COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

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Attachments

UNDER SEPARATE COVER
ORDINARY COUNCIL MEETING

6:00PM, TUESDAY, 31 MARCH, 2020

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CGRC INTERNAL AUDIT COMMITTEE MEETING - MINUTES

Meeting held 2:15pm Thursday, 12 March 2020, Alby Schultz Meeting Room, Cootamundra

1. Welcome and Apologies

PRESENT:

Tony Donoghue (Chairman, Coolamon Shire Council), Courtney Armstrong (Coolamon Shire Council),

IN ATTENDANCE:

Cr Abb McAlister (Mayor CGRC), Phil McMurray (General Manager CGRC) and Greg Briscoe-Hough (Relief Governance Officer CGRC), Mr Ian Roberts (Blackadder & Associates)

APOLOGIES: Cr. David Graham and Cr. Doug Phillips, Susan Gheller (Manager Business), Tim Swan (Manager Finance and Customer Service)

2. Confirmation of Previous Minutes (7 November 2019)

RESOLVED on the motion of Tony Donoghue (2nd Courtney Armstrong) that the minutes of the Internal Audit Committee held on 7 November 2019 be confirmed as a true and correct record of the meeting.

3. Audit Methodology and Internal Audit Report – S355 Committees

RESOLVED on the motion of Courtney Armstrong (2nd Tony Donoghue) that the Committee note that CGRC accepts the recommendations of the audit and will take appropriate action as required.

4. Audit Methodology – Records Management

RESOLVED on the motion of Courtney Armstrong (2nd Tony Donoghue) that the Committee note that CGRC accepts the recommended approach of the proposed audit of records management procedures.

5. Internal Audit Recommendations and Management Actions

RESOLVED on the motion of Courtney Armstrong (2nd Tony Donoghue) that the updated *Internal Audit Recommendations and Management Actions register* be received and noted.

6. Notification of Incidents - It was noted that none were identified.

7. Other Business – **RESOLVED** on the motion of Courtney Armstrong (2nd Tony Donoghue) to receive and note:
   a) Additional *Internal Audit Recommendations and Management Action* pertaining to Council staff reaffirming commitment to Code of Conduct as part of performance reviews.
   b) Tabling of CGRC's audited annual accounts.

8. Next Meeting

June or July 2020, date to be confirmed.

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REPORT INTO SECTION 355 COMMITTEES

AT

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

March 2020

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01 Introduction

As provided by Section 355 of the Local Government Act 1993, a Council may exercise its functions in a number of ways. One of those is by way of Committees.

Councils will often establish Committees comprising representatives of the Council and members of local communities to operate facilities such as showgrounds, sporting fields or community halls or to provide advice on such issues as heritage, the environment or youth.

These Committees are generally referred to as Section 355 Committees.

The Committees exist for the life of the Council and are therefore dissolved at the end of the Council term but may be re-appointed by the incoming Council.

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02 Audit Scope and Methodology

The audit of Councils' Section 355 Committees will examine the following, but not limited to:

- The Section 355 Committees established by Council;
- The Terms of Reference for each Committee;
- How community representatives are appointed to each Committee;
- How often each Committee meets;
- How the Council supports these Committees;
- Whether the Council delegates any powers and authorities to these Committees;
- What training is provided to Committee members;
- The minutes of meetings of these Committees; and
- How Council reviews the performance of these Committees.

During the audit and particularly during the associated field visits it is expected that the internal auditor will need to speak with the General Manager, Director of Corporate Services and other relevant staff.

The audit will confirm whether Council has developed an Operational Manual for Section 355 Committees.

As well as the issues raised in the above Scope, the auditor will review any such Operational Manual and any policies and procedures related to these Committees and how these are communicated to members of these Committees.

To achieve this, the auditor will, by way of emails and during field visits:

- Make appropriate enquiries of the General Manager, Director of Corporate Services and any other relevant staff who are maybe involved with the Council's Section 355 Committees;
- Review any appropriate policy or governing documentation that the Council may have adopted.

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03 Approach taken during 2020 Audit of S355 Committees at CGRC

The auditor contacted staff via email and obtained various related documents. Additionally, the auditor conducted a field visit and met with relevant staff of Council on 6 February 2020 during which Council's Section 355 Committee regime was discussed.

In response to enquiries made via email and during the field visit the internal auditor formed opinions about the operation of the Council's Section 355 Committees and these are set out in the observations below.

It is understood that Council forms Section 355 Committees to assist in managing its facilities and functions. It was noted that the Council had the following 10 Section 355 Committees:

- Cootamundra Showground Users Group
- Cootamundra Heritage Centre Management Committee
- Stockinbingal Ellwood's Hall Committee
- Wallendbeen Memorial Hall Committee
- Muttama Memorial Hall Management Committee
- Tourism Action Group (Gundagai)
- Cootamundra Tourism Action Group
- Muttama Creek Regeneration Group
- The Arts Centre Cootamundra
- Cootamundra Beach Volleyball Festival Committee

Operational Manual for Section 355 Committees

Individual Councils use different terms to describe their Section 355 Committee Operational Manual.

It was noted that the Council has an adopted Section 355 Committees Management Manual which appears to cover those issues relevant to these Committees. A copy of this Manual, dated December 2017, had been provided to the internal auditor. It was pointed out that Council staff are currently looking at reviewing this document.

It was explained that all members of Council's Section 355 Committees are provided with copies of this document and would also be provided with any amendments. It was also explained that they are not required to sign an acknowledgement to the effect that they have received and read it.

The Internal Auditor is of the view that, ideally, any Operational Manual for Section 355 Committees (a document which is arguably a policy of Council) should be reviewed at least once during each Council term.

Given that, in the usual course of events, Section 355 Committees potentially operate somewhat remotely from the Council, the Internal Auditor is also of the view that all members of Council's Section 355 Committees should have a copy of this Operational Manual or have access to it (via electronic means) and to provide an assurance to the Council that they do in fact have it, either in hard copy or electronically, and have read it, and they should sign an acknowledgement to this effect.

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Terms of Reference for each Section 355 Committee

The Terms of Reference defines the purpose, objectives and structures of the Committee and any delegations to the Committee. It should clearly differentiate one Committee from all others.

It is noted that there are no Terms of Reference as such for each Committee; rather the Council has a Charter (amounting to a one or two paragraph statement) effectively setting out the objectives of each Committee. These Charters are contained in a document which is attached as an Appendix to the Section 355 Committees Management Manual.

It was explained that Council staff are looking at reviewing these every 2 years, including after every election.

Like the Operational Manual it is considered that the Terms of Reference should also be reviewed at least once during the Council's term and copies should be provided to all Committee members who should be required to sign to acknowledge that they have received and read it.

Appointment of Community Representatives to each Section 355 Committee

The Internal Auditor understands that the members of Section 355 Committees, being appointed by the respective Councils, effectively cease to hold that office within 3 months of the end of the Council term but may seek to be re-appointed.

It was explained that the community representatives on each Section 355 Committee are appointed by Council resolution following the general Council elections. It is understood that the Committees are dissolved after the election with advertisements placed inviting expressions of interest. It is noted that the Management Manual sets out how persons should go about becoming members of these Committees.

In the view of the Internal Auditor it is essential that the members of Section 355 Committees are appointed by the elected Council following consideration of nominations received in response to an invitation that was advertised publicly, as well as writing to organisations. This would seem to be the fairest method of selecting the preferred candidates.

Meetings of Section 355 Committees

In the opinion of the Internal Auditor, minutes must be taken of all meetings of Section 355 Committees with these minutes being submitted to a formal Council meeting for either notation or adoption. That way, the elected Council can be aware of the activities of the Committee.

It was explained that there is no set number of meetings that the Committees must hold each year and other than an AGM, it would be up to individual Committees to determine how many meetings were necessary.

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It was pointed out that the community is made aware of when meetings of the Section 355 Committees will be held with notices appearing in Council's newsletter. Also the public are entitled to attend these meetings.

It was also pointed out that minutes are made of these meetings and these are sent to Council. Upon receipt a report is prepared by a member of staff which would include comment on any recommendations by the Committee. This would be presented to the first available Council Meeting at which Council might either receive and note or make a decision depending upon the content of the report.

Section 355 Committee Member Training

It was explained that when the Council's Section 355 Committees are first appointed an induction session is conducted in-house with all community representatives invited to attend. As well as outlining their responsibilities there is training provided on the Code of Conduct. It was pointed out that there would be one of these sessions conducted each Council term.

It is up to Council what level of training is provided to members of Section 355 Committees, however, as a minimum, the Internal Auditor considers that after these Committees are re-appointed at the commencement of the Council term, a briefing should be scheduled for all Section 355 Committee members to provide guidance on the operation of the Committees and to confirm the Council's expectations for the Committees.

Administrative Support for Section 355 Committees

It was explained that no administrative support is generally provided by Council to Section 355 Committees excepting in those instances where an issue may arise upon which the Committee required advice.

It was noted that Council audits the books of all Committees annually.

The Internal Auditor does not have a firm view on what level of administrative support to Section 355 Committees is the most appropriate. From experience, some Councils provide staff to take the minutes while others allow the Committees to run their own operation with minimal interference. Importantly, whatever approach, the Council should have an "open door" policy so Committees feel that can readily approach the Council for advice or guidance at any time. In this regard, it is suggested that an appropriately experienced Council staff member should be nominated as the point of contact for Committees.

In relation to those Committees that operate financial accounts in respect of Council facilities, these need to be submitted to Council, either audited or for audit to facilitate lodgement of Council's BAS and for inclusion in Council's financial statements.

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Section 355 Committees and Council policies and procedures

It was explained that copies of the Council's Code of Conduct and any amendments that are made to it are provided to all community representatives on Section 355 Committees and they are required to sign off that they have received it and will abide by it.

It was pointed out community representatives on Section 355 Committees are not generally provided with copies of relevant Council policies and procedures, however apart from the Code of Conduct, the Section 355 Committees Management Manual specifically lists the following as being of relevance:

- Alcohol & Other Drugs Policy
- Work Health and Safety Policy
- Internal Reporting Policy
- Media Policy
- Digital Media Policy and guidelines

The Internal Auditor considers that all members of Section 355 Committees must be provided with a copy of (and received training on) Council's current Code of Conduct as well as any amendments which occur to this, either in hard copy or electronically. Additionally, it is considered that an acknowledgement should be provided to Council by each Committee member that they have received and read the Code.

In the same vein, Committee members should have access to Council policies and any relevant procedures particularly those that have a direct bearing on the Committee. It is suggested that this could be achieved either by providing hard copies or access electronically. Ideally, members should also be required to sign to acknowledge that they have received these documents.

Noting the comments made by Council staff during the field visits, the Internal Auditor is aware from personal experience the difficulties that can be encountered in getting some Section 355 Committees to provide information for inclusion in the annual budgets of Councils.

Accordingly, the Internal Auditor is also of the view that Councils need to impress upon those Section 355 Committees that operate Council facilities of the importance for them to promptly provide advice on suggested amendments to the fees and charges in respect of these facilities in sufficient time for Council staff to be able to include this information in the Council's Schedule of Fees and Charges when the Council's Annual Budget is being formulated.

Section 355 Committees and conflicts of interest

It was pointed out that the members of Section 355 Committees are subject to Council's conflicts of interest disclosure regime and are required to complete Pecuniary Interest Returns. The comment was made that if a Section 355 Committee member had an interest in a matter that was being discussed by the Committee then it would be expected that person would declare that interest and comply with the Code of Conduct.

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It is for each Council to determine whether the members of its Section 355 Committees are classified as designated persons and/or if they are required to complete and lodge pecuniary interest returns.

Of more importance is the need for these Committees members to be aware of their obligations about conflicts of interest and to declare any interests when they may arise.

Section 355 Committees Performance Review

It was noted that there is no formal process to review the performance of Section 355 Committees and that this would only occur if an issue arose.

It is suggested that a good time to review the performance of Section 355 Committees is when the Committees are appointed at the beginning of each Council term and at the Council meeting each September when Councillor delegates are generally appointed to the Committees for the forthcoming year. How each Council conducts such a review is up to the respective Council.

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04 Conclusion

The Internal Auditor is aware, from experience, that Councils sometimes appoint community based organisations as Section 355 Committees for reasons such as to either assist the group in accessing funding or to provide cover under the Council's insurance policies for the group.

At this point, it would be worthwhile to quote Section 355 of the local Government Act 1993:

"355 HOW A COUNCIL MAY EXERCISE FUNCTIONS

A function of a Council may, subject to this Chapter, be exercised--

(a) by the Council by means of the councillors or employees, by its agents or contractors, by financial provision, by the provision of goods, equipment, services, amenities or facilities or by any other means, or

(b) by a Committee of the Council, or

(c) partly or jointly by the Council and another person or persons, or

(d) jointly by the Council and another Council or Councils (including by means of a joint organisation or a Voluntary Regional Organisation of Councils of which the Councils concerned are members), or

(e) by a delegate of the Council (which may, for example, be a joint organisation or a Voluntary Regional Organisation of Councils of which the Council is a member)."

This seems to suggest that unless the Committee is carrying out a Council function, or providing advice about or related to a Council function, then it cannot be a Section 355 Committee.

RECOMMENDATIONS

That:

1. The Council's Operational Manual for Section 355 Committees Handbook and the Terms of Reference for individual Committees be reviewed at least once during each Council term.

2. When copies of the Manual and Terms of Reference are provided to community members of these Committees, an acknowledgement be provided to Council to attest to the fact that the community members have received these documents.

3. At the expiration of the Council term, review operations of all Section 355 Committees to ensure they continue to be fit for purpose, and their functions and expenditures align with the goals of the incoming Council's Delivery Program.

4. At the expiration of the Council term and upon the community members of Council's Section 355 Committees ceasing to hold office, Council publicly invite expressions of interest from persons interested in becoming members of these Committees with the decision on who to appoint to these Committees being made at an open Council Meeting.

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5. The proceedings of meetings of all Section 355 Committees be minuted with copies of the minutes of all of these meetings being presented to the Council at a formal Council Meeting.

6. A briefing be scheduled preferably soon after the appointment of community members of the Council's Section 355 Committees to provide these community members with guidance on the operation of the Committees and to confirm the Council's expectations for the Committees with particular emphasis on the Code of Conduct.

7. An appropriately experienced staff member be nominated as the point of contact for Section 355 Committees.

8. In relation to those Section 355 Committees that operate financial accounts in respect of Council facilities
   (a) procedures be implemented to ensure that these documents are submitted to Council, either audited or for audit, to facilitate lodgement of Council's BAS and for inclusion in Council's financial statements; and
   (b) Council impress upon these Committees the importance for them to provide advice of any proposed amendments to their fees and charges in sufficient time for Council staff to be able to include this information in Council's Schedule of Fees and Charges when the Council's Annual Budget is being formulated.

9. Copies of Council's Code of Conduct and any other relevant Council policies and procedures be provided to all community members of Council's Section 355 Committees with these community members to provide an acknowledgement that they have received these documents.

10. The community members of Council's Section 355 Committees be reminded of the need for them to appropriately declare any conflicts of interest that may occur during meetings of these Committees with the minutes of those meetings to record any such disclosures.

11. Appropriate arrangements be introduced by Council to enable it to review the performance of its Section 355 Committees.

Ian Roberts
Audit and Governance Associate
March 2020

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Strengthening local government

NSW GOVERNMENT Office of Local Government

Circular to Councils

Circular Details	20-10 / 25 March 2020 / A696536
Previous Circular	*20-06 Novel Coronavirus (COVID-19) Development Updates*
Who should read this	Councillors / General Managers / All council staff
Contact	Council Governance Team/ 02 4428 4100/ olg@olg.nsw.gov.au
Action required	Information

Postponement of the September 2020 Local Government Elections

What's new or changing?

- The Minister for Local Government has announced that the September 2020 local government elections will be postponed to address the risks posed by the COVID-19 virus.
- The *Local Government Act 1993* (the Act) has been amended to confer on the Minister, a time-limited power to postpone council elections.
- The amendment, which operates for only a limited period of 12 months, allows the Minister by an order published in the Gazette, to postpone elections for 12 months from the date of the order. The order may be extended for an additional period to 31 December in the year after the order is made.
- The postponement of the next election will not change the future schedule of council elections, and the subsequent election will still proceed in September 2024.

What this will mean for your council

- Where the Minister exercises the power to postpone elections under section 318B, the election requirements of the Act are suspended for the period specified in the order and current councillors will continue to hold their civic offices.
- Popularly elected mayors will continue to hold their office until an ordinary election is held. In the case of mayors elected by councillors, mayoral elections will need to be held for mayors elected in September 2018 when their two year-terms expire. Mayors elected in September 2019 will continue to hold office until September 2021, once the election date is determined.
- The composition of joint organisation boards may need to change if mayors of member councils elected by councillors are not re-elected.
- The postponement of elections will have implications for the activities councils may be required to undertake in the current and next integrated planning and reporting (IP&R) cycles. In general, OLG will seek to extend the current IP&R cycle for 12 months, with a next cycle to be truncated to 3 years. The Office of Local Government will be providing further detailed guidance on this and other changes to statutory timeframes that may become necessary as a result of deferring elections.

Where to go for further information

- For further information please contact the Council Governance Team on 02 4428 4100 or by email at olg@olg.nsw.gov.au.

Tim Hurst
Deputy Secretary
Local Government, Planning and Policy

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Office of Local Government

COVID-19 COUNCIL UPDATE

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25 March 2020

Council elections postponed to reduce the risk of COVID-19

To provide certainty to councils, communities and potential candidates, the NSW Government has made the decision to postpone the September local government elections in the face of the COVID-19 crisis.

The decision to postpone the elections is necessary to ensure the health and safety of voters, NSW Electoral Commission staff and election candidates.

It follows Parliament passing amendments to the Local Government Act last night to provide the Minister with the power to postpone the elections for 12 months with a possible further extension to 31 December 2021 should the need arise.

The Minister intends to make an order which will be published in the Government Gazette to postpone the 2020 local government elections. It is the Government's intention that these council elections will be held in September 2021.

Current councillors and popularly elected mayors will continue to hold their civic offices until the rescheduled local government elections are held.

Mayoral elections will need to be held for mayors elected by councillors in September 2018 when their two-year terms expire this year. Mayors elected in September 2019 will continue to hold office until September 2021 once the new election date is gazetted.

The postponement of the next elections will not change the future schedule of council elections, and the subsequent elections will still proceed in September 2024.

The Office of Local Government has issued a circular to provide further information to councils.

Councils can now hold meetings remotely

Amendments have now been made to the Local Government Act to allow councils to meet remotely to reduce the risk of COVID-19 and ensure compliance with the Public Health Order.

The amendments take effect immediately and will operate for six months.

This means that councillors can now participate in meetings by an audio-visual link instead of attending in person.

Council meetings can be held entirely remotely by audio-visual link.

Alternatively, where councils continue to meet in person, individual councillors are permitted to participate in the meeting by audio-visual link.

Requirements for members of the public to be permitted to attend meetings can now be satisfied by livestreaming the meeting using an audio-visual link.

The Minister for Local Government can approve other arrangements for satisfying the requirements for councillors and members of the public to "attend" meetings, but only if audio-visual links are not reasonably available.

The Office of Local Government has issued a circular containing further technical advice to councils about meetings.

Information and resources

New restrictions announced by National Cabinet
National Cabinet last night announced new restrictions and measures to combat COVID-19. This includes additional prohibited activities and

venues to apply from 11.59pm today. Councils can access further information here.

New Ministerial Order power
Changes to the Environmental Planning and Assessment Act have been made to allow the NSW Minister for Planning and Public Spaces to make an Order for development to be carried out without the normal planning approval in order to protect the health, safety and welfare of the public during the COVID-19 pandemic. Councils can access the Ministerial Orders currently in force here. They include changes to retail trading, waste and home businesses.

Webinar for councils
You can now access a recording of a council webinar held by the Office of Local Government from the State Emergency Operations Centre on 23 March 2020. The recording of the webinar can be accessed here.

Local Emergency Management Committees
A number of councils have sought NSW Education Department representation or input into Local Emergency Management Committees. All requests for Education input into Local Emergency Management Committees should be sent to edu.lo@det.nsw.edu.au.

Find the facts
Councils can access facts about COVID-19 on the NSW Government website here.

Template emergency plans
Councils can now access template emergency plans to help them manage COVID-19. The following templates have been provided by the City of Sydney for use by all councils:

- Pandemic Sub Plan
- Business Continuity Plan
- Cleansing and Waste Business Continuity Plan
- Business Continuity Recovery Team Plan

Quicklinks
Councils can access the latest information and resources about COVID-19 on the NSW Government, NSW Health and Commonwealth Government websites. The Office of Local Government has also set up a COVID-19 page on its website.

Please click here to unsubscribe from our mail list.

Strengthening local government

NSW GOVERNMENT Office of Local Government

Circular to Councils

Circular Details	20-10 / 25 March 2020 / A696536
Previous Circular	*20-06 Novel Coronavirus (COVID-19) Development Updates*
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What this will mean for your council

- Where the Minister exercises the power to postpone elections under section 318B, the election requirements of the Act are suspended for the period specified in the order and current councillors will continue to hold their civic offices.
- Popularly elected mayors will continue to hold their office until an ordinary election is held. In the case of mayors elected by councillors, mayoral elections will need to be held for mayors elected in September 2018 when their two year-terms expire. Mayors elected in September 2019 will continue to hold office until September 2021, once the election date is determined.
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Where to go for further information

- For further information please contact the Council Governance Team on 02 4428 4100 or by email at olg@olg.nsw.gov.au.

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Deputy Secretary
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Circular to Councils

Circular Details	20-09 / 25 March 2020 / A696524
Previous Circular	*20-06 Novel Coronavirus (COVID-19) Development Updates*
Who should read this	Councillors / General Managers / All council staff
Contact	Council Governance Team/ 02 4428 4100/ olg@olg.nsw.gov.au
Action required	Council to Implement

Compliance with social distancing requirements to limit the spread of the COVID-19 virus at council and committee meetings

What's new or changing?

- The Minister for Health and Medical Research, the Hon. Brad Hazzard MP, has issued the *Public Health (COVID-19 Gatherings) Order 2020* (the Public Health Order), restricting gatherings in indoor spaces exceeding 100 persons. Further information about the new Public Health Order is available here.
- Meetings of councils and committees of councils are **not** exempted from the order as *"essential gatherings"*, and councils **must** comply with the order.
- Amendments have been made to the *Local Government Act 1993* (the Act) allowing councils to meet remotely to assist them to manage the risk of transmission of the COVID-19 virus at their meetings and to ensure compliance with the Public Health Order. The amendments take effect immediately.
- The amendments will operate for a period of six months, but may be extended to 12 months by regulation if required.

What this will mean for your council

Council and committee meetings can be held remotely, and individual councillors can participate in meetings remotely

- An amendment has been made to the Act providing that any requirement that councillors attend a meeting is satisfied if the meeting is held remotely using audio-visual links.
- This means that councillors can now participate in meetings by an audio-visual link instead of attending in person.
- Council meetings can be held entirely remotely by audio-visual link. Alternatively, where councils continue to meet in person, individual councillors are permitted to participate in the meeting by audio-visual link.
- Where councillors participate in meetings remotely by an audio-visual link, they continue to be obliged to disclose and appropriately manage conflicts of interest they may have in matters being considered at meetings. Councillors continue to be obliged to remove themselves from the consideration of matters in which they have a pecuniary or significant non-pecuniary conflict of interest.
- Where councillors participate in meetings remotely by an audio-visual link, they continue to be obliged to protect any confidential information considered at the meeting. Where meetings are closed to the public under section 10A of the Act, councillors should ensure that they participate in the meeting in a location where it cannot be seen or heard by anyone else.

Office of Local Government
5 O'Keefe Avenue NOWRA NSW 2541
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Attendance of members of the public at meetings

- The amendment to the Act also provides that the requirement under section 10 of the Act that members of the public be permitted to attend meetings is satisfied if the meeting is held remotely using audio-visual links. The amendment also provides that the requirement under section 10 for meetings to be open to members of the public is satisfied if a webcast of the meeting is made public.
- This means that the requirement under section 10 of the Act for members of the public to be permitted to attend meetings can now be satisfied by livestreaming the meeting using an audio-visual link. Where meetings are livestreamed in this manner, members of the public can be excluded from the chamber.
- All councils have been required to webcast their meetings since 14 December 2019 and the Office of Local Government (OLG) has recently issued a G*uide to webcasting council and committee meetings*. The Guide is available here. Among other things, the Guide provides information on how councils can livestream their meetings using audio-visual links, including technical guidance based on the experiences of councils that currently livestream their meetings using audio-visual links.
- Councils continue to be permitted to close their meetings to the public on the grounds specified under section 10A of the Act. Where councils livestream their meetings, they should ensure that the webcast is stopped while the meeting is closed to the public and resume it when the meeting is reopened to the public.
- Where councils continue to permit members of the public to physically attend meetings, the numbers of members of the public present in the chamber can and should be limited to comply with the Public Health Order and the Australian Health Protection Principal Committee's (AHPPC) recommendations on indoor gatherings (see below).
- Where the number of people seeking to physically attend a meeting exceeds the numbers permissible under the Public Health Order or would prevent compliance with the AHPPC's recommendations on indoor gatherings, councils may consider accommodating excess numbers of people wishing to attend the meeting in another indoor or outdoor space and broadcast the meeting's proceedings to that space.

Public forums

- Requirements for the holding of public forums prior to or at meetings will vary from council to council depending on the provisions contained in their adopted codes of meeting practice.
- Under the provisions contained in Part 4 of the *Model Code of Meeting Practice for Local Councils in NSW* (the Model Meeting Code), public forums are discretionary.
- To ensure compliance with the Public Health Order, public forums should only be held in a manner that is consistent with the Public Health Order and the AHPPC's recommendations on indoor gatherings. Where this is not possible, public forums should not be held, or alternative arrangements should be made for the making of public submissions to councillors. For example, submissions could be made to councillors via an audio-visual link or in writing instead of in person.

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Delegations

- As previously advised in Circular 20-06, councils should review their delegations as a matter of urgency to ensure that decisions can be made quickly in response to any developments outside of the normal council meeting cycle. Councils' functions (other than those specified in section 377 of the Act) can be delegated to the general manager, the mayor or another body such as a committee.

Cancellation of meetings

- If councils consider that the holding of a meeting will pose a risk to those attending the meeting, the meeting can be cancelled.
- If adopted by councils, clause 5.14 of the Model Meeting Code provides that where it becomes apparent prior to the commencement of a meeting that the safety and welfare of councillors, council staff and members of the public may be put at risk by attending the meeting, the mayor may, in consultation with the general manager and, as far as is practicable, with each councillor, cancel the meeting.
- Where a meeting is cancelled, notice of the cancellation must, at a minimum, be published on the council's website. Councils should also take additional steps to communicate the cancellation to ensure as many people know about it as possible.
- Where a meeting is cancelled, the business to be considered at the meeting may instead be considered, where practicable, at the next ordinary meeting of the council or at an extraordinary meeting.

Other measures

- The amendment to the Act allows the Minister for Local Government to approve other arrangements for satisfying the requirements for councillors and members of the public to "attend" meetings, but only if audio-visual links are not reasonably available.
- If councils are not able to comply with any of the above requirements, they should advise OLG in writing so that alternative arrangements may be considered for approval. In doing so, councils should advise:
    - why they are not able to comply with any of the options outlined above
    - what alternative arrangements are being proposed
    - how the proposed arrangements will ensure any members of the public wishing to attend a meeting can view the meeting in real time
    - arrangements for ensuring that conflicts of interest are appropriately disclosed and managed
    - arrangements for ensuring that confidential information is protected.

Key points

- The AHPPC has made recommendations on risk mitigation measures to be applied to indoor gatherings. The recommendations are available here.
- The AHPPC recommends the following risk mitigation strategies:
    - In a given occupied space, there must be a density of no more than one person per four square metres of floor space.
    - Availability of hand hygiene products and suitable waste receptacles, with frequent cleaning and waste disposal.

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  - Promotion of the Department of Health recommendations for unwell individuals to isolate at home and not attend.
  - For settings where there is ongoing movement and an increased number of interactions between individuals, an individual's attendance should be less than two hours in duration.
  - For settings that are primarily static, an individual's attendance should be limited to four hours in duration.
- Councils should apply these measures when holding council or committee meetings and any other indoor gatherings.

Where to go for further information

- See OLG's *Guide to webcasting council and committee meetings* which is available here.
- If councils require assistance to identify and procure technical solutions to allow councillors to participate in meetings by audio-visual link or to livestream their meetings by video, the Local Government Procurement (LGP) ICT Panel Contract (LGP115) has a variety of providers who can deliver video collaboration solutions. For more information see the LGP website here or contact Luke Kenny, Chief Executive Officer, on 0421 059 172 or at lkenny@lgp.org.au.
- For further information please contact the Council Governance Team on 02 4428 4100 or by email at olg@olg.nsw.gov.au.

Tim Hurst
Deputy Secretary
Local Government, Planning and Policy

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COVID-19

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

FREQUENTLY ASKED QUESTIONS

Coronavirus – General

What is a coronavirus and COVID-19?

Coronaviruses are a large family of viruses known to cause respiratory infections. These can range from the common cold to more serious diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). This new coronavirus originated in Hubei Province, China and the disease caused by the virus is named COVID-19.

How is this coronavirus spread?

COVID-19 is most likely to spread from person-to-person through:

- Direct close contact with a person while they are infectious or in the 24 hours before their symptoms appeared.
- Close contact with a person with a confirmed infection who coughs or sneezes.
- Touching objects or surfaces (such as door handles or tables) contaminated from a cough or sneeze from a person with a confirmed infection, and then touching your mouth, nose, eyes or face.

All information supplied in this booklet has been sourced from health.gov.au

What are the symptoms of COVID-19?

The symptoms of COVID-19 are similar to other colds and flus and include:

- Fever
- Sore throat
- Cough
- Fatigue
- Difficulty breathing

National Coronavirus Help Line on 1800 020 080

While COVID-19 is of concern, it is important to remember that most people displaying these symptoms are likely suffering with a cold or other respiratory illness – not COVID-19.

What do I do if I develop symptoms?
Call the National Coronavirus Help Line on 1800 020 080. It operates 24 hours a day, seven days a week. If you require translating or interpreting services, call 131 450.

Who needs to isolate?
All people who arrive in Australia from midnight 15 March 2020, or think they may have been in close contact with a confirmed case of coronavirus, are required to self-isolate for 14 days.

Someone I live with is getting tested for COVID-19. Should I self-isolate and get tested as well?
If a household member is a suspected case, you may need to be isolated. This will be determined by your public health unit on a case-by-case basis. Your public health unit will contact you if you need to isolate. For more information, read the NSW Health fact sheet on home isolation.

What is social distancing?
Social distancing is one way to help slow the spread of viruses such as COVID-19. Social distancing includes staying at home when you are unwell, avoiding large public gatherings if they're not essential, keeping a distance of 1.5 metres between you and other people whenever possible and minimising physical contact such as shaking hands, especially with people at higher risk of developing serious symptoms, such as older people and people with existing health conditions. There's no need to change your daily routine, but taking these social distancing precautions can help protect the people in our community who are most at risk.

How is social distancing implemented in the workplace?

- Stay at home if you are sick.
- Stop handshaking as a greeting.
- Hold meetings via video conferencing or phone call.
- Defer large meetings.
- Hold essential meetings outside in the open air if possible.
- Promote good hand and sneeze/cough hygiene and use hand sanitisers.
- Take lunch at your desk or outside rather than in the lunch room.
- Clean and disinfect high touch surfaces regularly.
- Limit food handling and sharing of food in the workplace.
- Avoid non-essential business travel.
- Reschedule, stagger or cancel large gatherings.

Who is most at risk of a serious illness?
Some people who are infected may not get sick at all, some will get mild symptoms from which they will recover easily, and others may become very ill, very quickly. The people at most risk of serious infection are:

- People who have been in close contact with someone who has been confirmed as having coronavirus.
- People with compromised immune systems (e.g. cancer).
- Elderly people.
- Aboriginal and Torres Strait Islander people, as they have higher rates of chronic illness.
- People with diagnosed chronic medical conditions.
- People in group residential settings.
- People in detention facilities.
- Very young children and babies.*

*At this stage the risk to children and babies, and the role children play in the transmission of COVID-19, is not clear. However, there has so far been a low rate of confirmed COVID-19 cases among children, relative to the broader population.

NSW GOVERNMENT

If you develop flu like symptoms, call your **GP** or **healthdirect (1800 022 222)**, or visit your local **Emergency Department**

How can we help prevent the spread of coronavirus?
Practising good hand and sneeze/cough hygiene and keeping your distance from others when you are sick is the best defence against most viruses.

You should:

- Stay at home if you feel unwell or have cold or flu like symptoms to avoid contact with others.
- Wash your hands frequently with soap and water, before and after eating, and after going to the toilet.
- Cover your cough and sneeze, dispose of tissues, and use alcohol-based hand sanitizer.
- Stay more than 1.5 metres from people.
- Exercise personal responsibility for social distancing measures.

My workplace has more than 500 people. Can I still go to work?
Yes, you can still go to work. The Government currently recommends that organised, non-essential gatherings be limited to a maximum of 100 people indoors and 500 people outdoors. This advice does not include workplaces, schools, universities, shops, supermarkets, public transport and airports, as they are deemed essential.

If you are unwell, you should stay home to avoid spreading your germs to others.

Should I wear a face mask?
You do not need to wear a mask if you are healthy. While the use of masks can help to prevent transmission of disease from infected patients to others, masks are not currently recommended for use by healthy members of the public for the prevention of infections like coronavirus.

Is the flu vaccine effective in combatting COVID-19?
While the vaccine won't combat COVID-19, it will help reduce the severity and spread of underlying flu viruses. The NSW Health Department has advised that receiving a vaccination from April provides optimal protection from the flu ahead of the peak period, which typically occurs from June to September. Research has shown that the effectiveness of the vaccination begins to wane after three to four months, so timing is very important.

If you are or someone you know is feeling mentally distressed and need to contact someone urgently, please call Murrumbidgee Local Health District Mental Health AccessLine on 1800 800 944.

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

25 March 2020

COVID-19 UPDATE 25th March 2020 – Playground equipment off limits. Funeral Numbers Restricted.

The announcement last night from Prime Minister Scott Morrison, regarding a nationwide crackdown on social gatherings has prompted Cootamundra-Gundagai Regional Council (CGRC) to take the decision to close the regions recreational equipment. This includes playground equipment, skate and pump track parks, outdoor gym equipment. CGRC staff will be erecting signage today advising the general public that this equipment is no longer available for public use. The decision was taken to discourage social gatherings following on from the Prime Ministers announcement.

Council will be upscaling cleaning regimes in the regions public toilets and public spaces where possible, and urges all residents to practice increased hygiene levels when coming into contact with hard surfaces.

All residents are urged to limit visits to public places, maintain social distancing measures and be vigilant with hygiene.

CGRC mayor Cr Abb McAlister said Council was taking advice from the appropriate health authorities and making decisive decisions.

"We have been meeting regularly, and making decisions based on directives from State and Federal Governments, accessing risk based strategies and making logical decisions for the safety and wellbeing of our staff, residents and the community as a whole," Cr McAlister said.

Council's customer service areas, in both centres will have strict social distancing measures in force.

"I can't reiterate this enough, if you don't absolutely need to come into our offices, please don't. Almost all transactions can be done using other methods, our customer service teams are on the front line in regards to dealing with the general public, if you are feeling unwell, or have the ability to pay Council fees and charges on line or by phone, please don't come into the office," Cr McAlister added.

Residents can access a host of information and forms on the Council website, including

- Your Council
- Rates Information
- Rating Information and forms

Forms include:

- Pensioner Concession Form
- Change of Details form
- Request for Rating information
- Direct Debit Request
- Payment Arrangement Form

The Prime Minister announced further restrictions on public gatherings. Funerals will be restricted to 10

people. Council will be informing local funeral directors, of the new restriction.

Residents can stay updated on the COVID-19 situation by visiting www.cgrc.nsw.gov.au or NSW Health, www.health.nsw.gov.au/Infectious/diseases/Pages/coronavirus.aspx. Customer Service can be contacted on 1300 459 689 or email mail@cgrc.nsw.gov.au

Photo and caption:

Council has taken the decision to close the regions recreational equipment. This includes playground equipment, skate and pump track parks, outdoor gym equipment.

-END-

Cootamundra-Gundagai Regional Council
www.cgrc.nsw.gov.au

For further media information contact:
Maxine Imrie Media Officer 1300 459 689
Maxine.Imrie@cgrc.nsw.gov.au

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

20 March 2020

Cootamundra-Gundagai Regional Council's response to managing the risk of Coronavirus – Update at 20 March 2020

The COVID-19 outbreak has been declared a Global Pandemic by the World Health Organisation and it continues to create massive disruption across the world.

Cootamundra-Gundagai Regional Council (CGRC) continues to take advice and guidance from the New South Wales Government (NSW Health) and the Federal Government (Department of Health) which are the lead agencies in this situation. Council is monitoring the situation to ensure an adequate response plan is in place for the community. Council is aware that information should weigh up the need to protect individuals from infection but also ensure essential services, business and communities can still operate on a viable level. Residents will be informed about any changes regarding the availability to Council services and facilities if and when the need arises, and as decisions are made in response to the evolving situation.

"Although there has been no confirmed cases in the Cootamundra-Gundagai Regional Council local government area at this stage, rest assured, we have the safety of our people and our residents in the forefront of our response to this challenge" said Mayor Abb McAlister.

For accurate and consistent information on COVID 19 please refer to NSW Health - www.health.nsw.gov.au

We'll keep you updated with any Council related matters on our website – www.cgrc.nsw.gov.au and through our media outlets.

WHAT YOU CAN DO

If you believe you may have contracted the COVID-19 virus (returned travellers/had contact with a confirmed case/showing symptoms: fever, sore throat, dry cough and shortness of breath) you should:

- call HealthDirect 1800 022 222 or
- call the Murrumbidgee COVID-19 Hotline 1800 831 099 or
- contact/phone your GP, advise them in advance if you have symptoms
- If you are sick – stay away from others.

We can all help to slow the spread of COVID-19 in Australia, and residents are reminded of what they can do:

HYGIENE
Practice food, hand and sneeze/cough hygiene;
• wash your hands frequently with soap and water, before and after eating, and after going to the toilet
• cover your cough and sneeze, dispose of tissues, and use alcohol-based hand sanitiser, and
• if unwell, avoid contact with others (stay more than 1.5 metres from people).

SOCIAL DISTANCING
Social distancing is an effective measure, but it is recognised that it cannot be practised in all situations and the aim is to generally reduce potential for transmission.
While practising social distancing, people can travel to work (including public transport). For non-essential activities outside the workplace or attendance at schools, universities and childcare – social

distancing includes:
• avoiding crowds and mass gatherings where it is difficult to keep the appropriate distance away from others
• avoiding small gatherings in enclosed spaces, for example family celebrations
• attempting to keep a distance of 1.5 metres between themselves and other people where possible, for example when they are out and about in public place.
• avoiding shaking hands, hugging, or kissing other people
• avoiding visiting vulnerable people, such as those in aged care facilities or hospitals, infants, or people with compromised immune systems due to illness or medical treatment

BULK-BUYING
There is no need to bulk-buy products at supermarkets including toilet paper, paracetamol and canned food.
It is prudent for households to have a small stock of non-perishable groceries to cover the event that in the coming months the household has been asked to self-isolate for 14 days. However, it's important to note the role of family and friends in supporting those in isolation.

SELF-ISOLATION
If you have been diagnosed with COVID-19, you must stay at home to prevent it spreading to other people.
You will be directed to stay at home if you may have been exposed to the virus - Recently travelled from overseas, or been in contact with someone who has the virus.
Staying at home means you:

- Do not go to public places such as work, school, shopping centres, childcare or university
- Ask someone to get food and other necessities for you and leave them at your front door
- Do not let visitors in — only people who usually live with you should be in your home
- You do not need to wear a mask in your home. If you need to go out to seek medical attention, wear a surgical mask (if you have one) to protect others.
- You should stay in touch by phone and on-line with your family and friends.

WHAT YOU CAN DO FOR COUNCIL

Residents are requested to rethink whether they need to come into Council offices for day to day transactions such as payments of rates, applications and general requests. Online options are available via Council's website or Council can be contacted by phone 1300 459 689 or email mail@cgrc.nsw.nsw.gov.au during office hours. For out of hours emergencies, residents can still contact Council by phone 1300 459 689.

If you are ill, please do not visit a Council venue.

WHAT COUNCIL IS DOING NOW

Work Health and Safety is paramount and must be at the forefront of everyone's mind when responding to the COVID 19 pandemic. As far as reasonably practicable, workers, contractors, and other persons at the workplace are not to be put at risk from work carried out as part of the business of Council. Appropriate provisions for the management of our employees are being considered where necessary including special leave, workplace flexibility, exclusions, workplace closures, and redeployments. Should the need arise then Council is implementing plans to ensure the continuous delivery of essential services such as water supply, sewerage services and garbage collections.

Part of that plan has been the identification of critical staff and seeking agreement to work from alternate

locations, in the event that a Council office needs to be shut down. Council is also ensuring that critical staff have the capacity to work from home if the need arises.

Council staff have implemented good personal hygiene practices.
Council staff are sanitising benches, keyboards and counters in public facing areas including customer service areas as appropriate.
Council staff have implemented additional cleaning within touchpoints of all public spaces.
Council will put into place enhanced handwashing reminders in all public facilities.
Council staff will be wearing gloves and/or using hand sanitiser when handling cash.
Councillors and Council Staff are not attending work related conferences or gatherings or participating in non-essential face to face meetings.

Council's Health Officer will be contacting local cafes, eateries and food handlers to pass on advice regarding hygiene and safe food handling practices. For example outlets will be encouraged in the use of take away cups to limit the amount contact with customers. Contact details can be updated on these visits so that information received by Council from appropriate peek bodies is distributed to them as soon as possible. Street stalls and markets will be allowed to continue on a case by case basis, but will be subject to similar good practices being introduced or observed.

Council will relax regulations on outdoor dining spaces to enable restaurants and cafes to spread out tables and chairs to extend space and allow for social distancing. Food outlets are encouraged to contact Council Health Officer for more information.

CHANGES TO BUSINESS OPERATIONS – SERVICE INTERUPTIONS

It is noted that the latest directive from Government is that indoor gatherings are not to be held when exceeding 100 people, and outdoor gatherings are not to exceed 500 people.

Council is required to abide by this determination. Cancelling events and use of facilities is necessary, but it is better to be safe than sorry.

Council encourages all community, social, cultural and sporting organisations that use Council facilities, to abide and suspend non-essential meetings and such gatherings until further notice.

Council are taking measures to reduce the risk to our most vulnerable members of the community. The elderly and frail. Council recognises that many of our volunteers across the region are in this high risk group and are working within our visitor service areas. Council is taking precaution, to protect our valuable volunteer workforce by temporarily closing these facilities immediately until further notice.

Facility closures include:
Bradman Birthplace
Cootamundra Heritage Centre
Gundagai Museum

Events cancellations include:
ANZAC Day services across the region
The Gundagai Cup - Ladies Day
Cootamundra Vintage car event

Postponed Events:
Gundagai Community Wellbeing Day
Bling it On Charity Ball
Seniors Week activities
Youth Week activities

POOLS
Council's Outdoor Swimming Pools in Gundagai and Cootamundra are closed for the season.
Cootamundra's heated pool will be closing to the public effective Monday 23rd March until further notice. The venue has been determined as a high risk area to control due to the large number of visitors and interaction with aged user groups.

LIBRARIES
Libraries in both centres will remain open at this stage, however some programs have been cancelled. Residents are reminded that a home delivery service is available. More information can be obtained by contacting the Libraries – Cootamundra on 6940 2200, and Gundagai on 6944 0270.

VISITOR INFORMATION CENTRES
The visitor information centre at Gundagai remains open to the general public at this time, as staffed by Council employees. Online options are available for most services. Please use the website where possible - http://www.visitgundagai.com.au/
The visitor information centre at Cootamundra is closed, as staffed by volunteers. Please use the website - https://www.visitcootamundra.com.au/

For more information please visit the Cootamundra-Gundagai Regional Council Website or NSW Department of Health

https://www.health.nsw.gov.au/Infectious/diseases/Pages/coronavirus.aspxA

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Cootamundra-Gundagai Regional Council
www.cgrc.nsw.gov.au

For further media information contact:
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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

23 March 2020:

COVID-19 UPDATE 23RD MARCH 2020 – HOW OUR RESIDENTS CAN MAKE A DIFFERENCE

The COVID-19 outbreak has been declared a Global Pandemic by the World Health Organisation and it continues to create massive disruption across the world. Australian Health Authorities and Governments both Federal and State are issuing directives and guidelines on community behaviour daily.

Cootamundra-Gundagai Regional Council mayor Cr Abb McAlister said he wanted to encourage residents to follow the social distancing and hygiene announcements.

"We are in uncharted waters, daily the situation evolves and we all have to take measures to combat this virus," Cr Abb McAlister said.

"The CGRC team, are working on advice from Health authorities and looking at what Council can do to make our region as safe as it can be. We can't do that, unless our residents take this seriously and follow the social distancing and hygiene strategies put forward by the health authorities. I urge all residents to think about their safety and the safety of others," Cr McAlister added.

Cootamundra-Gundagai Regional Council requests that face to face contact with our Customer Service Team be kept to essential contact only. For day to day transactions such as payments of rates, applications and general requests online options are available via Council's website or Council can be contacted by phone 1300 459 689 or email mail@cgrc.nsw.nsw.gov.au during office hours. For out of hours emergencies, residents can still contact Council by phone 1300 459 689.

If you are ill, please do not visit a Council venue.

We can all help to slow the spread of COVID-19 in Australia. If you believe you may have contracted the COVID-19 virus (returned travellers/had contact with a confirmed case/showing symptoms: fever, sore throat, dry cough and shortness of breath) you should:

- call HealthDirect 1800 022 222 or
- call the Murrumbidgee COVID-19 Hotline 1800 831 099 or
- contact/phone your GP, advise them in advance if you have symptoms
- If you are sick – stay away from others.

HYGIENE

Practice food, hand and sneeze/cough hygiene;

- wash your hands frequently with soap and water, before and after eating, and after going to the toilet
- cover your cough and sneeze, dispose of tissues, and use alcohol-based hand sanitiser, and
- if unwell, avoid contact with others (stay more than 1.5 metres from people).

SOCIAL DISTANCING

Social distancing is an effective measure, but it is recognised that it cannot be practised in all situations and the aim is to generally reduce potential for transmission.

While practising social distancing, people can travel to work (including public transport). For non-essential activities outside the workplace or attendance at schools, universities and childcare – social distancing includes:

• avoiding crowds and mass gatherings where it is difficult to keep the appropriate distance away from others
• avoiding small gatherings in enclosed spaces, for example family celebrations
• attempting to keep a distance of 1.5 metres between themselves and other people where possible, for example when they are out and about in public place.
• avoiding shaking hands, hugging, or kissing other people
• avoiding visiting vulnerable people, such as those in aged care facilities or hospitals, infants, or people with compromised immune systems due to illness or medical treatment

SELF-ISOLATION

If you have been diagnosed with COVID-19, you must stay at home to prevent it spreading to other people.

You will be directed to stay at home if you may have been exposed to the virus - Recently travelled from overseas, or been in contact with someone who has the virus.

Staying at home means you:

- Do not go to public places such as work, school, shopping centres, childcare or university
- Ask someone to get food and other necessities for you and leave them at your front door
- Do not let visitors in — only people who usually live with you should be in your home
- You do not need to wear a mask in your home. If you need to go out to seek medical attention, wear a surgical mask (if you have one) to protect others.
- You should stay in touch by phone and on-line with your family and friends.

BULK-BUYING

There is no need to bulk-buy products at supermarkets including toilet paper, paracetamol and canned food.

It is prudent for households to have a small stock of non-perishable groceries to cover the event that in the coming months the household has been asked to self-isolate for 14 days. However, it's important to note the role of family and friends in supporting those in isolation.

Residents are encouraged to keep up to date by checking the CGRC website regularly. www.cgrc.nsw.gov.au or www.health.nsw.gov.au

Photo and Caption:

Cootamundra-Gundagai Regional Council requests that cash transactions be kept to a minimum, and encourage the use of online payments or EFTPOS.

-END-

Cootamundra-Gundagai Regional Council
www.cgrc.nsw.gov.au

For further media information contact:
Maxine Imrie Media Officer 1300 459 689
Maxine.Imrie@cgrc.nsw.gov.au

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

23 March 2020

COVID-19 UPDATE 23RD MARCH 2020 – LIBRARIES OFFER SUPPORT.

The libraries in Cootamundra and Gundagai are stepping up to the challenge of offering library services to the residents across the Cootamundra-Gundagai Regional Council area.

From Wednesday both libraries will be increasing their home delivery service and introducing a take away facility to library members.

CGRC mayor Cr Abb McAlister said it was a necessary measure to scale back direct access to our library buildings.

"Our libraries are for many in our community a vital resource, the decision to reduce public access hasn't been made lightly, we have taken advice from the peak body, the Riverina Regional Library, in regards to the sanitisation of library articles. We will offer from Wednesday a phone in service where library members can phone in and have the option of either a take away service or home delivery service within the town boundaries," Cr McAlister said.

The towns' libraries will close the doors for public access on Wednesday 25th March, however access to resources will still be available through the take-away or home delivery methods. Library patrons are encouraged to phone the libraries on Cootamundra on 6940 2200, and Gundagai on 6944 0270, or via email, Cootamundra.Library@cgrc.nsw.gov.au or Gundagai.Library@cgrc.nsw.gov.au

-END-

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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

23 March 2020

COVID-19 UPDATE 23RD MARCH 2020 – WHAT COUNCIL IS DOING

Facility closures this week within the Cootamundra-Gundagai Regional Council area include:

The Cootamundra Indoor Stadium.

Visitor Information Centres – Cootamundra and Gundagai

Gundagai Gymnasiums – both of which are operated from Council facilities (Gundagai Swimming Pool complex and Tigers dressing shed at Anzac Park)

The Council libraries in Cootamundra and Gundagai will be closed to public access with home delivery and take away services offered to library patrons.

Cootamundra Aerodrome events set for 3rd and 4th April, 8th and 9th May and 22nd and 23rd May are postponed due to being non-essential gatherings.

Council will be redeploying staff to assist with increased cleaning regimes across the regions public facilities and facility maintenance.

CGRC mayor Cr Abb McAlister said we are taking the directions from the NSW and Federal Government Health authorities seriously.

"We are constantly being updated and are meeting regularly to discuss what we need to do to keep our residents and visitors safe," Cr McAlister said.

"We want to keep our people working, and we have increased challenges, the extra cleaning of public facilities needs to be more rigorous and more often than in the past, our challenge is to meet public expectations and reassure our staff and residents that Council is doing all it can in these testing times," Cr McAlister added.

Residents are encouraged to keep up to date by checking the CGRC website regularly. www.cgrc.nsw.gov.au

-END-

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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

24 MARCH 2020:

SALEYARDS TO REMAIN OPEN

The Cootamundra Saleyards will remain open as an essential service. Following discussions with Cootamundra-Gundagai Regional Council staff and Associated Agents, the next Cootamundra Sheep Sale Sheep scheduled for Wednesday 1 April 2020 commencing 8.30am will take place as planned.

With the evolving COVID-19 threat Council and Agents request, if possible, vendors not attend the sale. Agents, buyers, transport drivers and Council staff in attendance will be required to adhere to Good Hygiene practices and Social Distancing principles. The canteen will not be operating.

Stock agent Andrew Adams from Delta Ag said "In these uncertain times we have to expect to make some sacrifices, it is great that Council is doing all it can to keep the sale yards operating."

CGRC mayor Cr Abb McAlister said the operation of the sale yards is essential.

"Council, in conjunction with local Agents, is dedicated to ensuring the Cootamundra Saleyards continues operation and I ask Saleyard users to assist us in ensuring this remains possible,"
Cr McAlister said.

Photo and caption
Cootamundra Saleyards to remain open, with strict social distancing, increase hygiene and reduced attendance practices put in place.

-END-

Cootamundra-Gundagai Regional Council
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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

24 March 2020

CGRC encourages residents to utilise online methods.

Cootamundra-Gundagai Regional Council is encouraging all residents to use the online options available for most Council based transactions during the COVID-19 pandemic.

In an effort to reduce the amount of fact to face contact Council's customer service team deal with on a daily basis. Council is constantly managing and updating information and services available for residents seeking information through Council's website: www.cgrc.nsw.gov.au .

Payment of rates and other Council fees can be made via BPay (reference numbers are included on all notices), Telephone 1300 276 468 (credit card only), Online www.bpoint.com.au (credit card only), or by post PO Box 420 Cootamundra 2590 (with cheque or money order). Should residents absolutely need to pay in person at the Council offices, please ensure social distancing (1.5metres) is practiced. If you are feeling unwell, please do not enter the building.

If you're seeking council approval on a new build or renovation, you can now submit development applications (DA) online – anywhere, anytime, with the online DA lodgement service. These applications can be submitted online through the NSW Government Planning Portal https://www.planningportal.nsw.gov.au/onlineDA. The portal does have a 'Your guide to the Development Application process' information pack to guide applicants through the process. Council staff are also able to assist with questions over the phone or via email.

Residents are also able to access library facilities, via the Home Delivery (town boundaries) or Take Away services. Up to 30 items can be borrowed at each transaction. Books, magazines, DVD's and CD's are available. Residents can also download the free apps to take the library with you, wherever you are. For more information on these free apps, visit the Riverina Regional Library website https://rrl.nsw.gov.au/library-apps/. Most products including BorrowBox require your member number followed by a Password/PIN. These apps include ULibrary, BorrowBox which allow users to borrow, browse, read and listen to eAudiobooks and eBooks. Rb digital allows reader to access digital magazine collections and Kanopy is a streaming service for films and documentaries.

Photo and caption:

A list of Free Apps available to library members.

-END-

Cootamundra-Gundagai Regional Council
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Home

President's Message 20 March 2020

Related Links

Latest News

President's message

Economic Stimulus for Local Governments, join us to take action

Join Local Government NSW in calling for the Federal and State Governments to direct economic stimulus packages to local governments.

Local councils are best placed to deliver locally led solutions, including recovery efforts and economic stimulus in response to the global COVID-19 pandemic – as demonstrated during bushfires, drought and floods.

We know economic stimulus provided to local governments during the Global Financial Crisis were effective at generating significant local economic recovery for Australia.

Further NSW government stimulus packages must include substantial funding and resources for councils to help drive local economic recovery for every corner of the state, ensuring local employment and support for local businesses across NSW, as well as ongoing investment in public infrastructure and community services for the public good.

But what works in the City of Sydney may not work in Cobar. We need the NSW Government to support local economic development strategies to boost jobs and the resilience of every community across NSW. We know Councils can deliver this.

Please join LGNSW in calling for economic stimulus for NSW councils by passing a motion, writing a letter to your State and Federal MPs and undertaking local media about this issue.

This week we have successfully secured you:

- **Progress towards legislative change needed to enable councils (as democratically-elected bodies) to meet via phone or video-conference** facilities as a social distancing measure. Minister for Local Government Shelley Hancock has advised this change is imminent. For further information, email Senior Policy Officer Elizabeth Hayes.
- **Advocacy for certainty on local government election dates**. While LGNSW does not have a policy position on whether to delay local government elections, we've called on the NSW Government to provide certainty for councillors, candidates and communities. LGNSW will continue to liaise with the NSW Government on this matter as a priority. For further information contact Strategy Manager Damian Thomas on 02 9242 4063 or by email
- **Clarification on the delivery of grocery and other supplies to supermarkets and retailers**. We're proud to note the acknowledgement from Minister for Planning and Public Spaces Rob Stokes MP that councils and retailers have been working well together to allow greater flexibility in delivery hours already. Nevertheless, the introduction by the NSW Government of a new SEPP to lift curfews under a COVID19 State Environmental Planning Policy is now in place until October and it will potentially ease some of the administration burden on Councils. Contact

Strategy Manager Jane Partridge on 02 9242 4093 or by email should you have any ongoing issues.

- ***Clarification on the Joint Workplace Response to COVID-19*** by LGNSW, the United Services Union, Local Government Engineers Association and Development and Environmental Professionals Association on how councils and their staff should respond from a workplace relations perspective. Whilst this is an advisory guide only, it is imperative councils uphold their legal and other obligations to balance budgets, occupational health and safety obligations and moral obligations to continue to employ people where we can to provide council's essential services, during challenging times. For further information, email LGNSW Workplace Relations Unit or call (02) 9242 4142.

WINS!

- ***NSW Government-funded rates relief for properties destroyed beyond repair by bushfire:*** We welcomed the government's announcement of six months of council rates relief, including the land rates component and fixed service charges such as waste, water and sewerage.
- ***Council of Australian Governments review of Disaster Recovery Funding Arrangements:*** Leaders agreed to review and, if necessary, update and streamline arrangements following the experience of the national-scale bushfire disaster. They also agreed to take immediate action to improve the resilience of the national telecommunications network and consider how to adapt the built environment to future climate and hazard conditions.
- ***Bridges renewal program:*** We welcomed the Deputy Prime Minister's announcement this week that applications are now open for the federal government Bridges Renewal Program, Round 5, and the Heavy Vehicle Safety and Productivity Program, Round 7. Councils affected by bushfires will be assessed as a priority, but all councils are able to apply. The total available funding across the two programs is $300m.

HELP AMPLIFY OUR SECTOR'S ADVOCACY WORK

Good communication is critical during emergencies like the COVID-19 outbreak. LGNSW is monitoring and responding to latest developments and assessing and addressing any potential impacts of State and Federal government measures on local government. However, we'd appreciate your help.

- **Tell us what you need and the issues you are experiencing in relation to COVID-19.** It's important to acknowledge a lot of what is happening is unprecedented. These circumstances demand flexibility from all of us. Please let us know if we can support you should service delivery be potentially impacted by this pandemic or you have issues or concerns in relation to the confirmed cases in your communities.
- **Help us secure funding and action to Save our Recycling.** The NSW government must set aside extra funding in this year's state budget for recycling glass and other waste ahead of an export ban in July. We need fast tracked funding for council-led recycling measures. Please resolve the Save our Recycling Mayoral Minute. For further information, call 9242 4080 or email Susy Cenedese, Strategy Manager - Environment.
- **Promote the importance of superannuation for Councillors** by moving a resolution at your council, ensuring your council is sharing your views with the Office of Local Government, or by contributing to the LGNSW submission via email to the Workplace Relations Unit.

REMINDER:

All employers covered by the Award are to provide the Industrial Relations Commission information relating to casual, labour hire and fixed term contract employees by no later than 4pm on 30 March 2020.

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

-FOR IMMEDIATE RELEASE-

25 March 2020:

BOUNDARIES COMMISSION SUBMISSIONS INVITED

Residents across the Cootamundra-Gundagai Regional Council local government area (LGA) can make submissions to the Boundaries Commission in relation to the de-amalgamation of the Cootamundra-Gundagai Regional Council from Tuesday 24th March 2020.

The Boundaries Commission has determined that public notices of the proposal and a call for submissions will be advertised in local and national newspapers. The notices will also appear on CGRC and Office of Local Government websites from Tuesday 24th March.

Residents can also access a "Frequently Asked Questions" document from Councils website www.cgrc.nsw.gov.au/boundaries-commisson-inquiry or www.olg.nsw.gov.au/lgbc

Council has engaged Professor Joseph Drew to develop a series of short (5 minute) videos explaining various important concepts. Dr Drew's video on lodging submissions can be viewed on the CGRC Website by following the link https://www.cgrc.nsw.gov.au/boundaries-commission-inquiry. This video encourages residents to write a submission even if they have already done so, and gives a clear and concise message on what the submission should contain.

Other videos are included that give residents an explanation of other important concepts such as rate harmonisation and harmonisation of fees and charges such as wast, water and sewerage.

Submissions will be close on Friday 24th April 2020.

-END-

Cootamundra-Gundagai Regional Council
www.cgrc.nsw.gov.au

For further media information contact:
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Maxine.Imrie@cgrc.nsw.gov.au

29/01/2020

wma water

Cootamundra Flood Study

Model Build & Calibration

Floodplain Management Committee Meeting #2

29th January 2020

www.wmawater.com.au

1

Meeting Overview

- Flood Study Process Recap
- Work to date
  - Community Consultation
  - Data Collection
  - Model Build
  - Calibration
- What's next?
- Project Timeline

Muttama Creek at Thompson Street, Sept 2016

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

wma water

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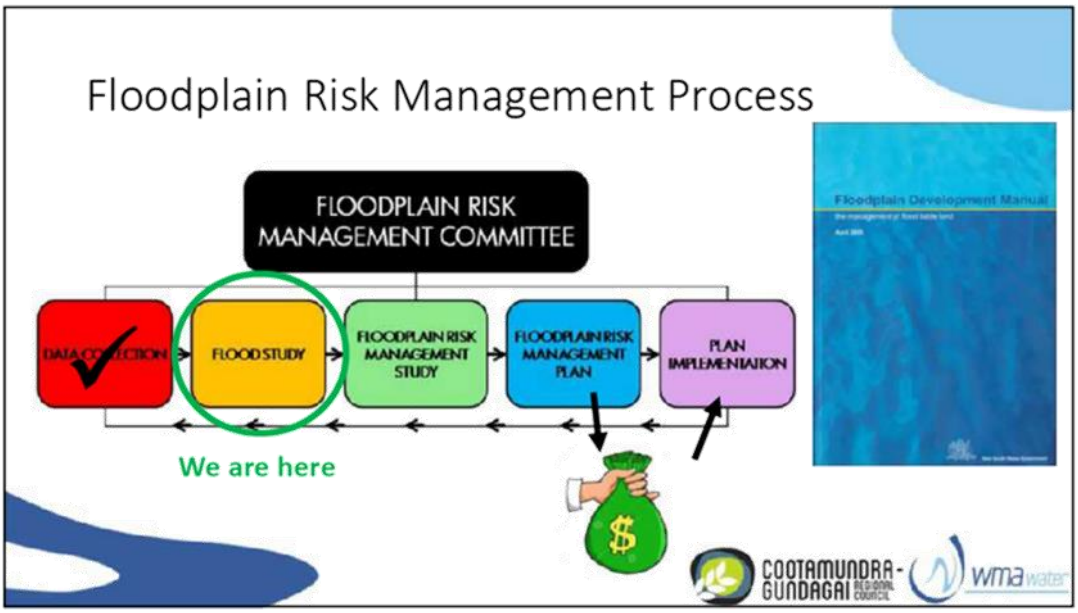
29/01/2020



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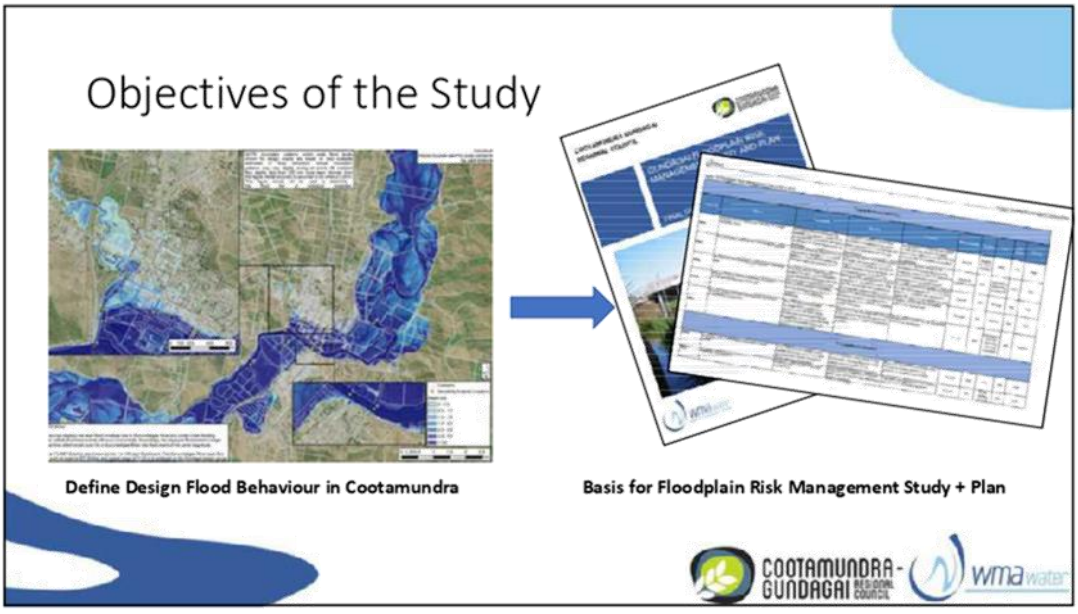

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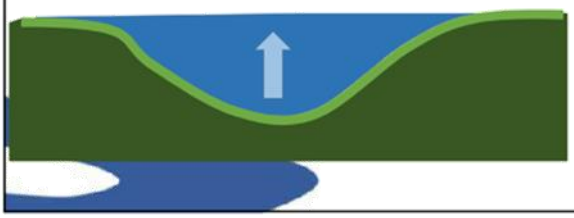
Flood Risk in Cootamundra

Mainstream Flooding:

- Muttama Creek
- Jindalee Creek
- Cootamundra Creek



COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL wma water

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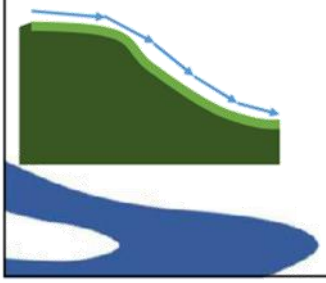
Flood Risk in Cootamundra

Overland Flow



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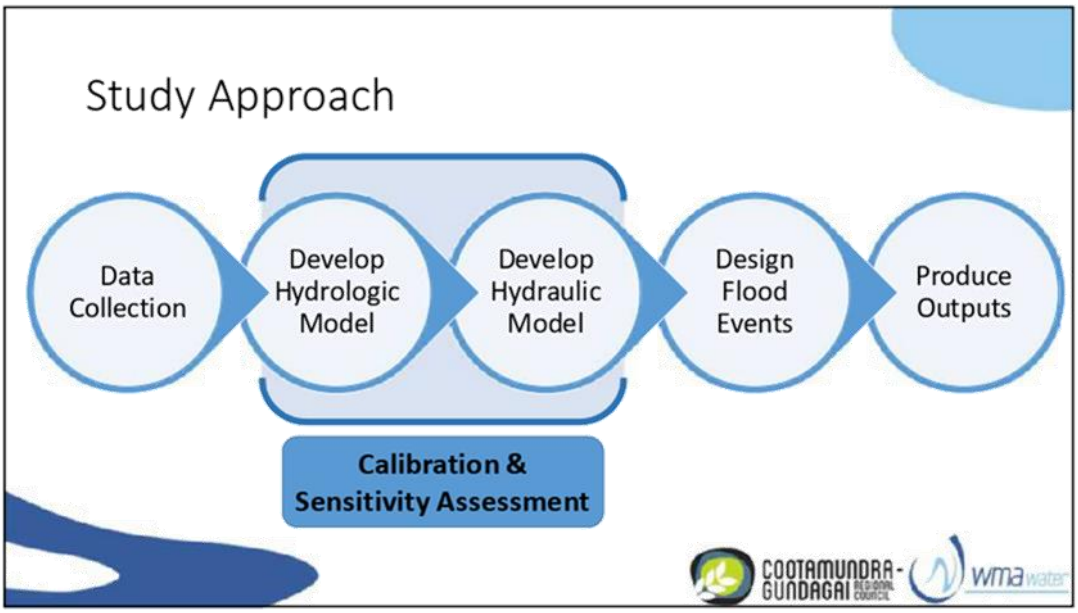

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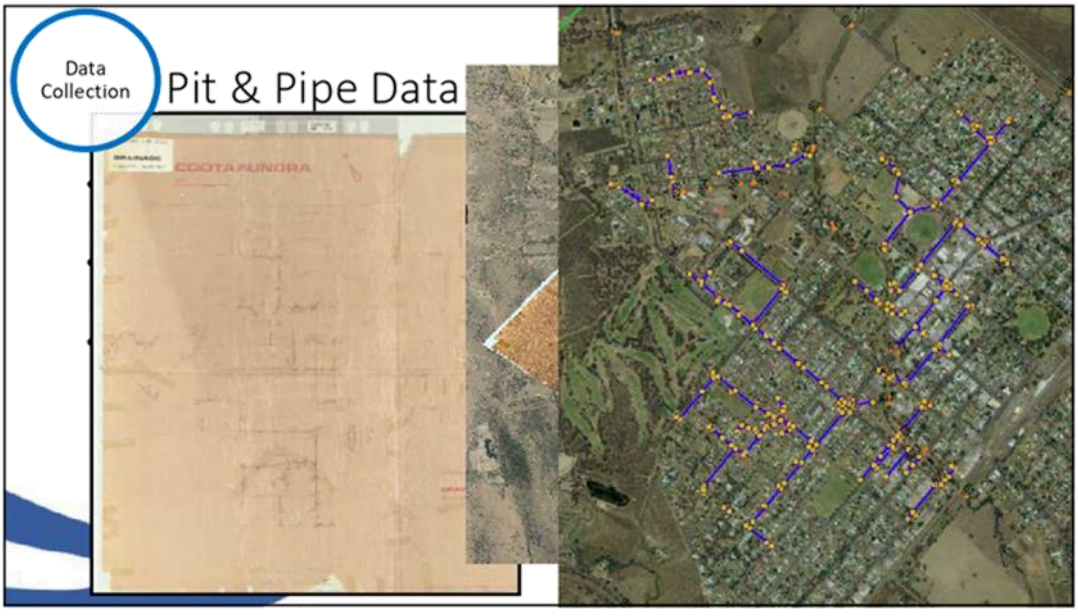

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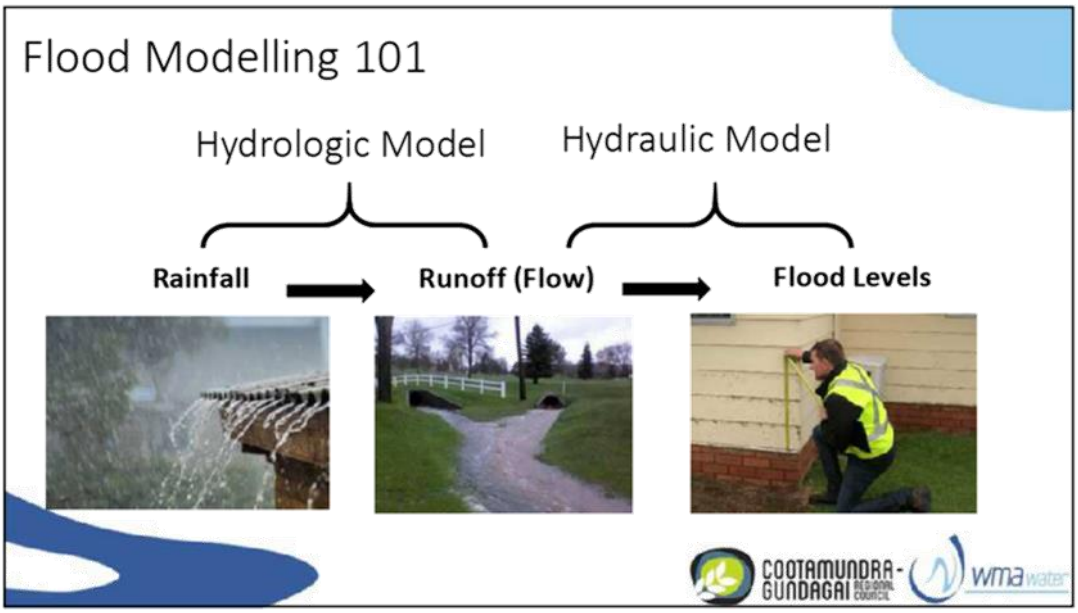
Flood Modelling 101
Hydrologic Model
Hydraulic Model
Rainfall
Runoff (Flow)
Flood Levels
COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
wma water

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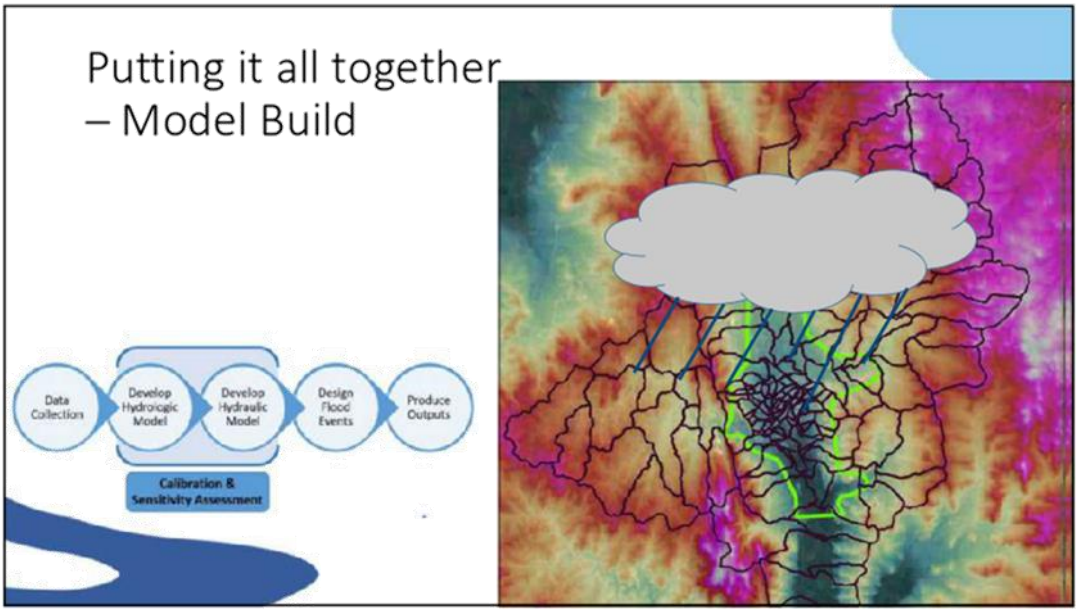
Putting it all together – Model Build
Data Collection
Develop Hydrologic Model
Develop Hydraulic Model
Design Flood Events
Produce Outputs
Calibration & Sensitivity Assessment

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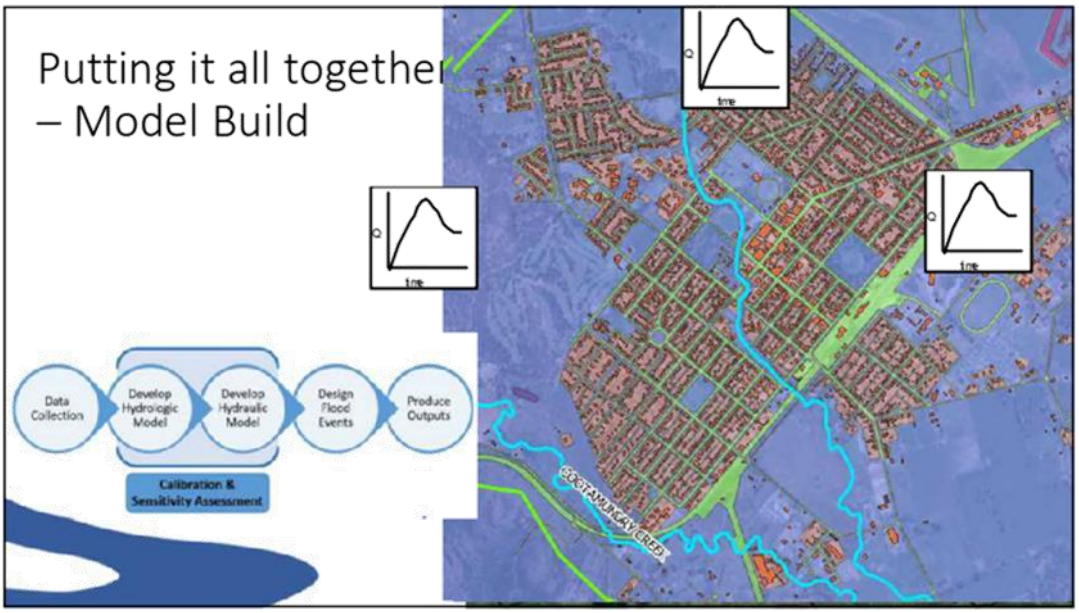
29/01/2020



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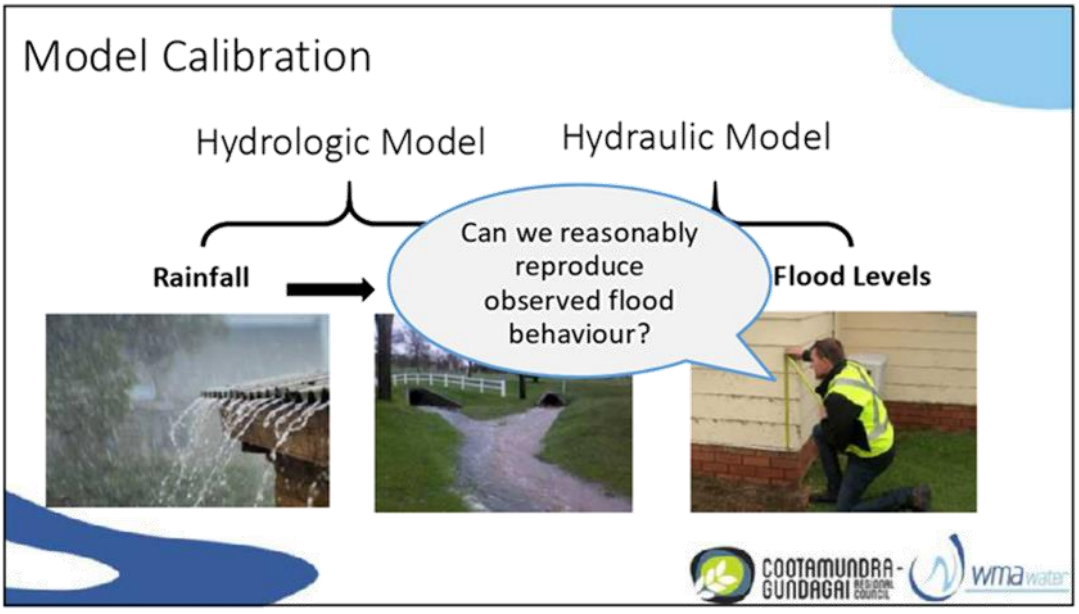

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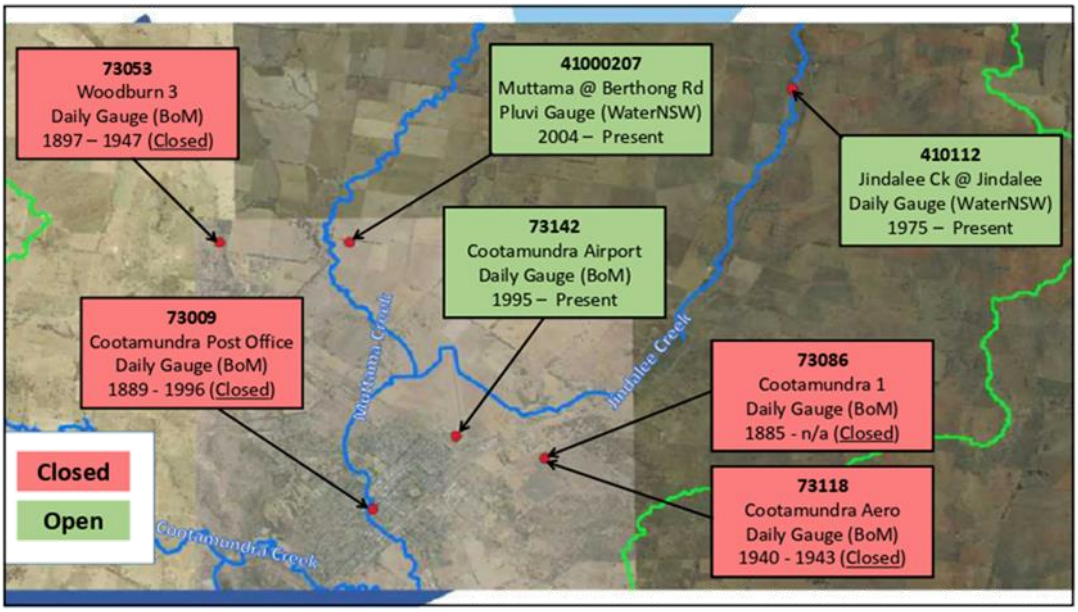

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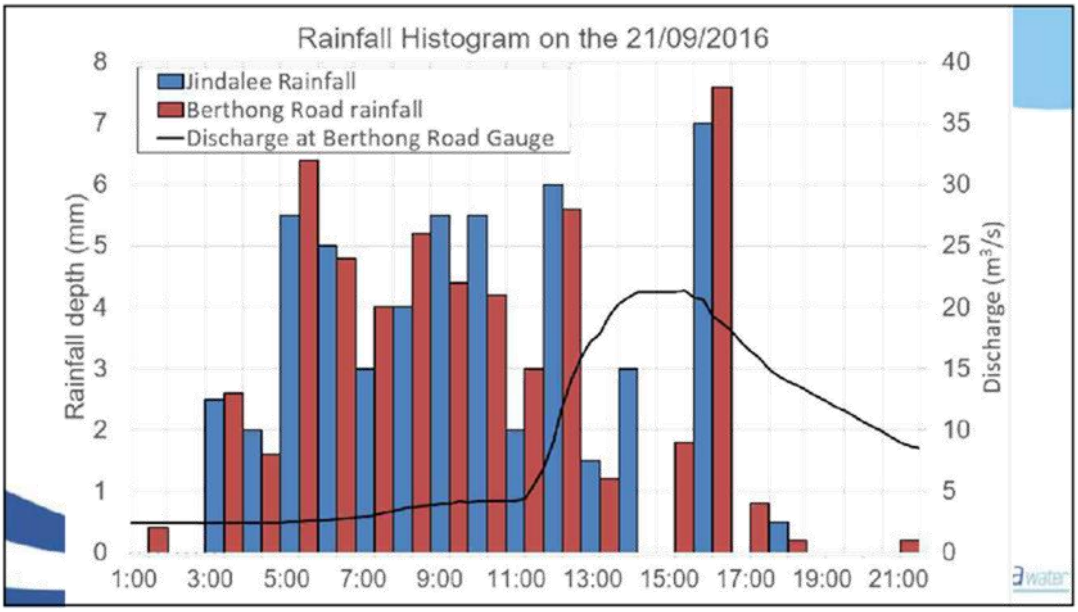

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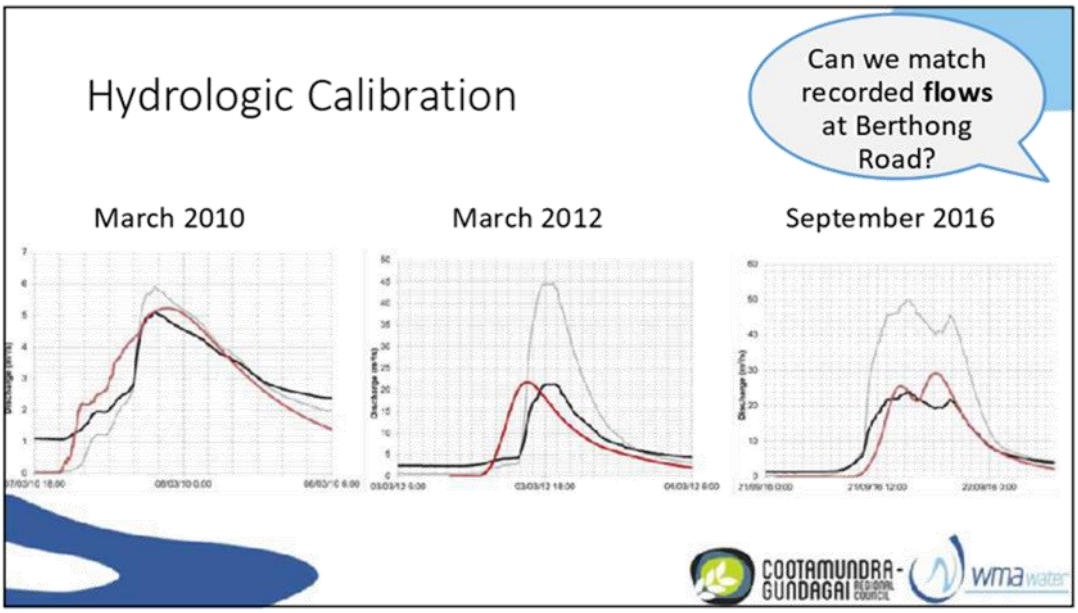

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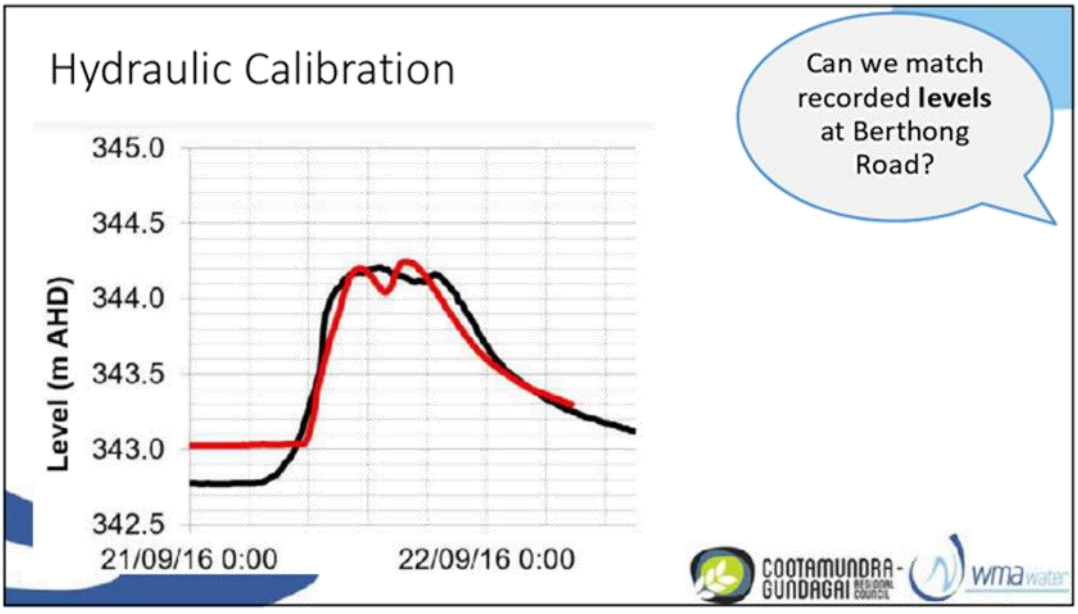

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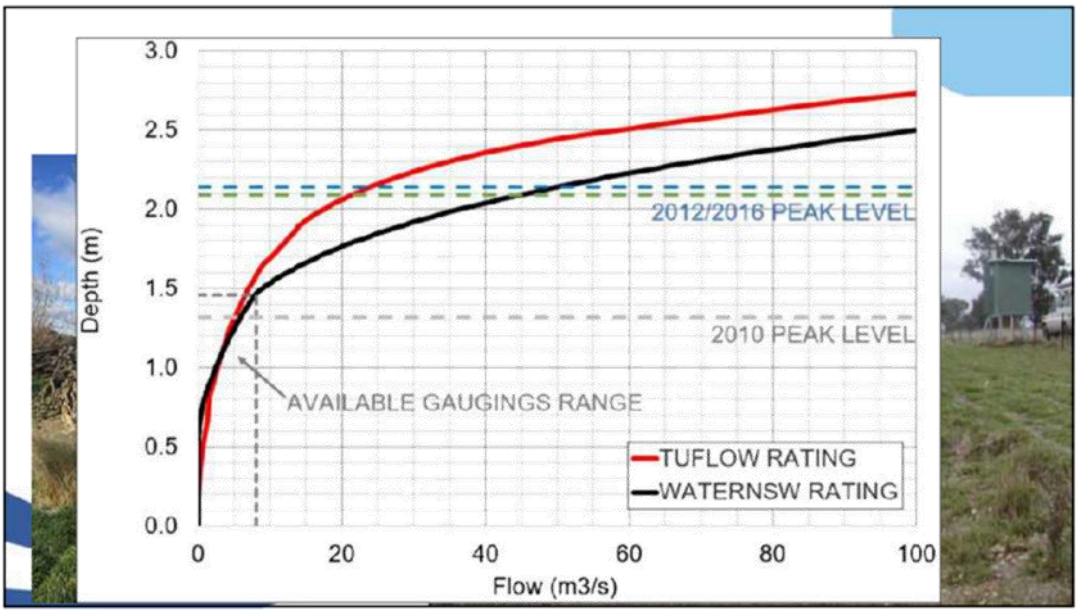

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Calibration

January 1974 Flood event:

Data available:

- 6 Flood Marks
- Daily Rainfall: 132 mm over 2 days at Cootamundra Post Office

1986 Flood Study estimated the peak flow of 76 m^3/s at a point where the flow was confined (location not specified)

➢ Not appropriate for this study

Can we use any older flood events?

29

Calibration

Not enough available data for calibration on other flood events:

August 1983 and January 1984 flood event:

- Jindalee pluviometer available
- no flood marks available
- no stage hydrograph available

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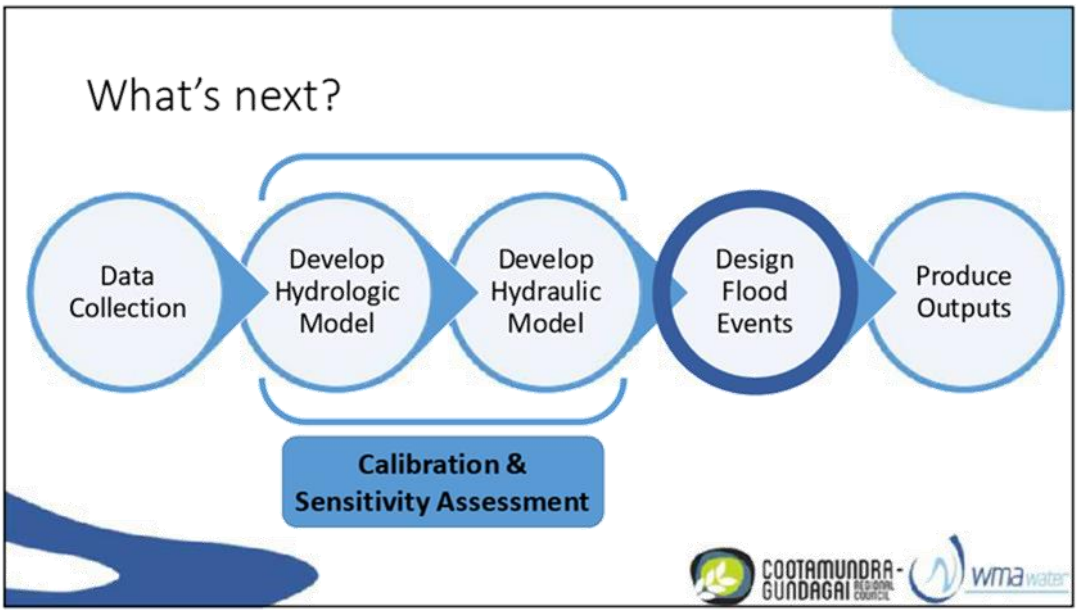

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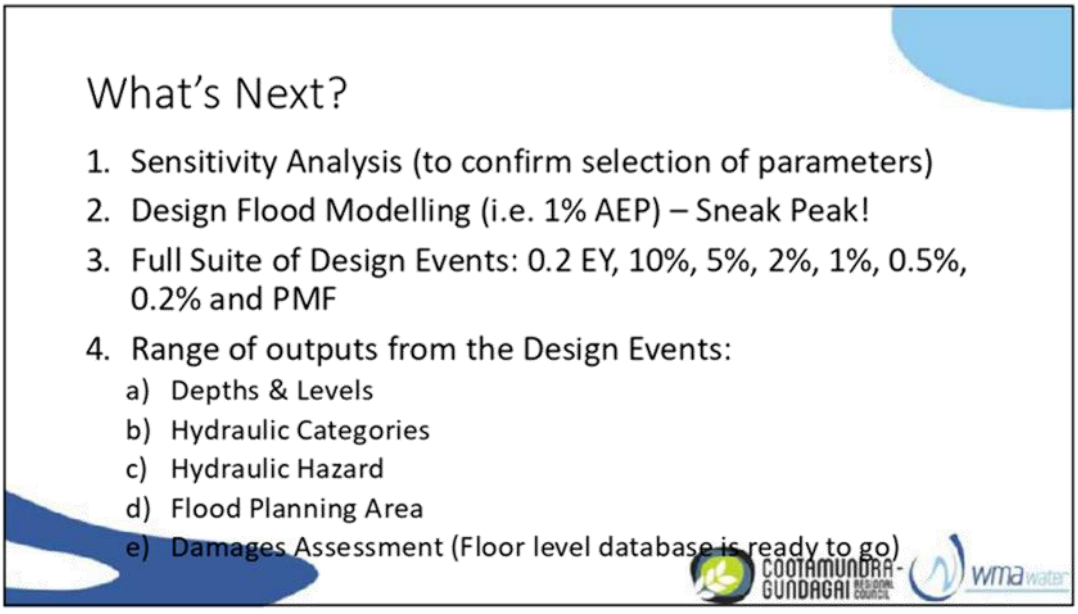

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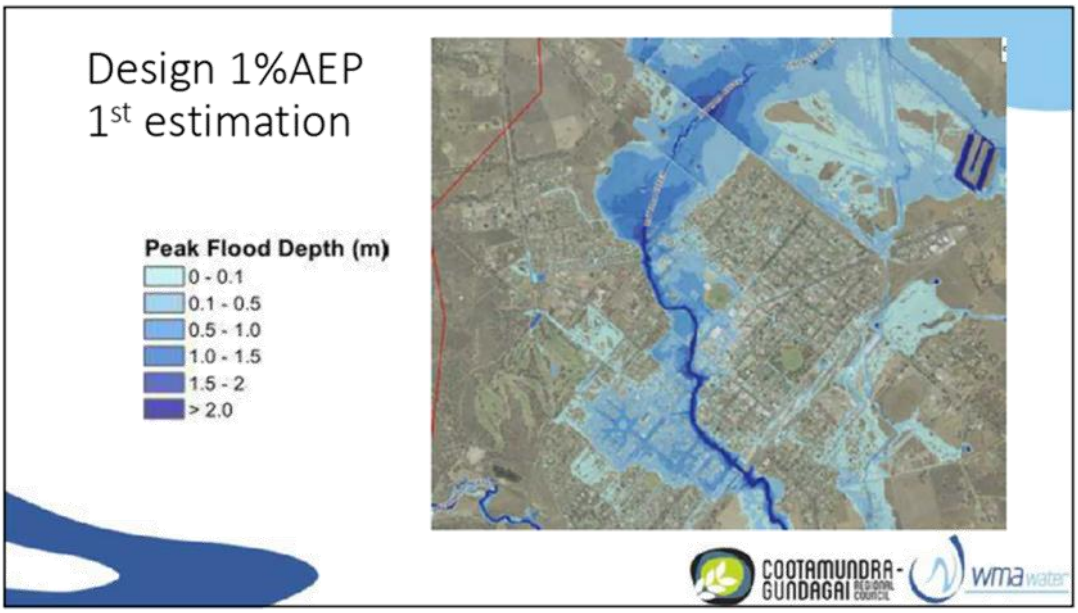

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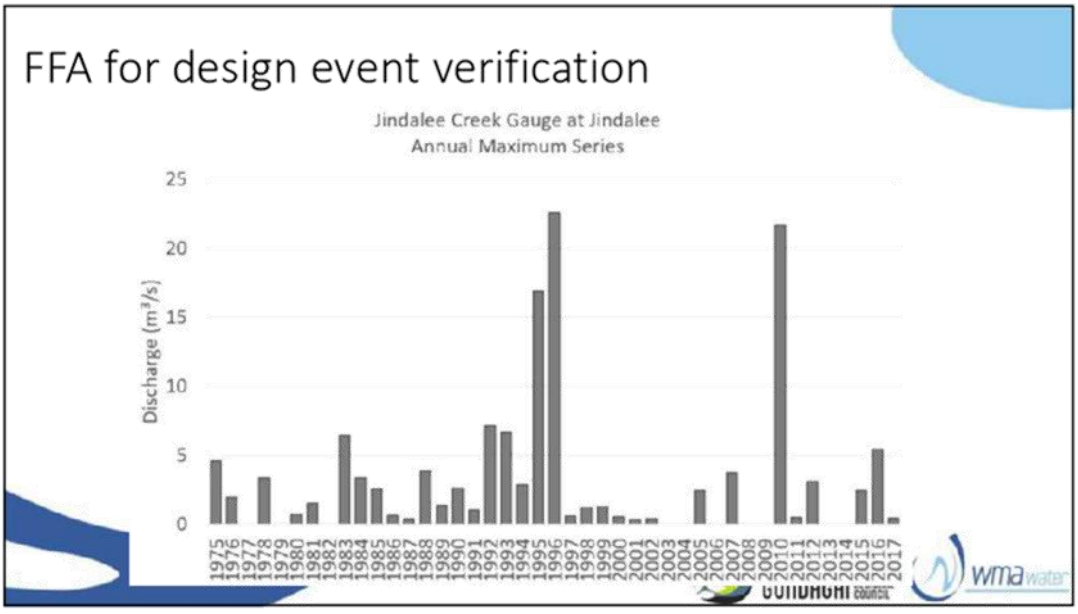

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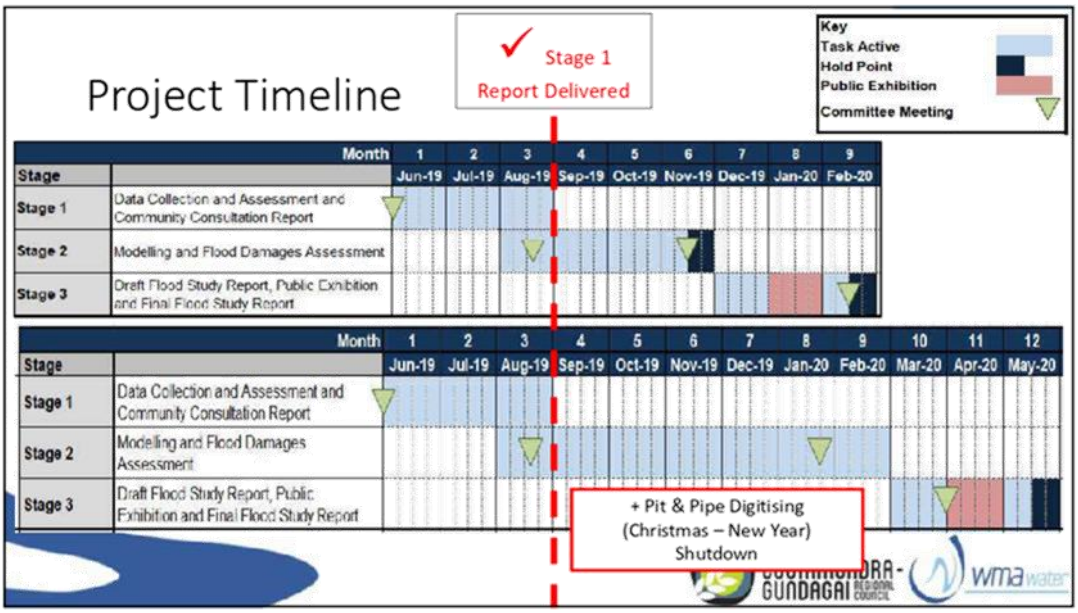

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GP SYNERGY

ABN 52 099 141 689
ACN 099 141 689

10 February 2020

Mrs Katrina Humphries
Chairwoman
Attention Country Mayors' Association

Council@mpsc.nsw.gov.au

Dear Katrina

ATTRACTING DOCTORS TO RURAL TOWNS

Further to our conversation last month, I am writing to ask if the Country Mayors' Association members could nominate a staff member per town that could be a 'go to' person for potential rural doctors to meet and speak with when visiting rural centres with a view to future work.

GP Synergy is the largest federally funded GP training provider in Australia and is contracted to deliver the Australian General Practice Training (AGPT) program for whole of NSW and the ACT. As part of my role, I directly place Rural Generalist registrars with procedural skills such as anaesthesia, obstetrics and emergency medicine into towns where their skills are needed and can be used. GP Synergy also actively incentivises our trainees to go rural.

I have found during the seventeen years I have been involved in GP training that registrars who spend time with locals when visiting potential towns are more likely to move to those towns for their future practice. Those that do, talk about how they appreciated someone taking the time to meet with them over coffee or a meal and discuss the opportunities their town could offer. GP Registrars tend to want to know about the town's facilities, schools, transport, real estate and recreational opportunities which all factor into their decision regarding location of future placements.

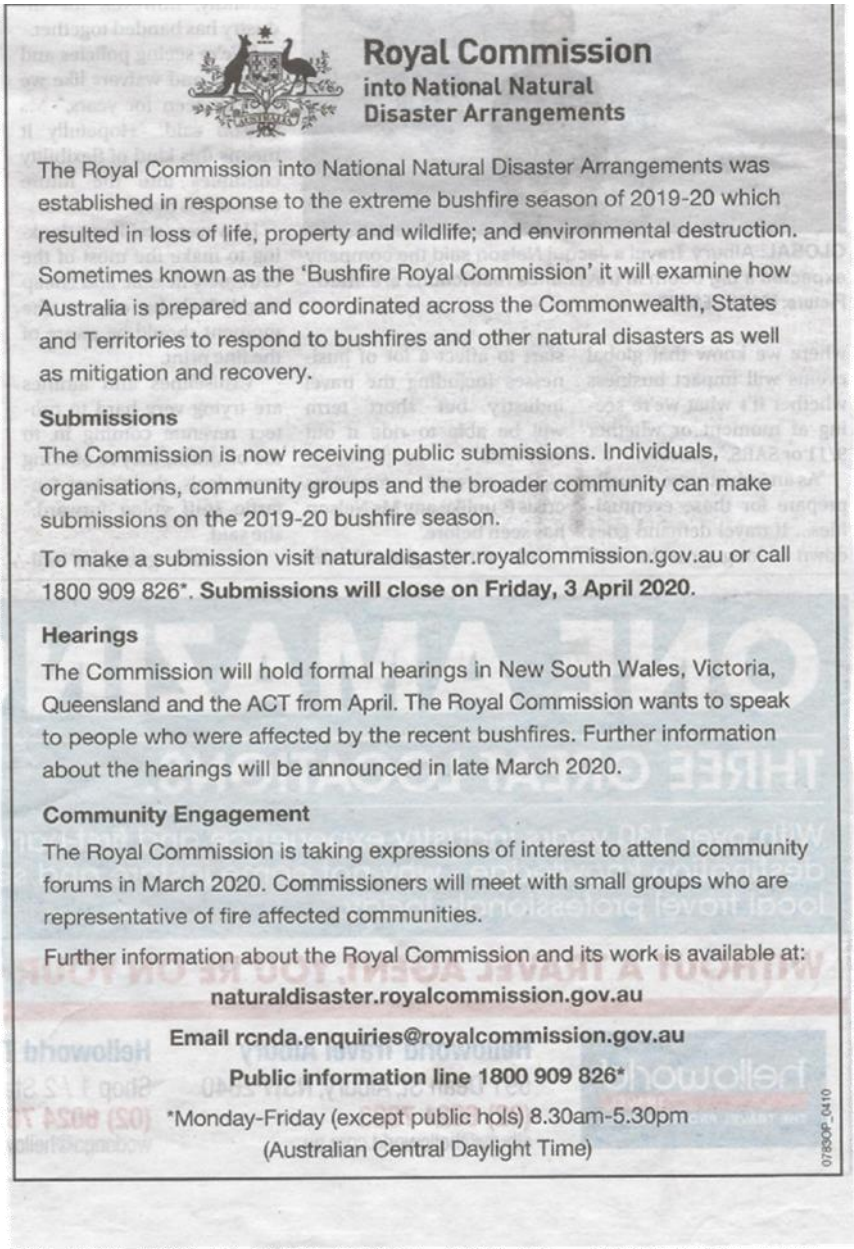
Could the Country Mayors' Association please consider providing me with the contact details of a staff member per town that could meet with potential GP Registrars who wish to visit?

This list would be for our internal use only and not distributed more widely without express permission.

Yours sincerely

Ms Felicity Gemmell-Smith
Special Education Programs Manager

P 1300 477 963 F +61 2 9756 5755 E info@gpsynergy.com.au A PO Box 3398 Liverpool Westfield NSW 2170 W gpsynergy.com.au
ALEXANDRIA ARMIDALE BALLINA CANBERRA DUBBO LIVERPOOL NEWCASTLE WAGGA WAGGA WOLLONGONG
GP Synergy acknowledges the traditional owners of country. We pay our respects to them, and their cultures, and to their elders both past and present.



Royal Commission
into National Natural Disaster Arrangements

The Royal Commission into National Natural Disaster Arrangements was established in response to the extreme bushfire season of 2019-20 which resulted in loss of life, property and wildlife; and environmental destruction. Sometimes known as the 'Bushfire Royal Commission' it will examine how Australia is prepared and coordinated across the Commonwealth, States and Territories to respond to bushfires and other natural disasters as well as mitigation and recovery.

Submissions

The Commission is now receiving public submissions. Individuals, organisations, community groups and the broader community can make submissions on the 2019-20 bushfire season.

To make a submission visit naturaldisaster.royalcommission.gov.au or call 1800 909 826*. **Submissions will close on Friday, 3 April 2020.**

Hearings

The Commission will hold formal hearings in New South Wales, Victoria, Queensland and the ACT from April. The Royal Commission wants to speak to people who were affected by the recent bushfires. Further information about the hearings will be announced in late March 2020.

Community Engagement

The Royal Commission is taking expressions of interest to attend community forums in March 2020. Commissioners will meet with small groups who are representative of fire affected communities.

Further information about the Royal Commission and its work is available at:

naturaldisaster.royalcommission.gov.au

Email rcnda.enquiries@royalcommission.gov.au

Public information line 1800 909 826*

*Monday-Friday (except public hols) 8.30am-5.30pm
(Australian Central Daylight Time)

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Strengthening local government

NSW GOVERNMENT Office of Local Government

Circular to Councils

Circular Details	20-04 / 21 February 2020 / A692152
Previous Circular	*If applicable*
Who should read this	Councillors / General Managers / Council Land Use Planning staff
Contact	Bushfire Response Advice Line on 13 77 88 or codes@planning.nsw.gov.au
Action required	Information

Land use planning changes to assist communities recover from NSW bushfires

What's new or changing

- Due to the recent bushfires and the number of homes and properties damaged and destroyed the NSW Government has introduced several changes to planning rules to make it easier for people to recover and rebuild.

What this will mean for your council

- The NSW Government is committed to managing timely rebuilding processes for councils and their communities.
- Changes to planning rules have been made to ensure more people impacted by the bushfires are able to clean up and make safe their property and allow bush fire affected people to establish temporary accommodation, without the need for council approval.
- From 4 February 2020, the applicable government planning fees – BASIX Certificate and the Planning Reform Fund fees – will be waived on all development applications related to homes damaged or destroyed in the recent bushfires.
- From 5 February 2020, councils have the flexibility to modify conditions applying to a primitive camping ground, provided the council is satisfied it is necessary for the purposes of accommodating people who have lost their homes in the bushfires.
- Council staff should ensure they are aware of the regulatory changes and ensure relevant guidance is updated as necessary.

Key points

- Amendments to the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008 (Codes SEPP) allow a range of low impact works to be carried out as exempt development. These works need to meet the relevant development standards in order to be carried out without council approval, including:
  - Temporary repairs and non-structural permanent repairs to damage caused by a declared state of emergency in relation to the bushfires can be carried out as exempt development. The repairs need to be carried out within two years of the state of emergency being declared
  - People will be able to temporarily put a shipping container on private land affected by the fires for storage purposes, where a state of

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emergency, in relation to the bushfires, has been declared, for up to two years
    - People impacted by bushfires will be able to demolish buildings that have been substantially damaged by bushfire. People will also be able to partially demolish buildings to make them safe.
- These changes commenced on 31 January 2020.
- Amendments to the *Local Government (Manufactured Homes Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005* assist in the provision of emergency accommodation for persons affected by bushfires. These changes include:
    - People who are unable to return to their homes as a result of a bushfire will be able to stay in a moveable dwelling, such as a caravan, in a caravan park or camping ground for an extended period of up to two years without the need for council approval
    - People whose homes have been badly damaged in a bushfire can install a moveable dwelling, such as a caravan, on land without council approval for up to two years. If a person wishes to stay in the moveable dwelling beyond two years, council approval will be needed.
- These changes commenced on the 5 February 2020.
- Affected property owners can contact the Department to arrange for a BASIX Certificate to be issued free of charge. Councils can refer applicants to the dedicated BASIX bushfire recovery hotline. The contact number is 1300 054 464.
- The NSW Government has been working in partnership with bushfire-affected councils on the new planning provisions.
- The NSW Government is continuing to work with councils and state agencies on what else is needed to support the recovery and rebuilding effort.

