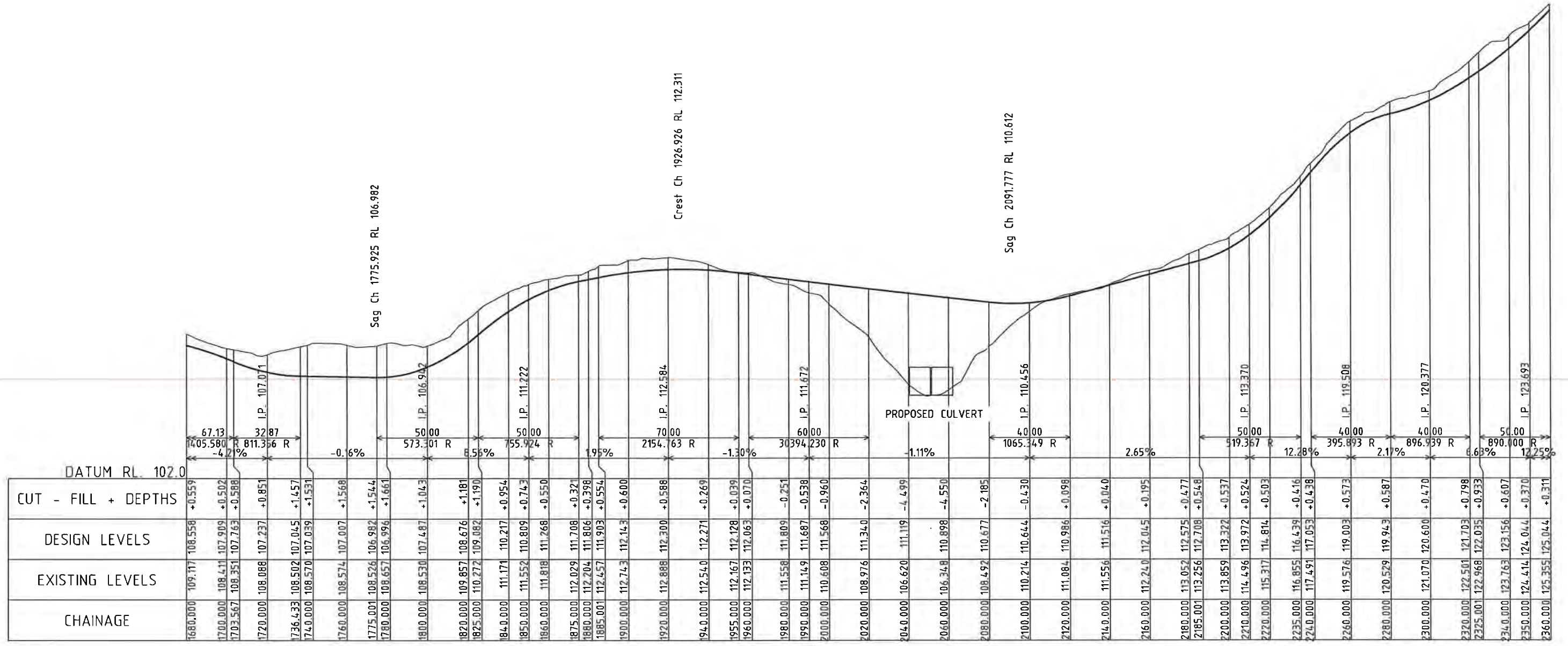
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DRAWN	J.M.M.	???.???.17	COORDS ADOPTED	PM ??????
CHECKED	???	???.???.17	EASTING	557777.???
HORIZONTAL DATUM	MGA		NORTHING	687777.???
VERTICAL DATUM	AHD		R.L.	???

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD - ROAD LONGITUDINAL SECTION - OPTION 2A

PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-13
ISSUE	A

ACAD FILE No: G:_AAA DESIGN PROJECTS\WAT170-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT170-1_06_A_07-A_08-A_09-A.dwg



CHAINAGE	EXISTING LEVELS	DESIGN LEVELS	CUT - FILL + DEPTHS
1680.000	109.117	108.558	+0.559
1700.000	108.411	107.909	+0.502
1703.567	108.351	107.763	+0.588
1720.000	108.088	107.237	+0.851
1736.433	108.502	107.045	+1.457
1740.000	108.570	107.039	+1.531
1760.000	108.574	107.007	+1.568
1775.001	108.526	106.982	+1.544
1780.000	108.657	106.996	+1.661
1800.000	108.530	107.487	+1.043
1820.000	109.857	108.676	+1.181
1825.000	110.272	109.082	+1.190
1840.000	111.171	110.217	+0.954
1850.000	111.552	110.809	+0.743
1860.000	111.818	111.268	+0.550
1875.000	112.029	111.708	+0.321
1880.000	112.204	111.806	+0.398
1885.001	112.457	111.903	+0.554
1900.000	112.743	112.143	+0.600
1920.000	112.888	112.300	+0.588
1940.000	112.540	112.271	+0.269
1955.000	112.167	112.128	+0.039
1960.000	112.133	112.063	+0.070
1980.000	111.558	111.809	-0.251
1990.000	111.149	111.687	-0.538
2000.000	110.608	111.568	-0.960
2020.000	108.976	111.340	-2.364
2040.000	106.620	111.119	-4.499
2060.000	106.348	110.898	-4.550
2080.000	108.492	110.677	-2.185
2100.000	110.214	110.644	-0.430
2120.000	111.084	110.986	+0.098
2140.000	111.556	111.516	+0.040
2160.000	112.240	112.045	+0.195
2180.000	113.052	112.575	+0.477
2185.001	113.256	112.708	+0.548
2200.000	113.859	113.322	+0.537
2210.000	114.496	113.972	+0.524
2220.000	115.317	114.814	+0.503
2235.000	116.855	116.439	+0.416
2240.000	117.491	117.053	+0.438
2260.000	119.576	119.003	+0.573
2280.000	120.529	119.943	+0.587
2300.000	121.070	120.600	+0.470
2320.000	122.501	121.703	+0.798
2325.001	122.968	122.035	+0.933
2340.000	123.763	123.156	+0.607
2350.000	124.414	124.044	+0.370
2360.000	125.355	125.044	+0.311

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000	0 10 20 40 60 80 100m
SCALE: A1 SHEET 1:100, A3 SHEET 1:200	0 1 2 4 6 8 10m
# USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.	

DESIGN UNIT
COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

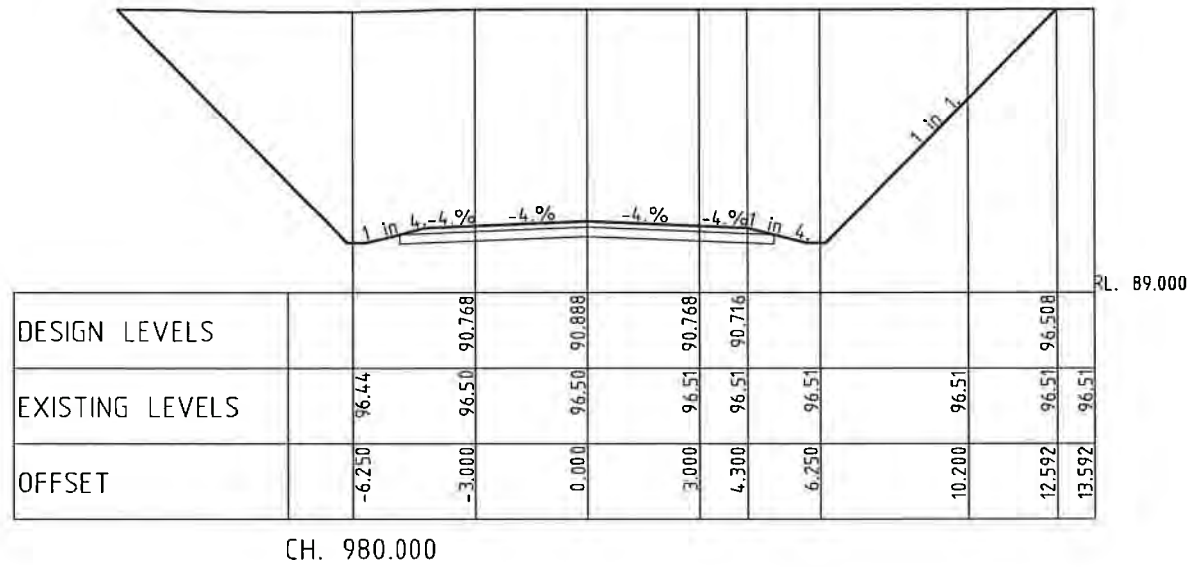
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

DESIGNED	???	??.	??.	??.	??.
DRAWN	J.M.M.	??.	??.	??.	??.
CHECKED	???	??.	??.	??.	??.
HORIZONTAL DATUM	MGA	NORTHING	6877777.???	EASTING	557777.???
VERTICAL DATUM	AHD	R.L.	???	COORDS ADOPTED	PM ??????

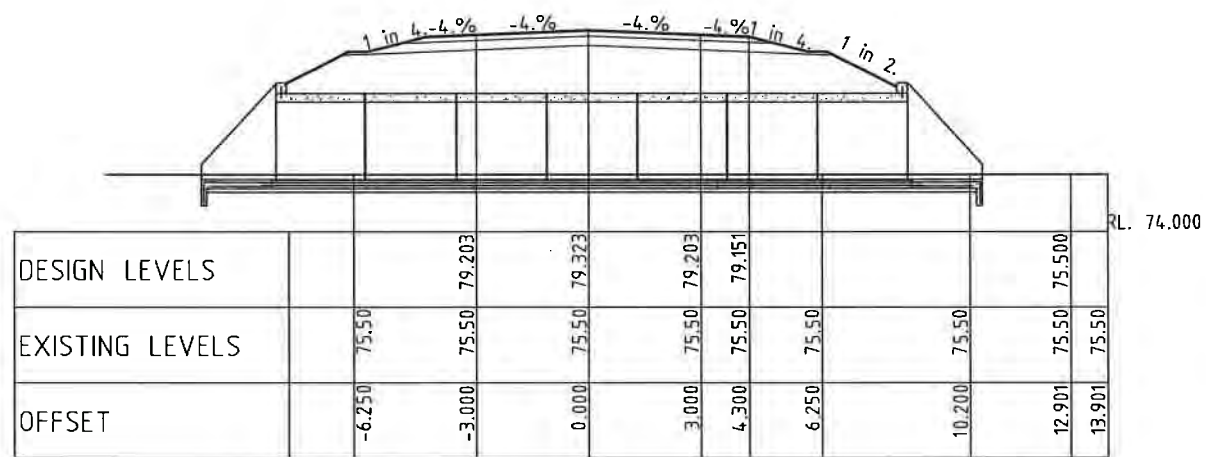
PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD - ROAD LONGITUDINAL SECTION - OPTION 2A

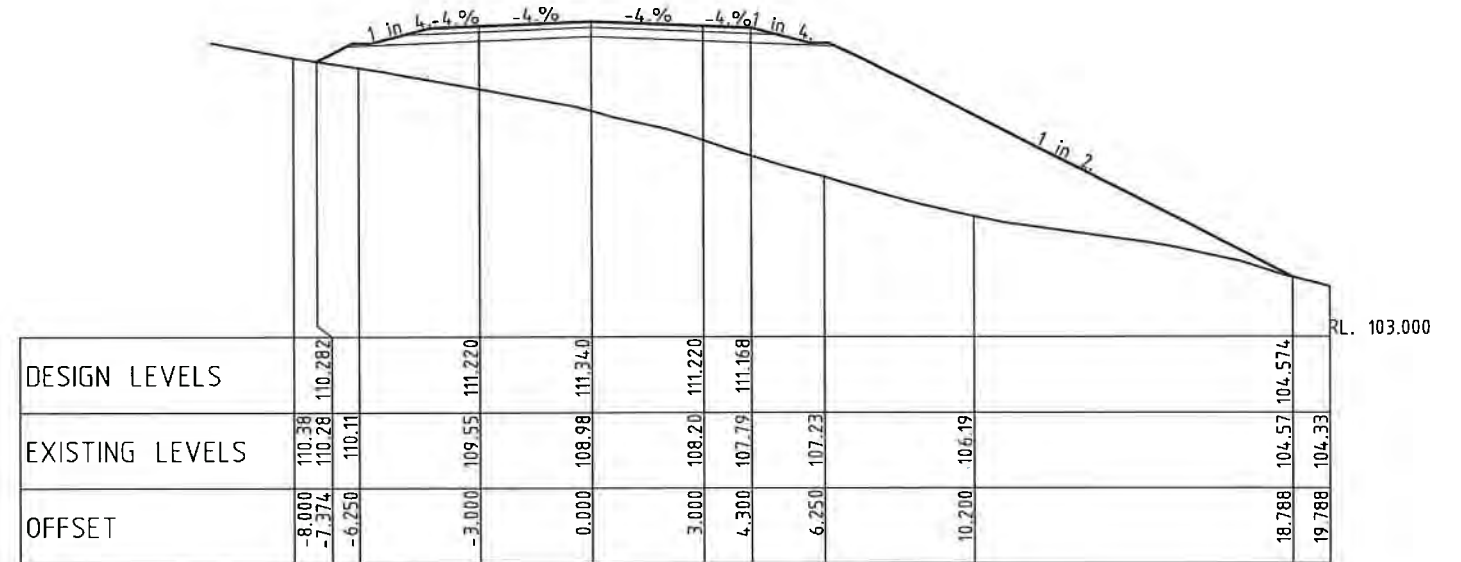
PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-14
ISSUE	A