Where to go for further information

- Further information on the changes is available at https://www.planning.nsw.gov.au/Policy-and-Legislation/Bushfires-recovery

Tim Hurst
Deputy Secretary
Local Government, Policy and Planning

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3 March 2020

Mr Phil McMurray
General Manager
Cootamundra-Gundagai Regional Council
PO Box 420
COOTAMUNDRA NSW 2590

Also via email: mail@cgrc.nsw.gov.au

Dear Mr McMurray

Building stronger partnerships with local councils

Essential Energy is focused on improving strategic relationships with local councils. We recognise we need to offer local councils safe, reliable and affordable services that meet the changing needs of councils, whilst facilitating new energy solutions to deliver the network of the future. We also recognise that electricity is a non-discretionary purchase and is a critical enabler of economic activity.

Our current focus is on improving streetlighting service levels to enhance public safety and wellbeing and automating our network connections process to better support regional development. To facilitate these and other opportunities for operational improvement, I am looking to strengthen Essential Energy's relationship with local councils through a series of actions. These actions are outlined below.

- **Focusing on council relationships at an Executive level**
  As part of my Executive responsibilities for asset management and engineering, I am focused on driving improved relationships with local councils.

- **Establishing a new, dedicated role to build stronger relationships**
  A new Head of Strategic Council Partnerships will report directly to me and drive a whole-of-business approach to engaging with councils to ensure that our strategic planning reflects the needs of local councils. The new Head of Strategic Council Partnerships is Geoff Burgess.

  Geoff Burgess
  Head of Strategic Council Partnerships
  Mobile: 0408 259 518
  Email: geoff.burgess@essentialenergy.com.au

- **Piloting a joint strategic planning initiative**
  On 7 February 2020, we piloted a joint strategic planning approach with Tamworth Regional Council, aiming to building linkages between our systems, processes and future energy needs planning. We shared information on some of the renewable energy trials we are working on and canvassed opportunities for Essential Energy to assist Tamworth Regional Council's future energy sourcing strategies. Future workshops with other local councils will be based on learnings from this pilot

- **Engaging with all Councils on a regular basis**
  A few months ago, we invited all regional local councils, in groups of five to six, to attend a series of video conferences on streetlighting. Of a total of 86 councils in our electricity distribution area, more than 60 attended. Feedback from the sessions was highly positive.

  We are holding video conference engagements during February/March 2020 and have expanded the agenda to cover streetlighting, connections, strategic planning, easements, development applications, vegetation management and more. Contact has been made with councils to nominate the relevant attendees from their councils for these sessions.

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Telephone: (02) 6589 8619 | Interpreter Services 13 14 50 | essentialenergy.com.au

Essential Energy has been transforming its business over recent years. Our core business has transformed from being a distributor and retailer, supplying electricity to residential and business customers through our network of poles and wires as well as retailing electricity, to becoming a network-only business, responsible solely for distributing electricity. We distribute electricity to around 855,000 customers across regional, rural and remote areas of NSW.

How we operate has been influenced by a number of regulatory changes. These changes include the introduction of competitive market protections through national Ring Fencing Guidelines and a Competition in Metering Rule Change under 'Power of Choice', strengthening of laws around vegetation in proximity to the network and maintenance of private assets in relation to bushfires.

The industry in which we operate is also undergoing a fundamental transition to decarbonisation, decentralisation and digitisation that will, in time, result in lower cost, more reliable and less carbon intensive energy.

I look forward to working with all local councils to support regional growth and opportunity through the measures outlined above.

In the meantime, if you would like to discuss any aspect of our operations, please do not hesitate to contact me either by phone, on 02 6589 8619, or e-mail via david.salisbury@essentialenergy.com.au.

Yours sincerely

David Salisbury
Executive Manager Engineering

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Australian Government
Australian Radiation Protection and Nuclear Safety Agency

arpansa

3 February 2020

Cootamundra Gundagai Regional Council
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Ref: 2020/00283

Cr Abb McAlister, Mr Phil McMurray
Cootamundra-Gundagai Regional Council
PO Box 34
GUNDAGAI NSW 2722

Re: Public concern around 5G mobile networks and impact on people and the environment

Dear Cr McAlister and Mr McMurray

I am writing to you with information about the new generation of mobile phone technology - 5G. In recent months, the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) has received a growing number of enquiries from local governments around Australia with respect to 5G mobile networks and concerns about the impact on the health of individuals or the environment. As such, I wanted to take the opportunity to provide you with some technical information that may assist should you receive similar enquiries.

ARPANSA is the Australian Government's primary authority on radiation protection and nuclear safety. This includes electromagnetic radiation, including from radio waves like those used in wireless communications, such as 5G mobile networks. In order to provide the best advice on the protection of the Australian public from the effects of radiation, ARPANSA undertakes its own research and reviews relevant scientific research. This includes research and reviews of exposure to radio waves from telecommunications sources such as mobile phone base stations – sometimes called 'towers'.

ARPANSA has no role in promoting the deployment of the 5G network, and no decision-making role regarding the regulatory arrangements. The Australian Communications and Media Authority (ACMA) regulates radio waves from mobile phone base stations and other communications installations. The ACMA's regulatory arrangements require base stations to comply with the exposure limits in ARPANSA's *Radiation Protection Standard for Maximum Exposure Levels to Radiofrequency Fields - 3 kHz to 300 GHz* ('ARPANSA RF Standard'). The ARPANSA RF Standard is designed to protect people of all ages and health status against all known adverse health effects from exposure to radio waves.

Exposure to sufficiently high levels of radio waves can heat biological tissue and potentially cause tissue damage. However, the amount of environmental radio waves routinely encountered by the general public from telecommunications sources is far too low to produce significant heating or increased body temperature. At low levels of exposure to radio waves (that is, intensities lower than those that would produce measurable heating) the evidence for harmful health effects is ambiguous and unproven. Although there have been studies reporting a range of biological effects at low levels, there has been no indication that such effects might constitute a hazard to human health or the environment.

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In a 2016 measurement survey that ARPANSA conducted on radio wave levels in the environment, we found that exposure to traditional radio broadcasts, particularly AM radio, continues to be the most dominant source of background exposure for radio waves, with exposure 50,000 times below the safety limit in the ARPANSA RF Standard. Deployment of technologies to support 5G mobile networks including small cells in close proximity to people's homes is unlikely to change this situation, with the radio wave exposure from current mobile networks currently being on average 500,000 times below the safety limit.

The 5G mobile networks in Australia will initially use frequencies in the current mobile phone network, then move to higher frequencies in the future. It is important to note that higher frequencies do not mean higher exposure. It's not expected that the higher frequencies from 5G technologies, where they are still below the limits of the ARPANSA RF Standard, will cause any health effects or impact to the environment.

Authorities around the world including ARPANSA and the World Health Organization have examined the scientific evidence regarding possible health effects from base stations and mobile phones. Current research indicates that there are no established health effects, including cancer, from the low exposure to radio waves from mobile phone base station antennas.

ARPANSA continues to review the research into the potential health effects of radio wave emissions from base stations and other sources in order to provide accurate and up-to-date advice to the Government and the Australian people. Further information or fact sheets on this and other topics can be obtained from the ARPANSA website (https://www.arpansa.gov.au). We also operate a Talk to a Scientist program that provides a unique opportunity for the public and community to talk directly with our scientists on issues about radiation exposure and protection in Australia. You are welcome to refer any individuals seeking information on 5G technologies to this program via the details on the ARPANSA website (https://www.arpansa.gov.au/talk-to-a-scientist).

You may also be aware that the Commonwealth Government recently announced a $9 million program over four years[1] to provide additional funding for research and to deliver accessible information to communities about the safety of regulated radio waves from telecommunications facilities. Relevant departments and agencies including ARPANSA are working on the detail and deployment of this program, and I expect further information will be provided in future.

I hope this information provides some assurance around the state of the science, and assists you with managing any concerns raised in your local government area.

Yours sincerely

Dr Gillian Hirth
Chief Radiation Health Scientist
Australian Radiation Protection and Nuclear Safety Agency

[1] https://www.minister.communications.gov.au/minister/paul-fletcher/news/building-community-confidence-5g-safety

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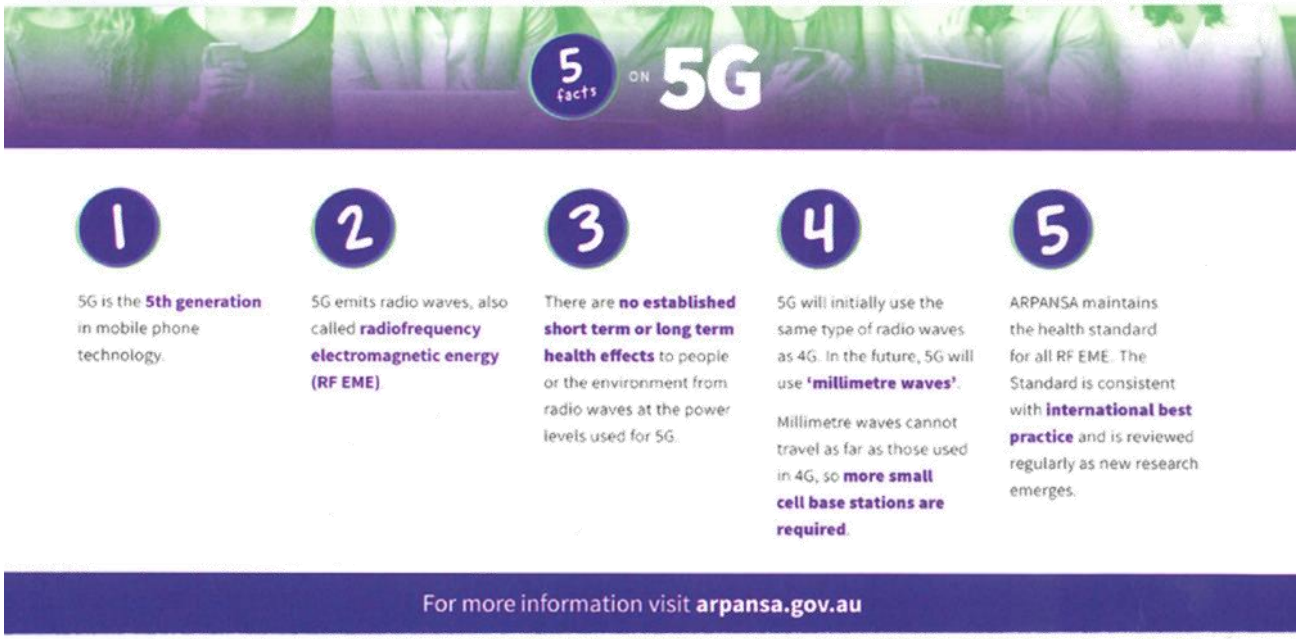
5 facts ON 5G
1
5G is the 5th generation in mobile phone technology.
2
5G emits radio waves, also called radiofrequency electromagnetic energy (RF EME)
3
There are no established short term or long term health effects to people or the environment from radio waves at the power levels used for 5G.
4
5G will initially use the same type of radio waves as 4G. In the future, 5G will use 'millimetre waves'.
Millimetre waves cannot travel as far as those used in 4G, so more small cell base stations are required.
5
ARPANSA maintains the health standard for all RF EME. The Standard is consistent with international best practice and is reviewed regularly as new research emerges.
For more information visit arpansa.gov.au

Australian Institute for Disaster Resilience

BSP: 019 - 162
Mr Phil McMurray
General Manager
Cootamundra-Gundagai Regional Council
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Cootamundra Gundagai Regional Council
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Dear Phil,

As Executive Director Australian Institute for Disaster Resilience (AIDR), I am pleased to provide you a copy of our 2018-19 *Year in Review*.

The current bushfire crisis has shown that Australia's hazards are becoming more severe and stretching the capacity of our emergency management systems and the resilience of our communities.

As Australia moves from bushfire response into relief and recovery with impacted communities, we know from previous disasters that a long-term approach to recovery is needed. Now more than ever we need to place resilience at the centre of everything we do. We have an opportunity to build knowledge and resilience into the recovery process and to think about how we can build back better to mitigate against future disasters.

Since 2015 AIDR has been developing, maintaining and sharing knowledge and learning to support a disaster resilient Australia. This exchange of knowledge is critical to Australia's ability to reduce disaster risk and enhance disaster resilience.

As demonstrated by our *Year in Review*, AIDR continues to deliver a program of work aligned to its core purpose of enabling disaster resilience. Through themed knowledge products, services and capability development events, AIDR facilitates professional and community development to support shared responsibility in a more disaster resilient Australia.

We are here to support and assist governments of all levels, communities, NGO's, not-for-profits, research organisations, education partners, volunteers and the business community, by connecting you to knowledge and resources to assist you in your work with communities.

Please get in touch if we can assist your organisation in any way in 2020.

Kind regards,

Amanda Leck
Executive Director
Australian Institute for Disaster Resilience

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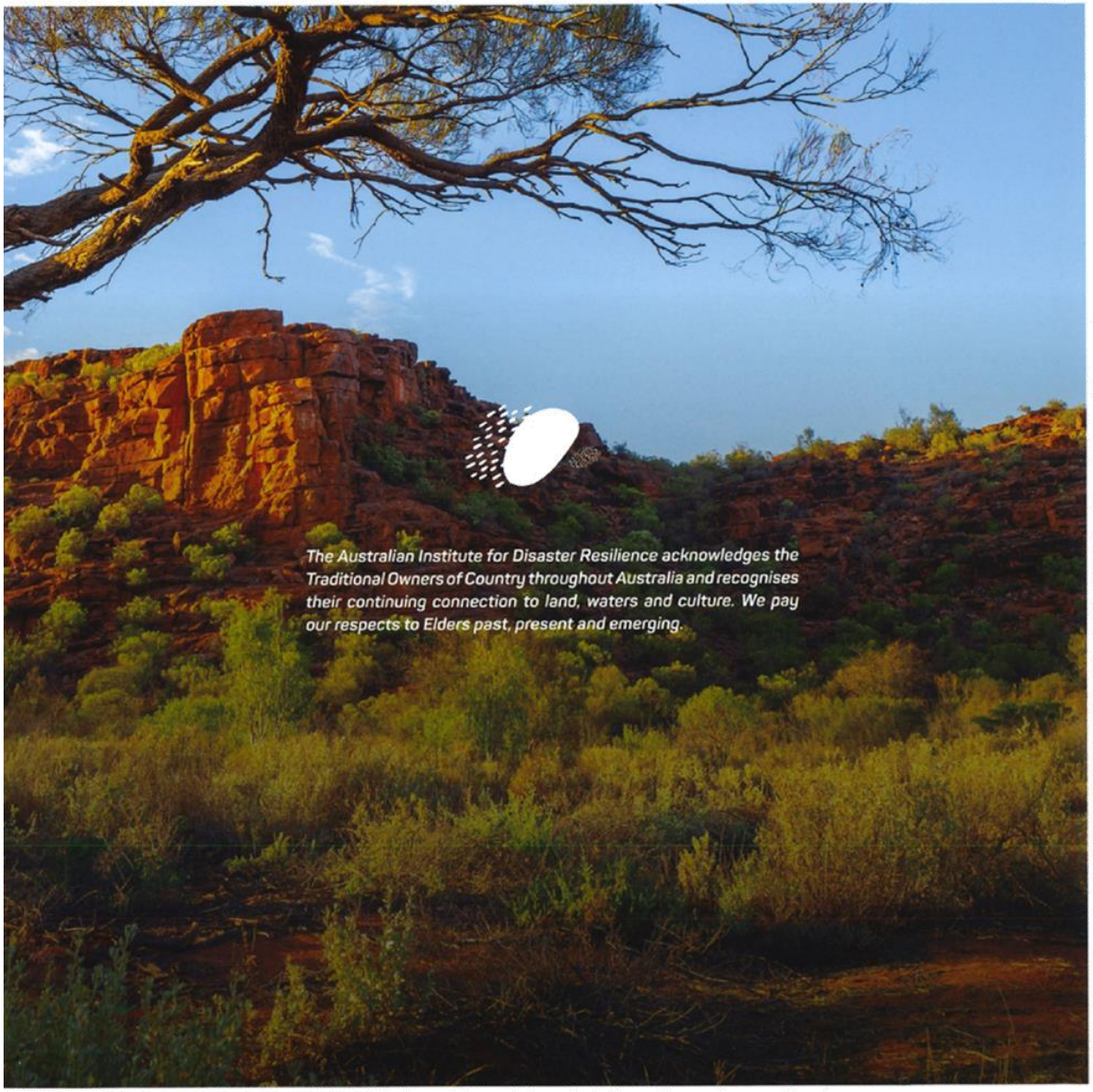
The Australian Institute for Disaster Resilience acknowledges the Traditional Owners of Country throughout Australia and recognises their continuing connection to land, waters and culture. We pay our respects to Elders past, present and emerging.

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The Australian Institute for Disaster Resilience
The Australian Institute for Disaster Resilience (AIDR) develops, maintains and shares knowledge and learning to support a disaster resilient Australia. Building on extensive knowledge and experience in Australia and internationally, we work with governments, communities, NGOs, not-for-profits, research organisations, education partners and the private sector to enhance disaster resilience through innovative thinking, professional development and knowledge sharing.
AIDR is supported by its partners: the Australian Government Department of Home Affairs through Emergency Management Australia (EMA) , AFAC, the Australian Red Cross and the Bushfire and Natural Hazards CRC.

Rob Cameron OAM

Director-General
Emergency Management Australia

As 2019 draws to a close, Australia's hazards are setting precedents and stretching the capacity of our emergency management systems, and the resilience of our communities. The fires in New South Wales and Queensland in August, September and October clearly demonstrate the lengthening of the traditional 'summer' season of hazards that Australia faces and our evolving exposure to sources of risk. Bushfires are getting starts in winter and are occurring in areas with little or no recorded history of burning.

The exchange of knowledge is critical to Australia's ability to prevent, prepare for, respond to and recover from this changing and escalating disaster landscape. The Australian Institute for Disaster Resilience – funded by EMA, our national disaster management organisation – continues to successfully serve in its role of facilitating this knowledge management for Australia.

AIDR, through its broad engagement with Australian volunteers, fire and emergency services authorities, private sector organisations, academia, and the not-for-profit sector, provides world leading emergency management doctrine. The ongoing lessons management process that AIDR leads through doctrine development and maintenance, enables the environment in which evidence-based decisions and actions can be taken to improve the safety of our communities. As we confront a changing climate, complex systemic, societal and economic interdependencies, and increasing vulnerabilities, the importance of this work is self-evident.

In close partnership with EMA, AIDR recently delivered a national series of Understanding Disaster Risk workshops that explored contemporary thinking and guidance on how we understand our relationship with hazards, vulnerability, risk and the reduction of those factors. These forums introduced discussion on perhaps the least understood dimension of disaster risk – vulnerability – to the Australian community. Further exploration of vulnerability will allow us to better understand and address the underlying causes of disaster risk.

I also want to acknowledge the good work AIDR has delivered this year in supporting Australia's emergency management volunteers. Our volunteers are critical members of our communities who routinely sacrifice precious time away from families, responsibilities and jobs for our safety and security. Again, in close partnership with EMA, AIDR has delivered scholarship and development programs that support emergency management volunteers to contribute in ever greater ways to their organisations and the communities they serve.

This past year has again demonstrated how critical it is that all sections of Australian society work together to improve Australia's disaster resilience. EMA and the broader Department of Home Affairs looks forward to informing the way ahead in continuing a close partnership with AIDR.

Amanda Leck

Executive Director
Australian Institute for Disaster Resilience

As the Executive Director of AIDR I am delighted to report that it continues to deliver a program of work aligned to its core purpose of enabling disaster resilience. An independent evaluation of AIDR this year found it delivered considerable value for money and overachieved in several areas. Through themed knowledge products, services and events, AIDR facilitates professional and community development to support shared responsibility in a more disaster resilient Australia.

AIDR's role in knowledge management is reflected in the growing wealth of resources on the Knowledge Hub, including the Australian Journal of Emergency Management, the Australian Disaster Resilience Handbook Collection, the National Disaster Recovery Monitoring and Evaluation Database and the Australian Disaster Resilience Glossary.

AIDR's Professional Development Program is sharing knowledge among emergency management agencies, volunteers, teachers and educators, researchers and community groups. Working closely with Queensland Fire and Emergency Services, AIDR facilitated the delivery of the High Consequences Decision Making and Leadership in Disaster Crisis and Adversity professional development modules, which were very well received.

In 2019, AIDR delivered new events and attracted a record number of abstracts, applicants and registrants for existing events, including the Resilient Australia Awards, the Lessons Management Forum and the Australian Disaster Resilience Conference.

The Emergency Management Scholarship Program has completed its fifth and final round, with scholarships awarded to volunteers from all jurisdictions across a wide range of volunteer agencies. The Volunteer Leadership Program also continued across regional locations in all jurisdictions.

Recognising young people as active participants in disaster resilience, DRANZSEN has engaged with an increasingly diverse network, including local government and youth-focused organisations such as Scouts and Save the Children, to bring new perspectives to light.

The Centre of Excellence for Prescribed Burning continues to promote a holistic approach to prescribed burning for ecological, cultural and community safety outcomes. In 2019, it delivered resources and field trips and established the inaugural Excellence in Prescribed Burning Award.

AIDR would like to thank its partners: the Australian Government Department of Home Affairs, AFAC, Australian Red Cross and the Bushfire and Natural Hazards CRC for their support in the development and delivery of knowledge products and services for a more disaster resilient Australia.

Disaster risk reduction

Knowledge management

The Australian Disaster Resilience Knowledge Hub continues to grow as a key platform to share disaster resilience knowledge. It is home to curated collections of knowledge and resources, as well as the Australian Journal of Emergency Management and the Australian Disaster Resilience Handbook Collection. An important part of the Knowledge Hub is the DisasterMapper, enabling everyday Australians to learn more about disaster events that have occurred in the past.

In 2018–19, AIDR published five new collections on the Knowledge Hub and significantly updated two others.

The **Lessons Management Collection** highlights key resources, information and examples to guide a consistent approach to lessons management in Australia.

The **Black Saturday Collection** commemorates the ten year anniversary of this highly significant event, bringing together a range of information, research and recovery resources.

The **Warnings Collection** hosts key guidance material and research on public information and warnings, and professional development resources for practitioners.

The **Disaster Risk Reduction Collection** is home to critical national resources for disaster risk reduction, including the National Disaster Risk Reduction Framework, Profiling Australia's Vulnerability report, and Guidance for Strategic Decisions on Climate and Disaster Risk.

The **Disaster Resilience Directory** provides a central point to access international, national and jurisdictional strategies, frameworks, plans and major reports that frame disaster resilience in Australia. It also brings together a directory of key high-level organisations and groups.

Knowledge management and professional development go hand-in-hand, and AIDR has been working to curate content so that the knowledge generated through events continues to benefit the disaster resilience sector going forward.

The **Australian Disaster Resilience Conference Collection** was developed to house conference proceedings and the significant knowledge products that are created in association with the annual conference.

The **Professional Development Collection** bridges knowledge management and professional development, by outlining available professional development offerings as well as hosting the proceedings from past events.

Education for Young People

The Education for Young People Program supports learning about natural hazards in Australia and highlights initiatives that enable young people to take part in building community resilience before, during and after an emergency or disaster.

The program is guided and supported by the Disaster Resilience Education Strategy Group (DRESG) and Disaster Resilient Australia–New Zealand Schools Education Network (DRANZSEN). Both the strategy group and the education network have continued to grow and diversify, with a shared focus on partnerships for learning and youth participation.

The strategy group of 13 members includes experts in teaching, community engagement, emergency services and research. The group maintains an overview of program activities and events, helping to align the program with the priorities of our stakeholders, especially young Australians in schools and other educational settings. *Disaster Resilience Education: Young Australians for a disaster resilient future* was published in November 2018 to communicate the group's strategic vision for the Education for Young People Program in more detail.

AIDR education network (DRANZSEN) membership has increased by 50 per cent in 12 months to more than 600 members. Key stakeholders in emergency services continue to provide strong leadership in extending the reach of the network and identifying new partnerships. A strengthened presence from local councils, for example, introduced the network to a range of projects undertaken in partnership with schools and young people around the country to reduce the risk of disaster in a changing climate.

Active network members worked collaboratively to shape the program of successful state DRANZSEN events in Victoria, New South Wales, Queensland, Tasmania, Western Australia and South Australia followed by the National Forum in Melbourne, with over 200 participants overall. Presentations from education representatives, including teachers and students, enabled the network to develop a better understanding of what works best for today's students and facilitated dynamic cross-sector dialogue.

Additional engagement with the education sector was pursued through Education for Young People Program presentations at two of the largest geography teacher association conferences in Australia. The conferences were attended by hundreds of educators responding to a demand for better understanding of the link between climate change, natural hazards and local disaster risk.

The audience for the Education for Young People newsletter, launched in 2018 to support the network and celebrate good practice in disaster resilience education, has grown to 750 subscribers. The newsletter provides access to all DRANZSEN event materials for those unable to attend, as well as linking to case studies, news and resources from around the country to inspire subscribers to engage with young people as learners, innovators and important members of the community.

Trinity College students present to SA DRANZSEN. Photo: Brigid Little, AIDR

Marymede Catholic College student presents at the DRANZSEN Forum, Melbourne. Photo: Brigid Little, AIDR

"The DRANZSEN event was a really valuable opportunity to make connections across networks and see the work of increasing students' disaster resilience from a range of perspectives. Presenting our school's project at the forum was an exciting way to share our ideas and experiences with agencies and get their feedback and ideas.

The network has connected me to a range of resources that I would otherwise have been unaware of. These resources have been embedded into teaching and learning programs across our school to add rich and varied expert input into cross-curricular units. As a way of breaking down the silos of agencies that support our young people, the AIDR education program is a valuable addition to our broader learning networks. Our students benefit from the increased rigour and connection that engagement with the program has added to their learning.

– Jen Faulconbridge | Teacher

Jen Faulconbridge presented at the New South Wales DRANZSEN event in June 2019. A primary school teacher with a passion for STEM education, Jen shared the 'Technology can keep us safe' unit she developed for students in response to a community concern for the safety of children in the school holidays. This initiative was supported by the SES, who consulted with the students as experts on storms, floods and emergencies and formed part of a community audience when students shared their learning in an exhibition.

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Australian Journal of Emergency Management

The Australian Journal of Emergency Management (AJEM) is Australia's premier journal for emergency management covering resilience, disaster risk reduction, natural hazards and emergencies. From research to practice, global government to community engagement, the journal focuses on promoting and facilitating discussion and debate about emergency preparedness, response and recovery. AJEM's papers feature extensive analysis, considered views, lessons learned and insights into current and future issues from contributing researchers and practitioners.

In 2018–19, the AJEM expanded its readership through its online presence on the Knowledge Hub and AIDR's social media channels and at events. Engagement levels have remained constant, with case studies and news and views our most popular content. AJEM is published under the advice of an editorial advisory board and editorial committee.

As a companion to AJEM, the Monograph Series publishes ongoing and timely information in select topic areas of relevance to emergency management and disaster resilience in Australia and internationally. In 2018–19, AIDR published the *Diversity in Disaster Monograph*, which included a depth and breadth of content from issues and communities represented at the inaugural Diversity in Disaster Conference held in Melbourne in April 2018.

Readers also enjoyed a variety of articles in editions across 2018–19, including case studies, short research papers and in-depth peer review articles on diverse topics from natural hazards, to community preparedness and volunteer intentions. Popular news and views articles considered the mental health needs of police and emergency services, the Resilient Australia Awards, tsunami in Australia, volunteering, integrating animal welfare in emergencies, risk taking and floodwater, the Thai cave rescue and how people from refugee backgrounds build disaster resilience.

On the advice of the editorial advisory board, AJEM began a process of considering its strategic position in the emergency management, disaster risk reduction and resilience landscape, and the need for themed editions to address key concerns. In 2019, AJEM is increasingly looking to the future and is well positioned to respond to the nexus of disaster risk, natural hazards and climate change.

Volunteer Leadership Program

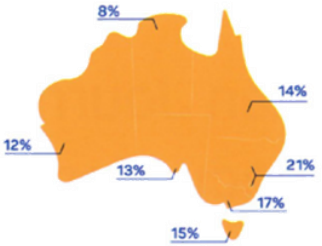
The Volunteer Leadership Program (VLP) equips emergency sector volunteers with the skills and confidence to grow as leaders. The VLP brings together volunteers from different organisations and agencies to build knowledge and share experiences with each other.

The immersive and collaborative program explores practical leadership frameworks through interactive learning and participants gain both self awareness and an enhanced ability to understand and contribute to their organisations.

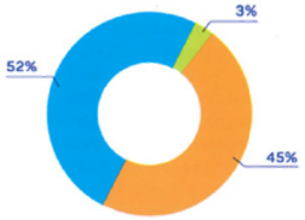
The VLP is delivered by the Australian Red Cross on behalf of AIDR and is supported by members of the Australian Emergency Management Volunteer Forum. Each volunteer is endorsed by their organisation to attend.

AIDR delivered 12 VLP courses between July 2018 and October 2019. AIDR continued its approach of decentralising delivery of the program, with nine of the programs being delivered outside of metropolitan areas.

A total of 239 volunteers participated in the program during this period, with an average of 24 volunteers per program.

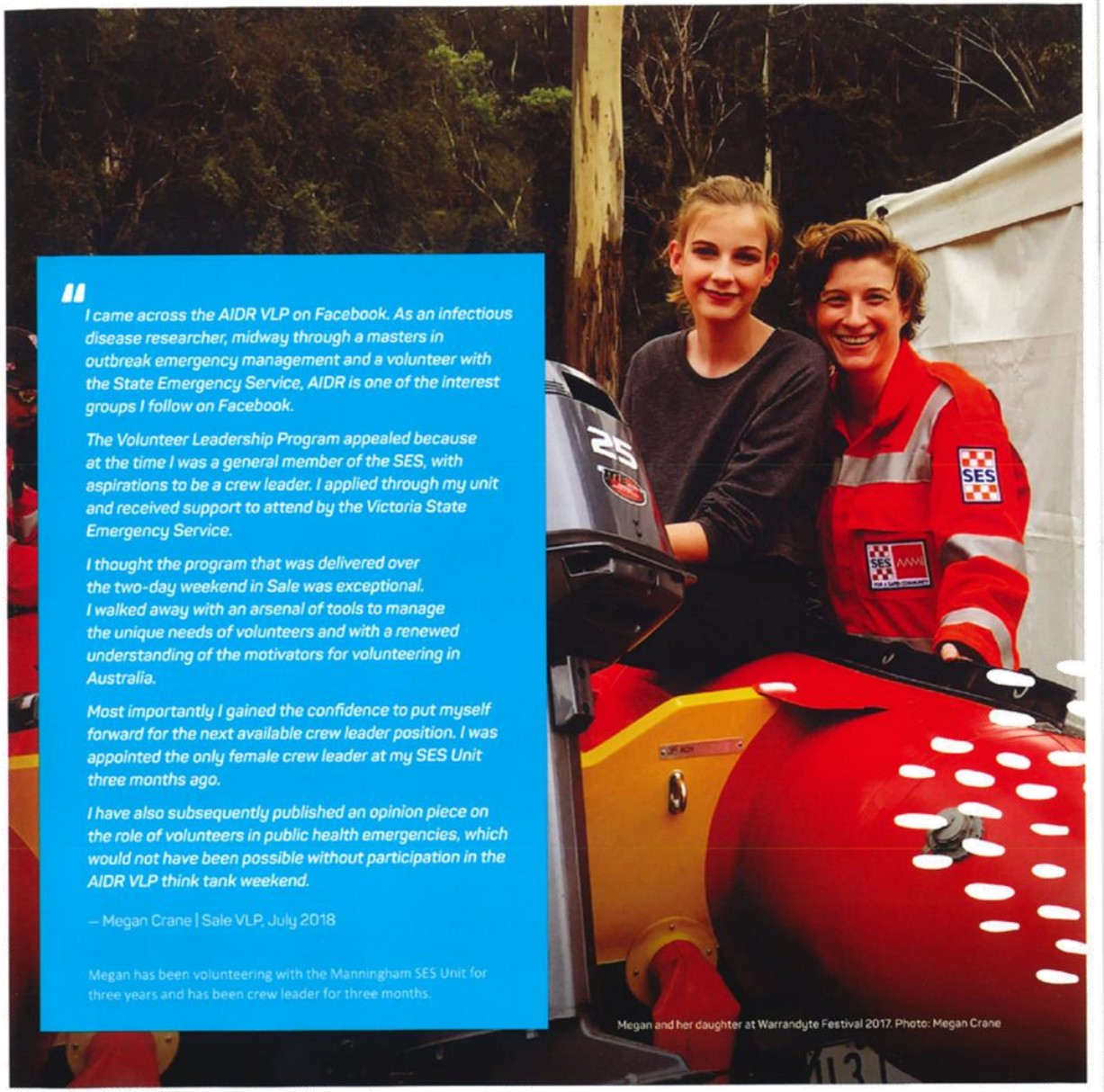


JURISDICTION BREAKDOWN



GENDER BREAKDOWN

> *Absolutely fantastic!! I have attended a number of similar programs with various corporations during many years of staff management, but none have come close to this course for practical application of the concepts.*
>
> – Ted Dunford | Albury VLP, November 2018


"
I came across the AIDR VLP on Facebook. As an infectious disease researcher, midway through a masters in outbreak emergency management and a volunteer with the State Emergency Service, AIDR is one of the interest groups I follow on Facebook.
The Volunteer Leadership Program appealed because at the time I was a general member of the SES, with aspirations to be a crew leader. I applied through my unit and received support to attend by the Victoria State Emergency Service.
I thought the program that was delivered over the two-day weekend in Sale was exceptional. I walked away with an arsenal of tools to manage the unique needs of volunteers and with a renewed understanding of the motivators for volunteering in Australia.
Most importantly I gained the confidence to put myself forward for the next available crew leader position. I was appointed the only female crew leader at my SES Unit three months ago.
I have also subsequently published an opinion piece on the role of volunteers in public health emergencies, which would not have been possible without participation in the AIDR VLP think tank weekend.
– Megan Crane | Sale VLP, July 2018
Megan has been volunteering with the Manningham SES Unit for three years and has been crew leader for three months.
Megan and her daughter at Warrandyte Festival 2017. Photo: Megan Crane

Handbook Collection

The Australian Disaster Resilience Handbook Collection is an authoritative portfolio of resources that provide nationally agreed principles and guidance for good practice across a range of disaster risk reduction and resilience themes.

The Handbook Collection draws on the expertise and insight of leading disaster risk reduction, resilience, and emergency management practitioners and scholars from all Australian jurisdictions and sectors, as well as applied research and data analysis from trusted Australian and international knowledge sources.

Each handbook is developed and reviewed through a rigorous process of stakeholder engagement with a specialised working group and dedicated steering committee as needed.

In 2018–19, working groups comprised of a cross section of representatives from emergency service authorities, private sector organisations, universities and knowledge-based organisations, non-government and not-for-profit organisations, and community based organisations and groups.

Companion documents and online resource collections on the Knowledge Hub continue to offer contemporary, best-practice examples of disaster risk reduction and resilience in practice.

The Handbook Collection continues to gain prominence as Australia's leading authority on disaster risk reduction and resilience. The five handbooks reviewed and four published in 2018–19 reflect increasing national and international focus on the need to reduce disaster risk and build disaster resilience, as considered in the Australian Government Department of Home Affairs' *National Disaster Risk Reduction Framework* and *Profiling Australia's Vulnerability*.

The following handbooks will be reviewed in 2019–20:

Community Engagement, Communication and Inclusion for Disaster Resilience

Emergency Planning

Flood Planning for Disaster Resilience

Land Use Planning for Disaster Resilient Communities

NERAG (2015 revised 2nd edition)

The Handbook Collection is available at ◁ knowledge.aidr.org.au/handbooks

Australian Disaster Resilience Handbook Collection
2019
Health and Disaster Management
Australian Disaster Resilience Handbook Collection
2019
Lessons Management
Australian Disaster Resilience Handbook Collection
2019
Australian Emergency Management Arrangements
AUSTRALIAN TSUNAMI - DETECTION
Australian Institute for Disaster Resilience

Some things people have said about our Lessons Management Handbook
Congratulations to you on pulling this together, it's state-of-the-art!
– Dr Adriana Keating | International Institute for Applied Systems Analysis, Risk and Resilience Program
In a word, tremendous! An excellent job by all concerned.
As one of the few fully-fledged lesson nerds in Tasmania, I have been promoting lessons management more broadly for several years now. The updated handbook is a fantastic resource to help that journey along down here.
– Cheryl Ames | Tasmania State Emergency Service
...the Lessons Management Handbook has been very well received here in WA – to the extent that we are looking to reference the handbook directly in our State EM policy.
– Tracy Smith | WA State Emergency Management Committee
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The following handbooks were produced in 2018–19
(in order of production)

TSUNAMI EMERGENCY PLANNING

The handbook is a guide to the key principles of tsunami preparedness. Its purpose is to enhance the capacity and knowledge of emergency managers related to emergency planning for tsunami in Australia.

The handbook outlines key scientific information and principles of risk assessment, warning systems, emergency planning, community education, response management and recovery in the context of tsunami.

The handbook is supported by a companion document *Tsunami hazard modelling guidelines* and a visual guide to tsunamis *Tsunami: The Ultimate Guide.*

LESSONS MANAGEMENT

The handbook identifies core principles and suggests frameworks and processes to support the successful implementation of lessons management, which is integral to the continuous improvement of organisational capability, individual learning and our collective resilience.

The handbook is supported by two companion documents: *Lessons Management Case Studies* and *Lessons Management Models and Examples*; and the Lessons Management Collection on the Knowledge Hub.

AUSTRALIAN EMERGENCY MANAGEMENT ARRANGEMENTS

The handbook is an important development of national consequence for the EM sector.

It provides 11 core principles and a high-level, scalable overview of how Australia addresses the risks and impacts of hazards through a collaborative approach to the prevention of, preparedness for, response to and recovery from emergencies.

HEALTH AND DISASTER MANAGEMENT

The handbook provides guidance to individuals and organisations working in the health system to understand their capability and capacity to support communities before, during and after disasters.

It outlines how parts of the health system contribute to the management of disasters, specifically in disasters where the health sector will be the lead.

Emergency Management Volunteer Scholarship Program

The Emergency Management Volunteer Scholarship Program was established to support emergency management volunteers' access to emergency and disaster management related qualifications. The scholarship program was funded by a $2 million Australian Government grant.

Volunteers could apply to complete accredited vocational or higher education courses related to emergency and disaster management. Over the five rounds of the scholarship program, 306 scholarship offers totalling over $1,977,829 were made to emergency management volunteers. Scholarships were awarded to volunteers from all jurisdictions and across a wide range of volunteer agencies.

> *"The course was interesting, informative, challenged my preconceptions and exposed me to a world of disaster prevention, preparedness, response and recovery.*
>
> – Megan Davies | NSW Rural Fire Service volunteer

Megan Davies is a volunteer with the NSW Rural Fire Service and completed the Graduate Certificate in Disaster Risk Reduction at the University of Newcastle. She describes the course and opportunity to study as an invaluable experience that has expanded her understanding.

'The course was interesting, informative, challenged my preconceptions and exposed me to a world of disaster prevention preparedness, response and recovery. The other students I studied with came from all over the world, and the amount of knowledge and experience they shared during the course was invaluable.'

Megan describes this knowledge as directly applicable to her volunteer role, and able to be utilised to better prepare her local area for future disasters.

'I completed assessments that had me reviewing disaster preparedness at a local government level, and finding ways to improve community preparedness and ability to respond to and recover from disasters.'

Beyond outlining the importance of learning new skills, Megan highlights the benefit of monetary support for volunteers.

'Studying at a graduate level would likely have been out of my reach without the scholarship.'

Megan Davis on the job with NSW Rural Fire Service. Photo: NSW Rural Fire Service

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Major Incidents Report

The 2018–19 *Major Incidents Report* provides an overview of major incidents that have involved the fire and emergency services sector from July 2018 to June 2019.

The report highlights significant incidents that have been of impact or consequence for fire and emergency services, as identified by the sector. The report provides background information about each incident and the corresponding response.

The 2018–19 report harnesses the lessons management capability of the emergency services sector and includes key observations (where identified) to identify and analyse recurring and emerging insights across hazards, sectors and jurisdictions.

knowledge.aidr.org.au/resources/major-incidents-report

Australian Disaster Resilience Glossary

The Australian Disaster Resilience Glossary continues to develop and grow as key organisations from around Australia contribute to and support its review.

In 2018–19, over 800 terms related to bushfire, urban fire and risk were reviewed and published in the glossary, in addition to six core emergency management terms: catastrophic disaster, community, disaster, emergency, emergency management and resilience. The glossary contains over 3,000 disaster risk reduction, resilience, and emergency management terms and definitions including reference to nine Australian and international glossaries. In 2017–18 the online glossary went live with new functionality including the ability to save and export terms and improved search capability. The glossary will continue to develop to include links to related terms, images and additional resources.

knowledge.aidr.org.au/glossary

Professional development

AIDR's Professional Development Program has continued to make an important contribution to enhancing capability in the disaster resilience sector. From September 2018 to October 2019, AIDR delivered 39 professional development events across Australia, reaching close to 1,800 people.

Over time AIDR has worked to build a suite of clinics and masterclasses that can be made available as part of our regular calendar of events or delivered directly to organisations and established groups such as disaster management teams. These include:

- Decision making under pressure clinic
- Facilitating debriefs clinic
- Leadership and adversity masterclass
- Meteorology for disaster managers masterclass
- Planning for spontaneous volunteers' clinic

In 2018–19, AIDR worked with the Victorian Department of Health and Human Services to deliver four clinics on facilitating debriefs and decision making under pressure to staff as part of internal disaster management capability building initiatives.

AIDR also worked with AFAC to deliver the 2018 Lessons Management Forum in Melbourne, the 2019 Lessons Management Forum in Sydney, and with Australian Red Cross to host a Collective Trauma Events seminar in Sydney.

Masterclasses in Queensland

In 2019, AIDR worked with Queensland Fire and Emergency Services (QFES) under a contractual arrangement to develop customised masterclasses as part of their operational leadership and crisis management masterclass series.

A masterclass on high consequence decision making and a masterclass on leadership in disaster, crisis and adversity were delivered in Brisbane, Bundaberg, Cairns, Gympie, Longreach, Mackay, Rockhampton, Roma, Toowoomba and Townsville.

This initiative enabled capability building at scale for Queensland disaster management stakeholders, and was very highly valued by those who attended. Around 50 per cent of masterclass attendees represented local government, reflecting their critical role in disaster management.

> *"The masterclass series has proved highly beneficial to key disaster management stakeholders in Queensland with feedback and evaluations from participants indicating high levels of satisfaction and capability enhancement.*
>
> – Jane Zsombok, QFES Executive Manager | Emergency Management Training Command

Participants at the Toowoomba High Consequence Decision Making Masterclass
Photo: QFES

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Case study — QFES masterclasses: knowledge.aidr.org.au/resources/ajem-october-2019-queensland-s-leadership-and-crisis-management-education

Understanding Disaster Risk forums

In October 2019, AIDR worked with Emergency Management Australia and CSIRO to host Understanding Disaster Risk forums in every state and territory of Australia engaging more than 700 people. The forums highlighted contemporary thinking and guidance on how we understand our relationship with hazards, vulnerability, risk and its reduction.

The forums provided an opportunity to become more familiar with key national guidance launched in 2019, including:

- National Disaster Risk Reduction Framework
- Profiling Australia's Vulnerability: The interconnected causes and cascading effects of systemic disaster risk
- Guidance for Strategic Decisions on Climate and Disaster Risk

Decision makers from across sectors benefited from a national perspective on climate and disaster risk, stories of lived experience from across Australia, examples of novel projects, and state-specific discussion and insights on key initiatives, challenges and opportunities.

The forums were attended by a broad range of sectors, reflecting a growing commitment to collaborate and take action on reducing disaster risk. This included critical infrastructure, planning, finance and insurance, private sector and consulting, health, peak bodies, all levels of government, not-for-profit, academia, emergency services and the emergency management sector.

A series of short videos were produced to share the expertise and experiences of decision makers and business people at the national forums. These are available on the forum proceedings page on the Knowledge Hub and will be a valuable resource to disaster resilience practitioners looking for an engaging way to share key messages.

The forums were a significant opportunity to build a platform for transformative change at scale, and assist to move forward with a new agenda for disaster risk reduction.

> *"Changing how we think about disasters opens new perspectives, new insights and new ways of thinking to come up with real solutions that make a real difference to people's lives.*
>
> *Reducing disaster risk is everyone's business.*
>
> — Rob Cameron OAM | Director General, Emergency Management Australia

Monica Osuchowski presents at the Understanding Disaster Risk forum in Sydney. Photo: Leone Knight, AIDR

Centre of Excellence for Prescribed Burning

The Centre of Excellence for Prescribed Burning communicates guiding frameworks and principles developed under the National Burning Project, to promote a holistic and consistent approach to prescribed burning practices and supports the implementation of those practices by a range of agencies and organisations.

Awareness of Centre of Excellence products and their utilisation is achieved through strong engagement at conferences, forums and facilitated workshops in all jurisdictions across the country. This year the focus was communicating the Prescribed Burning Program Logic model developed through the National Burning Project.

The Centre of Excellence hosted a workshop at the Sixth International Fire and Fuels conference with the Bushfire and Natural Hazards CRC in 2019.

It also organised a field trip in southwest Perth following AFAC18 and a highly engaging field trip with Traditional Owners in Victoria following AFAC19.

With support from Forest Technology Systems (FTS) the inaugural Excellence in Prescribed Burning Award was presented at AFAC19.

Prescribed burning practitioners are encouraged to share news and updates to a network of over 600 prescribed burning practitioners through regular newsletters and a dedicated Facebook page and Facebook group.

A regular webinar series is key to this engagement and the six webinars during 2018–19 attracted 200 people watching live with a further 1600 views of the recorded versions.

> ***"The webinar series recordings provide me with detailed information with respect to what's occurring both nationally and internationally in the area of prescribed burning. It is an excellent forum for land management agencies and researchers to collaborate and share knowledge, and for us all to develop a deeper insight into successful approaches when planning and implementing fuel reduction programs.***
>
> — Tim Sanders | Area Lead, Catchments and Land (Catchment, Land & Waterways Services) Melbourne Water

PARKS AND
WILDLIFE
"The access to research, policies, procedures and information obtained from the Prescribed Burning Centre of Excellence, has ensured a robust platform for our Local Government to base fuel management activities. The information and support has allowed the City of Albany to tailor our Fuel Management Doctrine to our particular needs.
Close working relationships with our Key industry stakeholders has been key to our ability to provide safe and functional management to our community and environment.
– Darren 'Stretch' Little | Bushfire Risk Management Planning Officer/Fire Liaison Officer, City of Albany
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Prescribed burning clinic, Queensland. Photo: Deb Sparkes, AIDR

2018 RESILIENT AUSTRALIA AWARDS

2018 Resilient Australia Awards

The Resilient Australia Awards celebrate initiatives that build whole of community resilience to disasters and emergencies around Australia, as well as images capturing resilience in action. The awards recognise collaboration and innovative thinking across all sectors.

Since 2000, the awards have recognised outstanding contributions in each state and territory in five categories:

Community | Business | Government | School | Photography

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National Schools Award Winner | Firestick Project – A Wurundjeri-led project in partnership with Dixons Creek Primary School, supported by Yarra Ranges Council and the Department of Environment, Land, Water and Planning, Victoria (VIC). Photo: Dixons Creek Primary School

National Award Winner | My Resilient Community – Queensland Fi
& Moreton Bay Regional Council (QLD). Photo: Moreton Bay Region

The program recognises a wide range of initiatives with past projects centred on risk assessment and mitigation; education, training and research; community engagement; and response and recovery.

In November 2018, AIDR hosted the National Resilient Australia Awards Ceremony at the Queensland University of Technology. Nearly 100 people from around Australia were in attendance, including finalists for the National Award, National School Award and the National Photography Award.

Senator the Hon Linda Reynolds CSC, Assistant Minister for Home Affairs, presented the awards on behalf of the Commonwealth.

Winners and finalists from the 2018 program were profiled in the January 2019 edition of the Australian Journal of Emergency Management and on the AIDR website.

AIDR congratulates the winners and finalists from across Australia and looks forward to sharing more inspiring stories from the 2019 program.

The Resilient Australia Awards is proudly sponsored by the Australian Government in partnership with the states and territories and managed by the Australian Institute for Disaster Resilience (AIDR).

nd Emergency Services, Queensland Police Service
ouncil

National Photography Award Winner | Dousing the flames – Navin Chandra (NT)

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Introducing the

Australian Disaster Resilience Conference

In September 2018 AIDR hosted the inaugural Australian Disaster Resilience Conference at the Perth Convention and Exhibition Centre. The theme of the conference was 'The rise of resilience: from the individual to the global'.

As part of the strategy to launch the conference, it was run in partnership with the well-established and highly regarded AFAC conference. Both conferences shared opening keynote speakers; AFAC18 delegates were able to attend disaster resilience presentations; and Australian Disaster Resilience Conference delegates were able to access the extensive AFAC18 powered by INTERSCHUTZ trade exhibition.

The conference attracted more than 80 delegates in its first year and received highly positive feedback in the evaluation survey:

100% **rated** the Australian Disaster Resilience Conference as a whole as **very good** or **excellent**

100% said they **would recommend** the conference to others

100% said the conference **met** or **exceeded their expectations**

The launch of the Australian Disaster Resilience Conference has created an important space for disaster resilience practitioners from across the nation to come together to share knowledge, challenge thinking and build connections for a disaster resilient Australia.

Building on the success of the inaugural Australian Disaster Resilience Conference (ADRC), the second conference was held on 28 and 29 August 2019 at the Melbourne Convention and Exhibition Centre. The theme of the conference was 'Are we future ready?' and featured sessions on connecting for resilience; supporting recovery; taking action; diverse perspectives; and inclusive approaches.

In 2019, attendance at the Melbourne event grew to a total of 160 delegates. Sponsorship from the City of Melbourne enabled a number of delegates from the volunteering, not-for-profit and community sectors to attend via sponsored places and was a great benefit to the conference. Once again, the conference was highly rated by those who attended. In the post-conference survey, more than 80 per cent of respondents indicated that they would like to see the Australian Disaster Resilience Conference continue to run in association with the AFAC conference.

afac19
ITY OF MELBOURNE
Art Resides Here
Strathewen
MELBOURNE CONVENTION
CITY OF MELBOURNE
33
Clockwise from top left:
Dr Robert Glasser, Strathewen Primary School year six students, Angela Spiteri, Euan Ferguson, 10 years on from Black Saturday panel and Victor Steffensen at the 2019 conference. Photos: AIDR

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COUNCIL MEETING ACTION REPORT

MEETING / ITEM	ACTION	OFFICER	STATUS
05.07.2017 18.06.2019 19.09.2019	Amend Gundagai LEP 2011 to correct mapping discrepancies	Manager Development, Building and Compliance	Ongoing. Amendment No 4 is currently being reviewed following feedback from the Department of Planning prior to a Gateway determination. Gateway determination issued, currently on exhibition for 28 days. To be reported back to October 2019 Council meeting. Partly complete – schedule 1 amendment gazetted
30 October 2018			
Council, with further consultation, consider the representations made by Mr Peter Beath on behalf of the members of the Cootamundra Aboriginal Working Pary, in his letter dated 24 October 2018. 8.1.4 Resolution 215/2018	"It is recommended the CGRC take a proactive approach engaging with the existing community groups and organisations to look at the formation of a formal Aboriginal Advisory/Consultative Committee under section 355 of the local Government Act 1993"		
8.1.5 Resolution 216/2018	2. In time, and subject to available funding, CGRC, in conjunction with the local Aboriginal communities, the Brungle-Tumut LALC and the Young LALC, undertake the mapping of the sites of cultural significance to Aboriginal people in this LGA.	Manager Development	

	3. CGRC, in consultation and negotiation with Aboriginal communities in the region, form an Aboriginal Advisory Committee to liaise with Council about matters of importance and concern to local Aboriginal people. 4. The Consultative Committee consider the implementation of an Indigenous Employment Strategy	Manager Culture and Community HR	
	CGRC put in place Cultural (Aboriginal) Competency/Cross Cultural training to Council Staff and Councillors.	Manager Culture and Community	
28.11.2017 – 7.3.2.1 22.08.2018 17.09.2018 26.09.2018 17/01/2019 4.02.2019 11.02.2020	Waste Collection Services Waste Collection Services cont.	Manager Waste, Parks and Recreation	Council adopted for Stage 3 to commence with a schedule of works and timelines currently being prepared for staff's consideration. Once the schedule and estimates have been approved works will commence with council to be informed accordingly of the adopted schedule of works and timelines. 18/6/19 update- First draft of the financial plan has been completed and review sent back to consultant for consideration. Next stage is the development of the Business Plan. For full details of the scope of works, timelines etc. refer to the Waste, Parks & Recreation Managers' report to the June, 2019 Council meeting. 23/10/19 update - Draft financial plan delivered to council in September with the final plan scheduled to go to the November Council meeting.

			November 2019 - Report to November 2019 for Councils consideration February 2020 – report adopted in principal, report to Feb meeting seeking council approval to place the report out to the community for 3 months seeking comment. March – Reviewed report going to council this month.
31.01.2018 – 7.1.1.3 19.06.2019 07.2019 12.02.2020	Continue with land transfer of Inland Aircraft Fuel Depot	GM/ Manager Facilities	Remediation works to be completed by Caltex prior to finalising transfer of title. Transfer progressing. Following up remediation work. Site meetings undertaken with consultants. Funding options being investigated. Additional funding required for site development
31.01.2018 – 7.1.1.4 18.06.2019	Prepare detailed design and cost estimates for Turners Lane industrial subdivision. Include budget allocation in 2018/2019 budget.	GM Bill	22/03/2018 To be outsourced. An amount of $500K has been included in budget estimates. Proposals being sought. Awarded to MJM – Designs expected Dec 18. Draft final civil design plans have been submitted by consultants and returned to consultants requiring some minor amendments for finalisation. Receipt of the final designs is anticipate early July, 2019. Works to commence in 2019/20. July 2019 update - Final civil design plans received. Awaiting final electrical design

			(anticipated mid-August). Awaiting result of funding application prior to commencement of construction.
17.01.2019	Investigations to be undertaken to determine feasibility of providing a safe and accessible pedestrian pathway to link Cootamundra town centre and the cemetery on Yass Rd.	Manager Civil Works/ Road Safety Officer	Long term project. Include in new PAMP CYCLEWAYS Plan Safety audit of rail overpass completed.
31.07.18 – 9.2 11.02.2020	Council, in collaboration with the Muttama Creek Regeneration Group, investigate the feasibility of creating a walking track alongside sections of Muttama Creek. *Council, in collaboration with the Muttama Creek Regeneration Group, investigate the feasibility of creating a walking track alongside sections of Muttama Creek. continued*	Manager Waste, Parks and Recreation	Application prepared and submitted for grant funding for footpath/walking track. 17/01/2019 update - Still awaiting response on submission. Actively seeking alternative funding options or grants as they become available. 21/03/2019 update - Arrangements are current being arranged to meet onsite with the group to discuss future plans. Once this has been determined a report will need to be presented to council for determination and approval. 18/06/2019 update -Any plans will need to consider the Muttama Flood Study and seek recreational opportunities. July 2019 update - A meeting between the group and the Waste, Parks & Recreations Manager is yet to be arranged. It is the intention to arrange a meeting for September 2019. **November 2019** - This is still yet to happen with the current work load and this rated as a low priority action will be implemented ASAP.

			In the meantime Council is working with the Group with the existing works as and when required **no change to date.** **March – no change**
Ordinary Meeting - 26 March 2019			
Item 8.1.7	Showground users group	Manager Facilities	A masterplan for the Showground be prepared with staff and the Committee including the provision of a caretakers cottage. 18/06/2019 update - Drone work complete. Being presented to users group Wednesday 19-6-2019. July 2019 update - Awaiting feedback from user groups. 12.02.2020 Feb 2020-No further progress. User groups still working on requests.
Item 8.4.1	NSW Public Works Advisory be invited to prepare a proposal for a concept design incorporating an optional PV arrangement to offset power costs and with the provision for future chlorine treatment should Council wish to supply treated effluent for irrigation purposes within the village.	GM/ Manager Assets	23/05/2019 update - Discussions with Public Works are continuing.
ORDINARY MEETING - 28 MAY, 2019			
Question 8.1.10 Council Meeting Action Report	Follow up progress detailed design for Turners Lane and include in action report.	Bill	See 31.01.2018 – 7.1.1.4 on page 2

	Bridge Safety Audit Report	Manager Civil Works/ Manager Technical Services	Prepare report for June/July business paper. Ongoing. Seeking funding opportunities for bridge assessment.
8.7.2 Council Mini Bus (165/2019)	The Council Hiace mini bus be retained for a period of six months and a report on the bus's usage income and costs against the bus be prepared and submitted to the November, 2019 Ordinary Meeting.	GM	Gundagai Neighbourhood Centre manage bus Group induction for users to drive bus Provide requirements e.g. current licence, log books, user spreadsheet, booking form, data spreadsheet to collate use hours, kilometers, use contract and guidelines/limitations (if any) etc.
9.1 Notice of Motion (172/2019) 07.2019	Council investigate the feasibility of extending the Cootamundra indoor pool weekend operating hours. Further, Council undertake a review of the facility's processes and expenditure and incorporate options regarding the use of staff or contractors in the management of both the pool and stadium facilities.	GM/ Manager Waste, Parks and Recreation	No time frame was provided for a report to be submitted to Council. An independent report to be prepared at the conclusion of the trial period and with a report to be submitted for the Council consideration. The extended winter season operating hours have been implemented as per Council resolution, with the outcomes to be reported back to Council at the end of the winter pool season. A report to Council will be presented in August, 2019 indicating the cost associated with the undertaking of an independent review of the aquatic centre and stadium operations. 23/10/19 update - Associated reports will be submitted to council regarding both the trail extended hours and aquatic centre feasibility study. November 2019 – Report to the November council meeting. March – Pool and Sports Stadium now closed.

ORDINARY MEETING - 25 June, 2019			
	Aside request from Cr Sheahan	GM	Provide Road Safety Audits to EA to GM & Mayor to upload to Councillor Drive.
	Access and Inclusion Committee	Manager Waste, Parks and Recreation	Lift and change table in the Cootamundra pool facility. Adult change facility. 23/10/19 update - MWP & R is still to follow up on this issues. November 2019 – waiting on Manager Facilities to come back to work to give financial details on this project. March – No further action as no funds available
		Manager Development, Building and Compliance	Disability access audit of business' with awareness programme delivered by Council staff to business owners/managers Starting with Council premises first.
ORDINARY MEETING - 30 July, 2019			
8.1.2 Cootamundra Tourism Action Group s.355 Committee Meeting Minutes and Membership	The Manager Waste, Parks and Recreation meet with Friends of Pioneer Park to discuss improvements proposed in the Friends of Pioneer Park Management Plan, attached to the report, and report back to Council.	Manager Waste, Parks and Recreation	This is pending the results of a grant submission made as part of the Stronger Community Grants R3 in October. November 2019 – no change, result on grant application is expected early 2020. **March – Grant application unsuccessful no further action to be taken at this stage. The Friends group to be notified.**
ORDINARY MEETING - 28 AUGUST, 2019			

Item 8.1.9 Gundagai TAC Minute Recommendations	Council seeks funding for a Tuckerbox plinth for tourists to pose their dogs on for a photo as a permanent fixture at the Dog on the Tuckerbox Site.	Manager Community & Culture	Seeking funding opportunities. Update to be provided at a later date. November 2019 – It is intended to use the proceeds of the donations received. Still awaiting quotation to be able to apply for funding 11.02.2020
8.5.1 Pigeon Strategy Report	Council prepare a fact sheet to distribute to residents and local businesses providing information on pigeon control. Council undertake pigeon proofing on Council assets where roosting pigeons congregate. Council liaise with business owners to facilitate efforts to eradicate pigeons from the CBD area and seek Expressions of Interest from pest exterminators with the intention of providing a report to Council once the information has been collated. The report and resolution be distributed to CBD businesses.	Manager Regulatory Services	12.02.2020 Manager Regulatory Services has written to the Cootamundra Development Corporation and, in turn, they have written to the local businesses regarding contributing towards a pigeon control program. A meeting to be held with interested local businesses will be arranged at the end of February.
8.10.1 Cootamundra Aquatic Centre Access	3. The cost for the installation of permanent barricades be investigated with the consideration to disabled access.	Manager Waste, Parks and Recreation	This has been completed on a temporary trial basis. November 2019 – no change. **March – Pool now closed no further action at this stage.**
8.10.2 Cootamundra Aquatic Centre Independent Review	3. A further report be prepared containing any Expressions of Interest received and be submitted to Council for consideration.	Manager Waste, Parks and Recreation	Report going to Council in October 2019. November 2019 – completed, consultants are to be engaged and works undertaken as per Council resolution,

			March – First draft completed will go to council workshop in April
ORDINARY MEETING - 24 September, 2019			
9.1 Notice of Motion - The Lighting Scheduled for Replacement at Fisher Park be donated to the Cootamundra Rodeo Association	The lighting scheduled for replacement at Fisher Park be donated to the Cootamundra Rodeo Association.	Manager Waste, Parks and Recreation	**November 2019** - Lights and towers will be removed and stored until collected by the Rodeo Club. All electrical works completed, tower footings completed delivery of towers and lights scheduled for November. Tower erecting and commissioning is scheduled for November early December. Project is on time, budget and quality. **March – Lights not considered by council and Rodeo to be suitable**
9.2 Notice of Motion - Cootamundra-Gundagai Local Area Traffic Committee Develop Draft Guidelines for Roadside Trailer Advertising	Council request Cootamundra-Gundagai Regional Council Local Traffic Committee develop a draft policy guidelines paper to regulate the use of advertising trailers across the local government area. Once the draft policy guidelines to regulate the use of advertising trailers has been completed a report will be prepared and submitted for the consideration of Council. The policy guidelines should commit to: a) Present a degree of fairness, reflecting Council's ongoing support for the promotion of local businesses, b) Regulate appropriate sites to protect public access and safety,	Manager Civil Works	Initial report went to November, 2019 Traffic committee to consider suitable sites

	c) The proposal of a fee to cover the cost of administration of the regulation of the policy guidelines, and d) Ensure the proposed fee reflect fair commercial advertising costs.		
ORDINARY MEETING - 29th October, 2019			
ITEM	ACTION	STAFF	Status
8.1.1 Local Government Elections 2020	Council invite a representative from the Australian Electoral Commission to address Council and explain the costs included in the quote received for the local Government elections 2020.	GM/ EA to GM & Mayor	Waiting on response from AEC to indicate their availability to attend a Councillor Workshop Elections deferred due to COVD-19
8.1.8 Gundagai Tourism Action s.355 Committee Meeting Minutes	From Minutes – council wait for outcome of SCCF 3 funding before spending $300K	Manager Community & Culture	
8.1.9 Muttama Creek Regeneration Group s.355 Committee Meeting Minutes	Arrange meeting between s355 Committee and Manager Waste, Parks and Recreation	Manager Waste, Parks and Recreation	**November 2019** – as detailed in items 31.07.18 – 9.2 **March – no further action at this stage.**
8.1.10 Information Bulletin Attachment 5 – Government response to IPART's review of local government election costs	Write to the Minister for Local Government, the Hon Shelley Hancock, MP	GM/ EA to GM & Mayor	
8.3.1 Friends of Old Gundagai Gaol Committee Meeting AGM Minutes	Restricted funds audit report to Council	Manager Community & Culture	Manager Community & Culture and Manager Finance to discuss to determine what is required.
ITEM	**ACTION**	STAFF	STATUS
9.3 Notice of Motion - Save our Recycling Campaign	**4.** Council write to the local State Member(s) Ms (Steph) Stephanie Anne Cooke MP, Hon	EA to GM & Mayor	

	Michael McCormack MP, Minister for Energy and Environment the Hon Manager Technical Serviceshew Kean MP, Local Government Minister the Hon Shelley Hancock MP, NSW Treasurer the Hon Dominic Perrottet MP, Premier the Hon Gladys Berejiklian MP, Opposition Leader Jodi McKay MP, Shadow Minister for Environment and Heritage Kate Washington MP, and Shadow Minister for Local Government Greg Warren MP to confirm their support for recycling and outline the urgent need to educate, innovate and invest in local waste and recycling services via the Waste Levy. 5. Council formally write to its own Youth Council advising its members of its support for the Save Our Recycling campaign and asking them to consider endorsing and sharing it with their own networks across the CGRC local government area. 6. Council advise LGNSW President Linda Scott of the passage of this Motion.		
9.4 Council develop a local services preference policy detailing that, where opportunity exists, service providers, based within town boundaries are given preference should they be available, they are able to meet essential criteria and	Council develop a Local Services Preference Policy detailing that, where opportunity exists, service providers, based within town boundaries are given preference should they be available, they are able to meet essential criteria and specifications and their quote or tender amount is comparative with other submissions received by Council.	Procureme nt Officer	**March The Procurement Policy has been updated with reference to buying local and further information will be contained in the Procurement Procedure document to go to the April Council Meeting.**

specifications and their quote or tender amount is comparative with other submissions received by Council.			
ITEM	**ACTION**	STAFF	STATUS
ORDINARY MEETING 26TH NOVEMBER, 2019			
8.3.4 EVERYONE CAN PLAY APPLICATION - LINDLEY PARK SOUTH GUNDAGAI RESOLUTION 429/2019 Moved: Cr David Graham Seconded: Cr Charlie Sheahan	Council endorse a matched application for funding for Lindley Park South Gundagai to the Everyone Can Play Grants.	Manager Finance/ Manager Community & Culture	If grant application successful set aside funding in budget. Determine how to fund. Works in kind from what department. Discuss with relevant Managers.
8.7.2 COUNCIL MINI HIACE BUS COMMUNITY USAGE REVIEW RESOLUTION 437/2019 Moved: Cr Penny Nicholson Seconded: Cr Leigh Bowden	2. Council undertake consultation with representatives of Mirabooka to develop a fee proposal, to be included in the report, to be prepared and submitted to the Ordinary Meeting to be held Tuesday, 26th May, 2020 for the consideration of Council for inclusion in the 20/21 Fees and Charges. 3. A further report with more accurate hire details be prepared and submitted to the Ordinary Meeting to be held Tuesday, 26th May, 2020 for the consideration of Council.	Manager Civil Works / GM	12.02.2020 Trial continuing. **Report to be prepared for the consideration of Council at the Ordinary Meeting to be held 28th April, 2020**
ORDINARY MEETING 10TH DECEMBER, 2019			
ITEM	**ACTION**	**STAFF**	**STATUS**
8.7.2 Fixing Local Roads Funding Program. RES 471/2019	Council commit to a 25% contribution to all projects submitted under the program.	Manager Finance/Man	Reported at December 2019 meeting with nominated projects and 25% council contribution.

		ager Civil Works / Manager Technical Services	
9.1 Notice of Motion - Council Undertake Another Volunteer Induction For Drivers of the Council Community Hiace Mini Bus in February, 2020 RES 479/2019	That a group volunteer induction day be advertised in January, 2020 so members of local community groups be eligible to drive the Community Hiace Mini bus so as to optimise its use.	Manager Civil Works / Madlin	Madlin to arrange induction process **Deferred due to COVD-19**
9.4 Notice of Motion - The Cost of an Irrigation System for the Off Leash Dog Park in Hurley Street be Included in the 2020/21 Budget. RES 482/2019	That an amount of up to $30,000 be considered within the 2020/21 Budget for an irrigation system to be installed at the Off Leash Dog Park in Hurley Street, Cootamundra.	Manager Regulatory Services	Update required **March To be completed by Regulatory Services**
11.2 Proposed Compulsory Acquisition Land Affecting Lots 35, 71 and 88 DP751415 and Lot 2 DP1100263 Reno Road, Gundagai RES 485/2019	1. Council make application to acquire land affecting lots 35, 71 & 88 DP 751451 and lot 2 DP1100263 under the Land Acquisition (Just Terms Compensation) Act, 1991. 2. The General Manager be authorised to sign any relevant documentation in relation to the proposed acquisition referred to in 1 above. 3. Authority be granted to affix the common seal of Council to the necessary documents.	GM	Confidential Report. Confidential update required.
11.4 Proposed Acquisition by Cootamundra-Gundagai Regional		GM	Confidential Report. Confidential update required.

Council for Bangus Quarry Remediation Project - Late Report RES 487/2019	1. Council approve the acquisition of Crown land Lot 7300 DP1149008 and Lot 7004 DP1028797 for the Bangus Quarry Remediation Project. 2. The General Manager be authorised to sign any relevant documentation in relation to the proposed acquisition referred to in 1 above. 3. Authority be granted to affix the common seal of Council to the necessary documents. 4. Upon acquisition by Council the land be classified as operational.		
ORDINARY MEETING 28TH JANUARY, 2020			
ITEM	**ACTION**	**STAFF**	**STATUS**
8.1.7 Tender - Town Entry Signs, Cootamundra and Gundagai RES 012/2020	That the Tenderer, Gundagai Constructions be advised of the resolution of Council.	Manager Business	Update required by Procurement Officer
8.1.8 The Response to the New Risk Management and Internal Audit Framework for Local Councils in New South Wales RES 013/2020	Council make representations to Member for Cootamundra, Steph Cooke MP and the Office of Local Government in relation to the unfairness of the fees required to be paid by Council for the Audit, Risk and Improvement Committee.	Manager Business	**CGRC contributed to representations provided by REROC to the Office of Local Government. Letter to Steph Cooke MP outstanding.**
8.1.13 s.355 Committee Update RES 018/2020	Council dissolve the Cootamundra Concert Band s.355 Committee, for reasons detailed in the report.	Manager Business	Correspondence be sent to the Cootamundra concert Band informing them of the resolution of council **Correspondence has been sent to the Cootamundra concert Band informing them of the resolution of council Complete**

8.1.15 Cootamundra Tourism Action Group Section 355 Committee Minutes of meeting held 15 January 2020 RES 020/2020	1. That appropriate grant funding be acquired to develop a specific agri-tourism and regional tourism tours strategy for the Gundagai and Cootamundra region which develops rural, agriculture, food tourism and experiential tourism opportunities through the collaboration between Council, Local businesses and producers. 2. That Council seek an appropriate funding arrangement to ensure the position of Economic Development and Tourism Officer in Cootamundra, continues beyond the current one year tem which ends in November, 2020.	Manager Culture and Community	No update available to date
8.1.16 Gundagai Tourism Action Section 355 Committee RES 021/2020	Council seek permission from Transport for New South Wales to locate a variable message sign on the northern side of Gundagai, with the intention of encouraging south bound motorists to Stop, Revive, Survive in Gundagai.	Manager Culture and Community	Anthony Carroll taking to February, 2020 traffic committee
0.1 Finance			
8.2.1 December 2019 Quarterly Budget Review Statement RES 025/2020	A report on the funding of Cootamundra Water Mains Replacement Program be prepared and submitted to the Ordinary Meeting to be held 25th February, 2020.	Manager Finance	A report on the funding of Cootamundra Water Mains Replacement Program be prepared and submitted to the Ordinary Meeting to be held 25th February, 2020.
Ordinary Meeting February, 2020	Action	Manager	Update
Jan 2020 resolution 034/2020	The Motion to Review the 2019/20 budget with relation to staff and Councillor development with the view to allocate funds in the 2020/21 Budget was deferred until the Ordinary Meeting to be held 25th February, 2020 to source benchmark funding information to then be provided for the information of council at the Request of Cr Graham and with the approval of Cr Nicholson	Manager Finance	
8.3.1 Recreational Needs study public consultation (066/2020)	1. The Draft Cootamundra-Gundagai Recreational Needs Study (attached under separate cover) be placed on public	Manager	

	exhibition for a period of twenty eight days inviting submissions from the community. 2. A further report on the Cootamundra-Gundagai Recreational Needs Study including submissions, if any, be prepared and submitted for the consideration of Council.	Culture and Community	
8.3.2 Drought communities program (067/2020)	Applications be prepared and submitted through the Drought Communities Program for the Gundagai Main Street Development Stage Two (2) and Parker Street Cootamundra Upgrade.	Manager Culture and Community	

THE REPORT AND RECOMMENDATIONS OF THE COOTAMUNDRA HERITAGE CENTRE MANAGEMENT COMMITTEE MONTHLY MEETING HELD AT THE COOTAMUNDRA HERITAGE CENTRE ON WEDNESDAY 3 February 2020 COMMENCING AT 4.03PM

Present: Geoff Larsen (Chairperson), Betty Brown, Yvonne Forsyth, Hugh Hamilton, Michele Pigram, Betti Punnett, Craig Stewart, Ros Wight

Minutes from the Previous Meeting: Read and confirmed on the motion of Betti Punnett, seconded Craig Stewart **CARRIED**

Business Arising: * Training days - Yvonne Forsyth reported on a successful couple of days.

Financial Report: Betti Punnett presented the Financial Report with takings of CHC $670.55, VIC $374.00 since 4 November; No: CHC 470, VIC 372. Moved Betti Punnett, seconded Ros Wight. **CARRIED**

Correspondence: IN * Volunteers' Christmas Party invitation 4 December
* Jeana Bell - re sale of books at CHC. Members agreed the Management Committee recommend policy regarding CHC (eg sale of items), but volunteers may certainly express opinions as to viability or advisability of any changes to practices. Moved Yvonne Forsyth, seconded Ros Wight CHC/VIC continue not to not sell books. **CARRIED**
* Sam Leah - workshop for museums with Indigenous material 5 March Wagga Wagga City Council members expressed interest. Betti Punnett has enrolled.
* Teresa Breslin - C/GRC policy re expenditure limits on Section 355 Committees. Limit $500.00 "Any purchase/payment above that amount, or for capital purchases of any amount, are to be made by Council or receive the prior approval of Council."
* C/GRC - letter from Mayor Abb McAlister acknowledging "the work of Committee members for tirelessly contributing their time, knowledge and skills through active participation". This was appreciated by all members.
* C/GRC - storeroom tidy-up
* AM&G Magazine
OUT: December Newsletter and November Meeting Minutes

Regional Council
Document Received
2 6 FEB 2020
File No.
Initials

General Business:
*C/GRC - storeroom tidy-up. The safety aspect of CHC storeroom was questioned and recommendations made:
". Removing items off the floor and placing on shelves
. Making sure nothing will fall off shelves
. Securing items in containers or boxes to maximise storage and space, making items easy to find and safe to cart/carry."
Members agreed storage was a problem particularly as VIC material now virtually filled one storeroom.
Action to be taken: Black chairs to be returned to C/GRC
Small cupboard (storeroom) to be sold [moved Betty Brown, seconded Ros Wight **CARRIED**]
Ladder to be moved when storage space established
Main storeroom to be attended to when possible (working bees??)
Sink to be removed (water disconnected) from verandah storeroom
Every effort continue to be made to provide a safe environment for both visitors and volunteers
Members questioned the necessity to remove items stored in closed-in shower recesses.

Query - where is the storage shed which was mooted/promised (?) 2018?
* Progress on painting of CHC - ARTC to be contacted (*Betti Punnett*)
* Hugh Hamilton queried progress on obtaining model of Arthur Butler's Comper Swift. No action over holiday period.
* *Images of Bradman* - it was decided not to accept as not complete.
* Yvonne Forsyth commented on the condition of the blinds in some of the galleries. Some of the original blinds (2001) are torn. Members recommended that these damaged blinds be replaced 2020. Blind (above the sewing cabinet display) to remain down in the main gallery.
* Members joined in congratulating Geoff Larsen and Betti Punnett on each being presented with a "Certificate of Appreciation" at Cootamundra's 2020 Australia Day celebrations.

There being no further business, the meeting closed 5.25pm.

Betti Punnett
Secretary/Treasurer

Next Meeting: Monday 4 March 4.00pm

THE REPORT AND RECOMMENDATIONS OF THE COOTAMUNDRA HERITAGE CENTRE MANAGEMENT COMMITTEE MONTHLY MEETING HELD AT THE COOTAMUNDRA HERITAGE CENTRE ON WEDNESDAY 2 March 2020 COMMENCING AT 4.03PM

Present: Geoff Larsen (Chairperson), Betty Brown, Yvonne Forsyth, Hugh Hamilton, Michele Pigram, Betti Punnett, Craig Stewart, Ros Wight

Minutes from the Previous Meeting: **NB**: The receipt of a box of items presented by Georgina Ward *Gilgal* was inadvertently omitted from the Minutes. Minutes read and confirmed on the motion of Betti Punnett, seconded Michele Pigram. **CARRIED**

Business Arising: * The cupboard from the storeroom was sold $50.00. Receipt issued.
* The chairs from the Town Hall had been returned.
* No action as yet on removing the basin and disconnecting the water from storeroom. The basin to be discarded.
* ARTC has been contacted and a progress report to come from the Property Manager - re painting CHC.
* Gunnar Berg is considering making a model of the Comper Swift.
* No action on replacing blinds in galleries. *Desi's Fabrics & Blinds* to be asked for quote (*Betti Punnett*).

Financial Report: Betti Punnett presented the Financial Report with takings of CHC $290.10, VIC $82.00 since 3 February; No: CHC 115, VIC 125. Moved Betti Punnett, seconded Betty Brown. **CARRIED**

Cootamundra-Gundagai Regional Council
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Initials

Correspondence: IN * Tom Lockley email - latest on Darwin to Adelaide Celebration Flight
* M&GA - Volunteer Museum Grants 2020
* MOSAiC Workshop - notification
OUT: February Meeting Minutes

General Business: * Jim Caskie has installed 3 lengths of Curtrax in Shire Council gallery and both sides of bottom hallway. He reinstalled the Cootamundra Shire Council sign (damaged from falling from the wall) and installed the *Cunjegong Springs* sign presented by Georgina Ward. Two panoramas are now on display in the hallway, but more hooks are needed. It was decided to purchase 10 hangers and 100 hooks. Ros Wight suggested that detailed notes be recorded on the back of the photographs for future reference.
* *Gilgal* box - the toaster is now on display, after cleaning (as much as possible). Other material still to be assessed.
* Yvonne Forsyth and Michele Pigram reported on very successful visit by 49 Sacred Heart students, who were all very well behaved! It was noted that this was the first time each student recorded findings on individual ipads. Volunteers were thanked for their assistance.
* Ride-on mower - it was decided to keep the ride-on mower.
* Bethungra Spiral - booklet being prepared by Betti Punnett
* Cootamundra Aerodrome - Hugh Hamilton preparing a booklet to be available 17 March
* Arthur Butler pull-up - members noted the deterioration of this pull-up on display in the Aviation gallery. Advice to be sought on conservation of the item (*Ros Wight*).
* MOSAiC workshop - Campbelltown 20/21 April $132.00 each per day Betti Punnett and another volunteer to attend. Application to be made to M&GA for a grant.
* Storage space - representative from C/GRC to be invited to next meeting to discuss storage options for CHC/VIC.
* Working Bee to be held Tuesday 10 March 9.30am to work on storerooms.

There being no further business, the meeting closed at 4.50pm

Betti Punnett
Secretary/Treasurer

Next Meeting Monday 6 April 4.00pm

****** Working Bee to be held 17 March 9.30am ******

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Minutes

COOTAMUNDRA SHOWGROUND USERS SECTION 355 COMMITTEE

ALBY SCHULTZ MEETING CENTRE, COOTAMUNDRA
7PM, WEDNESDAY 18TH MARCH 2020

Meeting opened at 7:05pm

1 AGENDA ITEMS

1.1 Attendance and Confirmation of Quorum

Attendance: **Acting Chairperson:** Andrew Brock (Manager Facilities),
Acting Secretary/Treasurer: Susan Gheller (Manager Business)
Nominated Members: Rod Jones, Rebecca Medhurst, Trish Taylor, John Collins and David Manwaring
Others attendance: Joan Collins, Doreen O'Connor

Confirmation of a Quorum: There are **[7]** Members appointed to this Committee. Quorum numbers are met **[yes]**

1.2 Apologies Mayor Abb McAlister, Cr. Gil Kelly, Darren Absalom

1.3 Disclosure of Interests

There were no disclosures of Interest.

1.4 Confirmation of previous meeting Minutes

The minutes of the Showground Users Group Section 355 Committee ordinary meeting dated 19 February 2019 to be reviewed. Corrections will be made to minutes regarding attendees.

Moved: john Collins
Seconded: Trish Taylor

1.5 Business Arising from previous Minutes

Please note that an agenda was not provided for this meeting due to unexpected leave taken by the Secretary.

Item/Discussion	Action	Status
Andrew Brock (Chairperson) – New Sheds encouraging but clubs need to remember that they need to abide by inspections set out by Planners.	**Pony Club shed needs more space between buildings (minimum 1 metre). Pony Club to ensure that it is moved.**	Still to be amended. Pony Club has spoken to concreter who will attend when able. This issue is ongoing
The Showgrounds Committee has received a complaint stating that the lighting in the pavilion was disgraceful. There is also a broken sky light.	**Andrew Brock (Chairperson) will obtain quotes for new lighting. Complaint to be forwarded to Andrew.**	Work on lights completed to date: sensors on external and internal ? and luncheon pavilion. Public toilets, emergency lighting and upgrade to luncheon pavilion.
The Harness Club expo has been postponed due to conflicting events. Drainage works are required.	**Harness Club to write to Council to clarify the works required.**	CGRC is carrying out grading work nearby and will grade track at same time. There will also be work to install a pipe for irrigation which will be tidied up when completed.
Antique Car Club, Joan Collins would like to obtain master key.	**Andrew Brock (Chairperson) will organise key including an extra key for the showers and toilet.**	Master key system implemented. Extra keys obtained and locks changed
Coota & District Machinery Restoration Society, Rod Jones – Requested that the Committee use Showground funds to upgrade the lighting in the pavilion.	**Andrew Brock (Chairperson) to source quote for LED lighting in the new year.**	Ongoing
Rod Jones and David Manwaring: Would like to get cleaners in for the luncheon pavilion.	**Potential to disallow glass on the Pavilion. Requires signage and could be incorporated in hire agreement. Inspect post-hire and if there is an issue with cleanliness which isn't rectified then bond will be sacrificed. Alternatively, if cleaning was part of hire it will need to be incorporated into fees and charges.**	Current contract cleaner at Council will work at Pavilion over the next couple of weeks Reluctant to ban glass on site as there needs to be thought around beverages such as wine which mostly comes in bottles.
Condition of evacuation signs.	**Andrew Brock (Chairperson) will follow up with the Fire Services contractor for Council.**	New signage up
Crown Lands - Site condition assessment of all structures	**Darrell has completed. Andrew will investigate – hasn't got copy back.**	Still chasing Crown Lands for Information

Lights left off in toilets and pavilions. A sensor may need to be installed	**Andrew will investigate**	Sensors will be installed
Garbage Collection after a hiring	**Will discuss areas designated for pick up with Manager Waste** **Manager Waste to get the Rubbish Truck driver to do a loop of the site. Toilet cleaner to bring bins in after emptied.**	Will be amendment to agreement form with additional map so people using grounds know where to place bins. Customer service will advise the Truck Drivers. Still trying to resolve this issue at March meeting, bins full at camping area and Andrew will speak with the cleaner.
Brian Childs mentioned that a number of people walk their dogs particularly by the rear gates near the Pavilion. Would like to see a dog poo bag dispenser installed	**Andrew will investigate**	Currently there is a lack of funding for this but it will be raised with Regulatory Services to be put into budget
Riding for the Disabled fees have been waved in the past. Discussion as to whether RDA could contribute to Electricity and Water. Suggest RDA prepare a letter to the Showgrounds Committee requesting the waiver of fees.	**Requested letter from RDA**	Letter from RDA Received in the Meeting.
Condition of Evacuation Signs	**Andrew Brock will follow up with the Fire Services contractor for Council.**	Complete
Cootamundra Kennel Club requested more space to place rings and most likely area is in the area used by Riding for the Disabled. Discussion ensued regarding use of land as RDA use it to keep horses and use the land weekly as opposed to annual Dog Show.	**Decision noted by the Committee**	Shipping container removed and area needs additional clean up

Wind damage at showground	**Trees and branches and pump shed to be replaced (new garden shed). There is also a tree at RDA close to the fence which could fall on neighboring houses.** **Moved to build new shed for pump with Showground funds.** Moved: Rod Jones Seconded: Doreen	Andrew has engaged Spinifex to repair the pump over the bore.
Use of Tractor (no entry in log book)	**Reminder to log time in book when using the tractor.** **Tractor has been serviced by CGRC - organised by Rod**	This is still occurring regularly and the concern is that the person mowing has not had a safety induction. Also a wheel was missing last night when Rod went to mow. Resolved to change the code on the key lock. Not adverse to have others pitch in to assist but and induction must be carried out for WH&S
Cleaning of Luncheon Pavilion	**Andrew will engage cleaner to carry out big cleaning blitz and then will paint.** **Some basic maintenance to be carried out as well.**	To be addressed Female toilet by luncheon pavilion lock gone – and filthy need walkthrough
Signage at side entry gate	**Move the sign at entrance just before turn and move it to where old sign is plus arrow.** **According to Andrew has been ordered and he will follow up with council staff**	Andrew has three sigs to be put up directional signs
Evacuation Signs	**Andrew to follow up with Fire Service Provider**	
Condition of Toilet Block	Feedback from camper regarding state of toilet block Discussion: Committee in agreement we can look at hooks and seats and some basic improvements like mirrors. Look at obtaining a grant for showers. Caretaker facility is priority.	Andrew to organise repairs.
Wattyl Hire Storage	Wattyl Hire is moving business operations. Question as to whether they are moving stored items out of the pavilion.	Andrew has contacted Wattyl Hire and there will be not changes to

		storage
Relocation of tiered seating	The tiered seating used by the Beach Volleyball even needs to be moved from current position between two Pavilions to corner along the fence (corner of Berthong street and Pinkerton Street)	Andrew to follow up
Showgrounds Calendar	For the March meeting a copy of the current calendar needs to be made available so dates can be checked.	Susan will organize a copy of the calendar entries for each month this calendar year
Show Jumping	Interest from the Pony Club in including show jumping at the Showgrounds. Showjumping is very successful at Gundagai and there is an opportunity to get showjumpers to the Pony Club Gymkhana after the Gundagai Show. However, the condition of the grounds needs improvement before this can take place. Is it possible to have treatment such as sand prior to Gymkhana? Also is there irrigation or bore water that will green up the area. The Pony Club would like to host showjumping events for the community.	Irrigation will be attended to before track work is carried out. Andrew is organizing this at the moment.

Business arising from previous minutes report accepted.

Moved: John Collins
Seconded: Dave Manwaring

1.6 Correspondence in/out:

- Incoming correspondence:
  Letter from RDA

- Outgoing correspondence:

Motion to accept incoming correspondence and actions.

Moved: Rod Jones
Seconded: Trish Taylor

1.7 Report from the Treasurer/Chairperson/Secretary:

No treasurers report. Will be sent out in two weeks.

1.8 General Business

2

1. Bookings from the public will be restricted to the current calendar year. Public bookings will be taken once User Groups have set annual calendar. All new bookings will be placed on the s355 Showgrounds Committee Agenda.

2. Correspondence received from Riding for the Disabled regarding the either the rebate of fees paid this year or waving next year's fees.

Motion: Recommendation to reimburse fees or wave next year's fees of the s355 Showground Committee for Riding for the Disabled due to effects of drought and extra expenses.

Moved: Dave Manwaring
Seconded: John Collins

3. Dangerous tree – there is a dangerous tree at the back of the Showgrounds. A large branch dropped and almost hit a rider with RDA. Not sure if the tree is in tree register but agreement that this should go to Council as a recommendation to have the tree removed.

Motion: Recommendation that dangerous tree on Showgrounds border with private residence be removed.

Moved: Rod Jones
Seconded: Dave Manwaring

4. A member of the public has come forward regarding taking over the Caretakers role. This is encouraging as there have been squatters at the campground and it will also assist with the collection of camping fees.
Action: Andrew Brock will follow up.

5. There is a significant drainage issue between the Luncheon Pavillion and the Wattly hire storage space. – may be break in gutter. Water quite deep in solar on the lucheaon whatever the majig. Need larger one with grate and fix drainage

6 . The skylights on pavilion need cleaning and maybe replacing as they are black. We may need to source a grant for this.

9. Rod has requested volunteers to assist with mowing around the Columbara Pavilion. There is week that must be controlled now or will be difficult to remove.

10. A Tractor Trek is tentatively scheduled for the 2nd and 3rd of May starting from the Showgrounds. They may use the Luncheon Pavilion.

11. Rebecca advised that the Harness Club Expo has been cancelled.

12. Susan Gheller advised that this will be her last meeting with the Showgrounds s355 Committee as she has resigned from Council for family reasons. She has enjoyed working with the Showgrounds

Committee and has been very impressed by the member's commitment and contribution to the community. Wishing you all the best for the future.

Date and Time of Next Meeting

Council has decided to suspend all non-essential meetings for the foreseeable future. Since events at the Showgrounds have been cancelled, there is no reason for the s355 Showgrounds Committee to meet. The Chair will keep the Committee informed as to when Showground Committee meetings will resume. A copy of the calendar will be forwarded to members within the next week.

2.1 Time Meeting Closed

Meeting Closed at 8:06pm.

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Minutes

STOCKINBINGAL ELLWOOD'S HALL SECTION 355 COMMITTEE

ELLWOODS HALL, MARTIN ST, STOCKINBINGAL

DATE: 5.15PM THURSDAY 27TH FEBRUARY 2020

1 AGENDA ITEMS

1.1 Attendance and Confirmation of Quorum

Attendance:	**President/Chairperson:**	**Carmel Payne**
	Secretary:	**Absent – Kim Lee recording minutes.**
	Treasurer:	**Alan Pether**
	Councillor:	**Leigh Bowden**
	General Members:	**Stephen Neave, Kim Lee**
	Visitor:	**Lynn Basham**

Confirmation of a Quorum: There are **7** Members appointed to this Committee.
Quorum numbers are met - **yes**

1.2 Apologies

Lorna Nixon, Russell Vincent

1.3 Disclosure of Interests

No disclosures or conflict of interests.

1.4 Confirmation of previous meeting Minutes

The minutes of the last Ellwood's Hall Section 355 Committee meeting dated 16 January 2020 were confirmed as true and correct.
Moved: Kim Lee Seconded: Alan Pether

1.5 Business Arising from previous Minutes:

- The Lock Stock & Bingle Fund Raiser for fire victims was held on Saturday night of 15th Feb 2020 between 7.30 – 11.30pm with about 80 people attending a fun filled, dance filled evening and approximately $1200 raised for the Salvation Army to distribute.
  The Hall worked well for this function with the new vacuum cleaner put to good use by Kim and the Norwex mops were wielded by Russell, Carmel & Lorna to eliminate dust from several storms. The new 20L Urn & Trolley was also used on the night and the outside area was well lit by two new flood lights installed by Brendan O'Callaghan.
- Helene Johansson from the ARTC Grants accepted out request to use remaining grant funds (originally for the purchase of Room Dividers) for the purchase of an urn and trolley and a commercial vacuum cleaner. The same items were purchased that Rosalie Dale had previously requested from the ARTC. There was a small difference in the final cost to come from our own account.

- Greg Briscoe-Hough confirmed and notified the committee that councillor Leigh Bowden may act as a full member of the committee thus making it unnecessary to nominate a new committee member following the resignation of Rosalie Dale. **This advice has since been deemed incorrect. Evan Hutchins (who wrote the 355 Manual) and GM Phil McMurray have advised that Councillors cannot be full committee members, and cannot vote. They can attend to observe and help committees.**
- The submission to the ARTC for a grant of $2,550 to fund the July Model Trains weekend was completed and submitted before the end of January.
- Calendar for Bookings was delivered to Steve Neave to write up any forthcoming events and regular Hall bookings.
  Action: Meeting decided to purchase a Wall Planner to be put up in the Hall so that others may know what events are coming up. Secretary to purchase.
- **Car Boot Sale on 28th March –** is being advertised. Carmel doing some advertising on Facebook and posters for distribution. It has been seen on the Coota Development Page of Upcoming Events. Rosalie will include in the Newsletter. Carmel & Lorna taking bookings. **Bookings are to be confined to the yard area at $10 per site. Site to be no wider than the back of a car. No tea, coffee or BBQ will be provided for this event. Vendors are to be set up between 8.00am – 9.00am, entering and leaving via the back gate. Close at Noon.**
  There will be a need to check if the lawn needs mowing prior to the event and the removal of fallen tree branches. If Council have not mown the lawn, Moggy may be able to assist.
- Wedding on 18th April – Secretary spoke to the bride to be on 17 Jan. They will be providing their own round tables and chairs. They have requested having access to the hall on Wed 15th, Thursday 16th, Friday 17th to decorate the Hall, and Sat 18th for the reception. This will clash with Stop & Mingle on Thursday but Dana has said they will work around normal events. Michelle Harper, coordinator of Stop & Mingle, has been notified of this occurrence. The couple have also requested using some of the stools in the back stage room for outside at the wedding
- **Model Rail Club have requested a change of date for the July weekend – new date is 11 July 2020, 1 week earlier. Secretary to notify Rod Smith.**

1.6 Correspondence in/out:

- 17.01.2020: Helene Johansson approving the spending of the remaining funds from the grant.
- 17 .01.2020: Sec to Rosalie Dale regarding details of the April Wedding.
- 17.01.2020: Reply from Rosalie re wedding.
- 17.01.2020: To Brendan O'Callaghan requesting a quote for two external lights for the Hall.
- 19.01.2020: Sec to Committee re use of stools at the upcoming wedding.
- 20.01.2020: From ARTC Grants acknowledging our application for funding. We will be notified the outcome mid Feb.
- 21.01.2020: From Abb McAlister thanking our committee for their contribution and dedication and commitment.
- 21.01.2020: Tax Invoice from Godfreys for Vacuum Cleaner.
- 21.01.2020: from Nisbets – acknowledgement of Order for Trolley & Urn
- 29.01.2020: from Nisbets – Tax Invoice for Trolley & Urn
- 30.01.2020: Sec to Greg Briscoe-Hough re the electricity account
- 30.01.2020: Quote from Brendan O'Callaghan for external lights.
- 30.01.2020: Sec to Brendan O'Callaghan accepting his quote.

1.7 Report from the Treasurer:

Opening Balance: $ 8139.60

Income: $ 390.69
Expenses: $ 692.73

New Balance: $ 7837.56

Term Deposit of $5000 due to mature on 01.04.2020. Decision to be made at the next meeting whether to reinvest or not.

Alan Pether moved that his report be adopted. Seconded Stephen Neave.

1.8 General Business

1) **Stools/benches for the wedding** – Committee concerned about the safety and stability of the old, long stools being used outside.

Action: Stephen Neave to ask the couple if they would like to use the railway benches instead.

2) **Weather strips for Front Doors** – to prevent wind, leaves, dust, snakes etc from entering the Hall.

Action: Ask the Shire the best way to do weather strips on the main front doors.
Also if the shire could supply two new steel doors made to fit the front opening of the Storage Area which opens onto the street. The existing doors are damaged and have an unacceptable locking mechanism. Secretary to contact Andrew Brock.

3) Cleaning of Hall/Toilets prior to regular usage – Active Farmers (Mondays); Tai Chi Thursdays; Stop & Mingle 3rd Thursday;
And for bigger events – eg wedding on 18th April

Action: Lorna Nixon will clean Hall prior to Tai Chi. Stephen will keep up his weekly mopping on a Sunday. Active Farmers are in recess at present. Kim will discuss with Michelle Harper from Stop & Mingle about checking/cleaning prior to their Morning Teas.

4) Key Register: Currently Hall keys are held by Carmel Payne, Stephen Neave and Lorna Nixon.
Heritage Room keys are held by Stephen Neave and Rosalie Dale.

Action: Secretary to make a signing on/off list and record changes.

5) Heritage Room Committee – Discussion took place. Advice has been given that the Heritage Room is a "sub-committee as per requirements outlined from Section 355 Committee Management Manual – Sub Committees. The sub-committee must report back to the Hall Committee as they have no legal standing and recommend back to the Committee for ratification.
Activities of the Sub-Committee must be related to the delegated function(s) of the parent Section 355 Committee, and details of the persons and activities involved must be included in correspondence supplied to Council.
Members of the Sub-Committee must be duly appointed members of the Community Committee and will be covered in accordance with the Public Liability and Accident Insurance policies."

A letter has been received from Rosalie Dale rescinding her resignation from the Heritage Room Committee. (However as she is no longer a member of the Hall Committee she would be unable to be part of the Heritage Room Committee). Further discussion required.
Hall Committee also concerned about the finances of the Heritage Room. Clarification is required as to whether the sub-committee can have a separate account.
Stephen Neave is the only member of the Hall Committee who is on the Sub-Committee at present. He requires some time to consider the future of the Heritage Room and whether it will remain in the Hall or become a separate entity.

1.9 Date and Time of Next Meeting

5.15pm Thursday 26th March 2020

1.10 Time Meeting Closed

6.25pm

Signed: Carmel Payne — Lorna Nixon/Kim Lee

Chairperson — **Secretary/Acting Secretary**

COOTAMUNDRA - GUNDAGAI REGIONAL COUNCIL

GUNDAGAI TOURISM ACTION COMMITTEE

Meeting No 107
Monday 24th February 8:00am – Gundagai Council Chamber

Minutes

Meeting Commenced: 8:17am

Present: John Morgan, Miriam Crane, Abb McAlister, Renee Lindley, Penny Nicholson, Mike Kingwill, Peggy Elliott

Apologies: Jim Morton

Confirmation of Minutes

Moved: Renee Lindley

Seconded: John Morgan

Correspondence

NA

Key Focus Area Updates

a) **Branding and Marketing Strategy**

Recommendation: Council adopt the brand Concept 3: Gundagai, Gundagai "Unleash your Freedom", and refrain from adopting a regional logo.

b) **Launch and Promotion of Main Street**

Main Street Mural

Yianni Johns is coming will provide concepts/quotes and discuss with a view to completing.

c) **Proposal from Wiscombe Media**

Await outcome of Marketing Strategy.

d) River Access and Morley's Creek Plan (Old Mill)

Committee to work on a fishing grant application to improve river access with a focus on Deighton's beach. Due October.

e) Visitor Information Centre Upgrade

Pending outcome of SCCF3 application – due February 2020.

f) Truck Museum

No further update.

g) Railway Bridge & Cycle path

Tumbarumba Rail Trail is opening on 3rd & 4th April. Council are pushing for the reopening on Tumut Street. Potential steam launch reenactment project planned for 2025.

h) Social Media

Recruitment pending for Trainee Tourism Administration Officer. We are trying to keep up to date with posting in the meantime.

i) ANBC Update

The committee is considering moving this event in a different direction next year, possibly a two day format.

Recommendation: Council look at options for funding a speaker system down the main street that plays the local radio station and can be used for events.

General Business

a. Change of Name/Charter

Requires more thought. To be considered over coming months in conjunction with GREG.

b. Riverview Weekend

Sarah has provided some information to Miriam and Renee on the events.

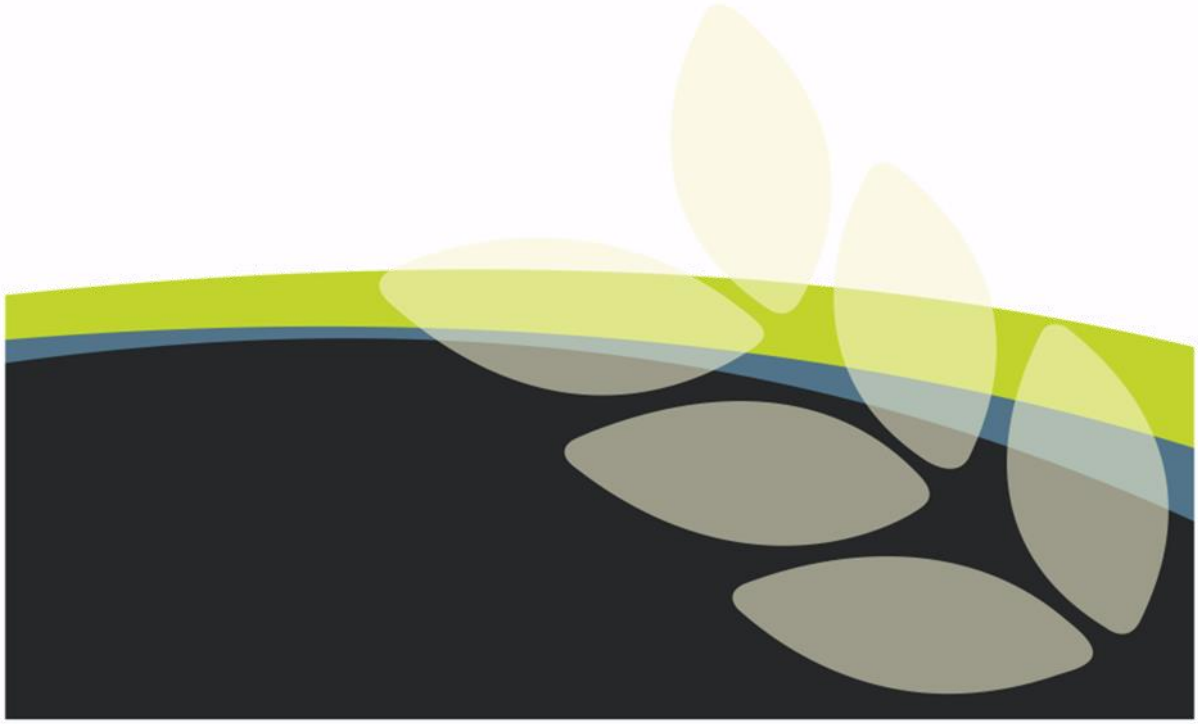
Next Meeting: 8:45am Wednesday 8th April at Gundagai Council Chamber

Minutes

THE ARTS CENTRE COOTAMUNDRA SECTION 355 COMMITTEE

THE ARTS CENTRE COOTAMUNDRA, 18 WALLENDOON STREET

6PM, THURSDAY 19 MARCH 2020



Minutes

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1.3 Disclosure of Interests 2
1.4 Confirmation of previous meeting Minutes 2
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1.6 Correspondence in/out: 2
1.7 Report from the WHS/Treasurer/PA/PM/WM/VA: 2
1.8 General Business (List Agenda Items) 5
1.9 Date and Time of Next Meeting 5
1.10 Time Meeting Closed 5

1 MINUTES

1.1 Attendance and Confirmation of Quorum

Present: **President/Chairperson: Isabel Scott**
Secretary: Rosemary Fowler-Sullivan
Treasurer: Maree Twomey
Council Representative: Leigh Bowden
General Members: Lindsey Baber, Susan Gheller, Leigh Scott

Confirmation of a Quorum: There are **[8]** Members appointed to this Committee.
Quorum numbers are met **yes**

Note: If quorum numbers are not met no actions can be made at this meeting. An informal discussion on items on the agenda can only take place. All agenda items from this meeting will be transferred to the next meeting for determination. Notes on the informal discussion can be made for reference at the next meeting.

1.2 Apologies

List Members that were unable to attend: Annabel Marley

1.3 Disclosure of Interests

There were **[no]** disclosures of Interest. **[Or list possible conflict of interests]**

1.4 Confirmation of previous meeting Minutes

The minutes of the last **Cootamundra Arts Centre Section 355 Committee** meeting dated **20 February 2020** are confirmed as true and correct.
(Moved: Rosemary, Seconded: Lindsey)

1.5 Business Arising from previous Minutes:

- ''Black Cockatoos'' have not contacted Leigh B with any follow up.

1.6 Correspondence in/out:

- Quote from Access all Areas Professional Audio Visual
- Quote from SoundFits Wagga
- Email from Julie Cowell on Fire Warden Training recommendations.

1.7 Reports from the WHS/Treasurer/PA/PM/VA:

1.7.1 WHS Report

- **Fire Warden Training –** recommendations at Training session from Jeremy Annetts to be complied with**.** Session was very long, perhaps to be condensed in future**.** Second training session recommended to those who were unable to attend first. Date to be confirmed.
- Suggestion ICE to be read & book in Office signed by volunteers.
- Defibrillator – perhaps apply for Sport & Rec Grant to source.

1.7.2 Report from Treasurer

- Treasurer's **February** reports presented to meeting.
-

Copy attached. (Moved: Maree, Seconded: Rosemary)

1.7.3 Report for Performing Arts

- Mike Smith, visitor to town who has established theatres in many regional towns, has offered to assist with movie hire. Information forwarded to Julie to follow up.
- **Testing & Tagging/Theatre Lighting** – Forward quotes to Andrew Brock to make decision – Isabel recommends Griffith quote which includes sorting equipment, testing & tagging & resetting grid with asset register.
  RECOMMENDATION 1 – that these works are undertaken by John Salvestro (Griffith) who delivers flow on support. TACC will cover any costs over & above that quoted by Soundfits ($111 shortfall).

  RECOMMENDATION 2 – A suggestion from Adam Bannister that TACC request Wagga Civic Theatre Lighting Board to accommodate future lighting upgrades to LED lighting in the future. The running cost of LED lighting is the cheapest lighting option to reduce future costs.

- **SmartFone Film Making for Youth** – run workshops for youth to create movies/videos. Suggest workshop during school holidays when possible. Isabel is following up.

Copy attached. (Moved: Isabel, Seconded: Lindsey)

1.7.4 Report for Project Management

- **Entry Tag System -** suggestion from Andrew Brock that Door tag system needs upgrading due to extra tags no longer available. He has one taken from another building which will enable extra tags & could be used by TACC.
  RECOMMENDATION TO COUNCIL – that tag system is changed as recommended by Andrew Brock & advise cost. This will enable future users to be responsible for unlocking & locking the building before & after use.

- **Stronger Country Communities Funding** – concerns that funds of $128K received in December 2018 for Rehearsal Space have not been able to be used. List of compliances issues have not been made available to TACC to be able to move forward.
  The footpath, entrance & lane egress issues need to be attended to urgently. Funds to be made available to assist with correcting egress concerns into & out of TAC plus undertake the works on old service station building upgrade as a Rehearsal Space and online learning space as documented in Application to SCCF Grant. This will facilitate a Youth Gathering Space under the newly formed Youth Council as well as a rehearsal space for TAC. The catering facility included in that grant not required so funds left over can go towards compliance works and creating an outdoor laneway series of canvasses for short term Youth Say Public Art.

  RECOMMENDATION TO COUNCIL – the funding can be used to rectify some construction around egress compliance issues for safe access to and from the centre. The footpath in front of TACC is upgraded for the safety of patrons & associated levels to the entry to the building, so wheelchairs & rollators access is smooth.
  Also, to be utilised to realise the original concept of the Grant application to provide a safe Rehearsal Space with online learning IT equipment and provide a Gathering Space for Youth around the new proposed Youth Council.

- **Youth Officer**, Cheney Dewar, has been established & met with Isabel & Gwen. Isabel suggested offering space near TACC for youth.

- **Studio Rentals** - fee structure to be used for Studio rentals in future. Fee structure to be submitted to Council for approval.

- **Staff** – Gwen in the office, will be employed as a casual from 3rd April to 30th June after her contract with the Board concludes. Her position will then continue as a contractor as explained in writing.

- **Training Videos** – The Board through the Fulcrum Grant have a series of training videos made with Adam Bannister & Evie Lord. The videos are available to be viewed on CGRC website. Recommended viewing

Copy attached. Moved: Isabel, Seconded: Leigh S.)

1.7.5 Report from Visual Arts

Cancellations of regular activities due to COVID-19 – Dabble Day, Bookmaking. Proposal from Gwen re Wattle Time.
Copy Attached. Moved: Rosemary, Seconded: Lindsey.

1.8 General Business (List Agenda Items)

1) Jan Preston 88 Pianos has been cancelled.
2) Report to CGRC from Board to be included for next Council meeting.
3) Report from Julie Cowell after Fire Warden Training to be accepted. Discussion took place in WHS
4) Meeting with Greg Briscoe-Hough with Susan, Isabel & Rosemary re TACC plan outline.
5) Due to COVID-19 – TACC will not be operating until further information & advice given from Council.

1.9 Date and Time of Next Meeting – 16 April 2020, 6.00PM

1.10 Time Meeting Closed – 7.30 PM

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
ABN: 46 211 642 339
PO Box 420, Cootamundra NSW 2590
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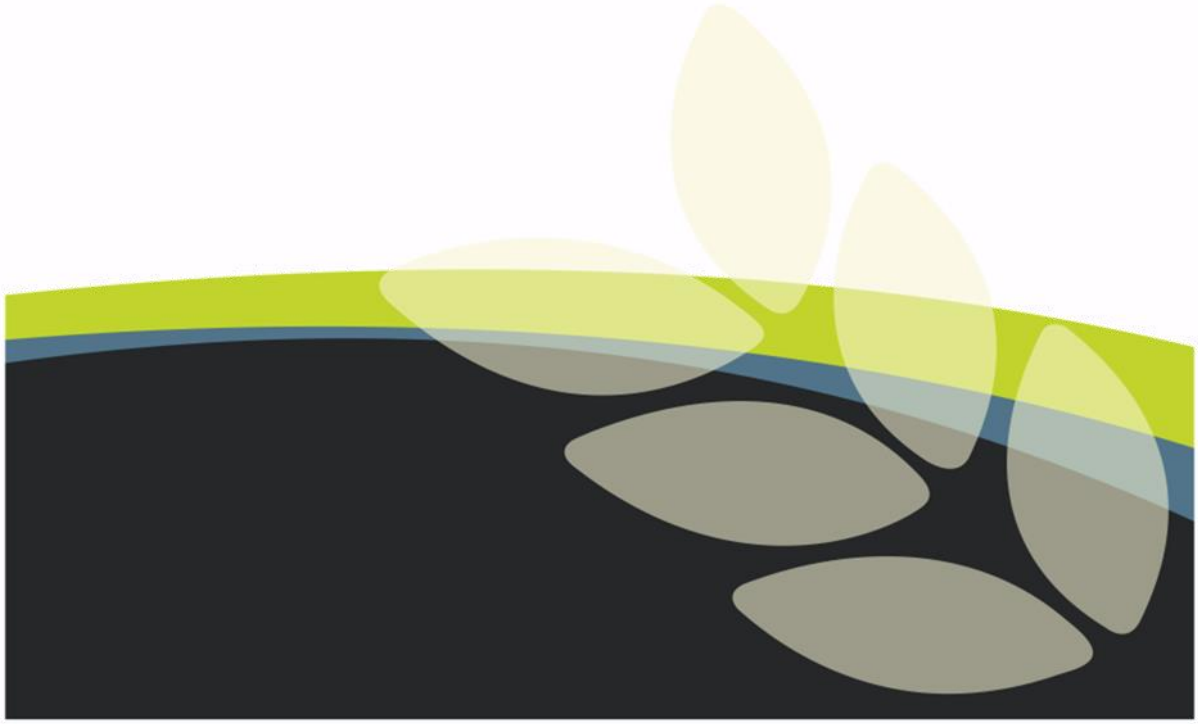
www.cgrc.nsw.gov.au

Minutes

THE ARTS CENTRE COOTAMUNDRA SECTION 355 COMMITTEE

THE ARTS CENTRE COOTAMUNDRA, 18 WALLENDOON STREET

6PM, THURSDAY 20 FEBRUARY 2020



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1.4 Confirmation of previous meeting Minutes 2
1.5 Business Arising from previous Minutes: 2
1.6 Correspondence in/out: 2
1.7 Report from the Treasurer/PA/PM/VA: 2-3
1.8 General Business (List Agenda Items) 4
1.9 Date and Time of Next Meeting 4
1.10 Time Meeting Closed 4

1 MINUTES

1.1 Attendance and Confirmation of Quorum

Present: **President/Chairperson: Isabel Scott**
Secretary: Rosemary Fowler-Sullivan
Treasurer: -
Council Representative: Leigh Bowden
General Members: Lindsey Baber, Leigh Scott, Annabel Marley
Other: Susan Gheller, Lyn Cameron, Juanita Marten, Lucy Main, Hans Bruitzman, Lyn Angus, Graham Cossey

Confirmation of a Quorum: There are **[8]** Members appointed to this Committee.
Quorum numbers are met **yes**

Note: If quorum numbers are not met no actions can be made at this meeting. An informal discussion on items on the agenda can only take place. All agenda items from this meeting will be transferred to the next meeting for determination. Notes on the informal discussion can be made for reference at the next meeting.

1.2 Apologies

List Members that were unable to attend: *Maree Twomey (Treasurer).*

1.3 Disclosure of Interests

There were **[no]** disclosures of Interest. **[Or list possible conflict of interests]**

1.4 Confirmation of previous meeting Minutes

The minutes of the last **Cootamundra Arts Centre Section 355 Committee** meeting dated 20 **November 2019** are confirmed as true and correct.
(Moved: Rosemary, Seconded: Lindsey)

1.5 Business Arising from previous Minutes:

- NIL

1.6 Correspondence in/out:

- Letter from Mayor, Abb MacAlister – Isabel to supply copy for Secretary's file.
- Letter to Elise Magrath – Lindsey Baber – to supply copy to Secretary to file.

1.7 Reports from the Treasurer/PA/PM/VA:

1.7.1 Report from Treasurer

	Advise proposed change of bank account to CBA to acquire Albert (Eftpos tablet) *Treasurer's reports presented to meeting. Copies attached.*	January & current reports tabled.

(Moved: Isabel, Seconded: Rosemary)

1.7.2 Report for Performing Arts

• Lighting & Audio – compliance issues. Silvesto & Matkovic have quoted • "What's New Pussycat" – 4/10/20 • Two plays scheduled for 2020 – Pull the Other One & Nuncracker • Bush firies Blues charity night – very successful • Movies are very successful – thank you to Julie & movie committee	Andrew Brock to acquire 2nd quote from Soundfits Wagga.

• All community groups & individuals to utilise the Rehearsal Space & TST for developing new initiatives. • Isabel moved a motion that signage on frames in car park for TST & PA be updated to replace previously damaged signs. Quote $450 approximately. • Suggestions were made to have an electronic sign, possible approximate cost $600. Non committee member Lyn Angus nominated to check costing. *Copy attached. (Moved: Isabel, Seconded: Annabel.)*	Moved: Isabel, Seconded Rosemary Moved: Lindsey, Seconded Leigh S

1.7.3 Report for Project Management

• Egress to and from building and associated OH&S problems • Compliance issues – Isabel in contact with Andrew Brock to address structural and maintenance issues • Quote submitted for maintenance, testing, tagging and documenting all theatre lighting and audio equipment. Accommodation offered to John Silvestro and John Matkovic. Quote supplied 14/2/20. Andrew Brock sourcing second quote from Soundfits Wagga. • Isabel moved a motion that she continues to negotiate with Andrew Brock to undertake the submissions by TACC to CGRC to upgrade the compliance issues identified by Andrew Brock for the TACC building. Also, that egress OH&S works be undertaken as soon as possible to ensure safe access to and from the centre in conjunction with a complete upgrade of the footpath on Wallendoon Street outside TACC, which poses problems to patrons. *Copy attached. Moved: Isabel, Seconded: Annabel.)*	Moved: Isabel, seconded: Lindsey.

1.7.4 Report from Visual Arts

• Dabble day – cardmaking with Jenny Neale was well attended – suggested 3rd Tuesday of month to repeat. • Scheduled – Tunisian knitting, flower pressing, collographs for March & April • UFO (unfinished objects) – 1st Tuesday of month commending March • Workshops planned – watercolour, felt scarf making, bookmaking, solar plate etching • Grant to run workshops in Tumut Arts Society, Temora Art Society & TACC • Spinlarks – Wednesday evenings • Mudlarks – Thursday mornings • Wattle time exhibition – Lyn Angus, Dotti LeSage taking charge. Opening night 30/7/20, open for two weekends. • Working with Children – see Gwen to register. • VA signage needs updating. • Insurance for exhibitors to be able to sell their items, approximately $600+. Artists should have own insurance, maybe umbrella insurance to cover all exhibitors. • *Copy attached. Moved: Annabel, seconded: Lindsey*	Susan to get more information from CGRC as to what insurance is required.

2.1 General Business (List Agenda Items)

1) Susan reported on the roles of CAC Inc & s355. **The Inc (Board)** operates as an incorporated body under the Corporations Act 2001, it employs staff, is responsible for TACC contracts for movies & purchase of shows, can apply for Grant funding to submit the application and administer the funds. Board has 7 members. **CCACC s355 committee** (currently 7 members) operates within the guidelines of the Local Government Act 1993 & the CGRC Committee Handbook. Liaises with CGRC regarding the control & management of the Arts Centre facilities as a recreational choice for the community. Carries out fundraising activities on behalf of council, coordinates activities at the Centre through staff employed by Inc & ensure compliance with 3s355 guidelines, carries out projects & programs that service the Community Recreational wishes, carries out and finances all ongoing even management, planning, facilitating, scheduling, setting up/clearing away of equipment and set. Manages the volunteer base.
   Action: Advise CGRC that Rae Webber is no longer on the committee of s355.

2) Publicity – try to maintain regular articles in Cootamundra Herald, continue with social media – Facebook etc & emails to the database. Lucy to continue with Coming Events.

Action: Check with Coota Herald requirements to have regular articles published.

3) Leigh B reported that the play ''Black Cockatoos'', Jeffery Atherton, the story of Johnny Muller, are planning to perform in regional areas. She will investigate the cost of them coming to TACC – accommodation, techo requirements, venue hire/ticket pricing etc.

Action: Leigh to report to next meeting with details.

4) Leigh S requested –
   - List of persons who hold RSA on file in office.
   - Copy of all RSA holders' licences on file in office – Andy, Graham, Leigh S, Annabel, Julie
   - Police walk-through – TBA
   - Advised Leigh S is now on Muttama Hall committee – request to borrow trolley from TACC.

Action: All RSA holders to be contacted to provide copy of licence to office.

5) Should we approach Pacolina Flaminco Group – meeting said NO.
6) Jan Preston will perform on 24/4/20 in Exhibition Room – a MADD eligible event.
7) What's New Pussycat matinee performance 18/10/20.
8) Scott Howie – Artstate in November to Wired Lab – Annabel suggest a tour of TACC 8/11/20

2.2 Date and Time of Next Meeting – 19 March 2020, 6.00PM

2.3 Time Meeting Closed – 7.30 PM

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
ABN: 46 211 642 339
PO Box 420, Cootamundra NSW 2590
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Email: mail@cgrc.nsw.gov.au
www.cgrc.nsw.gov.au

Report to Cootamundra Gundagai Regional Council on the Status of The Arts Centre Cootamundra

The Arts Centre Cootamundra (TACC) is an award winning facility that promotes the participation of locals and visitors in a range of cultural and economic activities. Since 2005, TACC has received almost one million dollars in State infrastructure funding which, in addition to the contributions of Council and the work of community volunteers has produced a multi-purpose Centre able deliver a variety of cultural and economic programs for the community. The Arts Centre Cootamundra is held in high esteem across the region and provides an attractive amenity for those considering moving to the area.

This report has been put forward by the Board, Cootamundra Creative Arts Inc. to update Council on recent changes to the governance structure of TACC and the impact this will have to future operations and service delivery.

Background

TACC is currently administered by two volunteer committees with different functions and responsibilities:

1. Cootamundra Creative Arts Incorporated (CCA Inc.):
   - Established originally to run the Visitor Information Centre (VIC) on behalf of Council (VIC no longer run by TACC).
   - Operates as an incorporated body under the Corporations Act 2001,
   - Employs staff:
     - 1 part time Office Coordinator 20 hours pw,
     - 1 casual Communications Officer 4 hours pw,
     - 1 casual Movie Officer 6 hours pw,
     - 1 casual Cleaner 3 hours pw
   - Responsible for programming TACC events, contracts for movies and purchase of Shows
   - Can apply for Grant funding unavailable to Local Government /Councils that require an incorporated body to submit the application and administer the funds.

2. Cootamundra Creative Arts and Cultural Centre s355 Committee (CCACC) – The s355 Committee:
   - Operates within the guidelines of the Local Government Act 1993 and the CGRC s355 Committee Handbook.
   - Liaises with CGRC regarding the control and management of the Art Centre Facilities as a recreational choice for Community.
   - Carries out fundraising activities on behalf of Council to provide services to Community.
   - Coordinates activities at the Centre through staff employed by CCA Inc. and volunteers and ensures compliance with Council s355 Guidelines and safety requirements.
   - Carries out and finances all ongoing event management, planning, facilitating, scheduling, setting up/clearing away of equipment and set. It maintains storage facilities and ongoing maintenance of fixed assets such as chairs, tables, etc.

To ensure that all activities held at TACC are financially sustainable, an annual program has been developed by the s355 Committee and the CCA Inc. Board with reduced services. Only activities such as Friendship Group meetings, venue hire and movies that are guaranteed to make a profit or have been subsidized will be delivered in 2020. This will ensure that financial commitments including the payment of wages to staff as well as rent and other outgoings will be covered by the current balance of funds. The 2020 Annual Program will be included with minutes of the of the s355 Committee.

Programming involves the commitment of funds and often contracts. The s355 Committee will work with Council and the Governance Officer to determine the best way to set and approving programming for TACC. Potentially a quarterly program could be approved by Council.

Review of Contracts

CCA Inc. is currently reviewing contracted services including employment contracts. After April, all TACC employees will be casual to allow flexibility in determining future TACC operations.

Contracts for the Movies, Performances/Performers and service contracts for accounting and software will be reviewed and discussed with CGRC's Governance Officer to determine future processes.

Acquittal of Outstanding CCA Inc. Grants

CCA Inc. was awarded a Grant (Fulcrum Grant) for $60,000 to improve governance and business operations. This funding was used to develop Volunteer Handbooks and procedures, provide Fire Safety training and ensure there is appropriate training and procedures for the use of technical equipment. This Grant will be fully acquitted prior to the dissolution of CCA Inc.

Susan Gheller

Chair
Cootamundra Creative Arts Inc.

Report for Boundaries Commission

Executive Summary

A de-amalgamation of Cootamundra-Gundagai Regional Council will cost under $1.75 million, which will have a payback period of just over eight years. From the tenth year onwards, a de-amalgamation should save at least $451,000 per annum. It should be noted that the aforementioned figures are worse-case scenarios based on very detailed examination of cost structures which do not include any items which can't be assured. The figures quoted are therefore completely reliable and stand in stark contrast to the guesswork used for projections of supposed amalgamation savings. In all likelihood, a well-managed de-amalgamation will cost less upfront and will reap greater savings.

De-amalgamation will not immediately fix all of the problems that currently afflict the local government area. There will still likely be a need for increases to rates and charges to mitigate the financial problems that the community now faces, and it would be critical for any new local governments that might emerge to practice strict cost control for the foreseeable future. However, it seems that by removing substantial diseconomies of scale, political uncertainty, and righting the strong sense of injustice that pervades much of the community that we might better lay the foundations for a more promising future.

It would not be reasonable to lay *any* of the blame for the current circumstances with the existing cohort of Councillors and executive management at Cootamundra-Gundagai Regional Council. As will be shown in the remainder of this report, there were gross failures by KPMG and the (then) Boundaries Commission Delegate back in 2016 that have contributed strongly to the circumstances now faced. In addition, some of the previous Administrators and executives did not perform as well as one might have expected. The current leadership team, by way of contrast, have done an extraordinary job of trying to address the problems caused by others and should be congratulated for their fine efforts on behalf of the community.

It is also important to be mindful that the decisions made back in 2016 were made under a different Minister for Local Government and a different Premier. Moreover, the poor advice that was received came from agents who are not involved in this present process. Indeed, the current Minister and Boundaries Commission have acted with great integrity and wisdom thus far, and the community therefore have reason to feel confident that this process in 2020 will be handled fairly and be based on robust evidence.

In sum, this Boundaries Commission and the current Minister are provided with a unique opportunity to right past injustices, remove the burden of otherwise unavoidable diseconomies of scale, and set the people of the local government area on a course to better financial sustainability outcomes and I commend this expert report to their attention.

About the Author:

Joseph Drew is Associate Professor of Public Policy and Local Government in the Institute for Public Policy & Governance at the University of Technology Sydney and adjunct Professor at the Department of Business Administration, Tokyo Metropolitan University. His research interests focus on public finance, performance measurement, local government structural reform, natural law philosophy and corporate governance. Previously he worked in executive positions in the retail banking sector. His work has been recognised in the 2004 Australian College of Educators awards and he is the recipient of the University Medal (Griffith University, 2003) and the D H Drummond award (University of New England, 2014). Recent publications have appeared in *Public Administration, Local Government Studies, Public Administration Quarterly, Publius: The Journal of Federalism, the Australian Journal of Public Administration, Australian Journal of Political Science,* and *Policy & Politics*. He has consulted with numerous Victorian, Tasmanian, South Australian and New South Wales councils on accounting, finance and economic matters. Joseph has also been called as an expert witness for multiple Australian State and Federal Government Upper House inquiries into local public finance, as well as working on a number of projects of national significance abroad. His Co-authored book *Local Government in Australia: History, Theory and Public Policy* has recently been published by Springer Palgrave and he is contracted for a new book titled *Reforming Local Government*, for delivery in 2020. Joseph serves on the Editorial Board of Australia's highest ranked public administration journal – the *Australian Journal of Public Administration*.

Introduction

The Cootamundra-Regional Council was formed by Governor's proclamation on the 12 May 2016 from a forced amalgamation of the former Cootamundra and Gundagai councils respectively. This amalgamation was the culmination of a lengthy, and at times unpredictable, process stretching back to a 2011 inquiry into the financial sustainability of local government in New South Wales. During the course of this process the Independent Local Government Review Panel (ILGRP, 2013) suggested that Gundagai be amalgamated with Tumut and Cootamundra with Junee. Moreover, IPART (2015) provided its endorsement of both a voluntary proposal for Cootamundra to amalgamate with Harden and the suggestion for Gundagai to amalgamate with Tumut. It therefore came as something of a surprise when the (then) Minister of Local Government released his proposal to amalgamate Cootamundra with Gundagai in January 2016.

The Minister's proposal was based heavily on the work of KPMG which has been widely discredited in the media and scholarly literature (see, for example, Drew and Grant, 2017; Dollery and Drew, 2016). KPMG's 'analysis' was largely based on assumptions without any empirical evidence. By way of contrast, the former Gundagai council engaged a *bona fide* expert who conducted rigorous empirical analysis based on scholarly theory and concluded that the proposed amalgamation would result in diseconomies of scale and thus reduce the financial sustainability of the local government community (Drew, 2016). In his deliberations, the Boundaries Commission Delegate chose to place full reliance on the work of KPMG and disregarded the body of scholarship to which his attention had been drawn (Turner, 2016).

Three full financial years have passed, and we are now in a good position to test the assumptions made by KPMG (2016). It is important to do so, because the analysis can clarify the likely outcomes should a decision be made to reverse the earlier amalgamation. Indeed, s263(3) of the Local Government Act (NSW 1993) lists the financial advantages or disadvantages (including economies or diseconomies of scale) as the first of a series of matters that a Boundaries Commission must examine. Notably, the legislation does *not* list the correction of past injustices as a valid consideration for the Boundaries Commission. However, the Minister will no doubt wish to include these matters in her considerations, and I therefore detail some of the perceived injustices in the material that follows.

De-amalgamation is not a novel concept in the context of Australian local government. Delatite Shire in Victoria was de-amalgamated in October 2002, and four Queensland councils (Cairns, Rockhampton, Sunshine Coast, and Tablelands) were de-amalgamated in 2013 (Drew and Dollery, 2014b; 2015a). Moreover, two of these de-amalgamations have been studied in detail by scholars, and we thus have a good body of knowledge to draw on should a decision be made to de-amalgamate Cootamundra-Gundagai. Inevitably, de-amalgamation will involve extra work and some stress for staff. However, a recent survey of staff suggests that the far majority (around 73%) are in favour of de-amalgamation (a further 12.5% are undecided) largely because they believe it will result in significant benefits for the community

over the medium term. These views should be given some serious consideration, given that it is the staff who work in the Council who are most likely to understand the full implications of a de-amalgamation. Moreover, the work and stress associated with de-amalgamation needs to be set against the substantial work that is still outstanding with respect to the 2016 amalgamation (harmonisation of rates and many fees and charges), as well as the stress engendered by constant uncertainty. Notably, the state political opposition has publicly declared, on a number of occasions, that they will allow de-amalgamation should they gain office and many people therefore consider de-amalgamation to be an inevitability given the strength of feeling in the community. Clearly if de-amalgamation is inevitable (as believed by many) then it is better that this occurs early on before more damage is inflicted on the community. Earlier intervention will also allow the current government to better protect its legacy (Drew, 2018).

In the next section I briefly outline the projections made by KPMG in the Ministers' Proposal of January 2016. I also provide a brief account of the TCorp assessments of financial sustainability for both councils prior to amalgamation, a review of the expert evidence tendered by the former Gundagai Shire, as well as an evaluation of the performance of the Delegate in executing his duties. Following this I review the financial performance of the local government area prior to and since amalgamation, in addition to reviewing the relevant financial performance ratios over the same period. I then analyse the relative technical efficiency of the local government area prior to and following amalgamation which is particularly important given that the relevant legislation places great emphasis on efficiency and associated concepts (such as economies and diseconomies of scale). Thereafter, I outline both the one-off costs of de-amalgamation as well as the ongoing savings that might be reasonably expected to arise from a boundary change. In the penultimate section I comment on the remainder of the criteria set out for the Boundaries Commission in Section 263 of the Act (1993). I conclude the report with some observations regarding the benefits of de-amalgamation for the citizens of Cootamundra-Gundagai.

Financial Sustainability, Amalgamation Projections and Boundaries Commission

The New South Wales (NSW) Treasury Corporation (TCorp) undertook financial sustainability reviews for the (then) Division of Local Government, following appointment in 2012. The reviews were based largely on ten financial sustainability ratios as well as some desktop analysis of financial statements. The ratios and benchmarks were the subject of some serious scholarly criticism in the peer review literature, as was the lack of transparency in arriving at an overall rating (see, for example, Drew and Dollery, 2014a; 2016). However, the sub-optimal assessments are the best evidence we have regarding the sustainability of these councils prior to amalgamation and are also important because the ILGRP and IPART both made later reliance on this work.

The TCorp completed its financial sustainability review of Cootamundra Council in March 2013 and concluded 'Council to be in a satisfactory[1] financial position' (TCorp, 2013a, p. 31). Moreover, it noted that 'both past performance and the financial forecasts support our findings that Council has sufficient financial capacity to service the additional borrowings proposed' (TCorp, 2013a, p. 31).

TCorp conducted a similar inquiry into the financial sustainability of Gundagai Council in April 2013. It concluded 'Council to be moderately sustainable in the short term with Council finding it increasingly difficult to fund infrastructure renewals in the medium to long term' (TCorp, 2013b, p. 28). The report expressed a concern that 'Council will not be able to maintain its assets at the current service level in the long term' (TCorp, 2013b, p.28).

To understand the conclusions reached by TCorp one must know the definitions of the terms 'sound' and 'moderate', as well as the distribution of councils. I reproduce the definitions from TCorp (2013c, p. 69) below:

> **Sound:** · A local government with an adequate capacity to meet its financial commitments in the short, medium and long term. While it is likely that it may have a record of minor to moderate operating deficits, the local government is expected to regularly report operating surpluses. It is likely able to address its operating deficits, manage major unforeseen financial shocks and any adverse changes in its business with minor or moderate revenue and/or expense adjustments. The expense adjustments are likely to result in some changes to the range of and/or quality of services offered. Its capacity to manage core business risks is sound.
>
> **Moderate** · A local government with an adequate capacity to meet its financial commitments in the short to medium term and an acceptable capacity in the long term. While it has some record of reporting minor to moderate operating deficits the local government may also have

[1] Curiously TCorp did not use the words later employed for the financial sustainability rankings in the case of Cootamundra. I have concluded that the word 'satisfactory' was used in a manner consistent with the later term 'sound' give the context of its use.

> recently reported a significant operating deficit. It is likely able to address its operating deficits, manage unforeseen financial shocks and any adverse changes in its business, with moderate revenue and/or expense adjustments. The expense adjustments are likely to result in a number of changes to the range of and/or quality of services offered. Its capacity to manage core business risks is moderate.

The distribution of financial sustainability ratings is reproduced from page 10 of TCorp (2013c):

Table 1 - FSR Distribution

Rating	Count	Percentage
Very Strong	0	0.0%
Strong	2	1.3%
Sound	32	21.1%
Moderate	79	52.0%
Weak	34	22.4%
Very Weak	5	3.3%
Distressed	0	0.0%
Total	**152**	**100.0%**

Thus, it can be seen that TCorp considered Cootamundra to be somewhere in the top 20% of sustainable NSW councils, and Gundagai somewhere in the third quartile. Moreover, consistent with both of the definitions reproduced above, TCorp clearly believed both councils to have *at least* 'adequate capacity to meet its financial commitments in the short to medium term and an acceptable capacity in the long term' (TCorp, 2013c, p. 69).

Otherwise stated, the NSW Treasury Corporation believed both councils to be financially sustainable at the time of their review.

Some readers will be aware that a Fit for the Future ratio analysis was then completed by IPART (with contributions by Ernst & Young and Mr John Comrie a local government 'expert' from South Australia). To the dismay of many, this analysis of fitness for the future was even more unsatisfactory (in terms of methodology) than the earlier extremely synecdochical effort of TCorp (2013c). Now, the community was asked to believe that the financial sustainability of complex local governments could be somehow guessed at by the use of just seven ratios, one of which (the so-called efficiency ratio) didn't even measure what it purported to report on (IPART, 2015). Benchmarks were changed (for example, the Operating Ratio which previously had a benchmark of -4% was now assigned a higher benchmark of 0%), data known to be inaccurate was employed (see Drew and Dollery, 2015b; Drew and Grant, 2017), and implausible and inappropriate analytical techniques (linear regression for data which was clearly not linear) were used by IPART (2015) and collaborators. An over-arching criteria was introduced (a subjective judgement on adequate scale and capacity which essentially boiled down to whether the council

had previously been identified by the Independent Local Government Review Panel, on the basis of no empirical evidence whatsoever, to be a suitable subject for amalgamation) with the effect that if a Council failed on this judgement then it was deemed to be *not* fit for the future. Clearly this work (ridiculed in the media and scholarly literature) can only be described as 'amateurish' by even the most well-disposed person and is thus not worthy of any consideration at all by anyone, given its obvious flaws.

Sometime towards the end of 2015 the Minister engaged the services of KPMG to 'model' the benefits of an amalgamation between Cootamundra and Gundagai Shires which formed the basis of the January 2016 Minister's proposal. Modelling is a generous term for what actually took place –KPMG made some assumptions (based on no evidence whatsoever, which means they were truly 'guestimates'), put the numbers into a spreadsheet to do some rudimentary arithmetic, made some more assumptions about future inflation rates to put the questionable arithmetic into nett present value terms (which made it sound far more sophisticated than it was), added in some substantial state government grants to make matters look more convincing, and declared a 'benefit by up to $18 million from a merged council' (NSW Government, 2016, p. 3).

When one reads into the report it becomes clear that the headline figure of $18 million included 'NSW government funding of $15 million' – which was a political decision to reward communities for submitting to amalgamations (there is no reason in principle why this $15 million could not have been given to non-amalgamated councils, in which case not amalgamating would have had a benefit of up to $15 million) (NSW Government, 2016, p. 3). So truly the projected benefit was really just up to '$3 million in net financial savings over 20 years' (NSW Government, 2016, p. 3).The KPMG (NSW Government, 2016, p. 8) work proposed that the savings would occur in the following areas of expenditure:

- 'streamlining senior management roles ($4 million);
- The redeployment of back office and administrative functions ($3 million); and
- Efficiencies generated through increased purchasing power of materials and contracts ($500,000)'

Otherwise stated KPMG predicted that there would be savings in the order of $7 million in employee costs, and savings of $500,000 in materials and contracts (both are specific line items in the audited financial statements). Both of these figures were apparently arrived at by guessing a percentage saving that might occur following amalgamation and multiplying the income statement line items through by the said percentage (see, KPMG, 2016). Moreover, the Ministers' merger proposal informs us that we might 'also expect to generate, on average, around $400,000 in savings every year from 2020 onwards' (NSW Government, 2016, p. 8). Furthermore we were informed that merger savings could be reinvested to 'improve infrastructure…enhance service delivery….reduce rate pressures'. This was the essence of the Ministers' Proposal that the 'suitably qualified' Boundaries Commission Delegate – Mr John Turner – was asked to assess (NSW Government, 2015, p. 2).

Mr Turner was required under Part 3 of the Local Government Act (1993) to assess the Minister's proposal against eleven specific criteria. It is not possible to comment on all of his report, due to a need for brevity, but the assessment of certain criteria do rate a mention given that the conclusions drawn by the Delegate seem unreasonable for anyone who had received a high school education, and provides additional weight for the community claims of a misapprehension of bias[2].

Financial Impacts

Mr Turner took note of the TCorp financial sustainability ratings (without defining what they meant), detailed the projected benefits of KPMG (noting that they 'have come under sustained questioning and criticism' (Turner, 2016, page 3)), and referred to the 'Drew Report' on an incidental matter (which confirms that he read it), but nevertheless concluded that 'there is strong evidence that there will be significant financial benefits to all residents and ratepayers as a result of the merger' (Turner, 2016, p. 19). This is an extraordinary conclusion for anyone of his education and experience to have arrived at – especially given the contents of the report by Dr Drew (then of UNE) that Mr Turner referred to, which provided robust empirical evidence from previous amalgamations, as well as sophisticated data envelopment modelling to conclude that:

(i) 'There is no reason to expect a significant and enduring reduction in staff expenditure' (based on a table of employee expenditure data from the Queensland amalgamations which demonstrated staff expenditure had indeed risen at a higher rate for amalgamated councils than their non-amalgamated peers following the 2008 Queensland amalgamations (Drew, 2016, p. 5)). I have reproduced this evidence on employee cost outcomes following amalgamation in the appendix.

(ii) Efficiency of the amalgamated cohort in Queensland had significantly under-performed relative to their peer group following amalgamations (Drew, 2016, p. 6) – therefore suggesting that hopes of realising economies of scale from amalgamation could well prove illusory.

(iii) An amalgamation of Cootamundra and Gundagai shires would result in 'decreasing returns to scale' in the order of 'just over $700,000' per annum, even in the unlikely event that the KPMG projections of savings 'of around $150,000 p.a.' did indeed come to pass. The diseconomies of scale were projected to be just over 8 percent.

In sum, Mr Turner was asked to weigh the arithmetic based on guestimates employed by KPMG (for which no evidence had been produced), against a widely published and respected scholar who had provided evidence based on the most recent Australian amalgamation program in addition to sophisticated modelling based on actual data drawn from the audited financial statements. I will let the reader of this report decide if a reasonable person with Mr Turner's education and

[2] Owing to his former position as Deputy Leader of the Nationals, and the Nationals' member of Parliament for Myall Lakes.

experience could have been expected to place such absolute faith in the KPMG work given the material set before him.

Resident and Ratepayer Attitudes

Mr Turner (2016, p. 31) states that he was presented with an 'IRS Research phone survey of 403 LGA residents aged over 18 commissioned by the Council and conducted at around the same time as the Public Inquiry recorded that around 90 per cent of those surveyed in every category disagreed with the proposal to merge Gundagai Shire with Cootamundra Shire'. On the basis of this evidence, numbers (which are hotly contested) of attendees at a public meeting (on Thursday February 4, 2016 between the working hours of 2pm to 5pm), and 'impressions' garnered from written submissions he concluded that:

> 'the majority of the population did not have a strong attitude one way or the other concerning the merger proposal'.

I will leave it to the readers of this report to decide whether it was reasonable for an educated person well acquainted with survey methods (such as those employed by political pollsters which he would have observed closely during his political career) to have ignored statistical evidence in favour of mere impressions formed from reading written submissions (in the full knowledge that the community had not been informed by him that the number of written submissions would be the deciding factor in his assessment of community attitudes).

Service Delivery and Access

In response to submissions made regarding the substantial distance between Cootamundra and Gundagai (in the order of 58 km which can only be traversed by a secondary local road), Mr Turner (2016, p. 36) stated:

'Given the distance covered under the proposed LGA it would be reasonable to retain the full-service offices in both towns to minimise any disadvantage to residents'.

Mr Turner goes on to note that 'Cootamundra Shire notes in its submission to the inquiry that the likely time and distance separation means that the new council will need to run operationally as two distinct halves, north and south, working in parallel'. He comments approvingly that 'this is a practice undertaken by many councils who are responsible for covering large areas' (Turner, 2016, p. 36). Later in the report he repeats the observation 'that the distance and time taken to travel between the two town centres means it is most likely that two completely separate and almost fully staffed offices will need to be maintained in order to ensure the effective and equitable delivery of services' (Turner, 2016, p. 39).

These various statements suggest that Mr Turner was: (i) well aware that the amalgamated entity would have to maintain essentially two separate sets of staff and assets (presumably with an additional layer of management to co-ordinate the two offices), and (ii) was cognisant of the time and cost required to travel between the two centres. The question arises whether it was reasonable to believe the projections of savings in employee costs in the order of $7 million (over 20 years)

given the concession that the two existing organisational structures would largely have to continue unchanged. It must also be asked whether it was reasonable for a Boundaries Commission Delegate who noted the time and cost of travel between the two centres to not question why this time and cost of travel (which is substantial and in the order of $150,000 p.a.[3] in direct costs alone (see my breakdown of de-amalgamation costs and benefits, below)) had clearly not been included in the KPMG modelling which formed the basis of the Ministers' Proposal (NSW government, 2016).

Concluding Comment on the Amalgamation Process

Clearly the consultants engaged by the (then) Minister failed to provide him with a satisfactory level of advice. Moreover, it is equally clear that the Boundaries Commission Delegate failed to perform his duties diligently at the level that might have been reasonably expected of someone with his education and political experience. The Minister and the government were thus badly let down and mislead by the various parties that were engaged by them. However, it needs to be noted that none of the Boundaries Commission criteria in S263 of the Act (1993) direct it to consider changes on the basis of righting injustices or grievous errors of judgement committed by previous Boundaries Commissions or agents of previous Ministers. Notably, the current Minister and Premier are not constrained by the legislative vacuum and will no doubt be keen to ensure that natural justice is ultimately observed. Critical to their decision-making calculus must be the magnitude of the fiscal damage inflicted on the Cootamundra-Gundagai communities as a result of poor advice and decision-making conducted on behalf of the NSW government back in 2016. It is to this matter that I now turn my attention.

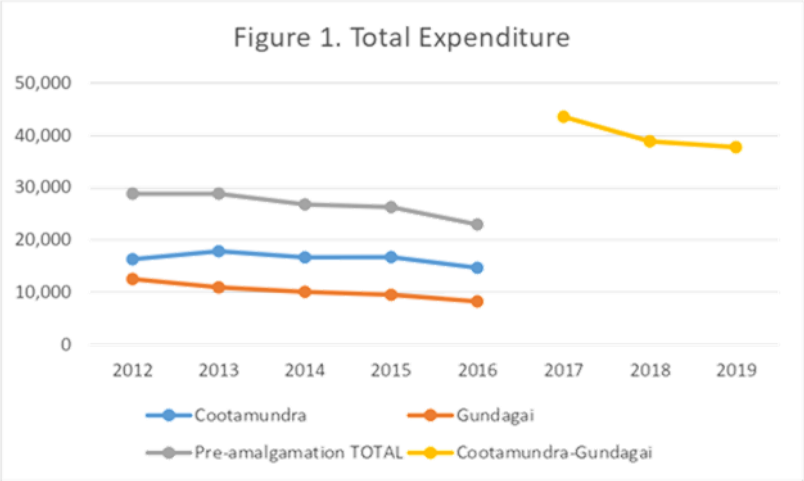
[3] Coincidentally this is the precise amount that Mr Turner (2016, p. 9) acknowledges was projected to be saved by KPMG – suggesting that the entire savings might have been eliminated had Mr Turner made reasonable inquiries regarding the obviously missing expenses from the 'modelling'.

Financial Performance of Cootamundra, Gundagai, and Cootamundra-Gundagai

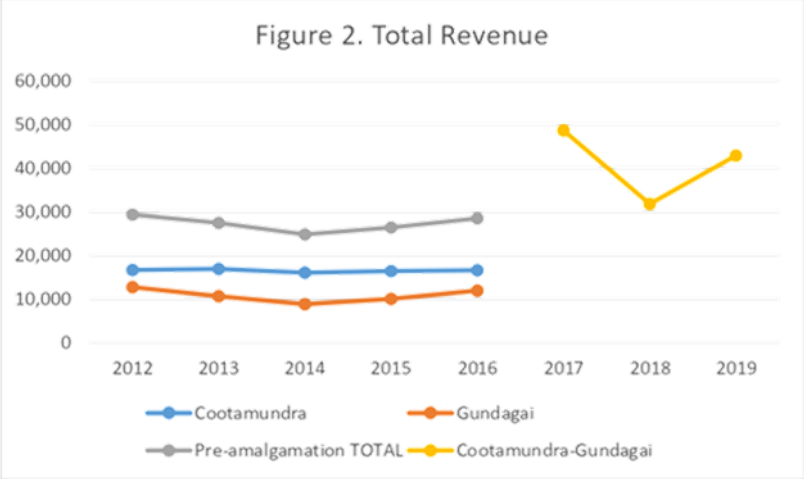
Three full financial years have now been completed since the amalgamation took place and we are thus in a good position to assess the accuracy of the KPMG projections upon which the (then) Minister, as well as the Boundaries Commission Delegate, placed so much reliance. Moreover, a review of the financial position of Cootamundra-Gundagai also provides us with an indication of the likely financial sustainability outcomes under the current boundary arrangements, and points to some of the benefits associated with the proposed de-amalgamation.

When examining the graphs that follow it is important to be mindful of a few matters. First, the 2016 financial year was cut short by a month-and-a-half, and the 2017 financial year was extended by the same time. Consequently, it is reasonable to expect a decrease in expenditure in 2016, and a concomitant increase in 2017. Accordingly, it might be prudent to emphasise comparisons between standard financial years – that is, the 2014 and 2015 financial years, compared to the 2018 and 2019 financial years. Second, to facilitate fair comparisons I have generated a pre-amalgamation total (coloured grey in the following graphs) which is simply the sum of the expenditure and other items of the two constituent councils for the period prior to amalgamation – this is completely reasonable and a common practice in the scholarly literature (see, for example, Drew and Dollery, 2014a). Third, the charts presented are in thousands of dollars, consistent with presentation of financial statements by NSW local governments. Fourth, 2019 figures were obtained from the most up-to-date version of the financial statements, which were in the process of being audited at the time that I wrote this report (significant changes to the draft numbers are not expected).

Figure 1 charts the total expenditure prior to and following amalgamation. Clearly there has been a large jump in expenditure (in the order of $12 million) which seems at odds with the projections made by KPMG. One must be mindful that in 2017 the reporting year was longer than usual and that there would have been one-off amalgamation costs in this period (and perhaps some even in the 2018 financial year). However, expenditure levels have only shifted down slightly in the most recent audited financial reports and it would be hard to argue that the 2019 financial year is not representative of the expenditure profile of Council.

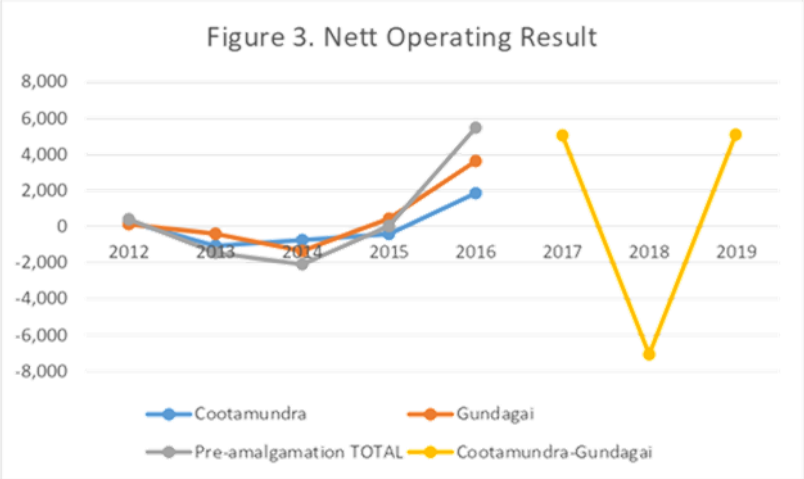


In Figure 2 I have plotted the revenue over time for the local government area. As can be seen from the graph, revenue has fluctuated significantly since amalgamation, principally as a result of extraordinary grant flows in 2017 (Stronger Community Fund $9 million), and 2019 (Stronger Communities Fund $3.4m), but also due to a doubling of fee revenue from the state government RMS in 2019. Thus, the increases in revenue seems to be very dependent on ongoing extraordinary grant income, which probably can't be relied on to continue into future years.

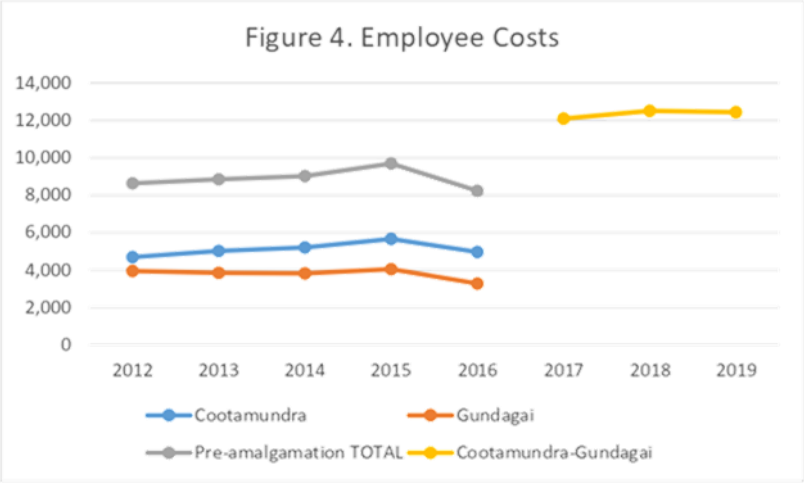


In Figure 3 I chart the nett operating result over time. As can be seen, the upward trend prior to amalgamation has been replaced by a highly fluctuating result since. Notably without the addition of $8.7 million in grant revenue in 2019, Cootamundra-Gundagai would still be well and truly in deficit. Moreover, by the NSW government preferred measure (operating result before grants provided for capital purposes) Council has been in deficit ever since amalgamation, and there is little reason to believe that this situation will change in the short term without considerable increases to fees and charges or local government taxation. One couldn't reasonably

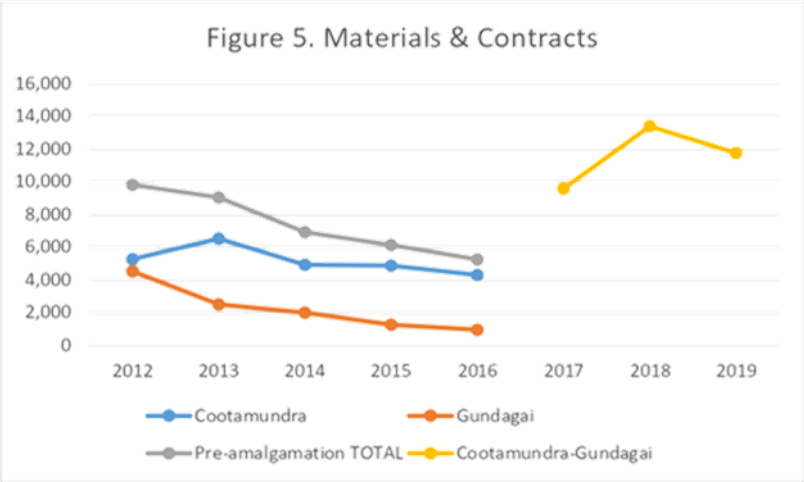
conclude on the basis of this data that the Cootamundra-Gundagai Regional Council is financially sustainable in the long-term.



Readers will recall from the previous section that KPMG projected that the majority of the post-amalgamation savings would occur in the area of employee costs ($7 million over 20 years was predicted). Moreover, it will be remembered that Dr Drew (2016) had provided the Boundary Commission Delegate with evidence that suggested staff expenditure was more likely to *increase* following amalgamation (see the appendix for the table provide to Mr Turner). Figure 4 compares the employee cost item from the audited financial statements over time. Comparing full financial years prior to and after amalgamation it is clear that employee costs have risen substantially (in the order of some $2.7 million). Thus, it seems that KPMG's guesswork was badly in error and that the actual outcomes were consistent with the evidence-base placed before the Delegate. This result is hardly surprising, given that the Delegate acknowledged that the new council would have to operate as two separate operations at Cootamundra and Gundagai respectively. The additional management required to co-ordinate two disparate operations, along with higher salaries paid to management commensurate with broader responsibilities, likely accounts for a good deal of the increase to the employee expenditure



It will be recalled that KPMG also projected savings in the order of half a million dollars in materials and contracts. Against this guesswork, the report by Drew modelled *dis*economies of scale of just over 8 percent (that is, higher expenditure than necessary in the order of 8 percent). Figure 5 charts the movement in this item from the audited financial statements over time. Once again, it seems that the KPMG projections were grossly inaccurate.

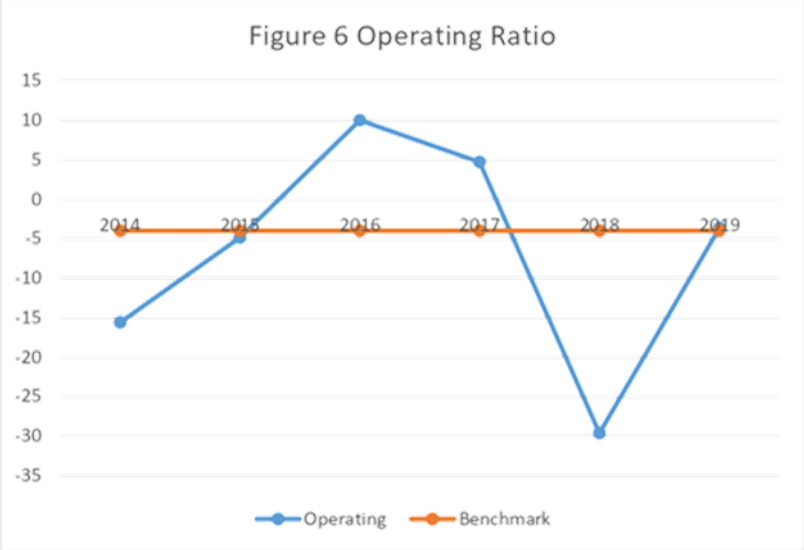


In sum, the analysis of audited financial data confirms that the KPMG projections were completely wrong. The amalgamation – far from reducing expenditure – has instead resulted in substantial increases to expenditure, consistent with the evidence presented to the Boundaries Commission Delegate in 2016. There is little reason to expect that the new higher employee costs will reduce in the future, in the absence of boundary reform, (indeed expenditure will likely increase when key positions such as the Deputy General Manager are filled). However, there is some potential that materials and contracts could be reduced in coming years under very strict budget control. Moreover, it is hard to see how the strong flows of extraordinary grant revenue could be expected to continue into future years. Without this revenue the

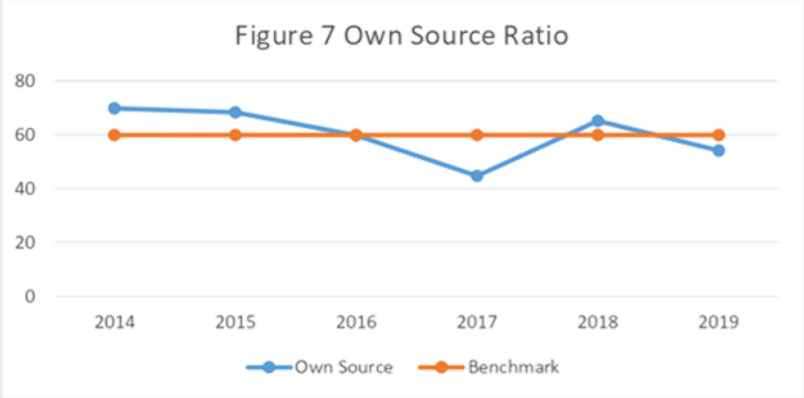
Cootamundra-Gundagai Regional Council will need to increase fees and rates substantially, in order to maintain a semblance of financial sustainability, in the absence of a de-amalgamation.

Readers will also recall that financial ratios were used by TCorp and IPART to measure the financial sustainability of local governments, and that performance against these (generally arbitrary) ratio benchmarks was used to determine which councils should be subject to amalgamation. If we follow the logic of this thinking through to its end, it is reasonable to expect that the ratios should be showing some sign of improvement after three full years since amalgamation. I have therefore charted the ratios for the period prior to and following the amalgamations. For the period prior to amalgamation I calculated a combined ratio which was the sum of individual ratio components of the constituent councils. This practice is consistent with the scholarly literature (see, Drew and Dollery, 2014a).

Figure 6 charts the operating ratio over time and I think it is pretty clear that the ratio fails to meet the benchmark for both of the standard financial years since amalgamation. Notably I have used the TCorp benchmark of -4%, were I to use the later IPART benchmark of 0, then matters would appear even less edifying.



A lot of emphasis was placed on the Own Source ratio during the amalgamation debates. Unfortunately, the ratio was poorly conceived and demonstrates a fundamental misconception of horizontal fiscal equalisation grants, as well as fiscal federalism. Nevertheless, the own source ratio has been below the NSW government benchmark since amalgamation, and by this measure suggests that the boundary change was not as successful as might have been hoped.



The unrestricted current ratio is a measure of liquidity – that is the ability of council to meet its financial obligations when they fall due. As can be seen from the graph liquidity has been reducing quickly since the spike in 2017 – however, it is at a satisfactory level and isn't a matter for immediate concern.

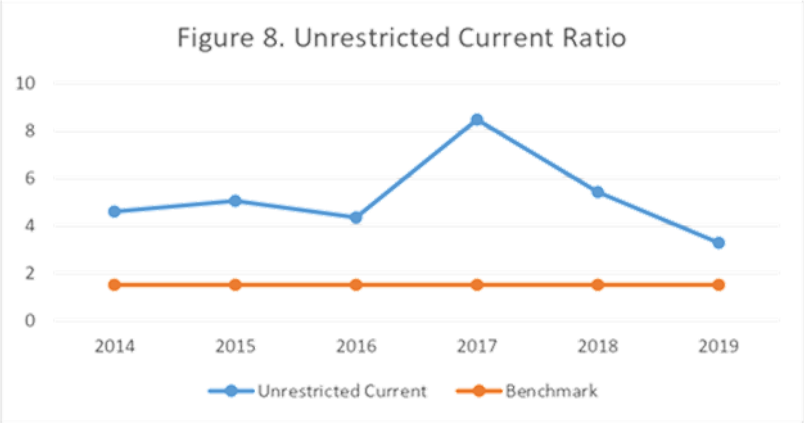
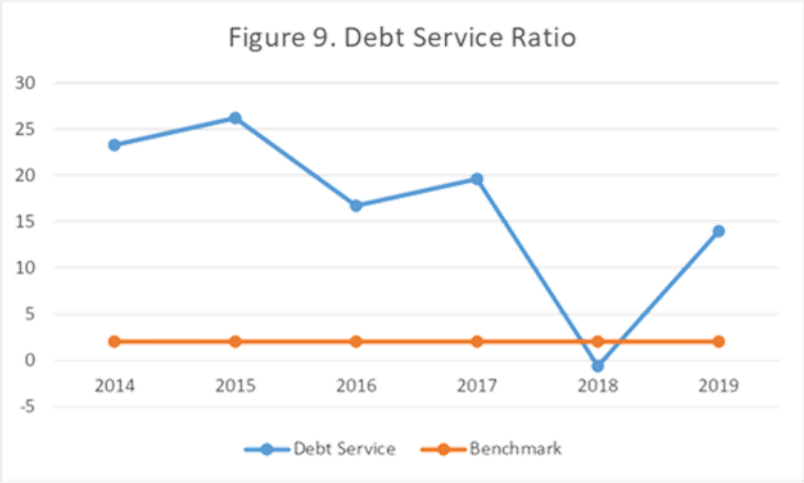
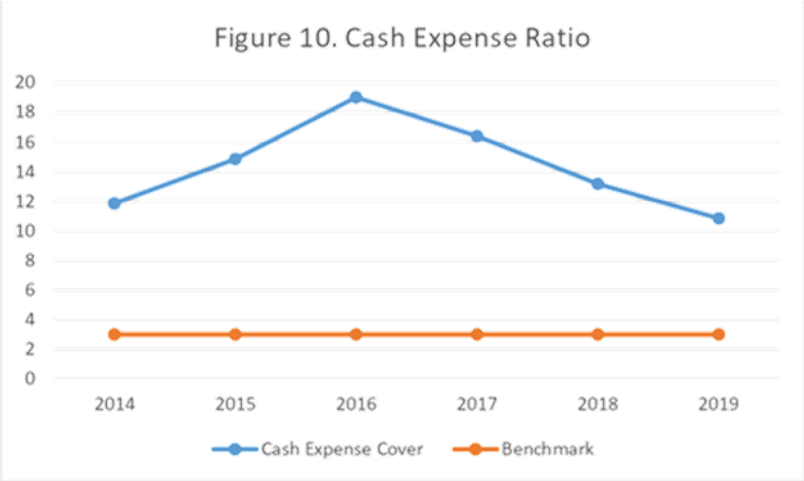


Figure 9 provides a picture of Council's ability to service debt. This has clearly diminished since amalgamation, and even dipped below the benchmark at one time, therefore suggesting that amalgamation may not have improved matters in this area of financial sustainability.

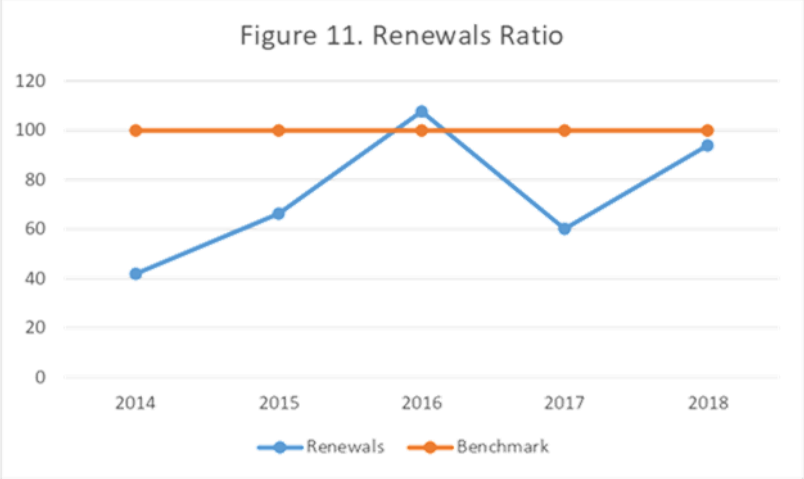


The cash expense ratio is another measure of liquidity. It has declined steadily since 2016, but is still well above the benchmark.

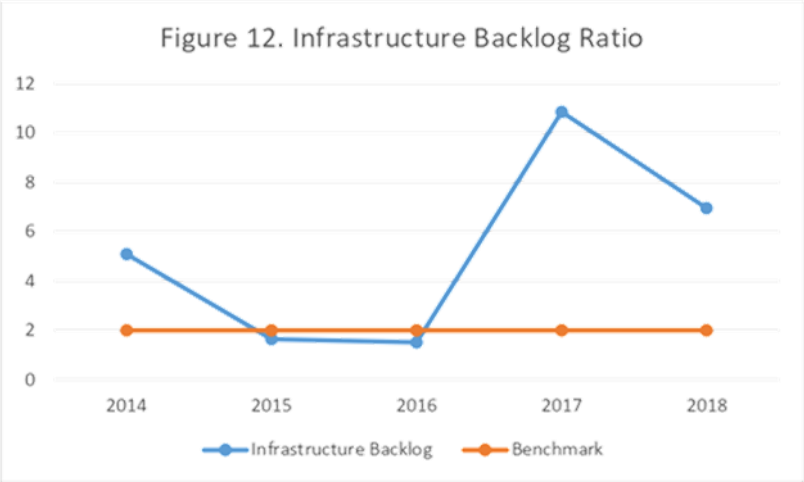


The next three ratios refer to asset management and were the subject of considerable contention during the 2011-2016 debate. Part of the problem with these ratios are that they involve some data which may be based on subjective criteria (Drew and Dollery, 2015b). It should also be noted that at the time of writing I did not have access to the 2019 data for these ratios.

Figure 11 purports to measure whether Council has renewed assets according to need. Prior to amalgamation, the constituent Councils rarely met this benchmark, and since amalgamation the benchmark still fails to be met.

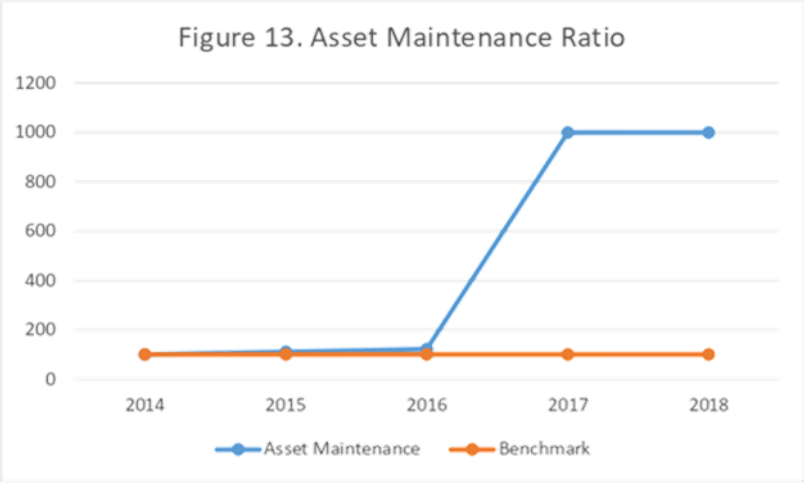


The infrastructure backlog was a key factor referred to in the Minister's Proposal (2016) and it appears to have been a major motivation for amalgamation. This ratio is the opposite of other measures in that achievement of the benchmark occurs when the blue line dips *below* the orange benchmark line. I think there can be little doubt that, by the measures provided in the financial statements, things have deteriorated significantly since amalgamation.



The asset maintenance ratio purports to measure whether Council has conducted required annual maintenance on its assets. I have set the last two years to '1000' because the Council has claimed that there is zero (0) required maintenance, which would yield the result of infinity[4]. By the data provided in the financial statements it appears that performance in this metric has benefited enormously by the amalgamation.

[4] Not zero as stated in the financial statements, because in mathematics anything divided by zero yields infinity.



In Figure 14 I provide details of the cost to bring assets up to a satisfactory standard, which was also a point of great contention during the amalgamation debate. The definition for this data is extremely subjective (what is 'satisfactory' or, more recently, 'agreed') and definitional drift means that it is difficult to form any reliable conclusions based on the data stated by *any* Council.

It might be noted that the 'efficiency' ratio (employed by IPART in its Fit for the Future assessments) has not been calculated and reported here as it was very misleading – given that it used data known to be inaccurate, and employed an empirical methodology that was obviously inappropriate (Drew and Dollery, 2015b). However, efficiency *is* an important aspect of financial sustainability and a major motivation for amalgamation according to the ILGRP, KPMG and NSW Government. Moreover, efficiency is specifically referred to in s263 of the Act (1993) as a matter that the Boundaries Commission must consider. It is therefore appropriate to measure Council efficiency over time and this is the matter to which I now turn my attention.

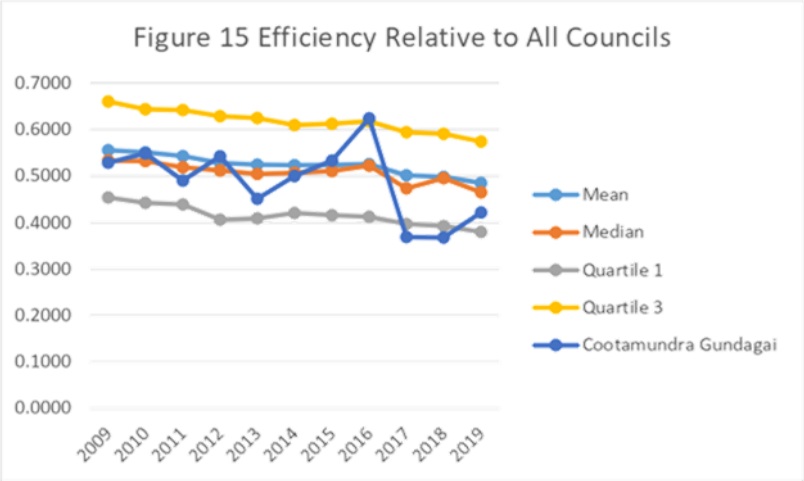
Efficiency of Cootamundra, Gundagai, and Cootamundra-Gundagai

Efficiency in economics is a term that is used to refer to the conversion of inputs into outputs and can be measured quite precisely using a sophisticated technique called data envelopment analysis (DEA) (see, for example, Cooper et al., 2007; Coelli et al. 2005). It essentially extends one output and one input ratios that we are familiar with (for example, expenditure per person, or kilometres per hour) to *multiple* inputs and outputs. The advantages of using multiple inputs and outputs is that we can more accurately model what actually occurs in the local government production function.

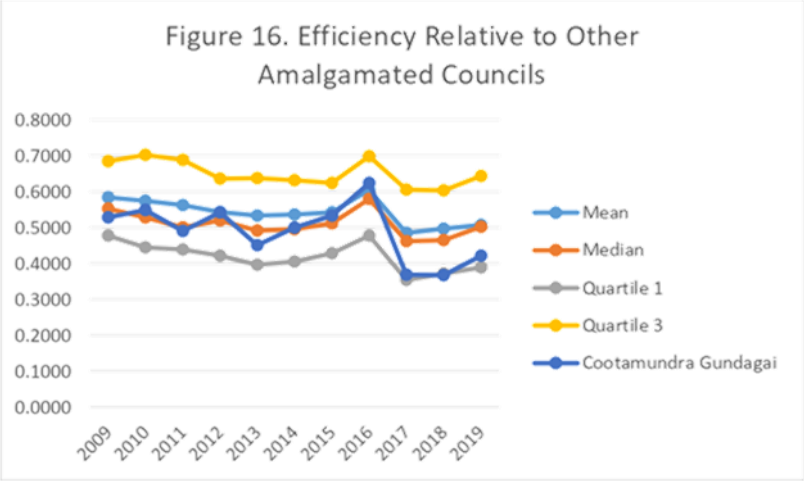
The inputs to local government are money and local government staff time. The outputs are specific services provided to different types of properties (residential, farmland and business) as well as the provision of local government roads (the single largest item of expenditure for local government). This specification is consistent with the scholarly literature (see, for example, Drew et al., 2015a; 2015b; 2015c).

I conducted two intertemporal DEA on the Cootamundra-Gundagai Regional Council over the period 2009 to 2019 inclusive. The word 'intertemporal' just means that a particular type of DEA was done so that legitimate comparisons could be made between successive years (I also did a refinement of this which is called local intertemporal DEA, which can be found in the appendix). To make a comparison prior to amalgamation I, once again, followed the established procedure of combining the various inputs and outputs of the pre-amalgamated entities (for example to get residential outputs I simply added the number of residential assessments in Cootamundra to the number of residential assessments in Gundagai).

Figure 15 presents the results for Cootamundra-Gundagai along with various measures of what is called central tendency for the entire cohort of NSW councils. Thus, I include the mean (or average) of NSW local government efficiency, the median (which is the middle number if one puts all numbers in ascending order), and each quartile (Q1 and Q3, which are the median of the first half and second half of the data respectively). As will be noted there was a spike in improved efficiency for Cootamundra-Gundagai in 2016 (owing largely to the financial year being shortened by several weeks because of the amalgamation). Following this time efficiency dropped quite significantly to recover slightly in 2019. Notably, prior to amalgamation efficiency at Cootamundra and Gundagai councils was pretty typical of most NSW local governments (that is, it was close to the mean and median – where 50% of councils lie below the median). However, following amalgamation it suddenly dipped below the lowest quartile (bottom 25% of performance) and has slightly improved this year. It therefore appears that the promised economies of scale were illusory (consistent with the report brought to the attention of the Boundaries Commission Delegate in 2016).



It is one thing to know that Cootamundra-Gundagai efficiency dropped alarmingly following amalgamation with respect to all NSW local governments, but one may also reasonably ask how performance compares to just the cohort of councils which were amalgamated. In Figure 16 I chart the results of a second intertemporal DEA which looks at just Cootamundra-Gundagai relative to other amalgamated councils. Once, again performance fell from more or less typical (close to the mean and median – where 50% of councils lie below the median) in 2016, to something just a little over the first quartile (which is the bottom 25% of councils). So, it would be fair to say that even when measured against other amalgamated councils the efficiency of Cootamundra-Gundagai has deteriorated alarmingly, contrary to the predictions of KPMG. This suggests that the amalgamation configuration of Cootamundra-Gundagai was particularly unhelpful and contributed to particularly poor outcomes for the community of Cootamundra-Gundagai.



The reason why efficiency reduced is because the amalgamation created a council that was too large – that is, the amalgamation generated diseconomies of scale. The report by Drew (2016) predicted that the amalgamation would shift the two former

councils from having potential for economies of scale into a configuration that would result in diseconomies of scale (relative inefficiency) of just over 8 percent. This analysis was provided to the Boundaries Commission Delegate in 2016 because the s263(3)(a) of the Act (1993) specifically required the Delegate to give consideration to 'economies or diseconomies of scale'.

The analysis that I completed for Figure 15 suggests that council is indeed currently operating with diseconomies of just under 11 percent, more or less consistent with the empirical analysis by Drew in 2016, but inconsistent with the lofty assumptions of KPMG in 2016.

To complete my analysis of the financial advantages and disadvantages of boundary change – which is the first criteria that the legislation requires the Boundary Commission to weigh – I will now set forth the pecuniary costs and benefits of de-amalgamation.

De-amalgamation Cost and Procedure

A potential de-amalgamation of Cootamundra-Gundagai Regional Council will be associated with two distinct kinds of costs and benefits. First, there will be one-off costs required to execute the de-amalgamation. Second, there will be a series of ongoing costs *and* benefits directly attributable to the new boundary structure. It is important to note that all of the following costs and benefits have been thoroughly investigated and are based on audited financial statement data, Human Resource records, surveys of staff travel, historical data from previous de-amalgamations and the requirements of legislation. It is not the kind of guesswork previously inflicted on the community, and the people of Cootamundra-Gundagai can be assured that the projections will be realised under able stewardship. Indeed, I have painted the worst-case scenario in all of my calculations, and I would not be at all surprise to find that the costs have been over-estimated and the benefits under-estimated.

One-off Costs of De-amalgamation.

To determine the one-off costs of de-amalgamation I consulted the scholarly literature on previous de-amalgamations (see for example, Drew and Dollery 2014b; 2015a), made a study of the costs associated with the 2016 amalgamation, inquired into contracts for executive staff, received estimates for work by IT providers, and consulted with management on each relevant area of expense. When faced with two cost projections (for example the actual costs of legal work for amalgamation and the historical cost of legal work from previous de-amalgamations suitably inflated), I have taken the higher of the two estimates. I have also added in extra margins for several costs to account for potential contingencies.

The total one-off cost for de-amalgamation should not exceed $1.75 million[5]. This will be constituted as follows:

Table 2. One-Off Costs of De-Amalgamation ($'000)

Communications and Branding	477
staff expenditure	211
ICT and finance	600
Governance	108
Asset Management	18
Legal	177
Plant	0
Transition Manager	120
Other	39
TOTAL	**1,750**

A few notable matters. I have confirmed with both the Works Supervisor and Technical Operations Manager that no plant will be required to be purchased as a direct result of a de-amalgamation. This state of affairs has arisen due to the conduct

[5] This cost compares favourably to the $1 million cost of the similar Delatite de-amalgamation, which is equivalent to $1.5 million in today's dollars.

of the councils as separate operations as recommended by the former Boundaries Commission Delegate. In previous de-amalgamations, elsewhere in the country, additional plant was a major cost of de-amalgamation. Second, I have included the costs for a Transition Manager – ideally this position would be filled by someone that holds the trust of both communities and understands the operations of the council(s) and the costs and tasks required for de-amalgamation. This is a 10-week appointment and I have priced it in at a consultant's rate appropriate for the level of expertise required. Third, ICT costs are considerably over the estimate made by the Council's provider and better reflect historical costs from previous de-amalgamations (and hence should not be subject to the kind of budget blowout that occurred during many amalgamations). Fourth, the branding costs are based on the assumption that both emerging councils would revert to previous logos and branding strategies.

Ongoing Costs and Benefits

To calculate the ongoing costs I consulted with staff, conducted surveys of travel frequency, reviewed historical human resource records, reviewed the age profile of staff, consulted with department managers, referred to the most recent local government remuneration tribunal ruling, consulted with the current Mayor and Deputy Mayor, attempted to consult with the State local government grants commission (on several occasions), and took note of new legislative requirements.

According to my calculations the de-amalgamation cost payback period is just over 8 years. The ninth year should see a nett benefit, accounting for the cost of de-amalgamation, and from the tenth year onwards annual savings should be in the order of $451,000 per annum.

As noted earlier, where there was any doubt about savings, I opted to omit the saving or record the lesser assured amount. Therefore, it is reasonable to expect that the nett benefit will occur much sooner and be much greater in magnitude. Given the previous damage inflicted on this community I was not prepared to include any saving that I could not be completely certain of.

Notably, I have not modelled any forced redundancies (except for the current General Manager contract). Instead I have used data on staff age and information about retirement plans to model savings in staff expenditure based on natural attrition. Unlike KPMG and others, I refuse to countenance the idea that any ongoing staff member should have their job placed in jeopardy as a result of Ministerial decision-making.

Projected costs and savings are detailed below:

Table 3. Ongoing Costs and Savings Arising from De-Amalgamation ($'000)

	Year 1	Year2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Employee savings	112	259	398	408	545	558	729	747	766	785
Additional employee costs (key positions)	271	278	285	292	299	307	314	322	330	338
Additional Governance	0	0	0	0	0	0	0	0	0	0
Travel savings[6]	154	157	160	163	167	170	173	177	180	184
Additional Assurance costs	192	197	202	207	212	217	223	228	234	240
Additional operating grant income (non FAG)	60	60	60	60	60	60	60	60	60	60
Additional FAG income	Waiting for NSW Local Government Grant Commission response									
Savings from eliminating diseconomies of scale	Substantial in the order of 11% but cannot be assured therefore not included									
ANNUAL SAVING	-137	2	132	132	260	265	425	434	442	451
CUMULATIVE SAVING	-137	-135	-4	129	129	654	1,079	1,513	1,955	2,406

(Please note slight rounding error occurs in the table – totals reflect precise costs and savings)

A few more matters should be noted. First, governance costs relate directly to the overall increase in the numbers of Councillors arising from a de-amalgamation. I have conferred with the current Mayor and Deputy Mayor and they both agree that a reduced number of councillors (relative to what existed prior to amalgamation) would be appropriate. Accordingly, I have priced in a total of 5 Councillors for Gundagai and 7 for Cootamundra, using the current minimum rate of Councillor Allowance prescribed for the rural category of councils by the Local Government Remuneration Tribunal, plus overheads. This actually results in a small annual saving (of just under $3,000), but I have not modelled the saving in order to err on the side of caution consistent with my overall approach to this matter. Second, reduction in diseconomies of scale modelled in the data envelopment analysis have not been included as a separate item. Some of these diseconomies have been captured in more specific line items (for example, travel costs). However, there will likely be further diseconomies captured following de-amalgamation that will contribute to outcomes better than those that I project. I took the decision not to include savings from mitigating diseconomies in my calculations because, whilst they are very likely, they cannot be 100% assured. Third, I have only modelled in extra operating grant income relating to the libraries grant. I am aware that Council has effectively missed out on a number (or some portions) of one-off grants (like federal drought assistance), but these cannot be counted on in the future. Moreover, I have focussed on operating grants only, because capital grants are not included in the NSW government preferred operating result figure. Fourth, I have not modelled in the extra Financial Assistance Grant likely to be forthcoming following de-amalgamation. On the 7th February 2006, the responsible Federal Minister proclaimed a variation under

[6] This does not include the value of staff time lost through commuting. When staff are driving between centres they cannot be performing their usual duties, which represents a significant opportunity cost to Council.

subsection 6(4) of the Local Government (Financial Assistance) Act 1995 (CTH) that a new national principle would come into force being that 'the general purpose grant provided to the new body for each of the four years following amalgamation should be the total of the amounts that would have been provided to the former bodies in each of those years if they had remained separate entities'. The reason why this proclamation was made was to re-dress a number of situations whereby FAG grants had altered significantly following amalgamation (which will almost certainly happen any time that councils without identical demographics are amalgamated). I have emailed the NSW Local Government Grants Commission back on the 8th of January (and 18th of February) to ask for: (i) the Local Government Grants Commission report for 2016-17, and (ii) the precise formulas *and* factors used to calculate the grants. I was told there would be no 2016-17 report which seems to be inconsistent with s3(4)(a) of the Act (1995) which states the Parliament's goal to 'increase the transparency and accountability of the States in respect of the allocation of funds under this Act to local governing bodies'. I have pointed out the inconsistency of the approach taken by the NSW Local Government Grants Commission but not received a satisfactory response. Without this degree of detailed information, I have no way of verifying that the proclamation under subsection 6(4) of the Act (1995) has been observed correctly[7], nor can I model by how much the FAG grant would likely be increased following de-amalgamation. It is regrettable for the community of Cootamundra-Gundagai that the NSW Local Governments Grant Commission has not been sufficiently transparent in their operations.

Of interest is the fact that a de-amalgamation is expected to yield a saving of *at least* $2.406 million over ten years. This saving, based on rigorous analysis, stands in contrast to the guestimate that was used to justify the original amalgamation projected saving of $3 million over 20 years. Otherwise stated, what I have shown here is a commensurate saving that occurs in almost half the time as what was assumed might occur from the amalgamation. However, unlike the work that was done in 2016 my calculations are prudent and rigorous.

If a saving of $3 million over 20 years was deemed sufficient cause to bring about an amalgamation, then the same logic must dictate that a saving of $2.4 million over 10 years is even more cause to bring about a de-amalgamation.

I will now proceed to answer a number of questions that are typically posed during de-amalgamation debates regarding how matters should be managed prior to the proclamation and during the transition period.

[7] Although in email correspondence it was confirmed that 'in 16/17 and 17/18 the FAGs were simply aggregated for amalgamated councils and apportioned based on population (ABS) or local road lengths (as reported by councils) where boundary changes occurred…in 2018/19 the FAGs went into a transition towards a revised model.' This seems inconsistent with the aforementioned proclamation and it is very possible that Council has received less FAGs than its entitlement.

How Should the Transition be Managed?

The transition should be managed by a team of executives and political representatives headed by an independent Transition Manager, who understands the council's structure and challenges and has the complete confidence of the community. This person should come from outside of the community and should be appointed for a temporary period of ten weeks.

It is absolutely imperative that the Transition Manager is appointed by the *existing Council* as quickly as possible after the Minister makes her decision known. A big part of the problem that we have been dealing with over the past four years or so, is that the community has felt (with good reason) that they have had little input into the structural decisions which significantly affect their lives. The community, not the Minister, must appoint the Transition Manager, because it is the community who will bear the consequences of the decisions made by this person. There needs to be no room for doubt, this time, that the community has had control over the process and have had a real say over the decisions. The most appropriate way to ensure that this occurs is for the Council to appoint a Transition Manager at a Council Meeting that is open to the public.

The transition team should include the current General Manager, the current Mayor and Deputy Mayor, and the new General Managers of the emerging entities (as soon as they have been appointed[8]). The Transition Manager must have the authority to have the final say on all matters described below. However, the Transition Manager should in all instances first seek a consensus and all members of the transition team should have equal say prior to a decision being made. This is similar to the model that has been used in successful de-amalgamations elsewhere.

The Transition Team and the Transition Manager should be communicating with the Council and public throughout the process. The most expedient way to achieve this Council and public consultation would be for the Transition Team to report to the fortnightly Council workshops. Part of this workshop time should be open to the public, so that interested members of the community have a chance to both hear about the progress being made, as well as raise any questions that they might have.

I have absolutely no doubt that the current senior political figures and executive of Council will work respectfully and co-operatively for both communities. Each person understands that *both* de-amalgamated local governments must thrive and prosper subsequent to de-amalgamation, for the decision to be validated, and will work hard to ensure that this result is the outcome.

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[8] Two General Manager Employment sub-committees should be formed from the body of existing Councillors as soon as the Minister has made her decision to de-amalgamate. The first sub-committee should comprise only Cootamundra Councillors and should be tasked with engaging a new General Manager for Cootamundra. The second sub-committee should be formed from only Gundagai Councillors and should be tasked with engaging a new General Manager for Gundagai. The Transition Manager should observe the engagement process to ensure that it is consistent with the de-amalgamation plan and provide her or his comments, but should not be given a binding say on any appointment.

Who Should Pay?

Principles of natural justice are generally considered to suggest that if one person inflicts damage upon another – whether intentionally or through negligence –then the person responsible for the damage is liable for the rectification of same. For instance, if I crash my vehicle into that of an innocent person going about their lawful business, then I would be responsible for the cost required to bring that person as close as possible back to their position prior to the accident.

This concept is clearly directly applicable to the amalgamation event. The people in Cootamundra and Gundagai did not act to bring about the amalgamation – indeed, many tried to bring facts to bear in the hope that the amalgamation architects would realise that the proposal was a particularly poor idea. However, the NSW government – probably relying heavily on some poor advice from their agents – drove the amalgamation vehicle into the community and, as I have shown, this caused significant financial damage. If we extend the principles of natural justice to this situation then there seems to be a clear case for the NSW government to bear some of the costs required to repair the damage done to the community. Notably, the current NSW government is under different management to the government that inflicted the damage. However, it seems that the current government is conscious of its obligations under principles of natural justice and the community might therefore have some reason to hope that the one-off costs of de-amalgamation might be granted to them (indeed, the one-off costs for de-amalgamation are likely to be far less than the ongoing support required from the NSW government to keep the Cootamundra-Gundagai Regional Council financially sustainable into the future and thus represents a wise investment). Even if one-off costs are covered by the NSW government, it should be noted that the damage that has occurred to the finances of the community over the last few years will still probably have to be repaired through future increases to fees and taxes.

In the past the precedent has been that the break-away community bear the entire cost of de-amalgamation (although in Victoria, in actual fact, the amalgamated entity bore most of the cost prior to de-amalgamation; see Drew and Dollery 2014b; 2015a). It is problematic for entities currently not in existence (Cootamundra council and Gundagai council respectively) to be bound to debts that they have had little say in (see, Drew and Dollery, 2014b). In Queensland, a particular piece of legislation had to be passed to facilitate this outcome, and there were grounds to contest both the morality and legality of doing so (Drew and Dollery, 2014b).

My strong preference (in the event that the NSW government declines to pay the costs of de-amalgamation) would be for the costs that are incurred by Cootamundra-Gundagai Regional Council – as it goes about the tasks that must be executed prior to de-amalgamation – to be borne by Cootamundra-Gundagai Regional Council. Costs that are incurred after amalgamation would also be borne by the Council that incurs the cost. This is clearly the most efficient and practical arrangement, but as I have alluded to earlier, also the arrangement with the least moral hazard.

In Table 4 I have set out the timing and responsibilities for most of the costs (if the state government declines to fund the de-amalgamation). As can be seen, a good

proportion of the costs would be borne by Cootamundra-Gundagai Regional Council, simply because of the fact that they need to be incurred prior to the actual day of de-amalgamation.

Table 4. Apportioning One-Off Costs of De-Amalgamation

Communications and Branding	477	Community communications about actual de-amalgamation born by CGRC, branding cost born by each emerging council
staff expenditure	211	Borne by CGRC for legal and practical reasons
ICT and finance	600	CGRC, but some borne by emergent councils
Governance	108	Borne by council where cost originates, mostly CGRC
Asset Management	18	Borne by CGRC
Legal	177	Borne by all three parties
Plant	0	
Transition Manager	120	$96k CGRC, remainder shared between new entities.
Other	39	Borne by council where cost originates
TOTAL	**1,750**	

I emphasise that my preferred position is that the NSW government pay for the one-off costs. However, if the state government declines to do so, then my calculations demonstrate that there is still a nett benefit for the community even if they bear the cost and my plan in Table 5 is the most economic and morally defensible way of accomplishing what must be done.

How Should Assets be Allocated?

There are three types of assets to consider, which all require different treatment – fixed assets, movable assets and cash and cash equivalents (Drew and Dollery, 2014b).

Fixed assets, such as buildings and sports infrastructure, are the simplest to deal with and should be allocated to the council in whose borders the asset is located.

In Cootamundra-Gundagai the moveable assets have mostly stayed within the pre-amalgamation borders and in most instances it will not be controversial to continue to keep the asset where it is currently located. Assets associated with specific staff (ICT equipment) should travel with the staff. There will inevitably be a small number of assets that do not fall into any category. These assets should be transferred according to the judgement of the independent Transition Manager after consulting with the relevant staff and representatives. I cannot emphasise enough the critical role that an independent Transition Manager will play in a de-amalgamation scenario. Inevitably judgements will need to be made by someone in authority and

hence it is imperative that a truly independent and knowledgeable Transition Manager is appointed.

Cash and cash equivalents should be allocated as part of a division of nett liabilities, as I will detail below.

How Should Staff be assigned?

In most cases staff have remained within the borders of the area that they were located in prior to amalgamation. In a few instances, key staff have been split between the two council chambers, and in other instances new staff have been taken on to fill positions that have become vacant over the last four years or so.

Staff who were located at a particular council chamber prior to and since amalgamation should remain at that location. Staff who have been split between the two locations should be assigned as follows:

For positions that will not be operated as a shared service, the views of the staff member involved should be given the greatest weight, followed by the needs of each emerging entity, followed by the preferences of the new entity management. If a shared consensus cannot be reached, then the Transition Manager's decision must be considered binding.

How Should Liabilities be Allocated?

The objective of the Transition Manager should be to ensure, as far as practical, that both emerging local governments end up with nett current assets and nett non-current assets respectively in proportion to those that existed immediately prior to amalgamation. Clearly liabilities associated with a particular fixed asset should be transferred to the new entity where the asset is located. Similarly, liabilities associated with staff (for example, leave entitlements) must be transferred to the entity where the staff member will be employed. Next, liabilities associated with a particular movable asset should be transferred to the entity where the movable asset will be located. The remainder of the nett current and nett non-current assets should be allocated *separately* such that the new entities are placed as close as possible in the situation that existed immediately prior to amalgamation. In this matter – as in most others – the independent Transition Manager will have a binding say on final allocations.

How Should Natural Attrition be Managed?

The objective of both councils should be to reduce the number of executive positions down to one General Manager and three Directors. There are currently one General Manager, one Deputy General Manager and 10 Director-equivalent positions at Cootamundra-Gundagai Regional Council. These 'legacy costs' of the amalgamation will, unfortunately, continue to weigh on the emerging councils for many years, and have substantially reduced the savings that would otherwise have arisen from de-amalgamation.

After de-amalgamation some changes to the job position of each Director-like position will need to be made to ensure that each emerging organisation has

oversight over all key functional areas of council. This will have to be done in consultation with the affected staff and in cognisance that no changes can be made to salaries. Soon after the de-amalgamation work has been completed the General Manager at each emerging entity should interview all senior staff with a view to understanding their career and retirement plans. At this point a succession plan should be put into place whereby ultimately functions of the departing executives are divided among the Directors who will be staying on. Appropriate plans should then be put into place to ensure that the remaining Directors will have the required skills and knowledge to absorb the function when their colleague ultimately leaves.

It will be tempting to replace positions as executive retire or resign. However, this should be resisted strenuously as many of the savings associated with de-amalgamation are contingent on reducing the numbers of managers over the next decade.

Similarly, the number of FTE that existed immediately prior to amalgamation – 51 at Gundagai and 89 at Cootamundra – should be set as the ceiling for the new de-amalgamated entities. Until numbers have reduced below this ceiling new staff should not be put on, unless there is both (i) a dire need for a certain expertise, *and* (ii) a plan to reduce the FTE by not filling a specifically identified position which will soon be vacated. Ideally this cap should be regulated somehow and perhaps there is a role for the new Councillors to play in approving any proposal to add extra staff to the payroll that would result in the ceiling being breached. At the very least, the General Managers of the emerging councils should be required to complete a new business case to justify positions other than those already modelled in the ongoing costs and savings[9] detailed in Table 3.

I cannot stress strongly enough that strict discipline will be required to manage a successful de-amalgamation. There are always good reasons that can be found for hiring new staff, however if the communities are going to successfully recover from the damage inflicted to them through amalgamation, then these reasons will have to be vigorously resisted. This may mean that service levels might need to be reduced slightly, and that some job descriptions may need to alter, but prudence must win out on every occasion. I have complete faith in the community and the staff that they will be able to make the difficult decisions required to recover.

How Many Councillors Should the New Entities Have?

There are currently nine Councillors, including a Mayor and Deputy Mayor. Prior to amalgamation Cootamundra had nine Councillors and Gundagai had eight. Section 224 of the Local Government Act (1993), states that a council must 'have at least 5 and not more than 15 councillors'. I have discussed the matter with both the current Mayor and Deputy Mayor and propose that a new Cootamundra council should have

[9] In my modelling I have included the salaries and on-costs to recruit a new Chief Financial Officer, increase the rate of pay for the current Human Resource Assistant to the rate for a Human Resource Manager, employ an additional Executive Assistant for the Gundagai General Manager, and convert the existing accounts payable traineeship position at Gundagai to a permanent position. All other non-duplicate positions will be conducted in the same way that they were performed prior to amalgamation.

7 Councillors and a new Gundagai, 5. This is a significant decrease on pre-amalgamation representation, but represents a large improvement on the representation ratios that have occurred over the last four years. Based on the numbers proposed Cootamundra residents would have just over 1,100 people per Councillor, and Gundagai residents just over 750 people per Councillor. This compares favourably to the current representation ratio which is a little less than 1,280 people per Councillor.

Furthermore, I have modelled for the Councillors to be paid at the bottom range of the annual fee guidance provided by the Local Government Remuneration Tribunal. In view of the sacrifices the community will be asked to jointly make and the relatively lower workload after the de-amalgamation has been bedded down, I believe that the lower level of remuneration is warranted.

Who Should Sit on the Inaugural Council?

When the Governor's proclamation is read then the currently elected Councillors should be considered duly elected Councillors of the emergent local governments. Three of the current Cootamundra-Gundagai Councillors hail from Gundagai, and six from Cootamundra. Until the September 2020 local government elections, the existing Mayor should be assume the role of Mayor for Gundagai and the existing Deputy Mayor should assume the role of Mayor of Cootamundra (subject to s294(4) of the Act (1993)). A by-election would be impractical, and depending when a de-amalgamation occurred, unnecessary under the Act (1993).

When Should a De-amalgamation Occur?

This largely depends on when the Boundary Commission produces their report and when the Minister makes her decision. However, it would reduce work considerably if the proclamation was made on the first day of the new financial year (1 July, 2020). Given the large number of tasks that will fall to an inaugural council all efforts should be made to execute the de-amalgamation on this date providing that it falls at least eight weeks away from when the Minister makes her decision known, so that the Transition Team can undertake necessary pre-requisite tasks.

What Should Happen to Service Levels?

A consequence of amalgamation is that service levels tend to be increased to the highest that existed in the constituent councils. This is referred to as service harmonisation, and its neglect in modelling is one reason why amalgamations don't always deliver on the projected savings.

It will be critical that with the establishment of each new entity that service levels are immediately reduced to those that existed prior to May 2016. This is the absolute minimum necessary to ensure that the de-amalgamated entities do deliver on projected savings.

However, it is also important for the de-amalgamated entities to each conduct a service level review with their communities within the first 12 months of operations. If the fiscal damage inflicted by the amalgamation is to be repaired with minimal hardship, then it is imperative that service levels be dropped wherever practical.

Moreover, great care needs to be made with respect to capital spending. Discretionary capital spending needs to be halted and maintenance focussed only on essential infrastructure for the first 5 years, *at least*. One of the unfortunate side-effects of the amalgamation has been the very high levels of discretionary capital spending on community assets that had the characteristics of 'wants', rather than 'needs'. Depreciation and required maintenance on these assets will be a burden on the community for decades. Moreover, this spending has engendered fiscal illusion with the effect being that the community was not always aware of the serious nature of the local government finances. Therefore, capital spending on non-essential infrastructure will need to be put on hold until budget repair has been completed – which could be a decade or so away. Notably, it would be prudent to cease all non-essential capital expenditure on 'wants' even if the de-amalgamation doesn't progress – indeed it would probably be more important to do so under that scenario given the very large gap in revenue adequacy.

What Should Happen to Rates?

In all likelihood there will not be time to develop and put on public display a new rate structure for the new local governments, for the 2020/21 year. To ensure each new entity has sufficient revenue for its first year of operations, rates should default to the pre-amalgamation paths that would have existed had the Cootamundra-Gundagai Regional Council not resolve to harmonise rates in accordance with the Local Government Amendment (Rates – Merged Council Areas) Act 2017, No 8.

However, the new entities should be required by the Minister to resolve and put on public display a new rating structure within nine months of de-amalgamation. Ideally the new structure should be simple and transparent and based on the principles adopted by the former Cootamundra-Gundagai Regional Council – to have just three categories and to minimise rate shock for any one given category.

Moreover, it should be presumed that both councils will submit a Special Rate Variation in November 2020 for the 2020/21 year. Furthermore, it should be presumed that the Boundaries Commission hearing and determination constitutes *prima facie* evidence of four of the five IPART assessment criteria, specifically:

- Community awareness of plans for a SRV
- Demonstrated need for higher increases
- A sustainable financing strategy
- A history of well-documented council productivity improvements

Emergent Councils will still be required to address the criteria that the proposed SRV has a reasonable impact on ratepayers, although the burden should be shifted to ratepayers to prove that a proposal is unreasonable in impact given the financial sustainability position of the emergent councils.

Otherwise stated a SRV should be considered a definite necessity for each emergent council.

Notably if the Minister decides against de-amalgamation it must be acknowledged that the need for a SRV will be even greater. In this instance the Minister would be

well-advised to also direct IPART to adopt the presumptions listed above for the case of Cootamundra-Gundagai Regional Council.

What Should Happen to Fees Already Harmonised?

In all likelihood there will not be time to develop and put on public display a new fee structure for the new local governments for the 2020/21 year. To ensure each new entity has sufficient revenue for its first year of operations, fees that have been harmonised downwards should default to those laid forth in the *2019* Operational Plan increased by 2.6% (some harmonised fees in the 2020 Operation Plan may not provide sufficient revenue for a particular emerging council). Fees that have been increased relative to the levels that previously existed at each Council should continue to be charged as detailed in the 2020 Operational Plan.

Moreover, both emergent councils should be directed by the Minister to ensure that new fees and charges are set for the next operational plan. Furthermore, the Minister should direct councils to ensure that new non-regulated fees and charges at least fully recover the costs and overheads of providing the service wherever possible. As part of the budget repair effort it will be important to review all fees to ensure that the full costs are being recovered (which is often not the case in most NSW local governments). There are also strong moral grounds for ensuring this (and hence reducing cross-subsidisation out of the common tax pool). Notably this exercise would still be required if the council was not de-amalgamated and, because of extant diseconomies of scale, would likely result in higher fees and charges, than might be expected in the de-amalgamation scenario.

Shared service for certain functions?

Previously Gundagai employed consultants or used informal shared service arrangements to meet some specialist skills needs such as town planning, building surveying, IT support, and environmental health. This should continue to be the arrangement going forward in a de-amalgamated Gundagai Shire. The new Council would be advised to give serious thought to engaging specialist skills from Cootamundra Shire when required. Hiring specialist staff from Cootamundra Shire (rather than private consultants or staff from other councils) will increase the overall benefits for the Cootamundra and Gundagai communities, and will likely result in better outcomes given that the staff involved will have a more comprehensive understanding of the operational environment at Gundagai.

What Legislation is required

The Queensland Government established the Local Government (De-amalgamation) Regulation 2013, to regulate its four de-amalgamations. The NSW Government is advised to enact similar legislation with respect to the following sections of the aforementioned regulation which should be changed as follows:

Section or Part	Purpose	Recommendation
Part 2	To establish new elections and term of inaugural council	Assuming a de-amalgamation takes place on the 1st of July section 294 of the existing Act (1993) allows for the Governor to proclaim the two new Mayors nominated by the Council who should be the existing Mayor and Deputy Mayor respectively.
		Current Councillors should be appointed as Councillors to the emerging councils (6 to Cootamundra and 3 to Gundagai). The casual vacancies effectively created (1 at Cootamundra and 2 at Gundagai) do not seem to need to be filled prior to the scheduled September 2020 elections (see Section 292)
		Existing Remuneration Tribunal classification (rural) can be used for the emerging councils.
Part 3	Transfer Manager	This is absolutely critical, however the Transfer Manager should be appointed for 10 weeks, which must extend 2 weeks after the changeover day.
		A clause should be inserted to state that the Transfer Manager should first seek consensus with the Transfer Team before making any decision. However, it needs to be noted in the legislation that the Transfer Manager will have the capacity to make binding decisions even if consensus is not reached.
		A Transfer Team should be specified as being made up of: the current Mayor, the current Deputy Mayor, the current General Manager, the two new General Managers (following appointment)
Division 2	Transfer methodology	This is not ideal. The people in the best position to formulate and execute a transfer methodology are the Transfer Team.
		Potentially the legislation might require the Transfer Manager to present a copy of the transfer methodology to the Minister for her approval. However, it is important not to lock the Transfer Team into a methodology that may ultimately prove insufficiently flexible to respond to the particular situations encountered during the process.
Division 3	Transfer Committee	This should be replaced with the Transfer Team as specified earlier.
		The Transfer Team should be established for a period of up to twelve months. Given that the frequency of meetings is not specified it makes sense to keep the team long enough to deal with problems that might arise at the time that

		the next Operational Plans are being developed.
Division 3, s30	Adjudication by Minister	Won't be required during the term of the Transfer Manager.
Division 4	Local Advisory Committee	Won't be required if recommendations to establish two new Mayors and Councillors are observed.
Division 5	De-amalgamation Costs	This part of the legislation was very problematic. If the NSW Government funds the one-off costs of de-amalgamation then the Division will be redundant. If the NSW Government declines to fund the de-amalgamation, then the clause should state that costs incurred by the Cootamundra-Gundagai Regional Council, should be borne by the Council, and costs incurred by the emerging councils should be borne by the emerging councils.
Part 4	Financial matters	Asset transfer – references to the 'transfer committee' should be replaced with the 'Transfer Manager'.
	Liabilities	As above
	Rates and Charges	In addition to what is already stated there needs to be a clause to clarify that if a council had previously adopted a harmonised rate, then this resolution would be declared void, and the new councils would be required to levy a rate consistent with the Local Government Amendment (rates – Merged Council Areas) Act 2017, No 8 for the first year (only).
	Charges	For charges that have been harmonised downwards it should be declared that fees will default to those laid forth in the 2019 Operational Plan, increased by 2.6%.
	Fees	see above
Part 5	Local Laws and Other Instruments	No major changes appear to be required
Part 5A	Disaster management Matters	Needs to be amended to reflect the situation in NSW
Part 6	Councillors	Needs to specify 5 Councillors for Gundagai and 7 for Cootamundra.
		Needs to reflect the plan for existing Councillors to continue their duties at the respective councils where they are domiciled, until the next Local Government elections.
Division 2	Employees	The new organisational structure should be specified – namely one General Manager and three Directors for each emerging council. Excess Director-like staff should be retained with amended duties.

s55		Allocation of staff must be conducted by the Transition Manager taking into account (i) pre-amalgamated location of staff member, (ii) pre-de-amalgamation location of staff member, (iii) the staff member's preference.
s55		The ideal of returning the Councils as close as possible to their pre-amalgamated FTE staffing (51 for Gundagai and 89 for Cootamundra) should be stated. However, it should be noted that non-contract staff will have their conditions of employment protected, even if this results in staff ceilings being temporarily breached. Notwithstanding the protections for employment and conditions, it should be specifically noted that the new General Managers will have full discretion to re-define employment duties and roles according to operational needs.
s56(4)	Employee conditions	This should be deleted – part of the reason for executing a de-amalgamation is to right an injustice. It is not morally licit to create an injustice to right an injustice.
s56(5)	Retrenchment and redundancy	Should be deleted
Division 3	Major Contracts	the amount in s57(4)(a) should be reduced to $50,000

In addition to the above, any references to continuing local governments should be deleted to reflect the particular scenario of NSW.

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Other Criteria for Consideration by Boundaries Commission (Local Government Act (1993) s263(3)).

Community of Interest and Geographic Cohesion

Anyone who has had even a passing acquaintance with Cootamundra and Gundagai cannot help but realise that they are two fundamentally different communities with very little community of interest and little geographic cohesion. As Gundagai submitted to the Boundaries Commission in 2016 the Australian Bureau of Statistics (ABS, 2015) Socio-Economic Index for Area (SEIFA) clearly reflects this difference[10]:

Council	Socio-Economic Rating (State Ranking)	SEIFA (National Ranking)	Largest Industry Employer
Cootamundra	32 (3rd decile)	129 (3rd decile)	Retail Trade
Gundagai	64 (5th decile)	213 (4th decile)	Agriculture, forestry & fishing

As can be seen the two towns were 32 rankings apart on a state-wide comparison, and 84 rankings apart in a national comparison – thus certainly not similar. Moreover, the dominant industries in the respective towns were recognised by the ABS as being different.

The Boundaries Commission Delegate chose to eschew evidence in favour of his personal perception that 'the populations are almost exclusively of Anglo-European origin and share a strong tradition of Christian values and conservative politics' (Turner, 2016, p. 22). By this dubious reasoning Cootamundra or Gundagai might have been just as easily amalgamated with North Sydney, which was also predominately Anglo-European, Christian and vote conservative!

To eschew evidence and then grasp at a ridiculous perceived similarity suggests that there were good grounds for suspecting a misapprehension of bias by the Delegate and a miscarriage of administrative procedure.

The 2020 Boundaries Commission is encouraged to visit both communities and spend sufficient time in each to understand how they operate and the commuting patterns of residents. It will be quite obvious from such a visit that the communities could hardly be more disparate, and that the geography is also plainly different. Moreover, after travelling the Muttama road which links the two towns, it will be clear that there has never been much cause for people to travel between the two communities – for had there been much commuting activity between the towns in the past then the road would have been upgraded substantially many decades ago.

Existing Historical and Traditional Values

The Delegate noted that the two towns are both located on the ancestral lands of the Wiradjuri people. This appears to be correct, but what was overlooked is that the

[10] Since amalgamation the ABS has not compiled statistics for the amalgamated councils, hence my reference to the 2015 data.

Wiradjuri Region was a vast area also encompassing Albury, Bathurst, Orange, Wagga Wagga, Denilliquin and Griffith to name just a few of the towns that share this heritage (Aboriginal Land Council, n.d.). If we were concerned to amalgamate according to this logic, then the resultant council would have encompassed around one fifth of the state of NSW.

Similarly, the Delegate noted that both townships were settled in the early 1800's and were part of the mid-century gold rush. So was Bendigo in Victoria, but it hardly suggests a shared history and values. Most of Southern Australia was settled during this period and the observations made by the Delegate are not salient for decision-making regarding the suitability of local government boundaries.

Indeed, the Delegate failed to recognise the differences in history and values when he conveyed his approval for a proposal that the new local government should be named 'Gundagai Regional Council'. The fact that this name was quickly changed following a post-amalgamation community survey is more evidence that the towns clearly did not feel they shared a common heritage.

Attitude of Residents and Ratepayers

I have already examined the attitude of ratepayers at the time of the first Boundaries Commission in 2016, and it is perfectly clear that the community was not in favour of the proposal. This is likely because the community understood that there was little commonality and a vast distance between the townships, serviced by a pretty ordinary road.

On Monday 9th March, 2020 I conducted a community forum at Cootamundra regarding the response of Council to the Boundaries Commission process. On Tuesday the 10th of March I conducted a similar forum at Gundagai. When interpreting the data which follows it is important to be mindful of a few matters. First, I have been regularly uploading information videos which a number of residents and staff told me they watch avidly – this might mean that people considered themselves already sufficiently informed regarding the Boundaries Commission proposal. Second, as we are all aware the coronavirus scare was in full swing during the week I attended, and many people have clearly decided to avoid public gatherings. Third, there was some confusion in Cootamundra (so I have been reliably informed by two different individuals) regarding the time and place for the forum. Moreover, there is a good deal of cynicism in Cootamundra – many people told me that they weren't bothering to express an opinion 'because it was a waste of time because no-one listened in 2016'. Given that the community went to a lot of trouble to consider a detailed plan for amalgamating with Harden in 2016 – a plan that was approved by various bodies (including IPART) as being fit for the future, only to be summarily dismissed with no reason given – it is probably not surprising that there is a trust deficit with state government in this present instance.

Despite this confusion and trust deficit 70 people registered as attending the Cootamundra forum, and a reliable count was made of 90 attendees (I know for a fact that there are names missing from the registration list of people I met and talked to before and after the event). A simple survey was conducted at the end of the

information and Q & A sessions. A copy of the survey appears in the appendix (this is the example I presented to residents on a PowerPoint presentation). Seventy surveys[11] were received with the following distribution of responses:

Cootamundra – *Were you in favour of the 2016 amalgamation?*

Yes	No	Undecided
6	59	5

Cootamundra – *Do you think de-amalgamation will save money?*

Yes	No	Undecided
54	12	4

Cootamundra – *Are you in favour of a de-amalgamation?*[12]

Yes	No	Undecided
64	3	2

The responses of informed persons give us a good indication of what people in Cootamundra would likely think if they were exposed to relevant information. Indeed it is indicative of the likely conclusions of anyone who approaches the matter purely on the basis of evidence, sans bias or political concerns.

What is particularly interesting about these results is that people who had been in favour of the amalgamation in 2016, have clearly decided it is not working (nor likely to work) in 2020. Moreover, the principle motivation for de-amalgamation is not necessarily financial. Twelve people don't believe the projections of savings (which is hardly surprising given how inaccurate projections have been in the past) – yet only three people are not in favour of a de-amalgamation. It seems very clear to me that the far majority of people at the forum understand that things just aren't working – financially as well as in terms of community cohesion and internal Council culture – and that a change is the only sensible option.

The standard of questions during the Q & A session were very sophisticated and clearly indicated that these residents had been watching the videos, doing their homework, and giving the matter serious consideration over a long period of time. Indeed, these were the opinions of very well informed, intelligent people more than capable of making good decisions about matters that will affect their lives consistent with our principles of local democracy.

The forum at Gundagai was heavily attended, but the physical set-up for the room was not ideal, and there is little doubt that many of the attendees failed to register and failed to submit their survey. Unlike Cootamundra, it was simply impractical to

[11] Copies of the scanned surveys can be obtained from Council.
[12] One response was missing

have tables at the front of the club to register people as they entered, and the numbers which follow must be considered a significant under-estimate.

Gundagai – *Were you in favour of the 2016 amalgamation?*

Yes	No	Undecided
4	253	3

Gundagai – *Do you think de-amalgamation will save money?*

Yes	No	Undecided
241	13	6

Gundagai – *Are you in favour of a de-amalgamation?*

Yes	No	Undecided
256	2	2

Clearly the people at Gundagai want a de-amalgamation and I don't think that this has ever been in doubt (nor was there any reasonable doubt that they didn't want the amalgamation back in 2016). What is interesting is that thirteen people don't think that the de-amalgamation will save money, but the far majority (over 98 percent) want it nevertheless. From the comments made after the presentations it is pretty clear that people are prepared to pay to guarantee more effective and responsive local government into the future for Gundagai.

We also need to be mindful that the decision-making by both communities will have inevitably been clouded by the fact that the real implications of the 2016 amalgamations have largely been hidden from residents due to the Local Government Amendment (Rates – Merged Council Areas) Act 2017 No 8, as well as Administrator and Council inaction on fee harmonisation. In addition, many in the community are still unaware of the pressing need to address substantial operating revenue shortfalls in the order of 2.9 million dollars annually (according to the latest draft of Cootamundra-Gundagai's 2019 Financial Statements). Moreover, Stronger Communities funding (for 'popular' community infrastructure) has been descending on these communities for almost four years now, clearly exacerbating chronic fiscal illusion. However, despite this contextual bias (presenting an unrealistically rosy picture of the current state of affairs) there can be no doubt that the consensus of informed opinions in both Cootamundra and Gundagai is in favour of de-amalgamation.

Whether we take note of these residents really depends on our views about democracy (Dahl, 1990). If you – like Aristotle, the late great Robert A. Dahl, and I – believe that most adults are capable of making good decisions about their futures when appropriately informed, then the survey results elicited from intelligent residents presented with rigorous and reliable evidence will prove compelling for

Boundaries Commission and Ministerial decision making. However, if like Plato you believe that the masses are incapable of competent decision making and need to be ruled by their betters, then these survey results will be disregarded and another decision will be made against the wishes of these people who clearly believe that they have already had their community wealth eroded, community cohesion disrupted and lives adversely affected from being ignored back in 2016.

Requirements in Relation to Elected Representation

I have already detailed the ideal configuration for each emergent council, and the procedure that can be followed to ensure that the community continue to have a voice during the transition period. There is no need to appoint an Administrator, as happened during the amalgamation, and the inadequate performance of the past Administrator confirms that it would not be in the community's interest to do so.

Impact of Proposal on Ability to Provide Adequate, Equitable and Appropriate Services

As things stand it would not be reasonable to conclude that Cootamundra-Gundagai Regional Council is financially sustainable in the long-run. Eliminating the large diseconomies of scale (which unfortunately will take up to a decade to do if we agree that it is not morally licit to force redundancies) will help to ensure that the community can receive adequate, equitable, and appropriate services into the future. However, even with this boundary change there will be a lot of work to do to repair the damage inflicted on the finances of the community. Special Rate Variations are almost certain to be required. The rate system at both councils will need to be simplified and made more transparent consistent with the plan presented to Cootamundra-Gundagai Regional Council in February 2020. Non-regulated fees and charges need to be examined again to ensure that they cover the full cost, plus overheads. Strict discipline will also be required to follow the plan set out in this report and realise the full benefits of a de-amalgamation.

However, not proceeding with the de-amalgamation will require even more extreme measures. Rates will need to be increased even further to make up for the foregone savings of just under half a million dollars per annum which are expected to occur by year 10. Fees and charges will have to be re-assessed and increased. Rates harmonisation – which will bring about high level of rate shock to some residents – will also need to proceed so that the flow of taxation revenue is morally defensible.

As I noted earlier, de-amalgamation is not the whole solution to the financial sustainability problems at Cootamundra-Gundagai – but it is an incredibly important part of the solution. The political certainty that a de-amalgamation brings about will put both councils in a better position to engage with their communities and press forward with essential reforms. It will also lead to much more efficient local government, consistent with the greater community homogeneity achieved, as predicted by the well-known Decentralisation Theorem (Oates, 1972).

Impact of Proposal on Employment of Staff

As I have stated earlier, I do not consider it morally licit to visit a wrong on staff in order to correct a wrong committed to the community in 2016. I have therefore not modelled any redundancies. This, of course, means that the full staff savings won't occur until the seventh year and that the total cumulative savings will be lower than might otherwise have been realised. However, I firmly believe that it is not acceptable to destroy the lives of staff and their dependents, and I know the community agrees with this position. If a de-amalgamation does not proceed, then there will need to be significant additional reductions to employee expenditure in the future (to offset the considerable diseconomies of scale) in order to bring about desperately required budget repair.

Impact of Proposal on Rural Communities

As has been shown over the course of this report the 2016 amalgamation had a devastating impact on the two rural communities. Moreover, to avoid further damage, and even more hardship for residents it is important to execute a de-amalgamation for the new financial year.

As my modelling has confirmed, de-amalgamation will have positive benefits for the community in terms of financial sustainability. However, a de-amalgamation will also help to heal the respective communities and return their dignity[13] which should lay the foundation for a brighter future. Indeed, discussions with senior management and political representatives suggests to me that de-amalgamated councils will have a strong relationship – sharing resources and expertise well into the future – which will maximise the benefits to both communities. As strange as it might seem to some outsiders (especially those from Sydney), a de-amalgamation is likely to ultimately bring these communities together more and heal the obvious rifts that exist at present.

Sub-sections e4 and e5 don't apply

These subsections both start with the words 'in the case of a proposal for amalgamation'. This is not a proposal for an amalgamation, therefore these subsections of the legislation clearly do not apply.

[13] Dignity here refers to the Natural Law position – the ability to choose existential ends without undue interference (see Messner, 1952).