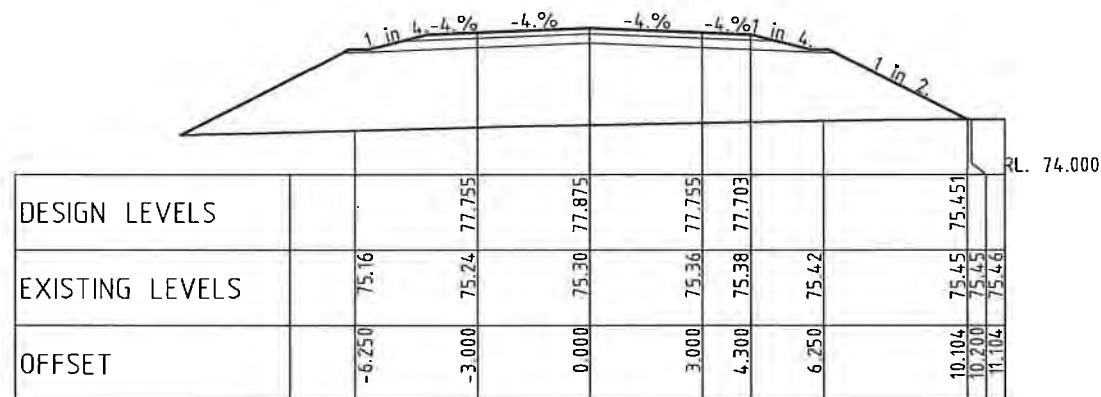
CH. 980.000



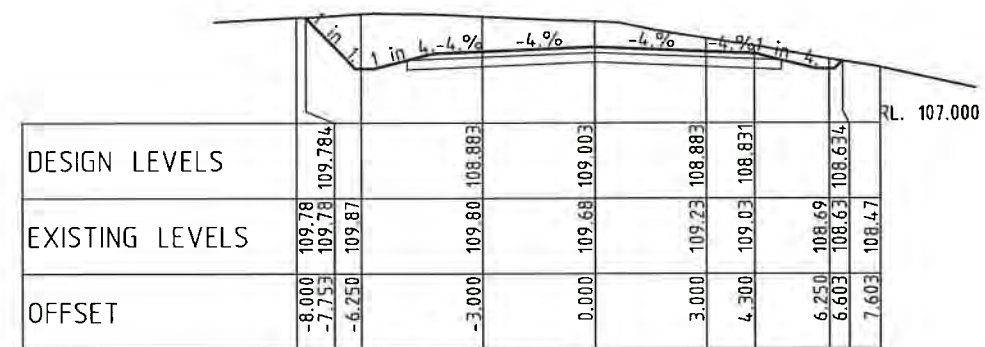
CH. 760.000



CH. 2020.000



CH. 540.000



CH. 1640.000

PRELIMINARY
NOT FOR CONSTRUCTION



DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

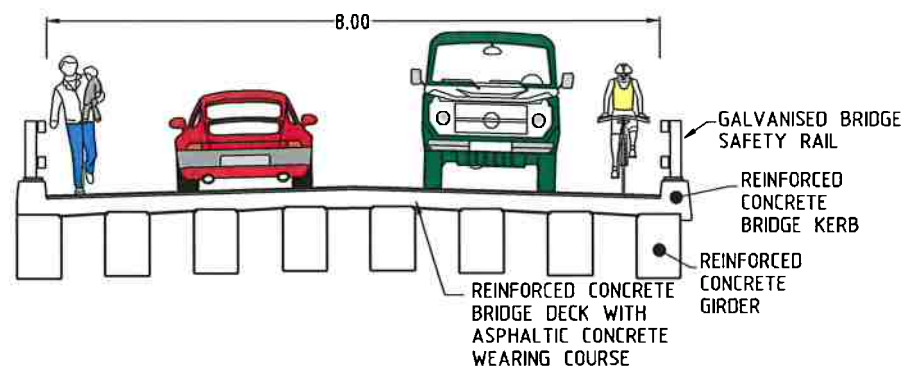


DESIGNED	???	???.???.17	DATE	???.???.17.
DRAWN	J.M.M.	???.???.17	COORDS ADOPTED	PM ?????
CHECKED	???	???.???.17	EASTING	55?????.???
HORIZONTAL DATUM	MGA		NORTHING	687?????.???
VERTICAL DATUM	AHD		R.L.	????

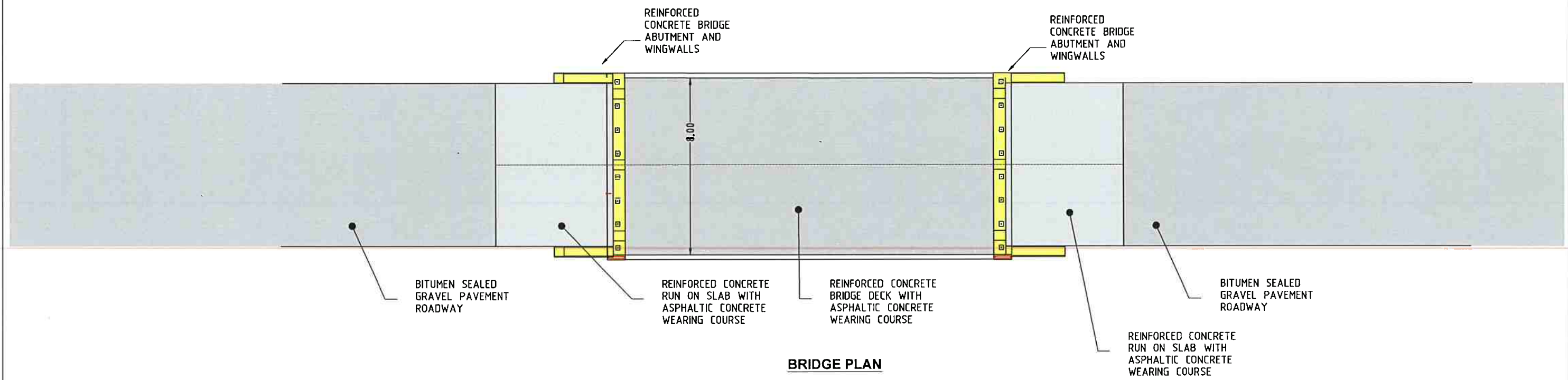
PROJECT:
**WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT**

PLAN TITLE:
**DIVERSION OF COMMISSIONERS
CREEK ROAD
ROAD CROSS SECTIONS - OPTION 2A**

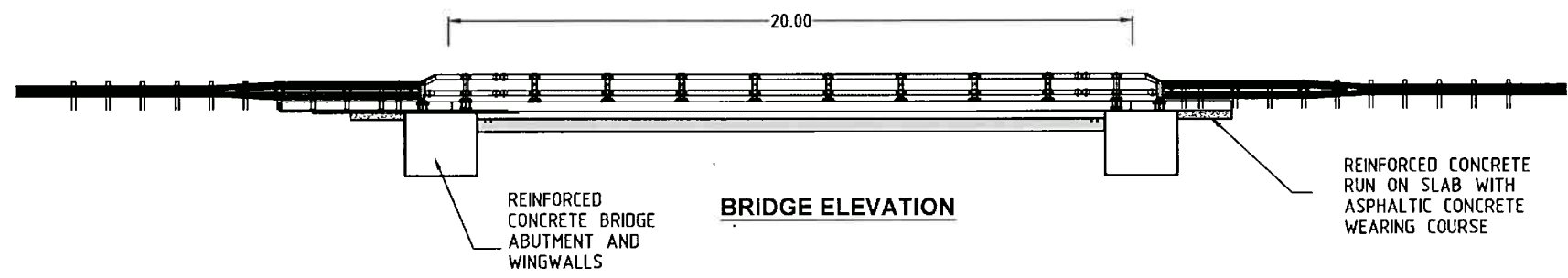
PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-16
ISSUE	A



BRIDGE CROSS SECTION



BRIDGE PLAN



BRIDGE ELEVATION

A	ORIGINAL ISSUE	J.M.M.	27.07.17
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK

SCALE: A1 SHEET 1:100, A3 SHEET 1:200

USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

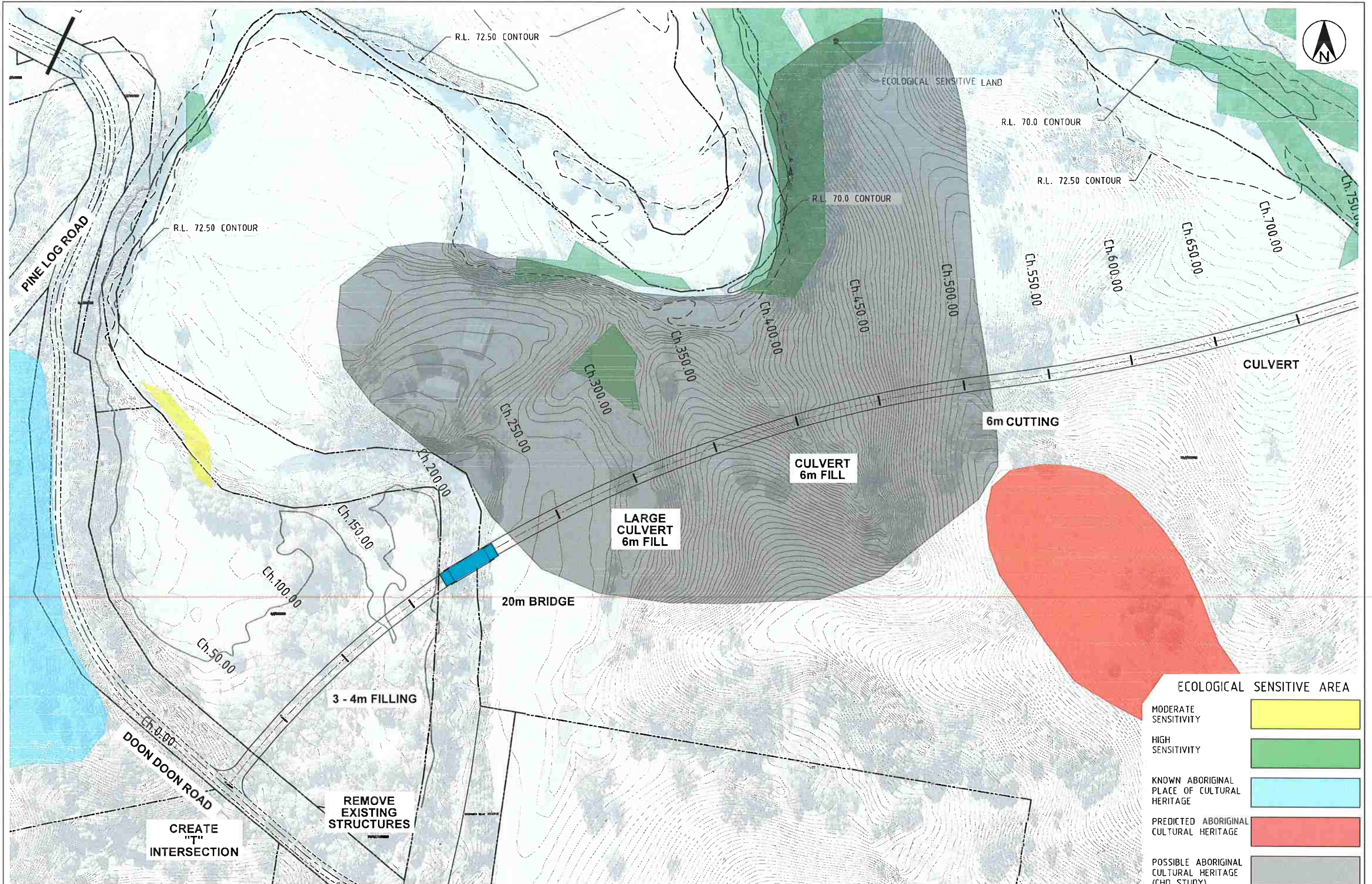
DESIGN ENGINEER	DATE
DESIGNED J.M.M. 25.07.17	COORDS ADOPTED PM 7777?
DRAWN J.M.M. 25.07.17	EASTING 557777.777
CHECKED	NORTHING 6877777.777
HORIZONTAL DATUM MGA	R.L. 7.777
VERTICAL DATUM AHD	

PROJECT: WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE: DIVERSION OF COMMISSIONERS CREEK ROAD - OPTION 2A AND 2B 20m SINGLE SPAN BRIDGE SECTIONS

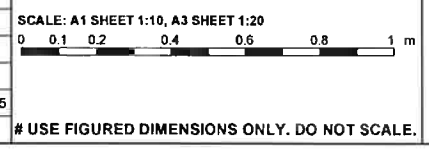
PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-17
ISSUE	A

ACAD FILE No: G:\AAA DESIGN PROJECTS\WATWAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_04-A_17-A.dwg



PRELIMINARY
NOT FOR CONSTRUCTION

ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE
A	ORIGINAL ISSUE	???	???	??/??/15



DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

DESIGN ENGINEER	DATE	??/??/15.
DESIGNED	???	??/??/15
DRAWN	???	??/??/15
CHECKED	???	??/??/15
HORIZONTAL DATUM	MGA	EASTING 557777.???
VERTICAL DATUM	AHD	NORTHING 687777.???
		R.L. 7.???

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - OPTION 2B

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER	ISSUE
WAT70-1-18	A

ACAD FILE No: G:\AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



ECOLOGICAL SENSITIVE AREA

- MODERATE SENSITIVITY
- HIGH SENSITIVITY
- KNOWN ABORIGINAL PLACE OF CULTURAL HERITAGE
- PREDICTED ABORIGINAL CULTURAL HERITAGE
- POSSIBLE ABORIGINAL CULTURAL HERITAGE (CHD STUDY)

PRELIMINARY
NOT FOR CONSTRUCTION

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000
0 10 20 40 60 80 100m

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGN ENGINEER		DATE 22.12.15	
DESIGNED	???	??.	??.
DRAWN	J.M.M.	??.	??.
CHECKED	???	??.	??.
HORIZONTAL DATUM	MGA	EASTING	557777.???
VERTICAL DATUM	AHD	NORTHING	687777.???
		R.L.	?.???