Concluding Remarks

The Cootamundra-Gundagai Regional Council is experiencing chronic fiscal stress, arising from the amalgamation as well as some poor decisions that were made during the administration phase. Indeed, the Council can no longer be considered financially sustainable in the medium or long term. If drastic action is not taken shortly, matters from the last four years will come to a head with serious implications for the community. I emphasise that the current management and councillors are not responsible for the problems that they now face – but they certainly need the help of fair minded people who are courageous enough to honestly consider the robust evidence that has been presented in this report and put the interests of this community first by allowing a de-amalgamation.

Removing political uncertainty will allow the executive the existential space it needs to put in place a number of reforms crucial to the community interest. Even if there was no direct financial benefit to de-amalgamation it would probably be worth executing boundary change to release the Cootamundra-Gundagai Regional Council from political uncertainty and division which constantly impedes the implementation of sound policy.

However, the proposed de-amalgamation will indeed result in significant financial benefits. In ten years, a benefit of *at least* $2.4 million will be delivered to the community contingent on de-amalgamation. Notably this figure is not much less than the supposed savings upon which the original decision to amalgamate was based – although in this latter case it was expected to take over twice the time, and was never likely to actually happen in any case.

If it was reasonable to conduct boundary change in 2016 mostly on the basis of a guesswork report projecting savings of $3 million over 20 years, then it almost obligatory in 2020 to conduct boundary change on a thoroughly researched and robust report projecting savings of $2.4 million over 10 years. The difference is that this time the savings will actually eventuate, and the proposal is consistent with the wishes and best interests of the community.

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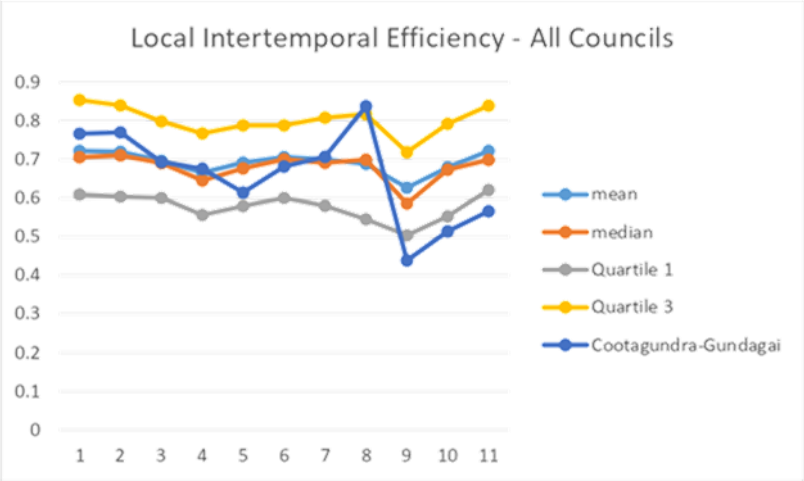
Appendix

Reproduced from Drew (2016) which was submitted to the Boundaries Commission Delegate by Gundagai Shire.

Table 1. Queensland Employee Expense: Mean Annual Change, 2009 to 2015 (standard deviation in parentheses).

Period	Non-Amalgamated Councils	Amalgamated Councils[14]
2009 to 2010	10.272% (14.406)	12.037% (18.550)
2009 to 2011	6.708% (8.780)	9.000% (8.961)
2009 to 2012	6.031% (5.674)	7.795% (6.331)
2009 to 2013	6.033% (5.088)	6.404% (5.369)
2009 to 2014	5.098% (3.564)	6.140% (4.862)
2009 to 2015	3.724% (2.985)	4.997% (4.280)

Source: 2009 data from *Queensland Local Government Comparative Information 2008-09*, Department of Infrastructure and Planning 2010, verified to individual financial statements. All other years from audited financial statements.



[14] Excludes the four de-amalgamated councils from the 2014 financial year onwards.

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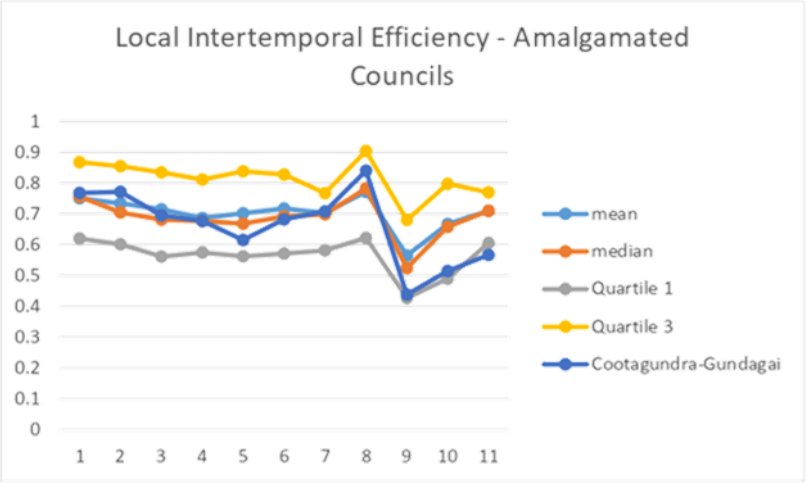

Ratio Definitions

Definitions, Benchmarks, and Weightings of TCorp Financial Sustainability Ratios

Variable	Weighting	Benchmark	Definition
Operating ratio	17.5%	>–4%	(Operating revenue[a] – operating expenses)/operating revenue[a]
Own-source Revenue ratio	17.5%	>60%	Rates, utilities, and charges/total operating revenue[b]
Unrestricted Current ratio	10.0%	>1.50×	Current assets less restrictions/current liabilities less specific purpose liabilities
Interest Cover ratio	2.5%	>4.00×	EBITDA/interest expense
Infrastructure Backlog ratio	10.0%	<0.02×	Estimated cost to bring assets to a satisfactory condition/total infrastructure assets
Debt Service Cover ratio	7.5%	>2.00×	EBITDA/(principal repayments + borrowing costs)
Capital Expenditure ratio	10.0%	>1.10×	Annual capital expenditure/annual depreciation
Cash Expense ratio	10.0%	>3.0 months	(Current cash and equivalents/(total expenses – depreciation – interest costs)) × 12
Buildings and Infrastructure Renewal ratio	7.5%	>1.00×	Asset renewals/depreciation of building and infrastructure assets
Asset Maintenance ratio	7.5%	>1.00×	Actual asset maintenance/required asset maintenance

[a]Revenue excludes capital grants and contributions. [b]Revenue includes capital grants and contributions.

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

BOUNDARIES COMMISSION INQUIRY COMMUNITY FORUM

Please complete this survey ***after*** you have listened to the presentation from Prof Drew and heard answers to any questions raised.

It is important Council understands the views of our residents on this matter and we thank you for your time in attending.

1. Were you in favour of the 2016 amalgamation? Please circle your response.

   Yes

   No

   Undecided

2. Do you think a de-amalgamation will save money? Please circle your response.

   Yes

   No

   Undecided

3. Are you in favour of a de-amalgamation? Please circle your response.

   Yes

   No

   Undecided

   Why? (please be brief)

   .....

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Dear Mayor McAlister, Deputy Mayor Palmer, and Mr McMurray,

Please find appended my report for Cootamundra-Gundagai Regional Council.

I stand ready to answer any questions that you may have in relation to this report.

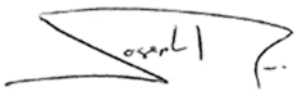
I am also more than happy to provide further evidence to the Boundaries Commission, the Minister for Local Government, the Deputy Premier, or the Premier. Please feel free to pass on my email address (Joseph.Drew@uts.edu.au) and phone number (0416489475) to these parties.

My sole interest in this exercise was to ensure that the community of Cootamundra-Gundagai received the best expert advice possible regarding its financial sustainability position and what might be done to address problems.

It is my firm belief that a de-amalgamation is the best way forward for the community.

If I can do anything to help decision-makers in their efforts to promote the community's interests, then I will certainly do so.

Yours Sincerely



Professor Joseph Drew

A/Prof University of Technology Sydney

Professor (adjunct) Tokyo Metropolitan University.

lgbc

LOCAL GOVERNMENT BOUNDARIES COMMISSION

FREQUENTLY ASKED QUESTIONS

What is the role of the Boundaries Commission?

The Local Government Boundaries Commission is an independent statutory authority which examines and reports on any matter referred to it by the Minister in relation to the boundaries of local government areas. The Boundaries Commission is constituted under section 260 of the Local Government Act.

Who are the members of the Boundaries Commission?

Four commissioners are appointed to the Boundaries Commission by the Governor for a five-year term.

They are Bob Sendt (chairman), Councillor Rick Firman (Temora), Councillor Lesley Furneaux-Cook (Burwood), and Grant Gleeson (Office of Local Government).

Of the four commissioners, one (Bob Sendt) is nominated by the Minister for Local Government, one (Grant Gleeson) is an officer of the Office of Local Government nominated by the agency's Deputy Secretary, and two (Councillors Rick Firman and Lesley Furneaux-Cook) are appointed from a panel comprising members nominated by Local Government NSW.

What proposals are currently being examined by the Boundaries Commission?

On 25 February 2020 Minister for Local Government Shelley Hancock referred to the Commission two elector initiated proposals that would affect boundaries in relation to Snowy Valleys Council and Cootamundra-Gundagai Regional Council.

In relation to Snowy Valleys Council, the proposal seeks to re-establish the area of the former Tumbarumba Shire local government area. It would reduce the local government area of Snowy Valleys Council so that it corresponds to the area of the former Tumut Shire Council.

In relation to Cootamundra-Gundagai Regional Council, the proposal seeks to re-establish the area of the former Gundagai Shire local government area. It would reduce the local government area of Cootamundra-Gundagai Regional Council so that it corresponds to the area of the former Cootamundra Shire Council.

In effect, these proposals seek to reverse the mergers that were put in place in 2016.

These proposals and the Minister's letters referring them to the Commission can be viewed here.

What will the Boundaries Commission take into consideration in their examination of the current proposals?

Section 263(3) of the Local Government Act sets out eleven factors that the Commission is required to have regard to in examining any proposal for changes to local government boundaries. Two of these factors relate only to proposals for merging council areas, so are not relevant to the Commission's current examinations. The remaining factors cover issues such as:

- financial advantages/disadvantages
- the community of interest and geographic cohesion
- attitude of residents and ratepayers
- requirements of the area concerned in relation to elected representation for residents and ratepayers at the local level
- any impact on council operations and staff, and
- any impact on rural communities in the areas concerned.

The Minister has also directed the Commission to hold an inquiry into each proposal. See below for further information on these public hearings.

Can I make a written submission to the Boundaries Commission?

Submissions already made by affected electors and councils to the Minister for Local Government have been provided to the Commission and do not need to be resubmitted.

The Commission has now published public notices in a number of newspapers calling for written submissions from parties affected by the proposals. This provides a further opportunity for parties who did not make a submission to the Minister or who wish to provide supplementary material.

How can I make a written submission?

Written submissions on each proposal should be forwarded to Local Government Boundaries Commission, Executive Officer, Locked Bag 3015, Nowra NSW 2541 or emailed to EO@lgbc.nsw.gov.au.

It would assist the Commission in its deliberations if parties could indicate in their submissions which of the section 263(3) factors they are addressing.

Submissions must be lodged by COB on 24 April 2020.

Will written submissions be made public?

Submissions received by the Commission may be made publicly available at its discretion. If submissions are made public, contact details will be redacted. The name

of the person making the submission may be released unless the person has requested to remain anonymous.

Any submissions received are also subject to the *Government Information (Public Access) Act 2009*.

Can I make an anonymous submission?

The Commission is required to have regard to the views of residents and ratepayers. While this does not preclude other parties from making a submission, any resident or ratepayer making a submission should identify themselves. In respect of anonymous submissions, the Commission may, at its discretion, take all or part of such a submission into account.

Those making a submission can request that their identity remains anonymous.

Will the Boundaries Commission hold public hearings?

The Minister has directed the Commission to hold public hearings as part of the examination process. It is intended that these will be held in Cootamundra, Gundagai, Tumut and Tumbarumba.

Any person who wishes to make an oral submission at the public hearing should notify the Commission in writing by COB on 24 April 2020.

Further information about times, location and procedures for any hearings will be published on the Commission's website at a later date.

How do I make an oral submission at the public hearings?

Persons making submissions should give written notice by COB on 24 April 2020 on whether they wish to speak to their written submission at one of the public hearings to be held by the Commission.

How will the public hearings be conducted?

Public hearings are open to members of the public and media. The Commission will determine how much time each speaker will be allowed so that all who wish to speak are given the chance to do so. Depending on the number of people wishing to speak, the Commission may hold the hearings over a number of consecutive sessions.

Is there protection from defamation at hearings or in written submissions?

Persons making written or oral submissions to the inquiry are not protected from defamation in respect of anything contained in those submissions. They should therefore ensure that they do not make any statement that may give rise to legal action by an aggrieved party.

Can I be represented at hearings?

Section 264 of the Local Government Act provides the circumstances in which a person can be represented in proceedings before the Commission. People who wish to be heard at the public hearings should make themselves aware of the restrictions set out in that section.

Will the hearings be recorded?

Audio recordings and written transcripts will be made of public hearings to assist in the Commission's consideration of the proposals. By making an oral submission to the Commission at a public hearing, the speaker consents to their submission being recorded. Audio recordings will not be made publicly available by the Commission, however recordings and transcripts are subject to the *Government Information (Public Access) Act 2009*.

What happens after the submissions and public hearings?

The Commission will prepare a report for the Minister on each proposal with recommendations as to whether the proposal should be implemented.

What happens to the Boundaries Commission's reports?

Once the Minister receives a report from the Commission, the Minister may recommend to the Governor that the proposal be implemented (with any modifications the Minister decides appropriate) or may decline to do so.

The report will only be published on the Commission's website with the Minister's consent.

How long will the examination by the Boundaries Commission take?

The Act does not provide a timeframe for the process to be undertaken. However the Commission is aware of the need for it to be completed in a reasonable timeframe to provide certainty to councils and residents.

Will COVID-19 impact on the process?

The Commission is monitoring all government requirements in respect of the coronavirus pandemic, particularly in relation to public gatherings. If the Commission subsequently needs to amend any arrangements due to the impact of COVID-19, details will be published on its website.

INVESTMENT REPORT

As at: 29-02-20

Date Invested	Interest Rate	Term Days	Investment Amount	Held With	Interest	Maturity Date
2 Oct 2019	1.75%	181	$2,027,575.34	AMP	$ 2,819.16	31 Mar 2020
21 Jan 2020	1.60%	91	$2,583,572.10	National Australia Bank	$ 3,284.32	21 Apr 2020
28 Jan 2020	1.60%	91	$1,003,989.04	Rural Bank Ltd	$ 1,276.30	28 Apr 2020
28 Jan 2020	1.60%	97	$1,505,983.56	BankVic	$ 1,914.46	4 May 2020
11 Feb 2020	1.80%	182	$3,072,746.34	AMP	$ 4,394.45	11 Aug 2020
19 Feb 2020	1.90%	181	$1,000,000.00	AMP	$ 1,509.59	18 Aug 2020
		AC	$1,139,943.63	Commonwealth Bank	$ 540.98	At Call
		BOS	$2,604,148.71	Commonwealth Bank	$ 1,212.65	At Call
		AC	$48,761.47	National Australia Bank	$ 41.81	At Call
Total			$14,986,720.19			
Matured in Report Month						
22 Oct 2019	2.05%	182	$3,041,654.79	AMP	$ 2,733.32	16 Feb 2020
29 Oct 2019	2.00%	182	$2,027,616.44	AMP	$ 1,999.84	18 Feb 2020
Totals					$ 21,726.89	

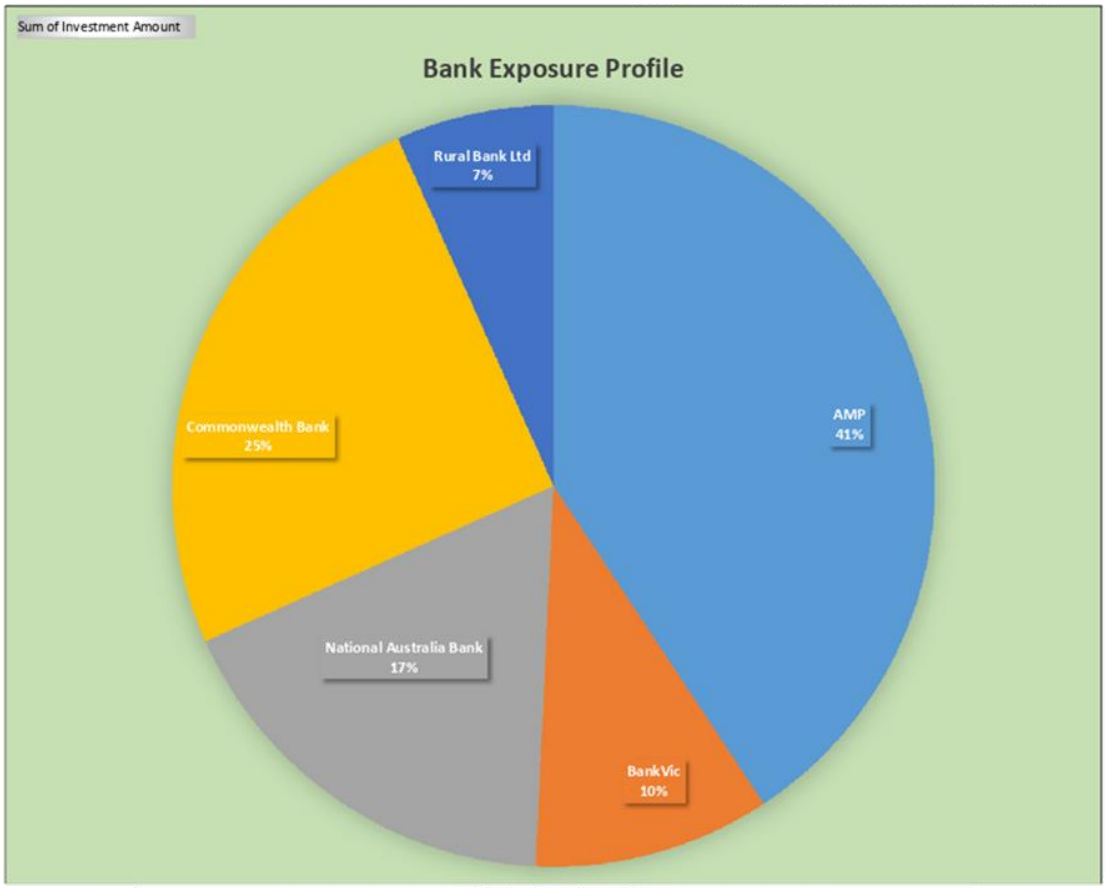
Budgeted Interest for Month	$ 29,126.00
Combined Interest Rate	1.74%
BBSW Benchmark Rate	0.8988%

This report is produced in accordance with section 625 of the local Government Act 1993 and all Investments have been made in accordance with the Act, the Regulations and council's investment policy.

Signed

Tim Swan
Responsible Accounting Officer

Investment Report
February 2020

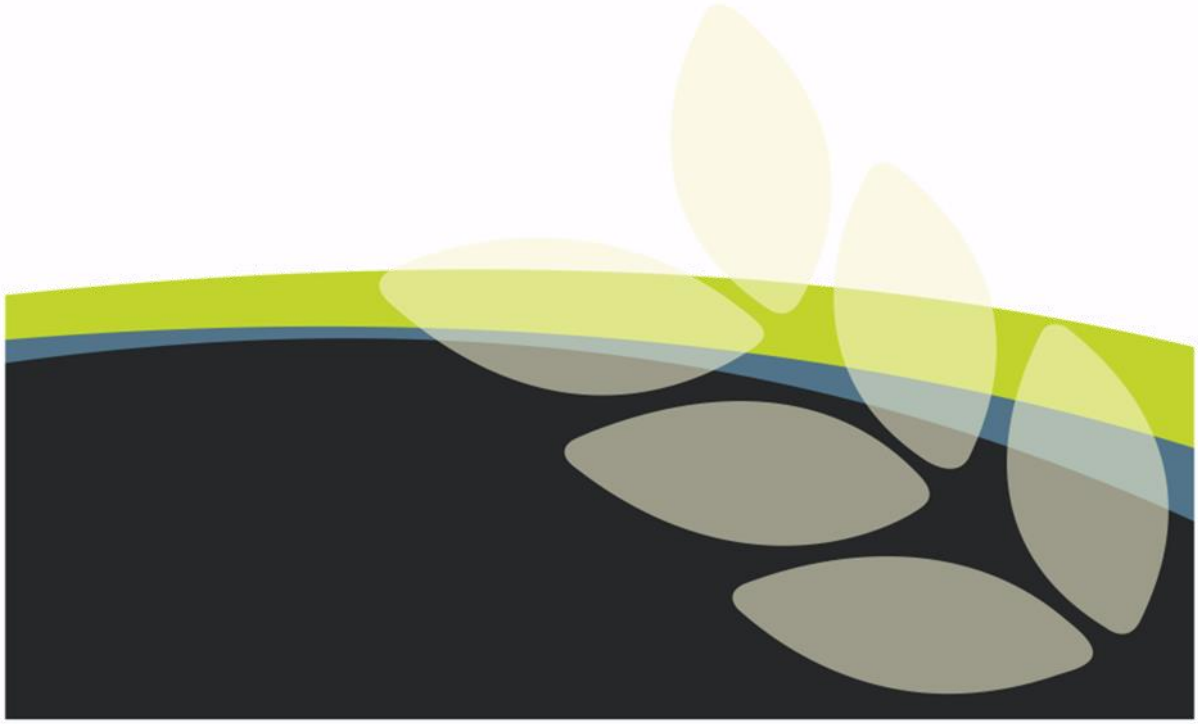


COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

February 2020

Financial reporting pack

Monthly operational analysis



Monthly budget variance report
Consolidated
Period ended 29 February

	Year to date actual								
	General	Waste	Water	Sewer	Consolidated total	Consolidated budget	Balance remaining	% of annual budget	Comments
Revenue									
Rates and annual charges	7,363,298	2,092,103	1,186,286	1,511,606	**12,153,292**	13,020,211	866,919	93.34%	
User charges and fees	1,744,628	202,536	2,020,425	414,792	**4,382,381**	8,280,772	3,898,391	52.92%	
Interest and investement revenues	246,849	5,284	18,281	7,895	**278,310**	497,517	219,207	55.94%	
Other revenues	470,275	-	4,576	-	**474,851**	519,740	44,889	91.36%	
Operating grants and contributions	3,308,919	69,406	53,677	51,539	**3,483,541**	8,072,705	4,589,164	43.15%	
Capital grants and contributions	434,180	-	-	-	**434,180**	15,859,165	15,424,985	2.74%	Adjustment planned for March QBR for STP grant income deferral
Internal Plant hire	1,860,046	-	-	-	**1,860,046**	3,420,000	1,559,954	54.39%	
Internal Overheads	-	-	-	-	-	2,278,576	2,278,576	0.00%	
Internal Easements	-	-	-	-	-	1,464,950	1,464,950	0.00%	
Total revenue	**15,428,195**	**2,369,329**	**3,283,245**	**1,985,832**	**23,066,601**	**53,413,636**	**30,347,035**	**43.18%**	
Expenditure									
Employee costs	7,005,773	334,403	434,554	335,295	**8,110,026**	12,279,857	4,169,831	66.04%	
Borrowing costs	46,304	-	-	-	**46,304**	183,823	137,519	25.19%	
Materials and contracts	7,193,488	952,180	1,730,267	252,750	**10,128,686**	12,782,221	2,653,535	79.24%	
Plant hire	1,166,545	132,906	52,183	34,418	**1,386,052**	2,686,202	1,300,150	51.60%	
Other expenses	2,803,537	6,181	106,319	122,698	**3,038,735**	3,588,112	549,377	84.69%	Includes annual expenses such as insurance, rates, subscriptions.
Internal Overheads	-	-	-	-	-	2,278,576	2,278,576	0.00%	
Internal Easements	-	-	-	-	-	1,464,950	1,464,950	0.00%	
Total expenses	**18,215,647**	**1,425,671**	**2,323,323**	**745,161**	**22,709,802**	**35,263,741**	**12,553,939**	**64.40%**	
Net result	**(2,787,453)**	**943,658**	**959,922**	**1,240,671**	**356,798**	**18,149,895**	**17,793,097**		

Business Unit Summary - Operating
Period ended 29 February

	Income					Expenditure				Comments
	Actual	Budget	Variance	%		Actual	Budget	Variance	%	
Development, Building and Compliance	220,709	384,120	163,411	57.46%		432,248	1,315,066	882,818	32.87%	OK
Regulatory Services	435,503	644,190	208,687	67.60%		708,503	1,099,122	390,619	64.46%	OK
Community and Culture	206,617	267,041	60,424	77.37%		1,124,089	1,392,227	268,138	80.74%	PO's raised for full year.
Business Services	22,435	5,780	(16,655)	388.15%		1,467,650	2,125,847	658,197	69.04%	OK
Finance and Customer Services	9,472,072	16,556,739	7,084,667	57.21%		988,756	2,086,194	1,097,438	47.40%	OK
Executive Office	(171,623)	10,000	181,623	-1716.23%		2,289,139	3,372,456	1,083,317	67.88%	Allocations between GM and Deputy changed since budget. Combined exp is OK.
Operations Management	1,453,118	5,568,349	4,115,231	26.10%		1,856,051	1,175,322	(680,729)	157.92%	Workers comp & Public Liability Insurances for full year.
Facilities	268,375	252,940	(15,435)	106.10%		861,572	1,383,492	521,920	62.28%	OK
Recreation	293,376	187,392	(105,984)	156.56%		1,577,673	1,720,677	143,004	91.69%	Expenditure being reviewed.
Technical Services	331,834	515,991	184,157	64.31%		1,311,361	2,316,033	1,004,672	56.62%	OK
Civil Works	642,010	3,366,180	2,724,170	19.07%		2,876,687	5,310,993	2,434,306	54.16%	Several major debtor invoices to be processed in March.
Asset Management	2,253,769	3,795,080	1,541,311	59.39%		2,721,919	3,300,691	578,772	82.47%	Expenditure includes termination paymentthat skews percentage. Plant income a concern.
Waste Services	2,369,329	2,458,338	89,009	96.38%		1,425,671	2,092,687	667,016	68.13%	Expenditure being reviewed.
Water	3,283,245	4,224,467	941,222	77.72%		2,323,323	4,073,219	1,749,896	57.04%	OK
Sewer	1,985,832	15,177,029	13,191,197	13.08%		745,161	2,499,715	1,754,554	29.81%	QBR adjustment required to defer STP grant income.
Total	23,066,601	53,413,636	30,347,035	43.18%		22,709,802	35,263,741	12,553,939	64.40%	

Capital expenditure

	YTD	Budget	Variance	%	Comments
Capital income					
Proceeds from sale of plant	326,843	696,500	(369,657)	**46.93%**	
Proceeds from sale of property	215,582	-	215,582	**0.00%**	
Sports facilities capital income			-	**0.00%**	
Storwater capital income			-	**0.00%**	
Roads capital income			-	**0.00%**	
Water capital income			-	**0.00%**	
Sewer capital income			-	**0.00%**	
Waste capital income			-	**0.00%**	
Other capital income			-	**0.00%**	
Total Income	542,425	696,500	(154,075)	**77.88%**	
Capital expenditure					
Plant and equipment	1,424,597	2,484,000	(1,059,403)	**57.35%**	
Office equipment	33,197	40,000	(6,803)	**82.99%**	
Buildings	264,889	210,000	54,889	**126.14%**	
Land improvements	49,628	25,000	24,628	**198.51%**	
Major projects	4,844,501	5,920,226	(1,075,725)	**81.83%**	
Roads, bridges and footpaths	2,642,520	4,290,000	(1,647,480)	**61.60%**	
Stormwater drainage	380,543	-	380,543	**0.00%**	
Recreation assets	22,326	-	22,326	**0.00%**	
Parks and Gardens	77,812	-	77,812	**0.00%**	
Waste Services	5,562	-	5,562	**0.00%**	
Water supply network	3,544,896	4,000,000	(455,104)	**88.62%**	
Sewerage network	1,874,467	12,856,000	(10,981,533)	**14.58%**	QBR adjustment likely for March.
Other assets	-	-	-	**0.00%**	
Total Expenses	15,164,937	29,825,226	(14,660,289)	**50.85%**	
Net capital expenditure	14,622,512	29,128,726	(14,506,214)		

NSW GOVERNMENT Public Works Advisory

Stockinbingal Sewerage Scheme

Concept Design Report

Report Number: ISR19178

February 2020

Prepared for:

COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL

Trim Project No. DIR19/1649

Report Number: ISR19178

Document control

Version	Author(s)	Reviewer	Approved for issue	
			Name	Date
Draft V1	Wayne Kennedy Heleen Lindeque	Brett Douglas	Hendrik van Rhijn	15/01/2020
Final	Heleen Lindeque	Brett Douglas	Brett Douglas	05/02/2020

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Executive Summary

General

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south west of Sydney and 102 km north east of Wagga Wagga. The town has a population of approximately 250 at present. A reticulated sewerage system is proposed to replace the existing individual property based on-site wastewater systems.

An options assessment to determine the type of wastewater system (including reticulation and treatment) was completed in March 2019. Following the assessment, Cootamundra-Gundagai Regional Council (CGRC), has endorsed a pressure sewerage collection system with a package type treatment plant as the preferred servicing strategy for Stockinbingal.

Public Works Advisory has been engaged by CGRC to prepare a concept design for the proposed Stockinbingal Sewerage Scheme based on the endorsed servicing strategy.

Serviced Population

A total of 111 properties have been identified for servicing with an additional 16 properties to be considered for servicing.

The properties identified for servicing include:

- 92 residential properties within the village zone boundary (land zoned RU5)
- 6 non-residential properties (2 churches, 1 school, 2 public toilets and a bowling club) within the village zone
- 8 commercial properties (7 shops and one hotel) within the village zone
- 5 properties adjoining the village zone boundary

The additional 16 residential dwellings identified by Council for possible servicing are located to the east of the village. These additional dwellings will be included in the concept level scheme development. The final decision to included or exclude any of these properties will be determined by Cootamundra-Gundagai Regional Council at a later stage.

It is noted that there are a significant number of vacant blocks within the village zone. Our understanding is that there is no driver at this time for infill development to occur. In order to accommodate some infill growth, a high flow scenario will be tested, to determine the ability of the system to accommodate future infill growth.

The average daily wastewater flow for the developed properties within and adjoining the village area is estimated to be 67 kL/day. This includes the non-residential properties such as churches, schools etc. The estimated total daily wastewater flow for the additional 16 properties (with a dwelling) outside the village area is 6 kL/day.

Pressure Sewer System

The proposed Pressure Sewerage System consists of small grinder pumps located on each property which macerates the sewage into a fine slurry and pumps it through a pressurised sewerage network directly or indirectly to a wastewater treatment facility. This system was selected in the Options Study as being the most suitable for Stockinbingal.

STP Options

Several secondary treatment options have been investigated:

- Option 1: Conventional Activated Sludge (CAS) Treatment
- Option 2: Membrane Aerated Biofilm Reactor (MABR)
- Option 3: Membrane Bioreactor (MBR)
- Option 4: Moving Bed Bio Reactor (MBBR)
- Option 5: Intermittently Decanted Extended Aeration (IDEA) reactor

Options 1-4 are for package type systems, whereas Option 5 is for a concrete aeration tank. These options were assessed with Option 5 being the preferred option. Option 5, a concrete IDEA based plant, is recommended for Stockinbingal as it will provide a more permanent solution. This type of STP will also meet the quality requirements, is cost effective to provide and operate, has no propriety equipment and requires a low level of operator skill. The adopted effluent management strategy is to discharge to Dudauman Creek.

STP Design

The pressure sewer modelling results were used as the input to the design flow rate and balancing requirement for the STP. Flow balancing will be used to minimise the size of the treatment plant. The inlet works will be sized for 7.2 L/s, based on the daily peak inflow and the rest of the STP will be designed for a maximum of 1.2 L/s based on the high daily inflow.

As there is not currently a STP, the values in Table S-1 have been assumed, based on typical domestic strength sewage, while the effluent values are based upon typical requirement values from the EPA for modern technology STPs and discharge to inland waterways.

For reuse requirements in the future, additional chlorination and a recycled water management plan will be required to conform with the Australian Recycled Water Guidelines.

Table S-1: Inflow and Effluent Values

Parameter	Inflow values	Effluent Values
Biochemical Oxygen Demand (BOD_5)	325-360 mg/L	10-15 mg/L
Faecal Coliforms		200 CFU/100 mL
pH		
Suspended Solids (SS)	275-300 mg/L	15 -20 mg/L
Ammonia		2-5 mg/L
Total Nitrogen (TN)	60-70 mg/L	10-15 mg/L
Total Phosphorus (TP)	13-15 mg/L	0.5 – 1 mg/L

Proposed New Infrastructure

The new infrastructure to be delivered as part of this proposed scheme includes:

A Pressure Sewerage network consisting of:

- 121 simplex pump units, control/alarm panels and associated electrical/control wiring
- 5 duplex pump units, control panels and associated electrical wiring (Elwood Hall, Bowling Club, School and public toilets)
- 1 quadraplex pump unit, control panel and associated electrical wiring (Commercial Hotel)
- 3,800m of DN40 property discharge pipework from the collection tank to the street network
- Street reticulation network 6,300 m long consisting of DN50-DN125 polyethylene pipes
- Network storage of about 16,500 L
- 4 air valves and vent pipes
- 14 flushing and 11 isolation valves.

A new STP which will include:

- An inlet screen
- A 50kL emergency storage tank
- A concrete IDEA reactor and balance tank
- Alum and caustic dosing facilities
- A UV disinfection unit and an effluent pump to Dudauman Creek (provisional)
- A sludge tank and geobag sludge drying system
- Interconnecting pipework and pumping
- Electrical Switchboard with HMI (Touch Screen)
- Provision for remote monitoring via a telemetry system
- A new power supply
- A containerised amenities building which will include a control room and a laboratory.

Cost Estimate for the Pressure Sewer System

A summary of the Pressure Sewer Network Costs based on the concept design is shown in Table S-2. A detailed costing is provided Appendix F.

For pipe lengths an additional 10% allowance has been made for changes during the detail design and to reflect the level of design (concept design level at this stage). In addition, five air valves and vent shafts have been allowed for, however based on the concept design, no vent shafts are required. These values have been added to the contingency.

Another thing to note, is that the 16 properties outside the village boundary contribute to a significant part of the capital, due to the long reticulation lines. The total cost of expanding the network beyond the village network is around $800,000.

Table S-2: Pressure Sewerage Network – Estimated Cost Summary

	Cost Item	Cost (includes GST)
1.	Site Establishment	
2.	Pressure Units	$1,373,200
3.	Reticulation	$1,365,000
4.	Miscellaneous	$44,000
	Sub Total – Direct Construction Costs	**$2,892,200**
	Contractor Indirect Costs	$144,610
	Total Construction Costs	**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)	$682,800
	Survey, Investigation, Design and Project Management	$289,220
	Total Estimated Project Cost[1]	**$4,008,830**

Note: 1 – Total Estimated Project Costs do not include client costs such as community consultation and client liaison by the project manager.

Cost Estimate for the STP

The following table shows the cost estimate for a concrete IDEA reactor plant.

Table S-3: STP - Cost Summary

Item No	Description	Cost (includes GST)
1.	Site Establishment	$108,000
2.	Roadworks and Site Drainage	$90,000
3.	Emergency Balance Tank	$25,200
4.	Inlet Works	$90,000
5.	Concrete IDEA reactor and balance tank	$728,471
6.	Sludge Tank	$18,200
7.	Sludge Dewatering	$83,700
8.	Chemical Dosing	$20,000
9.	Disinfection	$30,000
10.	Treated effluent outfall pump	$9,000
11.	Amenities Building	$200,000
12.	Pipework, Valves and Fittings	$72,500
13.	Installation/Testing/Commissioning	$145,000
14.	Electrical Works	$364,100
15.	Potable water connection to STP	$10,000
16.	Miscellaneous	$90,000
	Subtotal	**$2,084,171**
	Project Contingency (20%)	$416,834
	Survey, investigation, design and project management (10%)	$208,417
	Total Estimated Capital Cost	**$2,709,422**

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Abbreviations

ARTC	Australian Rail Track Corporation
BWL	bottom water level
CGRG	Cootamundra-Gundagai Regional Council
DPIE Water	Department of Planning, Industry and Environment - Water
EP	equivalent population
ET	equivalent tenement
HMI	Human machine interface
IDEA	Intermittently Decanted Extended Aeration
L/s	litres per second
MABR	membrane aerated biofilm reactor
MBBR	moving bed bioreactor
MBR	membrane bioreactor
OEH	Office of Environment and Heritage, NSW
PLC	programmable logic controller
PSS	Pressure Sewerage System
PWA	Public Works Advisory
REF	Review of Environmental Factors
RL	reduced level
RPZ	reduced pressure zone
SCA	Switchgear and control assembly
STP	sewage treatment plant
T.O.	top of
TWL	top water level
UPS	uninterruptible power supply
WHS	Workplace, Health and Safety

1. Introduction

1.1 General

Stockinbingal is a small town located in the South West Slopes and Riverina regions of New South Wales. Stockinbingal is 388 km south west of Sydney and 102 km north east of Wagga Wagga. The town has a population of approximately 250 at present. The town does not have a reticulated sewerage system and relies on individual property based on-site wastewater management.

A reticulated scheme is proposed. An options assessment to determine the type of wastewater system (including reticulation and treatment) was completed in March 2019. Following the assessment, Cootamundra-Gundagai Regional Council (CGRC), has endorsed a pressure sewerage collection system with a package type treatment plant as the preferred servicing strategy for the Stockinbingal village.

Public Works Advisory has been engaged by CGRC to prepare a concept design for the proposed Stockinbingal Sewerage Scheme based on the endorsed servicing strategy.

This report details the concept design for a Pressure Sewerage System and sewerage treatment plant serving the village of Stockinbingal.

1.2 Purpose of the Report

The purpose of this report is to provide a concept design for the Stockinbingal Pressure Sewerage Scheme that details the proposed scheme including the service area, the properties to be served and the assumptions made in developing the concept.

This report along with the environmental assessment and funding approvals will provide sufficient information for Council to move forward to the design and procurement stage.

1.3 Project Objective and Approach

The objective of the concept design is to provide a reticulated wastewater service to all existing developed properties within the village area as well as about sixteen properties that adjoin the village area (generally to the east of the village area) which will also be considered for servicing. The properties to be serviced are shown in Figure 2-1.

The network layouts have been developed whilst taking the following into consideration:

- Minimising the impacts on the community and the environment.
- Minimising construction, operational and maintenance costs.
- Eliminating and minimising potential wet weather flows.
- Pipe routes will serve the identified properties within and adjoining the properties minimising the total length of pipework wherever possible. Additional network routes will then be developed to serve the potential 16 properties identified.
- Minor deviation of pipe routes may be adopted where it serves additional existing dwellings.
- The number of rail and road crossings will be minimised and located to minimise construction difficulties.
- Crossing of major telecommunications cables will be minimised where possible.

The sizing of the pipework has been determined using the hydraulic criteria detailed in Section 2.2.3. There is often more than one pipe size which meets the criteria, however in order to help cater for future infill growth the largest possible pipe which meets the criteria has been adopted (note this is not expected to have a significant difference to the pipe sizes used).

The potential infill growth is significant compared to the number of current properties. However, significant infill development is unlikely to occur within the next 20 years. As a result, development of a concept which serves both the current properties and potential growth areas is problematic from a technical perspective. The approach undertaken was to identify the scale of the growth areas and allow for the future connection through the sizing of the reticulation network.

The sewage treatment plant (STP) should be robust and allow for sufficient treatment of sewage to enable effluent discharge to the nearby creek.

1.4 Project Scope

The project scope includes the following tasks:

- Developing and documenting a Basis of Design for the sewer network and the STP
- Producing preliminary layouts and determining a preferred system layout
- Network modelling of the preferred layout
- Using the outputs from the network modelling to size the STP
- Refining of the concept sewerage network layout and treatment plant site
- Discussion of key challenges and opportunities
- Compiling a cost estimate for the project.

2. Basis of Design

The Basis of Design (BOD) details the assumptions and parameters adopted during the concept development (e.g. layout development and hydraulic modelling) of the sewerage scheme.

Specifically:

- The properties to be served by the scheme.
- The current population and any planned future growth.
- Current and future wastewater flows.
- Hydraulic parameters and assumptions to be adopted.
- Approach and decisions made during the concept development.

2.1 General

2.1.1 Scheme Service Area

The service area includes the village area of Stockinbingal and 16 adjoining properties that may be included.

The village has a small commercial area on Hibernia and Martin Streets but is otherwise residential. Many properties comprise multiple lots and so there is a potential for infill growth however the likelihood for this to be substantial is low.

A rail corridor bisects the village area with the largest section of the service area (including the commercial area) to the north of the rail line. The major road through the village (Hibernia Street) runs parallel to the railway track through the village area.

Several creeks (Bland, Powder Horn and Dudauman Creeks) run through the village area. The village is flood prone as detailed in Councils Village Strategy Report. Infrastructure will be designed to minimise flood impacts.

2.1.2 Properties Serviced by the Proposed Scheme

A total of 111 properties have been identified for servicing with an additional 16 properties to be considered for servicing.

The properties identified for servicing include:

- 92 residential properties within the village zone boundary (land zoned RU5)
- 6 non-residential properties (2 churches, 1 school, 2 public toilets and a bowling club) within the village zone
- 8 commercial properties (7 shops and one hotel) within the village zone
- 5 properties adjoining the village zone boundary

The additional 16 residential dwellings identified by Council for possible servicing are located to the east of the village. These additional dwellings will be included in the concept level scheme development. The final decision to included or exclude any of these properties will be determined by Cootamundra-Gundagai Regional Council at a later stage.

Note: the GrainCorp facility on Troy St has not been included for servicing at this time.

All residential properties, including the additional properties being considered, are shown in Figure 2-1. It is noted that there are a significant number of vacant blocks within the village zone. Our understanding is that there is no driver at this time for infill development to occur. In order to accommodate some infill growth, a high flow scenario will be tested, to determine the ability of the system to accommodate future infill growth.

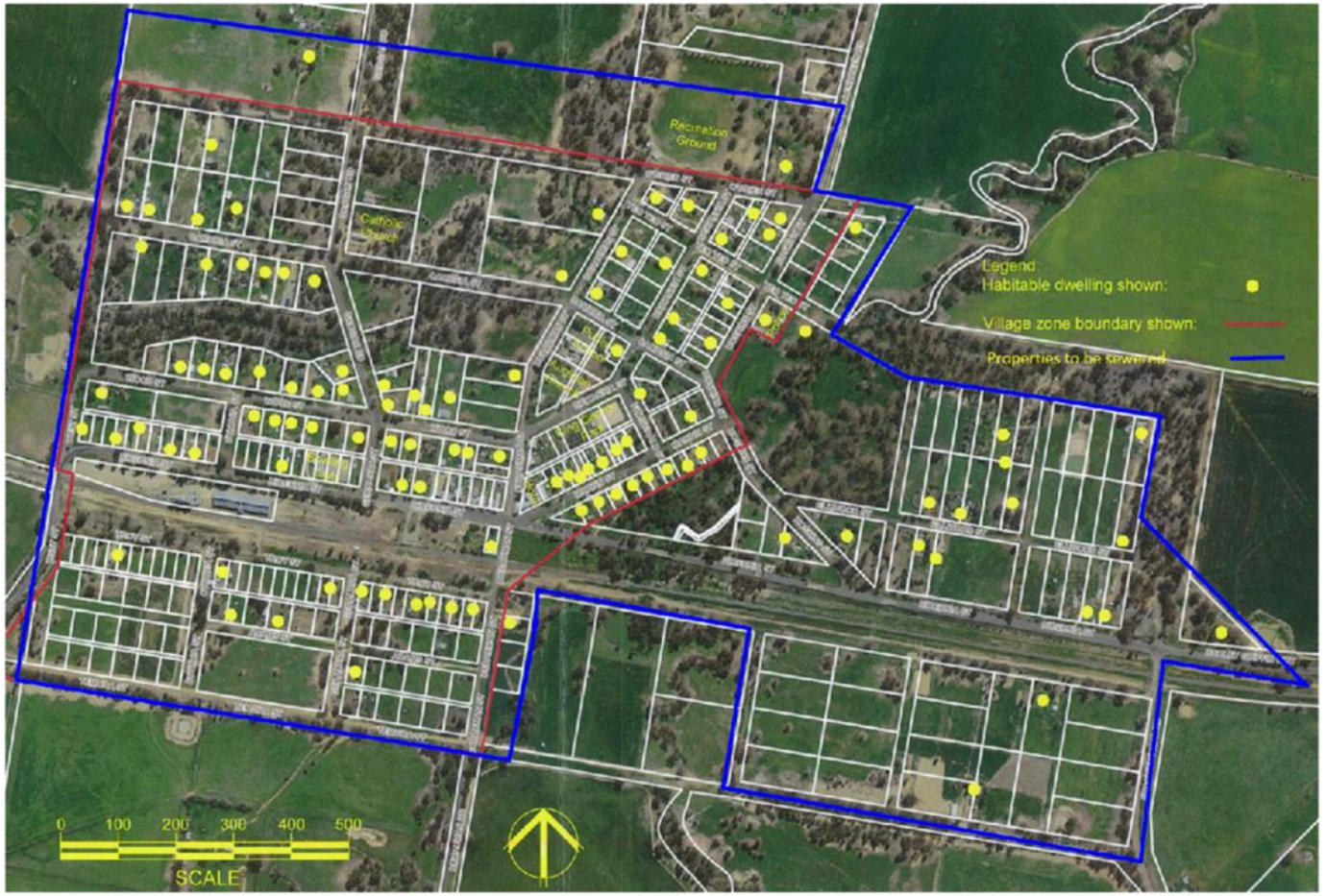


Figure 2-1: Properties to be Served by the Proposed Scheme

2.1.3 Property Zonings

The property zonings for the Stockinbingal village and surrounding area are shown in Figure 2-2. The village area is almost entirely zoned "Village - RU-5", with a park area to the north of the village zoned "Public Recreation - RE1" and the rail corridor through the village zoned "Infrastructure - SP2". The surrounding land is zoned "Primary Production - RU1".

The properties to be serviced are generally residential. Non-residential usage within the village include a small commercial centre, churches, a school and a bowling club.

The detail and location of the properties with a non-residential usage are listed below:

Table 2-1: Non-Residential Properties

Description	Location
Commercial Shops (approximately 6)	24-38 Hibernia Street
Commercial Hotel	32 Martin St (Lot 131 DP750619)
Post Office (Cootamundra Hall)	32 Martin St
St Joseph's Catholic Church	Grogan Rd (Lot 2, DP504837)
St James Anglican Church	Lot 1, Sec 7 DP758928
Stockinbingal Bowling Club	48 Hibernia St
Police Station	6 Hoskins St
GrainCorp Silo	Troy St
Stockinbingal Public School	Britannia St

2.1.4 Future Development Outside the Current Village Boundary

The Council's Village Strategy has identified four potential growth areas. This includes three residential areas and one industrial area. Council has indicated the development timeframe for these areas is beyond 20 years.

The potential residential areas have a combined area of about 55 hectares and based on 8 lots/gross hectares, the total number of potential lots is about 440 lots.

The potential industrial area is about 380 hectares in size. No information regarding the type of industrial business that may operate in the area are known at this time.

These potential development areas have not been included in the scheme concept. These development areas could be included in the future as new sewer catchments. The STP would likely need to be expanded should this development occur.

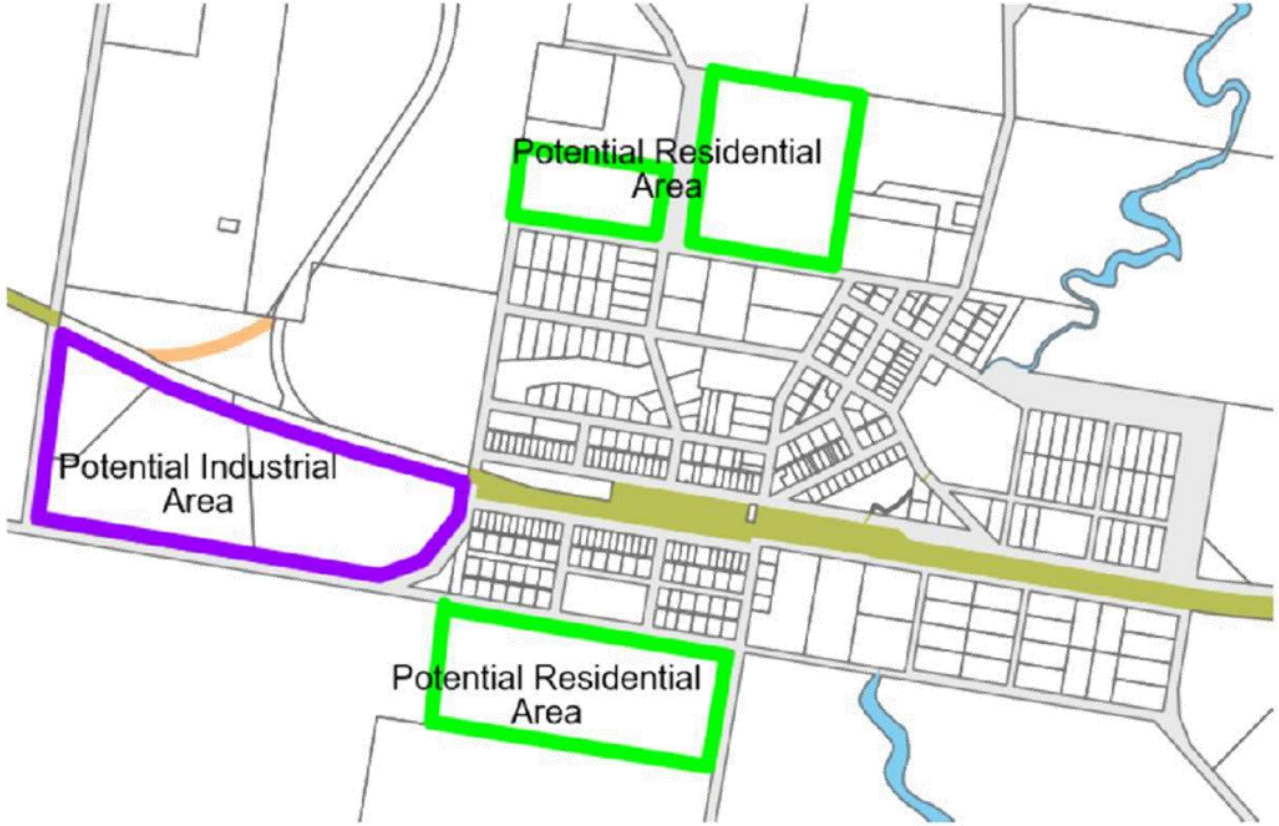


Figure 2-2: Zoning Plan - Stockinbingal

2.1.5 Climate

Mean minimum and maximum ambient temperatures for Cootamundra Airport (20 km from Stockinbingal) based on historical Bureau of Meteorology (BOM) data ranges 1.1 °C (July) and 32.2 °C (January), respectively. The maximum recorded low and high temperatures are -7.8 °C and 43.6 °C respectively.

2.1.6 Flooding

The Stockinbingal Floodplain Risk Management Plan – July 2002 found areas of the proposed wastewater scheme impacted by flooding. The STP site is above the 1 in 100 year flood level, however the 1 in 100 year flood level inundates a considerable area of the Stockinbingal village. A plan showing the 1 in 100 year flood level from the flood study is provided in Appendix E.

Measures to address the impact of flooding on the collection system is discussed in detail later in the report.

2.1.7 Topographical Survey

An engineering survey of the proposed site as part of this investigation was carried out by PWA. The survey identifies the location of existing structures/ facilities, surface levels/ contours and other surface features upon which the concept is developed within this report, and later detailed designs, are to be based. The survey drawings have been added in Appendix A.

2.1.8 Geotechnical Investigation

Based on the published data (Cootamundra 1:250,000, Geological Series Sheet SI/55-11, 2nd Edition, 1996), the Stockinbingal township and proposed STP site are completely located within Quaternary alluvial deposits, comprising gravel, sand, silt and clay.

At the topographic high point at the north-western outer region of the township, the area is underlain by Early Devonian, Lochkovian age igneous rocks of the Stockinbingal and Bethungra Formations comprising rhyolite, rhyodacite and dacite. At the topographic high point at the south-eastern outer region of the township, the area is underlain by Late Ordovician, Bolindian age sedimentary rocks of the Bribbaree Formation comprising siltstone, sandstone, chert and mudstone. Portions of the Bribbaree Formation are largely obscured by Quaternary colluvium and eluvium.

A geotechnical investigation for the reticulation scheme and STP was conducted by PWA as part of this engagement. The main findings are:

- Construction difficulties associated with groundwater are not expected.
- In agreeance with the regional geology map, bedrock was not encountered within any of the boreholes.
- Shallow excavations in soil deposits should be readily achievable using a hydraulic excavator.

2.1.9 Review of Environmental Factors (REF)

A Review of Environmental Factors (REF) is required for the new STP. The REF is currently being undertaken and will review the effect on existing flora and fauna at the STP as well as the reticulation scheme and the effect of noise and odours that will be generated by the treatment process on the environment.

2.1.10 Noise and Odour

The main sources of noise are the mechanical equipment particularly the aeration system and to a lesser extent, other mechanical equipment such as pumps and the mechanical screen. Mechanical equipment will be designed to ensure that noise at the plant's boundaries does not exceed ambient noise levels by 5 dB. The buffer will be approximately 200 m to the nearest residence.

The main source of odour will be the inlet works which will be covered. The buffer will likely prevent odour complaints from neighbours. A noise and odour study is being undertaken for the scheme.

2.1.11 Workplace, Health and Safety

Workplace, Health and Safety (WHS) aspects relating to the proposed works will be in accordance with WHS Act 2011 and WHS Regulation 2017.

Sewage Treatment Plant

WHS requirements for STPs and related infrastructure are predominantly concerned with providing safe access for operators, prevention of injury from slips, trips and falls, procedures and equipment for confined spaces and requirement for handling of hazardous materials.

Handrails, platforms, stairs and/or safety chains are required to provide safe access and working conditions in circumstances where work is at height or there is a potential for falling off or into structures. Appropriate fencing is required around the STP site to prevent unintentional or unauthorised entry.

Design of the proposed plant will incorporate the relevant safety provisions to meet current WHS requirements, including the completion of Safety in Design checklists that outline potential safety issues and how they have been addressed in the plant design.

In addition, an operation and maintenance (O & M) manual will be prepared for Council following construction of the plant. All as built drawings will be included in paper and electronic format; which will form part of the O & M manual. This critical document will provide a detailed guide to plant operation and maintenance requirements. This will also include training provided to the operators and maintenance staff in the operation and maintenance of the new STP.

Pressure Sewer Network

Operation and the maintenance of the pressure reticulation network can be separated into two categories, the on-property assets and the street network.

In regard to the on-property assets, access to private properties is required and private properties are not controlled sites. The risks associated with entry onto private property need to be assessed before access occurs. These risks include slip trips and falls, manual handling of the pump units, physical contact with wastewater as well as potential for electrocution associated with the electrical component of the on-property assets. As these sites also include interaction with property owners there is the potential risk associated with this interaction which may put maintenance staff at risk.

Operation and maintenance of the street network is similar to the requirements of maintaining a water supply network. Risks associated with the street network include, slip, trips and falls, manual handling, potential contact with wastewater and working on roadways.

In order to ensure OH&S risks are addressed appropriately a Risk in Design Workshop should be undertaken during the design stage and a report prepared detailing the steps required to meet legislative requirements.

2.2 Pressure Sewerage System

2.2.1 Relevant Codes and Standards

A number of reference documents have been used in developing this concept design. These documents include:

- Pressure Sewerage Code of Australia WSA 07 – 2007
- AS/NZ4799 Installation of Underground Utility Services and Pipelines within Railway Boundaries
- ARTC - Installation of Utility Services and Pipelines within Railway Boundaries ETG-17-01
- AS3000 National Electrical Installation Standard

2.2.2 Estimated Wastewater Flows

The average daily wastewater flow for the developed properties within and adjoining the village area is estimated to be 67,806 L/day. This includes the non-residential properties such as churches, schools etc. The estimated total daily wastewater flow for the additional 16 properties (with a dwelling) outside the village area is 6,336 L/day.

Estimated wastewater flows are detailed in Table 2-2, Table 2-3 and Table 2-4.

In general, the flows have been based on the existing residential population data for the village, relevant Australian Codes and where appropriate and estimates from water consumption data. An allowance of 180 L/EP/d has been adopted.

A high flow scenario is also shown in Table 2-2 based on 200 L/EP for each existing residential property and an allowance of 20% for infill properties. For non-residential flows, an increase of 20% has been adopted for the sensitivity assessment. For downstream infrastructure, an allowance of 20% on top of the high flow scenario is recommended. This has been used to test the robustness of the concept design and for determining the appropriate flow to the downstream treatment plant.

Table 2-2: Flow Summary

Description	Equivalent Population (EP)	Average Daily Flow (L/day)	Daily Flow - High Flow Scenario (L/day)
Properties within and adjoining the Village Area	213	38,142	51,216
Other Residential Properties Outside the Village Area (up to 16 properties)	35	6,336	8,448
Non-Residential Wastewater Flows (refer to Table 2-4)	N/A	23,328	27,994
Sub total		*67,806*	*87,658*
Allowance for receiving infrastructure – 20%			17,531
Total		**67,806**	**105,189**

Table 2-3: Existing Properties - Residential Wastewater Flows

Description	No of Lots	Density EP/Property	Equivalent Population	Average Daily Flows - based on 180 L/EP/day (L/Day)
Residential Properties within the Village Boundary	92	2.2	202.4	36,432
Residential Properties adjoining the Village Boundary	5	2.2	10.4	1,872
Sub Total				*38,412*
Other Residential Properties Outside the Village Area	16	2.2	35.2	6,336
Total				**44,748**

Note: Population densities are based on the Stockinbingal Village Strategy (202 residents in the 91 residential properties in the urban area).

Table 2-4: Non-Residential Wastewater Flows

Description	Criteria	Students/Occupants	Equivalent Tenement (ET)	Average Daily Flows (L/Day)
Commercial Premises				
6 Small Commercial Properties (24-38 Hibernia Street)	Considered as a Residential Dwelling	N/A	3.5 EP per property	3,780
Commercial Hotel [1]	See Notes		N/A	5,900
Sub Total			*N/A*	*9,680*
Non-Residential Properties (General)				
Stockinbingal Bowling Club [2]	0.25 EP/Occupant	95	23.6	4,248
St Josephs Catholic Church [3]	See Notes		6	1,080
St James Anglican Church [3]	See Notes		6	1,080
Stockinbingal Public School	0.2 EP/Student	27	6	1,080
Stockinbingal Police Station [4]	See Notes	N/A	7	1,260
Post Office (Ellwood Hall) [5]	0.25 EP/Occupant	100	0.25	4,500
2 x Public Toilets	20 people/d x 10 L/use per site			400
Sub Total				*13,648*
Total				**23,328**

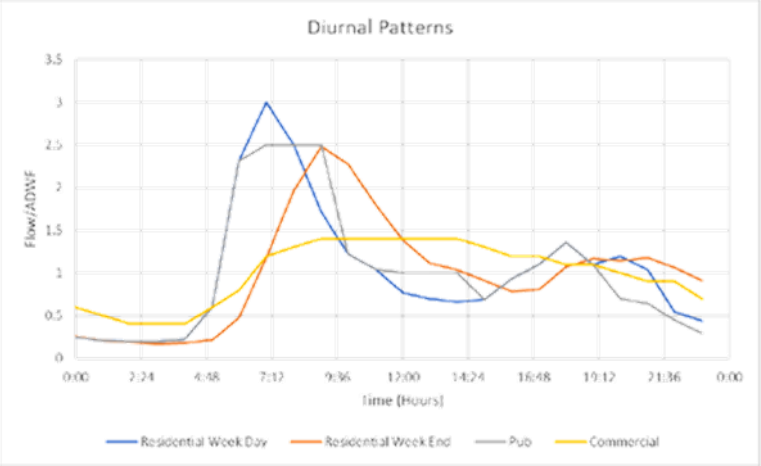
Notes:

1. Wastewater discharges have been based on the general water consumption information with an increase (approx. 25%) to allow for daily variations.
2. Based on water consumption data and assumes water used for non-sanitary use will be offset by liquids consumed and allowing an increase of 50% due to daily variations.
3. The churches do not appear to have any water demand. In order to allow for future toilet facilities a daily flow equivalent to 6 EP @ 180 L/EP/day has been adopted.
4. Based on water consumption data the water usage is approximately double that used by a typical single dwelling (e.g. 3.5 EP@ 180 L/EP/Day) and without further explanation it is considered that an EP of 7 is appropriate.
5. Flows for this property have been based on the use as a hall with potentially 100 occupants.

2.2.3 Pressure Sewerage System Parameters

The following table details the parameters assumed in the development of the concept design and hydraulic model.

Table 2-5: Pressure Sewerage Systems Hydraulic Parameters

Item	Parameter	Commentary
1	EP/Lot	For existing developed properties: 2.2 EP/Property For commercial premises: See below Wastewater flows for non-residential properties are based on EPs as detailed in Table A1 of the Sewerage Code of Australia WSAA 02-2002 or water demand data as appropriate.
2	Wastewater Flows	Wastewater flows per residential property are be based on 180 L/EP/day or available water demands for non-residential properties. The diurnal flow patterns for residential, commercial properties are shown below.  Wastewater network flows for development of concept options and initial pipe sizing are based on the probability method as per WSAA 07 - 2007. For hydraulic modelling appropriate diurnal curves for each property type (residential, commercial) have been adopted. No wet weather allowance is allowed for the peak wastewater flow analysis. It is recommended that an allowance of 20% on a high flow scenario be allowed at downstream infrastructure (refer item 9). Note that mitigation measures to address potential wet weather inflow and infiltration are included later in this report.
3	Flow Velocity	Maximum allowable velocity - 3.5 m/s as per WSAA 07 – 2007 Preferred maximum velocity - 2.5 m/s (Note maximum preferred velocity will be adopted to minimise unnecessary system head loss and power consumption) Minimum velocity - 0.6 m/s as per WSAA 07 – 2007. Note: At the extremities of the system where only one pump is connected the minimum velocity cannot be achieved. In this case a velocity of 0.4 m/s is considered acceptable.

Item	Parameter	Commentary
4	Friction factor	A pipe friction factor of 0.75 has be adopted as per WSAA 07 -2007 A sensitivity assessment using a lower friction factor of 0.6 has been used to examine any potential impacts. As the WSAA - 07 friction factors are considered a conservative (high) friction factor so no high friction factor sensitivity has been undertaken.
5	Pressure Pump Unit	Wastewater modelling is based on E-One Pump units. For residential and typical commercial properties EOne Simplex units (One Extreme Pump) with 2010P collection tanks has been adopted. For schools or other properties where additional storage, pump capacity or reliability is required an EOne Duplex unit (2 Extreme Pumps) with 2010P collection tanks has been adopted. For large wastewater discharge properties such as the bowling club and hotel the need for larger units will be considered at the detailed design stage. Pressure Sewer Pump Units meet the following criteria: ▪ Operational head of 55 m minimum ▪ Operating flow between 0.6-0.9 L/s ▪ High level and pump failure visible and audible alarm ▪ Motor thermal overpressure protection ▪ Power spike and brownout protection ▪ Automatic restart protocol for managing power outage conditions ▪ Remote operational analysis capacity to assess operating hours on a daily basis Note: EOne Extreme pumps require 240 volts at 50 Hz.
6	Pipe Type and Sizes	Polyethylene (PE 100) PN16 (SDR11) cream strip Note: WSAA 07 – 2007 requires a minimum pipe class of PN16. All pipes will be designed in accordance with AS/NZ 2655 Design and Installation of Buried Flexible Pipelines. A check of the maximum system pressure will be undertaken to ensure a PN16 pipe is satisfactory. Given the relatively flat terrain it is expected that a PN16 PE100 pipe should generally be satisfactory. The design of the pipeline under the rail corridor will need to meet the requirements of AS/NZ 4799 Installation of underground utility services and pipelines within railway boundaries and the requirements of the Australian Rail Track Corporation. Pipe sizes chosen in this concept report are available pipe sizes as detailed in Table 10.2 of the Pressure Sewerage Code of Australia WSAA 07 – 2007.
7	Power Outage Recovery	During power outage, the individual property pumps will be unable to function. When power returns the pumps will operate where required and this usually results in a higher than normal operating flow. In order to manage this, a number of alternatives are available including providing a small buffer volume at the receiving sewer/treatment facility or restricting the flow rate to the plant until the system recovers (either through a control valve or staging the pump restart). In order to understand the appropriate method of mitigating this issue a power outage recovery scenario has been modelled. The duration of power outage is based on information from the power supplier.

Item	Parameter	Commentary
8	Air Containment	While pressure sewerage systems are sealed, small amounts of air can find their way into the system. In order to alleviate potential hydraulic issues air needs to be moved through the system or allowed to vent from the system. Calculations in accordance with the Pressure Sewerage Code of Australia WSAA07 have been undertaken to ensure that any air in the system is able to be moved along and out of the system. Where this is not possible suitable vent locations have been included.
9	Sensitivity analysis	Sensitivity analysis has been undertaken to test the system concept. Specifically, a higher flow per EP (200 L/EP) for each existing residential property and an allowance of 20% for infill properties. For non-residential flows, an increase of 20% has been adopted for the sensitivity assessment. For downstream infrastructure, an allowance of 20% on top of the high flow scenario is recommended.

Table 2-6: Concept Design Considerations

Item	Description	Consideration
1	Location of Vent Shafts if required	Where possible vent shafts have been located away from sensitive receivers. Where this is not possible treatment of the air through carbon canisters is recommended.
2	Location of Stop Valves and Flushing Points	Stop Valves and Flushing Points are generally located as prescribed in the Pressure Sewerage Code of Australia WSAA 07. If the number of Stop Valves or Flushing Points appear excessive then the number have been reduced where it does not compromise the operability. This will be done in consultation with Council.
3	Rail Crossings	Discussions with the rail authority have been undertaken to understand their requirements. The concept design considers those requirements and detail an approach to meet them.
	Future adjustment to the rail corridor	It is noted that a future adjustment to the railway alignment through/near the village area may occur as part of the proposed Inland Rail Project. Contact with the relevant rail authority (Australian Rail Track Corporation) has occurred during the concept development to understand possible impacts and any mitigation measures or requirements to be adopted.
4	Potential Flood Impacts	The concept design has considered the flood impacts. Specifically, the 1% AEP flood event. The 1% AEP flood level will be taken from the "Stockinbingal Floodplain Risk Management Plan – July 2002. It should be noted that the flood level varies across the village and is not a single value." To address flooding the following would be undertaken: Pump unit, with a sealed lid with venting and power taken out the side of the tank with the cables to the building. The alarm panel will be mounted at a suitable height above the flood level. All tanks with the pumps will be installed with ballasting at the base to eliminate any chance of floatation.
5	Potential Impacts of Power Outages	The impact of power outages on commercial premises or lengthy power outages are considered later in this report.

2.3 Sewage Treatment Plant

2.3.1 Site Location

The STP will be constructed within Lot 7003 DP94543. The approximate location is outlined in red below.

Figure 2-3: Aerial View of Proposed new Stockinbingal STP Location

2.3.2 Design flows

The plant will be designed for an equivalent population of 450 EP. This is based on:

- Residential EP of 248 as per Table 2-2.
- Estimated industrial EP of 130 based on Table 2-2.
- An allowance for 20% growth in the future.

Therefore, the average dry weather flow (ADWF) will be 0.94 L/s. The pressure sewer modelling results were used to determine the peak inflow values. The methodology of the modelling is further discussed in Section 4.2. Figure 2-4 shows the modelled results based on normal operation. The peak instantaneous flow rate is 6 L/s, however, the peak 30 minute running averaged flow rate is 3 L/s.

The following design values have been adopted:

- Average dry weather flow (ADWF): 0.94 L/s.
- Design dry weather flow (DDWF) for secondary treatment: 3.6 L/s (3 L/s, based on averaged peak inflow plus 20% for future growth).
- The maximum plant inflow and flow requirement for the inlet works: 7.2 L/s (6 L/s based on instantaneous peak inflow plus 20% for future growth).

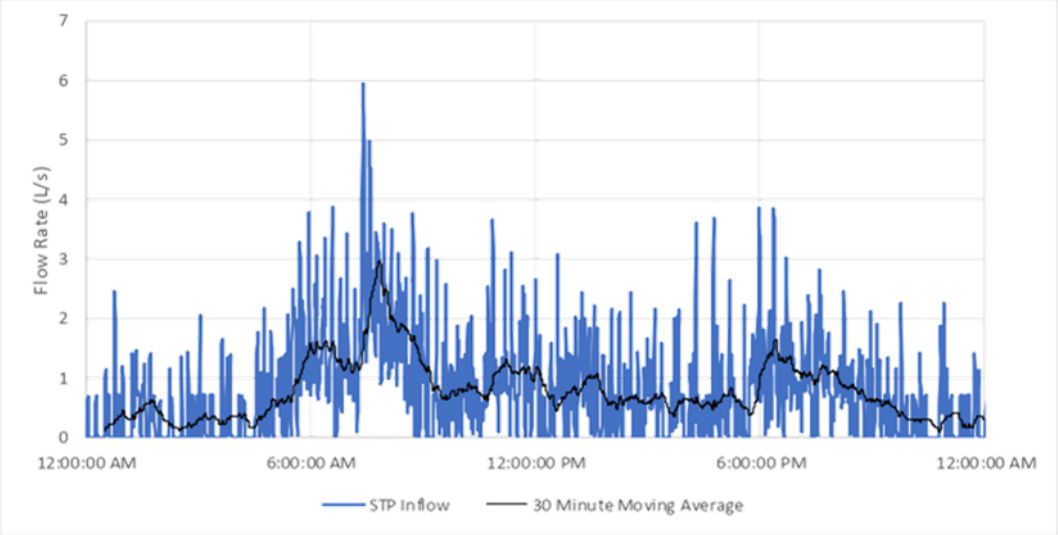


Figure 2-4: 24 hour modelled inflows

2.3.1 Inlet and Outlet Quality

As there is currently no STP the values in Table 2-7 have been assumed based on typical domestic strength sewage, while the effluent values are based upon typical requirement values from the EPA for modern technology STPs.

Table 2-7: Inflow and Effluent Values

Parameter	Inflow values	Effluent Values
Biochemical Oxygen Demand (BOD_5)	325-360 mg/L	10-15 mg/L
Faecal Coliforms		200 CFU/100 mL
pH		
Suspended Solids (SS)	275-300 mg/L	15 -20 mg/L
Ammonia		2-5 mg/L
Total Nitrogen (TN)	60-70 mg/L	10-15 mg/L
Total Phosphorus (TP)	13-15 mg/L	0.5 – 1 mg/L

2.3.2 Electrical Aspects

The main electrical aspect to be considered is a new power supply to the proposed STP site.

Instrumentation, uninterruptible power supply (UPS), programmable logic controllers (PLCs), telemetry and an HMI system will also be incorporated as part of the proposed electrical works. Other local switchgear control assemblies (SCAs) and field switch stands will be provided near minor mechanical plant, including chemical dosing pumps. The STP will have a high level of automation.

Building services such as power, lighting, air conditioning, security systems and smoke detectors will be included as required.

2.3.3 Water Supply to Site

Potable water will need to be supplied to the new STP. Service lines will be extended, from O'Brien Street (Council to confirm), to the new STP for washdown purposes, for the operator amenities and chemical safety shower/eyewash facilities. A new reduced pressure zone (RPZ) device will provide protection of the town supply from backflow contamination from the plant.

2.3.4 Structural Aspects

The structural design of a new treatment facility will be carried out in accordance with relevant Australian standards for steel and concrete structures and take the following into consideration:

- Allow construction to be facilitated to minimise costs.
- Requirements for corrosion protection and subsequent incorporation into the design.
- Buoyancy of structures with respect to groundwater and flood levels identified from investigations (no groundwater expected, based on Geotechnical investigation).

2.3.5 Construction Planning

Section 60 approval will be required from DPIE Water before construction can commence. The concept design report and a draft set of design drawings will have to be submitted to DPIE Water for review and comments as part of the approval process.

The target effluent quality limits will be assessed as part of the REF with DPIE Water for reuse and NSW EPA for discharge.

2.4 Key Challenges and Opportunities

A number of key challenges and opportunities have been identified during the development of the concept design.

Table 2-8 details the key challenges and opportunities identified during development of the concept design and the mitigation measure suggested to address these risks. Where mitigation measures are to be assessed in future stages this has also been identified.

Some of these risks and the mitigation measures are discussed in more detail later in this report. Table 2-8 provides a reference to direct the reader to the location in the report where an item is discussed in more detail.

Table 2-8: Summary of Key Challenges and Opportunities

Item	Challenge and Opportunity	Type of Risk	Action Required	Report Reference
On-property Pressure Sewer System Component				
1	*Flood Risk* During flooding the system can be inundated and there is potential for damage to the control/alarm panel.	Operational	Collection tanks will be sealed with a small one-way valve (duckbill valve) installed or vent pipes connecting to the properties plumbing vent to allow the top part of the tank to vent in properties with ground levels below the 1 in 100 flood level. Control Panels to be located a minimum of 0.5m above the 1in100 year flood level.	See 4.5.1
2	*Local flooding/overland flows* During rain events local overland floodwater flows may enter the collection tanks.	Operational	Collection tanks are not to be located in low points in the property where overland flows may occur. Location of tanks to be determined during the detailed design stage.	See 4.5.1
3	Non-Compliance of Electrical distribution boards	Legal compliance	Audit during the design stage to identify non-compliant electrical distribution boards to be upgraded during the project delivery.	See 4.5.5
4	Power Outage and pump failure causing overflow of the collection tank	Customer impact	The size of the tank is sufficient to store approximately one day's sewage discharge from an average house. Flows to the STP will be larger than normal following a power outage and emergency storage volume at the STP is recommended to allow all of the system to recover as quickly as possible and not compromise the treatment plant operation. Protocols to respond to extremely long power outages (longer than outages recorded) or pump/control failure will need to be put in place to ensure relatively prompt response. It is recommended that large commercial customers be required to provide backup power so that the impact of a power outage on their commercial operation is minimised and the potential for overflows from the tank are minimised.	See 4.4
5	Community education will be required to ensure property owners understand Council and property owners' responsibilities	Customer impact	Information about Pressure Sewerage Systems to be provided to property owners when Council determine to proceed with the scheme.	See 4.5.3 and 4.5.4

Item	Challenge and Opportunity	Type of Risk	Action Required	Report Reference
Reticulation Network Component				
1	Network Main Crossing of Railway	Design	The network will cross the rail corridor at Burley Griffin Way on the Western end of the village. Preliminary discussions with ARTC indicate that the location is suitable however there are some risks which will need to be resolved during the detailed design stage.	See 4.5.2
2	Allowing for Potential Growth	Operational	Infill growth will be catered for within the design and potential small volumes of growth outside the village area. Given the long lead time for growth outside the village area and the scale of growth outside the village area amplification of the system should be deferred until the scale and location of growth is known.	See 4.3
3	Odour and Air Management	Operational	Odour and air management will be addressed by ensuring air flow out of the reticulation network is minimised and odorous issues at the STP are addressed by chemical dosing or filtering of the air.	See 4.2.4
4	Training of Maintenance Staff	Operational	Training of maintenance staff to understand Pressure Sewerage Systems and how to respond to issues will be required. This should occur prior to project commissioning.	See 4.6
Sewerage Treatment Plant				
1	Proposed site location for STP is Crown Lands and part of an Aboriginal Land Claim	Customer impact	Council is working on resolving the land claim.	
2	Power outage recovery will result in larger than normal flows to the STP.	Operational	An emergency storage sufficient to accommodate additional flows shall be provided to allow recovery of the system as soon as possible after a power outage.	See 4.4 and 6.1

3. Pressure Sewerage System Description

Pressure Sewerage Systems consist of small grinder pumps located on each property which macerate the sewage into a fine slurry and pump it through a pressured sewerage network directly or indirectly to a wastewater treatment facility.

3.1 On-Property Infrastructure

The on-property system comprises a control/alarm panel, a collection tank containing the grinder pump, a property discharge line and property boundary assembly. Figure 3-1 provides a cross section of the on-property arrangement.

The house plumbing (customer sanitary drain) discharges to a collection tank. The grinder pump located inside the collection tank then macerates the sewerage and pumps it though a small polyethylene pipeline (property discharge line) to the pressurised street network.

A control/alarm panel is generally located on the dwelling (above the flood level) near the collection tank and is connected to the house's electrical distribution board providing power and control signals to the grinder pump. A property boundary assembly (small plastic valve pit) is located within the property boundary and includes a stop valve and reflux valve are located along the property discharge line and within the property boundary. These valves allow the system within the property to be isolated from the street network if necessary.

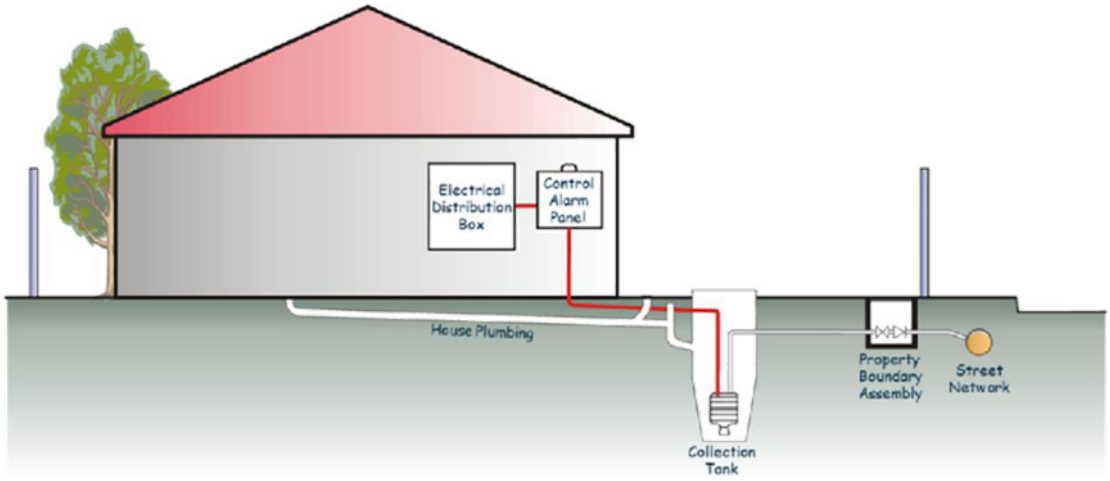


Figure 3-1: On-Property PSS Infrastructure

3.2 Street Network

The street network receives flows from each of the grinder pump units located on the properties served by the wastewater system. These networks are normally pressurised and are designed to transfer flows to a wastewater treatment facility. This may occur directly or via another wastewater system or wastewater pumping station.

Polyethylene pipes are generally used for the street network and are fully welded systems ensuring no ingress of water occurs. These pipes are relatively small compared to a gravity wastewater system and unlike gravity systems are generally laid at a shallower depth.

The infrastructure associated with PSS networks include:

- Isolation and flushing valves
- Vents
- Barometric loops where required
- Chemical dosing facilities where required

Isolation and flushing valves are located throughout the network to allow isolation and/or pipe flushing for maintenance purposes. The surface fittings for these valves are similar to that used in water systems.

While only relatively small amounts of air are able to enter a PSS system the accumulation of air at local high points in the network can be detrimental to the hydraulic performance of the system. In order to mitigate this issue systems are designed wherever possible to move air along and out of the system at the downstream discharge point. However, where this is not possible it may be necessary to provide a vent shaft to allow air to leave the network. The air is released through an air release valve to the vent before it is discharged to the atmosphere. The standard air valve arrangement (see Figure 3-2) shown in the Pressure Sewerage Code of Australia has the air valve located in a pit. Many authorities have adopted an alternative arrangement where the air valve is located in an above ground cubicle. This makes maintenance easier and avoids water building up in the pit. Where possible these vents should be located away from sensitive receivers (e.g. schools, nearby dwellings). Where there are sensitive receivers close to vent locations, local carbon filters can be used to minimise any potential odour issues.

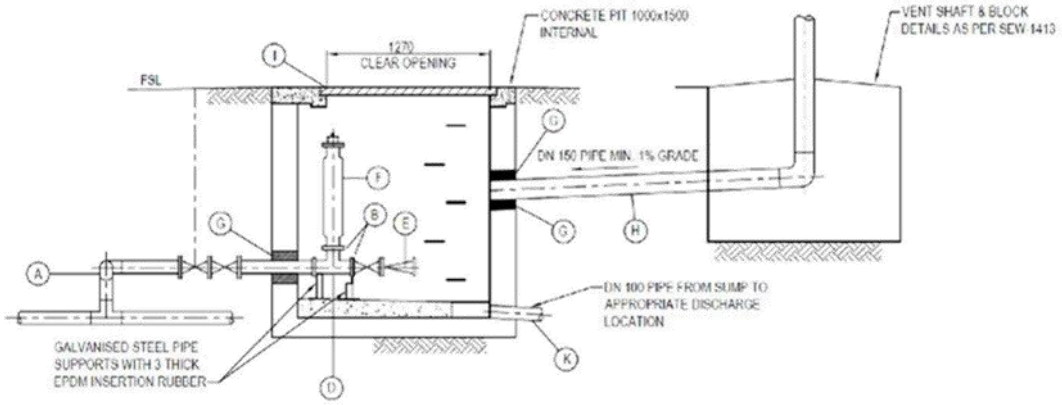


Figure 3-2: Standard Air Valve Arrangement

Barometric loops are required where part of the network is at a higher elevation than any part of the downstream system. The Barometric loop provides a high point in the system ensuring the entire network remains flooded, eliminating the movement of air in and out of the system. Barometric loops are not always required in a pressure sewerage system and the need for these will need to be assessed on a system by system basis.

Chemical dosing facilities are sometimes required where air movement out of the system may cause odour issues. In general PSS systems discharge only small amounts of air from vents within the system and chemical dosing within the network is not required for odour control in the network. However, chemical dosing may be required to address potential odour issues at the receiving infrastructure (pumping stations, gravity networks or sewerage treatment facilities). The need for and type of chemical dosing will need to be examined as part of an overall approach to odour control at the receiving infrastructure.

3.3 Wet Weather Flows

Pressure Sewerage systems remove the potential for infiltration and inflow via the street reticulation system with the only source on inflow being from the house plumbing or the small air vents in the collection tank. It is recommended that no wet weather allowance be included when determining the peak flow in the system.

Pressure Sewerage systems are not generally designed to cater for inflow and infiltration flows from the property plumbing. It is recommended that an audit of the property plumbing be undertaken and that the control panel used in the system has the capacity to identify properties with higher pump operation during rain events. This aids the water authority to identify sources of high inflow which may negatively impact the sewerage system. Identifying and rectifying this issue will reduce the power consumption of the pumps and the cost to the homeowner.

In order to accommodate some infiltration and inflow allowance it is recommended that receiving infrastructure be sized based on the high sensitivity analysis flow plus 20%.

3.4 Power Outages

In Pressure Sewerage Systems the peak flow to the downstream system occurs after a significant power outage. In order to assess the impact of a power outage records from the electricity supplier to the Stockinbingal area were examined and a hydraulic simulation of a power outage situation modelled. This is further discussed in Section 4.4.

4. Reticulation Network

In developing the reticulation network, a number of factors have influenced the network layouts. These factors include:

- The area to be served is bisected by the rail corridor. Potential crossing points have been limited to one location where the roads crosses the rail corridor, and this is preferred by the Australian Rail Track Corporation (ARTC). The single rail crossing minimises risks (approval timeframes, cost increases and potential construction impacts).
  It should be noted that ARTC have advised that there are no current plans to widen the rail corridor for the Inland Rail Project between the two locations where the Burley Griffin Way crosses the Rail corridor at Stockinbingal.
- To avoid potential environmental issues and for ease of construction all pipe routes were kept to existing roadways unless this was not possible.
- The location of the proposed wastewater treatment plant is lower than some of the village area and so a barometric loop will be required at the Sewerage Treatment Plant Site to keep the network flooded and minimising air movement in and out of the system.

4.1 Potential Network Layouts

Details of the preferred network layout has been attached in Appendix A. The layout was influenced by the factors detailed above.

The main difference in the options developed are, the location where the wastewater network crosses the railway corridor and the route adopted for the main serving the south-western part of the system from the corner of Hibernia and Dudauman Streets.

Two alternative crossing points of the railway corridor have been considered, one at Burley Griffin Way and the other at Dudauman Street. A third option further to the east was also discussed but was not considered further as it was not within a road corridor.

For the network serving the southern side of the railway and the western end of Hibernia Street two routes were considered for connecting the network to the sewerage treatment plant. One route from the corner of Dudauman Street and Hibernia Street going north along Hibernia Street and then O'Brien Street before crossing the recreation ground to the STP site. The other from the corner of Dudauman Street and Hibernia Street along Martin, Hoskins and O'Brien Streets then through the Park to the STP site.

Description of options developed:

- Layout 1A - This layout crossed the rail corridor at Burley Griffin Way (western end of the village) and transferred the southern part of the system to the STP via Dudauman Street, O'Brien Street and through the park to the STP site.
- Layout 1B – This layout crossed the rail corridor at Dudauman Street and transferred flows to the STP via the northern part of Dudauman Street, then O'Brien St before crossing the park to the STP site.
- Layout 1C – This layout crossed the rail corridor at Dudauman Street and transferred flows from the southern part of the system to the STP via Martin Street, Hoskins Street and O'Brien Street before crossing the park to the STP site.

Layout 1A was considered the best layout because:

- It would have larger pipework near the crossing at Burley Griffin Way providing greater potential for servicing growth either to a potential industrial growth area to the west of the village or infill growth between Dudauman and Burley Griffin Way (south of the rail corridor). Note the ability to service any growth would be limited. During modelling of the system, the pipe size required at the rail crossing was found to be a DN 63 which is still only a relatively small pipe diameter.
- There was a slight advantage in transfer of flows from the southern part of the system via Dudauman Street rather than via Martin and Hoskins Streets, however this is marginal. The route along Dudauman street is slightly shorter and while a pipe line would still be required along Martin and Hoskins Streets it would be smaller. The choice between these two alternatives may be reconsidered during the detailed design if other factors are identified during that stage.

Following discussions with Council it was agreed that Layout 1A would be the preferred layout and hydraulic modelling was undertaken using that layout.

4.2 Hydraulic Modelling

Hydraulic modelling was undertaken based on the Basis of Design (BOD) detailed earlier and using InfoWorks IWM. The modelling optimised the pipe sizing and performed a sensitivity analysis to review the robustness of the system.

The hydraulic modelling analysed the flowing:

- Peak flow rates and velocities in each section of the reticulation system
- Peak operating pressures within in the system (at pump connection points)
- The average sewage retention times

This analysis was undertaken for normal operating conditions and then with a sensitivity analysis to test the robustness of the system. The sensitivity analysis was undertaken assuming a higher flow per EP of 200 L/EP and an allowance of 20% for infill properties. For non-residential properties an increase of 20% of flow was also adopted.

4.2.1 Preferred Network

Option 1A (the preferred network layout) was refined with revised pipe sizes based on the model results. The preferred network is shown in Figure 4-1 with further detail shown in Appendix B.

In summary the network consists of the following:

- On Property Assets
  - 121 Simplex units, 5 duplex units and 1 Quadraplex units
    - Duplex units for the school, bowling club, public toilets and Elwood Hall
    - Quadraplex unit for hotel
  - 127 control alarm panels and associated electrical wiring
  - 127 boundary valves and associated pits
  - 127 property boundary assemblies
  - 3,800 m of DN40 property discharge line and pressure sewer lateral

- Street network
  - About 9,600m of network mains consisting of: DN50-4012m, DN63-2298m, DN75-1808, DN90-522, DN110-653, DN125-254
- A barometric loop at the STP approximately 7 m high
- 4 Air valves and vents
- Approximately 11 Isolation and 14 flushing valves

For estimating purposes 5% additional length has been added to reflect the potential for changes during the detailed design. It should be noted that during the detailed design changes may be required to address constraints identified during that phase.

4.2.2 Model Outputs

Appendix D details the key hydraulic outputs for the normal operating scenario as well as the full hydraulic outputs for both the base flow case and the sensitivity analysis.

For the location of Upstream (U/S) and Downstream (D/S) Nodes refer to Appendix C.

Figure 4-1: Network Layout

4.2.3 Peak Flow Rates, Velocities and Pump Pressures

Normal Operation

Peak flow rates and peak instantaneous velocities for each pipe section are provided in Appendix D. As flows in Pressure Sewer Systems have sharp instantaneous flows, the pipe sizing has been generally based on 95% of the peak instantaneous flow for each pipe section.

The peak velocities generally meeting the generally required minimum velocity to achieve self-cleansing (0.4 m/s for DN50 and 0.6 m/s for larger pipes).

The inflow hydrograph to the STP for the normal operating condition is shown in Figure 4-2. For design of the plant it is recommended that the total and instantaneous peak flow to the plant plus a 20% allowance, in accordance with the BOD, be allowed. The peak flow of approximately 7.2 L/s should be adopted as the peak flow to the plant.

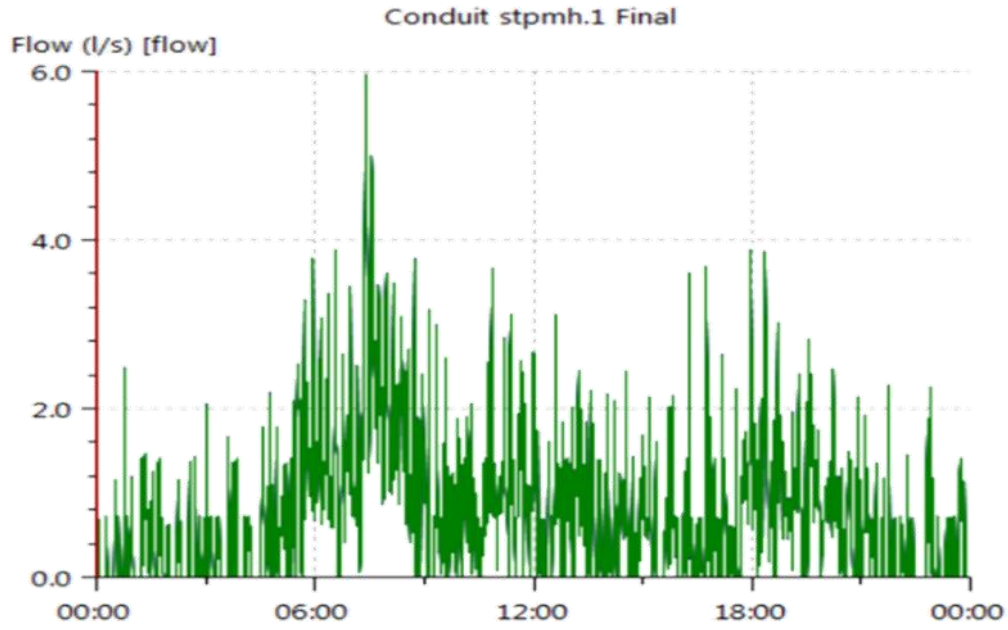


Figure 4-2: STP inflow hydrograph

Pump pressures do not exceed the 55 metres head recommended by the EOne Pump Manufacturer for any of the pumps under the normal operating scenario. 50% of the pumps see pressures less than 20 metres head and 96% see less than 30 metres head. In the sensitivity analysis the maximum recommended pressure was not seen for any of the pumps and the pressures were similar to that for the normal operating case.

4.2.4 Air, Odour Management and Corrosion Control

Air trapped within the network at local high points can lead to higher pressures in the network and is not desirable. Where possible, air should be moved along, and out of the system. Where this is not possible, air should be allowed to leave the system via air valves and vents.

The Network Layout has been developed so that the majority of the reticulation network is graded upwards in the direction of the flow. This allows air to move towards the STP and out of the system. However, there are some areas where this is not possible and so air needs to be driven along the system by the sewage flow or removed via a local vent.

The ability of an air bubble to move along a full pipe can be determined using the following formula as detailed in the Pressure Sewerage Code of Australia:

$$P = \frac{0.88\,V^2}{g \times D \times S^{0.32}}$$

Where:

- **V** is the velocity of the flow, m/s
- **g** is the gravitational constant, m/s^2
- **D** is the internal diameter of the pipe, m
- **S** is the grade of the pipe, m/m

Where P is greater than 1, the air pocket can theoretically be moved along the reticulation network by the sewage flow. Where P is less than 1 the air pocket is unable to be swept downstream with the flow. For the purpose of this project the maximum velocity has been assumed to be 90% of the maximum instantaneous velocity, as sufficient time to move the air along the system need to occur.

Results for normal operation

There are six local highpoints in the system. Based on the assessment and the calculated P factor, vent shafts are not required in the system. However, given the depth of cover under the rail line is yet to be determined, deeper pipework than indicated in the model may be required and so air movement through the pipe section under the rail line will not be possible. As a result, it is highly likely a vent will need to be provided on the upstream end (south of the railway rail crossing. Given the potential for vents to be required, potential vent locations have been included in the scheme layout.

It is recommended that the need for vents at high points be reassessed during the detailed design stage as alignments and levels may change to existing services and other yet unknown factors.

Odour issues are not generally an issue in Pressure Sewerage System networks (typically an issue at the point of discharge), the need for odour treatment using carbon activated treatment units should be considered at the detailed design stage. Based on the identified location of potential vents there does not appear to be any sensitive receivers (e.g. schools, nearby houses within 30 metres) and the potential to move them further away from the closest dwellings appears to be available.

The average age of the sewage when it arrives at the STP will be approximately 8.5 hours. This is considered a high risk for odour issues and will need to be addressed. Typically, odour issues can be managed by the use of chemicals in the network prior to reaching the treatment facility or at the STP inlet works. This normally involves covering the inlet works and extracting the odorous air through activated carbon or biological filters or through odour beds.

Chemicals normally used include magnesium hydroxide or ferric chloride. Given the relatively small flows, dosing of these chemicals is problematic, as the dosing equipment needs to pump more chemical into the system than is required to avoid blockages of dosing equipment. Ferric chloride creates a precipitate which often results in scale forming on pipe surfaces resulting in blockages which are difficult to remove. Due to these issues it is recommended that management of odours at the STP inlet be adopted.

As the reticulation network consists of polyethylene pipe, corrosion issues from the septic sewage within the street network should not be an issue. However, downstream infrastructure such as receiving maintenance holes or the inlet works at the STP should be coated with an appropriate coating to protect against corrosion.

4.3 Allowing for Growth

The village has the potential to have infill growth with many land holdings containing multiple lots. This is particularly evident for residential zoned properties on the southern side of the rail corridor.

Council's village strategy has identified four potential growth areas. This includes three residential areas and one industrial area. Council has indicated the development timeframe for these areas is beyond 20 years.

The potential residential growth areas have a combined area of about 55 hectares and based on 8 lots/gross hectares, the total number of potential lots is about 440.

The potential industrial growth area is about 380 hectares in size. No information regarding the type of businesses are available at this time.

The sensitivity analysis undertaken indicates that the system is capable of a 20% increase in flow distributed evenly across the system. Any substantial growth at the extremities of the system will require local amplifications as the pipe sizes are relatively small. Increasing these pipes as part of servicing the current village would create operation issues in the system as velocities would not be practical as self-cleaning requirements would not be met.

Given that the identified growth is much larger than the existing village, a pragmatic approach has been adopted where pipe sizing has favoured larger pipe sizes where possible. This will assist in providing some capacity to service growth in the future but will not be able to serve the scale of growth Council has identified in its growth strategy. However, given the relatively small size of the village area and the scale of the proposed growth, amplification of the proposed system would be required to service the identified growth areas outside the existing urban village.

If the growth identified by Council does occur, it is possible that very early stages may be able to be served by the proposed system. For the industrial growth area, it may be possible to limit the impact on the proposed system by limiting the flow rate from the properties and/or limiting them to off-peak pumping. This would allow some of the early growth in the industrial area to be serviced without amplification of the proposed system. It is also possible to provide a larger encasing pipe at the rail crossing which provides the opportunity to enlarge or provide an additional carrier pipe when required.

Given much of the growth outside the village area is expected to occur beyond a 20 year timeframe it is considered appropriate to plan and deliver the required amplifications to the sewerage system at that time. This allows the amplifications to be sized and located once the nature of the growth is better understood.

4.4 Power Outage Recovery

In Pressure Sewerage Systems the peak flow to the downstream system occurs after a significant power outage. In order to assess the impact of a power outage records from the electricity supplier to the Stockinbingal area were examined and a hydraulic simulation of a power outage situation modelled.

Power outage records from October 2014 till early July 2019 are shown in Figure 4-3. With the exception of one power outage in January 2018, which lasted almost 19 hours, there are two outages lasting just over six hours and the remainder were less than 6 hours in duration. Excluding the largest event, the average power outage is just under 3 hours.

Based on these records, the storage provided in the collection tanks at each property (nominally 24 hours of normal operating storage) is adequate for all of the likely power outages. For commercial properties (particularly those with large flows) it is recommended that the landlords/tenants be required to provide backup power to the pressure sewer unit or additional storage to lower the risk of overflows.

To assess the impact of power outage recovery, two scenarios were examined, a 6 hour and an 18 hour power outage. The storage requirements for the power outage recovery is discussed in Section 6.2.

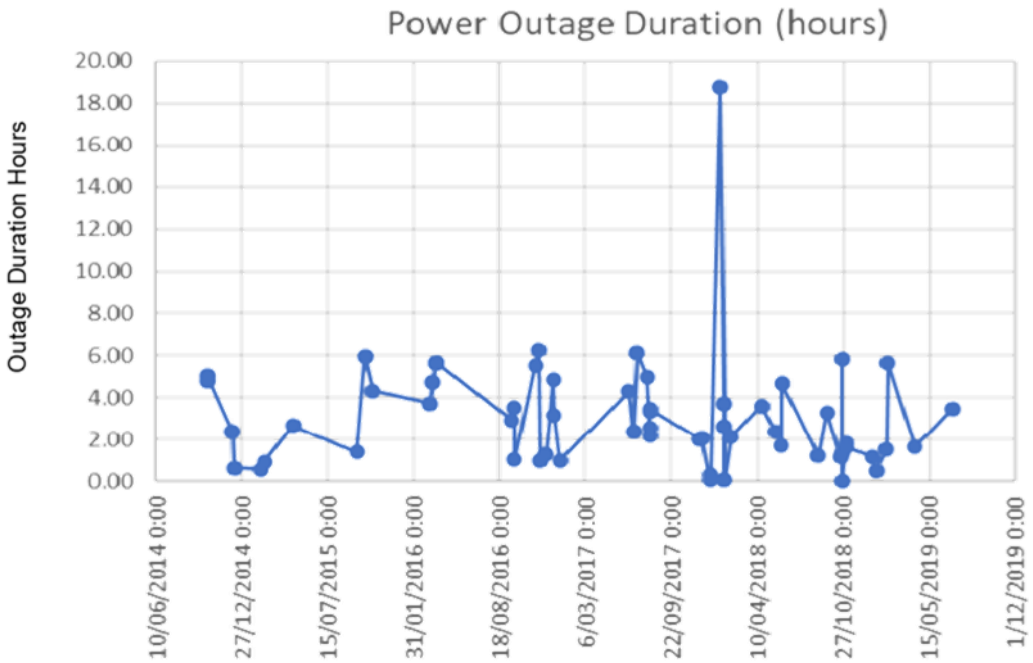


Figure 4-3 Power Outage Records

4.4.1 6 Hour Power Outage

When the system experienced a 6 hour power outage the system took approximately 1 hour to recover. A hydrograph of the discharge to the plant is shown in Figure 4-4. The period of power outage commences at 5 am and finishes at 11 am. The peak flow rate is 18 L/s but reduces to 3 L/s by 11.50 am.

During the power outage, only the hotel had overflow issues at the collection tank. This issue would be mitigated by requiring the property owners to provide backup power to the pumps in the case of a power outage. Alternatively, the collection tank volume can be increased to accommodate the additional flow. This issue should be investigated at the detailed design stage to determine the best method of addressing this issue.

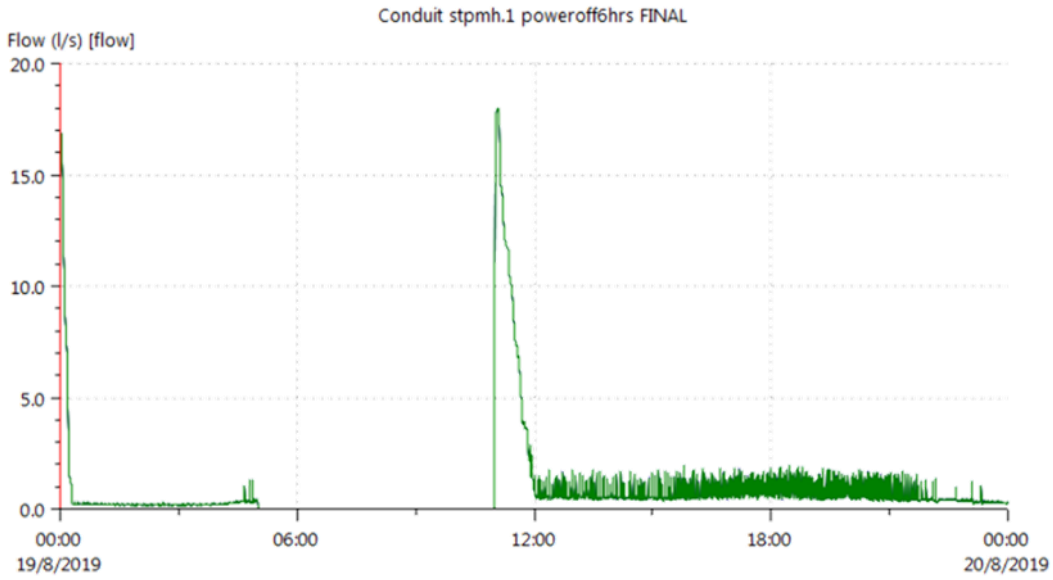


Figure 4-4: Sewerage network discharge hydrograph after 6 hour power outage

4.4.2 18 Hour Power Outage

This outage is considered an extreme event and has only occurred once in the records provided. When the system experienced an 18 hour power outage the system took approximately 2 hours to recover (flow rate of 5 L/s). A hydrograph of the discharge to the plant is shown in Figure 4-5. The period of power outage commences at 5 am and finishes at 10 pm. The peak flow rate is 18 L/s but reduces to 3 L/s at about 11.30 pm.

During the power outage the hotel, the bowling club, the hotel and Elwood Hall have overflows based on the collection tank storage provided in the model. This issue would be mitigated by requiring the property owners to provide backup power to the pumps, providing a larger collection tank volume to accommodate the additional flow or by restricting usage (closing the facility). This issue should be investigated at the detailed design stage to determine the best method of addressing this issue.

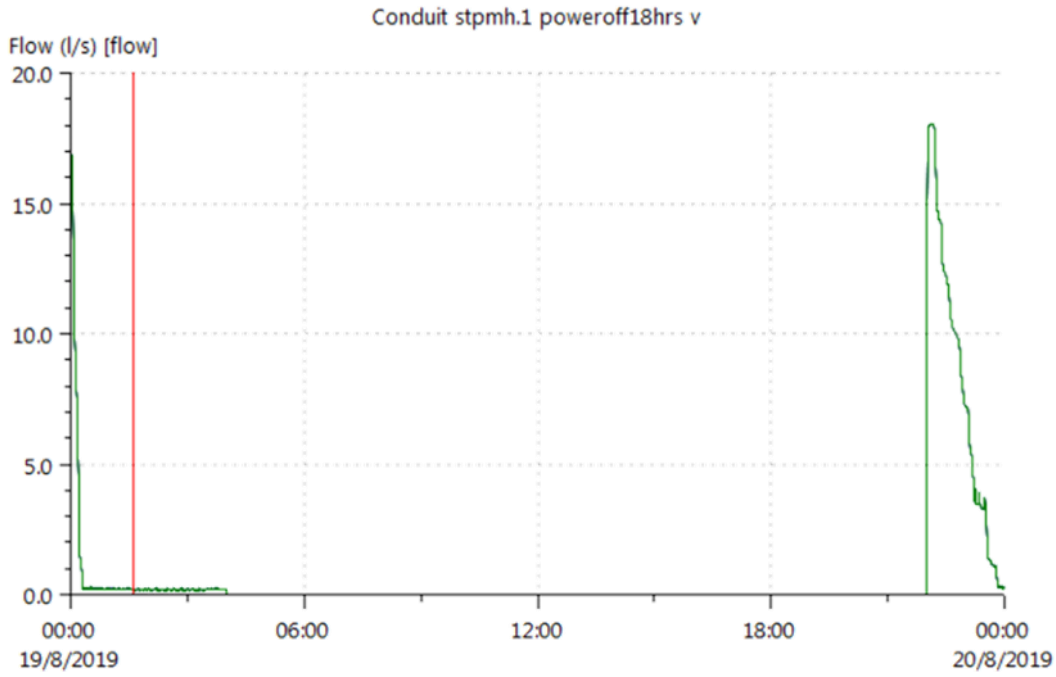


Figure 4-5: Sewerage network discharge hydrograph after 18 hour power outage

4.5 Required Controls and Mitigation Measures

4.5.1 Mitigating Flood Risk

The Stockinbingal village is prone to flooding and as a result measures will need to be taken to address this risk. Previous flood studies (Stockinbingal Floodplain Risk Management Plan – July 2002) provided by Council indicate that the depth of flooding for a 1 in 100 year event does not exceed 1 metre at any of the properties being served.

These measures include:

- Locating the control/alarm panel a minimum of 500 mm above the 1 in 100 flood level
- Installing flood proof gully trap covers on all properties where flood waters are likely to enter the house plumbing via the overflow relief gully.
- Installing either a duckbill valve on the collection tank to allow air to vent from the tank but keeping flood water from entering the tank or providing a vent pipe connected to the collection tank to the house vent.

4.5.2 Rail Crossing

The rail crossing at Burley Griffin Way on the western end of the village will need to comply with AS4799 – Installation of Underground Utilities Services and Pipelines within Railway Boundaries and ARTC requirements.

The key elements of these requirements are:

1. Services and pipelines shall be laid at least 3 m clear of rail structures, cable pits and stops, drains, signalling equipment, overhead masts, poles, underground cables, buildings, points and crossings, bridges and culverts.
2. The alignment of the services to be 90 degrees to the rail alignment.
3. The service will not be located within 6 m of the toe of banks or top of cuttings.
4. Pits and access chambers are not to be located within 6 m of the toe of embankments or top of cuttings, nor within 10 m of the nearest rail.
5. If boring the bore shall extend 3 m beyond the track or toe of the embankment whichever is the greatest.
6. Pressure pipelines under the track shall be either encased in a pipe designed in accordance with AS4799-2000 Clause 3.3.
7. The size of the encasing pipe shall be such that the internal diameter of the encasing pipe shall be at least 50 mm larger than the internal diameter of the carrier pipe (for pipes 150 mm or less).
8. The depth of installation from the top of the rails to the top of the encasing pipe shall be a minimum of 2000 mm and extend for 3000 mm beyond the rail tracks.

Note: this list is a summary of key requirements and is not a complete list.

In terms of the requirements 2-8 above, the proposed crossing will be able to either comply with the requirements or the requirements are not applicable (e.g. there are no embankments at the rail crossing).

In regard to requirement 1 above and based on photographic records it appears likely that the pipeline route can meet this condition but this would need to be confirmed by a survey of the railway assets and if necessary, discussions with ARTC.

If clearances to rail structures etc. cannot be met then the alignment could be adjusted to the west or east of the proposed crossing location. While this would move the alignment outside the rail corridor it may be necessary to meet the requirement above. It should be noted that there are existing service that cross the corridor at this location so it is unlikely that a crossing at this location cannot be achieved.

It is recommended that the full length of the carrier pipe be encased in the rail corridor as it is possible that additional rail tracks may be laid within the rail corridor in the future. As the ARTC are likely going to require that the carrier pipe be grouted in the encasing pipe, later amplification of the carrier pipe could be difficult. Therefore it is recommended to install an additional, larger, carrier pipe (sized for future use), within the same encasing pipe which could be connected when required. It is also recommended that isolation and flushing valves be located on either side and outside of the rail corridor allowing isolation of the pipework within the rail corridor without the need for Council personnel to work in the rail corridor.

Based on drawing PSS-1004 of the Pressure Sewerage Code of Australia WSA-07 it is expected that a steel encasing pipe of DN300 will be required. This sizing shall be confirmed during the detailed design stage and be subject to geotechnical assessment.

In order to avoid approval delays with the ARTC it is recommended that the ARTC be engaged during the design stage and “In Principle” approval sought.

4.5.3 Community Education

Unlike gravity systems the property owners play a greater role in reporting issues to the Council when the system fails. When pump alarms occur, property owners will be required to contact Council to let them know the pump failure has occurred. It is also necessary for property owners to understand that they can contribute to the failure of the pump because inappropriate items get flushed down the toilet.

In order to educate the property owners, it is suggested that information packages be provided to property owners once the decision to progress with the scheme occurs. Many examples of these information packages are available from various water authorities.

4.5.4 Suitable Access to Properties

Where possible collection tanks should be located in the front of the property to make access easier. However, in existing villages the tank is normally located near the existing septic tank which may be located at the rear of the property. In any case, safe access to the on-property pressure sewer infrastructure is required. As part of the detailed design it is recommended that properties be examined to identify any potential access issues and Council consulted to ensure access is appropriate.

The need to maintain a clear and safe access to the Pressure Sewerage infrastructure needs to be conveyed to property owners so they understand what is required.

4.5.5 Compliance of the Electrical Distribution Board

Electrical distribution boards need to comply with AS3000 the National Electrical Installation Standard. In practice this means that when the electrical supply to the pressure sewer systems control alarm panel is made the electrician has a responsibility to ensure that the electrical distribution board is compliant. While the power demand from the pressure sewer pump is not significant the original electrical distribution board may not be compliant and may need to be replaced.

In order to understand the number of electrical distribution boards which are not compliant it is recommended that an audit occur during the detailed design stage. It is also recommended that Council determine prior to this audit who will be responsible for the cost of upgrading any electrical distribution boards that are not compliant.

4.6 Operating Requirements

4.6.1 Training of Maintenance Personnel

Training of maintenance personnel is an important aspect for a new Pressure Sewerage Scheme. The people who will deal with the day to day maintenance of the system will need to understand how the system works and what to do when there is an issue.

In order to understand how to respond some training in the following areas should be undertaken:

- Problem identification of pump and control unit failure.
- Maintenance procedures for replacement of pump units and control panels.
- Repair of polyethylene pipes in the field.

It should be noted that Pressure Sewerage Systems are constructed as fully welded pipe systems and replacement of damaged pipes should ensure the integrity of the pipe including the ability to transfer loads along the pipe. As a result, the use of simple mechanical couplings to replace a section of damaged pipe may not be suitable.

4.6.2 System flushing

The WSA code specifies flush points in the reticulation network, however there is no guideline on the flushing requirements. Flushing is about reducing build up over time which will impact head losses and system performance. If no flushing occurs, the pipes should not block up as the velocities will increase where the pipe sizes are reduced. At Stockinbingal this is less of an issue due to the flat terrain.

As the system has been designed on the upper scale of pipe sizes to allow for future growth, occasional flushing might be required. It is recommended to do annual system flushing in the early years as a preventative measure.

Flushing operations should be undertaken by flushing the system extremities and then progressively flushing downstream until the complete system has been flushed. To achieve this, it is recommended that the extremities of the system are flushed by isolating the section to be flushed and collection tanks be allowed to fill so that the pumps will operate when the isolation valve is opened. For larger pipe sections (nominally DN75 and above) a pumped flow via the flushing valve is injected into the system. The volume and rate of flow should be sufficient to move any sediment along the pipe past the section of pipework being flushed.

4.6.3 Spare parts

Like any sewerage system spare parts are required to maintain the system. Given that parts may be required on the spot it is important to maintain an appropriate level of spare parts.

As a guide the following spare parts inventory is recommended:

Table 4-1: Recommended Spare Parts Inventory

Item	Suggested number of spare components
Control Panels	Number of spare control panels should be approximately 5% of the total number of control panels in the system. Where small numbers of duplex and quadraplex units are located in the system a minimum of one spare unit of each type should be held as a minimum.
Collection tanks	It is suggested that two spare tanks be held in inventory.
Pumps	In any year 5% of pumps will need replacement. As such at least 6 spare pumps should be kept to allow immediate replacement.
Polyethylene Pipe	Spare pipe sections should be held in stock, particularly as cream stripe pipe is not a common PE pipe designation. It is suggested that the length of pipe sections required should be determined in consultation with Councils Wastewater operating personnel.
Property Boundary Assembly	Approximately 4% of the number of properties.
Isolation and flushing valves	The number of spare isolation and flushing valves should be determined in consultation with the Councils maintenance area.

4.6.4 Protection of the Treatment Plant

Following Power Outages and flood events the treatment plant will see higher flows than under normal operating conditions. The plant will be capable of operating with higher flows to some degree but where the flows exceed this appropriate mitigation measures need to be in place.

It is suggested that a control valve be located in the pressure reticulation network just before the sewage treatment plant to reduce flows if and when required to protect the plant. This will ensure the integrity of the plant and utilise the available storage in the individual property collection tanks.

As detailed earlier it is recommended that emergency balancing storage is provided at the plant to allow system recovery during power outage.

5. Sewage Treatment Description

5.1 General Description

Generally, sewage treatment can be succinctly represented through Figure 5-1.

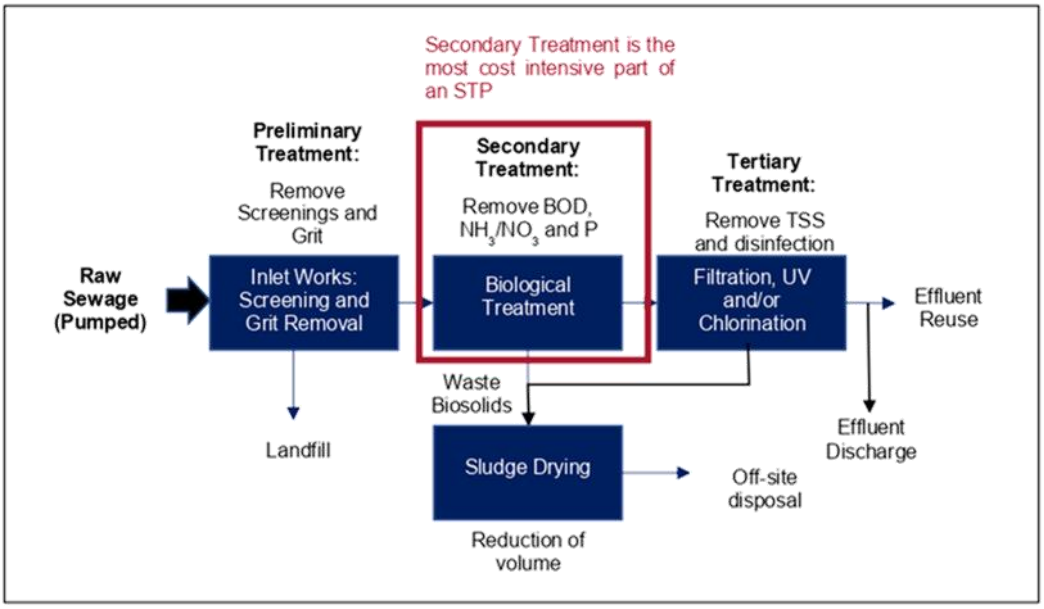


Figure 5-1: Flow Diagram of a STP

5.1.1 Preliminary Treatment

Preliminary treatment facilities will allow for:

- Reception of sewage inflow and internal recycle/ return streams (i.e. site drainage and sludge management system supernatant).
- Measurement of all inflows to the plant as well as the bypassed flows.
- Mechanical screening and washing of screenings to remove gross solid material. This material will go to landfill.
- Grit removal and washing to minimise grit accumulation in downstream main process units and to protect mechanical equipment from excessive wear.

5.1.2 Secondary Treatment

Secondary treatment facilities will allow for:

- Biological oxidation of organic material
- Nitrification and denitrification
- Stabilisation of waste MLSS
- Dewatering of stabilised sludge (via gravity or mechanical dewatering).

5.1.3 Tertiary Treatment

Tertiary treatment facilities will allow for:

- Filtration of suspended matter
- Disinfection of the effluent (degree of disinfection will depend on whether effluent is discharged or reused)
- Measuring of effluent volumes.

5.1.4 Chemical Dosing

If phosphorus removal is required, liquid alum may be used to facilitate phosphorus removal.

If pH correction is required, a caustic dosing system will likely be used.

5.1.5 Secondary Treatment Options Investigated

Several secondary treatment options have been investigated:

- Option 1: Conventional Activated Sludge (CAS) Treatment
- Option 2: Membrane Aerated Biofilm Reactor (MABR)
- Option 3: Membrane Bioreactor (MBR)
- Option 4: Moving Bed Bio Reactor (MBBR)
- Option 5: Intermittently Decanted Extended Aeration (IDEA) reactor

Options 1-4 are for Package type systems, whereas Option 5 is for a concrete aeration tank. These options are further discussed in the following section.

5.2 Option 1 – Conventional Activated Sludge (CAS) Treatment

5.2.1 Scope of Supply

The simplest secondary treatment method is a conventional activated sludge unit. Hydroflux has a robust package treatment plant (Roadtrain) which operates as a CAS system. This is of a robust welded 6mm mild steel epoxy coated construction. There are other suppliers available for this technology.

The treatment system includes an aeration tank with course bubble diffusers and a clarifier tank as shown in Figure 5-2. The unit also includes a chlorine tank with a chlorination box which has chlorine tablets. For discharge to a creek, this will be replaced with UV disinfection.

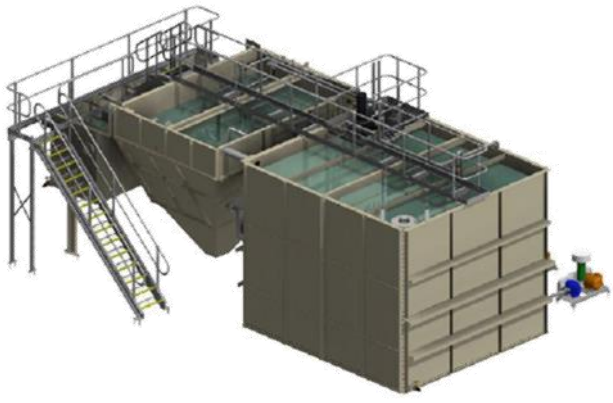


Figure 5-2: General Arrangement for Roadtrain Unit

The principal role of the aeration tank is to provide a favourable environment in which the bacteria can feed and reproduce. The bacteria in this tank consume the pollutants and oxygen (supplied via the blowers) and reproduce. This allows oxidation of both carbonaceous organics and ammonia, producing CO_2, more bacteria and nitrates.

The initial bacteria population is also elevated by the RAS (returned activated sludge) which is drawn from the bottom of the clarifier tank and returned to the aeration tank. This is the main biological stage in the treatment process. Oxygen input is achieved via a pair of duty-standby positive displacement air blowers and coarse-bubble cast iron diffusers.

Course bubble diffusers are less efficient with oxygen transfer than fine bubble diffusers but are more robust and provide mixing as well.

The blowers operate intermittently to allow for anoxic periods where denitrification takes place. Since aeration performs such a critical role in sewage treatment, the blower status is monitored by a pressure switch connected into the delivery pipework. Failure to develop pressure in the pipeline after a blower has started will initiate a changeover to the standby blower and signal an alarm.

5.2.2 Reference Installations

Roadtrain packaged sewage treatment plants are operating in over 140 sites around the world. Some installations in Australia are shown in the following table.

Table 5-1: Roadtrain Package Plants Reference Installations in Australia

#	Site	State	Capacity (EP)	Details
1	Port Hinchinbrook Resort	QLD	500	▪ Sewage from a resort with discharge to the great barrier reef ▪ High water quality required ▪ Prefabricated systems to reduce site installation time and costs
2	Wujal Wujal Community	QLD	350	▪ Sewage from a remote community ▪ Environmental discharge with high quality effluent required ▪ Prefabrication to simplify the site installation process
3	Masig Island	QLD	650	▪ Sewage from the island of Masig, located in the Torres Straits ▪ High discharge requirements, the site is in an environmentally sensitive area ▪ Robust solution to manage the variations experienced

5.2.3 Advantages and Disadvantages

This is a robust solution. There are no unique major replacement parts for this system.

This is the solution with the biggest footprint, however, the treatment plant would be less than 250 m^2, which would fit within the site.

The biggest concerns are the noise and odour from the aeration basin. The unit might have to be covered to mitigate odour emissions.

5.3 Option 2 - Membrane Aerated Biofilm Reactor (MABR)

5.3.1 MABR Technology

In an MABR, a spirally wound membrane is submerged in a tank. This tank is continuously fed with pre-treated sewage (includes pre-screening down to 1 mm dia.) and effluent discharged through an overflow. Low pressure air is blown through one side of the membrane and the biological activity takes place on the other side as shown in Figure 5-3.

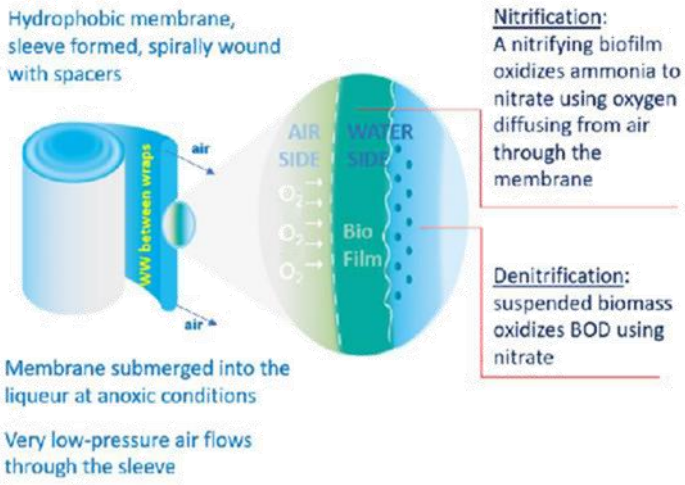


Figure 5-3: Operating Principles of a MABR Membrane

Oxygen is constantly available to a fixed biofilm that develops on the sewage side of the membrane sleeve. Simultaneous aerobic and anoxic conditions develop in this zone, leading to simultaneous nitrification and denitrification with little energy and space requirements. The low-pressure passive aeration results in significant cost savings over conventional high pressure diffused aeration, even at low temperatures.

Because the aeration is passive (not compressed), power requirements are minimised.

5.3.2 Scope of Supply

The recommended flow diagram for the whole process is shown in Figure 5-6.

The feed pumps provide effluent to the MABR package system through a fine (1mm) screen. The screened effluent then flows via gravity into the selector tank where screened effluent is mixed with the pumped RAS. The mixed effluent is then gravity fed into the L3 Aspiral treatment module tank (Figure 5-4). The mixed effluent is passed through the L3 Aspiral stage once only.

The 40 ft L3 Aspiral treatment module includes three MABR spiral units and one Conventional Activated Sludge (CAS) final stage. The effluent forms an anoxic zone in the MABR spiral compartment resulting in simultaneous nitrification/denitrification and advanced phosphorous removal, followed by BOD polishing through the aerobic CAS stage.

Following biological treatment, effluent is then pumped to the 20 ft clarifier module (Figure 5-5) where the supernatant is pumped back to the existing STP for discharge/ reuse. Settled solids in the clarifier are returned to the selector tank (RAS) or wasted (1-2%) via the RAS/ WAS pumps.

The secondary effluent is then tertiary treated (media filtration), disinfected by sodium hypochlorite and discharged or used as recycled water. For discharge to a creek, this will be replaced with UV disinfection.

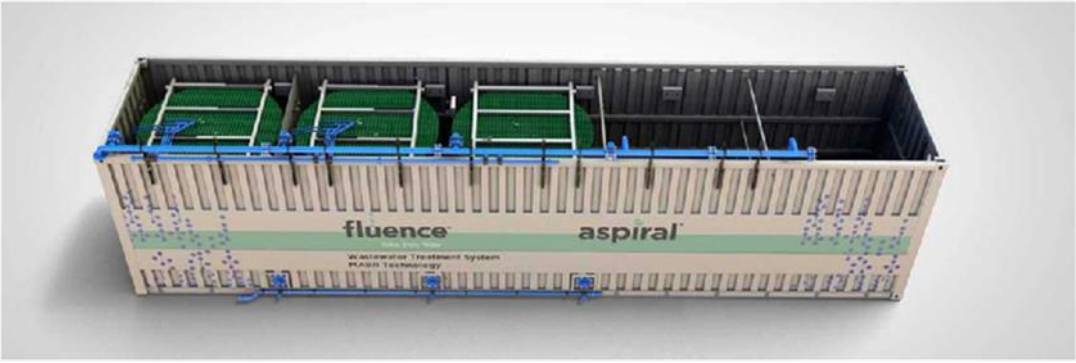


Figure 5-4: Fluence MABR unit (Aspiral L3)

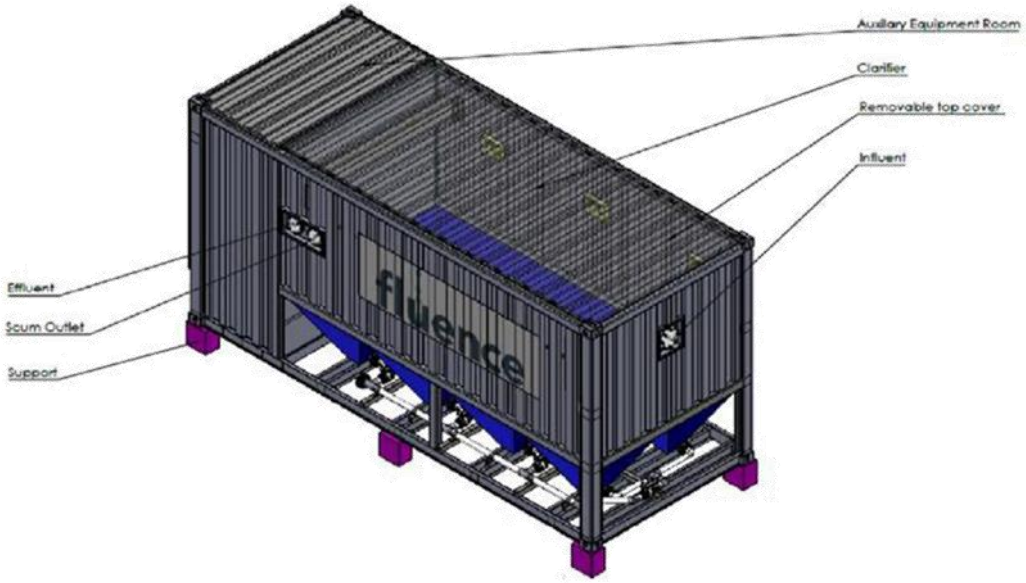


Figure 5-5: Clarifier Unit

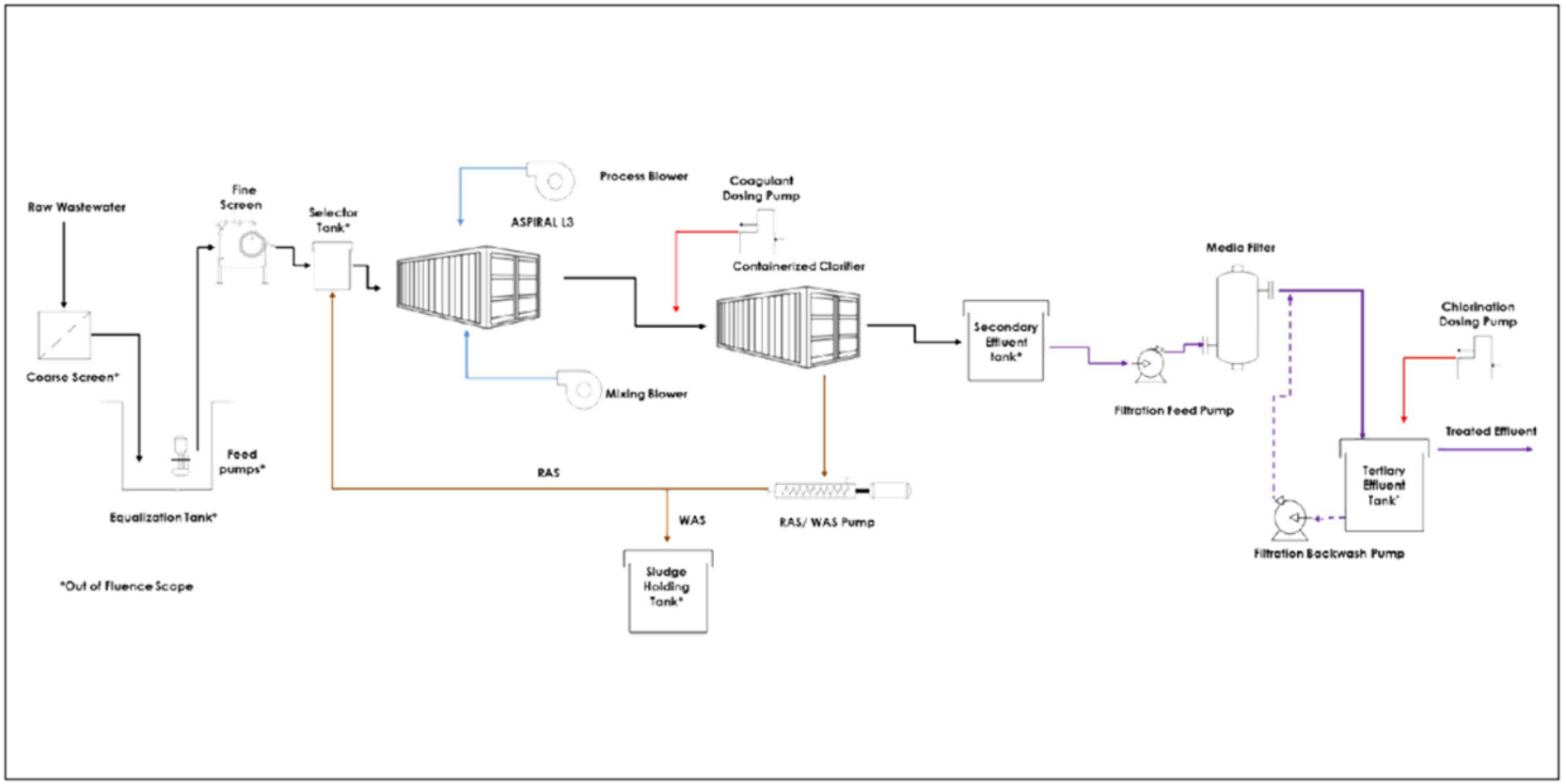


Figure 5-6: A Potential Flow Diagram of a MABR for Stockinbingal (Provided by Vendor)

5.3.3 Reference Installations

A reference MABR installation list is shown in Table 5-2. This company to date does not have an Australia reference plant.

Table 5-2: MABR Reference List

#	Site	Country	Capacity [GPD]	Partner/client	Status
1	Hayogev	Israel	18,000	Yuvaley Haemek	Operational (2016)
2	Bordeaux	USVI	26,500	VIMWA	Operational (2016)
3	Quzhou	China	10,500	Tiandi	Operational
4	Voss	China	5,300	Shanghai Winner	Installation on hold (by customer)
5	Wuxi	China	5,300	Wuxi DI	Demonstration (2017)
6	Tech. College Changzhou	China	5,300	Jinzi	Demonstration (2017)
7	Miyun, Beijing	China	5,300	Sinorichen	Demonstration (2017)
8	Jingmen, Hubei	China	5,300	CGGC	Demonstration (2017)
9	Codiga center, Stanford	US	3,200	Stanford	Demonstration (2018)
10	Mekelle University	Ethiopia	84,500	TTV	Under construction
11	REPI housing development	Ethiopia	49,000	TTV	Under construction
12	Luoyang	China	79,250	QSY	Under construction
13	ZHenfeng Educational Center	China	264,200	Jinzi	Under construction
14	Ma'ayan Zvi	Israel	1,585,000	Ma'ayanot Hamakim	Under construction
15	Hubei Xiaogan Highway	China	52,834	Hubei ITEST	Under construction (2018)
16	Xie Lin Gang, Yiyang, Hunan	China	52,834	Xie Lin Gang Township Gov.	Under construction
17	Westgrove	Philippine s	105,668	Uni-Field enterprises Inc.	Manufacturing
18	LNG worksite	Texas, USA	33,146	WaterFleet, LLC	Manufacturing

5.3.4 Advantages and Disadvantages

The advantages are that the power savings for this option is significant compared to the other options. However, the membrane is a proprietary product which will need to be replaced after around 7 years.

There are no reference installations of the MABR in Australia, therefore it has not been proven in local conditions.

5.4 Option 3 - Membrane Bioreactor (MBR)

5.4.1 MBR Technology

An MBR is basically a high density activated (suspended biomass) system that uses a membrane to separate the biomass from the liquid. Because of the higher suspended solids density, a smaller footprint is required than for a conventional activated sludge unit.

The Membrane Bioreactor (MBR) type packaged sewage treatment plants are designed to treat domestic strength sewage, to achieve high quality treated effluent, suitable for reuse in "risk category high" applications or for discharge to sensitive environments.

5.4.2 Scope of Supply

There are many package type membrane bioreactor suppliers for wastewater treatment. The MAK Water unit was used as a reference (shown in Figure 5-7).

The main secondary treatment aspects include a corrosion resistant fibre reinforced plastic (FRP) aeration tank with a membrane cassette and a sludge treatment system.

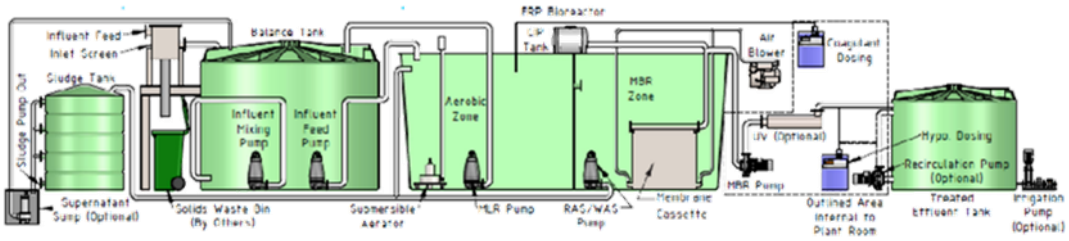


Figure 5-7: MAK Water's Modular MBR system

5.4.3 Reference Installations

There are many reference installations for MBR package plants in Australia and MAK Water has several different reference installations for wastewater treatment across Australia as shown in the following table.

Table 5-3: MAK Water MBR Reference Installation

Year	Application	Plant Type	Flow Rate
2017	Sewage Treatment for Coal Mine Infrastructure Area	MBR	30 m^3/day
2017	Sewage Treatment for Gas Plant Infrastructure Area	MBR	2 x 50 m^3/day
2015	Sewage Treatment for Quarry	MBR	5 m^3/day
2014	Sewage Treatment for LNG Project Permanent	MBR	2 x 250 m^3/day
2013	Sewage Treatment for LNG Barge	MBR	50 m^3/day
2013	Sewage Treatment for Airport Infrastructure	MBR	200 m^3/day

5.4.4 Advantages and Disadvantages

Although it is still a relatively new technology, it has been well established as an alternative to CAS treatment where space is limited or a high quality effluent is required. This option does not require additional filtration for suspended solids or further phosphorus removal. If additional odour measures are required, the aeration tank can easily be covered.

The main disadvantage is that the membranes need to be routinely cleaned. This can be done by a trained service technician (many suppliers include an option for service contracts however this may be expensive given the location of Stockinbingal).

The membranes typically last between 5-7 years, and the replacement cost for this size plant would be around $60,000.

5.5 Option 4 - Moving Bed Bio Reactor (MBBR)

5.5.1 MBBR Technology

A Moving Bed Bio Reactor (MBBR) system consists of an aeration tank (similar to an activated sludge tank) filled with special plastic carriers (Figure 5-8) that provide a surface where a biofilm can grow. The carriers will be mixed in the tank by the aeration system and thus will have good contact between the substrate in the influent wastewater and the biomass on the carriers.

In principle, the attached growth process works the same as a trickling filter or rotating bioreactor, but as it is more concentrated a smaller footprint is required.

Figure 5-8: Example of MBBR Packing

5.5.2 Scope of Supply

There are many package type MBBR suppliers for wastewater treatment. The MAK Water unit was used as a reference (shown in Figure 5-9).

The main secondary treatment aspects include a corrosion resistant fibre reinforced plastic (FRP) aeration tank with several zones. The zones include the aerobic zone filled with floating media, an anoxic and second aerobic zone and a clarifier. The setup is designed to optimise the required conditions for nitrogen removal.

The unit also includes a tablet chlorinator. For discharge to a creek, this will be replaced with UV disinfection.

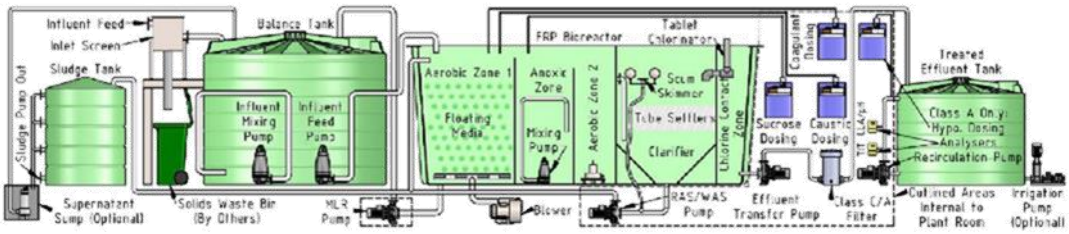


Figure 5-9: MAK Water's Modular MBBR system

5.5.3 Reference Installations

There are many reference installations for MBBR package plants in Australia and MAK Water has several different reference installations for wastewater treatment across Australia. The following table shows the MAK Water reference list for MBBR installations.

PWA also operates a 240 m^3/day package type MBBR plant at the John Morony Correctional Centre which was built in 2016.

Table 5-4: MAK Water Australian MBBR Project Reference List

Year	Application	Plant Type	Flow Rate
2016	Sewage Treatment for Gold Mine Camp	MBBR	200 m^3/day
2016	Sewage Treatment for Holiday Park	MBBR+	45 m^3/day
2014	Sewage Treatment for Iron Ore Mine Infrastructure	MBBR	35 m^3/day

5.5.4 Advantages and Disadvantages

An MBBR is very resilient to load fluctuations and toxic shock, which is advantageous for a small sewerage scheme like Stockinbingal. Sludge production is also much less than for the other options. The STP operation is fairly simple, comparable to the CAS option, as it does not rely on the use of membranes.

5.6 Option 5 – Intermittently Decanted Extended Aeration (IDEA) reactor

A smaller version of the PWA IDEA can be provided. PWA also operates a container-based version of this plant at the John Morony Correctional Centre. This was a one-off design that was built at the time when there were few alternatives. Currently no one is offering an IDEA based package treatment plant. Therefore, a concrete tank IDEA option, which has advantages in terms of longevity, has been investigated.

5.6.1 IDEA Process

An IDEA based process provides the functions of a traditional activated sludge treatment process with aeration and secondary settling within a single process unit. These functions are separated by means of timed process cycles controlled by a PLC (programmable logic controller). This process configuration is cost effective, as aeration and settling can be achieved within a single structure, in comparison to a conventional activated sludge treatment system where two or more units (i.e. at least a biological reactor and separate clarifier) are required.

5.6.2 Scope of Supply

The IDEA process will include a concrete aeration tank with diffused aeration and an end wall syphon decanting unit. This process has been proven to treat the effluent to achieve the required phosphorus concentration without an additional physical filtration unit.

5.6.3 Reference Installations

There are numerous IDEA reactors operating in NSW and it is a local proven process. The following table shows some examples of smaller IDEA reactors. The package type unit at John Morony currently runs in parallel with the newly installed MBBR package type reactor.

Table 5-5: Smaller IDEA Reactor Reference List

Year	Location	Flow Rate	Details
2018	Wyangala	1,400 m^3/day	Concrete structure
2010	Taralga	450 m^3/day	Concrete structure
1988	John Morony Correctional Centre	180 m^3/day	Package Type STP

5.6.4 Advantages and Disadvantages

The IDEA process is a robust process with little maintenance required. The advantage of a concrete structure is that the lifetime of the structure is 60 years, double the lifetime of the package plant structures.

Most of the construction, programming and testing will have to happen on site, whereas the construction and testing for the package plants happen off-site. The design and construction period will be longer.

5.7 Recommendation

A concrete IDEA construction is recommended for this design as it will provide a more permanent solution and is easy to operate. This type of STP will also meet the quality requirements, is cost effective to provide and operate, has no propriety equipment and requires a low level of operator skill.

Table 5-6: Comparison of Options

Criteria	1 - CAS	2 - MABR	3 - MBR	4 - MBBR	5 – IDEA
Effluent quality	Good w/ Proper Design	Very Good	Very Good	Good w/ Proper Design	Good w/ Proper Design
Additional filtration required for Phosphorus removal	Yes	Yes	No	Yes	No
Footprint	Large	Very Small	Small	Small	Intermediate
Sludge Production	High	Average	Average	Very Low	Average
Complexity in operation	Low	Complex	Complex	Higher than Average	Low
Proven performance	Proven for small, medium to large STPs	Proven in other than Australia	Proven for medium to large STPs	Proven for medium STPs	Proven for small, medium to large STPs
Operator skill required	Low	Higher than average	Higher than average	Higher than average	Average
Proprietary technology	No	Yes	No	No	No
Capital Cost (whole STP)	$2.4	$2.0mil	$1.9mil	$2.2	$2.4
25-year present value cost (7%)	$4.3	$2.6	$4.5	$3.6	$3.2

6. Sewerage Treatment Plant

6.1 Treatment Plant Overview

The scope of the new STP will include:

- An inlet screen
- A 50 kL emergency storage tank
- A concrete IDEA reactor and effluent balance tank
- Alum and caustic dosing facilities
- A UV disinfection unit and an effluent pump to Dudauman Creek (provisional)
- A sludge tank and geobag sludge drying system
- Interconnecting pipework and pumping
- Electrical Switchboard with HMI (Touch Screen)
- Provision for remote monitoring via telemetry system
- A new power supply
- An amenities building which will include a control room and a laboratory

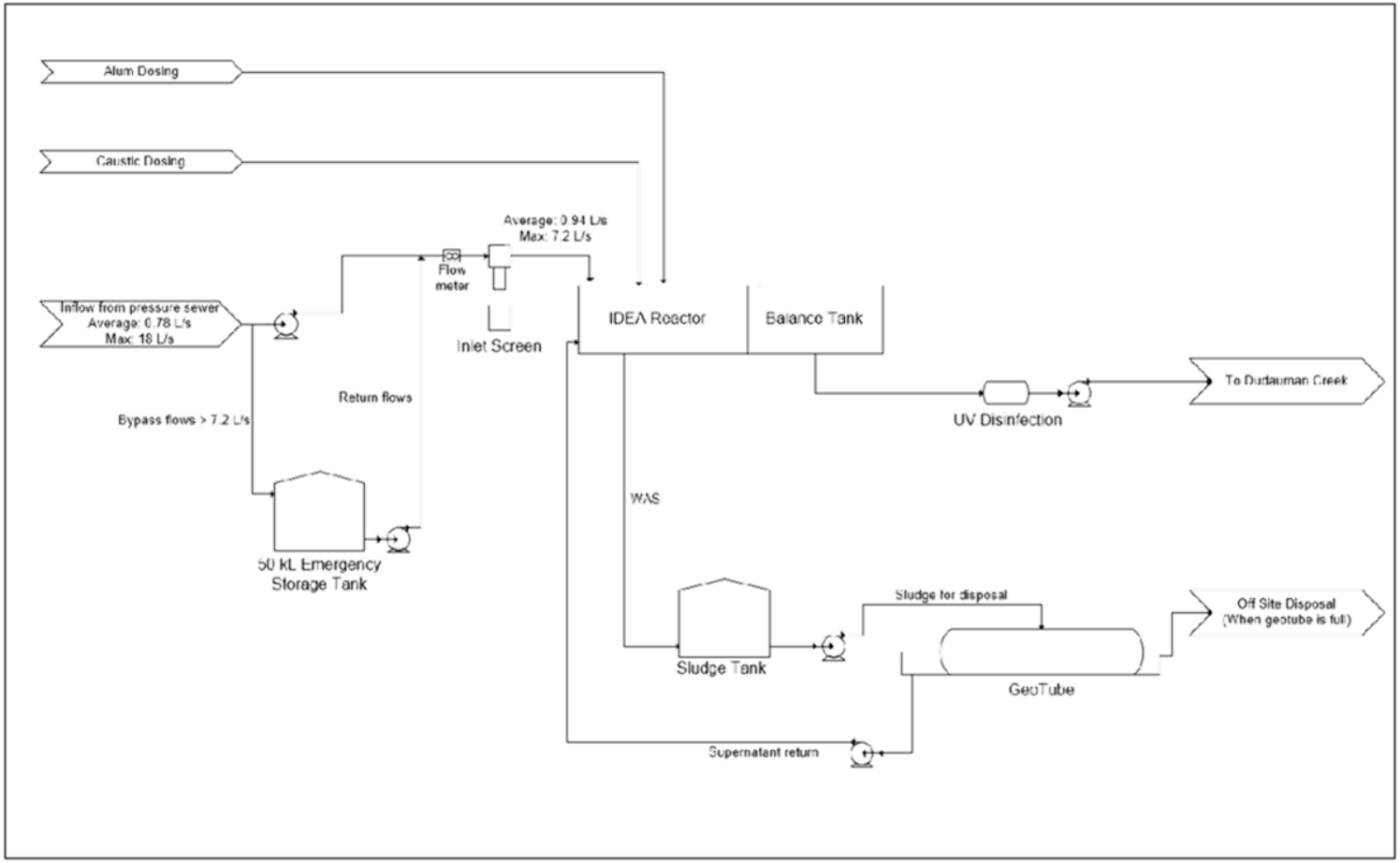


Figure 6-1: Flow Diagram For the STP

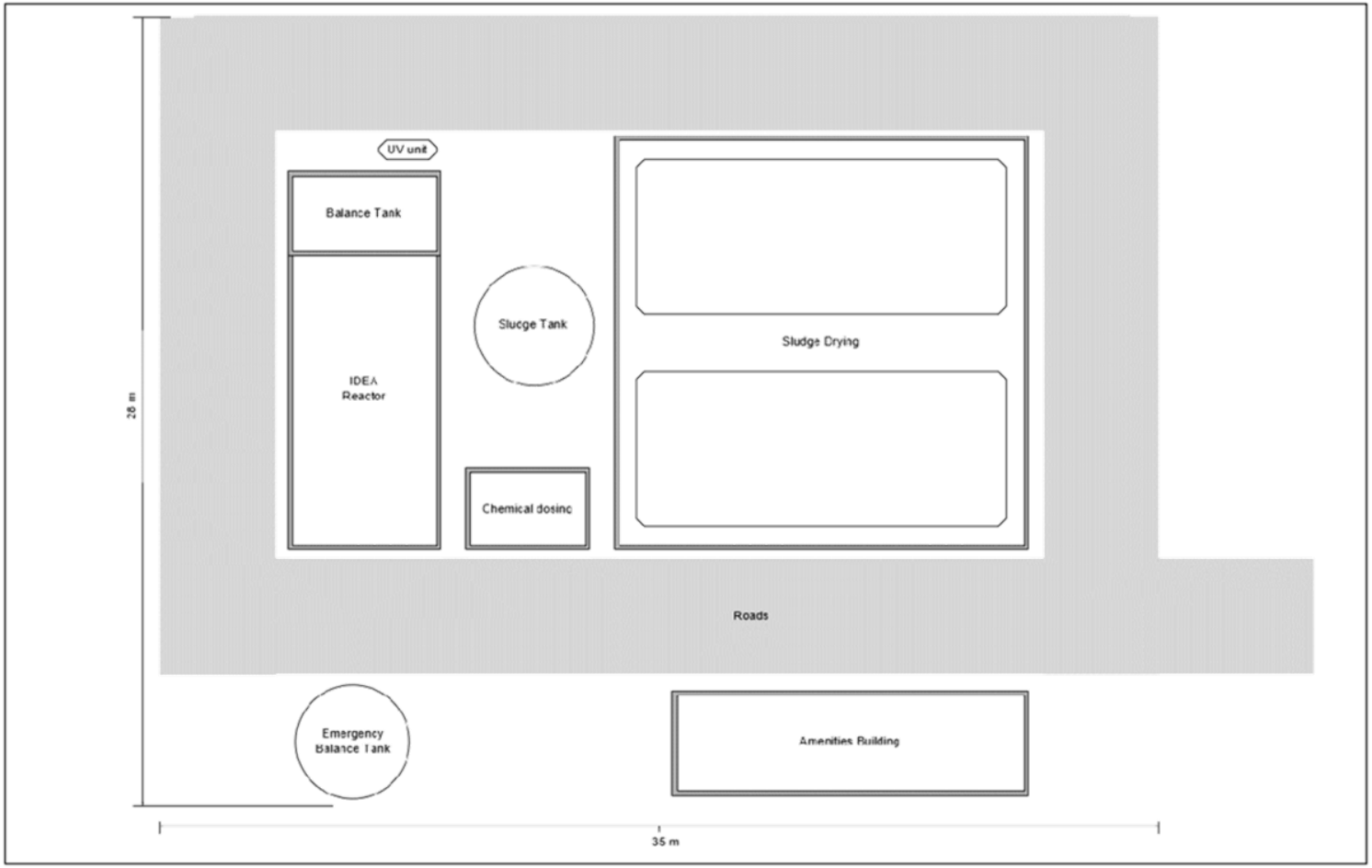


Figure 6-2: Proposed Site Layout

6.2 Inflow Balancing

The pressure sewer modelling results were used as the input to the design flow rate and emergency inflow balancing requirement for the STP.

6.2.1 Inlet Works

The inlet Works will be designed to treat the peak instantaneous inflow rate under normal conditions of 7.6 L/s.

6.2.2 IDEA Reactor

The IDEA reactor will be designed to accommodate 3.8xADWF (3.6 L/s). The reactor has sufficient capacity to absorb the instantaneous peak flows of 7.2 L/s, given that the 30 minute inflow average is below 3.6 L/s.

6.2.3 Emergency Balance After a Power Outage

The worst-case scenario for inflows to the STP is the period following an 18 hour power outage. As most of the pumps in the reticulation system will start up simultaneously, the maximum instantaneous inflow is 18 L/s. Therefore emergency storage is required. If any pressure pumps operate during the power outage (due to backup generators at pump sites), the inflow will be diverted to the emergency balance tank.

If the average inflow to the STP exceeds 3.6 L/s over a 30 minute period, all flows above 3.6 L/s will be diverted to the emergency balance tank. This will typically only happen after a long power outage.

Once the inflow has stabilised (after around 3 hours), flows from the storage tank will be pumped to the STP at a rate of 1 L/s. A 50 kL storage tank will be required. This tank will only be used occasionally (after a major power outage or if the STP is under maintenance), but as it will receive unscreened sewage, it will have to be cleaned after usage.

6.3 Inlet Works

The inflow to the STP will be macerated sewage from the town. The inlet works capacity has been based on the maximum daily instantaneous inflow of 7.2 L/s, based on normal operation.

A 0.5 mm rotary type inlet screen is proposed. The chute will be covered, and the screenings can go into a bagging unit in a collection hopper.

This is the part of the STP with the highest risk of generating odour. As such the inlet works will be epoxy coated, covered and have foul air extraction and an odour control system. The system would likely be a combined activated carbon and biological filter treatment unit.

An electromagnetic flow meter installed on the rising main will be used to monitor the inflow rate and cumulative inflow volumes.

6.4 Intermittently Decanted Extended Aeration (IDEA) Reactor

6.4.1 General

The IDEA process is the most commonly used secondary biological treatment process in NSW. IDEA is a modified form of the activated sludge treatment process. The process has been developed by PWA and is utilised at over 130 plants in NSW. This process configuration incorporates continuous influent feed to the reactor and intermittent aeration and subsequent settling and decant for clarification of effluent that allows the complex secondary treatment processes to take place in a single reactor, thus reducing capital costs and simplifying the process operation and control compared to alternative conventional processes that employ separate reactor and clarifier units (which require return activated sludge facilities).

6.4.2 Process Description

Activated sludge is composed of live and dead bacteria and algae which mediate removal of organic material and ammonia (NH_3) from the raw wastewater in the presence of oxygen, i.e. nitrification, and reduce nitrates (NO_3) and nitrites (NO_2) to gaseous nitrogen in the absence of oxygen, i.e. denitrification. These suspended micro-organisms are referred to as mixed liquor suspended solids (MLSS).

The inflow to the IDEA reactor is continuous. An operating cycle typically begins with the water level at the BWL when the decant mechanism is resting at this level and aeration is turned off. The decant mechanism is then raised and parked at the reactor TWL and aeration is turned on to start the aeration phase. The action of the aeration system, in addition to providing process oxygen, mixes the entire contents of the reactor. BOD_5 removal and biological nitrification take place during the aeration phase of the operating cycle.

During this aeration phase, the WAS pump will operate to withdraw MLSS or transfer to the sludge tanks. The quantity of activated sludge wasted from the reactor dictates the MLSS concentration within the reactor and sludge age for the process. For example, wasting 1/25th of the reactor BWL volume each day will maintain the sludge age at 25 days. Operation of the WAS pump will commence a short time period after aeration commences to ensure that reactor contents are fully mixed. The WAS will be controlled by operator adjustable timer or volume settings.

An electromagnetic flow meter installed on the WAS rising main will be used to monitor the activated sludge wastage rates and cumulative volumes. Historical trends of WAS flows recorded by the flow meter will also be capable of being displayed on the HMI screen.

After a set period of aeration has elapsed, aeration is switched off and the MLSS, which had previously been suspended throughout the reactor during aeration, begins to settle. Settlement leaves a clear supernatant layer at the top of the reactor. After a set settling period, the decanting mechanism is lowered at a controlled rate to decant the supernatant (treated effluent) that lies above the settled sludge blanket and draws the water level down to the reactor BWL.

It is during the settling and decanting phases of the operating cycle, in the absence of aeration, that biological denitrification takes place. Balancing of both the relative extent of nitrification and denitrification achieved for nitrogen removal and the oxidation of organic material in the process, requires careful design of the process cycle into the aeration, settling and decant phases.

6.4.1 New IDEA

The IDEA process will be designed to operate on the following basis:

- Full nitrification and denitrification for inflows up to 3.8xADWF
- No storm flow allowance is required for this unit.

Sizing of the reactor is based on maintaining a sludge age of 25 days assuming a process sludge yield 0.85 $gTSS/gBOD_5$.

The reactor will comprise:

- A single above ground concrete reactor of 450 EP capacity, based on a process sludge age of 25 days.
- High length to width ratio (minimum 2:1) to minimise the potential for short circuiting of flow from the reactor inlet to the end wall decanter.
- Inlet pipework from the feed pump, with a transverse diffuser manifold at one end of the reactor.
- A jet aerator with a submersible motor.
- A lowering trough type decanting mechanism. The trough will be located at the end of the reactor.

- A waste activated sludge (WAS) pump which is mounted on a plinth at ground level beside the reactor, with associated rising main and flow meter to transfer waste sludge to the sludge storage tanks.
- Outlet pipework between the decant mechanism and effluent balance tank.
- An access platform with handrails to support the decant mechanism and provide access to reactor equipment and instrumentation.
- Instrumentation for process monitoring and control, including level sensors, dissolved oxygen (DO) probes and a pH probe.

6.4.2 Inlet Zone

Flow from the balance tank will be pumped to the reactor via a transverse submerged diffuser inlet manifold. Port openings in the manifold will be positioned just above the reactor floor level to allow a relatively even distribution of sewage inflow across the full width of the reactor into the sludge blanket. This arrangement allows rapid dissipation of any temperature differential between the MLSS within the reactor and sewage inflows, minimising the potential for stratification of flow that may lead to short circuiting.

6.4.3 Aeration Equipment

Submersible jet aerators are ideal for small treatment systems. The system includes a static vertical pipe which protrudes above the water through which air is drawn by the action of the associated high-volume pump forcing mixed liquor past an eductor ring. This generates a negative pressure and draws in air which is sheared and mixed with the pumped discharge downstream of the eductor. This highly aerated diffused air-water mixture is then discharged into the reactor as a pressurized jet.

The main advantage of this type of aerator is that there is little noise other than the hiss of air entering the down-pipe and the "aeration" device is a standard, robust submersible pump.

It is less efficient in terms of energy use than diffused aeration, but the lift-in, lift-out aeration system offers a cost-effective alternative to fixed mechanical or diffused aeration systems. The aerator can be installed quickly without emptying the existing tank. Alternative aeration technologies can be investigated during the detail design phase.

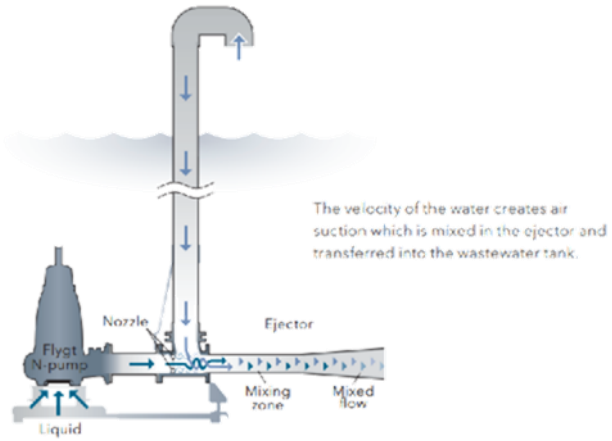


Figure 6-3: Jet Aerator Example

One 12 kW jet aerator (based on an efficiency of 0.85 kgO_2/kWh) will be required for a biological loading of 450 EP. The unit will be capable of delivering a total of 8.5 kgO_2/h as well as provide the required mixing in the tank.

6.4.4 Decant Mechanism

Decanting of effluent from the IDEA reactor will occur via an end located trough type mechanism. The trough will be positioned transverse to the longitudinal axis of the reactor and consist of a galvanised steel channel which is lowered from the TWL to BWL during the decant phase of each cycle. Lowering/raising of the decant trough is by a helical worm gear drive system and wire ropes attached to both ends of the trough. On reaching BWL at completion of the decant phase, the trough is raised to the reactor TWL to await filling of the tank under subsequent aeration and settling phases of the IDEA operating cycle.

Gradual lowering of the trough over the decant phase allows the flow of clarified effluent over the trough weir side in a controlled manner and down through the connecting outlet pipework. The outlet pipework conveys decanted effluent through the wall of the tank and into the existing effluent balance pond.

Table 6-1: Decanter Design Details

Parameter	Details
Number of troughs	1
Trough type	End wall
Weir length	5.8 m
Decant time	47 min
Maximum decant flow rate	13.6 L/s (2.3 L/m/s)

6.4.5 Waste Activated Sludge Pumping

Wastage of sludge (i.e. mixed liquor suspended solids) will be undertaken during the aeration phase of each process operating cycle.

The design sludge wasting rate is 0.8 L/s. This will be achieved by installation of a dry well type pump located under the IDEA walkway of the reactor, with suction pipework passing through the reactor wall. Pump operation will be controlled via the plant PLC and adjusted to suit the actual required wastage. WAS withdrawn by the pump during the aeration phase will be directed to the sludge storage tank via an 80 mm dia. main.

An uninstalled standby WAS pump will be kept in storage if the duty pump needs to the replaced or requires major pump overhaul/workshop servicing.

Operation of the WAS pump will normally be controlled by the operator adjusting the run time settings. However, when required to effect process changes that require operation at a different MLSS concentration for significant wastage to overcome operating problems, the operator may select to undertake wastage on an adjustable WAS volume setting. This will utilise an electromagnetic flow meter installed on the WAS rising main to monitor activated sludge wastage rates and cumulative volumes.

6.4.6 IDEA Reactor Sizing and Operation

PWA has developed a rotational method for sizing IDEA reactors. This considers the behaviour of the sludge blanket, process requirements and hydraulics within a reactor. The output of computer modelling for the proposed IDEA reactor configuration undertaken for the Stockinbingal STP is provided in summary form in Table 6-2. A 25-day sludge age has been adopted to provide a more robust design under foreseeable operational conditions with an appropriate margin of safety, and to maximise nitrification potential during the colder winter months.

Table 6-2: IDEA Reactor Design Criteria

Parameter	Value
Design EP	450 EP
Length	10 m
Width	6 m
TWL depth above reactor floor	3.7 m
BWL depth above reactor floor	3.2 m
Decanter length	5.8 m
Process Parameters	
Sludge Age	25 days
Design MLSS Concentration (at BWL)	3,700 mg/L
Sludge Settling Rate	5 m/h
DDWF Cycle	
Aeration Time	12 h/day
Aeration Time	90 mins/cycle
Mixing/Settling Time	36 mins/cycle
Decant Time	49 mins/cycle
Decanter Raising Time	5 mins/cycle
Total Cycle Time	180 mins/cycle
Aeration Requirements	
Total Oxygen Requirement	3.5 kgO_2/h
Average Standard Oxygen Transfer Rate (SOTR)	8.5 kgO_2/h

Operation of the aeration system will be DO controlled. The DO setpoint will normally be set between 1 to 2mg DO/L. The DO control will allow the aeration system to operate optimally and minimise electrical consumption and power costs. Two DO probes will be installed in the IDEA reactor to monitor the DO and to facilitate this method of process control.

Sludge age will be controlled by wasting MLSS from the reactor. The waste MLSS will be withdrawn from the reactor by a WAS pump. The WAS pump will operate for a set (adjustable) run time during the aeration phase to ensure that the sludge (i.e. MLSS) is fully mixed and to minimise the risk of 'rat-holing'. Based on a 25-day sludge age, the amount of sludge withdrawn daily will be equivalent to $1/25^{th}$ of the reactor BWL volume.

Should it be required to undertake process changes that require operation at a different MLSS concentration or if significant wastage is needed, the operator will be able to select to undertake wastage on an adjustable WAS volume setting.

Chemical dosing for P removal and/or for improving sludge settling characteristics will be directly into the IDEA reactor during the aeration phase. Dosing will be controlled by the plant PLC and sequenced to occur during the aeration phase.

6.5 Effluent Balance Tank

Balancing is required for effluent decanted from the IDEA reactor. The function is attenuating high intermittent decant flows and the higher flows after power outages. This attenuation reduces the size of UV disinfection system and effluent pump system.

A 66 kL volume is required. The balance tank will be a concrete tank at the decanting side of the IDEA reactor.

6.6 Chemical Dosing Facilities for Phosphorus Removal

Chemical dosing for phosphorus removal will be required for additional phosphorus removal before effluent discharge.

This section outlines the typical installation and sizing of units required.

6.6.1 Process description

The principle of chemical phosphorus removal is to precipitate phosphorus in the sewage using metal ions. Phosphorus must be in the ortho-phosphate form, i.e. soluble hydrolysed phosphate, to react with the metal ions added in the form of a metallic salt to the wastewater. The metal ions and the ortho-phosphate combine to form insoluble metal phosphates, this precipitate being flocculated in a settleable sludge, removed from the effluent stream.

The requirements for effective chemical phosphorus removal are:

- addition of correct quantities of chemical
- effective mixing of the chemical with the wastewater
- adjustment of pH, if required, to replenish alkalinity lost due to chemical phosphorus removal

Chemical dosing requirements are determined by the sewage P levels, and the degree of removal required. This is usually denoted as the mole ratio of the metal ion needed and the P removed. The theoretical mole ratio of metal ions added to P removed for 100% removal is 1:1. However, side reactions occur between the metal and hydroxide ions, forming metal hydroxide. This causes an increase in the metal ion dose ratio. The actual ratio would normally be between 1.5: 1 and 2.5: 1. Dose rates can be optimised by performing jar tests on the wastewater.

Three of the more commonly used chemicals for phosphorus removal are alum, ferrous chloride (spent pickle liquor) and ferric chloride.

Alum is recommended over iron based chemicals as:

- Iron based chemicals can discolour the effluent and can affect the performance of the downstream UV system
- The quality and supply of pickle liquor cannot be guaranteed. The $FeCl_2$ content of pickle liquor varies between 9 and 13% w/w, resulting in greater storage requirements (compared to liquid alum)
- Chemical sludge production for iron based chemicals is approximately double that of aluminium based chemicals, due to the higher atomic weight of iron (56 for Fe and 27 for Al).

The design criteria for the chemical phosphorus removal system are given in the following table.

Table 6-3: Design Criteria for Chemical Phosphorus Removal System

Parameter	Details
Dosing agent	Liquid aluminium sulphate (alum)
Metal ion: P removed	2.5 (Al): 1 (P removed)
Molar dose ratio	2.5 (Al): 1 (P removed)
Raw sewage TP	15 mg/L
Biological P removal	3.0 mg/L
TP of final effluent	0.5 mg/L (average)
Dosing control mechanism	Fixed dose rate into IDEA reactor during aeration phase

6.6.2 Chemical Usage

Phosphorus removal will be facilitated by a single stage dosing. Liquid alum will be dosed into the IDEA reactor during the aeration phase of its operating cycle. The dosing lines can be supported on a wire that can be placed across the reactor. Dosing will be programmed to occur during the aeration phase as this enables rapid mixing and flocculation within the reactor. The mixed liquor captures the resulting chemical sludge. Dosing into the reactor will also result in an overall improvement of the MLSS settlement rate during the settlement phase.

The estimated maximum liquid alum usage is 17 L/d at the design plant load.

6.6.3 Storage Area and Dosing Facility

Liquid alum would be delivered to the STP by chemical tanker trucks, 1 kL at a time, and will be stored in a 1.6 kL self-bunded liquid storage tank, which is sufficient for 3 months' storage. The bund will have a minimum volume of 110% of the total chemical storage tank located in the bund.

The dosing pumps are also located within the integrated bunding system. Safety shower and eyewash facilities will be provided adjacent to the storage tank for use in the event of operator (or other persons) direct contact with the chemical.

The storage tank will have two (2) sets of level indicators. One indicator will be a pressure sensor to relay a signal to the plant control system, with the second being a visual level indicator at the filling point.

6.6.4 Dosing Pumps

Dosing pump operation will be PLC controlled. Two (2) x 1 L/h dosing pumps (automatic duty and standby) will dose alum into the IDEA reactor during the aeration phase to enable rapid mixing and flocculation within the reactor.

The dosing pump operation will be PLC controlled for dosing to occur during the IDEA reactor aeration phase to ensure adequate mixing. Dosing will be at a fixed set rate (i.e. not flow paced). The reactor should sufficiently balance the inflow to offset any variations in influent wastewater P loads. Hence, changes of dose rates due to diurnal variations in inflow should not be required.

6.7 Chemical Dosing System for pH Correction

pH correction might be required due to the alum dosing, depending on the incoming alkalinity.

If pH correction is required it would be similar to the alum system, but the chemical would be caustic soda. A 1.6 kL self-bunded caustic soda tank and 1 L/h dosing pumps (automatic duty and standby) will be provided.

A set of pH sensors will be installed in the IDEA reactor. The caustic dosing pumps will only dose during the aeration phase to ensure adequate mixing of the caustic soda when the reactor pH falls below a minimum pH set point. Dosing rates will be fixed at a set rate (i.e. not flow paced) which will be operator adjustable.

6.8 Effluent Pumping

An effluent pump has been allowed for to transfer flows from the STP to Dudauman Creek. However, survey results might show that the effluent can gravitate from the catch tank through the UV system to the creek. This will be confirmed during the detail design phase.

6.9 Disinfection

Artificial UV will be required to provide disinfection of the effluent before discharge. The UV system will be sized for 0.78 L/s.

Table 6-4: Design Parameters for the UV System

Parameter	Value
Flow rate	0.78 L/s
UV wavelength	254 nm
Maximum ON/OFF switched per day	4
Design UVT	50%
Minimum lamp life	12,000 hours
Influent faecal coliform	1,000,000 CFU/100ml
Disinfection faecal coliform target	200 CFU/100ml (90th percentile)

6.10 Sludge Dewatering

After the inlet works, the sludge handling has the second highest risk of generating odours. A geobag system is proposed for sludge drying, as this process reduces the odours from the sludge as it is dried fairly quickly. In addition, sludge does not need to be stabilised before being pumped to the geobags. This process is also not very labour intensive except that when the bag is full it will need to be emptied via a loader and truck, this will be required once a year.

The dried sludge will be Stabilisation Grade C, which is suitable for landfill, but not agricultural reuse.

6.10.1 Operation

WAS from the IDEA reactor will be pumped to a sludge collection tank. From there, sludge is pumped to the geobag. The geobag traps the solids and effluent water drains through the pores. Over 99% of solids are captured, and clear filtrate can be collected and recirculated through the system. Filling the geobag with solids and draining the filtrate is a continuous process.

After the final cycle of filling and dewatering, the solids remain in the bag and continue to densify due to desiccation as residual water vapor escapes through the fabric. Volume reduction can be as high as 90%. When full, the geobag and contents can be deposited at a landfill.

6.10.2 Sizing

The process will produce approximately 420 m^3 sludge per year. If the sludge is dewatered to a final solids content of 15%, the total dry cake per year would be 83 m^3.

Two 83 m^3 bags are required in order to cycle between the units. The bags will be placed in a 14x14 m bund. Therefore, several truck loads will be required to transport the dried sludge to the Cootamundra Landfill site 25 km from the STP.

Table 6-5: Sludge Drying Design

Original in situ and final tube properties		
V_0	420	Sludge Volume rate (m^3/yr)
S_t	15%	Final in tube solids concentration of dewatered material (%)
S_0	3%	Original in situ solids concentration of sludge (%)
G	1.1	Specific gravity of solids in sludge
V_t	**83.1**	Final in tube volume of dewatered material (m^3/yr)

6.11 Amenities Building

This building will incorporate:

- an electrical switchroom
- a laboratory
- an office/lunch room
- a unisex/disabled toilet with shower
- a control room to accommodate the HMI control system
- a storage room.

The size of the building will be approximately 12 m x 6 m. A 1.5 m wide concrete veranda along the main entrance facade and a 1 m footpath around the rest of the building will be provided. Alternatively, a containerised amenities building can be provided to reduce the construction cost.

6.12 Electrical System

The following concept for electrical works should be considered only as a preliminary basis for design. Details may change during detailed design and development, and confirmation of power supply arrangement with the Electricity Distributor.

6.12.1 Power Supply

The electricity network solution for the new Sewage Treatment Plant has been based on a plant peak demand of 50 kW. This includes adequate spare capacity for future use.

The closest Essential Energy network infrastructure is a single-phase pole mounted substation that is on the shared boundary of Lot 7003 DP94543 with Lot 279 DP750619, with the pole positioned adjacent to Old Wallendbeen Road. This single-phase overhead power line is connected to a three-phase overhead power line on the eastern side of Old Wallendbeen Road within private property. It has been assumed that the three-phase power line has available capacity for the additional 50 kW

demand. This can only be verified when a connection application is lodged with Essential Energy as part of the design phase.

The scope of works will be:

1. Upgrade the single-phase HV power line to a three-phase HV power line.
2. Replace the existing substation power pole.
3. Upgrade the pole mounted transformer to a 200 kVA, three phase unit.
4. Reconnect the existing customer's service mains.
5. Install a customer LV pillar near to the new pole mounted substation, with service mains connected from the upgraded pole mounted substation to the customer LV pillar. This will allow the STP consumer's mains to be connected and not restricted by the distance limits for service mains.
6. Essential Energy statutory fees and Design Fees.
7. The customer LV pillar will be approximately 115 m from the new STP Main Switchboard.

6.12.2 Photovoltaic Power Supply

To offset the power cost of the operation of the STP, a small Photovoltaic (PV) system could be investigated during the detail design phase to provide alternative power to the STP.

6.12.3 STP Electrical Switchboard

A new electrical switchboard will be provided for the STP. This switchboard will be an indoor type, IP54, Form 3b/4 type to AS/NZS 3439.1 and will be located inside the new switchroom in the amenities building.

6.12.4 Meter Box

A new meter box will be provided for revenue metering and will be located on an external wall of the new electrical switchroom.

6.12.5 Provision for back-up power supply arrangement

Provisions for back-up power supply from a portable generator will be incorporated into the new Switchboard. A manually operated source change-over switch will be included.

6.12.6 PLC Panel

A PLC Panel will be provided as part of the Electrical Switchboard; and will be located in a segregated compartment.

6.12.7 HMI (Touch Screen)

The STP will include an HMI (Touch Screen) for operation and control. The HMI will be located on the front door of the PLC Panel/Compartment. This will help the Council Operator to view equipment status and alarms, make operational changes to operator adjustable settings, monitor/acknowledge/reset alarm conditions and undertake switching between manual and automatic equipment control.

The HMI system will interface with the new PLC panel and the telemetry system for remote access and monitoring. A telemetry system will be included for remote monitoring.

If required, a SCADA system could be provided instead of the HMI system. This has not been costed.

6.12.8 Cable and Cable Supports

New cabling will be provided to new equipment and systems. New underground conduits will be provided for installation of new cabling.

6.12.9 Emergency Stop Switches

Emergency stop switches will be provided for each motor and drive in compliance with AS/NZS 3000:2018, AS/NZS 4024.1, and current WHS regulations.

Each emergency stop switch will be mounted at a suitable location close to the respective drive/pump motor and will be readily and conveniently accessible.

6.12.10 Building Services

Building services will include LED lighting for daytime and night-time operation, EXIT lights and general power outlets (GPO). The building will include a smoke and fire alarm system and a new reverse-cycle air-conditioning system in the electrical switchroom, control room and laboratory.

7. Project Costs

7.1 Pressure Sewerage Network

A summary of the Pressure Sewer Network Costs based on the concept design is shown in Table 7-1. A detailed costing is provided in Appendix F.

These costs have been developed based on the quantity of items to be supplied and installed (number of PSS units and pipe lengths) and identified rates.

The quantity of items to be installed was determined based on the Basis of Design document, the concept design layout or the hydraulic model (e.g. pipe lengths). Rates used for developing the project cost have been based on available rates and discussions with suppliers or contractors where possible.

An allowance has been made for the railway underbore of approximately 40 m in length.

For pipe lengths an additional 10% allowance has been made for changes during detail design and to reflect the level of design (concept design level). In addition, five air valves and vent shafts have been allowed for, however based on the concept design, no vent shafts are required. These values have been added to the contingency.

Another thing to note, is that the properties outside the village boundary contribute to a significant part of the capital, due to the long reticulation lines. The total cost of expanding the network beyond the village network is around $800,000.

The cost of the audit and possible replacement of non-complying electrical distribution boards has not been allowed for in the cost estimate.

Table 7-1: Pressure Sewerage Network – Cost Estimation Summary

	Cost Item	Cost (includes GST)
1.	Site Establishment	$110,000
2.	Pressure Units	$1,373,200
3.	Reticulation	$1,365,000
4.	Miscellaneous	$44,000
	Sub Total – Direct Construction Costs	**$2,892,200**
	Contractor Indirect Costs	$144,610
	Total Construction Costs	**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)	$682,800
	Survey, Investigation, Design and Project Management	$289,220
	Total Estimated Project Cost[1]	**$4,008,830**

Note: 1 – Total Estimated Project Costs do not include client costs such as community consultation and client liaison by the project manager.

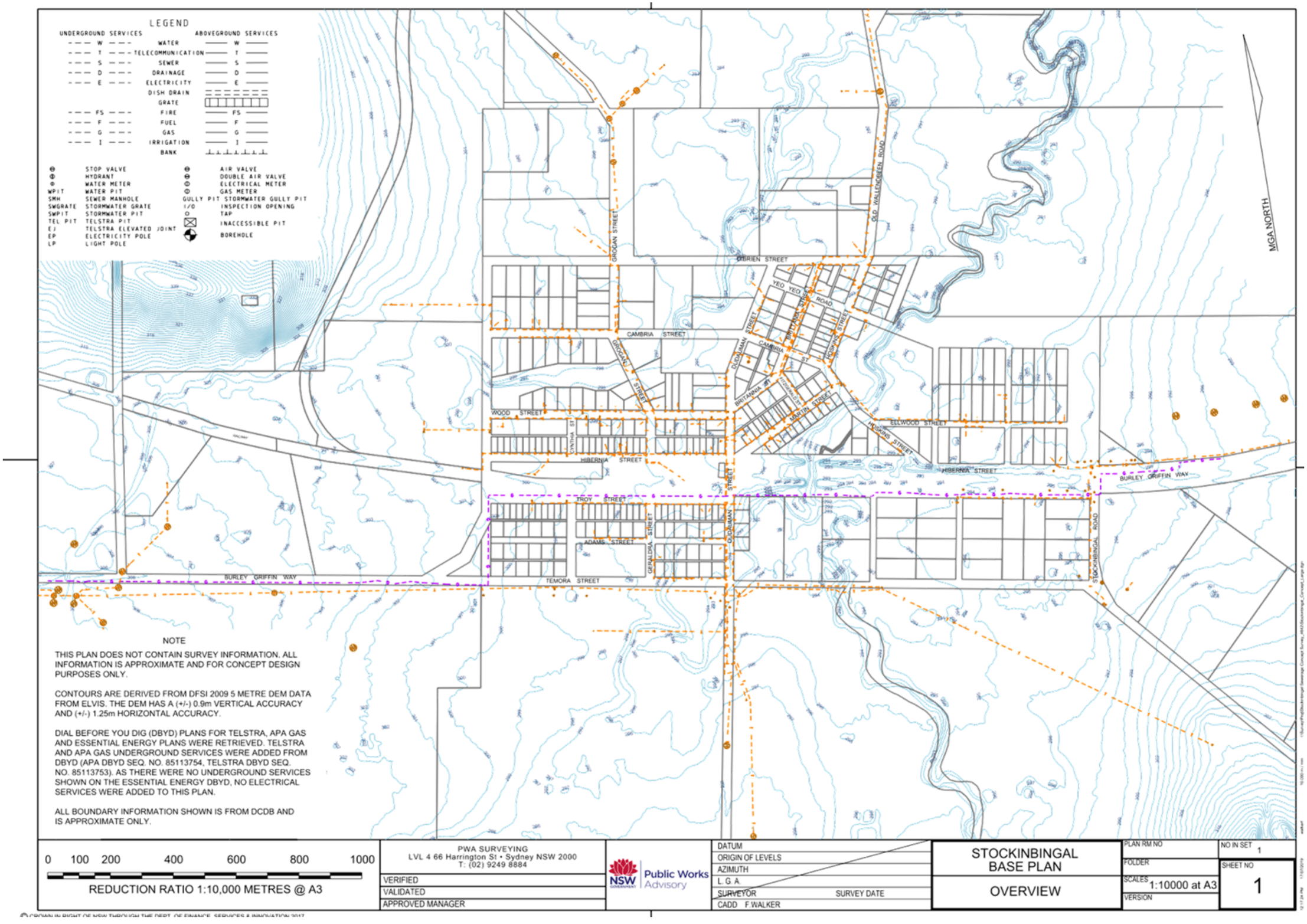
7.2 Sewage Treatment Plant Cost

The following table shows the cost estimate for a concrete IDEA reactor plant. A detailed estimated costing is provided Appendix F.

Table 7-2: STP - Cost Summary

Item No	Description	Cost (includes GST)
5.	Site Establishment	$108,000
6.	Roadworks and Site Drainage	$90,000
7.	Emergency Balance Tank	$25,200
8.	Inlet Works	$90,000
9.	Concrete IDEA reactor and balance tank	$728,471
10.	Sludge Tank	$18,200
11.	Sludge Dewatering	$83,700
12.	Chemical Dosing	$20,000
13.	Disinfection	$30,000
14.	Treated effluent outfall pump	$9,000
15.	Amenities Building	$200,000
16.	Pipework, Valves and Fittings	$72,500
17.	Installation/Testing/Commissioning	$145,000
18.	Electrical Works	$364,100
19.	Potable water connection to STP	$10,000
20.	Miscellaneous	$90,000
	Subtotal	**$2,084,171**
	Project Contingency (20%)	$416,834
	Survey, investigation, design and project management (10%)	$208,417
	Total Estimated Capital Cost	**$2,709,422**

Appendix A Survey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GAS
IRRIGATION
BANK
STOP VALVE
HYDRANT
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WATER PIT
SEWER MANHOLE
STORMWATER GRATE
STORMWATER PIT
TELSTRA PIT
TELSTRA ELEVATED JOINT
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LIGHT POLE
AIR VALVE
DOUBLE AIR VALVE
ELECTRICAL METER
GAS METER
GULLY PIT STORMWATER GULLY PIT
INSPECTION OPENING
TAP
INACCESSIBLE PIT
BOREHOLE
MGA NORTH
O'BRIEN STREET
OLD WALLENDBEEN ROAD
CAMBRIA STREET
WOOD STREET
HIBERNIA STREET
ELLWOOD STREET
BURLEY GRIFFIN WAY
TROY STREET
ADAMS STREET
TEMORA STREET
STOCKINBINGAL ROAD
NOTE
THIS PLAN DOES NOT CONTAIN SURVEY INFORMATION. ALL INFORMATION IS APPROXIMATE AND FOR CONCEPT DESIGN PURPOSES ONLY.
CONTOURS ARE DERIVED FROM DFSI 2009 5 METRE DEM DATA FROM ELVIS. THE DEM HAS A (+/-) 0.9m VERTICAL ACCURACY AND (+/-) 1.25m HORIZONTAL ACCURACY.
DIAL BEFORE YOU DIG (DBYD) PLANS FOR TELSTRA, APA GAS AND ESSENTIAL ENERGY PLANS WERE RETRIEVED. TELSTRA AND APA GAS UNDERGROUND SERVICES WERE ADDED FROM DBYD (APA DBYD SEQ. NO. 85113754, TELSTRA DBYD SEQ. NO. 85113753). AS THERE WERE NO UNDERGROUND SERVICES SHOWN ON THE ESSENTIAL ENERGY DBYD, NO ELECTRICAL SERVICES WERE ADDED TO THIS PLAN.
ALL BOUNDARY INFORMATION SHOWN IS FROM DCDB AND IS APPROXIMATE ONLY.
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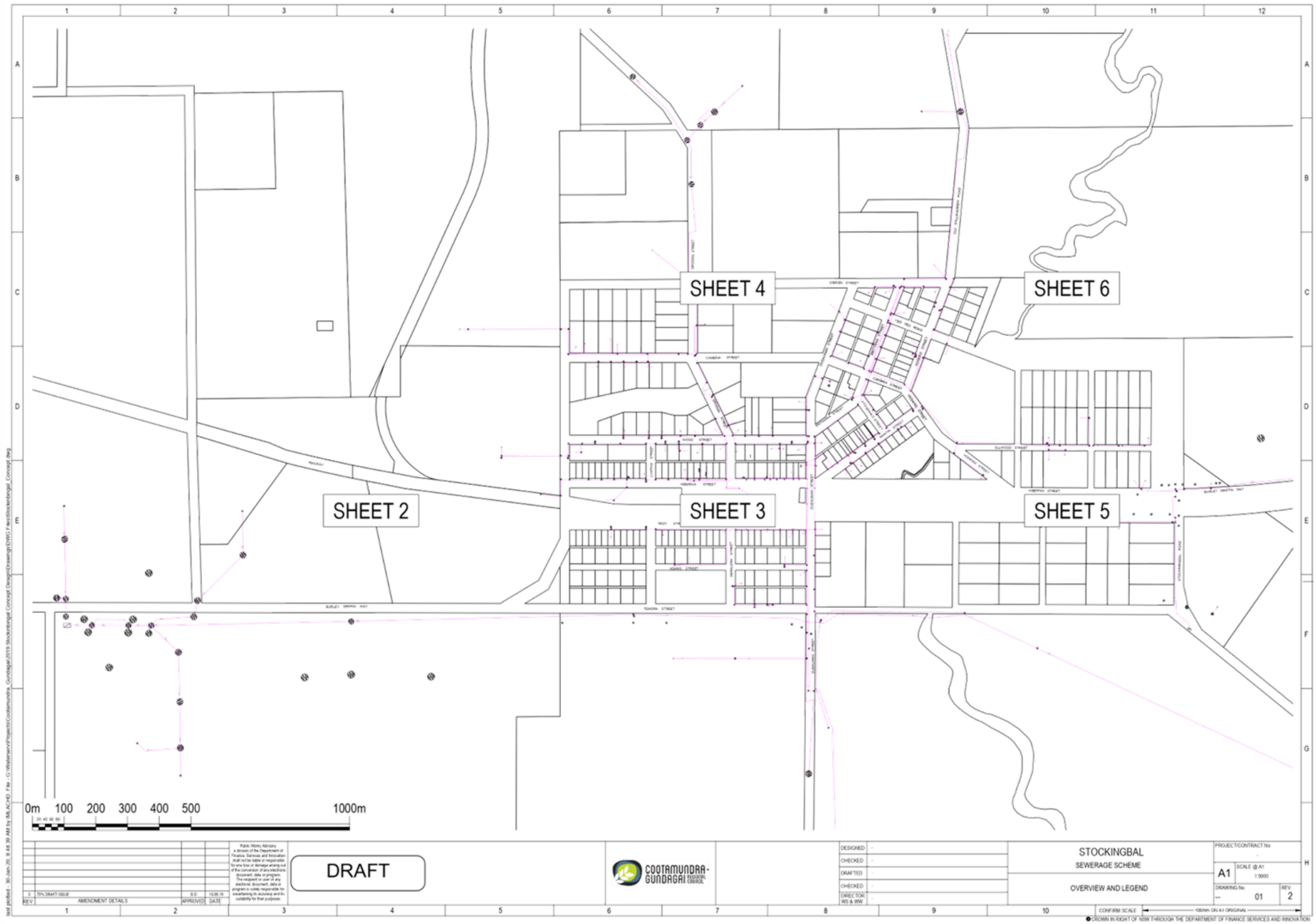
REDUCTION RATIO 1:10,000 METRES @ A3
PWA SURVEYING
LVL 4 66 Harrington St • Sydney NSW 2000
T: (02) 9249 8884
VERIFIED
VALIDATED
APPROVED MANAGER
Public Works Advisory
DATUM
ORIGIN OF LEVELS
AZIMUTH
L. G. A.
SURVEYOR
SURVEY DATE
CADD F.WALKER
STOCKINBINGAL BASE PLAN
OVERVIEW
PLAN RM NO
FOLDER
SCALES 1:10000 at A3
VERSION
NO IN SET 1
SHEET NO 1

Appendix B Preferred Network Layout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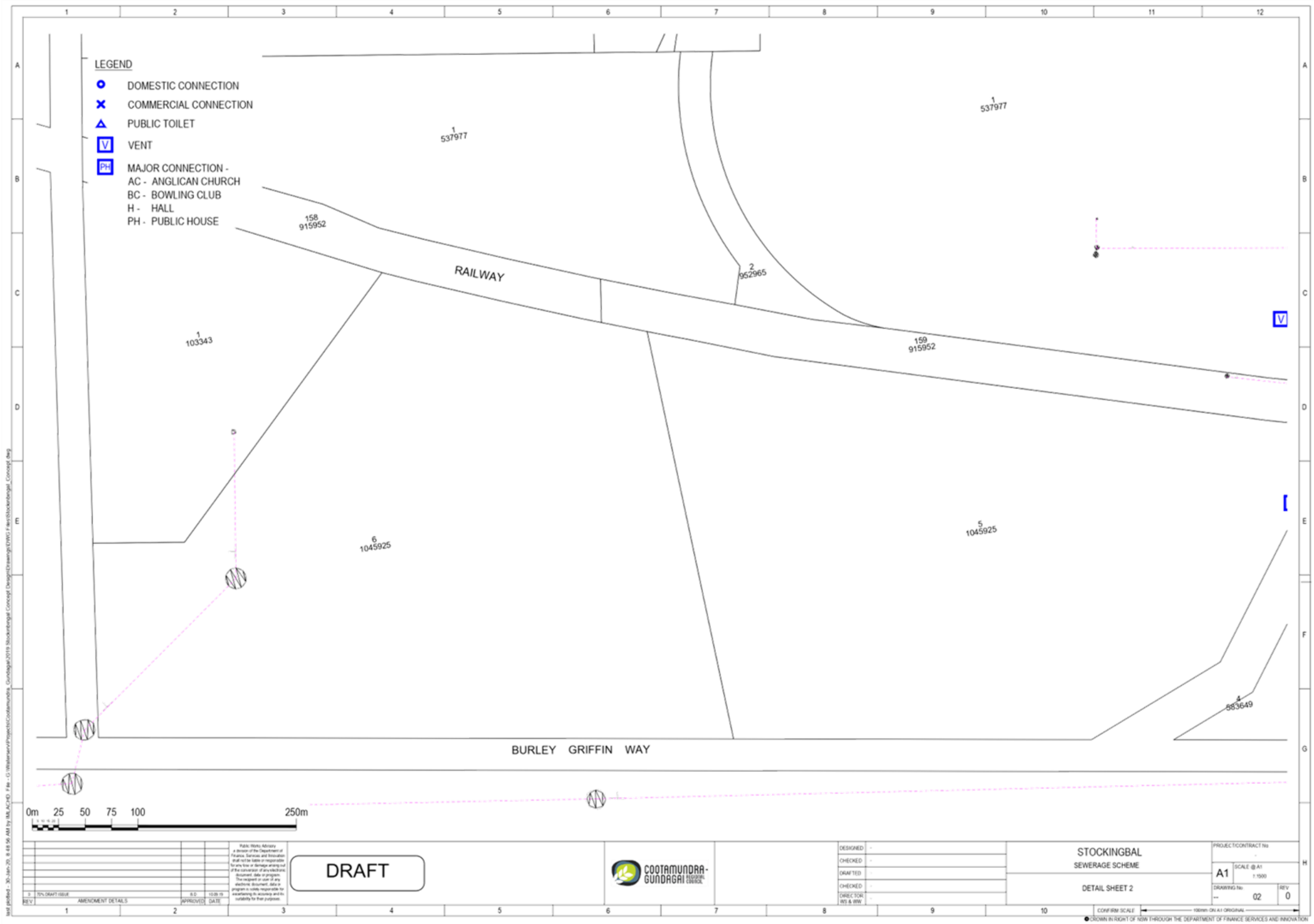
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RAILWAY
2 952965
159 915952
1 103343
6 1045925
5 1045925
4 883649
BURLEY GRIFFIN WAY
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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
STOCKINGBAL
SEWERAGE SCHEME
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WOOD STREET
CYNTHIA STREET
HIBERNIA STREET
BRITANNIA STREET
FITZGERALD STREET
MARTIN STREET
DUDAUMAN STREET
TROY STREET
ADAMS STREET
GERALDRA STREET
TEMORA STREET
LEGEND
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COMMERCIAL CONNECTION
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MAJOR CONNECTION -
AC - ANGLICAN CHURCH
BC - BOWLING CLUB
H - HALL
PH - PUBLIC HOUSE
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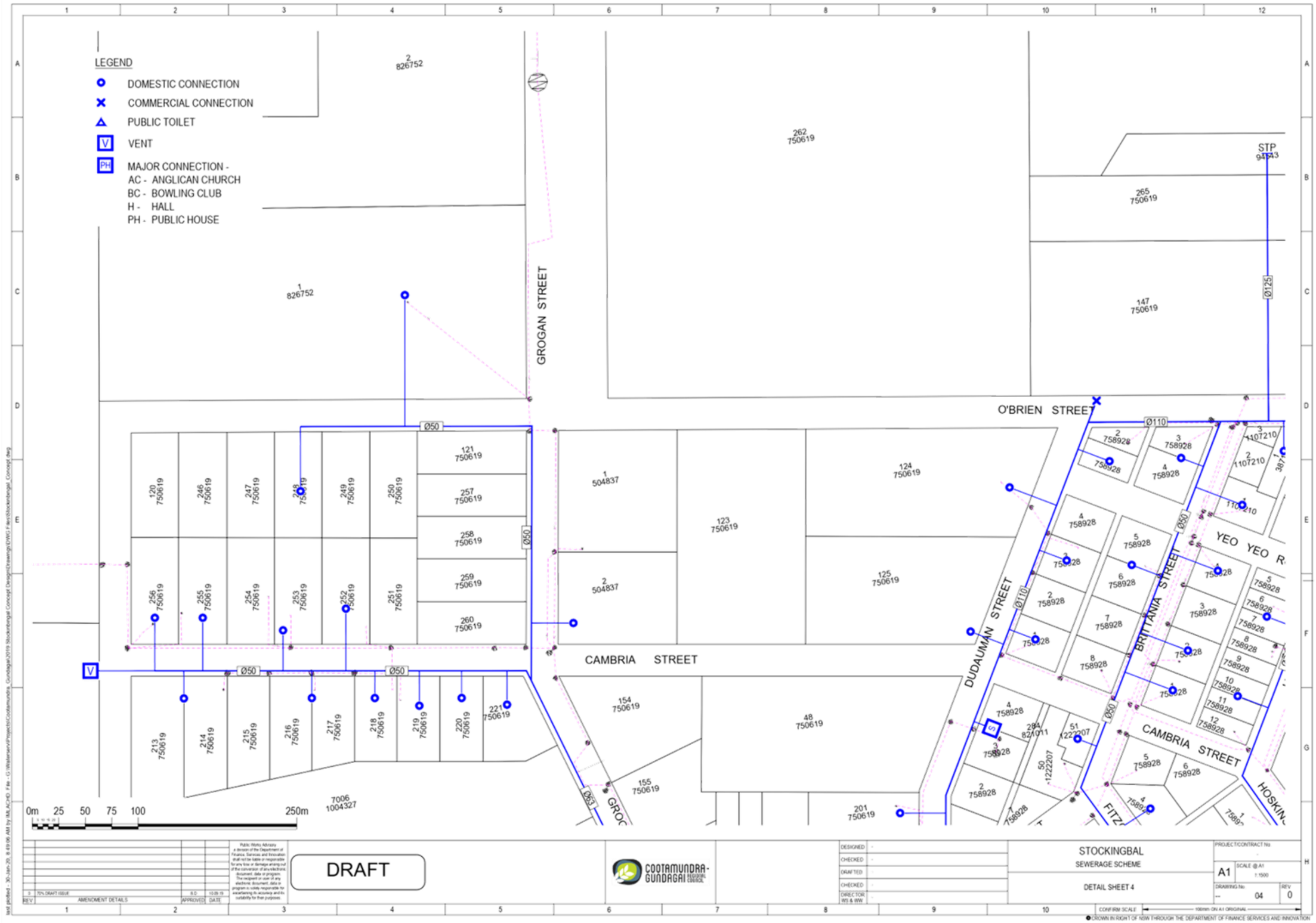
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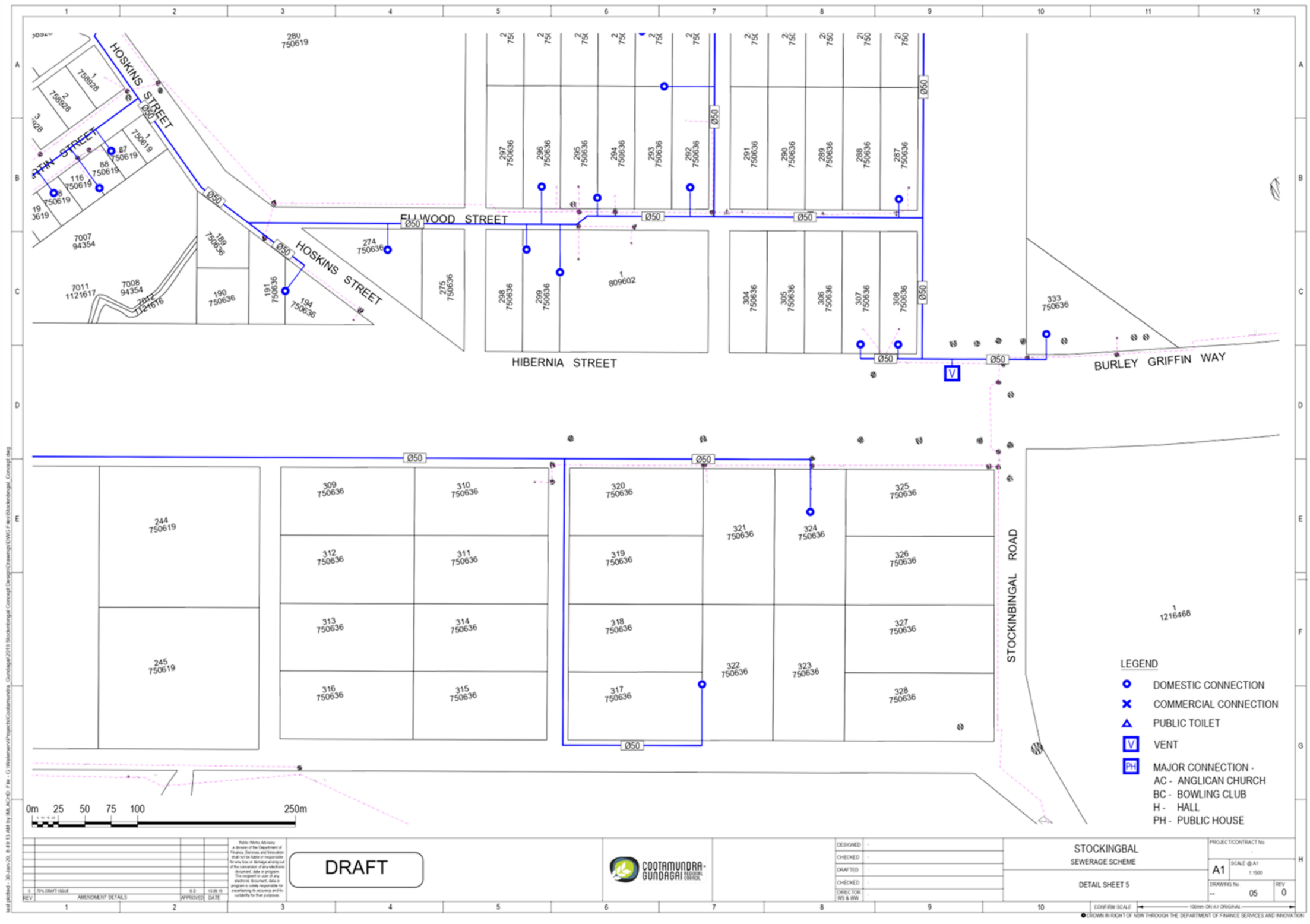
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MAJOR CONNECTION -
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BC - BOWLING CLUB
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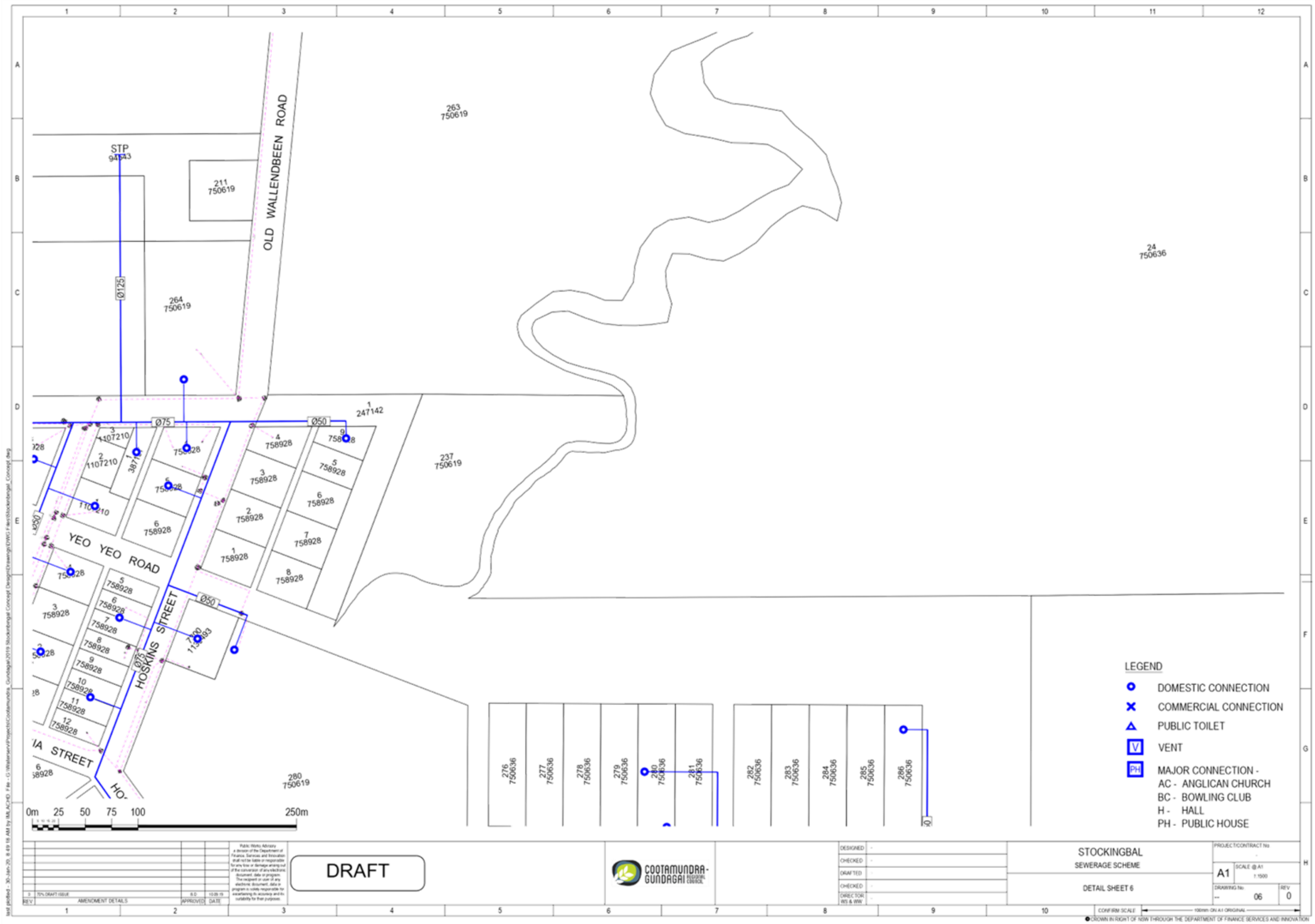
CROWN IN RIGHT OF NSW THROUGH THE DEPARTMENT OF FINANCE SERVICES AND INNOVATION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STP
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COOTAMUNDRA-GUNDAGAI REGIONAL COUNCIL
STOCKINGBAL
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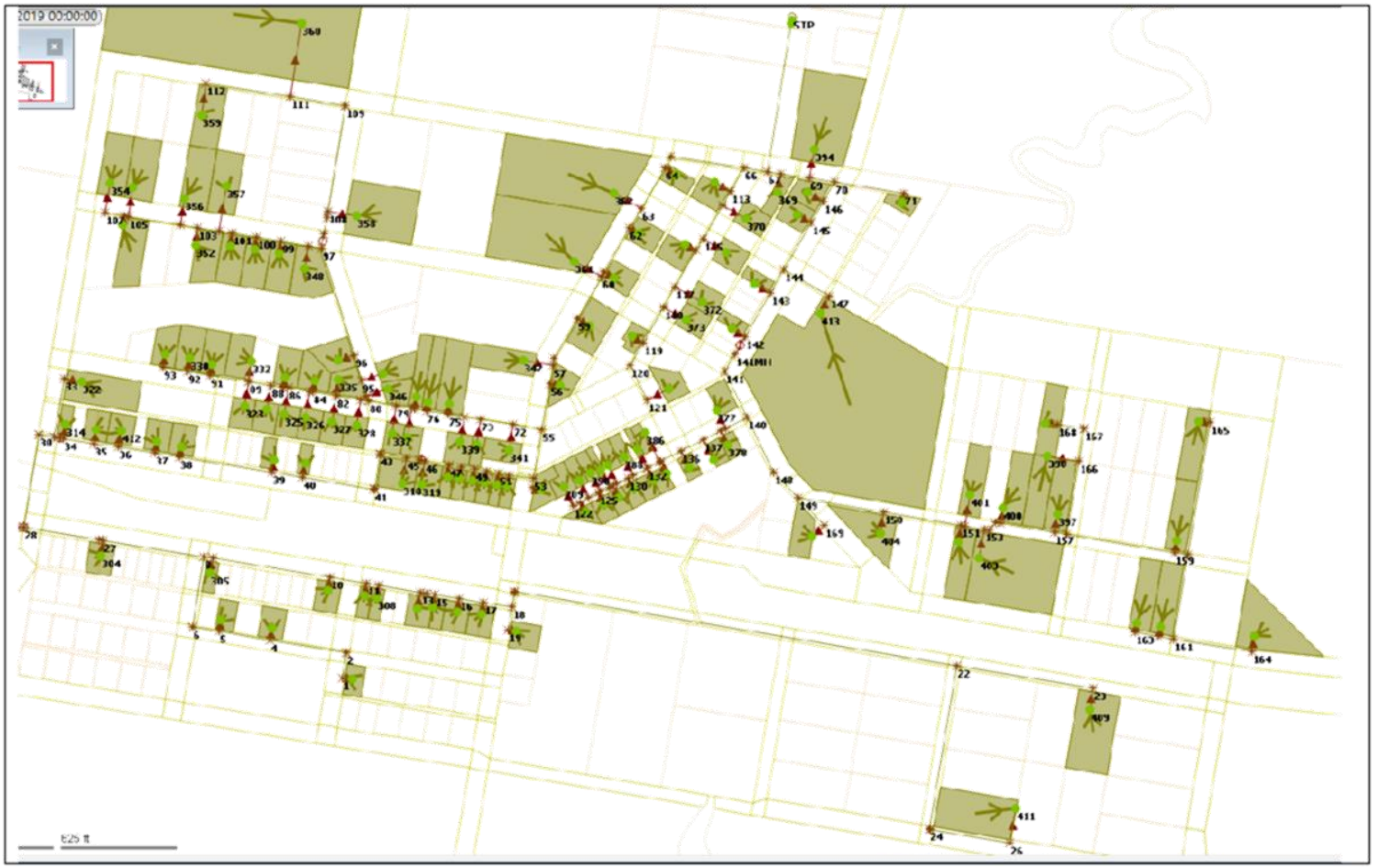
Public Works Advisory

Stockinbingal Sewerage Scheme

Concept Design Report

Appendix C Node Map



Appendix D Hydraulic Modelling Output

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
1	2	41	40	296.35	295.35	0.65	0.521	0.65	0.521	296.4	297	295.4	296
10	9	192.8	40	297.337	297.337	0.98	0.776	0.98	0.776	297.4	298	297.4	298
100	99	40.2	40	298.337	297.337	0.84	0.671	0.84	0.671	298.4	299	297.4	298
101	100	40.1	40	298.337	298.337	0.82	0.653	0.82	0.653	298.4	299	298.4	299
102	101	21.3	40	298.337	298.337	0.77	0.613	0.77	0.613	298.4	299	298.4	299
103	102	33.9	40	298.337	298.337	0.76	0.601	0.76	0.601	298.4	299	298.4	299
104	103	29.3	40	298.35	298.35	0.71	0.567	0.71	0.567	298.4	299	298.4	299
105	104	85.4	40	298.35	298.35	0.7	0.558	0.7	0.558	298.4	299	298.4	299
106	105	6.3	40	298.35	298.35	0.69	0.55	0.69	0.55	298.4	299	298.4	299
107	106	30.8	40	299.91	298.35	0.69	0.549	0.69	0.549	300	300	298.4	299
108	108MH	10.8	40	297.35	297.75	1.92	1.53	1.92	1.53	297.4	298	297.85	298
108MH	108F1	25.6	40	297.35	297.35	0.85	0.679	0.86	0.682	297.85	298	297.85	298
109	108	172.5	40	296.35	297.35	0.88	0.698	0.86	0.687	296.4	297	297.4	298
11	10	59.4	40	296.337	297.337	0.98	0.778	0.98	0.778	296.4	297	297.4	298
110	109	1.5	40	296.35	296.35	0.7	0.554	0.7	0.554	296.4	297	296.4	297
111	110	90.1	40	296.35	296.35	0.68	0.542	0.68	0.542	296.4	297	296.4	297
112	111	136.9	40	298.35	296.35	0.67	0.537	0.67	0.537	298.4	299	296.4	297
113	66	43.2	40	294.337	294.337	1.25	0.998	1.25	0.998	294.4	295	295	295
114	113	26.7	40	294.337	294.337	1.26	0.999	1.26	0.999	294.4	295	294.4	295
115	114	63.2	40	294.337	294.337	1.26	1	1.26	1	294.4	295	294.4	295
116	115	21.2	40	294.337	294.337	1	0.797	1	0.797	294.4	295	294.4	295
117	116	68.4	40	294.337	294.337	0.7	0.557	0.7	0.557	294.4	295	294.4	295
118	117	37.3	40	294.35	294.35	0.69	0.545	0.69	0.545	294.4	295	294.4	295
119	118	66.2	40	294.35	294.35	0.68	0.538	0.68	0.538	294.4	295	294.4	295
12	11	19.9	40	296.337	296.337	0.98	0.78	0.98	0.78	296.4	297	296.4	297
120	119	43	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
121	120	61.7	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
122	123	12.8	40	295.35	295.35	1.31	1.04	1.31	1.04	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
123	124	15.4	40	295.35	294.35	1.79	1.428	1.79	1.428	295.4	296	294.4	295
124	125	17.8	40	294.35	294.35	1.77	1.406	1.77	1.406	294.4	295	294.4	295
125	126	3.7	40	294.35	294.35	1.77	1.411	1.77	1.411	294.4	295	294.4	295
126	127	16	40	294.35	294.35	1.76	1.399	1.76	1.399	294.4	295	294.4	295
127	128	6.1	51	294.337	294.337	2.17	1.064	2.17	1.064	294.4	295	294.4	295
128	129	7.6	51	294.337	294.337	2.16	1.057	2.16	1.057	294.4	295	294.4	295
129	130	19.9	51	294.337	294.337	2.15	1.051	2.15	1.051	294.4	295	294.4	295
13	12	68.6	40	296.337	296.337	0.98	0.782	0.98	0.782	296.4	297	296.4	297
130	131	10.1	51	294.337	294.337	2.13	1.045	2.13	1.045	294.4	295	294.4	295
131	132	25.2	51	294.337	294.337	2.12	1.038	2.12	1.038	294.4	295	294.4	295
132	133	1.5	51	294.337	294.337	2.11	1.032	2.11	1.032	294.4	295	294.4	295
133	134	23	51	294.337	294.337	2.1	1.026	2.1	1.026	294.4	295	294.4	295
134	135	2	51	294.337	294.337	2.08	1.02	2.08	1.02	294.4	295	294.4	295
135	136	36.3	51	294.337	293.337	2.07	1.014	2.07	1.014	294.4	295	293.4	294
136	137	41.1	51	293.337	293.337	2.06	1.009	2.06	1.009	293.4	294	293.4	294
137	138	31.1	51	293.337	293.337	2.05	1.004	2.05	1.004	293.4	294	293.4	294
138	139	9.4	51	293.337	292.337	2.04	0.999	2.04	0.999	293.4	294	292.4	293
139	140	37.9	51	292.337	292.337	2.03	0.994	2.03	0.994	292.4	293	292.4	293
14	13	10.8	40	296.337	296.337	0.65	0.518	0.65	0.518	296.4	297	296.4	297
140	141	82.6	61	292.325	293.778	2.59	0.887	2.6	0.889	292.4	293	294	294
141	141MH	32.9	61	293.6	293.109	3.82	1.306	3.83	1.309	294	294	294	294
142	143	80.5	61	292.325	292.325	1.76	0.603	1.76	0.603	292.4	293	292.4	293
143	144	44.8	61	292.325	292.325	1.76	0.602	1.76	0.602	292.4	293	292.4	293
144	145	87.7	61	292.325	292.325	1.76	0.602	1.76	0.602	292.4	293	292.4	293
145	146	38.9	61	292.325	292.325	2.27	0.777	2.27	0.777	292.4	293	292.4	293
146	70	36.4	61	292.325	292.325	2.27	0.776	2.27	0.776	292.4	293	292.4	293
147	144	85.4	40	292.35	292.35	0.71	0.563	0.71	0.563	292.4	293	292.4	293
148	140	97.5	40	290.337	292.337	0.86	0.683	0.86	0.683	290.4	291	292.4	293

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
149	148	57.4	40	291.337	290.337	0.86	0.686	0.86	0.686	291.4	292	290.4	291
15	14	12.3	40	296.35	296.35	0.65	0.517	0.65	0.517	296.4	297	296.4	297
150	149	140.4	40	291.337	291.337	0.87	0.693	0.87	0.693	291.4	292	291.4	292
151	150	127.5	40	291.337	291.337	0.88	0.699	0.88	0.699	291.4	292	291.4	292
152	151	5.9	40	291.337	291.337	0.89	0.707	0.89	0.707	291.4	292	291.4	292
153	152	31.9	40	291.337	291.337	0.9	0.717	0.9	0.717	291.4	292	291.4	292
154	153	7.8	40	291.337	291.337	0.66	0.528	0.66	0.528	291.4	292	291.4	292
155	154	16.5	40	291.337	291.337	0.67	0.535	0.67	0.535	291.4	292	291.4	292
156	155	7.7	40	291.337	291.337	0.68	0.543	0.68	0.543	291.4	292	291.4	292
157	156	88.4	40	291.337	291.337	0.69	0.551	0.69	0.551	291.4	292	291.4	292
158	157	19.5	40	291.337	291.337	0.71	0.561	0.71	0.561	291.4	292	291.4	292
159	158	177	40	292.337	291.337	0.79	0.629	0.79	0.628	292.4	293	291.4	292
16	15	40.2	40	296.35	296.35	0.64	0.507	0.64	0.506	296.4	297	296.4	297
160	159	22.7	40	292.337	292.337	0.83	0.66	0.83	0.66	292.4	293	292.4	293
161	160	137.9	40	293.25	292.25	0.92	0.728	0.91	0.728	293.3	294	292.4	293
162	161	25.1	40	293.25	293.25	0.62	0.49	0.62	0.49	293.3	294	293.3	294
163	162	39.5	40	293.25	293.25	0.63	0.504	0.63	0.504	293.3	294	293.3	294
164	161	127.6	40	294.25	293.25	0.63	0.504	0.63	0.504	294.3	295	293.3	294
165	160	216.7	40	292.35	292.35	0.63	0.498	0.63	0.498	292.4	293	292.4	293
166	158	119	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
167	171	1	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
168	167	42.4	40	291.35	291.35	0.63	0.505	0.63	0.505	291.4	292	291.4	292
169	149	61.6	40	291.35	291.35	0.67	0.533	0.67	0.533	291.4	292	291.4	292
17	16	40.2	40	295.35	296.35	0.63	0.5	0.63	0.5	295.4	296	296.4	297
171	166	53.4	40	291.35	291.35	0.61	0.484	0.61	0.484	291.4	292	291.4	292
18	17	46.4	40	295.35	295.35	0.61	0.488	0.61	0.488	295.4	296	295.4	296
19	18	37.8	40	294.35	295.35	0.66	0.526	0.66	0.526	294.4	295	295.4	296
2	3	1.5	40	295.35	295.35	0.65	0.514	0.65	0.514	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
20	18	24.7	40	295.35	295.35	0.56	0.443	0.56	0.443	295.4	296	295.4	296
21	20	1.5	40	295.35	295.35	0.56	0.442	0.56	0.442	295.4	296	295.4	296
22	21	725.5	40	293.35	295.35	0.55	0.44	0.55	0.441	293.4	294	295.4	296
23	22	222.6	40	293.35	293.35	0.6	0.474	0.6	0.474	293.4	294	293.4	294
24	22	267.8	40	293.35	293.35	0.55	0.434	0.55	0.434	293.4	294	293.4	294
25	24	1.5	40	293.35	293.35	0.55	0.442	0.55	0.442	293.4	294	293.4	294
26	25	131.7	40	293.35	293.35	0.58	0.464	0.58	0.464	293.4	294	293.4	294
27	27MH	6	51	299.325	299.4	0.96	0.471	0.96	0.471	299.4	300	299.6	300
27MH	28	124	51	298.975	298.925	0.96	0.47	0.96	0.47	299.6	300	299	301
29	30	150.8	51	298.925	297.925	0.96	0.469	0.96	0.469	299	301	298	300
3	4	125.7	40	295.35	296.35	0.64	0.51	0.64	0.51	295.4	296	296.4	297
30	31	1	51	297.925	297.925	0.96	0.468	0.96	0.468	298	300	298	300
31	32	25.5	51	297.925	299.6	0.96	0.468	0.96	0.468	298	300	299.7	300
32	32F1	4.5	51	299.225	299.225	1.16	0.568	1.16	0.568	299.7	300	299.7	300
33	32	96.1	40	299.325	299.778	0.71	0.566	0.71	0.566	299.4	300	299.7	300
34	35	49.5	51	299.225	299.225	1.33	0.653	1.33	0.653	299.3	300	299.3	300
35	36	40.2	51	299.225	299.225	1.39	0.681	1.39	0.681	299.3	300	299.3	300
36	37	60.3	51	299.225	298.225	1.39	0.678	1.39	0.678	299.3	300	298.3	299
37	38	40.2	51	298.225	298.225	1.38	0.676	1.38	0.676	298.3	299	298.3	299
38	39	150.8	51	298.225	298.225	1.38	0.674	1.38	0.674	298.3	299	298.3	299
39	40	50.9	51	298.225	297.225	1.38	0.676	1.38	0.676	298.3	299	297.3	298
4	5	83.5	40	296.35	297.35	0.66	0.527	0.66	0.527	296.4	297	297.4	298
40	41	117.2	61	297.21	296.21	2.03	0.693	2.03	0.693	297.3	298	296.3	297
41	42	1	61	296.21	296.21	2.03	0.695	2.03	0.695	296.3	297	296.4	297
42	43	56.5	61	296.31	297.31	2.04	0.697	2.04	0.697	296.4	297	297.4	298
43	44	1	61	297.31	297.32	2.04	0.699	2.04	0.699	297.4	298	297.41	298
44	45	41.7	61	297.32	297.7	2.05	0.701	2.05	0.701	297.41	298	298	298
45	45MH	22	61	297.5	297.364	2.06	0.704	2.06	0.704	298	298	298	298