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

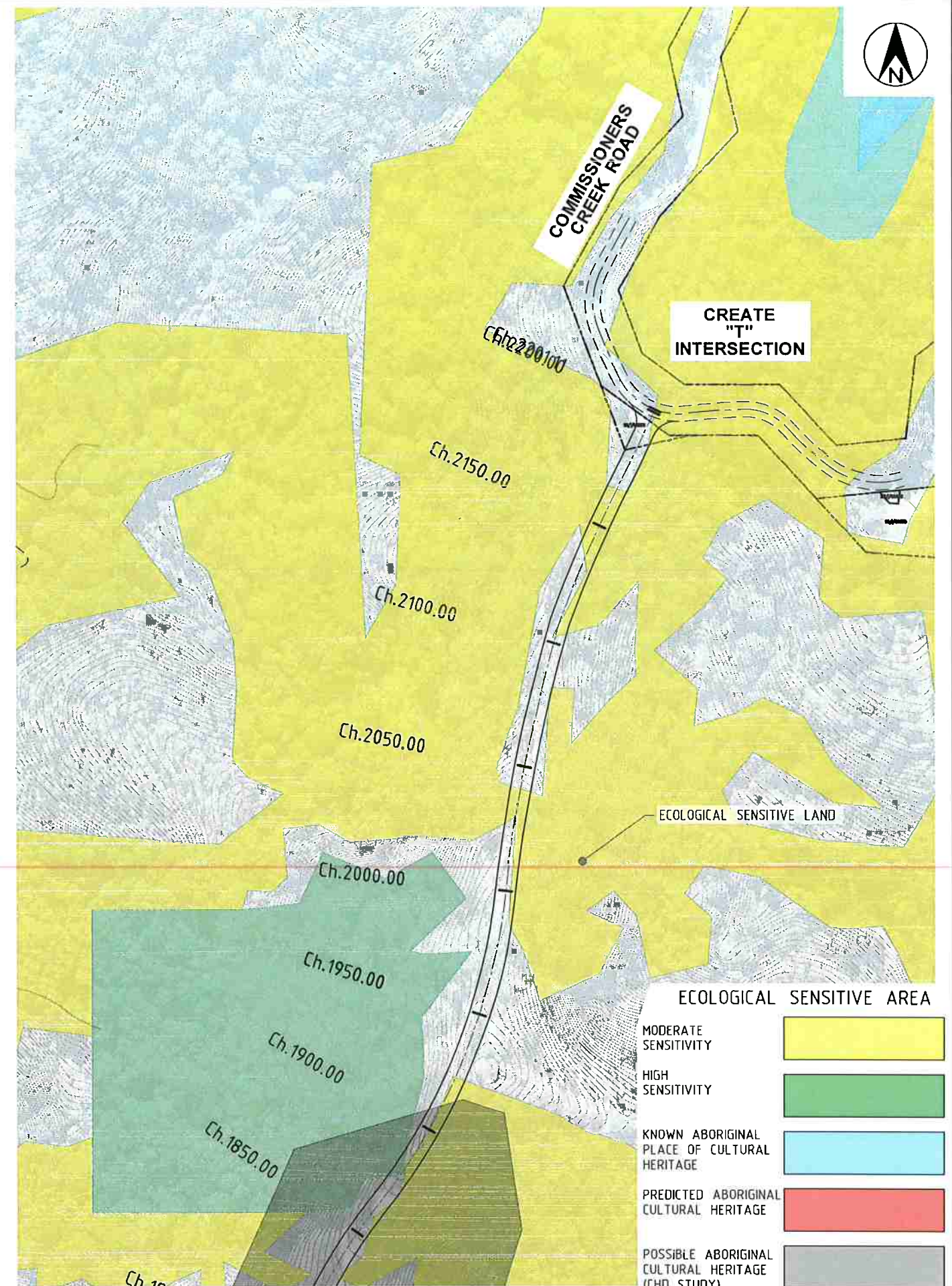
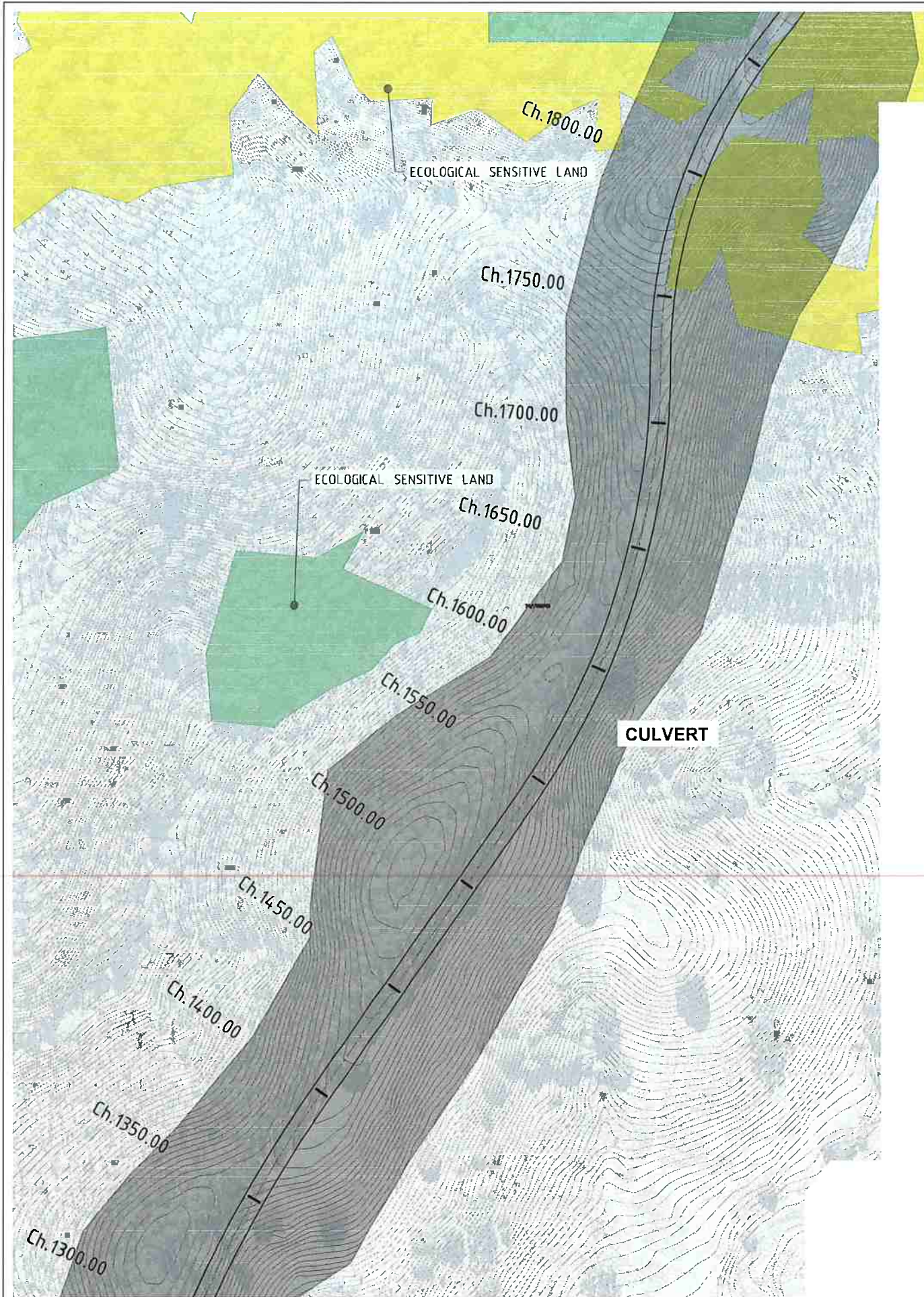
PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - OPTION 2B

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER	ISSUE
WAT70-1-19	A

ISSUE	AMENDMENT DETAILS	DRAWN/CHECK	DATE	# USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.
A	ORIGINAL ISSUE	J.M.M.	??.	??.

ACAD FILE No: G:\AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg



PRELIMINARY
NOT FOR CONSTRUCTION

A	ORIGINAL ISSUE	J.M.M.	7.7.7	7.7.7.15
ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000
0 10 20 40 60 80 100m

DESIGN UNIT
COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGNED	777	7.7.7.15	COORDS ADOPTED	PM 77777
DRAWN	J.M.M.	7.7.7.15	EASTING	55777.777
CHECKED	777	7.7.7.15	NORTHING	687777.777
HORIZONTAL DATUM	MGA		R.L.	7.777
VERTICAL DATUM	AHD			

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD ROADWORKS PLAN - STAGE 2B

PROJECT NUMBER:
WAT70-1

DRAWING NUMBER	ISSUE
WAT70-1-20	A

ACAD FILE No: G:\AAA DESIGN PROJECTS\WAT70-1 MCCABES BRIDGE STUDY\DRAWINGS\WAT70-1_BASE.dwg

EXISTING DOON DOON ROAD FORMATION
 PROPOSED NEW INTERSECTION

Sag Ch 130.878 RL 81.276

PROPOSED BRIDGE

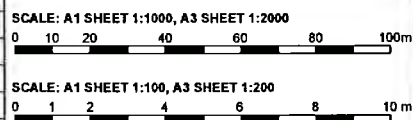
PROPOSED CULVERT

PROPOSED CULVERT

Crest Ch 504.600 RL 91.628

Chainage	Existing Levels	Design Levels	Cut Fill	Edge of Bitumen Left	Edge of Bitumen Right
0.000	83.294	83.294	+0.000	83.174	83.174
10.177	81.943	83.003	+1.060	82.883	82.883
20.000	80.836	82.733	+1.897	82.613	82.613
40.000	79.001	82.255	+3.254	82.135	82.135
60.000	78.776	81.871	+3.095	81.751	81.751
80.000	78.138	81.583	+3.445	81.463	81.463
85.177	78.023	81.523	+3.500	81.403	81.403
100.000	78.077	81.389	+3.312	81.269	81.269
120.000	77.763	81.290	+3.527	81.170	81.170
140.000	77.261	81.286	+4.025	81.166	81.166
160.000	77.483	81.376	+3.893	81.256	81.256
160.177	77.479	81.377	+3.898	81.257	81.257
180.000	75.178	81.515	+6.337	81.395	81.395
200.000	76.295	81.654	+5.359	81.534	81.534
220.000	77.599	81.793	+4.194	81.673	81.673
240.000	78.001	81.932	+3.931	81.812	81.812
260.000	77.771	82.071	+4.300	81.951	81.951
280.000	77.189	82.210	+5.021	82.090	82.090
300.000	75.500	82.349	+6.849	82.229	82.229
320.000	78.475	82.488	+4.013	82.368	82.368
340.000	82.303	82.627	+0.324	82.507	82.507
355.737	82.395	82.736	+0.341	82.616	82.616
360.000	82.123	82.779	+0.656	82.659	82.659
380.000	79.996	83.338	+3.342	83.218	83.218
380.737	79.864	83.370	+3.486	83.250	83.250
400.000	76.465	84.488	+8.023	84.368	84.368
405.737	78.014	84.926	+6.912	84.806	84.806
420.000	80.100	86.077	+5.977	85.957	85.957
440.000	83.163	87.690	+4.527	87.570	87.570
448.230	84.815	88.354	+3.539	88.234	88.234
460.000	88.587	89.204	+0.617	89.084	89.084
480.000	94.299	90.195	-4.104	90.075	90.075
498.230	96.787	90.599	-6.188	90.479	90.479
500.000	96.793	90.613	-6.180	90.493	90.493
520.000	94.252	90.458	-3.794	90.338	90.338
540.000	86.338	89.731	+3.393	89.611	89.611
548.230	84.433	89.666	+4.833	89.146	89.146
560.000	83.333	88.531	+5.198	88.411	88.411
580.000	84.203	87.282	+3.079	87.162	87.162
600.000	84.351	86.033	+1.682	85.913	85.913
620.000	83.996	84.785	+0.789	84.665	84.665
640.000	81.842	83.536	+1.694	83.416	83.416
660.000	78.585	82.287	+3.702	82.167	82.167
680.000	77.225	81.039	+3.814	80.919	80.919

PRELIMINARY
 NOT FOR CONSTRUCTION



DESIGN UNIT

COUNCIL OFFICES
 TUMBULGUM ROAD,
 MURWILLUMBAH NSW 2484.

PHONE 02 66702400
 FAX 02 66727513
 WEBSITE www.tweed.nsw.gov.au

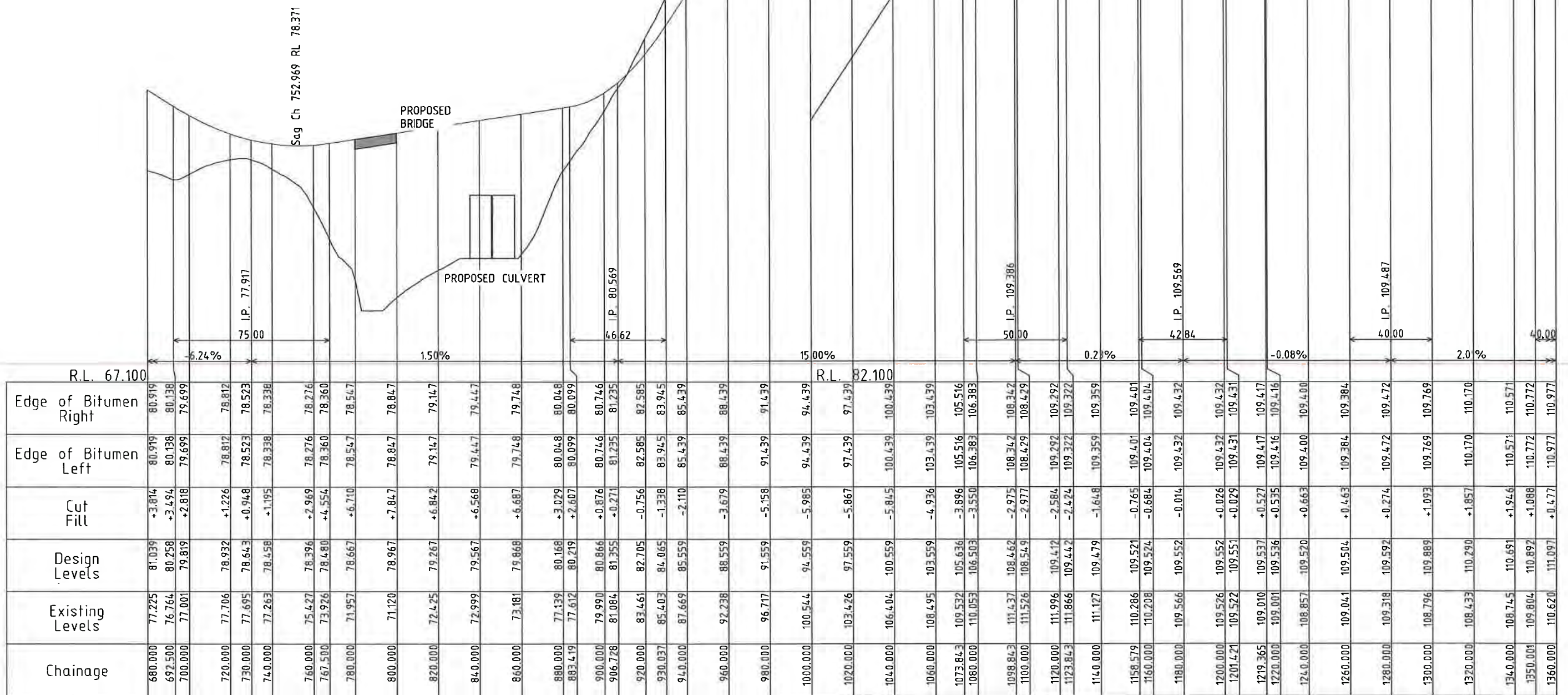


DESIGNED	???	???.???.17	DATE	???.???.17.
DRAWN	J.M.M.	???.???.17	COORDS ADOPTED	PM ?????
CHECKED	???	???.???.17	EASTING	557777.???
HORIZONTAL DATUM	MGA	NORTHING	687777.???	
VERTICAL DATUM	AHD	R.L.	7.???	