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
46	47	40.1	61	297.31	296.31	2.07	0.708	2.07	0.708	297.4	298	296.4	297
47	48	19	61	296.31	296.31	2.08	0.711	2.08	0.711	296.4	297	296.4	297
48	49	21.6	61	296.31	296.31	2.08	0.713	2.08	0.713	296.4	297	296.4	297
49	50	20.1	61	296.31	296.31	2.09	0.716	2.09	0.716	296.4	297	296.4	297
5	6	43	40	297.35	297.35	0.68	0.539	0.68	0.538	297.4	298	297.4	298
50	51	19.7	61	296.31	295.31	2.1	0.718	2.1	0.718	296.4	297	295.4	296
51	52	17.3	61	295.31	295.31	2.11	0.721	2.11	0.721	295.4	296	295.4	296
52	53	40.2	61	295.31	295.31	2.11	0.723	2.11	0.723	295.4	296	295.4	296
53	55	80.8	73	295.31	295.31	3.8	0.908	3.8	0.908	295.4	296	295.4	296
54	53	14.9	73	295.31	295.31	2.8	0.669	2.8	0.669	295.4	296	295.4	296
55	56	75.5	89	295.29	295.29	5.09	0.818	5.09	0.818	295.4	296	295.4	296
56	57	29.5	89	295.29	295.29	5.08	0.817	5.08	0.817	295.4	296	295.4	296
57	58	12.3	89	295.29	295.29	5.08	0.816	5.08	0.816	295.4	296	295.4	296
58	59	74.6	89	295.29	295.29	5.07	0.816	5.07	0.816	295.4	296	295.4	296
59	60	77.5	89	295.29	295.29	5.07	0.815	5.07	0.815	295.4	296	295.4	296
6	7	1	40	297.35	297.35	0.68	0.539	0.68	0.539	297.4	298	297.4	298
60	61	9.1	89	295.29	295.29	5.07	0.814	5.07	0.814	295.4	296	295.4	296
61	62	81.7	89	295.29	294.29	5.06	0.814	5.06	0.814	295.4	296	294.4	295
62	63	36.8	89	294.29	294.29	5.06	0.813	5.06	0.813	294.4	295	294.4	295
63	64	75.9	89	294.29	294.29	5.06	0.813	5.06	0.813	294.4	295	294.4	295
64	65	21.2	89	294.29	294.29	5.05	0.812	5.05	0.812	294.4	295	294.4	295
65	66	120.4	89	294.29	294.722	5.05	0.812	5.05	0.812	294.4	295	295	295
66	67	37.8	89	294.861	293.709	5.04	0.81	5.04	0.81	295	295	294	294
67	StandPipe	242.5	102	293.848	300.8	6.18	0.763	6.18	0.763	294	294	301	301
68	67	20.8	61	293.325	293.325	2.27	0.776	2.27	0.776	293.4	294	294	294
69	68	48	61	293.325	293.325	2.27	0.776	2.27	0.776	293.4	294	293.4	294
7	8	114.7	40	297.35	298.35	0.68	0.54	0.68	0.54	297.4	298	298.4	299
70	69	41.1	61	292.325	293.325	2.27	0.776	2.27	0.776	292.4	293	293.4	294

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
71	70	112.5	40	291.35	292.35	0.68	0.541	0.68	0.541	291.4	292	292.4	293
72	55	47.5	61	295.325	295.325	3.16	1.082	3.16	1.082	295.4	296	295.4	296
73	72	53.6	61	295.325	295.325	3.16	1.081	3.16	1.081	295.4	296	295.4	296
74	73	25.9	61	295.325	295.325	3.16	1.08	3.16	1.08	295.4	296	295.4	296
75	74	27.6	61	296.325	295.325	2.61	0.895	2.61	0.895	296.4	297	295.4	296
76	75	34.9	61	296.325	296.325	2.59	0.886	2.59	0.886	296.4	297	296.4	297
77	76	19.8	61	296.325	296.325	2.56	0.877	2.56	0.877	296.4	297	296.4	297
78	77	4	61	296.325	296.325	2	0.683	2	0.683	296.4	297	296.4	297
79	78	25.1	61	296.325	296.325	1.99	0.682	1.99	0.682	296.4	297	296.4	297
8	27	164.6	51	298.325	299.325	0.96	0.471	0.96	0.471	298.4	299	299.4	300
80	79	46.3	61	296.325	296.325	1.99	0.682	1.99	0.682	296.4	297	296.4	297
81	80	12.2	51	296.337	296.337	1.98	0.968	1.98	0.968	296.4	297	296.4	297
82	81	40	51	297.337	296.337	1.98	0.967	1.98	0.967	297.4	298	296.4	297
83	82	1.1	51	297.337	297.337	1.98	0.967	1.98	0.967	297.4	298	297.4	298
84	83	37.9	51	297.337	297.337	1.42	0.694	1.42	0.694	297.4	298	297.4	298
85	84	5.5	51	297.337	297.337	1.41	0.69	1.41	0.69	297.4	298	297.4	298
86	85	33.7	51	297.337	297.337	1.31	0.639	1.31	0.639	297.4	298	297.4	298
87	86	8.7	51	297.337	297.337	1.31	0.639	1.31	0.639	297.4	298	297.4	298
88	87	21	51	297.337	297.337	1.32	0.644	1.32	0.644	297.4	298	297.4	298
89	88	35.8	51	297.337	297.337	1.33	0.65	1.33	0.65	297.4	298	297.4	298
9	8	14.7	40	297.337	298.337	0.97	0.775	0.97	0.775	297.4	298	298.4	299
90	89	1.2	40	297.35	297.35	0.79	0.626	0.79	0.626	297.4	298	297.4	298
91	90	62.9	40	298.35	297.35	0.75	0.595	0.75	0.595	298.4	299	297.4	298
92	91	36.6	40	298.35	298.35	0.73	0.583	0.73	0.583	298.4	299	298.4	299
93	92	39.7	40	298.91	298.35	0.71	0.564	0.71	0.564	299	299	298.4	299
94	80	9.4	51	296.337	296.337	1.31	0.644	1.31	0.644	296.4	297	296.4	297
95	94	26.1	51	296.337	296.337	1.31	0.643	1.31	0.643	296.4	297	296.4	297
96	95	42	51	297.337	296.337	1.31	0.643	1.31	0.643	297.4	298	296.4	297

STOCKINBINGAL STP
Hydraulic Modelling Output
Normal Flow

US node ID	DS node ID	Length (m)	Pipe Internal Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
97	96	181.6	51	297.337	297.337	1.31	0.643	1.31	0.643	297.4	298	297.4	298
98	97	21.4	40	297.337	297.337	0.89	0.707	0.89	0.707	297.4	298	297.4	298
99	98	45.1	40	297.337	297.337	0.87	0.688	0.87	0.688	297.4	298	297.4	298
StandPipe	stpmh	6.4	102	300.8	291.8	6.01	0.692	6.01	0.227	301	301	292	292
stpmh	STP	4.4	102	300.8	291.306	6.01	4.126	6.01	4.126	292	292	292	292

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

US node ID	DS node ID	Length (m)	Internal Pipe Dia (mm)	US invert level (m AD)	DS invert level (m AD)	Max US flow (l/s)	Max US velocity (m/s)	Max DS flow (l/s)	Max DS velocity (m/s)	US Node MODEL Ground level (m AD)	US Node ACTUAL Ground Level	DS Node MODEL Ground level (m AD)	DS Node ACTUAL Ground Level
1	2	41	40	296.35	295.35	0.65	0.521	0.65	0.521	296.4	297	295.4	296
10	9	192.8	40	297.337	297.337	0.98	0.78	0.98	0.779	297.4	298	297.4	298
100	99	40.2	40	298.337	297.337	0.83	0.659	0.83	0.659	298.4	299	297.4	298
101	100	40.1	40	298.337	298.337	0.81	0.644	0.81	0.644	298.4	299	298.4	299
102	101	21.3	40	298.337	298.337	0.77	0.609	0.77	0.609	298.4	299	298.4	299
103	102	33.9	40	298.337	298.337	0.75	0.597	0.75	0.597	298.4	299	298.4	299
104	103	29.3	40	298.35	298.35	0.72	0.574	0.72	0.574	298.4	299	298.4	299
105	104	85.4	40	298.35	298.35	0.71	0.565	0.71	0.565	298.4	299	298.4	299
106	105	6.3	40	298.35	298.35	0.69	0.552	0.69	0.552	298.4	299	298.4	299
107	106	30.8	40	299.91	298.35	0.69	0.549	0.69	0.549	300	300	298.4	299
108	108MH	10.8	40	297.35	297.75	1.92	1.53	1.92	1.53	297.4	298	297.85	298
108MH	108F1	25.6	40	297.35	297.35	0.85	0.679	0.86	0.682	297.85		297.85	298
109	108	172.5	40	296.35	297.35	0.88	0.698	0.86	0.687	296.4	297	297.4	298
11	10	59.4	40	296.337	297.337	0.98	0.781	0.98	0.781	296.4	297	297.4	298
110	109	1.5	40	296.35	296.35	0.7	0.559	0.7	0.559	296.4	297	296.4	297
111	110	90.1	40	296.35	296.35	0.69	0.547	0.69	0.547	296.4	297	296.4	297
112	111	136.9	40	298.35	296.35	0.67	0.537	0.67	0.537	298.4	299	296.4	297
113	66	43.2	40	294.337	294.337	1.29	1.03	1.29	1.03	294.4	295	295	295
114	113	26.7	40	294.337	294.337	1.29	1.03	1.29	1.03	294.4	295	294.4	295
115	114	63.2	40	294.337	294.337	1.29	1.031	1.29	1.03	294.4	295	294.4	295
116	115	21.2	40	294.337	294.337	1.03	0.82	1.03	0.82	294.4	295	294.4	295
117	116	68.4	40	294.337	294.337	0.7	0.559	0.7	0.559	294.4	295	294.4	295
118	117	37.3	40	294.35	294.35	0.68	0.541	0.68	0.541	294.4	295	294.4	295
119	118	66.2	40	294.35	294.35	0.68	0.538	0.68	0.538	294.4	295	294.4	295
12	11	19.9	40	296.337	296.337	0.98	0.783	0.98	0.783	296.4	297	296.4	297
120	119	43	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
121	120	61.7	40	294.35	294.35	0.66	0.528	0.66	0.528	294.4	295	294.4	295
122	123	12.8	40	295.35	295.35	1.31	1.04	1.31	1.04	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

123	124	15.4	40	295.35	294.35	1.38	1.099	1.38	1.099	295.4	296	294.4	295
124	125	17.8	40	294.35	294.35	1.78	1.417	1.78	1.417	294.4	295	294.4	295
125	126	3.7	40	294.35	294.35	1.76	1.405	1.76	1.405	294.4	295	294.4	295
126	127	16	40	294.35	294.35	1.79	1.424	1.79	1.424	294.4	295	294.4	295
127	128	6.1	51	294.337	294.337	1.79	0.878	1.79	0.878	294.4	295	294.4	295
128	129	7.6	51	294.337	294.337	1.79	0.876	1.79	0.876	294.4	295	294.4	295
129	130	19.9	51	294.337	294.337	1.79	0.875	1.79	0.875	294.4	295	294.4	295
13	12	68.6	40	296.337	296.337	0.99	0.785	0.99	0.785	296.4	297	296.4	297
130	131	10.1	51	294.337	294.337	1.78	0.874	1.78	0.874	294.4	295	294.4	295
131	132	25.2	51	294.337	294.337	1.78	0.873	1.78	0.873	294.4	295	294.4	295
132	133	1.5	51	294.337	294.337	1.78	0.873	1.78	0.873	294.4	295	294.4	295
133	134	23	51	294.337	294.337	1.78	0.87	1.78	0.87	294.4	295	294.4	295
134	135	2	51	294.337	294.337	1.78	0.869	1.78	0.869	294.4	295	294.4	295
135	136	36.3	51	294.337	293.337	1.81	0.885	1.81	0.885	294.4	295	293.4	294
136	137	41.1	51	293.337	293.337	1.81	0.885	1.81	0.885	293.4	294	293.4	294
137	138	31.1	51	293.337	293.337	1.81	0.884	1.81	0.884	293.4	294	293.4	294
138	139	9.4	51	293.337	292.337	1.83	0.895	1.83	0.895	293.4	294	292.4	293
139	140	37.9	51	292.337	292.337	1.83	0.896	1.83	0.896	292.4	293	292.4	293
14	13	10.8	40	296.337	296.337	0.77	0.613	0.77	0.613	296.4	297	296.4	297
140	141	82.6	61	292.325	293.778	2.59	0.887	2.6	0.889	292.4	293	294	294
141	141MH	32.9	61	293.6	293.109	3.82	1.306	3.83	1.309	294	294	294	294
142	143	80.5	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
143	144	44.8	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
144	145	87.7	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
145	146	38.9	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
146	70	36.4	61	292.325	292.325	2.25	0.77	2.25	0.77	292.4	293	292.4	293
147	144	85.4	40	292.35	292.35	0.7	0.559	0.7	0.559	292.4	293	292.4	293
148	140	97.5	40	290.337	292.337	0.98	0.777	0.98	0.777	290.4	291	292.4	293
149	148	57.4	40	291.337	290.337	0.98	0.78	0.98	0.78	291.4	292	290.4	291
15	14	12.3	40	296.35	296.35	0.73	0.584	0.73	0.584	296.4	297	296.4	297
150	149	140.4	40	291.337	291.337	0.99	0.787	0.99	0.787	291.4	292	291.4	292
151	150	127.5	40	291.337	291.337	0.93	0.741	0.93	0.741	291.4	292	291.4	292
152	151	5.9	40	291.337	291.337	0.94	0.747	0.94	0.747	291.4	292	291.4	292

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

153	152	31.9	40	291.337	291.337	0.95	0.754	0.95	0.754	291.4	292	291.4	292
154	153	7.8	40	291.337	291.337	0.89	0.707	0.89	0.707	291.4	292	291.4	292
155	154	16.5	40	291.337	291.337	0.9	0.714	0.9	0.714	291.4	292	291.4	292
156	155	7.7	40	291.337	291.337	0.91	0.721	0.91	0.721	291.4	292	291.4	292
157	156	88.4	40	291.337	291.337	0.92	0.729	0.92	0.729	291.4	292	291.4	292
158	157	19.5	40	291.337	291.337	0.88	0.696	0.88	0.696	291.4	292	291.4	292
159	158	177	40	292.337	291.337	0.92	0.734	0.92	0.734	292.4	293	291.4	292
16	15	40.2	40	296.35	296.35	0.69	0.55	0.69	0.55	296.4	297	296.4	297
160	159	22.7	40	292.337	292.337	0.94	0.746	0.94	0.746	292.4	293	292.4	293
161	160	137.9	40	293.25	292.25	0.97	0.774	0.97	0.774	293.3	294	292.4	293
162	161	25.1	40	293.25	293.25	0.62	0.49	0.62	0.49	293.3	294	293.3	294
163	162	39.5	40	293.25	293.25	0.63	0.504	0.63	0.504	293.3	294	293.3	294
164	161	127.6	40	294.25	293.25	0.63	0.504	0.63	0.504	294.3	295	293.3	294
165	160	216.7	40	292.35	292.35	0.63	0.498	0.63	0.498	292.4	293	292.4	293
166	158	119	40	291.35	291.35	0.61	0.489	0.61	0.489	291.4	292	291.4	292
167	171	1	40	291.35	291.35	0.62	0.49	0.62	0.49	291.4	292	291.4	292
168	167	42.4	40	291.35	291.35	0.63	0.505	0.63	0.505	291.4	292	291.4	292
169	149	61.6	40	291.35	291.35	0.67	0.533	0.67	0.533	291.4	292	291.4	292
17	16	40.2	40	295.35	296.35	0.66	0.525	0.66	0.525	295.4	296	296.4	297
171	166	53.4	40	291.35	291.35	0.61	0.484	0.61	0.484	291.4	292	291.4	292
18	17	46.4	40	295.35	295.35	0.63	0.503	0.63	0.503	295.4	296	295.4	296
19	18	37.8	40	294.35	295.35	0.66	0.526	0.66	0.526	294.4	295	295.4	296
2	3	1.5	40	295.35	295.35	0.65	0.514	0.65	0.514	295.4	296	295.4	296
20	18	24.7	40	295.35	295.35	0.59	0.466	0.59	0.466	295.4	296	295.4	296
21	20	1.5	40	295.35	295.35	0.57	0.451	0.57	0.451	295.4	296	295.4	296
22	21	725.5	40	293.35	295.35	0.55	0.44	0.55	0.44	293.4	294	295.4	296
23	22	222.6	40	293.35	293.35	0.6	0.474	0.6	0.474	293.4	294	293.4	294
24	22	267.8	40	293.35	293.35	0.55	0.434	0.55	0.434	293.4	294	293.4	294
25	24	1.5	40	293.35	293.35	0.56	0.442	0.56	0.442	293.4	294	293.4	294
26	25	131.7	40	293.35	293.35	0.58	0.464	0.58	0.464	293.4	294	293.4	294
27	27MH	6	51	299.325	299.4	0.98	0.482	0.98	0.482	299.4	300	299.6	300
27MH	28	124	51	298.975	298.925	0.98	0.479	0.98	0.479	299.6		299	301
29	30	150.8	51	298.925	297.925	0.97	0.474	0.97	0.474	299	301	298	300

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

3	4	125.7	40	295.35	296.35	0.64	0.51	0.64	0.51	295.4	296	296.4	297
30	31	1	51	297.925	297.925	0.96	0.472	0.96	0.472	298	300	298	300
31	32	25.5	51	297.925	299.6	0.96	0.469	0.96	0.469	298	300	299.7	300
32	32F1	4.5	51	299.225	299.225	1.37	0.671	1.37	0.671	299.7	300	299.7	300
33	32	96.1	40	299.325	299.778	0.71	0.565	0.71	0.565	299.4	300	299.7	300
34	35	49.5	51	299.225	299.225	1.48	0.726	1.48	0.726	299.3	300	299.3	300
35	36	40.2	51	299.225	299.225	1.58	0.775	1.58	0.775	299.3	300	299.3	300
36	37	60.3	51	299.225	298.225	1.58	0.774	1.58	0.774	299.3	300	298.3	299
37	38	40.2	51	298.225	298.225	1.58	0.773	1.58	0.773	298.3	299	298.3	299
38	39	150.8	51	298.225	298.225	1.58	0.772	1.58	0.772	298.3	299	298.3	299
39	40	50.9	51	298.225	297.225	1.58	0.772	1.58	0.772	298.3	299	297.3	298
4	5	83.5	40	296.35	297.35	0.66	0.527	0.66	0.527	296.4	297	297.4	298
40	41	117.2	61	297.21	296.21	1.92	0.656	1.92	0.656	297.3	298	296.3	297
41	42	1	61	296.21	296.21	1.92	0.655	1.92	0.655	296.3	297	296.4	297
42	43	56.5	61	296.31	297.31	1.91	0.655	1.91	0.655	296.4	297	297.4	298
43	44	1	61	297.31	297.32	1.91	0.654	1.91	0.654	297.4	298	297.41	298
44	45	41.7	61	297.32	297.7	1.91	0.653	1.91	0.653	297.41	298	298	298
45	45MH	22	61	297.5	297.364	2	0.683	2	0.683	298	298	298	298
46	47	40.1	61	297.31	296.31	1.9	0.651	1.9	0.651	297.4	298	296.4	297
47	48	19	61	296.31	296.31	1.9	0.651	1.9	0.651	296.4	297	296.4	297
48	49	21.6	61	296.31	296.31	1.9	0.65	1.9	0.65	296.4	297	296.4	297
49	50	20.1	61	296.31	296.31	1.9	0.65	1.9	0.65	296.4	297	296.4	297
5	6	43	40	297.35	297.35	0.68	0.539	0.68	0.539	297.4	298	297.4	298
50	51	19.7	61	296.31	295.31	1.9	0.65	1.9	0.65	296.4	297	295.4	296
51	52	17.3	61	295.31	295.31	1.9	0.649	1.9	0.649	295.4	296	295.4	296
52	53	40.2	61	295.31	295.31	2.05	0.703	2.05	0.703	295.4	296	295.4	296
53	55	80.8	73	295.31	295.31	3.66	0.875	3.66	0.875	295.4	296	295.4	296
54	53	14.9	73	295.31	295.31	2.8	0.668	2.8	0.668	295.4	296	295.4	296
55	56	75.5	89	295.29	295.29	5.38	0.865	5.38	0.865	295.4	296	295.4	296
56	57	29.5	89	295.29	295.29	5.36	0.862	5.36	0.862	295.4	296	295.4	296
57	58	12.3	89	295.29	295.29	5.35	0.86	5.35	0.86	295.4	296	295.4	296
58	59	74.6	89	295.29	295.29	5.34	0.858	5.34	0.858	295.4	296	295.4	296
59	60	77.5	89	295.29	295.29	5.33	0.856	5.33	0.856	295.4	296	295.4	296

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

6	7	1	40	297.35	297.35	0.68	0.54	0.68	0.54	297.4	298	297.4	298
60	61	9.1	89	295.29	295.29	5.32	0.854	5.32	0.854	295.4	296	295.4	296
61	62	81.7	89	295.29	294.29	5.31	0.853	5.31	0.853	295.4	296	294.4	295
62	63	36.8	89	294.29	294.29	5.3	0.851	5.3	0.851	294.4	295	294.4	295
63	64	75.9	89	294.29	294.29	5.29	0.85	5.29	0.85	294.4	295	294.4	295
64	65	21.2	89	294.29	294.29	5.28	0.849	5.28	0.849	294.4	295	294.4	295
65	66	120.4	89	294.29	294.722	5.28	0.848	5.28	0.848	294.4	295	295	295
66	67	37.8	89	294.861	293.709	5.24	0.842	5.24	0.842	295	295	294	294
67	StandPipe	242.5	102	293.848	300.8	6.04	0.747	6.04	0.747	294	294	301	301
68	67	20.8	61	293.325	293.325	2.25	0.771	2.25	0.771	293.4	294	294	294
69	68	48	61	293.325	293.325	2.25	0.771	2.25	0.771	293.4	294	293.4	294
7	8	114.7	40	297.35	298.35	0.68	0.542	0.68	0.542	297.4	298	298.4	299
70	69	41.1	61	292.325	293.325	2.25	0.771	2.25	0.771	292.4	293	293.4	294
71	70	112.5	40	291.35	292.35	0.68	0.541	0.68	0.541	291.4	292	292.4	293
72	55	47.5	61	295.325	295.325	3.93	1.346	3.93	1.346	295.4	296	295.4	296
73	72	53.6	61	295.325	295.325	3.94	1.347	3.94	1.347	295.4	296	295.4	296
74	73	25.9	61	295.325	295.325	3.94	1.348	3.94	1.348	295.4	296	295.4	296
75	74	27.6	61	296.325	295.325	3.33	1.139	3.33	1.139	296.4	297	295.4	296
76	75	34.9	61	296.325	296.325	3.33	1.139	3.33	1.139	296.4	297	296.4	297
77	76	19.8	61	296.325	296.325	2.74	0.937	2.74	0.937	296.4	297	296.4	297
78	77	4	61	296.325	296.325	2.69	0.921	2.69	0.921	296.4	297	296.4	297
79	78	25.1	61	296.325	296.325	2.7	0.925	2.7	0.925	296.4	297	296.4	297
8	27	164.6	51	298.325	299.325	0.99	0.485	0.99	0.485	298.4	299	299.4	300
80	79	46.3	61	296.325	296.325	2.71	0.929	2.71	0.929	296.4	297	296.4	297
81	80	12.2	51	296.337	296.337	2.27	1.113	2.27	1.113	296.4	297	296.4	297
82	81	40	51	297.337	296.337	2.29	1.121	2.29	1.121	297.4	298	296.4	297
83	82	1.1	51	297.337	297.337	2.32	1.133	2.32	1.133	297.4	298	297.4	298
84	83	37.9	51	297.337	297.337	1.88	0.918	1.88	0.918	297.4	298	297.4	298
85	84	5.5	51	297.337	297.337	1.88	0.92	1.88	0.92	297.4	298	297.4	298
86	85	33.7	51	297.337	297.337	1.72	0.841	1.72	0.841	297.4	298	297.4	298
87	86	8.7	51	297.337	297.337	1.75	0.855	1.75	0.855	297.4	298	297.4	298
88	87	21	51	297.337	297.337	1.78	0.87	1.78	0.87	297.4	298	297.4	298
89	88	35.8	51	297.337	297.337	1.4	0.688	1.4	0.688	297.4	298	297.4	298

STOCKINBINGAL STP
Hydraulic Modelling Output
High Load

9	8	14.7	40	297.337	298.337	0.98	0.778	0.98	0.778	297.4	298	298.4	299
90	89	1.2	40	297.35	297.35	0.91	0.727	0.91	0.727	297.4	298	297.4	298
91	90	62.9	40	298.35	297.35	0.83	0.659	0.83	0.659	298.4	299	297.4	298
92	91	36.6	40	298.35	298.35	0.78	0.62	0.78	0.62	298.4	299	298.4	299
93	92	39.7	40	298.91	298.35	0.71	0.564	0.71	0.564	299	299	298.4	299
94	80	9.4	51	296.337	296.337	1.39	0.681	1.39	0.681	296.4	297	296.4	297
95	94	26.1	51	296.337	296.337	1.38	0.678	1.38	0.678	296.4	297	296.4	297
96	95	42	51	297.337	296.337	1.38	0.674	1.38	0.674	297.4	298	296.4	297
97	96	181.6	51	297.337	297.337	1.37	0.671	1.37	0.671	297.4	298	297.4	298
98	97	21.4	40	297.337	297.337	0.87	0.69	0.87	0.69	297.4	298	297.4	298
99	98	45.1	40	297.337	297.337	0.85	0.674	0.85	0.674	297.4	298	297.4	298
StandPipe	stpmh	6.4	102	300.8	291.8	5.39	0.623	5.39	0.203	301		292	292
stpmh	STP	4.4	102	300.8	291.306	5.39	3.785	5.39	3.785	292		292	292

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
201	1	40	315.825	18.525
202	1	52	313.587	18.187
203	1	51	313.65	18.25
204	1	50	313.772	17.372
205	1	49	313.899	17.499
206	1	48	313.933	17.533
207	1	47	313.965	17.565
208	1	54	313.674	18.274
208	2	54	313.674	18.274
208	3	54	313.674	18.274
208	4	54	313.674	18.274
209	1	122	325.222	29.822
209	2	122	325.222	29.822
210	1	56	311.219	15.819
211	1	59	309.586	14.186
211	2	59	309.586	14.186
212	1	127	321.13	26.73
301	1	1	327.521	31.121
302	1	4	325.721	29.321
303	1	5	324.871	27.471
304	1	27	323.319	23.919
305	1	9	323.423	26.023
306	1	10	323.263	25.863
307	1	11	323.24	26.84
308	1	12	323.235	26.835
309	1	15	325.34	28.94
310	1	13	325.173	28.773
311	1	17	325.927	30.527
312	1	16	325.632	29.232
313	1	19	326.277	31.877
314	1	34	323.107	23.807
315	1	35	322.776	23.476
316	1	38	319.904	21.604
317	1	37	320.721	22.421
318	1	45	312.248	14.248
319	1	46	313.964	16.564
320	1	39	316.849	18.549
321	1	123	324.618	29.218
322	1	33	324.479	25.079
323	1	89	318.973	21.573
324	1	88	318.445	21.045
325	1	86	318.019	20.619
326	1	85	317.551	20.151
327	1	82	316.958	19.558
328	1	81	316.446	20.046

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
329	1	93	320.326	21.326
330	1	92	320.327	21.927
331	1	91	319.822	21.422
332	1	90	318.988	21.588
333	1	87	318.141	20.741
334	1	84	317.476	20.076
335	1	83	316.972	19.572
336	1	96	316.437	19.037
337	1	79	315.908	19.508
338	1	78	315.702	19.302
339	1	74	314.318	18.918
340	1	73	313.899	18.499
341	1	72	313.039	17.639
342	1	57	310.805	15.405
343	1	75	314.767	18.367
344	1	76	315.341	18.941
345	1	77	315.67	19.27
346	1	94	316.307	19.907
347	1	95	316.351	19.951
348	1	98	316.871	19.471
349	1	99	316.868	19.468
350	1	100	316.866	18.466
351	1	101	316.863	18.463
352	1	103	316.861	18.461
353	1	106	316.86	18.46
354	1	107	316.86	16.86
355	1	105	316.86	18.46
356	1	104	316.86	18.46
357	1	102	316.862	18.462
358	1	108	317.409	20.009
359	1	112	318.554	20.154
360	1	111	317.406	21.006
361	1	60	308.502	13.102
362	1	63	306.723	12.323
363	1	64	305.666	11.266
364	1	113	306.002	11.602
365	1	116	311.873	17.473
366	1	62	307.236	12.836
367	1	61	308.376	12.976
368	1	119	311.869	17.469
369	1	68	303.814	10.414
370	1	114	307.645	13.245
371	1	115	311.542	17.142
372	1	117	311.871	17.471
373	1	118	311.87	17.47

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - Normal Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	Max Pressure at Pump Node (m)
374	1	142	308.552	16.152
375	1	143	307.538	15.138
376	1	121	311.869	17.469
377	1	139	311.4	19
378	1	138	311.8	18.4
379	1	137	313.144	19.744
380	1	136	314.956	21.556
381	1	135	316.586	22.186
382	1	132	317.791	23.391
383	1	130	319.48	25.08
384	1	128	320.827	26.427
385	1	125	323.116	28.716
386	1	134	316.678	22.278
387	1	133	317.72	23.32
388	1	131	318.994	24.594
389	1	129	320.453	26.053
390	1	126	322.738	28.338
391	1	124	323.912	29.512
392	1	146	305.384	12.984
393	1	145	305.872	13.472
394	1	69	304.412	11.012
395	1	165	319.875	27.475
396	1	159	319.675	27.275
397	1	157	318.194	26.794
398	1	166	318.291	26.891
399	1	168	318.29	26.89
400	1	156	317.79	26.39
401	1	152	316.687	25.287
402	1	151	316.509	25.109
403	1	153	317.666	26.266
404	1	150	312.683	21.283
405	1	169	310.011	18.611
406	1	162	321.577	28.277
407	1	163	322.054	28.754
408	1	164	322.248	27.948
409	1	23	332.319	38.919
410	1	71	305.032	13.632
411	1	26	335.694	42.294
412	1	36	321.952	22.652
413	1	147	306.975	14.575

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
201	1	40	313.114	313.114	15.814
202	1	52	314.044	314.044	18.644
203	1	51	314.043	314.043	18.643
204	1	50	314.042	314.042	17.642
205	1	49	314.041	314.041	17.641
206	1	48	314.041	314.041	17.641
207	1	47	314.041	314.041	17.641
208	1	54	314.195	314.195	18.795
208	2	54	314.195	314.195	18.795
208	3	54	314.195	314.195	18.795
208	4	54	314.195	314.195	18.795
209	1	122	320.635	320.635	25.235
209	2	122	320.635	320.635	25.235
210	1	56	312.134	312.134	16.734
211	1	59	310.326	310.326	14.926
211	2	59	310.326	310.326	14.926
212	1	127	317.079	317.079	22.679
301	1	1	326.554	326.554	30.154
302	1	4	324.569	324.569	28.169
303	1	5	323.603	323.603	26.203
304	1	27	321.56	321.56	22.16
305	1	9	321.863	321.863	24.463
306	1	10	325.503	325.503	28.103
307	1	11	327.33	327.33	30.93
308	1	12	327.946	327.946	31.546
309	1	15	330.22	330.22	33.82
310	1	13	330.089	330.089	33.689
311	1	17	330.689	330.689	35.289
312	1	16	330.451	330.451	34.051
313	1	19	330.973	330.973	36.573
314	1	34	320.969	320.969	21.669
315	1	35	320.462	320.462	21.162
316	1	38	316.702	316.702	18.402
317	1	37	317.773	317.773	19.473
318	1	45	313.007	313.007	15.007
319	1	46	314.041	314.041	16.641
320	1	39	313.277	313.277	14.977
321	1	123	319.939	319.939	24.539
322	1	33	322.41	322.41	23.01
323	1	89	327.129	327.129	29.729
324	1	88	326.659	326.659	29.259
325	1	86	326.272	326.272	28.872
326	1	85	325.836	325.836	28.436
327	1	82	324.629	324.629	27.229

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
328	1	81	323.468	323.468	27.068
329	1	93	328.336	328.336	29.336
330	1	92	328.336	328.336	29.936
331	1	91	327.894	327.894	29.494
332	1	90	327.143	327.143	29.743
333	1	87	326.385	326.385	28.985
334	1	84	325.765	325.765	28.365
335	1	83	324.66	324.66	27.26
336	1	96	323.347	323.347	25.947
337	1	79	322.232	322.232	25.832
338	1	78	321.754	321.754	25.354
339	1	74	318.27	318.27	22.87
340	1	73	317.071	317.071	21.671
341	1	72	315.071	315.071	19.671
342	1	57	311.673	311.673	16.273
343	1	75	319.505	319.505	23.105
344	1	76	321.073	321.073	24.673
345	1	77	321.679	321.679	25.279
346	1	94	323.143	323.143	26.743
347	1	95	323.221	323.221	26.821
348	1	98	323.926	323.926	26.526
349	1	99	323.925	323.925	26.525
350	1	100	323.925	323.925	25.525
351	1	101	323.924	323.924	25.524
352	1	103	323.924	323.924	25.524
353	1	106	323.923	323.923	25.523
354	1	107	323.923	323.923	23.923
355	1	105	323.923	323.923	25.523
356	1	104	323.924	323.924	25.524
357	1	102	323.924	323.924	25.524
358	1	108	324.401	324.401	27.001
359	1	112	324.4	324.4	26
360	1	111	324.401	324.401	28.001
361	1	60	309.132	309.132	13.732
362	1	63	307.18	307.18	12.78
363	1	64	306.026	306.026	11.626
364	1	113	305.927	305.927	11.527
365	1	116	311.928	311.928	17.528
366	1	62	307.742	307.742	13.342
367	1	61	308.992	308.992	13.592
368	1	119	311.928	311.928	17.528
369	1	68	303.541	303.541	10.141
370	1	114	307.593	307.593	13.193
371	1	115	311.581	311.581	17.181

STOCKINBINGAL STP
Hydraulic Modelling Output
Maximum Pump Head - High Load

US node ID	Link suffix	DS node ID	Max DS total head (m AD)	DS Node Max Level (m AD)	Max Pressure at Pump Node (m)
372	1	117	311.928	311.928	17.528
373	1	118	311.928	311.928	17.528
374	1	142	310.122	310.122	17.722
375	1	143	308.453	308.453	16.053
376	1	121	311.928	311.928	17.528
377	1	139	313.783	313.783	21.383
378	1	138	314.096	314.096	20.696
379	1	137	314.543	314.543	21.143
380	1	136	315.14	315.14	21.74
381	1	135	315.67	315.67	21.27
382	1	132	316.06	316.06	21.66
383	1	130	316.582	316.582	22.182
384	1	128	316.989	316.989	22.589
385	1	125	318.145	318.145	23.745
386	1	134	315.7	315.7	21.3
387	1	133	316.038	316.038	21.638
388	1	131	316.432	316.432	22.032
389	1	129	316.877	316.877	22.477
390	1	126	317.945	317.945	23.545
391	1	124	319.106	319.106	24.706
392	1	146	305.221	305.221	12.821
393	1	145	305.925	305.925	13.525
394	1	69	303.832	303.832	10.432
395	1	165	326.493	326.493	34.093
396	1	159	325.723	325.723	33.323
397	1	157	323.669	323.669	32.269
398	1	166	324.907	324.907	33.507
399	1	168	324.903	324.903	33.503
400	1	156	320.774	320.774	29.374
401	1	152	318.844	318.844	27.444
402	1	151	318.787	318.787	27.387
403	1	153	319.793	319.793	28.393
404	1	150	317.886	317.886	26.486
405	1	169	314.049	314.049	22.649
406	1	162	331.603	331.603	38.303
407	1	163	331.602	331.602	38.302
408	1	164	332.578	332.578	38.278
409	1	23	336.284	336.284	42.884
410	1	71	304.89	304.89	13.49
411	1	26	339.342	339.342	45.942
412	1	36	319.384	319.384	20.084
413	1	147	308.327	308.327	15.927

Appendix E Flood Map (1 in 100 Year Event)

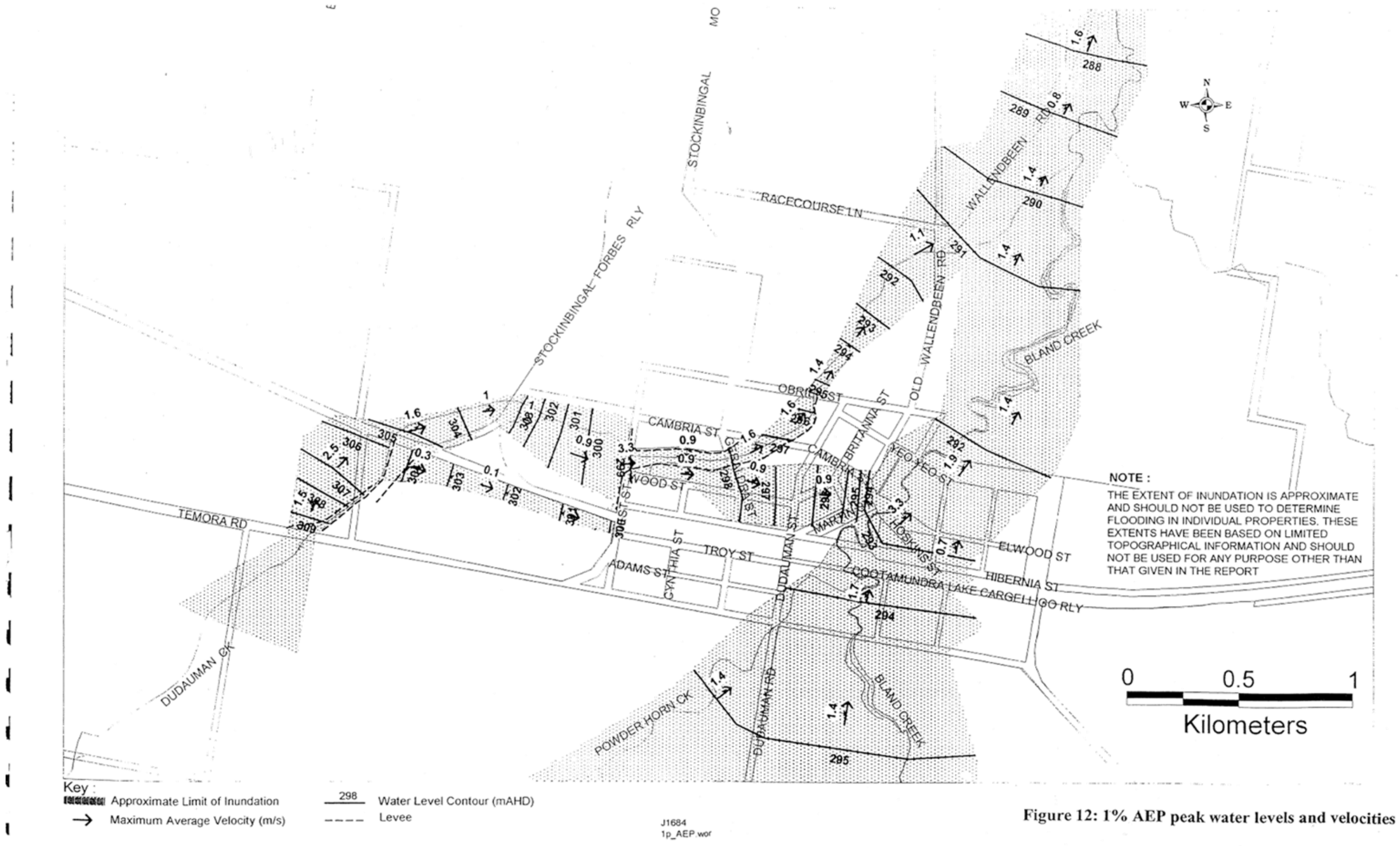
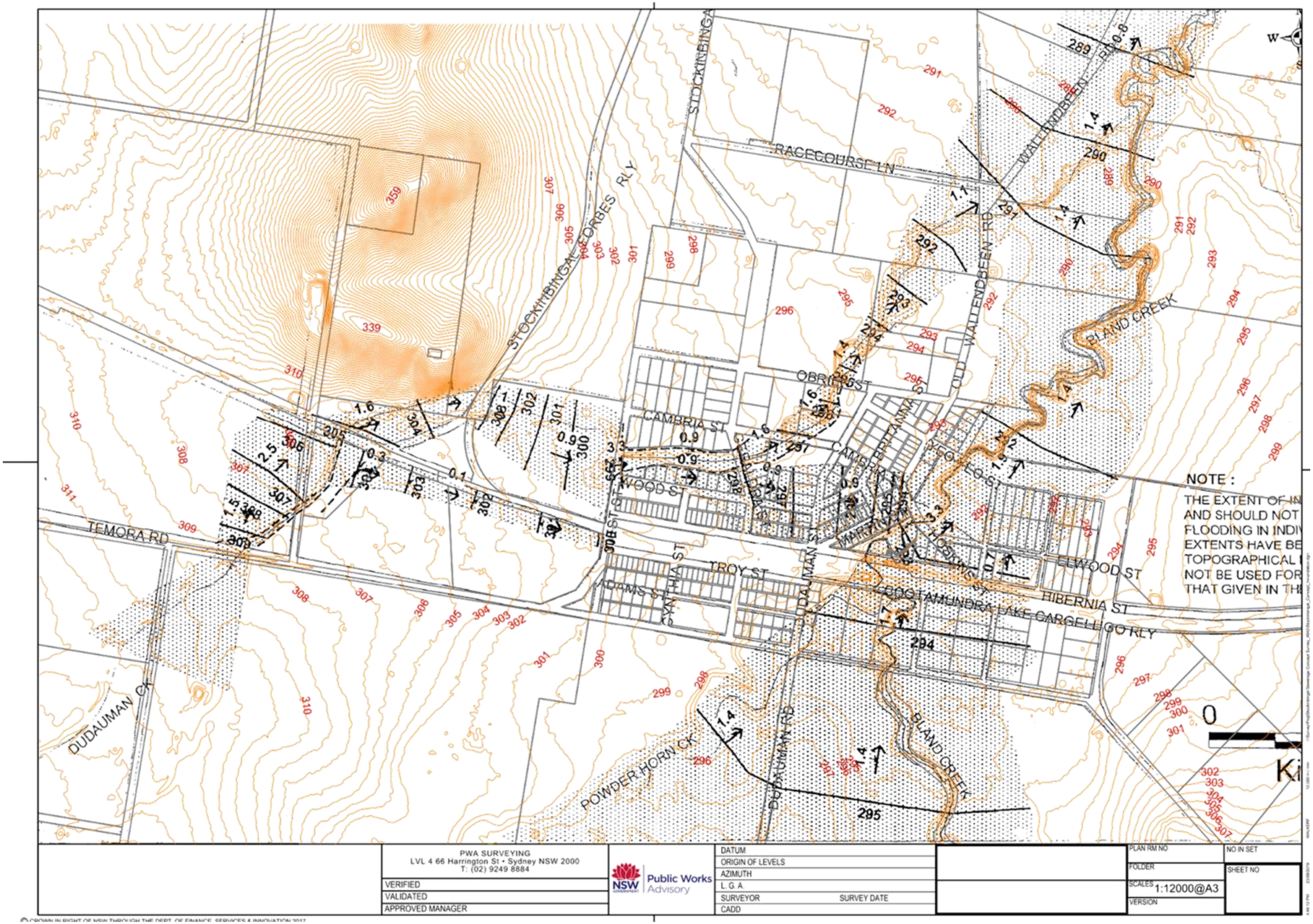


Figure 12: 1% AEP peak water levels and velocities


STOCKINBINGAL-FORBES RLY
RACECOURSE LN
WALLENDBEEN RD
OLD WALLENDBEEN RD
BLAND CREEK
OBRIEN ST
CAMBRIA ST
WOOD ST
TEMORA RD
TROY ST
ADAMS ST
CYNTHIA ST
DUDAUMAN ST
DUDAUMAN RD
HOBKINS ST
ELWOOD ST
HIBERNIA ST
BOOTAMUNDRA LAKE CARGELLIGO RLY
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NOTE :
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VERIFIED
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NSW Public Works Advisory
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L. G. A.
SURVEYOR
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VERSION

Appendix F Capital Cost Estimate

STOCKINBINGAL SGE
COLLECTION AND TRANSPORT SYSTEM
CAPITAL COST ESTIMATE

PRESSURE SYSTEM

ITEM NO.		QUANTITY	UNIT	RATE $/unit	AMOUNT $
1	**Site Establishment**				**$ 110,000**
1.1	Mobilisation / Demobilisation including site amenities.			Allowance	$ 50,000
1.2	Traffic management including personnel, barriers, control signals (where required) etc			Allowance	$ 60,000
2	**Pressure Units**				**$ 1,373,200**
2.1	i) Standard	121	each	$ 4,500	$ 544,500
	ii) Duplex	5	each	$ 9,000	$ 45,000
	iii) Quad units	1	each	$ 27,000	$ 27,000
2.2	Installation				
	i) Property Owner consultation, electrical checks, photographic records, property	127	each	$ 300	$ 38,100
	ii) Installation Simplex	121	each	$ 4,200	$ 508,200
	iii) Installation Duplex	5	each	$ 7,900	$ 39,500
	iiii) Installation Quadraplex	1	each	$ 18,500	$ 18,500
2.3	Supply and Installation of Boundary Kits and Laterals	127	each	$ 1,200	$ 152,400
3	**Reticulation**				**$ 1,365,000**
3.1	PE100, PN16 Polyethylene Pipe and Fittings				
	i) 40 mm	3,810	m	$ 80	$ 304,800
	ii) 50 mm	4,020	m	$ 80	$ 321,600
	iii) 63 mm	2,300	m	$ 80	$ 184,000
	iv) 75 mm	1,810	m	$ 80	$ 144,800
	v) 90 mm	530	m	$ 100	$ 53,000
	vi) 110 mm	660	m	$ 100	$ 66,000
	vii) 125 mm	260	m	$ 120	$ 31,200
3.2	Extra Over for Under Road Bore with Conduit				
	i) 63 mm	60	each	$ 1,200	$ 72,000
	ii) 75 mm		each	$ 1,300	$ -
	iii) 90 mm		each	$ 1,400	$ -
	iv) 110 mm		each	$ 1,500	$ -
3.3	Installation of Isolation Valves				
	i) 50 - 63 mm	5	each	$ 1,200	$ 6,000
	ii) 75 -125 mm	6	each	$ 1,500	$ 9,000
3.4	Flushing points (Type 1)				
	i) 50 - 110 mm	14	each	$ 2,500	$ 35,000
3.5	Barometric Loop	1	each	$ 86,000	$ 86,000
3.6	Railway Crossings	1	each	Allowance	$ 51,600
4	**Miscellaneous**				**$ 44,000**
	Testing and commissioning of the pressure sewerage system			Allowance	$ 20,000
	Prepare and submit operations and maintenance manuals.			Allowance	$ 8,000
	Work as excecuted documentation			Allowance	$ 8,000
	Operational environmental managament plan			Allowance	$ 8,000
	Sub-total Construction Cost				**$2,892,200**
	Contractor Indirect Costs	5%			**$144,610**
	Construction Cost				**$3,036,810**
	Contingency (additional reticulation, air valves and general allowance)				**$682,800**
	Survey investigation and design and project management 10%				**$289,220**
	Capital Cost				**$4,008,830**

STOCKINBINGAL STP
COST ESTIMATE

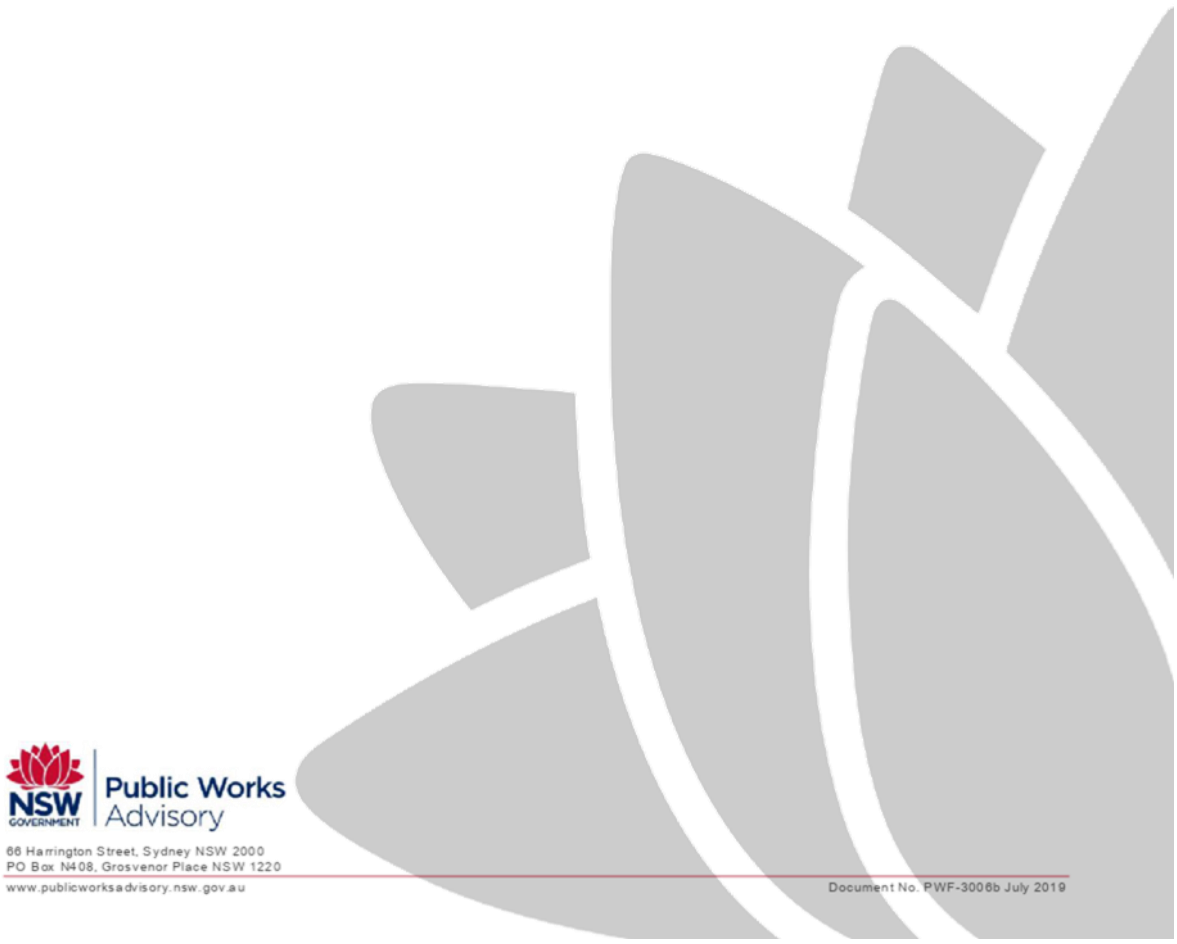
		IDEA reactor			
Item	**Item Description**	**Qty**	**Unit**	**Rate**	**Amount**
1.0	**Site Establishment**				**$108,000**
1.1	Site Establishment & disestablishment			Allowance	$40,000
1.2	Strip top soil			Allowance	$1,000
1.3	Provide and maintain erosion/ siltation control measures			Allowance	$2,000
1.4	Landscaping			Allowance	$10,000
1.5	Fencing	150	m	$100	$15,000
1.6	Operational Environmental Management Plan etc.			Allowance	$40,000
2.0	**Roadworks and Site Drainage**				**$90,000**
2.1	Roads				
	i) Sealed roadway (bitumen sealed)	500	m^2	$100	$50,000
2.2	Drainage Works			Allowance	$40,000
3.0	**Emergency Balance Tank**				**$25,200**
3.1	40 kL tank				$12,000
3.2	Concrete Base	4	m^3	$1,800	$7,200
3.3	Level sensor	1	each	$1,000	$1,000
3.4	Return pump	1	Item	$5,000	$5,000
4.0	**Inlet Works**				**$90,000**
4.1	Feed pump	1	Item	$5,000	$5,000
4.2	Flow meter	1	m^2	$5,000	$5,000
4.3	Mechanical Screen (5-8 mm bar screen) and auxiliary equipment		Item	LS	$20,000
4.4	Odour Control	1	each	$60,000	$60,000
5.0	**Concrete IDEA reactor and balance tank**				**$728,471**
5.1	Foundation and earthworks		No excavation		
	i) Foundation preparation		Item	LS	$150,000
5.2	Concrete				
	i) Walls	82	m^3	$2,500	$206,061
	ii) Base	47	m^3	$1,800	$84,109
	iii) Pits	15	m^3	$2,000	$30,000
5.3	Metalwork				
	i) Emergency ladders	1	each	$2,100	$2,100
	ii) Handrails	32	m	$150	$4,800
	iii) Grating	18	m^2	$300	$5,400
5.4	Mechanical Works				
	i) Jet aeration system		Item	LS	$70,000
	ii) Decanting system		Item	LS	$100,000
	iii) WAS pumps, pipework and fittings		Item	LS	$20,000
5.5	Pipework, valve and fittings				
	i) Decant pipework		Item	LS	$50,000
	ii) DO sensor	2	each	$2,000	$4,000
	iii) pH sensor	1	each	$1,000	$1,000
	iv) level sensor	1	each	$1,000	$1,000
6.0	**Sludge Tank**				**$18,200**
6.1	22.5 kL tank				$10,000
6.2	Concrete Base	4	m^3	$1,800	$7,200
6.2	Level sensor	1	each	$1,000	$1,000
7.0	**Sludge Dewatering**				**$83,700**
7.1	Foundation and Earthworks			Allowance	$10,000
7.2	Supply and place concrete, including reinforcement				
	i) Walls	7	m^3	$2,000	$14,000
	ii) Floor	29	m^3	$1,500	$43,500
	iii) Pit		Item	LS	$10,000
7.3	Dewatering bags	2	Item	$1,600	$3,200
7.4	Filtrate return pump			Allowance	$3,000
8.0	**Chemical Dosing**				**$20,000**
8.1	Colorbond roof			Allowance	$10,000
8.2	Self bunded tanks and pumps			LS	$10,000
9.0	**Disinfection**				**$30,000**
9.1	UV disinfection		Item	LS	$30,000
10.0	**Treated effluent outfall pump**				**$9,000**
10.1	Treated effluent pump skid		Item	LS	$9,000
11.0	**Amenities Building**				**$200,000**
11.1	Building	72	m^2	$2,000	$144,000
11.2	Laboratory equipment			Allowance	$18,000
11.3	Air conditioning			Allowace	$20,000
11.4	Drainage pipework			Allowace	$18,000
12.0	**Pipework, Valves and Fittings**				**$72,500**
12.1	Pipeworks				
	i) General pipework between equipment			Allowance	$30,000
	ii) Effluent discharge line to creek	85	m	$500	$42,500
13.0	**Installation/Testing/Commissioning**				**$145,000**
13.1	Installation of Equipment			LS	$40,000
13.2	Comissioning of Reactors			LS	$25,000
13.3	Further Process Comissioning			Allowance	$10,000
13.4	Mechanical			Allowance	$10,000
13.5	Electrical testing demonstration and comissioning			Allowance	$20,000
13.6	Demonstration to the Principal's technical personnel operation of installed equipment,			Allowance	$40,000

IDEA STP estimate V2 Cost Estimate 15/01/2020 3:11 PM

STOCKINBINGAL STP
COST ESTIMATE

				IDEA reactor	
Item	**Item Description**	**Qty**	**Unit**	**Rate**	**Amount**
14.0	**Electrical Works**				**$364,100**
14.1	Electrical Switchboard and PLC Panel		Item	LS	$41,000
14.2	Consumers' main cabling and Meter Box			LS	$20,000
14.3	Earthing			LS	$4,000
14.4	Electrical Conduits - trenching & bedding			LS	$6,500
14.5	Electrical Conduits, 100mm dia.			LS	$5,000
14.6	Electrical Pits 1.2mx1.2mx0.9m heavy-duty			LS	$6,600
14.7	Electrical cables - power and control			LS	$18,000
14.8	Building services - lights, power, alarm			LS	$9,000
14.9	Instruments - level transmitters & Switches			LS	$10,000
14.10	PLC and HMI programming			LS	$33,000
14.11	Telemetry			LS	$20,000
14.12	FD and CHAZOP Workshop			LS	$11,000
14.13	Electrical accessories & misc. cost			LS	$8,000
14.14	Electrical testing and commissioning			LS	$6,000
14.15	Upgrade power supply			Allowance	$100,000
14.16	Consumer mains supply and installation			Allowance	$37,000
14.17	Supply and installation of main switchboard			Allowance	$29,000
15.0	**Potable water connection to STP**				**$10,000**
	Potable Water			Allowance	$10,000
16.0	**Miscellaneous**				**$90,000**
16.1	Work As Executed Drawings			Allowance	$30,000
16.2	Training of personnel			Allowance	$30,000
16.3	O & M guidelines and instructions			Allowance	$25,000
16.4	QA plans			Allowance	$5,000
	TOTAL DIRECT CONSTRUCTION COST (inlcuding contractor margin)				**$2,084,171**
	Project Contingency			20%	**$416,834**
	Survey investigation anddesign and projectmanagement 10%			10%	**$208,417**
	TOTAL CAPITAL COST				**$2,709,422**

IDEA STP estimate V2 Cost Estimate 15/01/2020 3:11 PM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Document No. PWF-3006b July 2019

DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Guidelines for applicants 2020-21

Floodplain Management Program

environment.nsw.gov.au

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Cover photo: Flooded creek. Alexandra Gardiner/DPIE

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Introduction

The NSW Government provides technical and financial support to local government under the Floodplain Management Program (the Program) to manage flood risk. The primary objective of the Program is to support the implementation of the NSW Flood Prone Land Policy, which aims to reduce the impacts of existing flooding and flood liability on communities and to reduce private and public losses resulting from floods, using ecologically positive methods wherever possible.

The Program is administered by the Department of Planning, Industry and Environment (DPIE).

The NSW Government recommends that local government manage its flood risk by following the floodplain risk management process outlined in the Floodplain Development Manual (2005).

Closing date: **5.00pm 8 April 2020**.

Eligibility

The following organisations are eligible to apply.

- local councils
- county councils
- other government bodies with equivalent floodplain risk management responsibilities to local councils (e.g. Lord Howe Island Board, Hunter Local Land Services (LLS)).

Local councils can also work together in a group, provided that either:

- one council is the lead agency in terms of signing of the funding agreement, managing monies and reporting on the project
- a relevant Regional Organisation of Councils applies for and manages the funding.

What will be funded?

Table 1 Applications can be made for the following projects

Project Category	
Stage 1	Flood study (including data collection).
Stage 2	Prepare or review a floodplain risk management study and plan
Stage 3	Investigation, design and/or feasibility study (where required) for works identified in a floodplain risk management plan; this stage must be undertaken for all works projects that are likely to exceed a total project cost of $500,000.
Stage 4	Implementing actions identified in a floodplain risk management plan, including but not limited to: • structural works such as levees, detention basins, floodgates and flow conveyance improvements (if these are extensive works requiring a high level of funding, they should be broken into stages) • flood warning systems • evacuation management

	• upgrades of flood assets that have reached the end of their design life • voluntary house raising (further information on the eligibility criteria and implementation of voluntary house raising projects is available in Floodplain Management Program Guidelines for voluntary house raising schemes) • voluntary purchase (further information on the eligibility criteria and implementation of voluntary purchase projects is available in Floodplain Management Program Guidelines for voluntary purchase schemes).

Note: Lodging an application for financial assistance does not guarantee assistance will be offered.

Separate application forms must be completed for each project.

Councils can submit a maximum of four applications per funding round, these should be the highest priority projects for funding. An additional two applications (maximum six) will be considered if the applicant can demonstrate the need for all the projects and the ability to effectively manage the projects. Approval to exceed the four-application limit must be sought prior to submitting the additional applications from the Manager Contestable Grants – Coast, Estuary and Flood at coastalestuary.floodgrants@environment.nsw.gov.au.

What will not be funded?

Funding will not be provided for:

- GST – the project cost is to exclude GST.
- Retrospective projects – funding is not available for activities currently underway, completed or contractually committed to prior to the awarding of grants to successful applicants or prior to approval of the project work plan.
- Administration costs – unless otherwise approved in writing by the Department, all internal costs (including on-costs) associated with the core activities of the applicant are ineligible for funding. An applicant's core activities include preparing study briefs, reviewing proposals and tenders, researching and copying records, attending meetings, contract and grant administration, accounting costs, staff costs associated with liaising with the public and with government agencies. Costs related to the education of residents via mailouts, workshops or other methods will be funded where those costs are deemed to be reasonable and well justified.
- Project management costs – unless specifically approved at the time of application.
- Non-monetary contributions as matching funds – an applicant's matching funds must be in the form of monetary contributions from council revenue and cannot include in-kind or voluntary contributions or funding from other parties.
- Contingencies – should not be included in the application or work plan.
- Projects the applicant can reasonably be expected to undertake without financial assistance from the program.
- Maintenance of assets or replacement of assets that have not been appropriately maintained.
- Additional funding after commencing the project of more than 30% of the original amount requested.

Program objectives

The Floodplain Management Program objectives are to provide financial support to councils and eligible public land managers to:

- reduce the impacts of existing flooding and flood liability on communities and to reduce private and public losses resulting from floods
- make informed decisions on managing flood risk by preparing floodplain risk management plans (and associated background studies) under the floodplain risk management process
- implement floodplain risk management plans to reduce flood risk to both existing and future development, and reduce losses through a range of property, flood and response modification measures as outlined in the Floodplain Development Manual
- provide essential information to the NSW State Emergency Service to enable the effective preparation and implementation of local flood plans to deal with flood emergency response.

Note: Projects which cannot demonstrate that they meet the objectives of the Floodplain Management Program will be considered ineligible for funding.

Funding priorities

Generally, the highest priority will be given to the following projects:

- Flood studies or floodplain risk management studies and plans (or reviews), with the highest priority given to those in areas with significant development pressures or where existing communities are exposed to flood risk but this risk is not fully understood.
- The next stage of a mitigation work that is integral to a stage in progress; for example, the next stage of a levee project or works to offset the impacts from a levee project being constructed.
- Mitigation works that are identified as a high priority in floodplain risk management studies and plans adopted by councils.

What applicants will need to contribute

Assistance under the Program is $2 from government for every $1 provided by the applicant (from council revenue), except where special consideration is provided.

Contributions to the project from other funding sources (not council revenue) must be removed from the whole project cost prior to applying the funding ratio, except for voluntary house raising.

Special consideration

An applicant unable to match the Program's funding contribution may apply for special consideration.

When applying for special consideration, the application should demonstrate why the issue being addressed is of regional or statewide significance and that the applicant does not have the financial capacity to address it.

The applicant's financial capacity will be assessed considering its per capita general-purpose grants under the Local Government Financial Assistance Grants, as established by the Local Government Grants Commission.

If the applicant intends to apply for special consideration, they should contact the Manager Contestable Grants – Coast, Estuary and Flood to discuss an agreed maximum funding ratio prior to submitting the application.

If special consideration is awarded, the applicant will be eligible to:

- an increased government contribution towards the cost of the project
- claim project management costs (capped at a maximum of 10% of the total project cost) undertaken either:
  - internally (with the costs used as in-kind contributions to match funding)
  - externally (selected by a competitive process and funded as a specific cost).

Partnerships

Where a group of local councils are working together in partnership (either under the lead of one of the councils or a relevant Regional Organisation of Councils), then the lead council or Regional Organisation of Councils is able to claim a maximum of 10% of the total project cost for project management.

Eligible project management costs include:

- A project manager or staff member employed specifically for the project, who is selected by a competitive process. Note: We will not pay for staff already employed by the organisation submitting the application that will be supervising/project managing or working on the project as part of their usual duties.
- Administrative costs directly related to the funded project. This can include those noted under 'What will not be funded?'

Project implementation timeframe

Projects should not extend beyond three years.

Projects should be realistically timed as extensions to timeframes may not always be granted. It will also minimise the need for future paperwork to vary timeframes, which can take time to be assessed and stall progress on the project.

Funding agreements

Successful applicants must enter into a funding agreement that stipulates all funding obligations and conditions.

The agreement will need to be signed by the general manager (or someone with delegated authority) within 45 days of the formal grant offer.

The project will be tracked and managed against the work plan which must be kept current by the grant recipient, in consultation with the Department of Planning, Industry and Environment, throughout the funded period.

Consider the conditions in the sample funding agreement before submitting an application as changes to the agreement will only be made in exceptional circumstances.

Assessment process

Applications will be checked to confirm eligibility and completeness. Ineligible, late or incomplete applications will be considered ineligible for funding.

Applications will then be assessed by the Department's technical staff against the assessment criteria.

An independent panel, which includes expert and stakeholder representation, will then assess and prioritise applications on a statewide basis.

Successful applications will be announced.

Details of successful applications will be placed on the Department's website. All applicants will be notified in writing of the outcome of their application.

Assessment criteria

Essential criteria

All applicants must be able to demonstrate:

- the project meets the objectives of the Floodplain Management Program
- capacity to deliver the project, past grants management history, available resources and financial commitment, proposed timeframe, and whether the project is realistic based on completion of prerequisite consultant briefs, preconstruction work or approvals
- commitment to maintain any works in a condition suitable to meet its design intent for the design life
- the floodplain risk management process outlined in the Floodplain Development Manual (2005) has been followed.

Projects must meet all four essential criteria to be eligible for funding.

Other criteria

Applications will also be assessed on:

- the extent to which the project is cost-effective in addressing one or more of the Program's priorities
- the technical feasibility, effectiveness and efficiency of the risk mitigation solutions
- the level of regional significance, including the immediacy of any threats
- the level of community support
- for works, the outcomes of ranking based on the scoring system endorsed by Floodplain Management Australia (see New Works Ranking Form and 'Instructions on completing the application form' for more details)
- the priority of the project with regard to the relevant adopted floodplain risk management plan (if applicable)
- the current risk to people and/or property from flooding in this area and how effectively the application addresses these risks.

Note: An application will be awarded a reduced ranking if it is not well thought out or it has unclear objectives or outcomes.

Additional guidance on some specific items

Pit and pipe survey

Floodplain risk management is primarily aimed at addressing riverine and local overland flooding.

As part of this understanding, an assessment of the capacity and performance of trunk drainage systems may be necessary. This may, in some cases, require some survey of the trunk drainage system and this is generally eligible for funding. However, broader surveys of minor and feeder drainage systems are not funded. Surveying for asset management purposes is ineligible for funding.

The extent of the drainage system surveyed will need to be justified by the applicant commensurate with the risk to ensure that the survey incorporated in the study is fit for purpose. As a guide, trunk drainage systems can be considered to involve pipes of a minimum of 0.75 metre diameter.

Floor level survey

Floor level surveys may be undertaken using a range of methods depending upon the intended end use of the information and the terrain.

These purposes may vary from assessment of flood damages through to provision of more specific advice to the community.

The applicant should consider the intended purpose and methodology relevant to their situation and include a suitable budgetary allowance as part of their application. If highly specific and detailed floor level survey is required then strong justification as to why this level of detail is required should be included in the application.

Community consultation

Community consultation is an integral part of the floodplain risk management process.

The methodology used for community consultation will vary depending upon the type and scale of the study, the area of concern, the needs of the community and the general methods council may use to consult the community.

All applications for flood studies and floodplain risk management studies and plans are to include an appropriate budgetary allowance that considers the scope and scale of consultation appropriate for the study.

For projects dealing with evacuation management or flood warning systems, provide written evidence of support from the State Emergency Service or Bureau of Meteorology, respectively.

Detailed descriptions of what will be involved in the consultation are required for all projects if costs are to be included as a component of the grant funding.

New works ranking form

This form only needs to be completed for implementation project (stage 3 or 4 as outlined on page 1 of these guidelines).

For new works (including structural works, flood warning, evacuation management, voluntary purchase and voluntary house raising) please submit a New Works Ranking Form to enable

ranking using the scoring system endorsed by Floodplain Management Australia. The new works ranking form is available on the Floodplain management grants page.

Note that councils should update this form once the investigation and design have been completed.

Contacts for assistance

For assistance with grant applications, contact the Department of Planning, Industry and Environment offices listed below.

Region	Telephone
Hunter/Central Coast	02 4927 3248
South West	02 6229 7170
North East	02 8289 6318
South East	02 4224 4153
Greater Sydney	02 8837 6097
North West	02 6883 5315

General administration inquiries

For general grant administration inquiries, contact the Grants Unit – Coast, Estuary and Flood on 02 9895 6494 or by email at coastalestuary.floodgrants@environment.nsw.gov.au.

Submission process

Closing date

Applications must be received by **5.00pm 8 April 2020.**

Any application that is late, incomplete or ineligible will not be considered.

Other programs

The Department of Planning, Industry and Environment also offers a Coastal and Estuary Grants Program, for further information, please see the Current floodplain management grants page.

The NSW Environmental Trust offers a range of other environmental grants for local government. For further information, please see the Environmental Trust website.

Instructions for completing the New Works Ranking Form

The New Works Ranking Form assists with the ranking of new works only and is the scoring system endorsed by the Floodplain Management Association. It should be completed when submitting an application for a new works project which has not previously been scored or where the council would like to update a project's scoring based on improved information.

The New Works Ranking Form includes a number of project assessment sheets.

All applicants are to complete sheets 1 and 2. In addition, depending on the type of project, complete sheet:

- three for integrated schemes and structural works projects
- four for evacuation management improvement projects
- five for flood warning improvement projects
- six for voluntary purchase and house raising projects.

Information should be provided in relation to the flood on which the flood planning level is based or, if this is not available, the largest known historical flood.

Sheet 1	Provides preliminary data. This is usually available from the relevant flood study and/or floodplain risk management study and indicates the extent of the flood problem to which a community is exposed.
Sheets 2-6	Provide detailed and specific data required for projects seeking funding for floodplain management works. Works include structural works, flood warning, evacuation management, voluntary purchase and voluntary house raising projects. This data is used to determine the effectiveness and efficiency of the project in reducing flood problems and meeting associated objectives so these can be compared on a statewide basis.

Project assessment sheet 1: All categories of applications

C1. **The source of flood information** used to answer the questions must be indicated. Where DPIE does not have a copy of the appropriate studies and other documentation such as a review of environmental factors (REF) or environmental impact statement (EIS), as appropriate, a copy will be requested to assist in undertaking an impartial check of the data provided.

C2. **Hazard level in area** assesses important factors in defining the level of flood hazard in the area, as defined in the *Floodplain Development Manual*.

Questions C3 to C6 provide an outline of the impacts of the flood on the community.

C3. **Scale of problem – number of dwellings affected** provides an indication of the number of people affected by flooding.

C4. **Scale of problem – percentage of dwellings flooded** provides an indication of the scale of the problem from a local perspective.

C5. **Scale of problem – occurrence of over floor flooding** looks at the frequency of damaging flooding and gives an indication of the regularity and therefore the ongoing impact of flooding on the community.

C6. **Scale of problem – evacuation requirements** indicates the degree of evacuation problems to which the community is exposed.

Project assessment sheet 2: Detailed data – all categories of applications

Detailed data are required for all projects.

C7. Community involvement in project investigates the degree of project development in accordance with the principles of the *Floodplain Development Manual*.

C8. Strategic planning in place investigates the degree to which strategic planning is being used to control new development and redevelopment in the floodplain.

C9. Benefit/cost ratio for proposed works considers the economic efficiency of the project in reducing flood damages.

C10. Incorporation of environmental considerations and enhancements examines whether environmental impacts have been considered and whether these have been incorporated in the project. It also indicates whether opportunities for environmental enhancement have been considered and are being implemented as part of the project.

C11. Environmental assessment for compatibility with ecologically sustainable development (ESD) considers how the project has dealt with environmental impacts and addressed ESD principles.

Project assessment sheet 3: Specific data – integrated schemes and structural works only

Integrated schemes are projects that involved a range of structural work components or measures that work together as an integral scheme to provide flood benefits. The benefits of the scheme would generally significantly outweigh the benefits of individual components.

C12. Average damage per dwelling examines the existing damage level in the town based on average (determined from actual rather than potential) damage per dwelling that is likely to occur without the proposed management measures.

C13. Average annual damage per dwelling examines the cost of flooding per dwelling across a range of floods, not just the planning-level flood. This provides an indication of the long-term cost of flooding to the community.

C14. Percentage reduction in average annual damage per dwelling examines the efficiency of the project in reducing damage from a range of events on a per dwelling basis.

C15. Social improvements resulting from project examines the degree to which the project has addressed the social impacts.

Project assessment sheet 4: Specific data – projects to improve evacuation management only

C16. Hazard level (as defined in the *Floodplain Development Manual*) examines the hazard that exists in the township, the potential for isolation, the logistics of evacuation and the hazard associated with the evacuation route.

C17. Evacuation management examines whether external evacuation resources are required and flood predictions are available, how flood ready the community is, whether the State Emergency Service supports the project and whether their support reduces the need for external evacuation resources, i.e. there are fewer people to evacuate, or they can evacuate themselves unassisted.

C18. Scale of evacuation problem indicates the number of people requiring evacuation to provide information on the scale of the problem.

C19. Social improvements resulting from project examines the degree to which the project has addressed the social impacts.

Project assessment sheet 5: Specific data – projects to improve flood warning only

C20. Hazard level (as defined in the *Floodplain Development Manual*) examines the level of hazard in the community.

C21. Flood warning examines the feasibility and likely effectiveness of flood warning projects. These projects must have the support of the Flood Warning Consultative Committee.

C22. Flood warning – scale of problem examines the current shortcomings in the existing flood warning system, if any system exists.

C23. Social improvements resulting from project examines the degree to which the project has addressed the social impacts.

Project assessment sheet 6: Specific data – voluntary purchase and house raising projects only

C24. Average damage per dwelling examines the existing damage level in the town based on average (determined from actual rather than potential) damage per dwelling that is likely to occur without the proposed management measures.

C25. Average annual damage per dwelling examines the cost of flooding per dwelling across a range of floods, not just the planning-level flood. This provides an indication of the long-term cost of flooding to the community.

C26. Hazard level (as defined in the Floodplain Development Manual) examines the hazard that exists in the township, the potential for isolation, the logistics of evacuation and the hazard associated with the evacuation route.

C27. Social improvements resulting from project examines the degree to which the project has addressed social impacts.

Feasibility Study

Nangus Water Supply

8202004301- R01-V02

Prepared for
Goldenfields Water

17 February 2020

Cardno

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Document Information

Prepared for	Goldenfields Water
Project Name	Nangus Water Supply
File Reference	8202004301-R01-V02 Nangus Feasibility.docx
Job Reference	8202004301- R01-V02
Date	17 February 2020
Version Number	V02

Author(s):

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Effective Date 11/12/2019

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Date Approved 11/12/2019

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
V01	12/12/2019	Draft	JMK	BSE
V02	17/02/2020	Final	JMK	SB

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1 Introduction

Nangus is a village in the Cootamundra Gundagai Regional Council (CGRC) with an estimated population of 80 people. The village is located approximately 18 km west of Gundagai. Nangus does not currently have a reticulated water supply, and residents provide their own water supplies, typically from roof water, bottled water, bore water or water carting.

CGRC recently undertook community consultation for the Villages Strategy, which received strong support for provision of a reticulated water supply. CGRC has requested Goldenfields Water County Council (GWCC) investigate provision of a reticulated town water supply to Nangus.

The objectives of the overall project include:

- Provide appropriate levels of service (LOS) as part of the design assessment and ensure the LOS can be achieved throughout its design life.
- Achieve project delivery from initiation to construction completion in 4-6 years (should the project prove feasible).
- Undertake a feasibility assessment Phase (Phase 1) of the project
- Undertake a Business Case Phase of the project (Phase 2)
- Cost estimates for whole of life costs to be equal to or less than 100% of benefit, achieving BCR of 1 or over
- Achieve best practice principles
- Secure construction funding
- Assess and mitigate all risks associated with the delivery and ongoing operation of this project.

Cardno has been engaged by GWCC to undertake the Nangus Water Supply Feasibility Study, which meets Phase 1 in the above objectives. This study investigates and assesses a range of options to provide a reticulated water supply to Nangus.

2 Problem Definition

2.1 Existing Water Supply Arrangements

Nangus does not currently have a reticulated water supply. Residents are responsible for obtaining their own water supplies. This is typically achieved through the following:

- Rain water tanks
- Bottled water
- Bores
- Water carting

The current supply arrangements are onerous for residents to operate and maintain, and present potential risks in terms of supply quality and security.

Reticulated potable water supply systems currently exist to the west (GWCC network) and east (CGRC network in Gundagai) of Nangus. The regional context of Nangus is shown in Figure 2-1, while the town centre is shown in Figure 2-2.

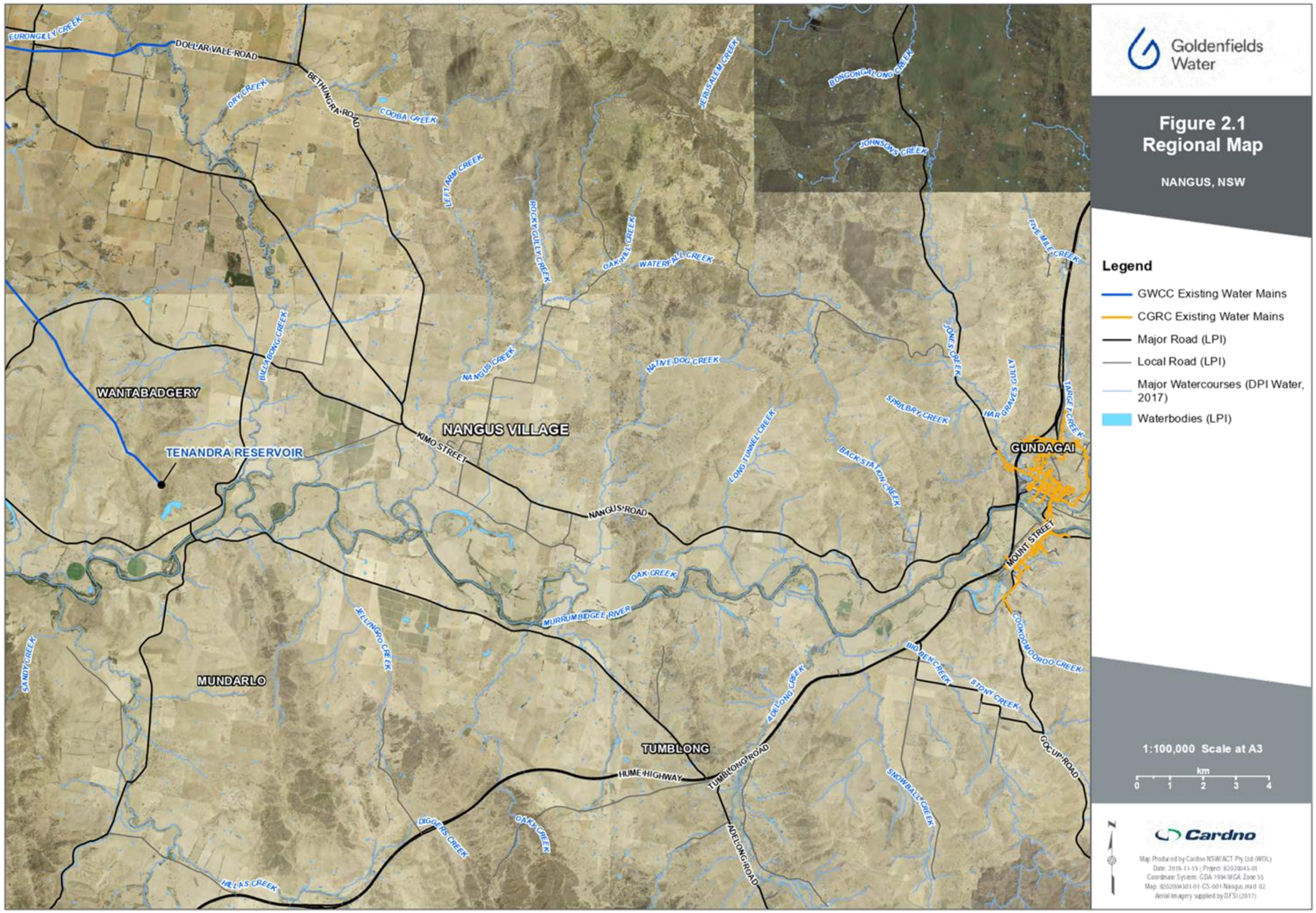
2.2 Drivers for a Reticulated Water Supply

Drivers for a reticulated water supply in Nangus are outlined below.

- Growth potential

  The lack of a reticulated water supply may be holding back potential growth in the Nangus area. Investigations by CGRC indicate that provision of a reticulated water supply would support residential and economic growth. The following factors point to the potential for growth in the Nangus area:

  - Nangus currently has other infrastructure and services, including a Public School, town hall, general store, post office, mechanic and a bus depot servicing Wagga Wagga and Gundagai. These existing facilities improve the outlook for growth in the area, should a reticulated water supply be provided.
  - Nangus Road is currently being upgraded to support B-double traffic. Improved road linkages through the area may lead to increased traffic and demand for services. Nangus could potentially develop as a service hub on this regional route.
  - At 15 minutes' drive from Gundagai, Nangus is an affordable residential lifestyle alternative to Gundagai. Nangus is also situated close to a number of other regional employment areas, including Junee (30 minutes), Wagga Wagga (45 minutes) and Cootamundra (45 minutes).
  - CGRC estimates that the unoccupied dwelling rate in Nangus is lower than other villages in the Local Government Area (LGA). This may indicate potential demand for additional housing and development in the area.
  - CGRC has identified an area adjacent to Nangus for subdivision into lots of 2 ha and 5 ha, as shown in Figure 2-3. It is proposed that this land will be rezoned from RU1 (Primary Production) to RU4 (Primary Production Small Holding).
  - There are approximately 27 occupied dwellings in Nangus (data from CGRC). Based on population projections from CGRC, this may increase to approximately 79 occupied dwellings (see Section 3).


Goldenfields Water
Figure 2.1
Regional Map
NANGUS, NSW
Legend
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-19 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-001-Nangus.mxd: 02
Aerial Imagery supplied by DFSI (2017)
EURONGILLY CREEK
DOLLAR VALE ROAD
DRY CREEK
BETHUNGRA ROAD
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAKHILL CREEK
WATERFALL CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
FIVE MILE CREEK
WANTABADGERY
BILLABONG CREEK
NANGUS CREEK
NANGUS VILLAGE
NATIVE DOG CREEK
KIMO STREET
TENANDRA RESERVOIR
NANGUS ROAD
LONG TUNNEL CREEK
BACK STATION CREEK
JONES CREEK
SPRILBRY CREEK
HARGRAVES GULLY
LARGE FLAT CREEK
GUNDAGAI
MOUNT STREET
OAK CREEK
MURRUMBIDGEE RIVER
JELLINGOTE CREEK
SANDY CREEK
MUNDARLO
BIG BEN CREEK
STONY CREEK
COOKAMOOROO CREEK
ADELONG CREEK
TUMBLONG
HUME HIGHWAY
TUMBLONG ROAD
GOCUP ROAD
SNOWBALL CREEK
DIGGERS CREEK
OAKY CREEK
HILLAS CREEK
ADELONG ROAD

NANGUS CREEK
Nangus Hall
Reserve for Public Recreation
Cemetery
Bushfire Shed
Cemetery
KIMO STREET
BANGUS STREET
TENANDRA STREET
BILLABUNG STREET
WANTIOOL STREET
OAKHILLS ROAD
NANGUS
Waste Transfer Station
NANGUS ROAD
SOLDIER SETTLERS ROAD
Goldenfields Water
Figure 2.2
Nangus Town Centre
NANGUS, NSW
Legend
Major Road (LPI)
Local Road (LPI)
Vehicular Track (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
CGRC Owned Lots
1:6,000 Scale at A3
m
0 50 100 150 200
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-20 / Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-002-NangusTown.mxd 32
Aerial imagery supplied by DFSI (2017)

Figure 2-3 Proposed area for rezoning (Source: CGRC)

- Community Support

  CGRC recently undertook community consultation as part of preparation of the Villages Strategy. The unanimous response from Nangus residents was in support of a reticulated water supply. Respondents indicated they believed lack of a reticulated water supply was holding the village back from potential residential growth.

- Security and water quality risks associated with current water supply arrangements

  Current water supply arrangements are onerous for residents, and present potential health risks to residents. Provision of a reticulated supply would remove the health risks associated with residents' current supplies, and increase supply security, particularly with respect to rainwater tanks.

- Sustainable Development Goals

  GWCC takes consideration of the United Nations Sustainable Development Goals (SDG) into account in its operations. Relevant goals to this project include:

  - Goal 6: Ensure availability and sustainable management of water and sanitation for all.
  - Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

- Equal opportunity and consistency of services for all townships within CGRC, which enables greater social cohesion through the provision of access to similar standard of water services currently available in the larger centres.

3 Water Demand

CGRC estimates the current population of Nangus to be approximately 80 people. The following are currently located within the village:

- Approximately 27 occupied dwellings
- Church
- Hall
- Public School
- RFS Shed
- General Store
- Workshop

Therefore, there is potential for approximately 33 connections at the existing level of development. In addition, there are currently approximately 36 vacant lots.

Population projections from CGRC estimate a population of 213 people could be possible in the long term. This equates to 79 property connections at the 2016 Nangus census occupation rate of 2.7 people/dwelling.

To allow for additional growth, CGRC and GWCC have agreed the feasibility study should be based on a supply for 100 ET (equivalent tenements) in the village of Nangus. This will allow for all foreseeable growth.

The design average day demand (ADD) and maximum day demand (MDD) from within the village of Nangus are shown in Table 3-1. The design criteria per ET for ADD and MDD are taken from the level of service targets in the GWCC Drinking Water Management System (Atom Consulting, 2017). Note that the ADD is given as 294 kL/y/ET in the above document, which equates to the 0.81 kL/d/ET ADD given in Table 3-1.

Options that involve construction of a pipeline transferring potable water from either GWCC or Gundagai will also present opportunities to provide potable water to rural properties along the route. For all pipeline options an allowance for five rural property connections has been made, each with a MDD of 25 kL/d and ADD of 5kL/d. The total demands for the pipeline options are given in Table 3-1. In the hydraulic modelling it has been assumed that the full demand will be catered for in the pipelines through to Nangus, as it is unknown where these rural demands will be located along the pipeline.

Table 3-1 Water demand

Parameter	Nangus Village		Nangus Village and Rural Demand (pipeline options only)		
	Design Criteria (kL/d/ET)	Total Demand (kL/d)	Design Criteria for Rural Connection (kL/d/ET)	Rural Demand (kL/d)	Total Demand (kL/d)
Average Day Demand	0.81	80.5	5	25	105.5
Maximum Day Demand	4	400	25	125	525
Maximum hour Demand	7	712 (8.2L/s)	45	223	935 (10.8L/s)

A typical residential diurnal pattern was applied to the Nangus demands to determine the maximum hour requirements. The diurnal pattern has a peaking factor 1.78, which occurs at 4pm of a typical day. The applied curve is shown in Figure 3-2.

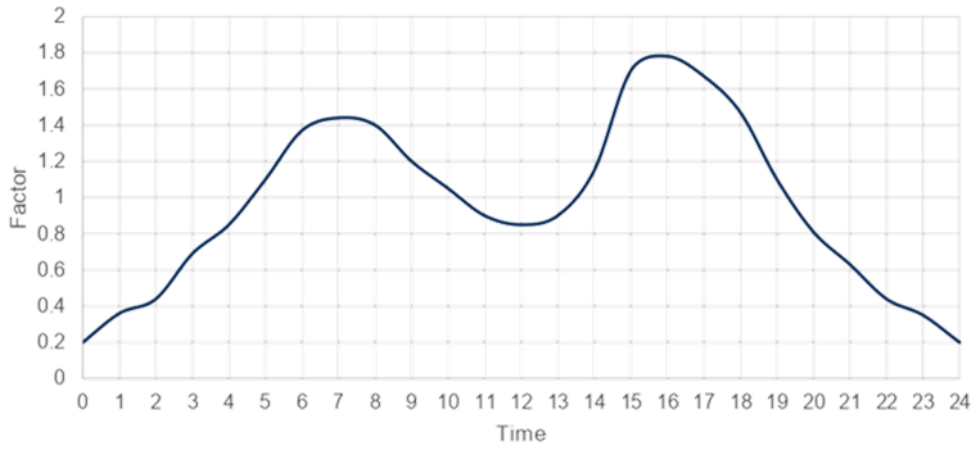


Figure 3-2 Typical Residential Diurnal Pattern

4 Options Identification

4.1 Options Previously Identified

GWCC previously identified the following potential options for supply of potable water to Nangus:

1. Extend the existing Gundagai potable water supply to Nangus
2. Connection to GWCC's Tenandra scheme at Oura Road to supply Nangus
3. Connection to GWCC's Tenandra, scheme near Tenandra reservoirs, and utilize the existing easement
4. Connection to GWCC's Tenandra reservoir and use the local terrain to determine the alignment to Nangus
5. River extraction including treatment process
6. Ground water extraction including treatment process
7. Do nothing, 'status quo'

4.2 Additional Options

A workshop was held with staff from GWCC, CGRC and Cardno to identify possible options not previously considered. The identified options include:

- Permanent water carting
- Dam on Billabong Creek with treatment
- Pipeline to Tarcutta water supply
- Pipeline to Riverina Water County Council Oura water supply

These options are further discussed below.

4.2.1 Permanent water carting

This option would involve construction of a reservoir and reticulation system in Nangus. However, water would be supplied to the reservoir by carting either from the GWCC system or from Gundagai. With a 20 kL tanker, at ADD this would equate to 4 truck movements per day, while at MDD 20 truck movements per day would be required.

Assuming a 20-minute drive between a truck fill location in Gundagai and a reservoir at Nangus and 50 minutes each for filling and emptying, a round trip would take approximately 2 hours. To accommodate ADD, the carting truck would be operational for 8 hours per day. To accommodate MMD, 5 trucks would be required to be in operation 8 hours per day.

Due to the high volume of truck movements required on a permanent basis, this option has been excluded from further analysis.

4.2.2 Dam on Billabong Creek with treatment

The Billabong Creek flows from the north to its confluence with the Murrumbidgee River west of Nangus. Note that the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (NSW Government, 2016), which includes this creek, refers to it as the Billabung Creek. Other resources refer to this watercourse as the Billabong Creek. The area drained by the Billabong Creek is shown in Figure 4-1.

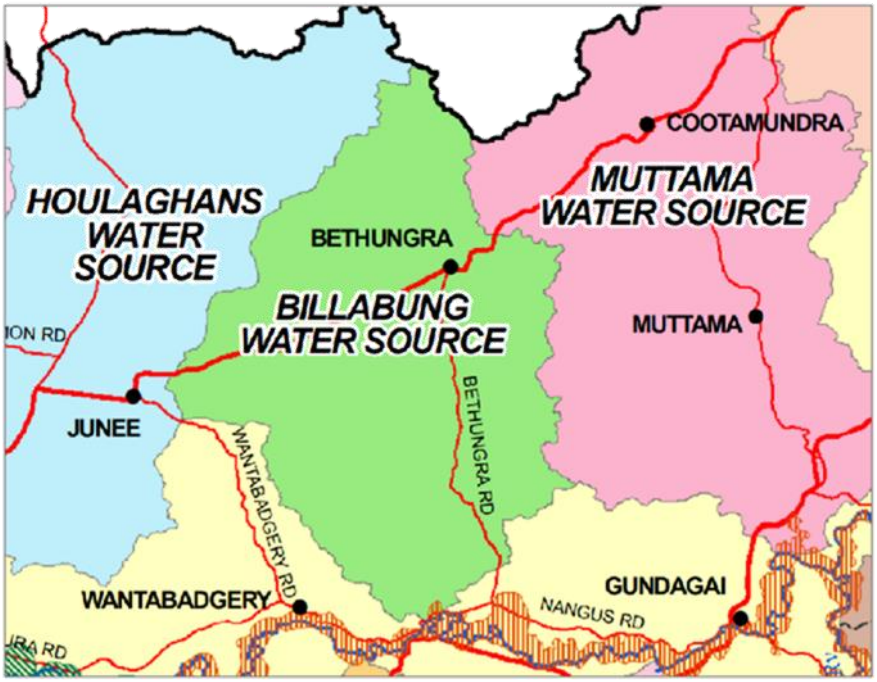


Figure 4-1 Billabung (Billabong) Water Source (Source: Plan Map WSP023_Version 2 from the Water Sharing Plan for Murrumbidgee Unregulated and Alluvial Water Sources 2012)

The creek is ephemeral, and as such either a dam or off-creek storage ponds would be required. Due to the significant costs associated with development of a new dam or off-creek storage, this option has been excluded from further analysis.

4.2.3 Pipeline to Tarcutta water supply

Riverina Water County Council currently operate a water supply scheme at Tarcutta using a groundwater source. Tarcutta is approximately 46 km from Nangus by road and approximately 31 km in a straight line. As the distance is significantly greater than options from the GWCC and Gundagai water schemes, this option is not considered any further in this study.

4.2.4 Pipeline to Oura water supply

Riverina Water County Council currently operate a water supply scheme at Oura using a groundwater source (separate from GWCC's Oura water supply system). Tarcutta is approximately 41 km from Nangus by road and approximately 35 km in a straight line. As the distance is significantly greater than options from the GWCC and Gundagai water schemes, this option is not considered any further in this study.

4.3 Options Assessed in this Feasibility Study

As no further practical options have been identified, the options carried forward for assessment in this Feasibility Study are based on those previously identified by GWCC, and are referred to by the following names in this report:

- Option 1: Pipeline from Gundagai water supply
- Option 2: Pipeline from GWCC water supply – from Oura Road
- Option 3: Pipeline from GWCC water supply – from Tenandra Reservoirs following existing easement
- Option 4: Pipeline from GWCC water supply – from Tenandra Reservoirs following new route
- Option 5: Murrumbidgee River extraction and treatment
- Option 6: Groundwater extraction and treatment
- Option 7: Do nothing

5 Evaluation Criteria

Options analysed in this study have been assessed in terms of capital cost and a risk assessment and multi-criteria analysis (MCA).

5.1 Capital Cost Estimate

Capital cost estimates for all options include:

- Costs for new delivery infrastructure, including pipelines, reservoirs, pump stations, bores, river intakes and treatment plants as required for each option.
- Modifications to existing water supply infrastructure in the GWCC network and Gundagai network, as required for the pipeline options.
- Costs for supply infrastructure including town reticulation and property service connections (excluding work after the supply meter required by the homeowner).
- Land acquisition and easements.
- Allowance for survey, investigation, design and project management.

Where appropriate, capital cost estimates have been based on the NSW Reference Rates Manual - Valuation of water supply, sewerage and stormwater assets (DPI, 2014), noting the following:

- 2014 rates have been factored for cost increases through to 2017 using the 2017 factors published by the Department of Industry (DPI). Factors have not been published for 2018 or 2019.
- Reference rates, which include an allowance for survey, investigation, design and project management, as directed by the manual, have been used.
- An 'inherent risk' contingency of 30% has been applied, as per guidance in the manual for feasibility studies.
- A 'contingent risk' of 10% has also been applied.
- The manual has been used for costs for pipelines, pump stations and reservoirs. Other works, such as WTPs, have been estimated by Cardno.

5.2 Multi-criteria Analysis and Risk Assessment

A key component of MCA is to identify the constraints, risks and opportunities that are associated with each option, and categorise each of these under a key heading or theme. Examples of these themes can be; safety (construction and operation), security of supply, flexibility, constructability, environment impact/risk, delivery timeframe risk, etc.

The criteria to be used for this analysis, a description of the scoring criteria and the weighting of each parameter are given in Table 5-1. Through the analysis, each option has been scored against the weighted criteria, providing an MCA score between zero and ten.

Table 5-1 Multi-Criteria Analysis Parameters and Weighting

No.	Criteria	Score and Description					Weighting
		0		5		10	
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	Low security. High frequency of water restrictions	↔		↔	High security. Complies with 5/10/10 rule.	20%
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	Does not consistently meet the existing AWDG health requirements and draft HBTs.	↔	Meets the majority of current ADWG, but will potentially need investment to satisfy future changes to the ADWG.	↔	Will meet current and likely future ADWG health requirements including HBTs.	15%
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	Does not consistently meet the AWDG aesthetic requirements.	↔	Meets the majority of current ADWG aesthetic requirements.	↔	Will meet consistently meet the AWDG aesthetic requirements.	10%
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	Catastrophic risk - likely loss of life and property across a wide area. Alternate water supply needed to support town. High risk of not retaining suitably qualified operational staff.	↔	Moderate Injury risk to operations staff. Moderate risk to public and property.	↔	Minimal risk to operations. No risk to public or property. Failure would result in a minor disruption to water supply. Low risk of not retaining suitably qualified operational staff.	15%
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	Constrained or limited access and egress for construction, significant impacts to day to day usage of the area. High WHS risk. Poor ground conditions. Complex work requiring specialist contractors.	↔	Average access and egress for construction, some impacts to day to day usage of the area. Moderate WHS risk.	↔	Easy access and egress for construction, minimal impacts to day to day usage of the area. Low WHS risk. Good ground conditions. Lower complexity work.	15%
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	Absence of available information for project definition increases the potential for project delays and budget exceedance.	↔	Reasonable level of project definition achieved. Typical project, with standardised design and construction needs. Moderate risk for project delays and budget exceedance.	↔	High level of project definition. Typical project, with standardised design and construction needs.	10%
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	Critical heritage likely to be impacted. Adverse/significant impact to key vegetation communities. Potential for extended approvals period. Risk of approvals not obtained.	↔	PADs likely to be impacted - AHIP approval required. Minor impact to key vegetation communities. Moderate risk extended approvals period. Moderate risk approvals not obtained.	↔	No heritage impact anticipated / Ability to avoid identified heritage sites. Avoid mapped key vegetation communities. Extended approvals period unlikely. Low risk of approvals not being obtained.	15%
	Total						100%

6 Existing GWCC Tenandra Water Supply

GWCC water distribution infrastructure currently extends to the Tenandra Reservoirs, located on a hilltop approximately 8.6 km west of Nangus. At Tenandra there are two concrete reservoirs with a total storage of 3.2 ML.

The rising/gravity main to the Tenandra Reservoirs is a DN300 cast iron (CI) pipe constructed in the 1930s. The reservoirs and main were originally part of a scheme used to supply water from the Murrumbidgee River (extracted approximately 2km west of the reservoir site) through to Junee. When the Oura groundwater source was developed in the 1970s the river extraction at Tenandra became redundant and was decommissioned. However, the reservoirs were retained to service the current system. The mains supplying the other villages within the Tenandra scheme consist of mostly PVC pipe ranging in sizes from 50 mm to 200 mm, constructed between the early 1970s and mid-1980s.

The Oura scheme, which currently supplies the Tenandra part of the network, consists of a borefield that extracts water from the Wagga Wagga Alluvial Groundwater Source. Water is treated by way of aeration, chlorination and fluoridation.

Access to the Wagga Wagga Alluvial Groundwater Source is controlled by the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (NSW Government, 2016). GWCC has a licence for extraction of 6 GL/y from the Oura system. The current demand on the supply is approximately 4.0 GL/y, projected to increase to 4.6 GL/y in 2048 (Cardno, 2019), not including Nangus. The peak day demand on the Oura scheme is currently 26.2 ML/d, projected to increase to 30.2 ML/d in 2048 (Cardno, 2019), not including Nangus. The Oura system supplies approximately 45% of the total water consumed by GWCC customers.

The Tenandra Reservoirs are used as header storage for the villages of Wantabadgery, Eurongilly, Illabo, Bethungra and minor rural consumers. Water is supplied from the Junee to Temora trunk main via an offtake to the Junee Silos Booster Pump Station, filling the Marinna reservoirs. Marinna Pump Station pumps to Tenandra, Wantabadgery, Eurongilly, Illabo and Bethungra reservoirs. Under gravity, water is fed out of the Tenandra Reservoirs via a common inlet/out supplying water to the reservoirs of Wantabadgery, Eurongilly, Illabo, Bethungra minor rural consumers and the east of Junee.

It is noted that GWCC's assets between the Junee Silos Pump Station and the Tenandra Reservoirs all have a condition rating of 3 (fair) or 4 (poor). Future investigations of options that incorporate supply from GWCC's network should include consideration of the condition of these assets, and what renewals may be necessary to ensure reliability of supply.

7 Existing CGRC Gundagai Water Supply

The Gundagai water supply scheme is owned and operated by CGRC. The scheme draws raw water from the Murrumbidgee River under water access licence (WAL) 6455, which allows an annual take of 1,250 ML. Access to water in the Murrumbidgee River in controlled under the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* (NSW Government, 2018).

The Gundagai WTP process incorporates coagulation, flocculation, clarification, filtration, chlorination and fluoridation. Treated water is delivered to four reservoirs and to the reticulation network (see Figure 8-1).

CGRC has confirmed that there is sufficient spare capacity in the raw water supply and treatment plant to supply Nangus.

8 Options Assessment

8.1 Nangus Service Area

For all options, allowance has been made for reticulation to service the existing developed lots within the town. As per Figure 2-3, CGRC propose to rezone land to the north and north-west of the existing town to allow future development. Allowance has been made in the design service pressure to service these areas. The lowest elevation in the service area is approximately RL 215 m (along Nangus Road), while the highest elevation is approximately RL 260 m (at the north-west edge of the area noted for rezoning). GWCC design service pressure is 12 m to 90 m. Therefore, it is proposed to service the town in a single pressure zone.

8.2 Desktop Environmental Constraints Analysis

Cardno has undertaken a desktop environmental constraints analysis as part of the Nangus Water Supply Feasibility Study. The intent of the analysis was to highlight any 'red-flags' which may influence the alignment/location of the infrastructure involved in the various options. The analysis was desktop based, and therefore site specific investigations will be required in future project stages. The constraints analysis for each option is detailed in the relevant section below.

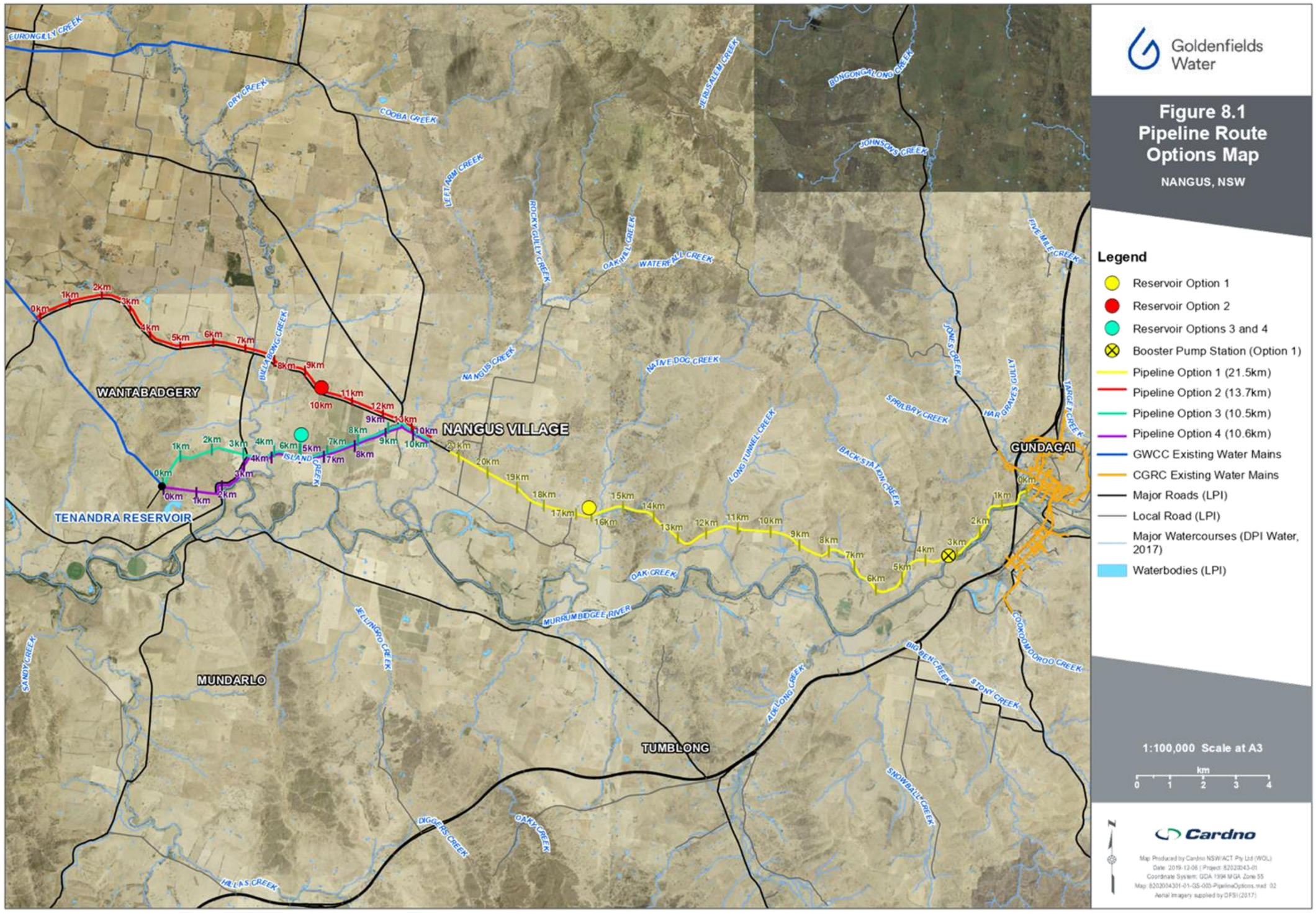
8.3 Options 1 to 4: Overview

Options 1 to 4 incorporate pipelines delivering potable water from existing networks; Option 1 from the CGRC system in Gundagai and Options 2 through 4 from the GWCC system to the west of Nangus. The pipeline routes are mapped on Figure 8-1, with comparative elevation profiles shown on Figure 8-2. Detailed maps are provided for the options in Appendix A.

For each option, reservoirs have been situated at locations of appropriate elevation along the pipe routes, as close as possible to Nangus. The elevations have been selected to provide sufficient service pressure as noted in Section 8.1.

In all options a DN100 pipeline between the supply source and the reservoir is suitable to convey peak day flows, while a DN150 pipeline is required between the reservoirs and the town to allow for peak hour flows.

A map of the proposed reticulation within Nangus (common to all options) is given in Figure 8-3. The reticulation is proposed to be constructed from DN100 PVC-O.


Goldenfields Water
Figure 8.1
Pipeline Route Options Map
NANGUS, NSW
Legend
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Booster Pump Station (Option 1)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Roads (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-12-06 (Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-003-PipelineOptions.mxd 02
Aerial Imagery supplied by DFSI (2017)
WANTABADGERY
NANGUS VILLAGE
TENANDRA RESERVOIR
MUNDARLO
TUMBLONG
GUNDAGAI
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAKHILL CREEK
WATERFALL CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
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NATIVE DOG CREEK
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SPRILBRY CREEK
HARGRAVES GULLY
TARGET CREEK
LONG TUNNEL CREEK
BACK STATION CREEK
OAK CREEK
MURRUMBIDGEE RIVER
JELUNGHO CREEK
SANDY CREEK
ADELONG CREEK
BIG TEN CREEK
STONY CREEK
COOKOOMOOROO CREEK
SNOWBALL CREEK
DIGGERS CREEK
HILLAS CREEK

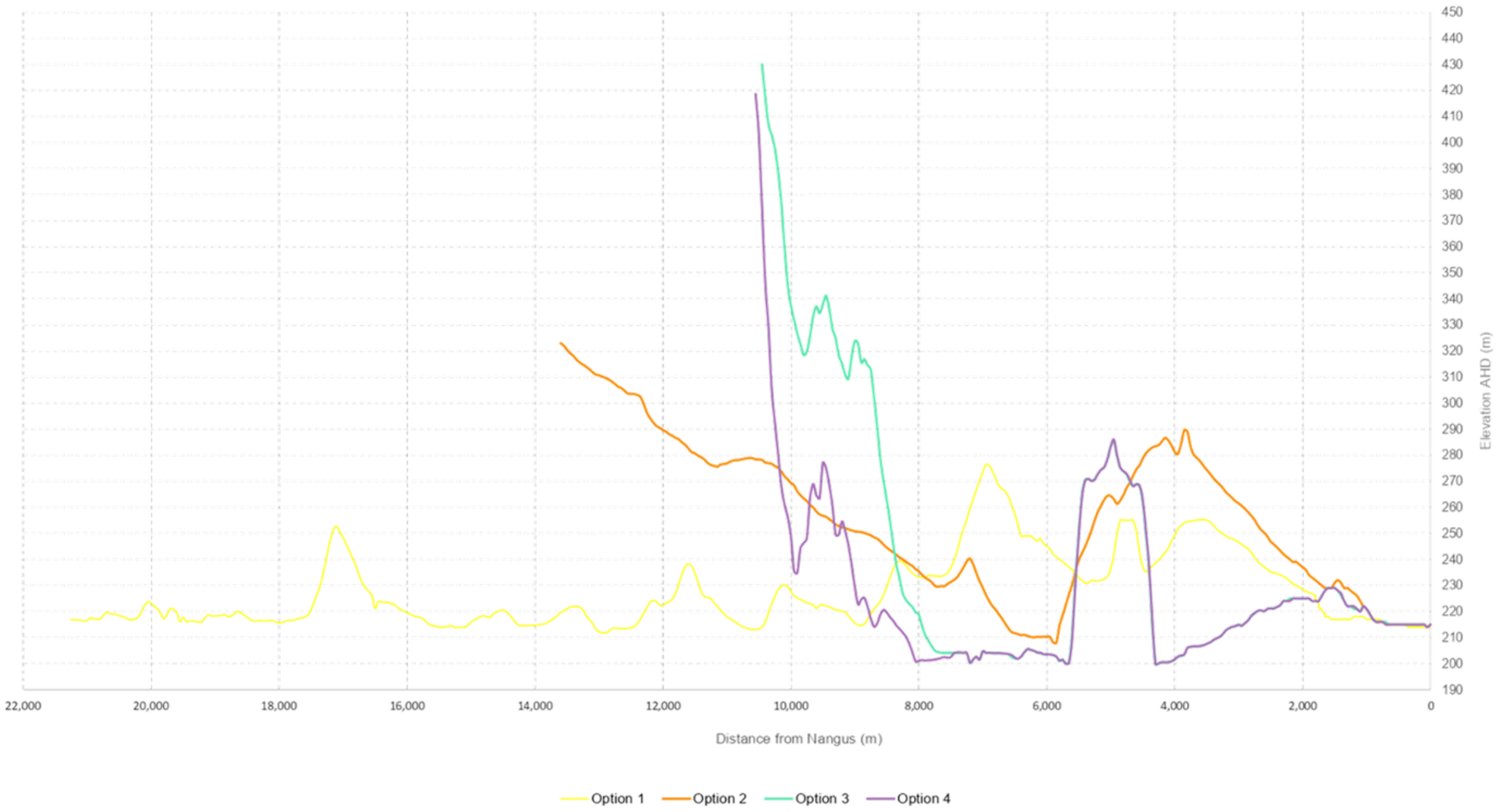


Figure 8-2 Pipeline Route Options Elevation Profile

Note: Nangus is located at distance 0m in the above figure for ease of comparison.

NANGUS CREEK
Nangus Hall
Reserve for Public Recreation
Cemetery
Bushfire Shed
KIMO STREET
BANGUS STREET
BILLABUNG STREET
TENANDRA STREET
HELONG STREET
Cemetery
NANGUS
WANTIOOL STREET
OAKHILLS ROAD
21Km
Waste Transfer Station
NANGUS ROAD
SOLDIER SETTLERS ROAD
Goldenfields Water
Figure 8.3
Nangus Reticulation Map
NANGUS, NSW
Legend
Proposed Reticulation
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Vehicular Track (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
CGRC Owned Lots
1:6,000 Scale at A3
m
0 50 100 150 200
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-12-06 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-004-NangusReticulation.mxd 02
Aerial imagery supplied by DFSI (2017)

8.4 Option 1: Pipeline from CGRC Water Supply at Gundagai

8.4.1 Description

Option 1 incorporates the supply of potable water from CGRC's water supply in Gundagai to Nangus. Key components of this option include:

- Connection to the existing CGRC watermain near the intersection Nangus Road and Sheridan Lane in Gundagai.
- Approximately 16.3 km of DN100 PVC-O pipeline from Gundagai to Nangus reservoir, located to the east of Nangus, as mapped in Appendix A.
- Booster pump station located at approximately CH3400 to deliver water from Gundagai to Nangus reservoir.
- Nangus reservoir, with a usable volume of 250 kL.
- Chlorine dosing facility at Nangus Reservoir to maintain quality.
- Approximately 5.2 km of DN150 PVC-O pipeline from Nangus reservoir to Nangus.
- Reticulation (DN100 PVC-O) to service the existing developed area in Nangus.

8.4.2 Preliminary Design and Pipeline Hydraulics

The pipeline connects to CGRC's water network in Gundagai via the existing watermain currently installed in Nangus Road, fronting Lot 11 DP1128590. From the connection point, the pipeline heads west towards Nangus. For the first 3,000 m of the pipe alignment Nangus road is followed closely by the Murrumbidgee River. For parts of this section, the road reserve becomes narrow and steeply battered. Specific consideration into the pipe's constructability through this section would need to be made.

A booster pump station is proposed to be located at CH3400. A pressure boost of approximately 85 m will be required. Existing overhead powerlines are adjacent to Nangus road at this location.

The proposed Nangus reservoir (CH16300) is located on elevated ground approximately 5 km east of Nangus. The reservoir will have a usable volume of 250 kL (three days of storage for the average day demand). This reservoir will be a steel standpipe type reservoir, due to the lack of sufficient ground elevation.

While a chlorine dosing facility has been allowed for at the proposed Nangus reservoir, water quality must comply with ADWG requirements at all locations in the network. There is the potential for chlorine residuals to fall between the chlorine dosing at Nangus reservoir and Nangus, and a secondary chlorination facility may be required downstream in the network to ensure chlorine residuals are maintained at suitable levels.

Refer to Appendix A for further details on the proposed pipe alignment for Option 1. The hydraulic grade line and elevation profile are shown in Figure 8-4.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-3, matching the other options.

The pipeline infrastructure has been sized to convey the Nangus and rural demand MDD to the reservoir as outlined in Table 3-1. From the reservoir to Nangus, the infrastructure has been sized to convey the peak hour demand.

A water pressure of 60 m (or a head of RL 275 m) has been assumed at the point of connection in Gundagai. Actual pressures were not available for the study, so the pressure was estimated using the elevation of the Gundagai reservoirs (approximately RL 295 m) and making an allowance of 20 m headloss between the reservoirs and the connection point. The hydraulics were modelled using Infoworks WSPro software.

GWCCs preference is for the pipeline to be installed within private property where possible, adjacent to the road reserve. GWCC's recent experience has shown installation in private property provides a more efficient pathway to obtaining environmental approvals than installation within road reserves.

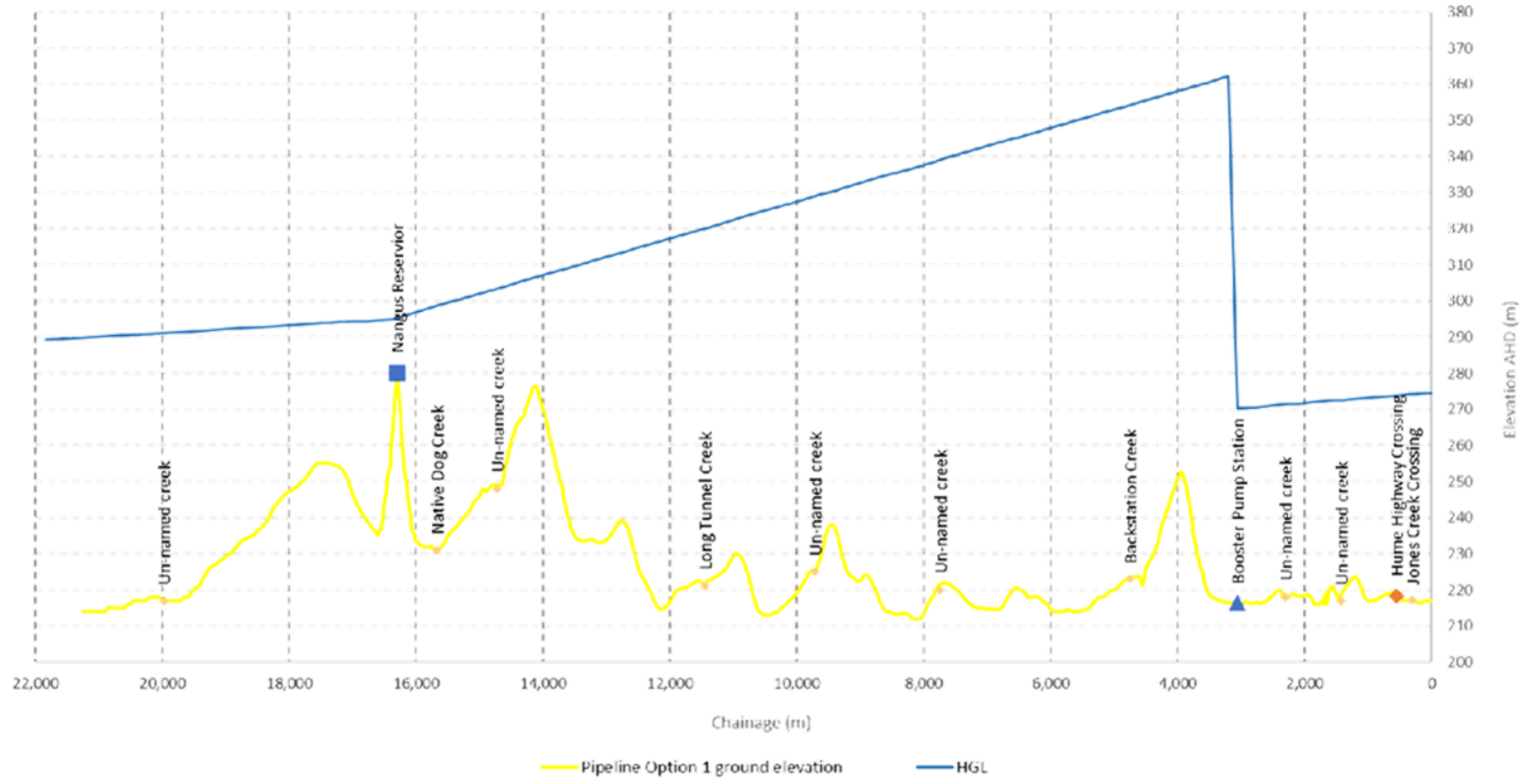


Figure 8-4 Option 1 – Hydraulic Grade & Elevation Profile

The proposed pipe alignment for Option 1 crosses the following watercourses (stream order 3 and higher) as shown on Figure 8-4. Crossing methodologies are also proposed.

- Jones Creek – attached to bridge.
- Backstation Creek – attached to bridge.
- Long Tunnel Creek – open trench.
- Native Dog Creek – attached to bridge.
- Six un-named creeks – all open trench.

8.4.3 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 1 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts. This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.4.3.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the vegetation map in Appendix B and a brief description of the constraints is provided below:

- The area is primarily dominated by non-native vegetation
- There are eight native vegetation communities present along the alignment of Option 1. These Plant Community Types (PCT's) may be associated with Threatened Ecological Communities (TEC's) protected under the *Biodiversity Conservation Act 2016* (BC Act) as shown in Table 8-1.
- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities undertaken on 22/11/2019 found 33 listed species under the BC Act recorded within the vicinity of the alignment. The alignment directly impacts on three recorded threatened flora species locations (Bionet, 2019).
- A search of DPI – Key Fish Habitat found that Option 1 crosses a number of waterbodies that are considered Key Fish Habitat including:
  - Native Dog Creek
  - Backstation Creek
  - Murrumbidgee River
  - Long Tunnel Creek
- According to the Gundagai LEP, Option 1 will have an impact on areas mapped as 'sensitive land' according to the Natural Resources Sensitivity Biodiversity Map. The objective of the mapped sensitive land is to help maintain terrestrial and aquatic biodiversity.

Table 8-1 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name*	Probable TEC Status*
5	River Red Gum herbaceous-grassy very tall open forest wetland on inner floodplains in the lower slopes sub-region of the NSW South Western Slopes Bioregion and the eastern Riverina Bioregion.	Not listed under the BC Act	NA
79	River Red Gum Shrub/Grass Riparian Tall Woodland or Open Forest Wetland	** Status of this vegetation under state and federal legislation is currently unknown and should be investigated further in later project development stages.	**
266	White Box Grassy Woodland	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	TEC
276	Yellow Box Grassy Tall Woodland	White Box Yellow Box Blakely's Red Gum Woodland	EEC
277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	EEC
289	Mugga Ironbark – Inland Scribbly Gum – Red Box Shrub/Grass Open Forest	Not listed under the BC Act	NA
347	White Box – Blakely's Red Gum Shrub/Grass Woodland	White Box Yellow Box Blakely's Red Gum Woodland	EEC
796	Derived Grassland	Listed	EEC

* Derived from the NSW Vegetation Information System (VIS) which allows you to match PCTs with probable TECs.
** Data not available in the VIS.

Federally listed biodiversity constraints

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 9 listed species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) found within the vicinity of this option.
- A search of the Protected Matters Search Tool (PMST) (Department of Environment and Energy (DOEE), 2019) was undertaken on 22/11/2019. The following Matters of National Environmental Significance (MNES) have been identified within 10 km of this option. Federally listed TEC's have been identified below in Table 8-2.
  - Four Wetlands of International Importance all of which are located approximately 400km – 800km downstream of Option 1.
  - 31 threatened species and 11 migratory species.

Table 8-2 Federally listed TECs

TEC	Status: Endangered (EEC) or Critically Endangered (CEEC)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	EEC
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC
Derived Grassland	CEEC

Important conservation tenures

- Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the (now repealed) *Threatened Species Conservation Act 1995* (TSC Act) have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.
- Option 1 does not impact on any listed National Parks and Wildlife Services (NPWS) reserves and national parks.
- A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA. No Biobanking sites were located within the area of this option.

8.4.3.2 Heritage

8.4.3.2.1 Historic Heritage

Local Heritage

Heritage item 'I14 – Nangus Station Group' is identified under Gundagai LEP 2011 as a local heritage item and is located approximately 800m south of the alignment of Option 1. There are also 12 locally listed items under the Gundagai LEP 2011 in the township of Gundagai. The alignment does not intersect any of the above mentioned heritage items.

Heritage item 'I20: War Memorial Nangus' is identified under Gundagai LEP 2011 as a local heritage item, but will not be impacted by the proposed option.

State Heritage

Two State Heritage registered items reside within the town of Gundagai:

- Gundagai Rail Station and Yard Group
- Gundagai Rail Bridge

There are also two listed Conservation Areas within the town of Gundagai:

- Gundagai Rail Station and Yard Group
- Old Gundagai Town Site

These are items in the vicinity of Option 1 however the option does not have a direct impact on the items.

Federal Heritage

- A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.
- The PMST search undertaken on 25/11/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of the pipeline route.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA.

8.4.3.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 56 Aboriginal sites and 0 (zero) Aboriginal places within the vicinity of Option 1. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

8.4.3.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- From east to west, the proposed Option 1 would traverse:
  - Jones Creek
  - Backstation Creek
  - Long Tunnel Creek
  - Native Dog Creek
  - Unnamed drainage channels
- Waterways range in size and, under the Strahler stream order system, are classified as ranging from major order streams (Murrumbidgee River) to third order watercourses (Department of Primary Industries (DPI) Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017).
- While works will be within 40m of these watercourses, a controlled activity approval under the Water Management Act 2000 (WM Act) is not required as the works would be undertaken by a public authority.
- Creek crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. The named waterways crossed by the pipeline which are listed as low potential GDE. Option 1 also runs near the Murrumbidgee River which has been classified as having a high potential GDE (Bureau of Meteorology (BOM), 2019).
- The pipeline would cross areas mapped as 'sensitive land' according to Gundagai LEP.
- There are numerous groundwater bores along Option 1 pipeline route, with a number of them being approximately 50m from the proposed alignment. It is not expected that the pipeline would have any impact on the bores as the alignment could be set to avoid them.
- According to the Australian Flood Study Database, there have been three studies conducted surrounding the Murrumbidgee River and surrounds. The studies include:
  - Gundagai Flood Scoping Study – 2013
  - Oura to Braehour Flood Model Extension – 2011
  - Murrumbidgee River Flood Modelling

  A thorough investigation into these studies will help shape future stages of the proposed development.

8.4.3.4 Soil and Contamination

- Soils present within the area are shown on the Soils figure in Appendix B.
- Option 1 traverses multiple different soil classes including:
  - Kurosols
  - Kandosols
  - Rudosols (Aluvial)
  - Sodosols
- Soil is not mapped as saline land in the DPE (2019) mapping.

A search of the OEH Contaminated Land Record and the Protection of the Environment Operation (POEO) Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 6 locations where a POEO License has been issued in the town of Gundagai. The listed locations of issued licences are not

impacted by Option 1. There are no known contaminated sites listed on the OEH Contaminated Land Register. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.4.3.5 *Socio-economic, Land Use and Zoning*

- The majority of Option 1 alignment is within land zoned RU1 – Primary Production (see the land use and zoning map in Appendix B) however part of the pipeline route extends into land zoned RU5 – Village and SP3 – Tourist.
- The pipeline option traversed across private properties in multiple locations.
- The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.
- Socio-economic considerations relevant to this option include:
  - Potential adverse impacts on private properties during pipeline installation
  - Positive impacts associated with securing a water supply for Nangus.

8.4.3.6 *Cumulative Impacts*

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed, under assessment or approved (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects). The register was searched for Cootamundra - Gundagai LGA and one major project was identified (the Adjungbilly Wind Farm), however the project is not in close proximity to this option and is therefore unlikely to generate cumulative impacts

Cootamundra – Gundagai Regional Council Development Application (DA) Tracking portal for Cootamundra - Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project. It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.4.3.7 *Summary of Environmental Constraints & Approval Pathway*

Summary

The key environmental constraints related to Option 1 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final alignment during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes and budgets allocated could be substantially increased. From this high level desktop constraints analysis, and given the proposed pipeline route could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. State Environmental Planning Policy (SEPPs) guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP), as the pipeline and associated ancillary structures is considered a "water reticulation system".

Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the pipeline project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent, and therefore it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act.

Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and potential impacts which will be confirmed at later stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

8.4.4 Cost Estimate

The estimated capital cost for Option 1 is $4.56 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.4.5 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-3.

Table 8-3 Option 1 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	10	▪ It is assumed that CGRC's Gundagai water supply will meet or exceed the 5/10/10 rule. Water is sourced from the Murrumbidgee Regulated Water Source, and has a high level of security.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	8	▪ It is assumed that water supplied by CGRC's Gundagai water supply network will meet the ADWG health requirements. ▪ Chlorine dosing facility to be provided at Nangus reservoir to maintain residual. ▪ Nangus reservoir is proposed to be a standpipe type to gain the required elevation. A significant dead volume of water will be stored in the reservoir, increasing water age. ▪ Potential for chlorine residuals to fall between chlorine dosing at Nangus reservoir and Nangus, which would necessitate an additional chlorine dosing facility.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to aesthetic criteria.	10%	10	▪ It is assumed that water supplied by CGRC's Gundagai water supply network will meet the ADWG aesthetic requirements.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	7	▪ Proposed infrastructure (pipeline, booster pump station and chemical dosing facility) considered familiar to operators. ▪ Pump station required for Option 1 (no pump station required for other pipeline options). Potential point of failure. ▪ Longest pipeline option – more potential failure points. ▪ Majority of infrastructure will be located close to roads – easy access. ▪ In the event of a prolonged failure of the pipeline water may be carted from Gundagai or GWCC to the Nangus reservoir. ▪ Materials readily available and close by in case of repair.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	7	▪ Mostly conventional construction methods – open trenching. ▪ No specialised materials. ▪ Many experienced contractors available for this type of work. Similar works are currently being undertaken at other locations across NSW. ▪ The ability to swiftly construct water pipelines similar to this project has been proven at other sites in NSW. ▪ Due consideration to be made for steep batters and narrow road reserve along alignment, particularly near the Hume Highway crossing. ▪ Terrain considered generally suitable for pipeline installation works. ▪ Some constructability risk related to unknown geotechnical conditions. ▪ Ten creek crossings to be suspended from bridge, open trenched or directional drilled.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	7	▪ Geotechnical conditions unknown, however, the pipeline can be installed at minimum depth and rock is not considered to be a significant risk. ▪ Some unknown issues around pressure at the point of connection at Gundagai and the ability of the Gundagai network to deliver the required flow rate to the connection point.

No.	Criteria	Weighting	Score	Discussion
				▪ Ability to mount pipeline on bridges (proposed at three locations) is not known. Underboring or open trenching are alternatives.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	7	▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways. ▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development. ▪ Obtaining easements for installation of the pipeline within private property presents a possible project delivery risk. However, experience has shown that use of private property can avoid delays due to environmental approvals for installation in the road reserve. The majority of the pipeline will be installed adjacent to the road reserve, so if significant barriers to implementing easement at certain locations are encountered, diverting to the road reserve will provide an alternative. ▪ Environmental approvals unlikely to significantly delay the project as careful route selection should allow avoidance of impacts.
	Total	100%	8.1	

8.5 Option 2: Pipeline from GWCC Water Supply – from Oura Road

8.5.1 Description

Option 2 incorporates the supply of potable water from GWCC's Oura Water Supply Scheme. This option would see the supply of water via a pipeline built along Oura Road from an existing DN300 CI watermain to the township of Nangus.

Key components of this option include:

- Connection to the existing DN300 CI rising / gravity main operating between Marina Reservoir and the Tenandra Reservoir.
- Pressure reducing valve (PRV).
- Approximately 9.8 km of PN35 DN100 DI pipeline from the existing network to Nangus reservoir, located west of Nangus.
- Nangus reservoir, with a usable volume of 250 kL.
- Chlorine dosing facility at Nangus reservoir to maintain quality.
- Approximately 3.9 km of DN150 PVC-O pipeline from Nangus reservoir to Nangus.
- Reticulation (DN100 PVC-O) to service the existing developed area in Nangus.

8.5.2 Preliminary Design and Pipeline Hydraulics

The pipeline connects to GWCC's Oura Water supply scheme via an existing DN300 CI watermain that Crosses Nangus Road and fronts Lot 2 DP541744. From the connection point, the pipeline heads east towards Nangus.

A PRV will be located near the connection to reduce the pressure to that required to convey the water to Nangus.

The proposed Nangus reservoir (CH9770) is located on elevated ground approximately 4 km east of Nangus. The reservoir will have a usable volume of 250 kL (three days of storage for the average day demand). A concrete reservoir is proposed.

While a chlorine dosing facility has been allowed for at the proposed Nangus reservoir, water quality must comply with ADWG requirements at all locations in the network. There is the potential for chlorine residuals to fall between the chlorine dosing at Nangus reservoir and Nangus, and a secondary chlorination facility may be required downstream in the network to ensure chlorine residuals are maintained at suitable levels.

Refer to Appendix A for further details on the proposed pipe alignment for Option 2. The hydraulic grade line and elevation profile are shown in Figure 8-5.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-3, matching the other options.

The pipeline infrastructure has been sized to convey the Nangus and rural demand MDD to the reservoir as outlined in Table 3-1. From the reservoir to Nangus, the infrastructure has been sized to convey the peak hour demand.

GWCCs preference is for the pipeline to be installed within private property where possible, adjacent to the road reserve. GWCC's recent experience has shown installation in private property provides a more efficient pathway to obtaining environmental approvals than installation within road reserves.

The proposed pipe alignment for Option 2 crosses the following watercourses (stream order 3 and higher) as shown on Figure 8-5. Crossing methodologies are also proposed.

- Billabong Creek – attached to bridge.
- Nangus Creek – attached to bridge.
- Four un-named creeks – all open trench.

The model of the existing GWCC network was also analysed to determine any impacts due to the Nangus supply. No significant impacts were observed and it is therefore considered that no upgrade to the existing network will be required to supply Nangus on the basis of the additional demand. However, as noted in Section 6, future investigations should include consideration of the condition of these existing assets, and what renewals may be necessary to ensure reliability of supply.

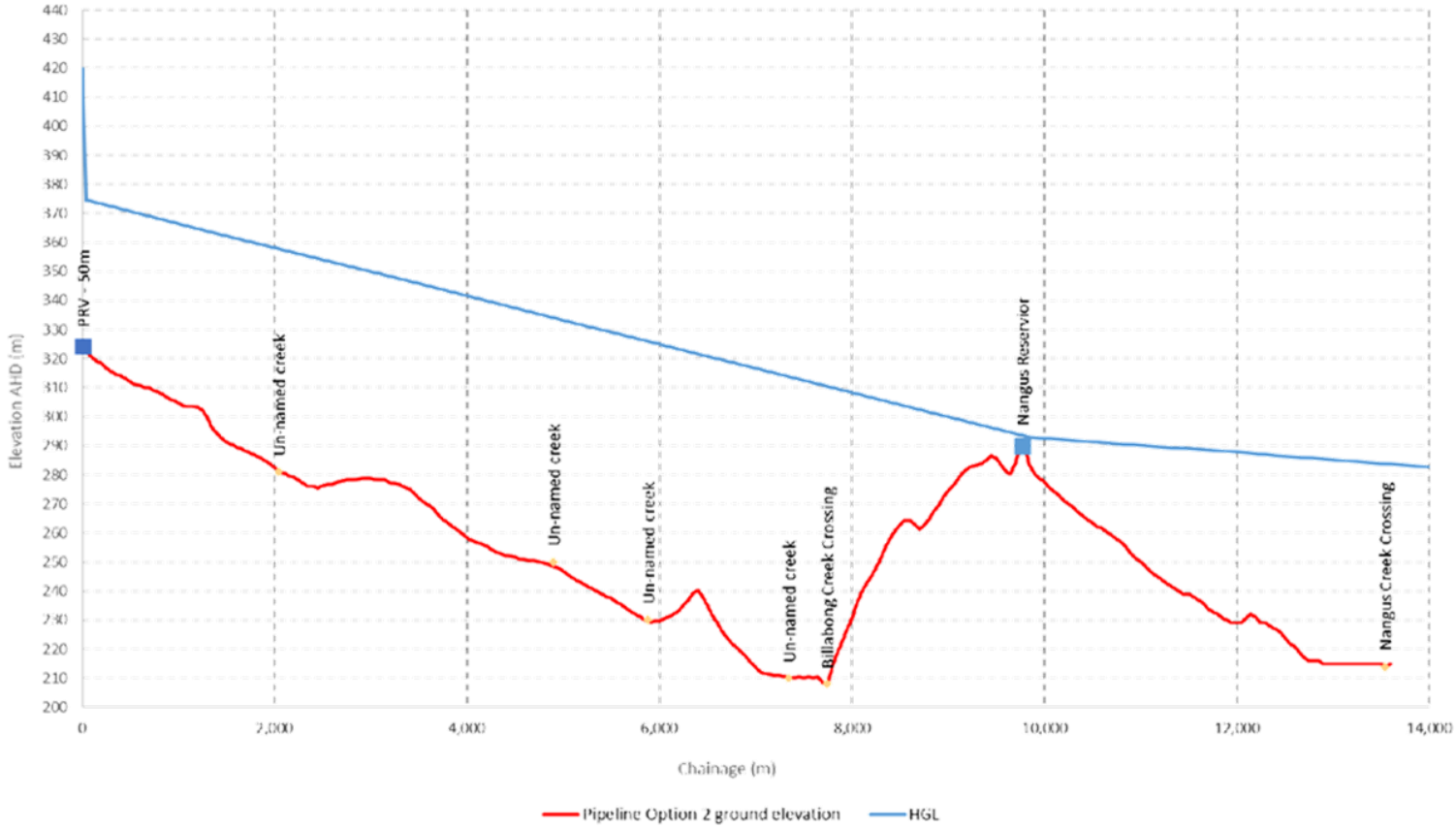


Figure 8-5 Option 2 – Hydraulic Grade & Elevation Profile

As noted in Section 6, the MDD and annual demand on the Oura WTP are projected to be 30.2 ML/d and 4,600 ML/y respectively by 2048 (without the Nangus supply). Supply of water to Nangus would equate to an additional 1.7% to the MDD and 0.8% to the annual demand.

8.5.3 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 2 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts.

This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.5.3.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the vegetation map in Appendix B and a brief description of the constraints is provided below:

- The area is primarily dominated by non-native vegetation
- There are three native vegetation communities present along the alignment of Option 2. These PCT's may be associated with TEC's protected under the BC Act as shown in Table 8-4.

Table 8-4 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name*	Probable TEC Status*
79	River Red Gum Shrub/Grass Riparian Tall Woodland or Open Forest Wetland	** Status of this vegetation under state and federal legislation is currently unknown and should be investigated further in later project development stages.	**
266	White Box Grassy Woodland	White Box Yellow Box Blakely's Red Gum Woodland	EEC
277	Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	White Box Yellow Box Blakely's Red Gum Woodland	EEC

* Derived from the NSW Vegetation Information System (VIS) which allows you to match PCTs with probable TECs.
** Data not available in the VIS.

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 22 listed species under the BC Act were recorded within the vicinity of the alignment. The alignment directly impacts on four recorded threatened flora species locations (Bionet, 2019).
- A search of DPI – Key Fish Habitat found that Option 2 crosses two waterbodies that are considered Key Fish Habitat including:
  - Nangus Creek
  - Billabong Creek
- According to the Gundagai LEP and Junee LEP, Option 2 will have an impact on areas mapped as 'sensitive land' according to the Natural Resources Sensitivity Biodiversity Map. The objective of the mapped sensitive land is to help maintain terrestrial and aquatic biodiversity.

Federally listed biodiversity constraints

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 5 listed species under the *EPBC Act* within the vicinity of the alignment.
- A search of the PMST (DoEE, 2019) was undertaken on 22/11/2019. The following MNES have been identified within 10km of this option. Federally listed TEC's have been identified below in Table 8-5:
  - 4 Wetlands of International Importance all of which are located approximately 400km – 800km downstream of Option 2.
  - 30 threatened species and 11 migratory species

Table 8-5 Federally listed TECs

TEC	Status: Endangered (EEC) or Critically Endangered (CEEC)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	EEC
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC

Important conservation tenures

- Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the TSC Act have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.
- Option 2 does not impact on any listed National Parks and Wildlife Services (NPWS) reserves and national parks.
- A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA and Junee LGA. No Biobanking sites were located within the area of this option.

8.5.3.2 Heritage

8.5.3.2.1 Historic heritage

Local Heritage

There is one heritage item identified under the Gundagai LEP 2011 in proximity to the proposed option (and none under the and Junee LEP 2012).

- I20: War Memorial Nangus – located on the outskirts of the town of Nangus

The abovementioned locally listed heritage item will not be impacted by the proposed option.

State Heritage

There are no State Heritage Register listed heritage items within proximity of Option 2.

Federal Heritage

- A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.
- A search of the Australian Governments Australian Heritage Database (DoEE, 2019) identified 14 federally listed heritage items within the Junee LGA.
- The PMST search undertaken on 25/11/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of the pipeline route.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA and Junee Shire Council LGA.

8.5.3.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 7 Aboriginal sites and 0 (zero) Aboriginal places within the vicinity of Option 2. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

8.5.3.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- From east to west, the proposed Option 2 would traverse:
  - Nangus Creek
  - Billabong Creek
- Waterways range in size and under the Strahler stream order system are classified as ranging from fifth order streams to third order watercourses (DPI Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017).
- While works will be within 40m of these watercourses, a controlled activity approval under the Water Management Act 2000 (WM Act) is not required as the works would be undertaken by a public authority.
- Creek crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. Two named waterways are crossed by the pipeline (Nangus Creek and Billabong Creek) which are listed as moderate potential GDE (BOM, 2019).
- The pipeline would cross areas mapped as 'sensitive land' according to Gundagai LEP 2011 and within Groundwater Vulnerable areas mapped in Junee LEP 2012.
- In the vicinity of Option 2, there a number of groundwater bore locations. The eastern extent of the alignment in Nangus Village has a large number of bores within 50m of the alignment. It is not expected that the pipeline would have any impact on the bores as the alignment could be set to avoid them.
- According to the Australian Flood Study Database, there have been three studies conducted surrounding the Murrumbidgee River and surrounds. The studies include:
  - Gundagai Flood Scoping Study – 2013
  - Oura to Braehour Flood Model Extension – 2011
  - Murrumbidgee River Flood Modelling

  A thorough investigation into these studies will help shape future stages of the proposed development.

8.5.3.4 Soil and Contamination

- Soils present within the area are shown on the Soils figure in Appendix B.
- Option 2 traverses multiple different soil classes including:
  - Kurosols
  - Kandosols
- Option 2 passes through soils that are identified as saline land according to the DPE (2019) mapping.

A search of the OEH Contaminated Land Record and the Protection of the Environment Operation (POEO) Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 22 locations where a POEO License has been issued in Cootamundra – Gundagai LGA and 4 issued in Junee LGA. The listed locations of issued licences are not impacted by Option 2. There are no known contaminated sites listed on the OEH Contaminated Land Register in the vicinity of Option 2. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.5.3.5 *Socio-economic, Land Use and Zoning*

- The majority of Option 2 alignment is within land zoned RU1 – Primary Production land zoning (see the land use and zoning map in Appendix B).
- This option traverses both Junee LGA and Cootamundra – Gundagai LGA
- The pipeline option traversed across private properties in multiple locations.
- The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10 km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.
- Socio-economic considerations relevant to this option include:
  - Potential adverse impacts on private properties during pipeline installation
  - Positive impacts associated with securing a water supply for Nangus.

8.5.3.6 *Cumulative Impacts*

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed, under assessment or approved (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects) either under assessment of approved. The register was searched for Cootamundra - Gundagai LGA and Junee LGA. Three major projects were identified (the Adjungbilly Wind Farm, Sebastopol Solar and Young to Wagga Looping Pipeline), however the projects are not in close proximity to Option 2 and is therefore unlikely to generate cumulative impacts.

Cootamundra – Gundagai Regional Council DA Tracking portal for Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

Junee Council DA Tracking portal for Junee LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from October 2019 through to November 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.5.3.7 *Summary of Environmental Constraints & Approval Pathway*

Summary

The key environmental constraints related to pipeline Option 2 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final alignment during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the EP&A Act. Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes and budgets allocated could be substantially increased. From this high level desktop constraints analysis, and given the proposed pipeline route could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. State Environmental Planning Policy (SEPPs) guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP), as the pipeline and associated ancillary structures is considered a "water reticulation system". Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the pipeline project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent, and therefore it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act. Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and potential impacts which will be confirmed during future stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

8.5.4 Cost Estimate

The estimated capital cost for Option 2 is $3.26 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.5.5 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-6.

Table 8-6 Option 2 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	10	▪ It is assumed that GWCC's Oura water supply network will meet or exceed the 5/10/10 rule. Water is sourced from the Murrumbidgee Regulated Water Source, and has a high level of security.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	9	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the ADWG health requirements. ▪ Chlorine dosing facility to be provided at Nangus reservoir to maintain residual. ▪ Potential for chlorine residuals to fall between chlorine dosing at Nangus reservoir and Nangus, which would necessitate an additional chlorine dosing facility.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	10	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the majority of current ADWG aesthetic requirements.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	9	▪ Operation and maintenance of pipeline, PRV, reservoir and chemical dosing facility considered familiar to operators. ▪ Majority of infrastructure will be located close to roads – easy access. ▪ In the event of a prolonged failure of the pipeline water may be carted from Gundagai or GWCC to the Nangus reservoir. ▪ Materials readily available and close by in case of repair.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	9	▪ Mostly conventional construction methods – open trenching. ▪ No specialised materials. ▪ Many experienced contractors available for this type of work. Similar works are currently being undertaken at other locations across NSW. ▪ The ability to swiftly construct water pipelines similar to this project has been proven at other sites in NSW. ▪ Terrain considered favorable for pipeline installation works. ▪ Some constructability risk related to unknown geotechnical conditions. ▪ Six creek crossings to be suspended from bridge, open trenched or directional drilled.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	9	▪ Geotechnical conditions unknown, however, the pipeline can be installed at minimum depth and rock is not considered to be a significant risk. ▪ Ability to mount pipeline on bridges (proposed at two locations) is not known. Underboring or open trenching are alternatives.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	8	▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways. ▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development.

No.	Criteria	Weighting	Score	Discussion
				▪ Obtaining easements for installation of the pipeline within private property presents a possible project delivery risk. However, experience has shown that use of private property can avoid delays due to environmental approvals for installation in the road reserve. The majority of the pipeline will be installed adjacent to the road reserve, so if significant barriers to implementing easement at certain locations are encountered, diverting to the road reserve will provide an alternative. ▪ Environmental approvals unlikely to significantly delay the project as careful route selection should allow avoidance of impacts.
	Total	100%	9.2	

8.6 Option 3: Pipeline from GWCC water supply – from Tenandra Reservoirs following new route

8.6.1 Description

Option 3 incorporates the supply of potable water from GWCC's Oura Water Supply Scheme. This option would see the supply of water via a pipeline built from the existing Tenandra Reservoirs to the township of Nangus.

Key components of this option include:

- Connection to the existing Tenandra Reservoirs outlet pipeline.
- Approximately 2.7 km of PN35 DN100 DI pipeline from the Tenandra Reservoirs to a PRV, located near River Road.
- A PRV located near River Road.
- Approximately 2.8 km of PN35 DN100 DI from the PRV to Nangus reservoir.
- Nangus reservoir, with a usable volume of 250 kL.
- Chlorine dosing facility at Nangus reservoir to maintain quality.
- Approximately 5.0 km of DN150 PVC-O pipeline from Nangus reservoir to Nangus.
- Reticulation (DN100 PVC-O) to service the existing developed area in Nangus.

8.6.2 Preliminary Design and Pipeline Hydraulics

The pipeline connects to GWCC's Oura Water supply scheme at the Tenandra Reservoirs located in Lot 1 DP172773, before heading east towards Nangus. The alignment for pipeline Option 3 primarily follows the top of natural ridge lines, fence lines, Island Creek and local access roads to Nangus. Refer to Appendix A for further details on the proposed pipe alignment for Option 3.

A PRV will be located near River Road at the base of the Tenandra mountain to reduce the pressure to that required to convey the water to Nangus.

The proposed Nangus reservoir (CH5500) is located on elevated ground approximately 5 km east of Nangus. The reservoir will have a usable volume of 250 kL (three days of storage for the average day demand). A concrete reservoir is proposed.

While a chlorine dosing facility has been allowed for at the proposed Nangus reservoir, water quality must comply with ADWG requirements at all locations in the network. There is the potential for chlorine residuals to fall between the chlorine dosing at Nangus reservoir and Nangus, and a secondary chlorination facility may be required downstream in the network to ensure chlorine residuals are maintained at suitable levels.

Refer to Appendix A for further details on the proposed pipe alignment for Option 3. The hydraulic grade line and elevation profile are shown in Figure 8-6.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-3, matching the other options.

The pipeline infrastructure has been sized to convey the Nangus and rural MDD to the reservoir as outlined in Table 3-1. From the reservoir to Nangus, the infrastructure has been sized to convey the peak hour demand.

GWCCs preference is for the pipeline to be installed within private property where possible, adjacent to the road reserve. GWCC's recent experience has shown installation in private property provides a more efficient pathway to obtaining environmental approvals than installation within road reserves.

The proposed pipe alignment for Option 3 crosses the following watercourses (stream order 3 and higher) as shown on Figure 8-6. Crossing methodologies are also proposed.

- Billabong Creek – horizontal directional drill.
- Nangus Creek – attached to bridge.

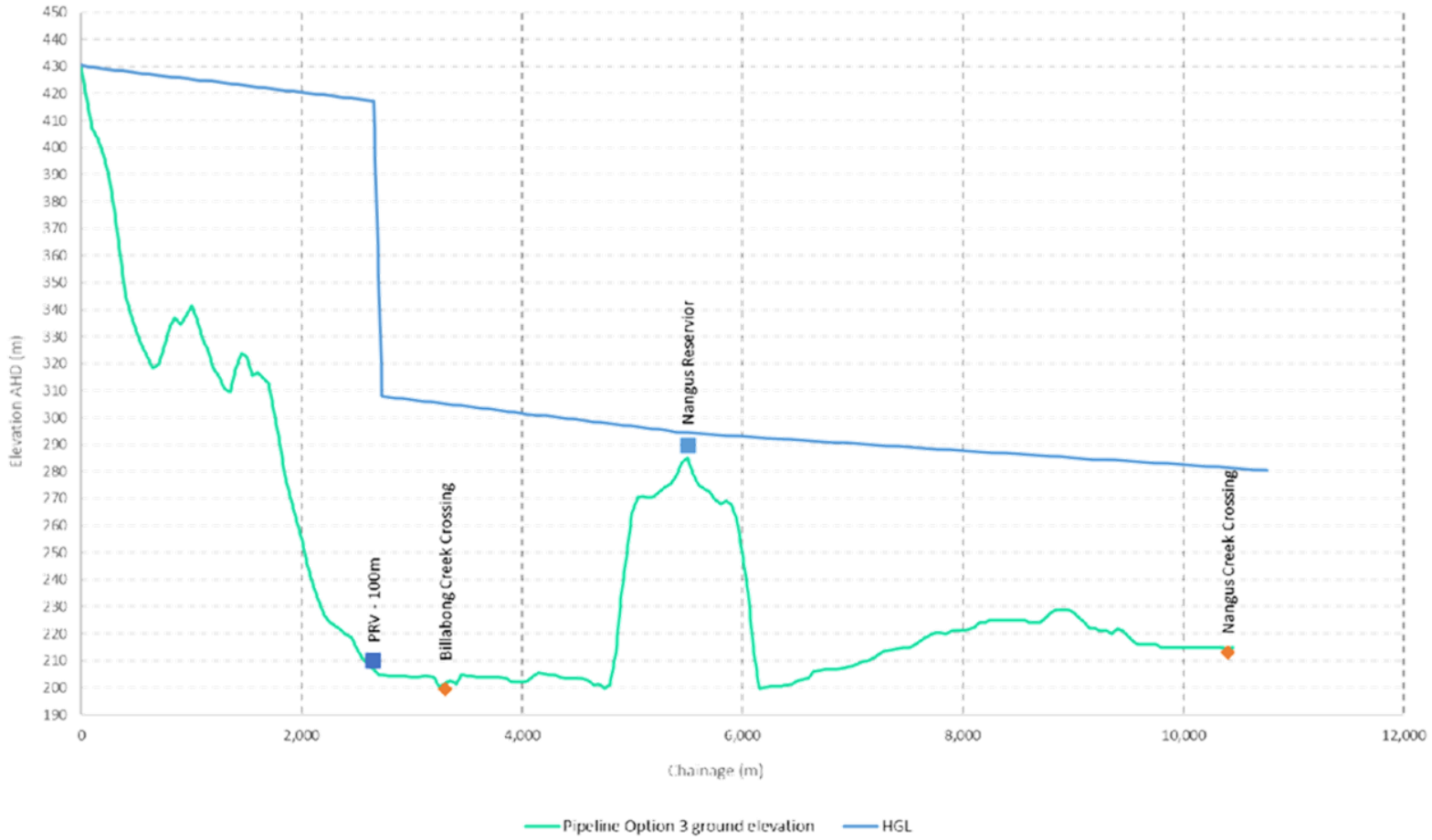


Figure 8-6 Option 3 – Hydraulic Grade & Elevation Profile

The model of the existing GWCC network was also analysed to determine any impacts due to the Nangus supply. No significant impacts were observed and it is therefore considered that no upgrade to the existing network will be required to supply Nangus on the basis of the additional demand. However, as noted in Section 6, future investigations should include consideration of the condition of these existing assets, and what renewals may be necessary to ensure reliability of supply.

As noted in Section 6, the MDD and annual demand on the Oura WTP are projected to be 30.2 ML/d and 4,600 ML/y respectively by 2048 (without the Nangus supply). Supply of water to Nangus would equate to an additional 1.7% to the MDD and 0.8% to the annual demand.

8.6.3 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 3 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts.

This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.6.3.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the vegetation map in Appendix B and a brief description of the constraints is provided below.

- The area is primarily dominated by non-native vegetation
- There are two native vegetation communities present along the alignment of Option 3. These PCT's may be associated with TEC's protected under the BC Act as shown in Table 8-7.

Table 8-7 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name*	Probable TEC Status*
5	River Red Gum Herbaceous – Grassy Very Tall Open Forest Wetland	Not listed under the BC Act	NA
79	River Red Gum Shrub/Grass Riparian Tall Woodland or Open Forest Wetland	** Status of this vegetation under state and federal legislation is currently unknown and should be investigated further in later project development stages.	**

* Derived from the NSW Vegetation Information System (VIS) which allows you to match PCTs with probable TECs.
** Data not available in the VIS.

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 20 listed species under the BC Act were recorded within the vicinity of the alignment. The alignment does not directly impact on known sighting locations of threatened flora or fauna.
- A search of DPI – Key Fish Habitat found that Option 3 crosses two waterbodies that are considered Key Fish Habitat including:
  - Billabong Creek
  - Nangus Creek

- According to the Gundagai LEP 2011 and Junee LEP 2012, Option 3 will have an impact on areas mapped as 'sensitive land' according to the Natural Resources Sensitivity Biodiversity Map. The objective of the mapped sensitive land is to help maintain terrestrial and aquatic biodiversity.

Federally listed biodiversity constraints

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 4 listed species under the *EPBC Act* found within the vicinity of this option.
- A search of the PMST (DoEE, 2019) was undertaken on 22/11/2019. The following MNES have been identified within 10 km of this option. Federally listed TEC's have been identified below in Table 8-8:
  - 4 Wetlands of International Significance all of which are located approximately 400km – 800km downstream of Option 3.
  - 30 threatened species and 11 migratory species

Table 8-8 Federally listed TECs

TEC	Status: Endangered (EEC) or Critically Endangered (CEEC)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	EEC
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC

Important conservation tenures

- Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the TSC Act have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.
- Option 3 does not impact on any listed National Parks and Wildlife Services (NPWS) reserves and national parks.
- A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA and Junee LGA. No Biobanking sites were located within the area of this option.
- Option 3 traverses across a federally listed environmental stewardship zone for the maintenance or improvement of the condition and extent of the Box Gum Grassy Woodland Ecological Community. The pipeline will have a direct impact on this stewardship zone P1-Z1, a zone with an area of 413.9 ha. The landholder is under a legal obligation to ensure the management actions stipulated in the Environmental Stewardship Funding Deed are met and achieved for the lifetime of the agreement. The management actions that may impact Option 3 are shown in Table 8-9.

Table 8-9 Environmental Stewardship Funding Deed management actions that may impact Option 3

Management Action	Management Objective	Description of Management Actions
No cultivation or major soil disturbance	Remediate and minimise soil disturbance	The land manager will not cultivate, including cultivation for fire breaks, or undertake other measures resulting in significant soil disturbance within the area. Revegetation, where required, is to be undertaken only by means that involve minimal soil disturbance.

Soil disturbance is expected to be significant in the direct area of the proposed option alignment as a result of trenching for installation of the pipeline. Impacts are not expected to be widespread like cultivation works would induce.

8.6.3.2 Heritage

8.6.3.2.1 Historic Heritage

Local Heritage

There is one heritage item identified under the Gundagai LEP 2011 in proximity to the proposed option (and none under the and Junee LEP 2012).

- I20: War Memorial Nangus – located on the outskirts of the town of Nangus

The abovementioned locally listed heritage item will not be impacted by the proposed option.

State Heritage

There are no State Heritage Register listed heritage items within proximity of Option 3.

Federal Heritage

- A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.
- A search of the Australian Governments Australian Heritage Database (DoEE, 2019) identified 14 federally listed heritage items within the Junee LGA.
- The PMST search undertaken on 25/7/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of the pipeline route.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA and Junee LGA.

8.6.3.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 5 Aboriginal sites and 0 (zero) Aboriginal places within the locality of Option 3. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

8.6.3.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- From east to west, the proposed Option 3 would traverse:
  - Nangus Creek
  - Billabong Creek
- Waterways range in size and under the Strahler stream order system are classified as ranging from sixth order stream to fourth order watercourses (DPI Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017)
- While works will be within 40m of these watercourses, a controlled activity approval under the Water Management Act 2000 (WM Act) is not required as the works would be undertaken by a public authority.
- Creek crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. Two named waterways are crossed by the pipeline (Nangus Creek and Billabong Creek) which are listed as moderate potential GDE (BOM, 2019).
- The pipeline would cross areas mapped as 'sensitive land' according to Gundagai LEP 2011 and within Groundwater Vulnerable areas mapped in Junee LEP 2012.
- There are numerous groundwater bore locations along Option 3 pipeline route. The eastern extent of the alignment in Nangus Village has multiple bores within 50 m of the alignment and the western extents will join the GWCC existing water mains. It is not expected that the pipeline would have any impact on the bores as the alignment could be set to avoid them.

- According to the Australian Flood Study Database, there have been three studies conducted surrounding the Murrumbidgee River and surrounds. The studies include:
  - Gundagai Flood Scoping Study – 2013
  - Oura to Braehour Flood Model Extension – 2011
  - Murrumbidgee River Flood Modelling

  A thorough investigation into these studies will help shape future stages of the proposed development.

8.6.3.4 *Soil and Contamination*

- Soils present within the area are shown on the Soils figure in Appendix B.
- Option 3 traverses multiple different soil classes including:
  - Rudoslos and Tenosols
  - Kandosols
  - Kurosols
  - Rudosols (Aluvial)
- Soil is not mapped as saline land in the DPE (2019) mapping.

A search of the OEH Contaminated Land Record and the Protection of the Environment Operation (POEO) Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 22 locations where a POEO License has been issued in the LGA of Cootamundra - Gundagai and 4 issued in Junee LGA. The listed locations of issued licences are not impacted by Option 3. There are no known contaminated sites listed on the OEH Contaminated Land Register in the vicinity of Option 3. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.6.3.5 *Socio-economic, Land Use and Zoning*

- The majority of Option 3 alignment is within land zoned RU1 – Primary Production land zoning. As the alignment enters the township of Nangus the zoning changes to RU5 – Village. (see the land use and zoning map in Appendix B)
- This option traverses both Junee LGA and Cootamundra – Gundagai LGA
- The pipeline option traversed across private properties in multiple locations.
- The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.
- Socio-economic considerations relevant to this option include:
  - Potential adverse impacts on private properties during pipeline installation
  - Positive impacts associated with securing a water supply for Nangus.

8.6.3.6 *Cumulative Impacts*

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed, under assessment or approved (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects) either under assessment of approved. The register was searched for Cootamundra - Gundagai LGA and Junee LGA. Three major projects were identified (the Adjungbilly Wind Farm, Sebastopol Solar and Young to Wagga Looping Pipeline), however the projects are not in close proximity to Option 3 and is therefore unlikely to generate cumulative impacts.

Cootamundra – Gundagai Regional Council DA Tracking portal for Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

Junee Council DA Tracking portal for Junee LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from October

2019 through to November 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.6.3.7 Summary of Environmental Constraints & Approval Pathway

Summary

The key environmental constraints related to pipeline Option 3 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final alignment during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the EP&A Act. Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes and budgets allocated could be substantially increased. From this high level desktop constraints analysis, and given the proposed pipeline route could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. State Environmental Planning Policy (SEPPs) guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP), as the pipeline and associated ancillary structures is considered a "water reticulation system". Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the pipeline project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent, and therefore it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act. Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and potential impacts which will be confirmed at later stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

Further investigations into the direct impacts on the environmental stewardship zone (Zone P1-Z1) will need to occur pending the outcomes of the options analysis. Land use applications and further studies will likely be required if Option 3 proceeds.

8.6.4 Cost Estimate

The estimated capital cost for Option 3 is $3.07 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.6.5 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-10.

Table 8-10 Option 3 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	10	▪ It is assumed that GWCC's Oura water supply network will meet or exceed the 5/10/10 rule. Water is sourced from the Murrumbidgee Regulated Water Source, and has a high level of security.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	9	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the ADWG health requirements. ▪ Chlorine dosing facility to be provided at Nangus reservoir to maintain residual. ▪ Potential for chlorine residuals to fall between chlorine dosing at Nangus reservoir and Nangus, which would necessitate an additional chlorine dosing facility.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	10	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the majority of current ADWG aesthetic requirements.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	7	▪ Operation and maintenance of pipeline, PRV, reservoir and chemical dosing facility considered familiar to operators. ▪ Significant length of the pipeline will be located through steep farmland with potentially difficult access for maintenance. ▪ Access to reservoir and chlorine dosing facility will pose difficulties. ▪ In the event of a prolonged failure of the pipeline water may be carted from Gundagai or GWCC to the Nangus reservoir. ▪ Materials readily available and close by in case of repair.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	5	▪ A significant length of the pipeline is through steep, rocky terrain. ▪ Some constructability risk related to unknown geotechnical conditions. ▪ Mostly conventional construction methods – open trenching. ▪ No specialised materials. ▪ Many experienced contractors available for this type of work. Similar works are currently being undertaken at other locations across NSW. ▪ The ability to swiftly construct water pipelines similar to this project has been proven at other sites in NSW. ▪ Two creek crossings to be suspended from bridge or directional drilled.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	6	▪ Geotechnical conditions unknown. Rock is likely to be a risk in elevated terrain near Tenandra and the proposed Nangus reservoir. ▪ Geotechnical conditions for proposed directional drilling of Billabong Creek are not known. ▪ Ability to mount pipeline on bridge (proposed at one location) is not known. Directional drilling or open trenching are alternatives.

No.	Criteria	Weighting	Score	Discussion
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	5	▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways. ▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development. ▪ It is understood from CGRC that there is local opposition to the Option 3 route due to land use issues. ▪ Obtaining easements for installation of the pipeline within private property presents a possible project delivery risk. However, experience has shown that use of private property can avoid delays due to environmental approvals for installation in the road reserve. Significant portions of the pipeline are not close to road reserves, so diverting into the road reserve is not an option if there are issues with easements. ▪ The route passes through an Environmental Stewardship area for Box Gum Grassy Woodlands, for which the landowner has a contractual agreement with the federal government to protect/enhance the ecological value of the area. Mitigation measures, including 'no major soil disturbance' are included within the agreement. The construction of the pipeline will induce major soil disturbance localised to the construction footprint. This presents a risk to the viability of this project, and further investigation will be required to confirm the impact on the approvals.
	Total	100%	7.5	

8.7 Option 4: Pipeline from GWCC water supply – from Tenandra Reservoirs following existing easement

8.7.1 Description

Option 4 incorporates the supply of potable water from GWCC's Oura Water Supply Scheme. This option would see the supply of water via a pipeline built from the existing Tenandra Reservoirs to Nangus.

Key components of this option include:

- Connection to the existing Tenandra Reservoirs outlet pipeline.
- Approximately 1.7 km of PN35 DN100 DI pipeline from the Tenandra Reservoirs to a PRV, located near River Road.
- A PRV located near River Road.
- Approximately 3.9 km of PN35 DN100 DI from the PRV to Nangus reservoir.
- Nangus reservoir, with a usable volume of 250 kL.
- Chlorine dosing facility at Nangus reservoir to maintain quality.
- Approximately 5.0 km of DN150 PVC-O pipeline from Nangus reservoir to Nangus.
- Reticulation (DN100 PVC-O) to service the existing developed area in Nangus.

8.7.2 Preliminary Design and Pipeline Hydraulics

The alignment for pipeline Option 4 connects to GWCC's Oura Water supply scheme at the Tenandra Reservoirs located in Lot 1 DP172773. From here, the pipe heads east along an old pipeline alignment to River Road. The alignment then follows the River Road corridor, before crossing Billabong Creek and following Island Creek and local access roads to Nangus.

A PRV will be located near River Road at the base of the Tenandra mountain to reduce the pressure to that required to convey the water to Nangus.

The proposed Nangus reservoir (CH5600) is located on elevated ground approximately 5 km east of Nangus. The reservoir will have a usable volume of 250 kL (three days of storage for the average day demand). A concrete reservoir is proposed.

While a chlorine dosing facility has been allowed for at the proposed Nangus reservoir, water quality must comply with ADWG requirements at all locations in the network. There is the potential for chlorine residuals to fall between the chlorine dosing at Nangus reservoir and Nangus, and a secondary chlorination facility may be required downstream in the network to ensure chlorine residuals are maintained at suitable levels.

Refer to Appendix A for further details on the proposed pipe alignment for Option 4. The hydraulic grade line and elevation profile are shown in Figure 8-7.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-3, matching the other options.

The pipeline infrastructure has been sized to convey the Nangus and rural MDD to the reservoir as outlined in Table 3-1. From the reservoir to Nangus, the infrastructure has been sized to convey the peak hour demand.

GWCCs preference is for the pipeline to be installed within private property where possible, adjacent to the road reserve. GWCC's recent experience has shown installation in private property provides a more efficient pathway to obtaining environmental approvals than installation within road reserves.

The proposed pipe alignment for Option 3 crosses the following watercourses (stream order 3 and higher) as shown on Figure 8-7. Crossing methodologies are also proposed.

The proposed pipe alignment for Option 4 crosses the following watercourses:

- Un-named creek (River Road) – within pavement above culvert.
- Billabong Creek – horizontal directional drill.
- Nangus Creek – attached to bridge.

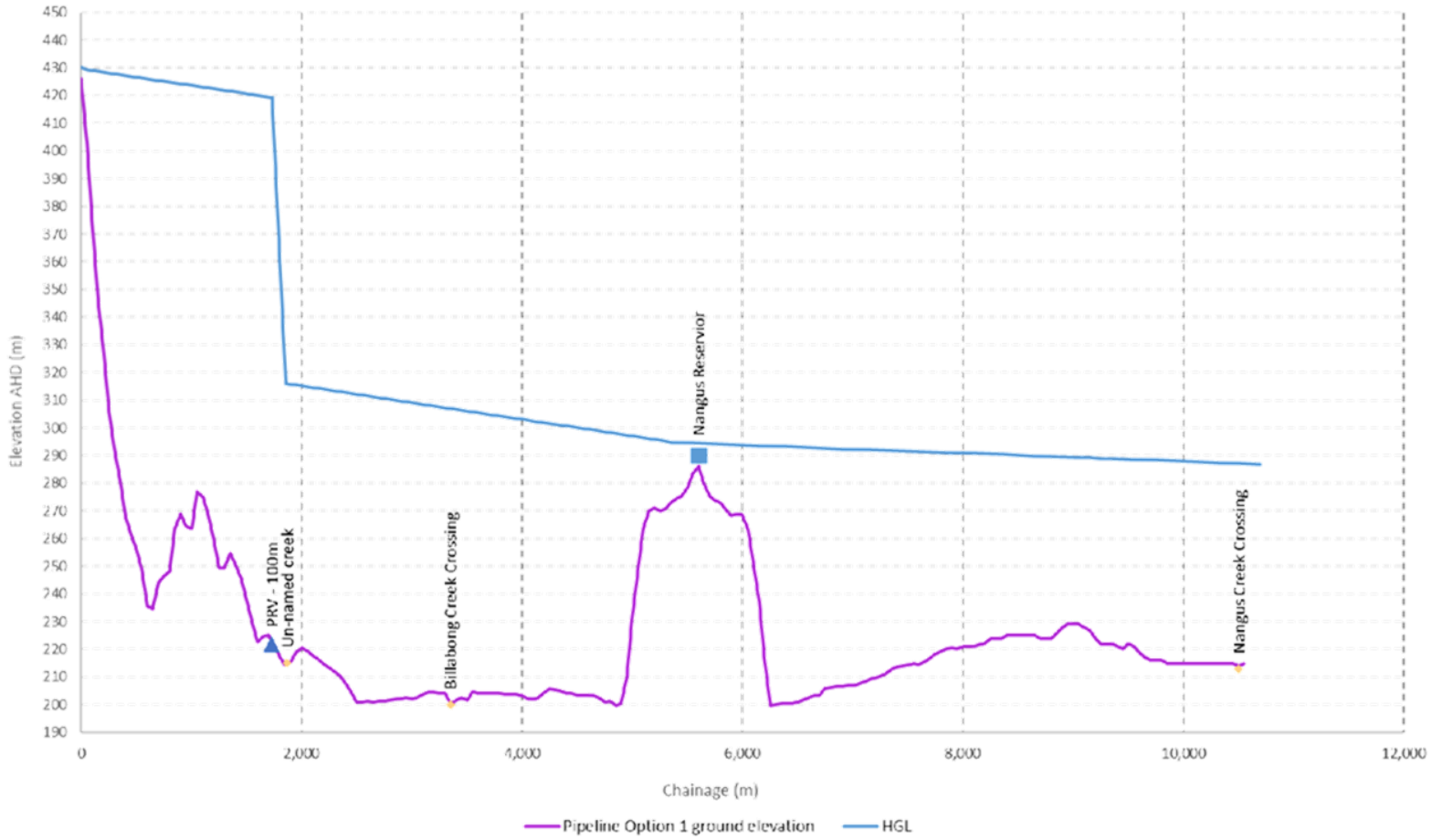


Figure 8-7 Option 4 – Hydraulic Grade & Elevation Profile

The model of the existing GWCC network was also analysed to determine any impacts due to the Nangus supply. No significant impacts were observed and it is therefore considered that no upgrade to the existing network will be required to supply Nangus on the basis of the additional demand. However, as noted in Section 6, future investigations should include consideration of the condition of these existing assets, and what renewals may be necessary to ensure reliability of supply.

As noted in Section 6, the MDD and annual demand on the Oura WTP are projected to be 30.2 ML/d and 4,600 ML/y respectively by 2048 (without the Nangus supply). Supply of water to Nangus would equate to an additional 1.7% to the MDD and 0.8% to the annual demand.

8.7.3 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 4 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts. This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.7.3.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the vegetation map in Appendix B and a brief description of the constraints is provided below:

- The area is primarily dominated by non-native vegetation
- There are three native vegetation communities present along the alignment of Option 4. These PCT's may be associated with TEC's protected under the BC Act as shown in Table 8-11.

Table 8-11 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name*	Probable TEC Status*
5	River Red Gum Herbaceous – Grassy Very Tall Open Forest Wetland	Not listed under the BC Act	NA
79	River Red Gum Shrub/Grass Riparian Tall Woodland or Open Forest Wetland	** Status of this vegetation under state and federal legislation is currently unknown and should be investigated further in later project development stages.	**
266	White Box Grassy Woodland	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	EEC

* Derived from the NSW Vegetation Information System (VIS) which allows you to match PCTs with probable TECs.
** Data not available in the VIS.

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 14 listed species under the BC Act were recorded within the vicinity of the alignment. The alignment does not directly impact on known sightings of threatened flora or fauna.
- A search of DPI – Key Fish Habitat found that Option 4 crosses three waterbodies that are considered key Fish Habitat including:

- Billabong Creek
- Nangus Creek
- Island Creek

> According to the Gundagai LEP 2011 and Junee LEP 2012, Option 4 will have an impact on areas mapped as 'sensitive land' according to the Natural Resources Sensitivity Biodiversity Map. The objective of the mapped sensitive land is to help maintain terrestrial and aquatic biodiversity.

Federally listed biodiversity constraints

> NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 22/11/2019 with 4 listed species under the *EPBC Act* found within the vicinity of this option.

> A search of the PMST (DOEE, 2019) was undertaken on 22/11/2019. The following MNES have been identified within 10km of this option. Federally listed TEC's have been identified below in Table 8-12.

- 4 Wetlands of International Importance all of which are located approximately 400km – 800km downstream of Option 4 alignment.
- 30 threatened species and 11 migratory species

Table 8-12 Federally listed TECs

TEC	Status: Endangered (EEC) or Critically Endangered (CEEC)
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	EEC
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	CEEC

Important conservation tenures

> Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the TSC Act have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.

> Option 4 does not impact on any listed National Parks and Wildlife Services (NPWS) reserves and national parks.

> A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA and Junee LGA. No Biobanking sites were located within the area of this option.

8.7.3.2 Heritage

8.7.3.2.1 Historic Heritage

Local Heritage

There is one heritage item identified under the Gundagai LEP 2011 in proximity to the proposed option (and none under the and Junee LEP 2012).

> I20: War Memorial Nangus – located on the outskirts of the town of Nangus

The abovementioned locally listed heritage item will not be impacted by the proposed option.

State Heritage

There are no State Heritage Register listed heritage items within proximity of Option 4.

Federal Heritage

> A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.

- A search of the Australian Governments Australian Heritage Database (DoEE, 2019) identified 14 federally listed heritage items within the Junee LGA.
- The PMST search undertaken on 25/11/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of the pipeline route.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA and Junee LGA.

8.7.3.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 5 Aboriginal sites and 0 (zero) Aboriginal places within the locality of Option 4. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

8.7.3.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- From east to west, the proposed Option 4 would traverse:
  - Nangus Creek
  - Billabong Creek
- Waterways range in size and under the Strahler stream order system are classified as ranging from sixth order stream to fourth order watercourses (DPI Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017).
- While works will be within 40m of these watercourses, a controlled activity approval under the Water Management Act 2000 (WM Act) is not required as the works would be undertaken by a public authority.
- Creek crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. Two named waterways are crossed by the pipeline (Nangus Creek and Billabong Creek) which are listed as moderate potential GDE (BOM, 2019).
- The pipeline would cross areas mapped as 'sensitive land' according to Gundagai LEP 2011 and within Groundwater Vulnerable areas mapped in Junee LEP 2012.
- There are numerous groundwater bore locations along Option 4 alignment. The eastern extent of the alignment in Nangus Village has a large number of bores within 50m of the alignment and the western extents will join the GWCC existing water mains. It is not expected that the pipeline would have any impact on the bores as the alignment could be set to avoid them.
- According to the Australian Flood Study Database, there have been three studies conducted surrounding the Murrumbidgee River and surrounds. The studies include:
  - Gundagai Flood Scoping Study – 2013;
  - Oura to Braehour Flood Model Extension – 2011; and
  - Murrumbidgee River Flood Modelling

  A thorough investigation into these studies will help shape future stages of the proposed development.

8.7.3.4 Soil and Contamination

- Soils present within the area are shown on the Soils figure in Appendix B.
- Option 4 traverses multiple different soil classes including:
  - Rudosols and Tenosols
  - Kandosols
  - Kurosols
  - Rudosols (Aluvial)
- Soil is not mapped as saline land in the DPE (2019) mapping.

A search of the OEH Contaminated Land Record and the Protection of the Environment Operation (POEO) Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 22 locations where a POEO License has been issued in the LGA of Cootamundra - Gundagai and 4 issued in Junee LGA. The listed locations of issued licences are not impacted by Option 4. There are no known contaminated sites listed on the OEH Contaminated Land Register in the vicinity of Option 4. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.7.3.5 Socio-economic, Land Use and Zoning

- The majority of Option 4 alignment is within land zoned RU1 – Primary Production land zoning. As the alignment enters the township of Nangus the zoning changes to RU5 – Village (see the land use and zoning map in Appendix B).
- This option traverses both Junee LGA and Cootamundra – Gundagai LGA.
- The pipeline option traversed across private properties in multiple locations.
- The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10 km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.
- Socio-economic considerations relevant to this option include:
  - Potential adverse impacts on private properties during pipeline installation
  - Positive impacts associated with securing a water supply for Nangus.

8.7.3.6 Cumulative Impacts

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects) either under assessment of approved. The register was searched for Cootamundra - Gundagai LGA and Junee LGA. Three major projects were identified (the Adjungbilly Wind Farm, Sebastopol Solar and Young to Wagga Looping Pipeline), however the projects are not in close proximity to Option 4 and is therefore unlikely to generate cumulative impacts.

Cootamundra – Gundagai Regional Council DA Tracking portal for Cootamundra - Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

Junee Council DA Tracking portal for Junee LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from October 2019 through to November 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.7.3.7 Summary of Environmental Constraints & Approval Pathway

Summary

The key environmental constraints related to pipeline Option 4 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final alignment during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the EP&A Act. Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes and budgets allocated could be substantially increased. From this high level desktop constraints analysis,

and given the proposed pipeline route could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. State Environmental Planning Policy (SEPPs) guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP), as the pipeline and associated ancillary structures is considered a "water reticulation system". Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the pipeline project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent, and therefore it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act. Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and potential impacts which will be confirmed at later stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

8.7.4 Cost Estimate

The estimated capital cost for Option 4 is $3.04 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.7.5 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-13.

Table 8-13 Option 4 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	10	▪ It is assumed that GWCC's Oura water supply network will meet or exceed the 5/10/10 rule. Water is sourced from the Murrumbidgee Regulated Water Source, and has a high level of security.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	9	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the ADWG health requirements. ▪ Chlorine dosing facility to be provided at Nangus reservoir to maintain residual. ▪ Potential for chlorine residuals to fall between chlorine dosing at Nangus reservoir and Nangus, which would necessitate an additional chlorine dosing facility.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	10	▪ It is assumed that water supplied by GWCC's Oura water supply network will meet the majority of current ADWG aesthetic requirements.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	7	▪ Operation and maintenance of pipeline, PRV, reservoir and chemical dosing facility considered familiar to operators. ▪ Significant length of the pipeline will be located through steep farmland with potentially difficult access for maintenance. ▪ Access to reservoir and chlorine dosing facility will pose difficulties. ▪ In the event of a prolonged failure of the pipeline water may be carted from Gundagai or GWCC to the Nangus reservoir. ▪ Materials readily available and close by in case of repair.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	6	▪ A significant length of the pipeline is through steep, rocky terrain. ▪ Some constructability risk related to unknown geotechnical conditions. ▪ Mostly conventional construction methods – open trenching. ▪ No specialised materials. ▪ Many experienced contractors available for this type of work. Similar works are currently being undertaken at other locations across NSW. ▪ The ability to swiftly construct water pipelines similar to this project has been proven at other sites in NSW. ▪ Three creek crossings to be suspended from bridge or directional drilled.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	6	▪ Geotechnical conditions unknown. Rock is likely to be a risk in elevated terrain near Tenandra and the proposed Nangus reservoir. ▪ Geotechnical conditions for proposed directional drilling of Billabong Creek are not known. ▪ Ability to mount pipeline on bridge (proposed at one location) is not known. Directional drilling or open trenching are alternatives.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	8	▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways.

No.	Criteria	Weighting	Score	Discussion
				▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development. ▪ Obtaining easements for installation of the pipeline within private property presents a possible project delivery risk. However, experience has shown that use of private property can avoid delays due to environmental approvals for installation in the road reserve. Significant portions of the pipeline are not close to road reserves, so diverting into the road reserve is not an option if there are issues with easements. ▪ Environmental approvals unlikely to significantly delay the project as careful route selection should allow avoidance of impacts.
	Total	100%	8.1	

8.8 Option 5: Murrumbidgee River extraction and treatment

8.8.1 Description

For Option 5 raw water would be extracted from the Murrumbidgee River via a new water intake. The raw water would be pumped to a new WTP located near Nangus. The water would be treated in compliance with the ADWG and draft ADWG health based targets (HBTs) and discharged to a reservoir. From the reservoir, treated water would be pumped into the reticulation system for supply.

A map of Option 5 is shown in Figure 8-8. Note that this plan is indicative only, for the purposes of generally displaying the infrastructure required. Locations for the river intake and WTP have not undergone a site selection process.

8.8.2 Preliminary Design

A detailed analysis of the proposed surface water treatment option is in the Surface and Groundwater Treatment Options report in Appendix C. A schematic of the proposed process is shown in Figure 8-9. The system is proposed to comply with all requirements of the ADWG.

A new raw water intake and pump station would be constructed at the Murrumbidgee River to transfer water to the WTP. A typical surface water intake would comprise a wedgewire screen to prevent entry of course solids and to ensure that fish are protected. This would be surrounded by a reinforced concrete structure to protect the screen and channel floor. A pumping station on the shore would transfer the raw water to the treatment plant. It is noted that the actual configuration would need to be determined based on a detailed investigation of the river conditions and adjacent flood plain.

From the raw water pump station a DN100 pipeline would convey raw water to the WTP site.

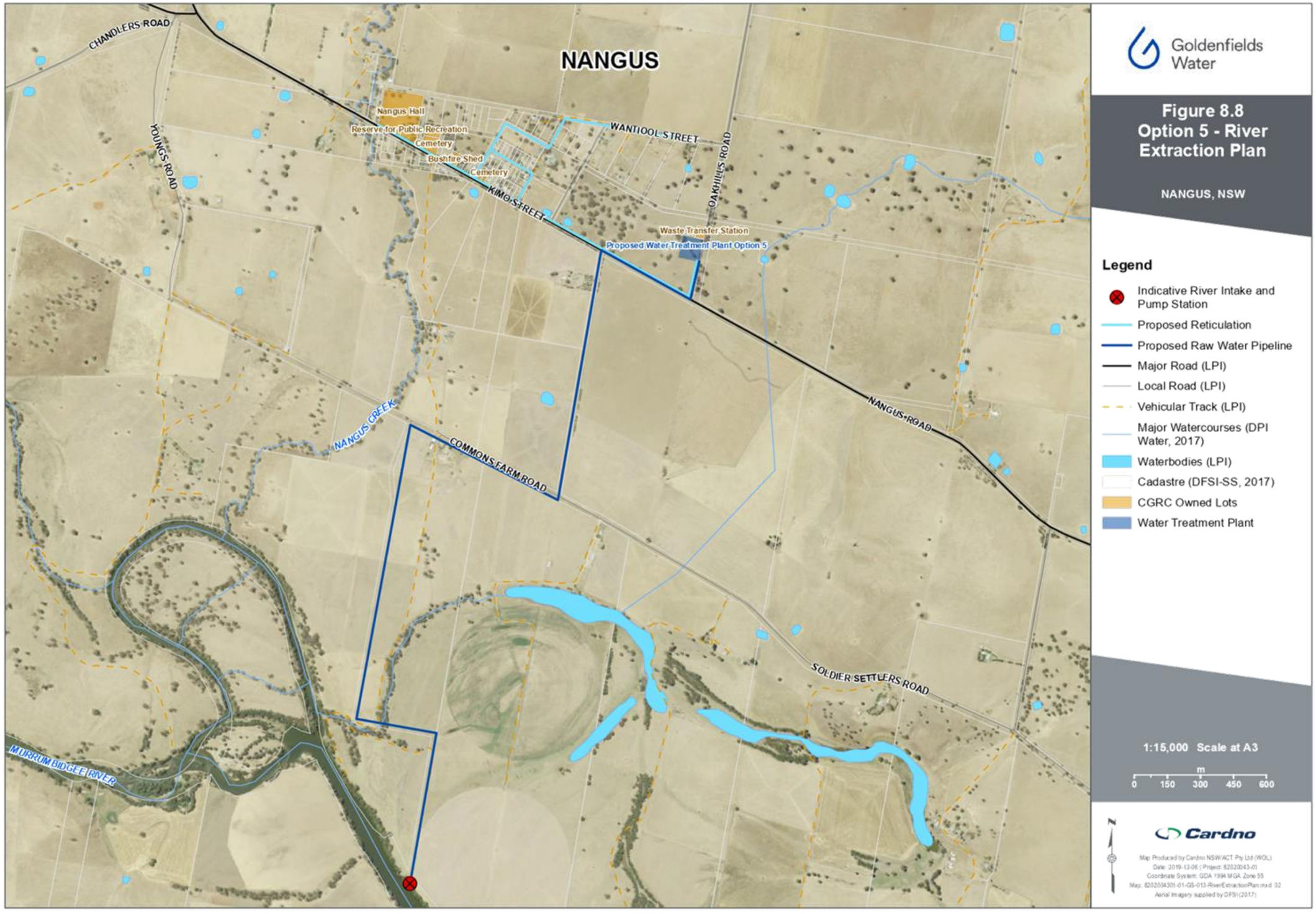
It has been assumed that the raw water source is a vulnerability category 4 (unprotected) catchment under the draft ADWG HBTs. The water treatment process would involve the following major process components:

- Powdered activated carbon (PAC) dosing for taste and odour control
- pH correction
- Oxidation for iron and manganese removal
- Coagulation, flocculation and sedimentation
- Membrane ultrafiltration
- Ultraviolet disinfection
- Chlorine dosing
- Fluoridation
- Sludge ponds for solids management

The production capacity of the WTP would be 400 kL/d, matching the peak demand from Nangus. The peak extraction from the Murrumbidgee River would be approximately 420 kL/d, allowing for 5% losses in waste streams.

A reservoir of approximately 250 kL storage volume is required, to provide for three days of average day demand, in line with GWCC requirements. It is proposed that this reservoir be constructed at ground level from concrete, and the reticulation network be supplied by pumps drawing from the reservoir. A standby generator would be provided for backup power to the pumps.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-8, matching the other options.


NANGUS
CHANDLERS ROAD
YOUNGS ROAD
Nangus Hall
Reserve for Public Recreation
Cemetery
Bushfire Shed
Cemetery
WANTIOOL STREET
OAKHILLS ROAD
KIMO STREET
Waste Transfer Station
Proposed Water Treatment Plant Option 5
NANGUS ROAD
NANGUS CREEK
COMMONS FARM ROAD
SOLDIER SETTLERS ROAD
MURRUMBIDGEE RIVER
Goldenfields Water
Figure 8.8
Option 5 - River Extraction Plan
NANGUS, NSW
Legend
Indicative River Intake and Pump Station
Proposed Reticulation
Proposed Raw Water Pipeline
Major Road (LPI)
Local Road (LPI)
Vehicular Track (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
CGRC Owned Lots
Water Treatment Plant
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-12-06 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Aerial Imagery supplied by DFSI (2017)

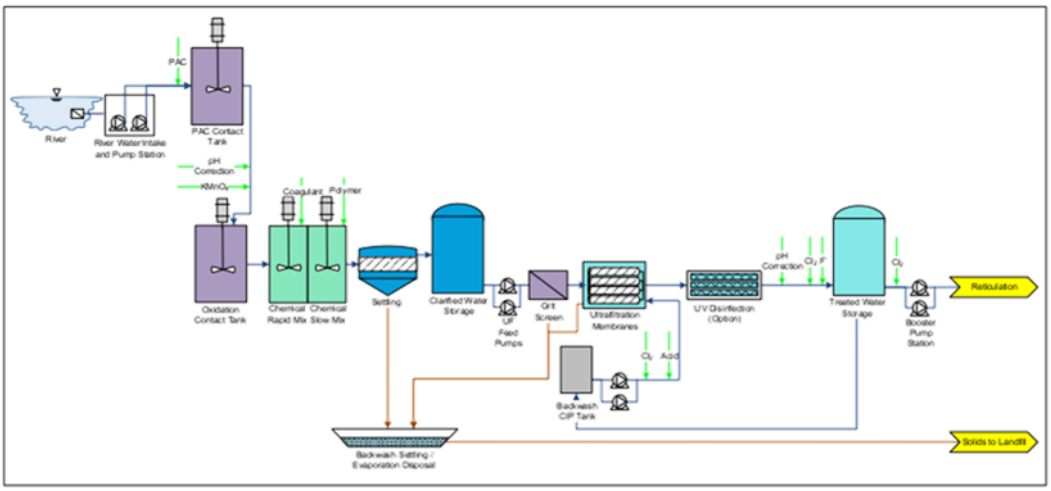


Figure 8-9 Option 5 – Water Treatment Process

8.8.3 Water Access Licence Implications

Option 5 involves extraction of water from the Murrumbidgee Regulated River Water Source. This activity is controlled under the *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2016* (NSW Government, 2018). A specific purpose WAL in the 'Local Water Utility' category is required to extract water from the Murrumbidgee Regulated River Water Source for town water supply.

GWCC currently holds WAL6456 for extraction of 5,590 ML/y from the Murrumbidgee Regulated River Water Source for use in town water supply. Water extraction for GWCC's Jugiong WTP is carried out under this WAL.

CGRC currently holds WAL6455 for extraction of 1,250 ML/y from the Murrumbidgee Regulated River Water Source for use in town water supply. Water extraction for CGRC's Gundagai WTP is carried out under this WAL.

Both the above WALs do not specify a particular location for the water withdrawal, other than in the referenced works approvals, which specifically relate to the intake works at Jugiong and Gundagai respectively. Advice obtained from the Natural Resource Access Regulator (NRAR) indicates that it should be possible to use the allocations under either of these WALs for Nangus, provided that a new works approval can be obtained for an intake at Nangus, and attached to either WAL. A new works approval would be processed by NRAR, but linking of the works approval to the WAL would be approved via WaterNSW. Both organisations would need the concurrence of DPIE.

Alternatively, under the Water Sharing Plan, a new specific purpose WAL may be granted by the Minister responsible, provided "the Minister is satisfied that the share and extraction component of the access licence is the minimum required to meet the circumstances in which the access licence is proposed to be used". An application would need to be made to the NRAR for approval, and would require endorsement by DPIE. A new works approval for the intake would also be required from NRAR.

8.8.4 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 5 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts. This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.8.4.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the vegetation map in Appendix B and a brief description of the constraints is provided below:

- The area is primarily dominated by non-native vegetation.
- A small portion of the proposed alignment will have an impact on one native vegetation community – the River Red Gum Herbaceous – Grassy Very Tall Open Forest Wetland (known as PCT 5 - PCT 5 is not listed as a threatened ecological community under state or federal legislation.

Table 8-14 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name	Probable TEC Status
5	River Red Gum Herbaceous – Grassy Very Tall Open Forest Wetland	Not listed under the BC Act	NA

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 25/11/2019 with 39 listed species under the BC Act recorded within the vicinity of the alignment.
- A search of DPI – Key Fish Habitat) found that Option 5 directly extracts from the Murrumbidgee River which is listed as Key Fish Habitat.

Federally listed biodiversity constraints

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 25/11/2019 with 13 listed species under the *EPBC Act* found within the vicinity of the alignment.
- A search of the PMST (DOEE, 2019) was undertaken on 25/11/2019. The following MNES have been identified within 10km of this option.
  - Four Wetlands of International Importance all of which are located approximately 400km – 800km downstream of Option 5.
  - PMST results identified 28 threatened species and 11 migratory species within 10km of Option 5.
- No federally listed TEC within the vicinity of this option.
- According to the Gundagai LEP, Option 5 passes through land that is mapped as sensitive land on the Natural Resources Sensitivity Biodiversity Map.

Important conservation tenures

- Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the TSC Act have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.
- Option 5 does not impact on any listed NPWS reserves and national parks.
- A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA. No Biobanking sites were located within the vicinity of this option.

8.8.4.2 Heritage

8.8.4.2.1 Historic Heritage

Local Heritage

There are two heritage items identified under the Gundagai LEP 2011 in proximity to the proposed option.

- I20: War Memorial Nangus – located on the outskirts of the town of Nangus

- I14 Nangus Station Group – located east of the option

Neither of these items will be impacted by the proposed option.

State Heritage

There are no State Heritage Register listed heritage items within the vicinity of Option 5.

Federal Heritage

- A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.
- The PMST search undertaken on 25/11/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of Option 5.

8.8.4.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 23 Aboriginal sites and 0 (zero) Aboriginal places within the vicinity of Option 5. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA.

8.8.4.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- This option would draw water directly from the Murrumbidgee River and cross one associated drainage course as the alignment travels north towards Nangus Village. The Murrumbidgee River has been classed as a higher order watercourse (>8) under the Strahler stream order system. The alignment also crosses an unnamed drainage channel close to the Murrumbidgee (DPI Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017).
- While works will be within 40m a watercourse, a controlled activity approval under the WM Act is not required as the works would be undertaken by a public authority.
- The requirements for a Water Access Licence and Works Approval are discussed in Section 8.8.3.
- Waterway crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. Option 5 proposes to extract water directly from the Murrumbidgee River which is classed as high potential GDE (BOM, 2019).
- This option would cross areas mapped as 'sensitive land' according to Gundagai LEP 2011.
- Option 5 does not impact on any existing bores in its proposed locations. It is not expected that the option would have any impact on existing bores as the locations of infrastructure could be set to avoid them.

8.8.4.4 Soil and Contamination

- Soils present within the area are shown on the soils figure in Appendix B.
- Option 5 traverses two different soil classes including Kurosols and Rudosols (Aluvial)
- Soil is not mapped as saline land (DPE, 2019).

A search of the OEH Contaminated Land Record and the POEO Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 22 locations where a POEO License has been issued in the LGA of Cootamundra - Gundagai. The listed locations of issued licences are not impacted by Option 5. There are no known contaminated sites listed on the OEH Contaminated Land Register in the vicinity of Option 5. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.8.4.5 Socio-economic, Land Use and Zoning

- The majority of Option 5 is covered by RU1 – Primary Production land zoning. As the alignment enters the township of Nangus the zoning changes to RU5 – Village (see the land use and zoning map in Appendix B).

- The option traversed private properties in multiple locations.
- The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.
- Socio-economic considerations relevant to this option include:
  - Potential adverse impacts on private properties during construction.
  - Positive impacts associated with securing a water supply for Nangus.

8.8.4.6 Cumulative Impacts

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed, under assessment or approved (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects). The register was searched for Cootamundra - Gundagai LGA and 1 major project was identified (the Adjungbilly Wind Farm), however the project is not in close proximity to this option and is therefore unlikely to generate cumulative impacts.

The Cootamundra – Gundagai Regional Council DA Tracking portal for Cootamundra - Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 concluded that there are no relevant DA Applications that will have an influence on the proposed project.

It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.8.4.7 Summary of Environmental Constraints & Approval Pathway

Summary

The key environmental constraints related to Option 5 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final infrastructure locations during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. This proposed option would be directly extracting water from the Murrumbidgee River, a key ecosystem for aquatic and terrestrial biodiversity. A detailed investigation into the Murrumbidgee River would be necessary to scope appropriate extraction points and alignment with the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012*. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the EP&A Act. Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes and budgets allocated could be substantially increased. From this high level desktop constraints analysis, the river extraction option could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. SEPPs guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP). The pipelines and associated ancillary structures are considered a "water reticulation system". Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent.

Under Clause 125(3A) of ISEPP, development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in a prescribed zone. The proposed location of the Water Treatment Plant for Option 5 is on land in a prescribed zone and is therefore permissible without consent. Therefore, it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act.

Option 5 involves the extraction of water directly from the Murrumbidgee River. This activity is controlled under the *Water Sharing Plan for the Murrumbidgee River Water Source 2016* (NSW Government, 2018). A specific purpose Water Access License (WAL) in the 'Local Water Utility' category is required to extract water from the Murrumbidgee River for town water supply. As discussed above in Section 9.3.6, there are multiple options to consider when it comes to accessing this WAL. Advice obtained by NRAR indicates that it should be possible to use allocations of existing WAL's in Nangus for Option 5. A new works approval would be processed by NRAR, but linking of the works approval to the WAL would be approved by WaterNSW.

Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage or water treatment facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and project footprint. The potential impacts which will be confirmed at later stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

8.8.5 Cost Estimate

The estimated capital cost for Option 5 is $9.12 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.8.6 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-15.

Table 8-15 Option 5 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	10	▪ A high level of water security is provided from the Murrumbidgee River.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	9	▪ The proposed treatment system will meet the requirements of the ADWG and the draft HBTs. ▪ Potential risks in maintaining treatment performance at a small facility with low staffing level.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	9	▪ The proposed treatment system will meet the requirements of the ADWG. ▪ Potential risks in maintaining treatment performance at a small facility with low staffing level.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	6	▪ Risk of damage to intake structure and raw water pump station during flood conditions and from debris. ▪ Relatively complex WTP required due to water quality. Higher risk of operational failure than pipeline options. ▪ Moderate resourcing risk.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	6	▪ Work to install intake in Murrumbidgee River – high risk. ▪ Moderate risk related to procuring suitably qualified construction contractors that can meet program requirements. Construction delays have been observed in treatment plant construction in recent projects in NSW. ▪ Land acquisition delays are a potential risk.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	5	▪ Impacts of flooding unknown. ▪ Geotechnical conditions unknown. ▪ Unknown risks around site selection of intake location – site specific impacts, river morphology etc.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	6	▪ Potential direct impacts to the Murrumbidgee River to be investigated further. ▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways. ▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development. ▪ Environmental approvals unlikely to significantly delay the project as careful selection of the locations for infrastructure should allow avoidance of impacts. ▪ Several options existing for obtaining rights (WAL) to extract water from the Murrumbidgee River. However, risk remains around this approval. ▪ A new works approval will be required from NRAR for the river intake.
	Total	100%	7.5	

8.9 Option 6: Groundwater extraction and treatment

8.9.1 Description

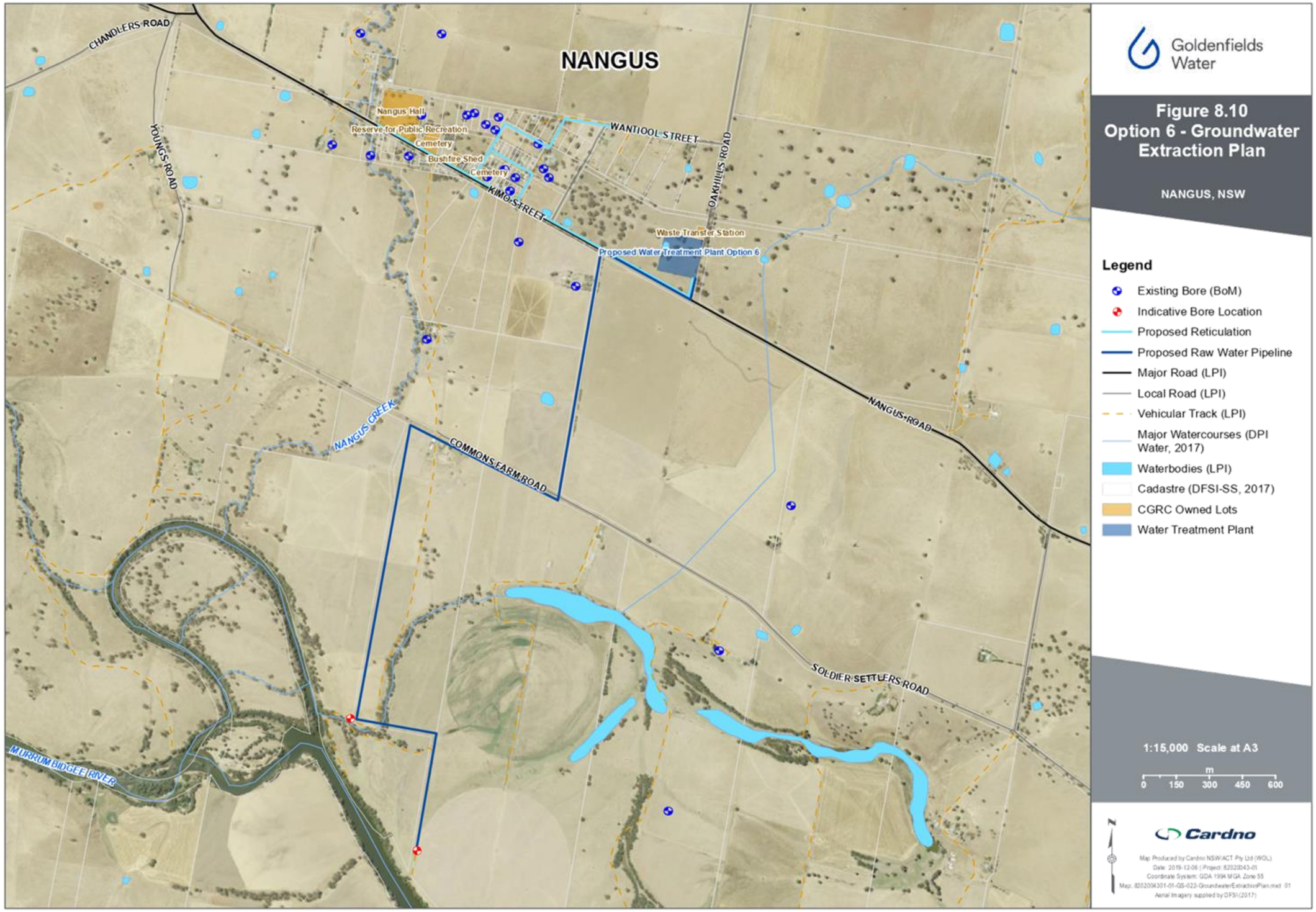
For Option 6 raw water would be taken from new groundwater bores. The raw water would be pumped to a new WTP located near Nangus. The water would be treated in compliance with the ADWG and draft ADWG health based targets (HBTs) and discharged to a reservoir. From the reservoir, treated water would be pumped into the reticulation system for supply.

A map of Option 6 is shown in Figure 8-10. Note that this plan is indicative only, for the purposes of generally displaying the infrastructure required. Locations for the bores and WTP have not undergone a site selection process.

8.9.2 Hydrogeological Study

Cardno has undertaken a Desktop Hydrogeological Review (see Appendix D) to investigate the viability of groundwater resources in the area around Nangus. The Gundagai Alluvial Groundwater Source underlies Nangus, and is controlled under the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (NSW Government, 2016). The report concluded that:

- Groundwater in the study area is likely be present in porous media alluvial aquifers or in fractured bedrock aquifers.
- Groundwater in alluvial aquifers may occur at depths ranging from approximately 5 m to 19 m below ground surface, based on existing bores near the town of Nangus. Depth of groundwater in bedrock aquifers is not known at this stage.
- Groundwater yields are reported to range from approximately 1 to 13 L/s in the alluvial aquifer in the study area, with an average yield of about 3 L/s. Bore yields are expected to be relatively high in the alluvial aquifers, but may not be sufficient for the peak daily requirement which is understood to be 4.6 L/s. Bore yield in the bedrock aquifers is expected to be variable, though generally lower.
- Groundwater quality, with respect to salinity, is expected to be fair to unacceptable in alluvial aquifers (based on available data) and poor to unacceptable in bedrock aquifers (based on our experience of bedrock aquifers).
- A total of 51 registered groundwater bores have been identified within the study area. Groundwater uses mostly include water supply and irrigation, with minor stock/ domestic and monitoring uses. Potential impacts on existing registered bores would need to be considered if town supply bores were to be installed in the study area.
- It is considered that there is potential for suitable groundwater resources to exist in the study area. However, testing of bore yields and salinity is required to confirm this. Low yields may be addressed by using more than one bore for the groundwater supply. Poor groundwater quality can be addressed through the treatment of the groundwater prior to use as drinking water. Further, it is likely that groundwater salinity may be lower closer to the Murrumbidgee River, and groundwater investigations could target areas closer to the river.
- Further investigation is required to confirm the potential yield and quality of groundwater available. This would involve exploratory drilling of one or more groundwater bores at selected locations in the alluvial aquifer in the study area, followed by pumping tests and water quality testing.


NANGUS
CHANDLERS ROAD
YOUNGS ROAD
Nangus Hall
Reserve for Public Recreation
Cemetery
Bushfire Shed
Cemetery
WANTIOOL STREET
KIMO STREET
OAKHILLS ROAD
Waste Transfer Station
Proposed Water Treatment Plant Option 6
NANGUS ROAD
NANGUS CREEK
COMMONS FARM ROAD
SOLDIER SETTLERS ROAD
MURRUM BIDGEE RIVER
Goldenfields Water
Figure 8.10
Option 6 - Groundwater Extraction Plan
NANGUS, NSW
Legend
Existing Bore (BoM)
Indicative Bore Location
Proposed Reticulation
Proposed Raw Water Pipeline
Major Road (LPI)
Local Road (LPI)
Vehicular Track (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
CGRC Owned Lots
Water Treatment Plant
1:15,000 Scale at A3
m
0 150 300 450 600
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-12-06 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-023-GroundwaterExtractionPlan.mxd 01
Aerial imagery supplied by DFSI (2017)

8.9.3 Preliminary Design

New bores will be required to be constructed into the alluvial aquifer. We have assumed two bores will be required to provide sufficient yield and redundancy. Each bore would require a bore pump, surface well head protection to prevent contamination and backflow, and an electrical supply.

Bore locations have been indicatively shown near to the Murrumbidgee River, as salinity levels are expected increase with distance from the river (NSW DPI, 2016). The required bore depth is estimated to be around 25 m. There are also few existing bores near these locations that may be impacted.

From the bores, a DN100 raw water pipeline would convey the water to the WTP.

A detailed analysis of the proposed groundwater treatment option is in the Surface and Groundwater Treatment Options report in Appendix C. A schematic of the proposed process is shown on Figure 8-11. The system is proposed to comply with all requirements of the ADWG.

The Draft Chapter 5 Microbial Quality of Drinking Water (NHMRC, 2018) states that for groundwater a starting point for classification of the source is to "assume a groundwater resource is unprotected until objective, credible scientific evidence can conclusively demonstrate otherwise". In the worst case, if information is not available, the aquifer should be considered to be the same category as the surface water that recharges the aquifer.

Based on evidence that existing bores in the locality are shallow, the recharge source is likely to be the Murrumbidgee River and surface rainfall/runoff. There is not yet any water quality monitoring of the particular source, therefore, a conservative approach needs to be taken. For these reasons the groundwater sources within the study area have been given a preliminary microbiological risk assessment of Category 4. With further assessment of an actual source it is possible that the result could be a Category 3 classification.

Based on available data for water quality in the aquifer, total the dissolved solids (TDS) are elevated, ranging from 800 - 4,200mg/L (estimate based on converting electrical conductivity measurements to TDS). According to the ADWG this degree of salinity would be poor to unacceptable quality, with TDS required to be below 600mg/L to be aesthetically acceptable. It is also common that groundwater in the region has elevated iron and manganese. Therefore, it is highly likely that a suitable groundwater treatment process will have to address iron, manganese and TDS.

The proposed water treatment process would involve the following major process components:

- Iron and Manganese oxidation and filtration
- Chlorine neutralisation
- Reverse osmosis for TDS and pathogen removal
- Recarbonation / pH Correction
- UV for disinfection
- Chlorine dosing for disinfection
- Fluoridation
- Brine storage and evaporation
- Sludge ponds for solids management

The production capacity of the WTP would be 400 kL/d, matching the peak demand from Nangus. The peak extraction from the bores would be approximately 600 kL/d, allowing for losses in waste streams, in particular the brine from the reverse osmosis process.

A reservoir of approximately 250 kL storage volume is required, to provide for three days of average day demand, in line with GWCC requirements. It is proposed that this reservoir be constructed at ground level from concrete, and the reticulation network be supplied by pumps drawing from the reservoir. A standby generator would be provided for backup power to the pumps.

The reticulation system would consist of DN100 PVC-O, with the extents as shown on Figure 8-8, matching the other options.

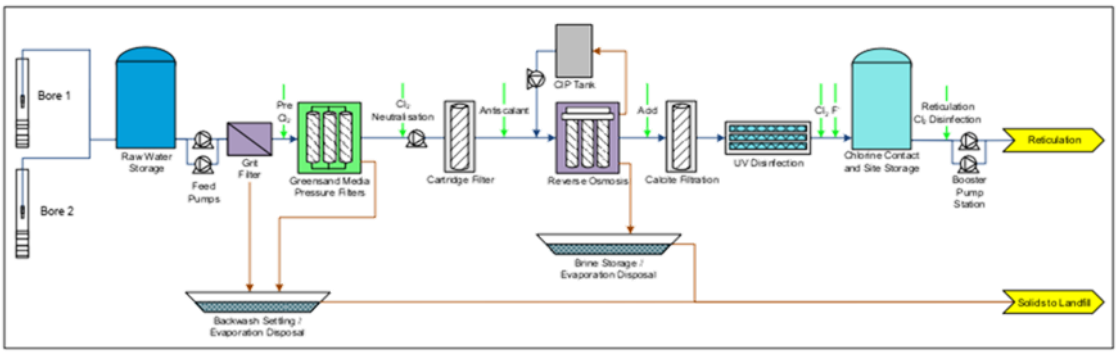


Figure 8-11 Option 6 – Water Treatment Process

8.9.4 Water Access Licence Implications

Option 6 involves extraction of water from the Gundagai Alluvial Groundwater Source. This activity is controlled under the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012* (NSW Government, 2016).

GWCC currently holds WAL33469 for extraction of 6,000 ML/y from the Wagga Wagga Alluvial Groundwater Source for use in town water supply. This water feeds GWCC's Oura system. As the licence is for a different Source, it cannot be used for groundwater extraction at Nangus, and the water sharing rules for the Gundagai Alluvial Source prevent trading from other sources into this one. Further specific advice may be obtained from WaterNSW relating to water dealings that may allow transfer of a portion of the licence to the Gundagai Alluvial Source, however, these discussions will need to be undertaken directly between GWCC and WaterNSW.

A new WAL will likely be required under the Water Sharing Plan. The Minister responsible may grant a new specific purpose licence, provided "the Minister is satisfied that the share and extraction component of the access licence is the minimum required to meet the circumstances in which the access licence is proposed to be used". An application would need to be made to NRAR for approval, and would require endorsement by DPIE.

A water supply works approval will be required for construction and use of new bores to supply groundwater. The application would be made to NRAR and require the concurrence of DPIE. The Water Sharing Plan and Gundagai Alluvial Groundwater Source rules place a number of conditions on bore construction, including distance restrictions and construction standards. Distance restrictions are implemented to minimise interference between bores, and include:

- 1,000 m from an aquifer access licence bore on another landholding.
- 400 m from a basic landholder rights bore on another landholding.
- 1,000 m from a local or major water utility access licence bore.
- 1,000 m from a DPI Water monitoring bore.
- 500 m from a property boundary.

It may not be possible to comply with the above rules (for example, the property boundary restriction, which would require the purchase of a large amount of land or consent of the adjacent landholders). However, these requirements may be waived by the Minister responsible provided it can be demonstrated "to the Minister's satisfaction that the location of the water supply work at a lesser distance will result in no more than minimal impact on existing extractions within these water sources". A hydrogeological study would be required to determine the impact on existing bores, and confirm the suitability of reduced distances.

8.9.5 Environmental Constraints

A desktop review has been undertaken using online resources to provide initial high level advice of the environmental constraints associated with Option 6 which includes biodiversity, heritage, major waterbodies and watercourses, socio-economic considerations, soils and contamination, cumulative impacts and land use and land zoning.

Key features are presented in Appendix B and the findings of the desktop review are discussed below. Database searches were conducted between 20 and 25 November 2019 and are considered accurate at the

time of writing. Most of the searches conducted present findings at a scale that does not allow for precise impact assessment, and the constraints would need to be confirmed on-site during future stages of the project in order to determine and either avoid and/or minimise potential impacts.

This is particularly the case for heritage items and threatened flora, fauna and vegetation communities where the records reported generally relate to those found within a 10 km search area and/or are recorded imprecisely in public databases.

8.9.5.1 Biodiversity

NSW listed biodiversity constraints

The vegetation communities present in the area are mapped on the Vegetation map in Appendix B and a brief description of the constraints is provided below.

- The area is primarily dominated by non-native vegetation
- A small portion of the proposed alignment will have an impact on one native vegetation community. This PCT may be associated with a TEC protected under the BC Act. See below Table 8-16 for details.

Table 8-16 State listed vegetation communities and associated BC Act TECs

PCT - ID	PCT	Associated BC Act listed TEC name*	Probable TEC Status*
5	River Red Gum Herbaceous – Grassy Very Tall Open Forest Wetland	Not listed under the BC Act	NA

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 25/11/2019 with 39 listed species under the BC Act were recorded within the vicinity of the alignment.

Federally listed biodiversity constraints

- NSW BioNet Atlas (OEH, 2019c) – a search for threatened species, populations and ecological communities was undertaken on 25/11/2019 with 13 listed species under the *EPBC Act* within the vicinity of the alignment.
- A search of PMST (DOEE, 2019) was undertaken on 25/11/2019. The following MNES have been identified within 10km of this option.
  - Four Wetlands of International Importance all of which are located approximately 400km – 800km downstream of Option 6 alignment.
  - PMST results identified 28 threatened species and 11 migratory species within 10 km of Option 6.
- No federally listed TEC within this the vicinity of this option.
- According to the Gundagai LEP, Option 6 alignment passes through land that is mapped as sensitive land on the Natural Resources Sensitivity Biodiversity Map.

Important conservation tenures

- Areas of Outstanding Biodiversity Value (AOBV): AOBVs are special areas that contain irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally. Areas of declared critical habitat under the TSC Act have become the first AOBVs in NSW with the commencement of the new BC Act. A search of the Critical habitat register NSW Office of Environment and Heritage (OEH, 2019a) was conducted on 22/11/2019 and no areas of critical habitat/AOBVs are located within proximity of this option.
- Option 6 does not impact on any listed NPWS reserves and national parks.
- A search of the Biobanking Public Register (NSW OEH, 2019) was used to search for Biobanking agreements, expressions of interest and statements within the Cootamundra - Gundagai LGA. No Biobanking sites were located within the vicinity of this option.

8.9.5.2 Heritage

8.9.5.2.1 Historic Heritage

Local Heritage

There are two heritage items identified under the Gundagai LEP 2011 in proximity to the proposed option.

- I20: War Memorial Nangus – located on the outskirts of the town of Nangus
- I14 Nangus Station Group – located east of the option

Both of the abovementioned locally listed heritage items will not be impacted by the proposed option (OEH, 2019).

State Heritage

There are no State Heritage Register listed heritage items within proximity of Option 6.

Federal Heritage

- A search of the Australian Government's Australian Heritage Database (DoEE, 2019) identified 15 federally listed heritage items within the Cootamundra - Gundagai LGA.
- The PMST search undertaken on 25/11/2019 found that no World Heritage Properties or National Heritage Places were identified within 10 km of the pipeline route.

8.9.5.2.2 Aboriginal Heritage

A search of the AHIMS register (NSW OEH, 2019d) on 25/11/2019 identified 23 Aboriginal sites and 0 (zero) Aboriginal places within the locality of Option 6. The search does not identify the precise locations of the sites and Aboriginal heritage constraints would be subject to confirmation during future project stages.

A search of the Native Title Register and Native Title Claims Register (Native Title Tribunal, 2019) conducted on 25/11/2019 returned no records within the Cootamundra – Gundagai LGA.

8.9.5.3 Hydrology, Water Quality and Groundwater

The hydrological, water quality and groundwater related features associated with this option are shown on the Hydrology figure in Appendix B.

- This option would draw water from indicative bore locations south of Nangus village. The bore locations are indicative and proposed shown in Appendix B. A more detailed investigation would be necessary to determine their exact locations during future stages of this project.
- Option 6 only crosses one drainage stream which has been classified as a minor waterway and a class of 3 under the Strahler stream order system. The southern extent of the alignment and final indicative bore location come within 200 m of the Murrumbidgee River which has been given a higher order classification (DPI Water, 2017).
- The Murrumbidgee River is mapped as Key Fish Habitat (DPI Water, 2017).An indicative bore location crosses over a drainage watercourse which is directly associated with the Murrumbidgee River.
- While works will be within 40 m of these watercourses, a controlled activity approval under the WM Act is not required as the works would be undertaken by a public authority.
- The requirements for a Water Access Licence and Works Approval are discussed in Section 9.7.4.
- Creek crossings would need to be designed to be sensitive to the biodiversity values present at site.
- Groundwater Dependent Ecosystems (GDE) are aquatic and terrestrial ecosystems which are sustained, to a degree, by groundwater. Option 6 does not directly impact on GDE's, however, the proposed alignment does cross a drainage channel which is directly associated with the Murrumbidgee River which has been classified as having high potential GDE (BOM, 2019).
- This option would cross areas mapped as 'sensitive land' according to Gundagai LEP 2011.
- Option 6 does not impact on any existing bores in its proposed locations. It is not expected that the option would have any impact on existing bores as the locations of infrastructure could be set to avoid them.
- Option 6 involves the extraction of water from the Gundagai Alluvial Groundwater Source.