PROJECT:
 WATER SUPPLY - RAISING OF CLARRIE
 HALL DAM - MCCABES BRIDGE
 REPLACEMENT

PLAN TITLE:
 DIVERSION OF COMMISSIONERS CREEK
 ROAD - ROAD LONGITUDINAL SECTION -
 OPTION 2B

PROJECT NUMBER:	WAT70-1	
DRAWING NUMBER	WAT70-1-21	ISSUE
		A



Chainage	Existing Levels	Design Levels	Cut Fill	Edge of Bitumen Left	Edge of Bitumen Right
680.000	77.225	81.039	+3.814	80.919	80.919
692.500	76.764	80.258	+3.494	80.138	80.138
700.000	77.001	79.819	+2.818	79.699	79.699
720.000	77.706	78.932	+1.226	78.812	78.812
730.000	77.695	78.643	+0.948	78.523	78.523
740.000	77.263	78.458	+1.195	78.338	78.338
760.000	75.427	78.396	+2.969	78.276	78.276
767.500	73.926	78.480	+4.554	78.360	78.360
780.000	71.957	78.667	+6.710	78.547	78.547
800.000	71.120	78.967	+7.847	78.847	78.847
820.000	72.425	79.267	+6.842	79.147	79.147
840.000	72.999	79.567	+6.568	79.447	79.447
860.000	73.181	79.868	+6.687	79.748	79.748
880.000	77.139	80.168	+3.029	80.048	80.048
883.419	77.612	80.219	+2.607	80.099	80.099
900.000	79.990	80.866	+0.876	80.746	80.746
906.728	81.084	81.355	+0.271	81.235	81.235
920.000	83.461	82.705	-0.756	82.585	82.585
930.037	85.403	84.065	-1.338	83.945	83.945
940.000	87.669	85.559	-2.110	85.439	85.439
960.000	92.238	88.559	-3.679	88.439	88.439
980.000	96.717	91.559	-5.158	91.439	91.439
1000.000	100.544	94.559	-5.985	94.439	94.439
1020.000	103.426	97.559	-5.867	97.439	97.439
1040.000	106.404	100.559	-5.845	100.439	100.439
1060.000	108.495	103.559	-4.936	103.439	103.439
1073.843	109.532	105.636	-3.896	105.516	105.516
1080.000	110.053	106.503	-3.550	106.383	106.383
1098.843	111.437	108.462	-2.975	108.342	108.342
1100.000	111.526	108.549	-2.977	108.429	108.429
1120.000	111.996	109.412	-2.584	109.292	109.292
1123.843	111.866	109.442	-2.424	109.322	109.322
1140.000	111.127	109.479	-1.648	109.359	109.359
1158.579	110.286	109.521	-0.765	109.401	109.401
1160.000	110.208	109.524	-0.684	109.404	109.404
1180.000	109.566	109.552	-0.014	109.432	109.432
1200.000	109.526	109.552	+0.026	109.432	109.432
1201.421	109.522	109.551	+0.029	109.431	109.431
1219.365	109.010	109.537	+0.527	109.417	109.417
1220.000	109.001	109.536	+0.535	109.416	109.416
1240.000	108.857	109.520	+0.663	109.400	109.400
1260.000	109.041	109.504	+0.463	109.384	109.384
1280.000	109.318	109.592	+0.274	109.472	109.472
1300.000	108.796	109.889	+1.093	109.769	109.769
1320.000	108.433	110.290	+1.857	110.170	110.170
1340.000	108.745	110.691	+1.946	110.571	110.571
1350.001	109.804	110.892	+1.088	110.772	110.772
1360.000	110.620	111.097	+0.477	110.977	110.977

PRELIMINARY
NOT FOR CONSTRUCTION

ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE
A	ORIGINAL ISSUE	J.M.M.	???	???.??.

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000
0 10 20 40 60 80 100m

SCALE: A1 SHEET 1:100, A3 SHEET 1:200
0 1 2 4 6 8 10m

USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

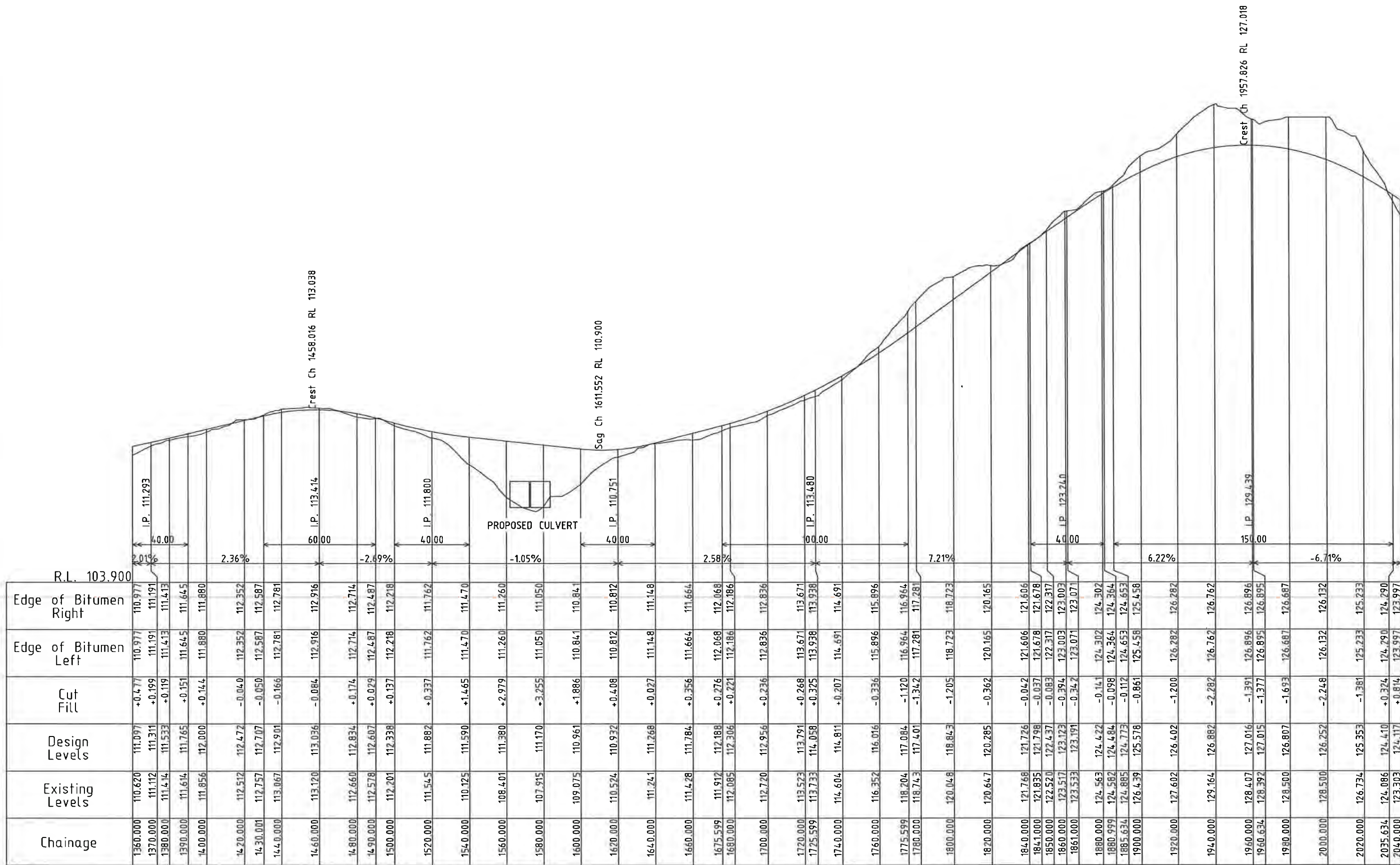


DESIGNED	???	???.??.	DATE	???.??.
DRAWN	J.M.M.	???.??.	COORDS ADOPTED	PM ?????
CHECKED	???	???.??.	EASTING	687777.???
HORIZONTAL DATUM	MGA	NORTHING	687777.???	
VERTICAL DATUM	AHD	R.L.	???	

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

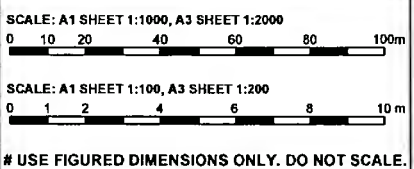
PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD - ROAD LONGITUDINAL SECTION - OPTION 2B

PROJECT NUMBER:	
WAT70-1	
DRAWING NUMBER	ISSUE
WAT70-1-22	A



PRELIMINARY
NOT FOR CONSTRUCTION

ISSUE	AMENDMENT DETAILS	DRAWN	CHECK	DATE
A	ORIGINAL ISSUE	J.M.M.	???	??/??/17



DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

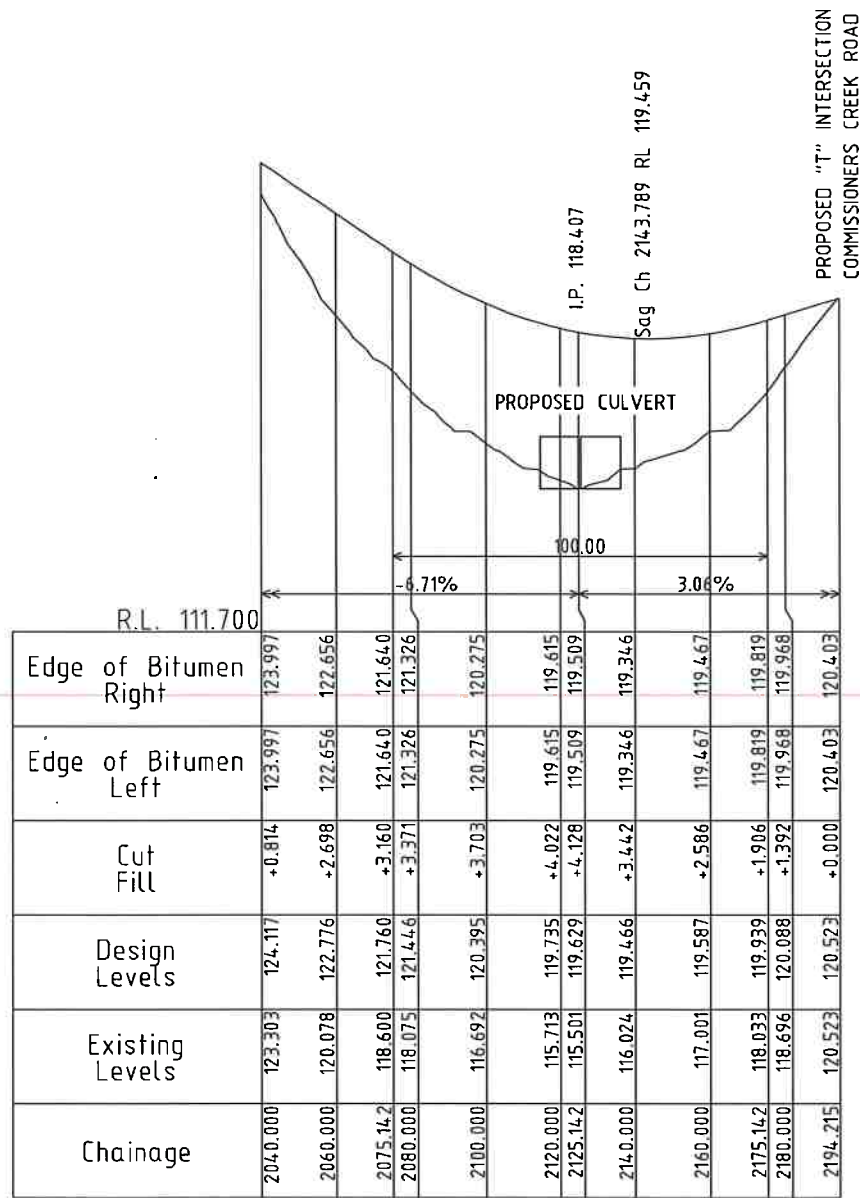
PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au

DESIGNED	???	??/??/17	DATE	??/??/17
DRAWN	J.M.M.	??/??/17	COORDS ADOPTED	PM ?????
CHECKED	???	??/??/17	EASTING	557777.777
HORIZONTAL DATUM	MOGA	NORTHING	687777.777	
VERTICAL DATUM	AHD	R.L.	?????	

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE HALL DAM - MCCABES BRIDGE REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS CREEK ROAD - ROAD LONGITUDINAL SECTION - OPTION 2B

PROJECT NUMBER:	WAT70-1
DRAWING NUMBER	WAT70-1-23
ISSUE	A



PRELIMINARY
NOT FOR CONSTRUCTION

SCALE: A1 SHEET 1:1000, A3 SHEET 1:2000



SCALE: A1 SHEET 1:100, A3 SHEET 1:200



USE FIGURED DIMENSIONS ONLY. DO NOT SCALE.

DESIGN UNIT

COUNCIL OFFICES
TUMBULGUM ROAD,
MURWILLUMBAH NSW 2484.

PHONE 02 66702400
FAX 02 66727513
WEBSITE www.tweed.nsw.gov.au



DESIGNED	???	???.???.17	DATE	???.???.17.
DRAWN	J.M.M.	???.???.17	COORDS ADOPTED	PM ??????
CHECKED	???	???.???.17	EASTING	557777.???
HORIZONTAL DATUM	MGA	NORTHING	687777.???	
VERTICAL DATUM	AHD	R.L.	7.???	

PROJECT:
WATER SUPPLY - RAISING OF CLARRIE
HALL DAM - MCCABES BRIDGE
REPLACEMENT

PLAN TITLE:
DIVERSION OF COMMISSIONERS
CREEK ROAD - ROAD LONGITUDINAL
SECTION - OPTION 2B

PROJECT NUMBER:	WAT70-1	
DRAWING NUMBER	WAT70-1-24	ISSUE
		A