8.9.5.4 Soil and Contamination

- Soils present within the area are shown on the Soils figure in Appendix B.
- Option 6 traverses multiple different soil classes including:
  - Kurosols

- Rudosols (Aluvial)

> Soil is not mapped as saline land in the DPE (2019) mapping.

A search of the OEH Contaminated Land Record and the POEO Act Public Register of Licences was undertaken on 24/11/2019. The search highlighted 22 locations where a POEO License has been issued in the LGA of Cootamundra - Gundagai. The listed locations of issued licences are not impacted by Option 6. There are no known contaminated sites listed on the OEH Contaminated Land Register in the vicinity of Option 6. All of these locations are outside of Option 6 alignment. There were no sites listed that were relevant to this option. There are no locations of contaminated lands according to OEH, 2019. This does not mean there is no contaminated land on site as not all contaminated areas have been recorded and constraints would need to be confirmed in future project stages.

8.9.5.5 Socio-economic, Land Use and Zoning

> The majority of Option 6 is covered by RU1 – Primary Production land zoning. As the alignment enters the township of Nangus the zoning changes to RU5 – Village (see the land use and zoning map in Appendix B).

> The option traverses across private properties in multiple locations.

> The PMST search identified 1 potential area of Commonwealth Land protected under the EPBC Act within 10 km of this option. The precise location of this land parcel will need to be confirmed in future investigations with impacts to these areas avoided and/or minimised where possible. If the project is likely to have a significant impact on Commonwealth land it may require referral to DoEE under the EPBC Act.

> Socio-economic considerations relevant to this option include:

- Potential adverse impacts on private properties during construction.
- Positive impacts associated with securing a water supply for Nangus.

8.9.5.6 Cumulative Impacts

The potential for cumulative impacts was considered through review of the Major Projects Register which identifies major projects proposed (including State Significant Development (SSD) and State Significant Infrastructure (SSI) projects) either under assessment of approved. The register was searched for Cootamundra - Gundagai LGA. One major project was identified (the Adjungbilly Wind Farm), however the project is not in close proximity to this option and is therefore unlikely to generate cumulative impacts.

The Cootamundra – Gundagai Regional Council DA Tracking portal for Cootamundra - Gundagai LGA was accessed on 25 November 2019 to check for any development that may impact on the proposed pipeline option. The search included results from January 2019 through to June 2019 and concluded that there are no relevant DA Applications that will have an influence on the proposed project.

It is noted that this search was not comprehensive and local developments should be checked as part of future project stages.

8.9.5.7 Summary of Environmental Constraints & Approval Pathway

Summary

The key environmental constraints related to Option 6 are the biodiversity and heritage constraints identified above. A more detailed assessment of the final infrastructure locations during future stages of the development will allow for avoidance or minimisation of potential impacts identified above. This proposed option would be directly extracting groundwater from the Gundagai Alluvial Groundwater Source. Further investigation would be necessary to determine appropriate bore locations and extraction would need to be within the limits specified in the *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012*. Impacts on other matters can generally be managed through careful construction management processes developed at future construction stages of development. Impacts to private property will also need to be minimised where possible with appropriate consultation with interested stakeholders and impacted community members where necessary.

The location and extent of all constraints, but in particular the biodiversity and heritage constraints, will need to be confirmed in future stages of the project through on-ground surveys and research. Significant impacts to biodiversity can trigger the need for an Environmental Impact Statement (EIS) under Part 5, Division 5.1, Subdivision 3 of the EP&A Act. Significant impacts to Commonwealth listed threatened entities or Commonwealth land can trigger the need for a referral to the Federal Government and assessment under the EPBC Act. If an EIS becomes necessary due to unavoidable impacts, the project approval timeframes

and budgets allocated could be substantially increased. From this high level desktop constraints analysis, the groundwater extraction option could be developed to avoid or minimise such impacts, it is considered unlikely that the proposed alignment would have a significant impact on biodiversity and/or Commonwealth matters. This would need to be confirmed during future stages of the project as the constraints analysis is high level and the design is at a preliminary stage.

Initial approval pathway advice

The project will need assessment under the EP&A Act. SEPPs guide the approval pathways under the EP&A Act.

The initial approval pathway will be assessed under the State Environmental Planning Policy (Infrastructure) 2001 (ISEPP). The pipelines and associated ancillary structures are considered a "water reticulation system". Under Clause 125(1) of ISEPP, development for the purpose of a water reticulation system (including reservoirs) may be carried out by or on behalf of a public authority without consent on any land. As the project would be undertaken by GWCC or CGRC (both public authorities) the proposal would be permissible without consent.

Under Clause 125(3A) of ISEPP, development for the purpose of water treatment facilities may be carried out by or on behalf of a public authority without consent on land in a prescribed zone. The proposed location of the Water Treatment Plant for Option 6 is on land in a prescribed zone and is therefore permissible without consent. Under Clause 125(5) of ISEPP, a reference to development for the purpose of water supply system of any kind includes a reference to development for a number of purposes including groundwater investigation works, groundwater bore stations, borefields, minewater works and the like. The definition of a 'water supply system' includes a water reticulation system which is what has been proposed in this option. Therefore, it is currently anticipated that the applicable approval pathway is via a Review of Environmental Factors under Part 5 of the EP&A Act.

Option 6 involves the extraction of water directly from the Gundagai Alluvial Groundwater Source. This activity is controlled under the *Water Sharing Plan for the Murrumbidgee River Water Source 2016* (NSW Government, 2018). A new Water Access Licence would be required for the extraction under the Water Sharing Plan, as discussed in Section 9.7.4 above. An application would need to be made to the NRAR for approval, and would require endorsement by DPIE.

Clause 14(1) of the State and Regional Development SEPP states that development for the purpose of water storage or water treatment facilities that has a capital investment value of more than $30 million would be subject to a more intense approvals pathway which may trigger the need for an Environmental Impact Statement.

The approval pathway will need to be confirmed and will be dependent on confirmation of pipeline alignment and potential impacts which will be confirmed at later stages of the project. This will involve specialist studies and on-ground surveys to confirm environmental constraints, confirmation of land use and applicability of Part 5 provisions, confirmation of capital investment value and consideration of 'significant impacts' on the environment which could trigger the need for an EIS.

8.9.6 Cost Estimate

The estimated capital cost for Option 6 is $8.76 million, excluding GST. A detailed breakdown of this estimate is provided in Appendix E. See Section 5.1 for a description of the inclusions and methodology for cost estimates.

8.9.7 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1) and a discussion on the risks related to each parameter are given in Table 8-17.

Table 8-17 Option 6 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	6	▪ Yield and security of the aquifer are currently unknown. Aquifer relies on recharge from the Murrumbidgee River and local rainfall/runoff.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	10	▪ The proposed treatment system will meet the requirements of the ADWG and the draft HBTs. ▪ Potential risks in maintaining treatment performance at a small facility with low staffing level.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	10	▪ The proposed treatment system will meet the requirements of the ADWG. ▪ Potential risks in maintaining treatment performance at a small facility with low staffing level.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	3	▪ Risk of damage to bores located near the Murrumbidgee River during flood conditions. ▪ Complex WTP (reverse osmosis) required due to water quality. Higher risk of operational failure than pipeline options. ▪ Potential for groundwater extraction to impact water level in existing bores. ▪ Resourcing risk for obtaining suitably qualified staff to operate a reverse osmosis plant. ▪ Brine management will remain an ongoing risk: – Potential for leakage or breach of containment. – Alternative disposal routes will be required for emergency conditions.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	5	▪ Risk of finding suitable groundwater resources in terms of yield and quality. ▪ Moderate risk related to procuring suitably qualified construction contractors that can meet program requirements. Construction delays have been observed in treatment plant construction in recent projects in NSW. ▪ Land acquisition delays are a potential risk.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	3	▪ Additional site investigations (exploratory drilling) to confirm the viability of the groundwater source in terms of yield and quality. ▪ Impacts of flooding unknown. ▪ Geotechnical conditions unknown.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	7	▪ Potential direct impacts to the Gundagai Alluvial Groundwater Source to be investigated further. ▪ Avoidance of impacts to known state and federally listed TEC's and threatened species is likely to be possible. ▪ Waterway crossings will need to be sensitively designed to have minimal impact on the waterways. ▪ Impacts to indigenous heritage and a more accurate and verified survey of the land is needed for future project development. ▪ A new WAL will be required for extraction of groundwater. Risk remains around this approval. ▪ A new works approval will be required from NRAR for construction of bores.
	Total	100%	6.0	

8.10 Option 7: Do nothing

8.10.1 Description

For the 'do nothing' option, the current situation is maintained. No reticulated water is supplied to Nangus, and residents will continue to make their own water supply arrangements, as described in Section 2.

8.10.2 Hazards Related to Rainwater and Groundwater Supplies

The hazards related to the existing use of rainwater tanks and groundwater for water supply are outlined below.

8.10.2.1 Rainwater Tanks

NSW Health (https://www.health.nsw.gov.au/environment/water/Pages/rainwater.aspx) and enHealth (2011) provide guidance on the use of rainwater tanks for drinking water supply to individual households.

In NSW around 7.3% of households use rainwater tanks as the main source of drinking water. Rainwater collected from roof catchments is generally considered safe to drink, and the risk of illness is considered low provided that the roof, gutters, tank, piping and surrounds (i.e. overhanging trees) are properly maintained. However, maintenance is generally observed to be poor. Proper maintenance is essential to ensure the supply remains safe to drink.

The greatest risk to human health comes from microbiological pathogens which may be present. Pathogens may come from two primary sources:

- Faecal matter from birds, lizards, mice, rats possums and other animals.
- Dead insects and other animals in gutters or in the tank.

Thermotolerant coliforms and E. coli are commonly identified in domestic rainwater tanks, which implies enteric (intestinal) pathogens may often be present. However, research involving testing for individual pathogens has generally shown low levels of detection.

Studies of gastrointestinal illness rates for people drinking from rainwater tanks vs. drinking from a supply complying with the ADWG have found little evidence for increased illness rates. This may be partly due to acquired immunity to pathogens in people that drink rainwater.

Rainwater can present a higher risk to immunologically compromised people.

Chemical hazards in rainwater can generally come from:

- Off-site sources, such as pesticides, industrial emissions, traffic emissions and windblown particulate.
- On-site sources such as materials used in roof, gutter and tank construction

Proper maintenance is key to reducing the potential for chemical hazards to exist in the supply. For example, sediments that collect in the base of rainwater tanks can contain significant concentrations of chemicals, including lead, and sediment removal is required to manage these risks.

8.10.2.2 Groundwater

It is understood that some residents may use bore water for drinking. The level of treatment of this water, if any, that individual residents undertake is not known.

The aquifer underlying Nangus is shallow and unconfined (see Appendix D). Shallow aquifers are at greater risk of pathogen contamination from septic tanks and animal wastes, as well as chemical contamination from agricultural runoff and other sources. Available data on the local aquifer also shows that the water may have higher levels of salinity, reducing its palatability (see Appendix D).

NSW Health recommends that groundwater sources undergo testing to determine its microbiological and chemical quality and its suitability to be used as a drinking water source. enHealth (2011) recommends that groundwater from shallow aquifers should not be used as a drinking water source unless it has been recently tested for microbial and chemical quality (e.g. arsenic, nitrate, fluoride, health-related heavy metals, petroleum hydrocarbons and other organic chemicals).

8.10.3 Multi-criteria Analysis and Risk Assessment

MCA scoring (as per the template in Table 5-1), and a discussion on the risks related to each parameter are given in Table 8-18.

Table 8-18 Option 7 – Multi-Criteria Analysis

No.	Criteria	Weighting	Score	Discussion
1	**Security of Supply** Consider the security of the water supply and the impact/risks of prolonged drought.	20%	0	▪ No improvement in security of supply. ▪ Potential that security of supply for resident's rainwater tanks would decrease over time due to the impact of climate change.
2	**Water Quality - Health** Consider the reliability and risks to water quality with regard to health criteria.	15%	0	▪ Continued use of rainwater tanks and, in particular, groundwater from the shallow aquifer presents a higher risk to health than from a reticulated supply which will meet the requirements of the ADWG.
3	**Water Quality - Aesthetic** Consider the reliability and risks to water quality with regard to asthenic criteria.	10%	0	▪ Improperly maintained rainwater systems can result in aesthetic issues. ▪ Groundwater supplies may have lower palatability due to high salinity levels.
4	**Operational Risk** Consider the consequence of failure with regards to operator safety, community safety, scheme complexity, time needed to reinstate supply and resourcing risk.	15%	10	▪ No operational risk as no water supply system is installed.
5	**Constructability** Consider the ability to construct each option, including safety, availability of materials, availability of suitably qualified contractors, ground conditions, impact on existing services, access etc.	15%	10	▪ No constructability risks as no works are proposed.
6	**Project Definition Risk** Consider risk associated with level of definition and potential for currently unknown issues to impact schedule and budget.	10%	10	▪ No project definition risks as no works are proposed.
7	**Heritage, Environment and Approvals** Consider environmental and heritage impacts and risks and the risk associated with obtaining approvals.	15%	10	▪ No heritage, environment or approvals risks as no works are proposed.
	Total	100%	5.5	

9 Conclusions and Recommendations

Nangus does not currently have a reticulated water supply, and residents provide their own water supply, typically from roof water, bottled water, bore water or water carting. Seven options for provision of potable water services to Nangus were investigated, including:

- Option 1: Pipeline from Gundagai water supply
- Option 2: Pipeline from GWCC water supply – from Oura Road
- Option 3: Pipeline from GWCC water supply – from Tenandra Reservoirs following existing easement
- Option 4: Pipeline from GWCC water supply – from Tenandra Reservoirs following new route
- Option 5: Murrumbidgee River extraction and treatment
- Option 6: Groundwater extraction and treatment
- Option 7: Do nothing

These options were assessed and compared based on capital cost and a multi-criteria analysis. Estimated capital costs are provided in Table 9-1 and a summary of the MCA scoring is provided in Table 9-2.

Pipeline Options 2, 3 and 4 have similar capital costs, within the level of accuracy of a feasibility assessment. Pipeline Option 1 is significantly more expensive, largely due to the additional length of the pipeline. Options 5 and 6, involving surface and groundwater treatment respectively, are significantly more expensive than any of the pipeline options.

Option 2 scored highest in the MCA. This pipeline option scored higher than the other pipelines mostly due to lower construction risks, lower operational risk and the higher level of project definition that is possible at this stage of the project development.

Pipeline options 1, 2 and 4 scored higher than the surface and groundwater treatment options. Option 7 (do nothing) scored lowest in the MCA.

At the current stage of project development, Option 2 is the preferred option.

It is noted that significant capital outlay will be required to service Nangus. This options analysis is based on a supply for 100 ET. The current number of potential water supply connections is 33 (including occupied dwellings and non-residential developments), with approximately 36 vacant lots in the village. The financial viability of servicing Nangus has not yet been assessed. When financial analysis is carried out in later stages of project development, consideration should be given to the risks related to population projections and sensitivity to different growth rates in the short, medium and long term, as this may impact the financial viability of the project.

Table 9-1 Capital Cost Summary

Option	Estimated Capital Cost (ex. GST)
Option 1: Pipeline from Gundagai water supply	$4,590,000
Option 2: Pipeline from GWCC water supply – from Oura Road	$3,260,000
Option 3: Pipeline from GWCC water supply – from Tenandra Reservoirs following existing easement	$3,070,000
Option 4: Pipeline from GWCC water supply – from Tenandra Reservoirs following new route	$3,040,000
Option 5: Murrumbidgee River extraction and treatment	$9,120,000
Option 6: Groundwater extraction and treatment	$8,760,000
Option 7: Do nothing	$0

Table 9-2 Multi-criteria Analysis Summary

		Option						
Criteria	Weighting	1	2	3	4	5	6	7
Security of Supply	20%	10	10	10	10	10	6	0
Water Quality - Health	15%	8	9	9	9	9	9	0
Water Quality - Aesthetic	10%	10	10	10	10	9	9	0
Operational Risk	15%	7	9	7	7	6	3	10
Constructability	15%	7	9	5	6	6	5	10
Project Definition Risk	10%	7	9	6	6	5	3	10
Heritage, Environment and Approvals	15%	7	8	5	8	6	7	10
Total MCA Score	100%	8.1	9.2	7.5	8.1	7.5	6.0	5.5

10 References

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Cardno (2019) *Strategic Asset Plan: Oura Treatment Plant and Pump Station*

enHealth (2011) *Guidance on use of rainwater tanks*

Mitchell M (2009) *Mid Murrumbidgee Alluvium. Groundwater Management Area 013: Gundagai to Narrandera. Groundwater Resources Status Report – 2007*

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NSW Health (no date) *Groundwater Treatment Fact Sheet*

NSW Health (accessed 6 November 2019) *Rainwater Tanks,* https://www.health.nsw.gov.au/environment/water/Pages/rainwater.aspx

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WSAA (2011) *WSA03-2011: Water Supply Code of Australia*, Third Edition, Version 3.1

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APPENDIX A

PIPELINE OPTION ROUTE MAPS

OURA ROAD
0km
1km
2km
3km
4km
5km
Goldenfields Water
Pipeline Options Page 1
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
10m Contours (LPI)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
m
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Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GIS-020-PipelineOptionsDDP.mxd 02
Aerial imagery supplied by DFSI (2017)

Goldenfields Water
Pipeline Options Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
10m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
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Coordinate System: GDA 1994 MGA Zone 55
Aerial Imagery supplied by DFSI (2017)
BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km

Goldenfields Water
Pipeline Options Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Reticulation
10m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
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Cardno
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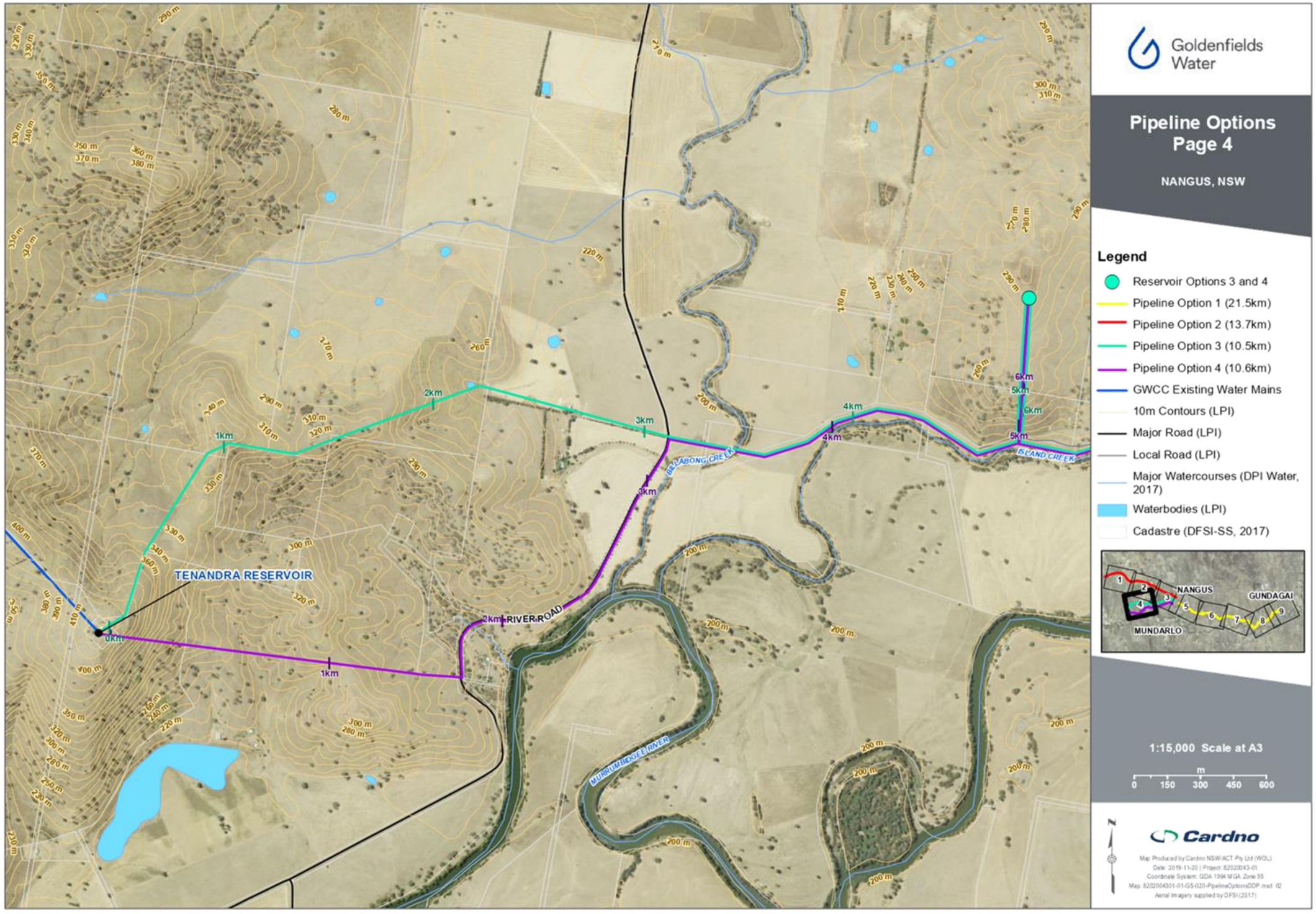
Date: 2019-11-20 (Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-020-PipelineOptionsDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)
NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
NANGUS CREEK
LEFTARM CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
10km
11km
12km
13km
9km
8km
7km
21km


Goldenfields Water
Pipeline Options Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
10m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
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Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-20 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Aerial Imagery supplied by DFSI (2017)
TENANDRA RESERVOIR
RIVER ROAD
BELVABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
0km
1km
2km
3km
4km
5km
6km

Goldenfields Water
Pipeline Options
Page 5
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Reticulation
10m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
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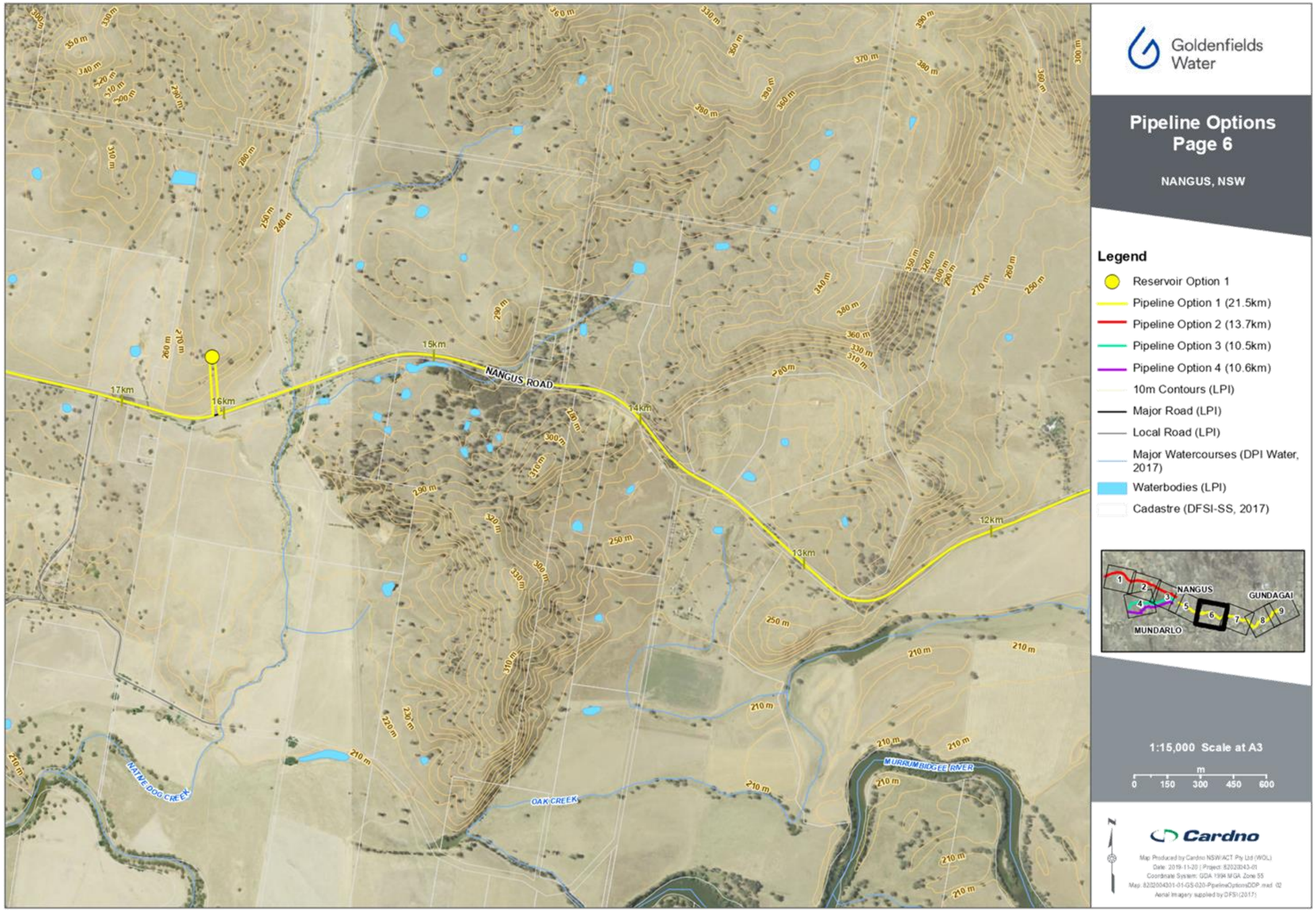
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-20 / Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-020-PipelineOptionsDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)
KIMO STREET
NANGUS
NANGUS ROAD
NANGUS CREEK
MURRUMBIDGEE RIVER
13km
10km
10km
21km
20km
19km
18km


Goldenfields Water
Pipeline Options
Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
10m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
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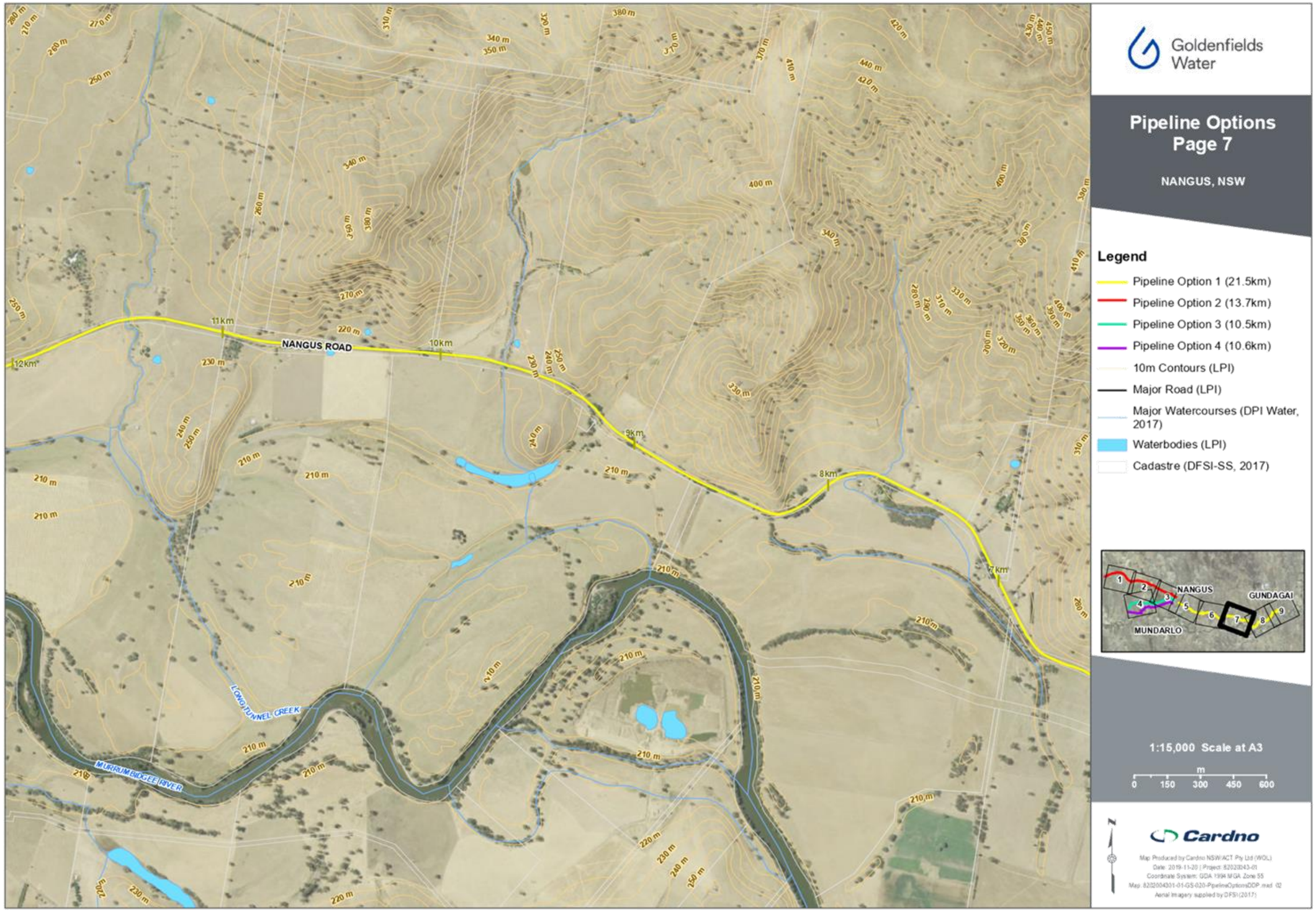
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-20 / Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Aerial Imagery supplied by DFSI (2017)
NANGUS ROAD
MURRUMBIDGEE RIVER
NATIVE DOG CREEK
OAK CREEK
12km
13km
14km
15km
16km
17km


NANGUS ROAD
11km
10km
9km
8km
7km
12km
LOWDI TUNNEL CREEK
MURRUMBIDGEE RIVER
Goldenfields Water
Pipeline Options
Page 7
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
10m Contours (LPI)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
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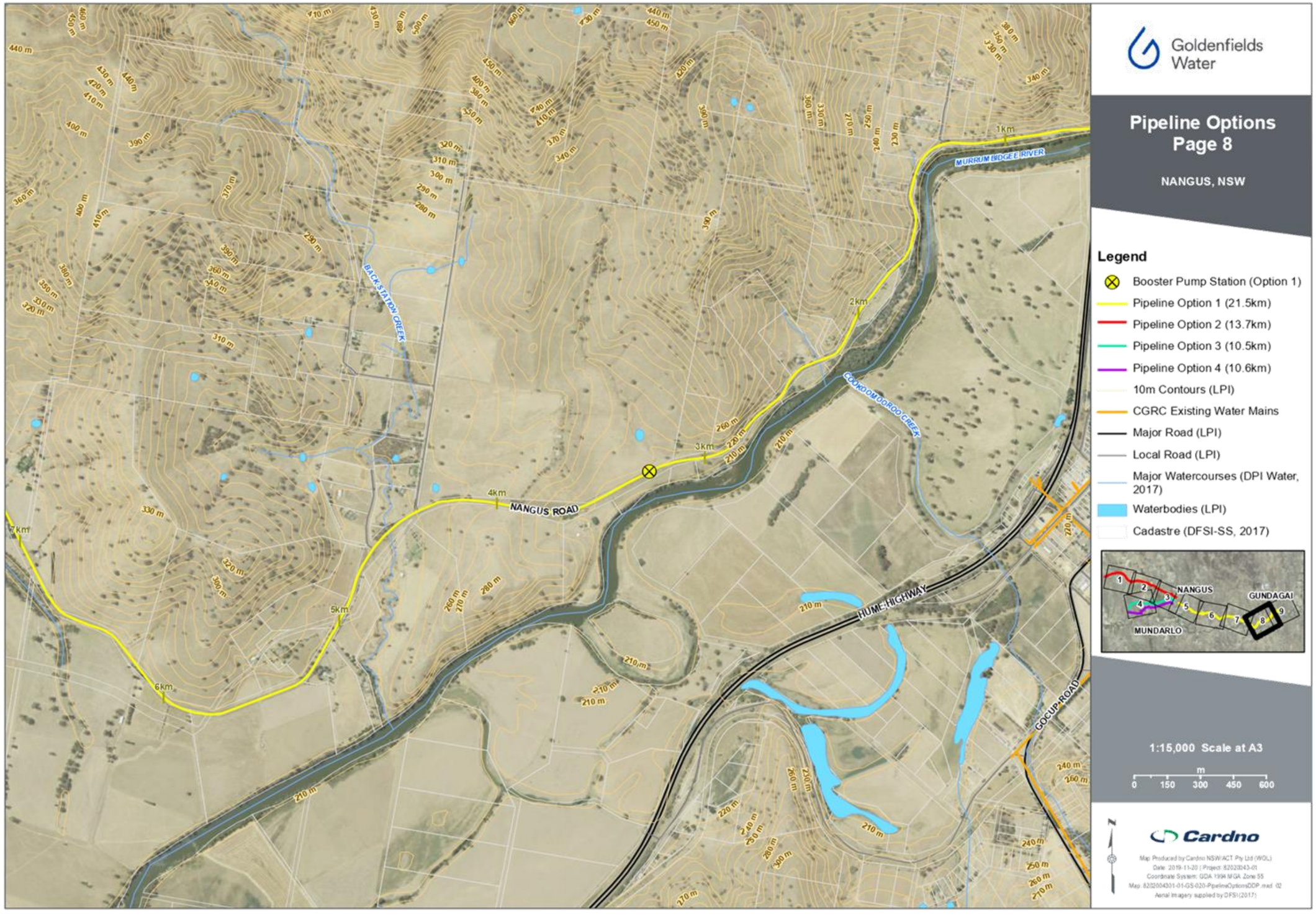
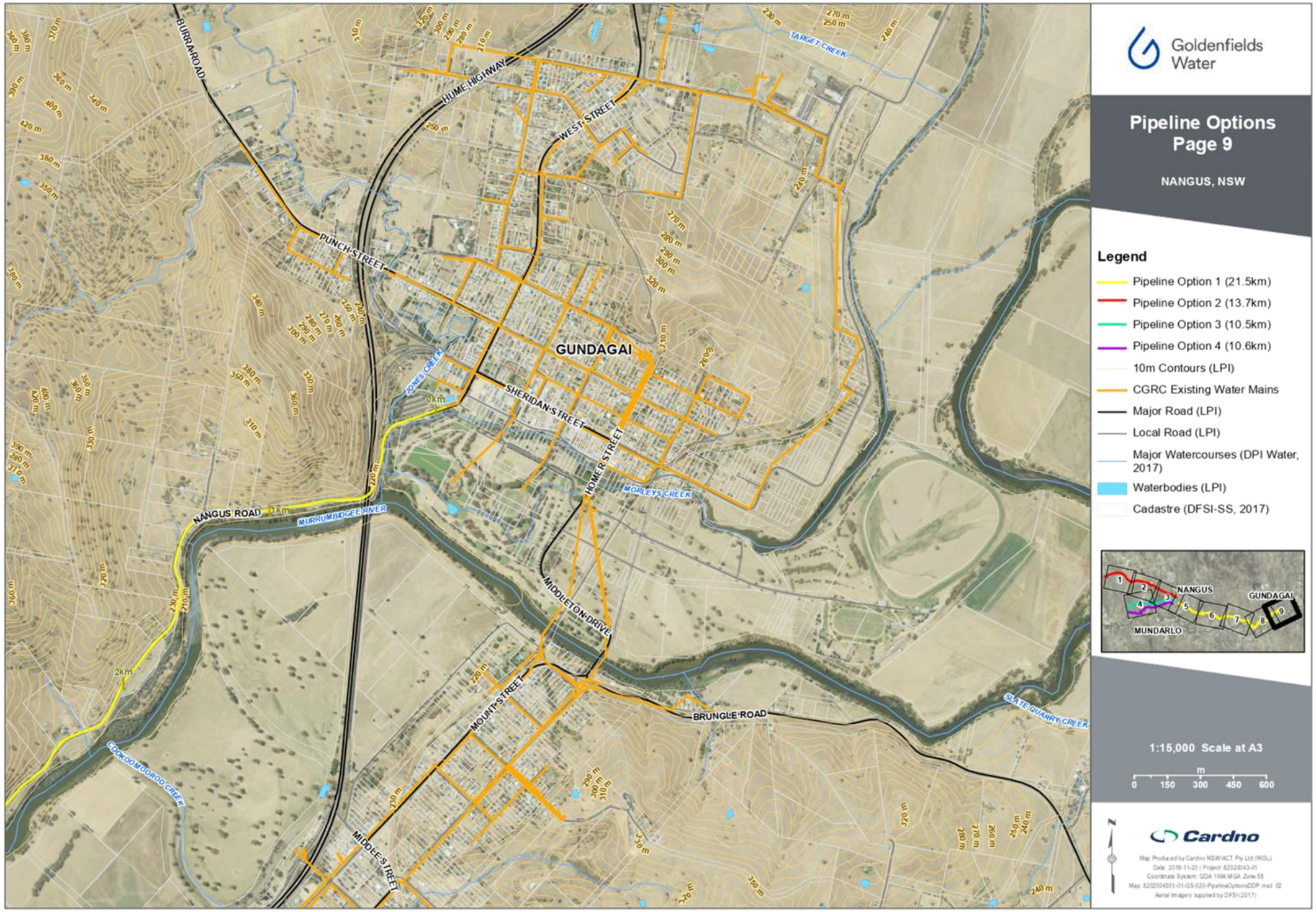
Aerial imagery supplied by DFSI (2017)


Goldenfields Water
Pipeline Options Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
10m Contours (LPI)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
MURRUM BIDGEE RIVER
BACK STATION CREEK
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km


BURRA ROAD
HUME HIGHWAY
WEST STREET
TARGET CREEK
PUNCH STREET
GUNDAGAI
JONES CREEK
SHERIDAN STREET
HOMER STREET
MORLEYS CREEK
NANGUS ROAD
MURRUMBIDGEE RIVER
MIDDLETON DRIVE
MOUNT STREET
BRUNGLE ROAD
SLATE QUARRY CREEK
COOKOOM OORDO CREEK
MIDDLE STREET
Goldenfields Water
Pipeline Options
Page 9
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
10m Contours (LPI)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Cadastre (DFSI-SS, 2017)
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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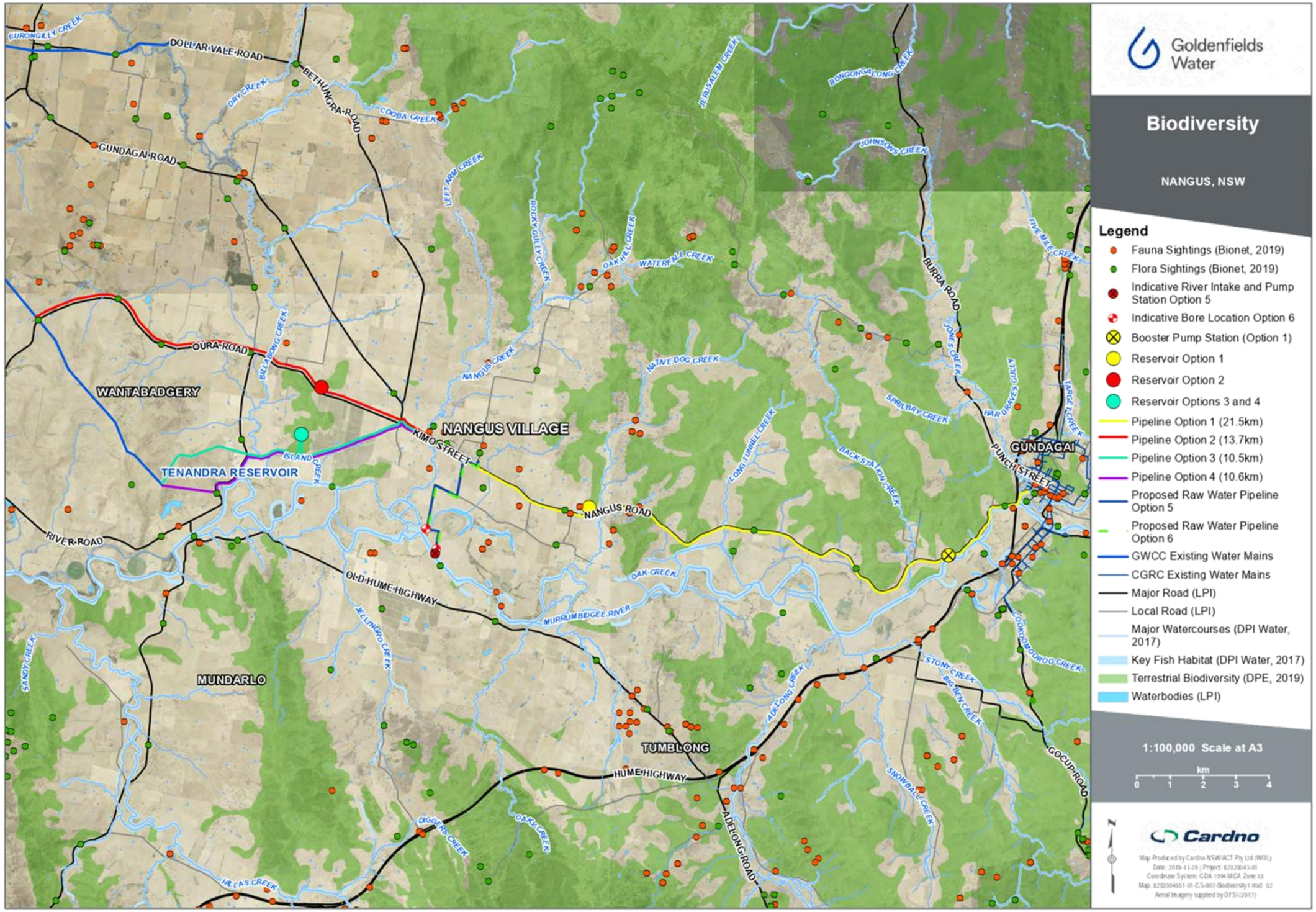
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-020-PipelineOptionsDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)

APPENDIX B

ENVIRONMENTAL CONSTRAINTS


Goldenfields Water
Biodiversity
NANGUS, NSW
Legend
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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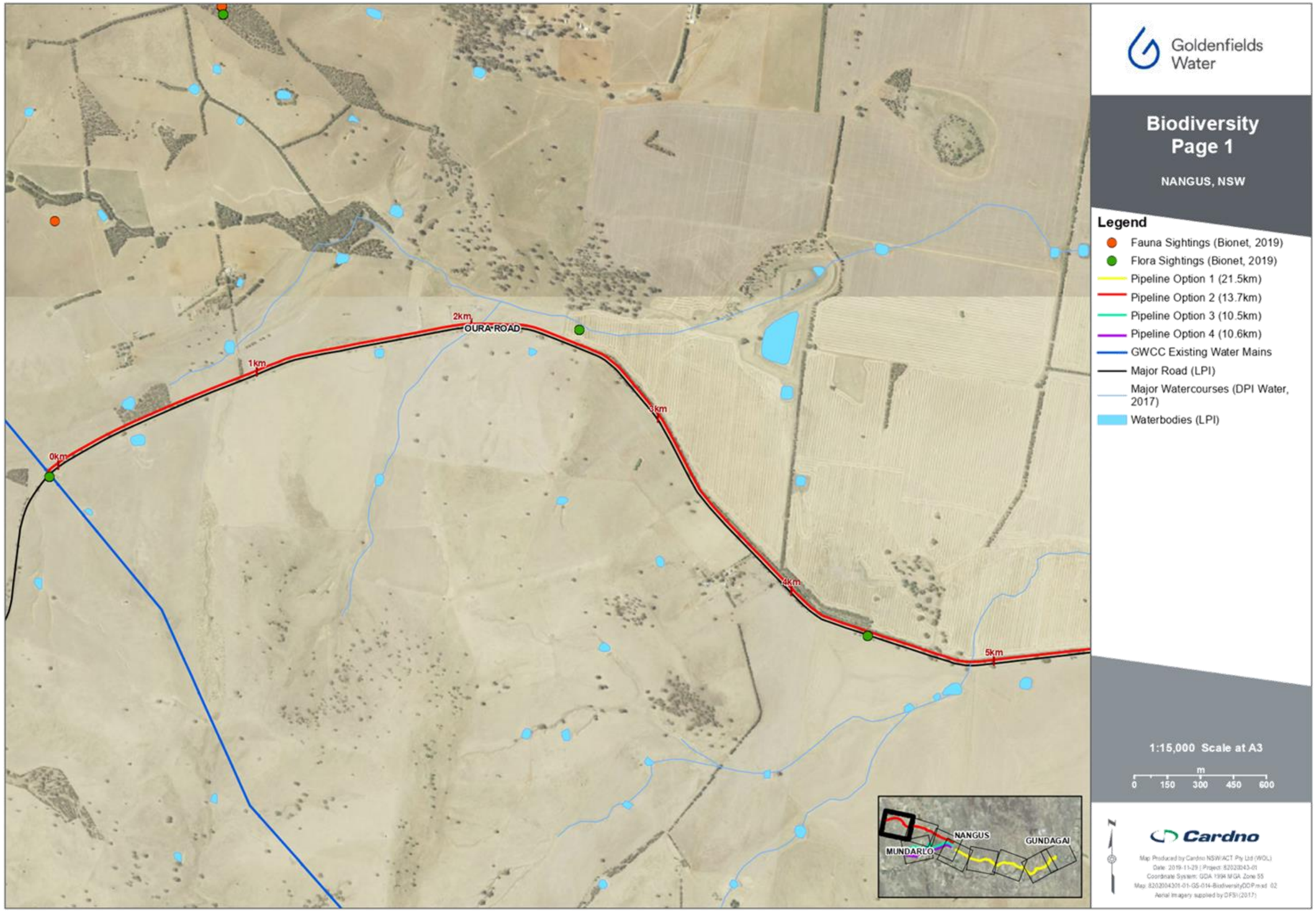
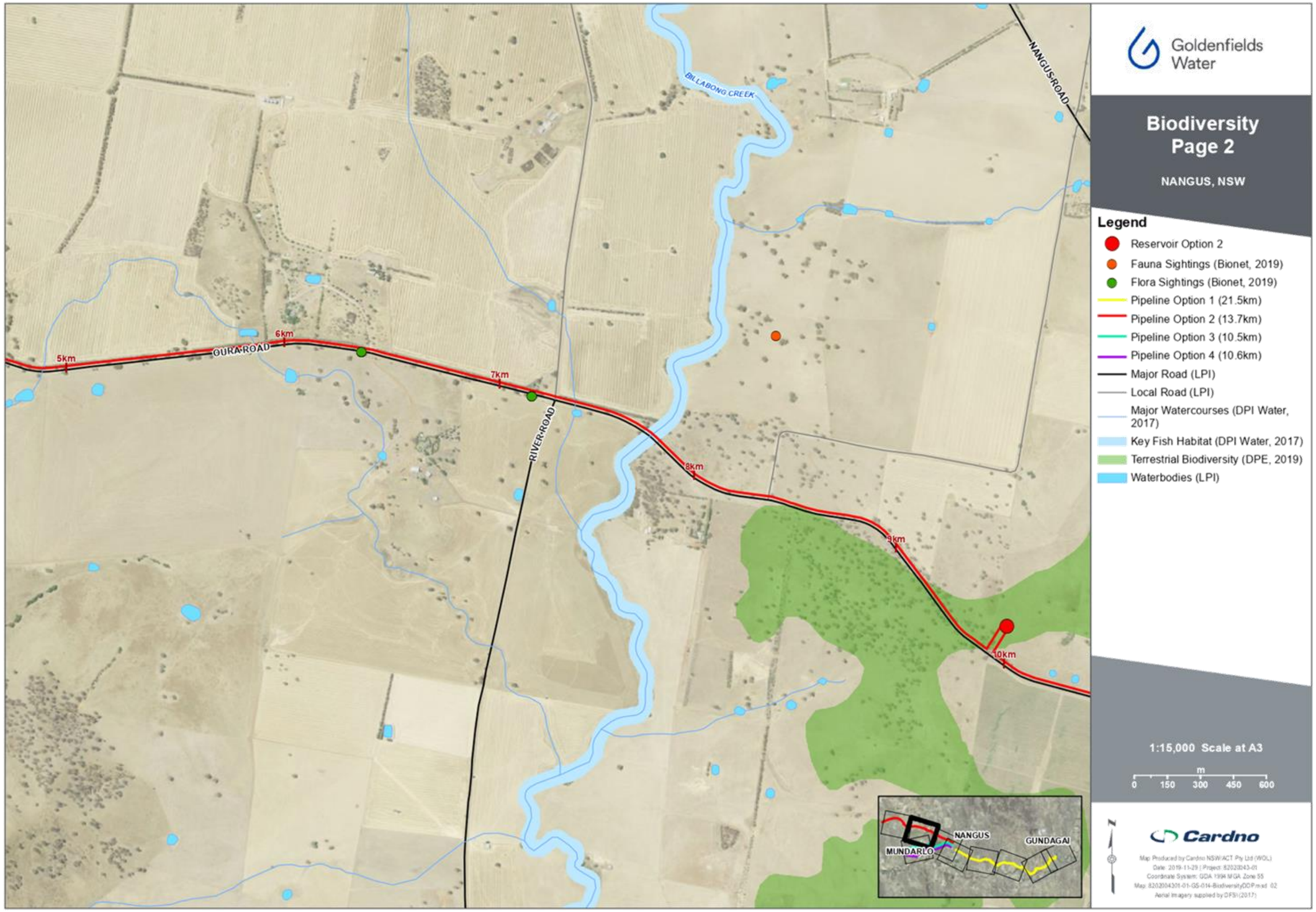
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GIS-007-Biodiversity1.mxd 02
Aerial Imagery supplied by DFSI (2017)
WANTABADGERY
NANGUS VILLAGE
TENANDRA RESERVOIR
MUNDARLO
TUMBLONG
GUNDAGAI
DOLLAR VALE ROAD
GUNDAGAI ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
NANGUS ROAD
RIVER ROAD
OLD HUME HIGHWAY
HUME HIGHWAY
BURRA ROAD
ADELONG ROAD
GOCUP ROAD
PUNCH STREET
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
OAK MILL CREEK
WATERFALL CREEK
FIVE MILE CREEK
BILLABONG CREEK
NANGUS CREEK
NATIVE DOG CREEK
JONES CREEK
SPRUBY CREEK
HAR GRAVES GULLY
LARGE CREEK
ISLAND CREEK
LONG TUNNEL CREEK
BACK STATION CREEK
SANDY CREEK
JELLINGRO CREEK
MURRUMBIDGEE RIVER
OAK CREEK
DIGGERS CREEK
OAKY CREEK
HILLAS CREEK
STONY CREEK
BIG BEN CREEK
SNOWBALL CREEK
COOKAMIDGERA CREEK


Goldenfields Water
Biodiversity Page 1
NANGUS, NSW
Legend
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
0km
1km
2km
3km
4km
5km
OURA ROAD
1:15,000 Scale at A3
m
0 150 300 450 600
MUNDARLO
NANGUS
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-014-BiodiversityDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)


BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km
Goldenfields Water
Biodiversity Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
MUNDARLO
NANGUS
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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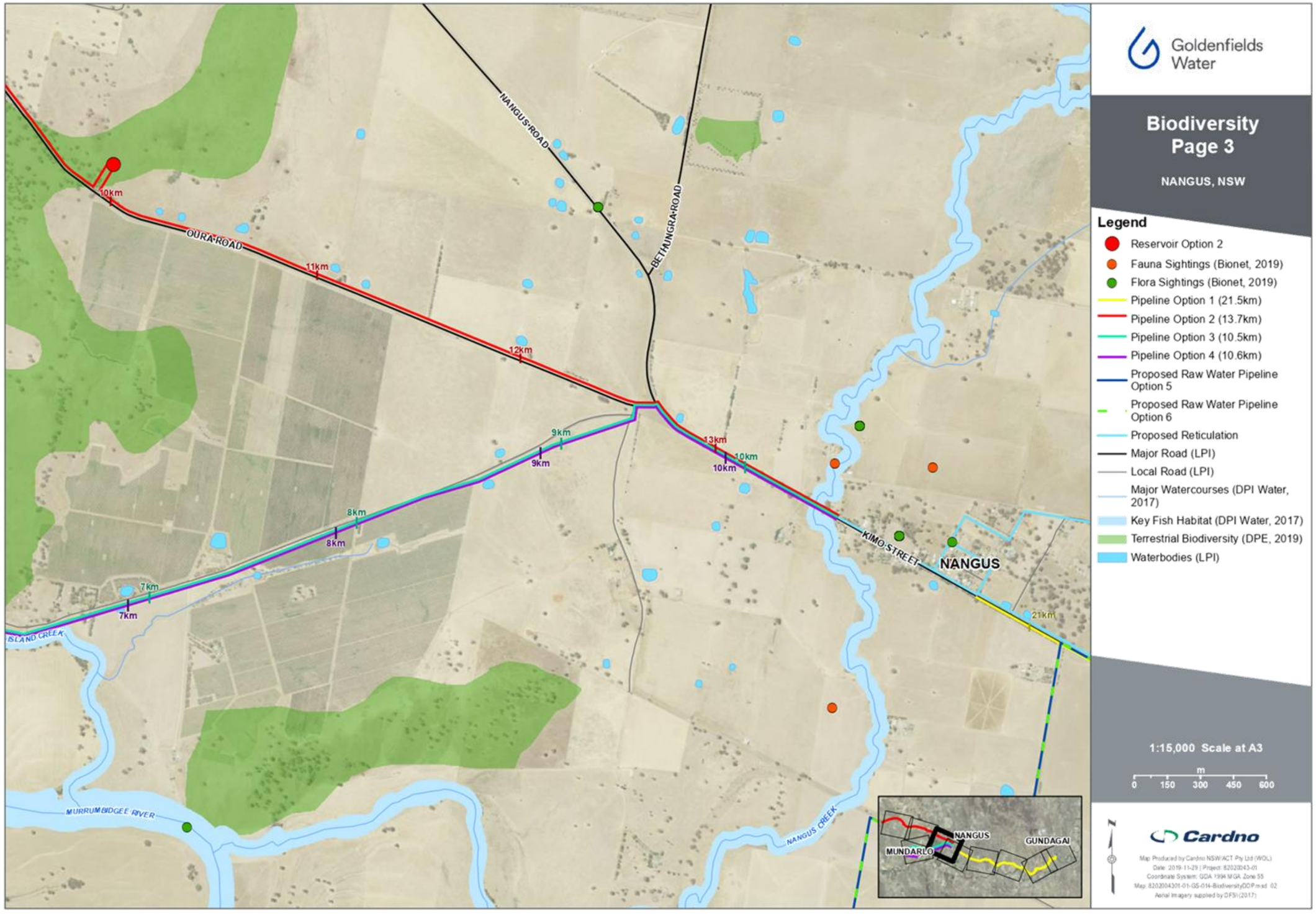
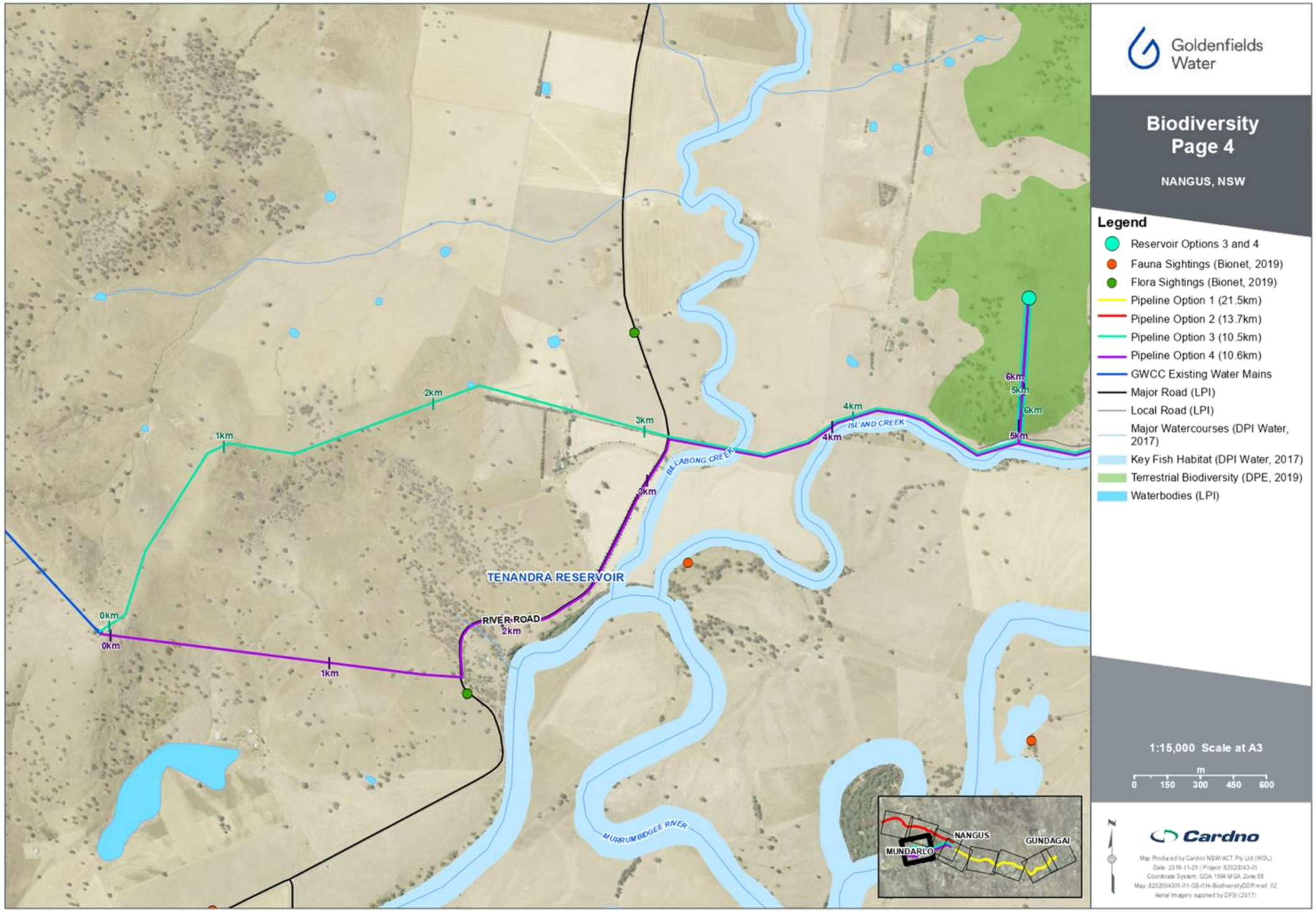
Aerial Imagery supplied by DFSI (2017)


NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
10km
11km
12km
13km
10km
10km
9km
9km
8km
8km
7km
7km
KIMO STREET
NANGUS
21km
ISLAND CREEK
MURRUMBIDGEE RIVER
NANGUS CREEK
Goldenfields Water
Biodiversity Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-014-BiodiversityDDP.mxd 02
Aerial imagery supplied by DFSI (2017)


Goldenfields Water
Biodiversity Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
TENANDRA RESERVOIR
RIVER ROAD
BILLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
0km
1km
2km
3km
4km
5km
6km
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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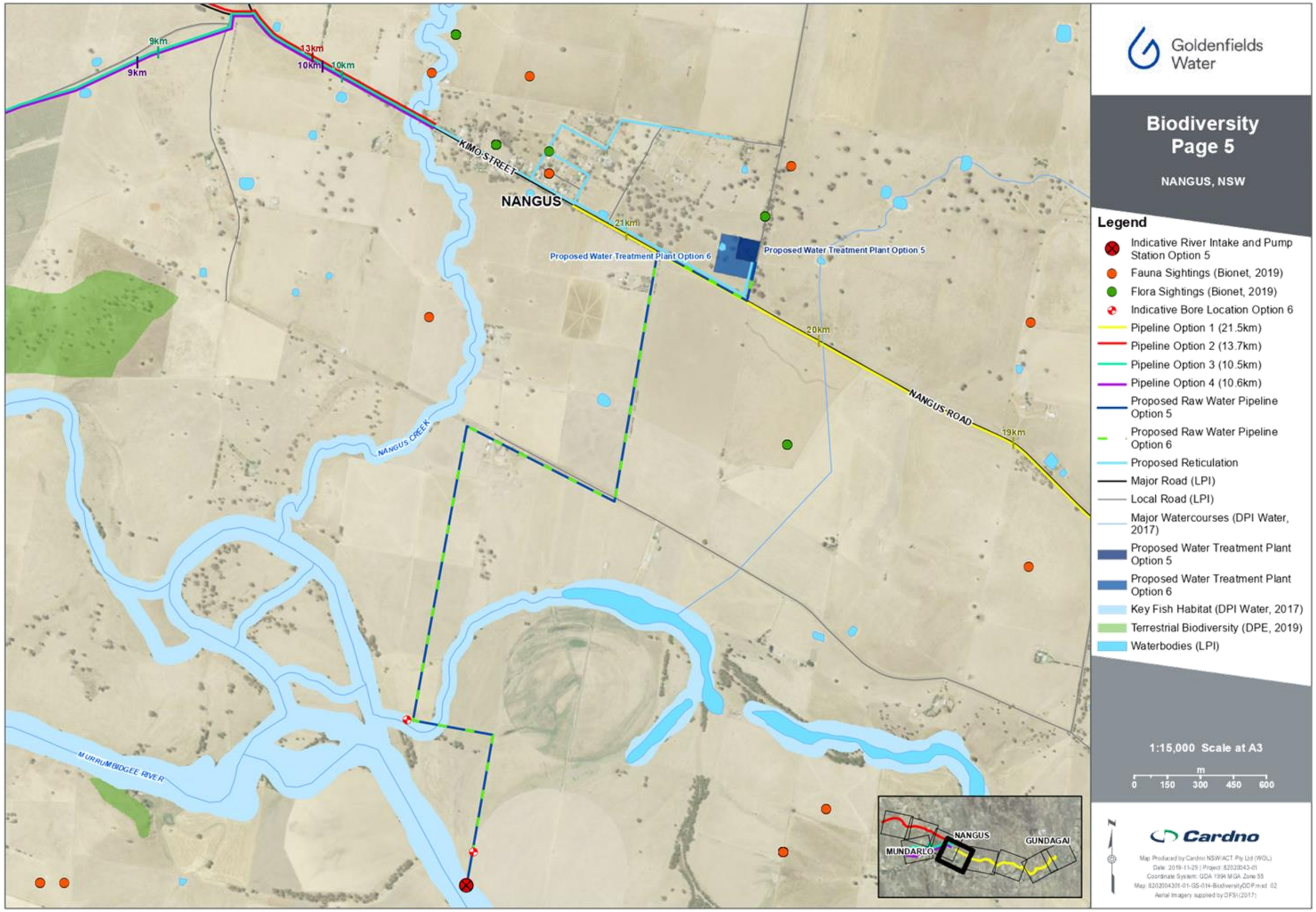
9km
9km
13km
10km
10km
KIMO STREET
NANGUS
21km
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
20km
NANGUS ROAD
19km
NANGUS CREEK
MURRUMBIDGEE RIVER
Goldenfields Water
Biodiversity Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Indicative Bore Location Option 6
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Proposed Water Treatment Plant Option 5
Proposed Water Treatment Plant Option 6
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
MUNDARLO
NANGUS
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-014-BiodiversityDOP.mxd 02
Aerial Imagery supplied by DFSI (2017)

Goldenfields Water
Biodiversity Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
18km
17km
16km
15km
14km
13km
NANGUS ROAD
NATIVE DOG CREEK
OAK CREEK
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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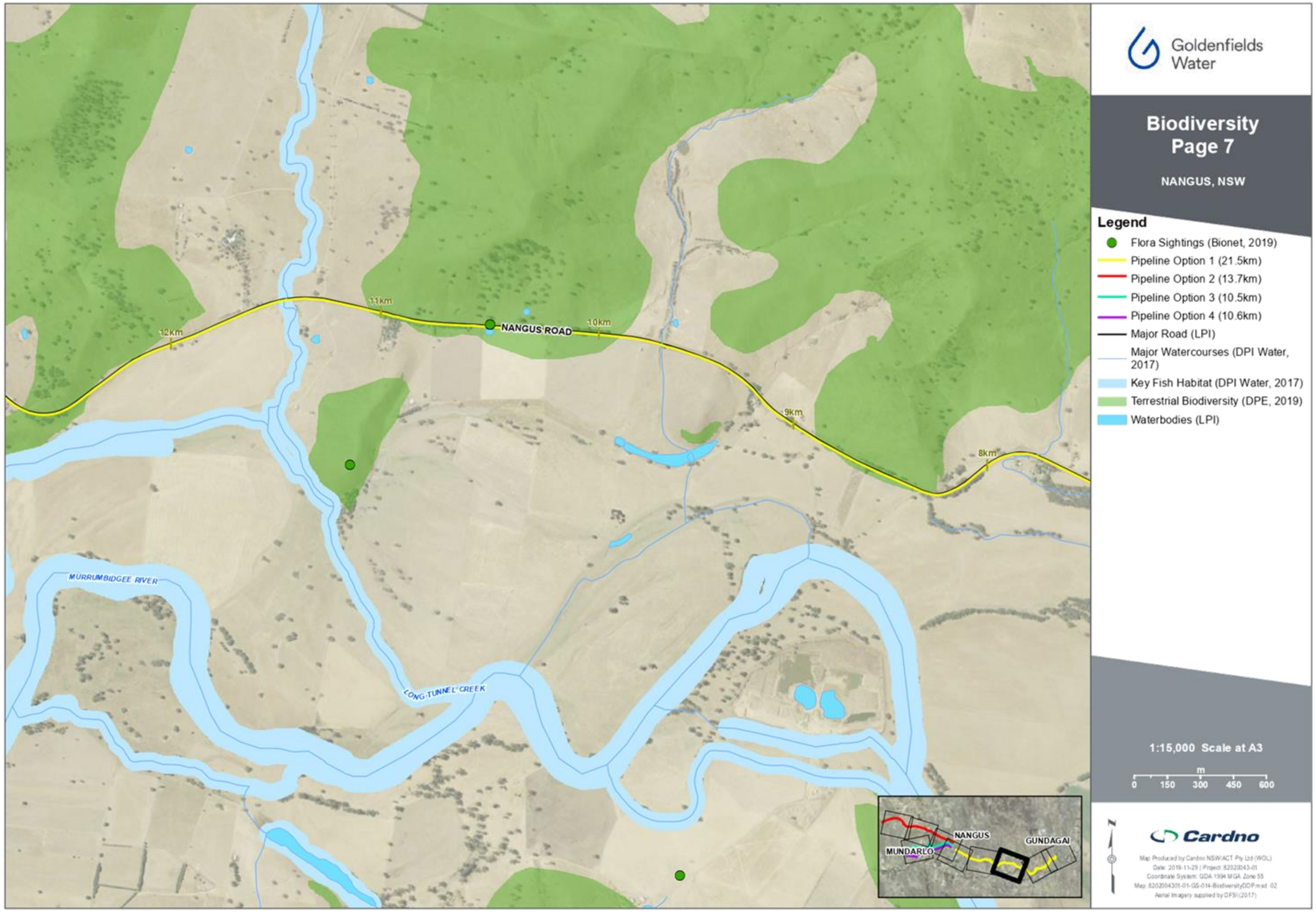
Coordinate System: GDA 1994 MGA Zone 55
Map: 82023043-01-GS-014-BiodiversityDOP.mxd 02
Aerial Imagery supplied by DFSI (2017)


NANGUS ROAD
12km
11km
10km
9km
8km
MURRUMBIDGEE RIVER
LONG TUNNEL CREEK
MUNDARLO
NANGUS
GUNDAGAI
Goldenfields Water
Biodiversity Page 7
NANGUS, NSW
Legend
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
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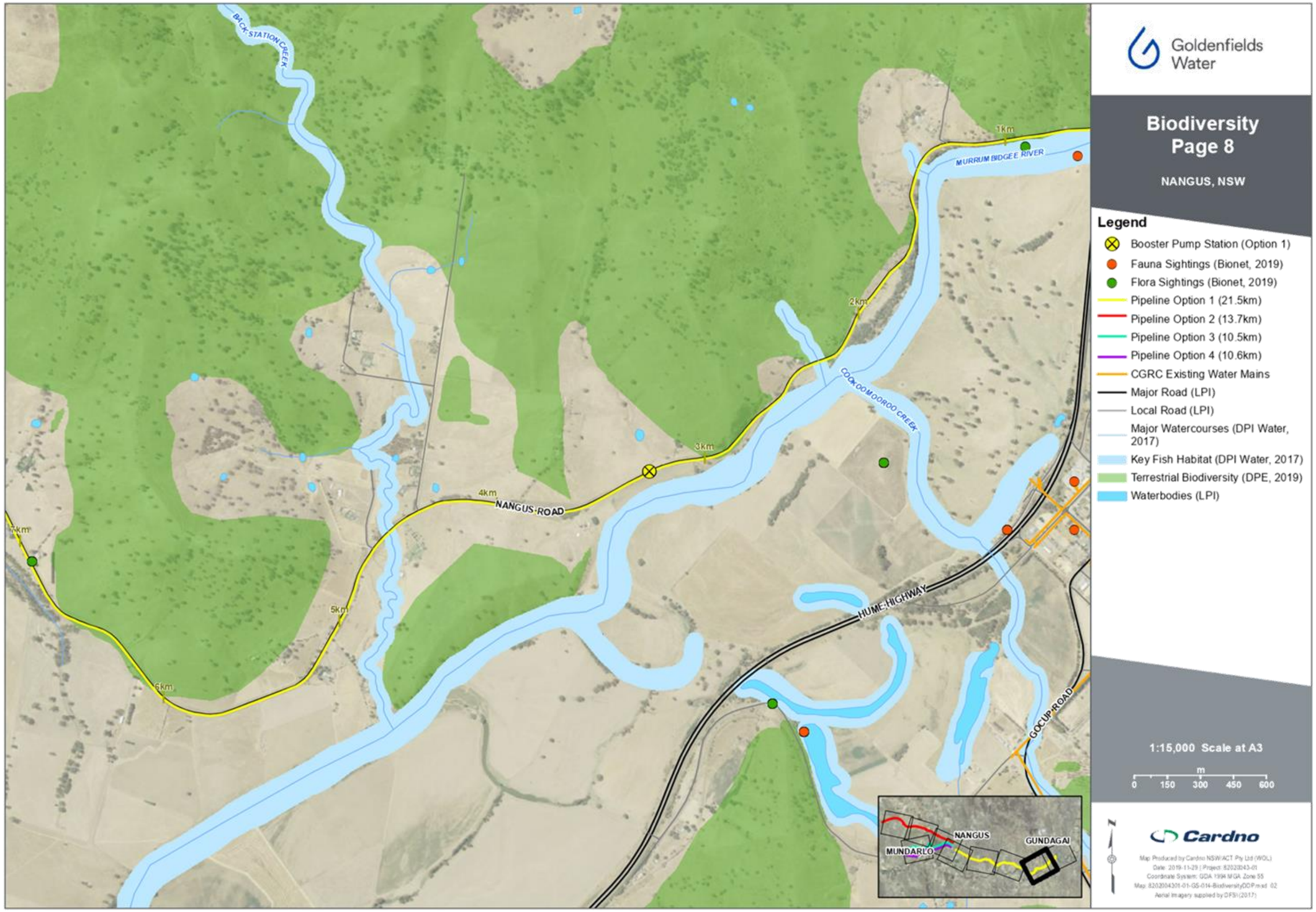
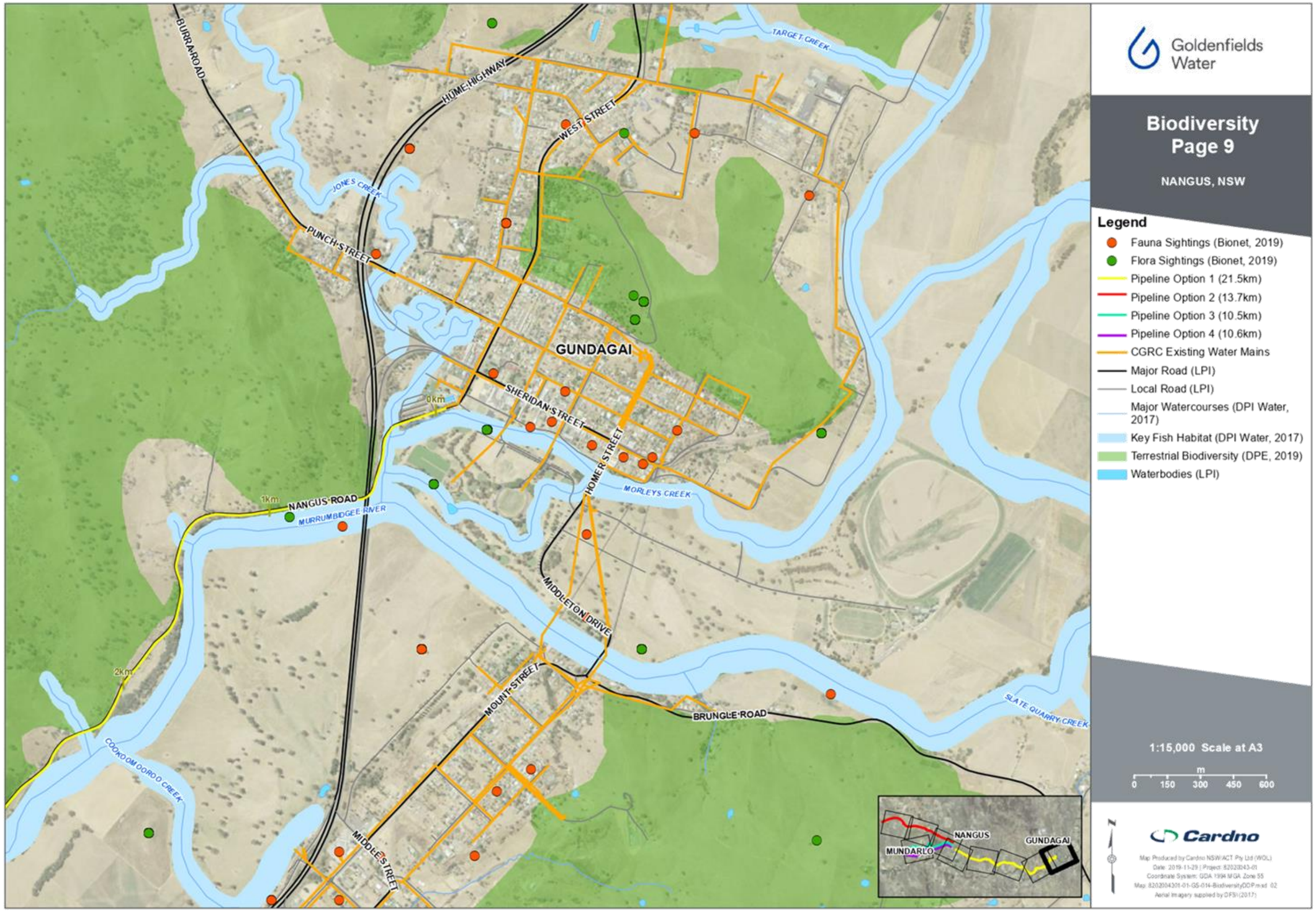
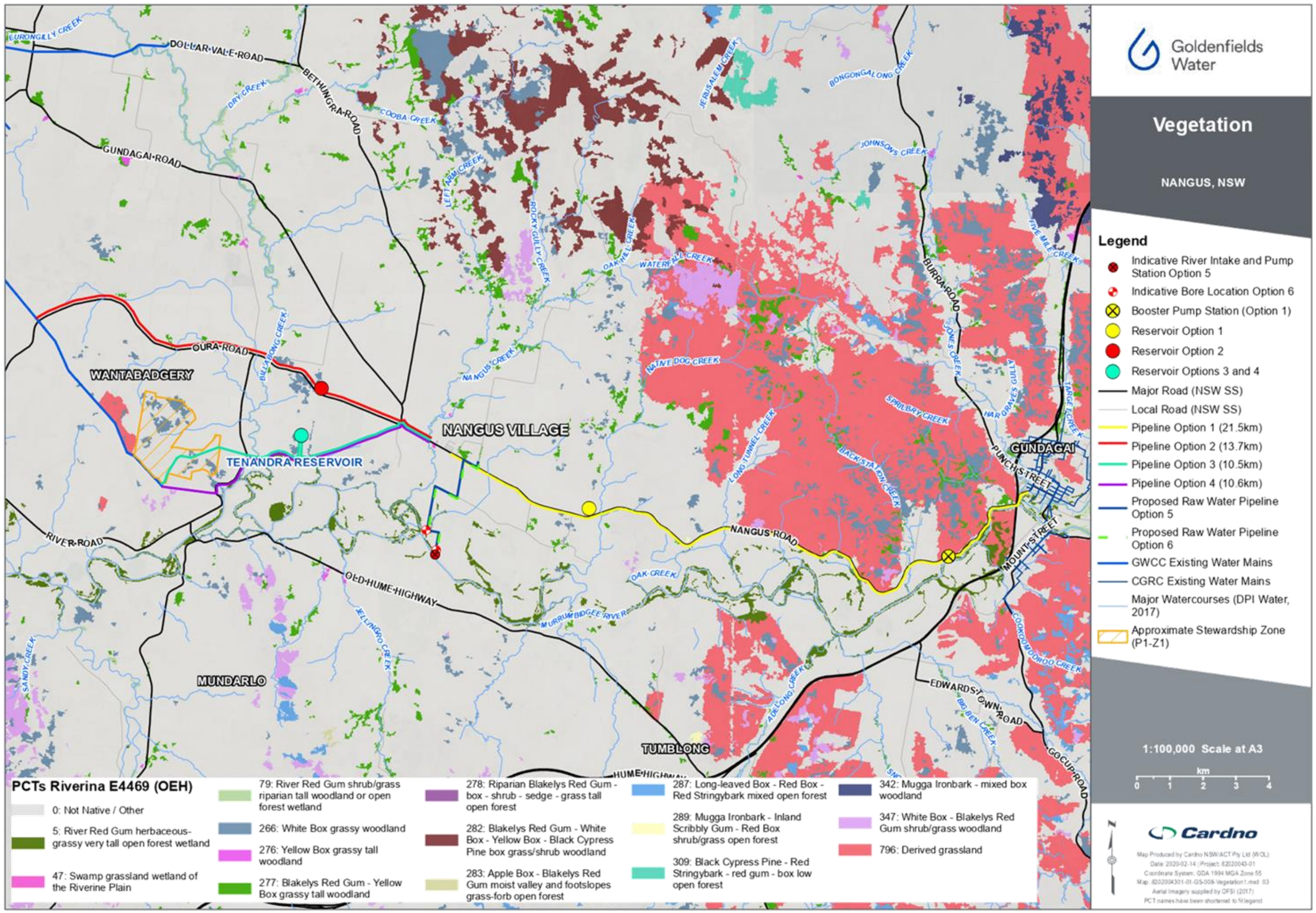
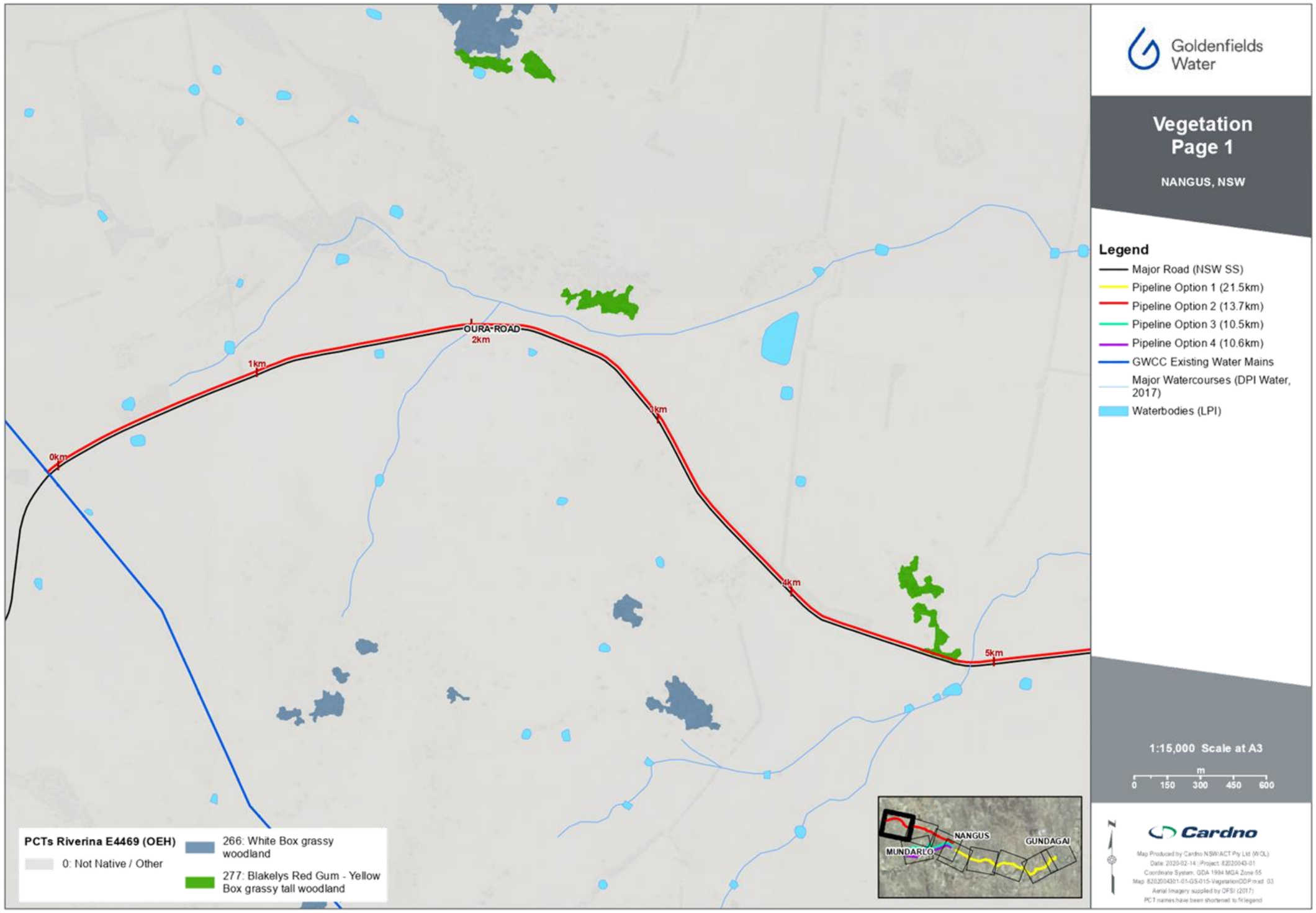
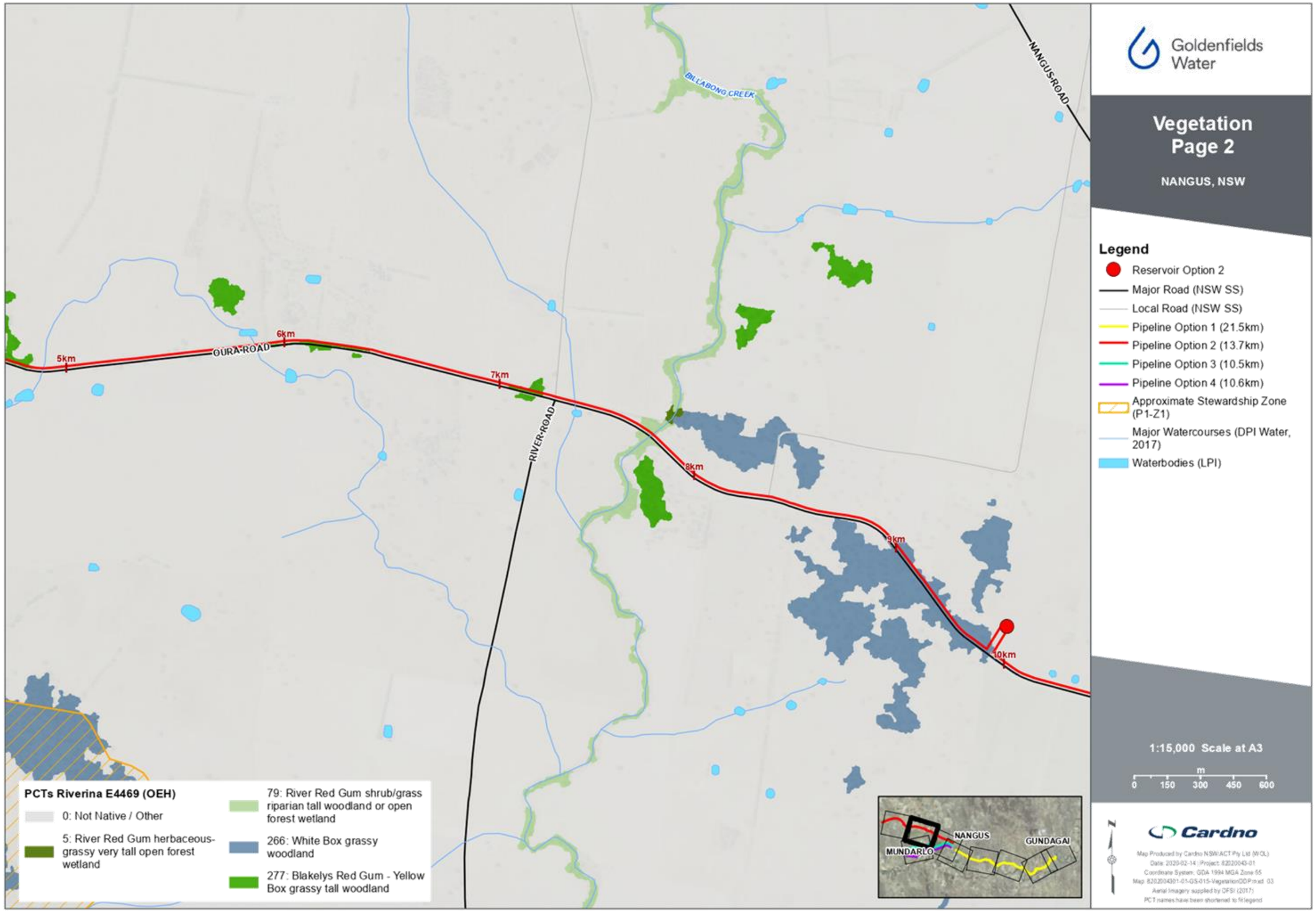
Map: 82028043-01-GS-014-BiodiversityDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)

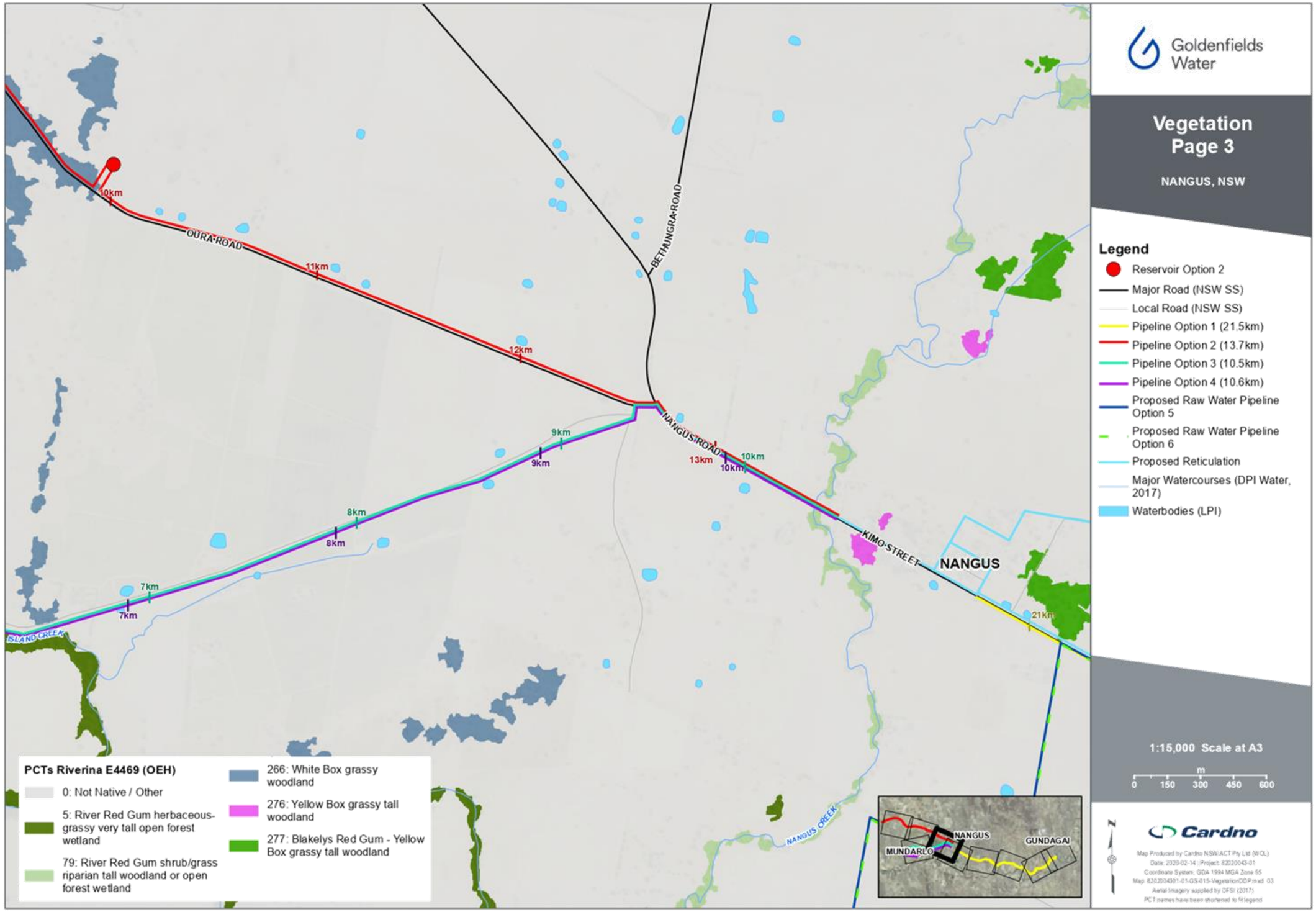

BACK STATION CREEK
MURRUM BIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
Goldenfields Water
Biodiversity Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-014-BiodiversityDDP.mxd 02
Aerial imagery supplied by DFSI (2017)

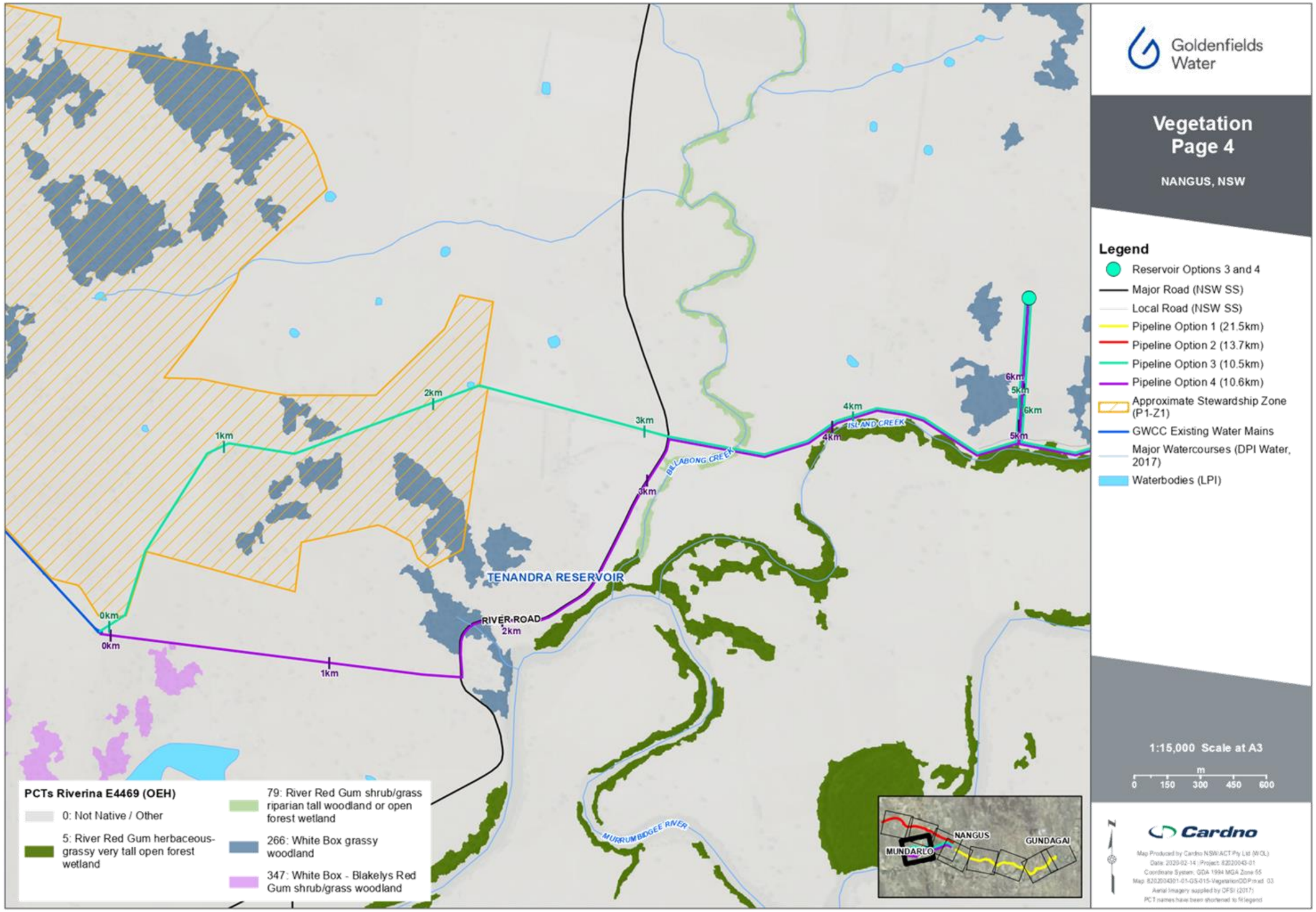

BURRA ROAD
HUME HIGHWAY
TARGET CREEK
WEST STREET
JONES CREEK
PUNCH STREET
GUNDAGAI
SHERIDAN STREET
0km
HOMER STREET
MORLEYS CREEK
1km
NANGUS ROAD
MURRUMBIDGEE RIVER
MIDDLETON DRIVE
2km
MOUNT STREET
BRUNGLE ROAD
SLATE QUARRY CREEK
COOKOOM OORO O CREEK
MIDDLE STREET
Goldenfields Water
Biodiversity Page 9
NANGUS, NSW
Legend
Fauna Sightings (Bionet, 2019)
Flora Sightings (Bionet, 2019)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Key Fish Habitat (DPI Water, 2017)
Terrestrial Biodiversity (DPE, 2019)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-014-BiodiversityDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)

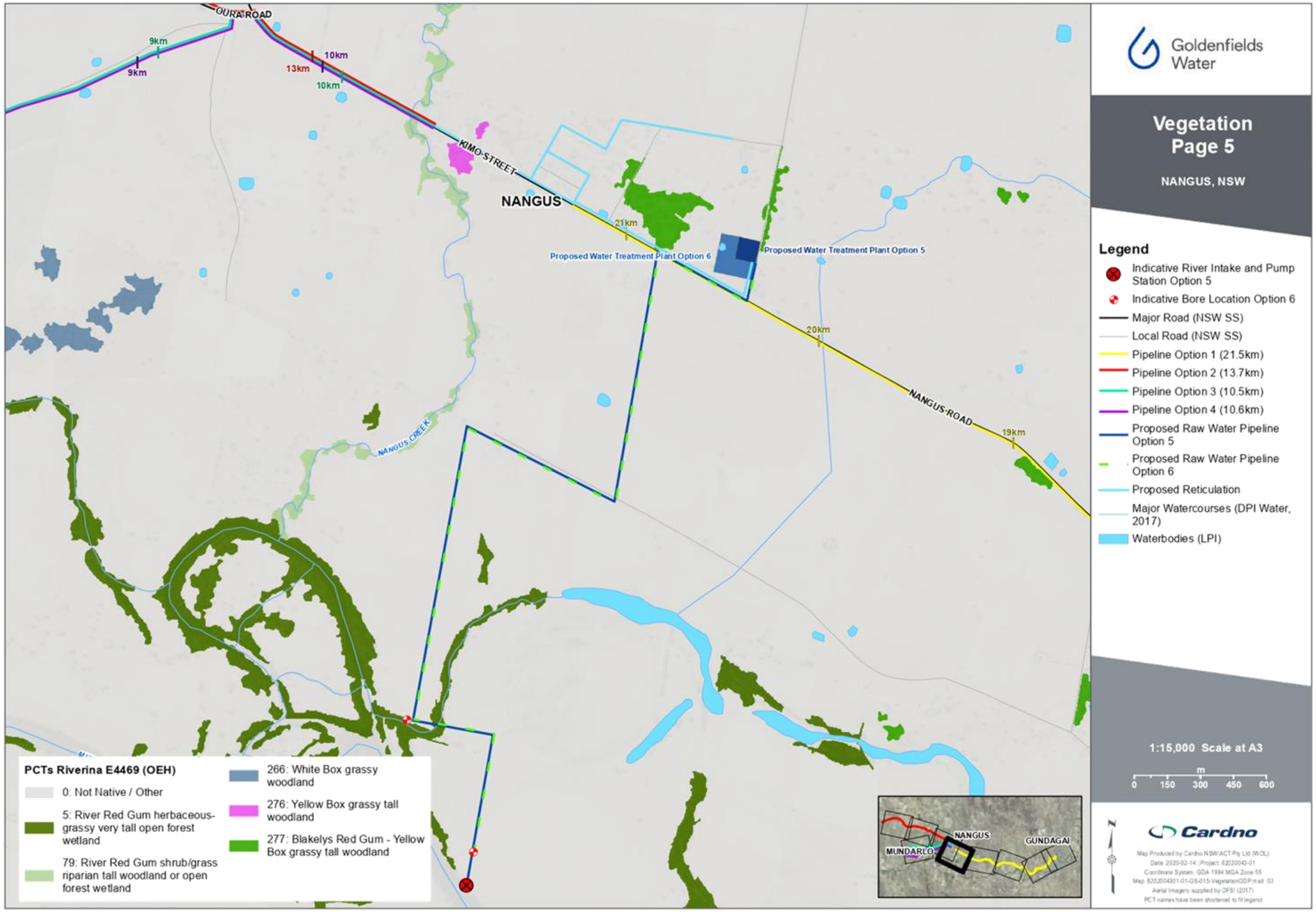

Goldenfields Water
Vegetation
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Watercourses (DPI Water, 2017)
Approximate Stewardship Zone (P1-Z1)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
WANTABADGERY
NANGUS VILLAGE
TENANDRA RESERVOIR
MUNDARLO
TUMBLONG
GUNDAGAI
DOLLAR VALE ROAD
BETHUNGRA ROAD
GUNDAGAI ROAD
OURA ROAD
RIVER ROAD
OLD HUME HIGHWAY
NANGUS ROAD
BURRA ROAD
PUNCH STREET
MOUNT STREET
EDWARDSTOWN ROAD
GOCUP ROAD
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
47: Swamp grassland wetland of the Riverine Plain
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
276: Yellow Box grassy tall woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
278: Riparian Blakelys Red Gum - box - shrub - sedge - grass tall open forest
282: Blakelys Red Gum - White Box - Yellow Box - Black Cypress Pine box grass/shrub woodland
283: Apple Box - Blakelys Red Gum moist valley and footslopes grass-forb open forest
287: Long-leaved Box - Red Box - Red Stringybark mixed open forest
289: Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest
309: Black Cypress Pine - Red Stringybark - red gum - box low open forest
342: Mugga Ironbark - mixed box woodland
347: White Box - Blakelys Red Gum shrub/grass woodland
796: Derived grassland

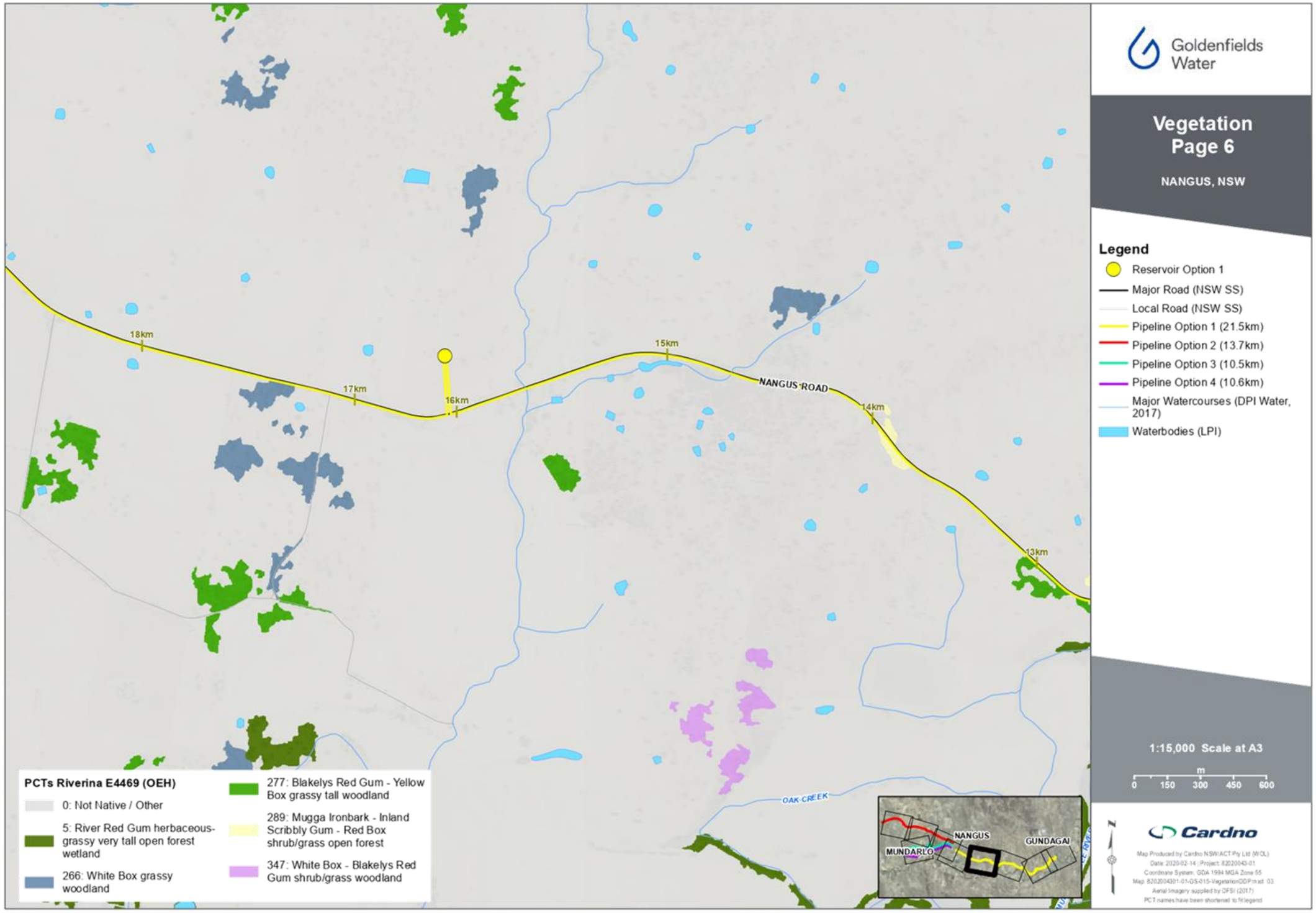

Goldenfields Water
Vegetation Page 1
NANGUS, NSW
Legend
Major Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
OURA ROAD
0km
1km
2km
3km
4km
5km
PCTs Riverina E4469 (OEH)
0: Not Native / Other
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno

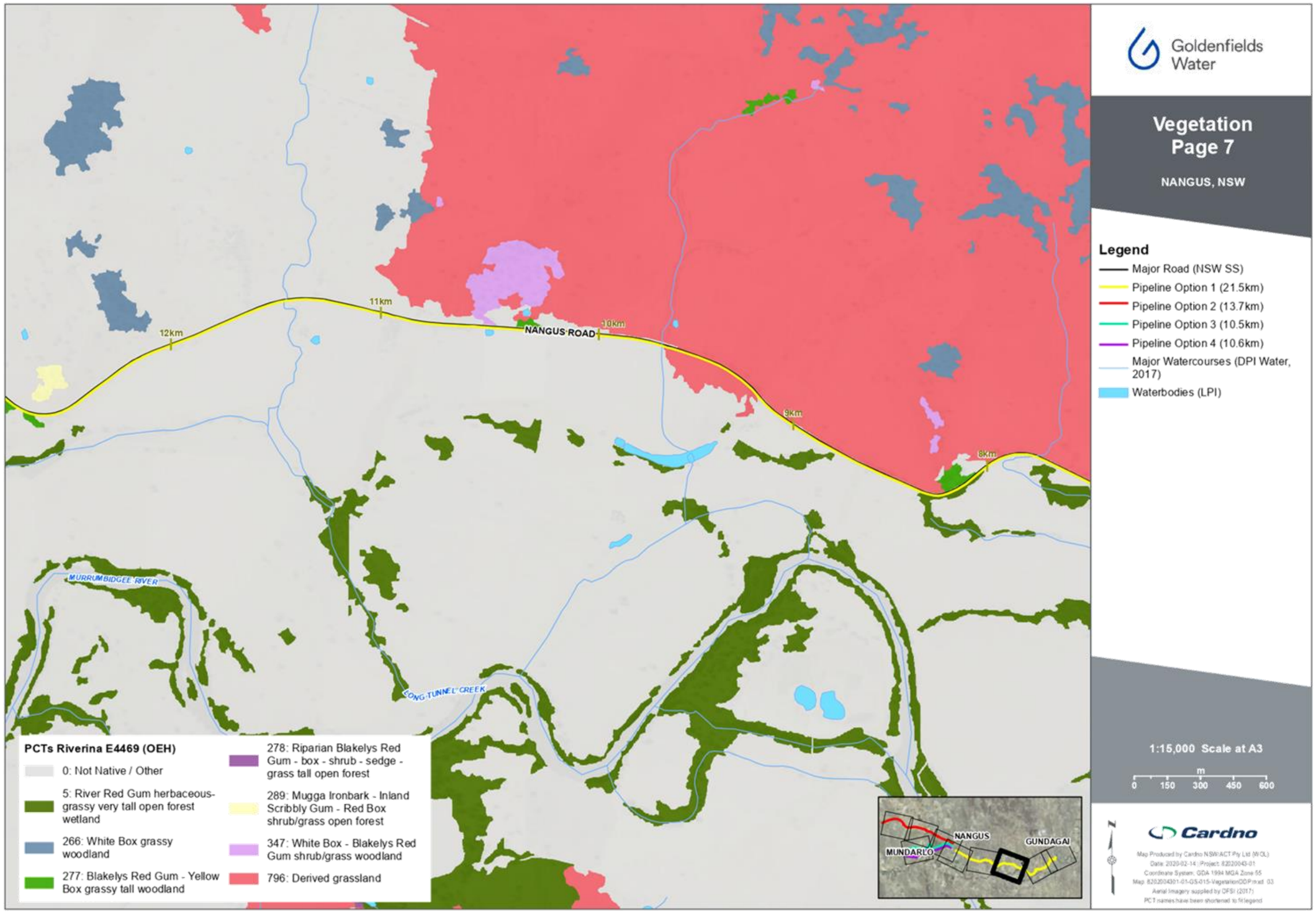

Goldenfields Water
Vegetation Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Approximate Stewardship Zone (P1-Z1)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-14 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-015-VegetationODP.mxd 03
Aerial Imagery supplied by DFSI (2017)
PCT names have been shortened to fit legend


Goldenfields Water
Vegetation Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
OURA ROAD
BETHUNGRA ROAD
NANGUS ROAD
KIMO STREET
NANGUS
NANGUS CREEK
ISLAND CREEK
10km
11km
12km
13km
9km
8km
7km
21km
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
276: Yellow Box grassy tall woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
NANGUS
MUNDARLO
GUNDAGAI
Cardno


Goldenfields Water
Vegetation Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Approximate Stewardship Zone (P1-Z1)
GWCC Existing Water Mains
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
TENANDRA RESERVOIR
RIVER ROAD
BILLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
NANGUS
MUNDARLO
GUNDAGAI
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
347: White Box - Blakelys Red Gum shrub/grass woodland
Cardno


OURA ROAD
9km
9km
13km
10km
10km
KIMO STREET
NANGUS
21km
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
20km
NANGUS ROAD
19km
NANGUS CREEK
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
276: Yellow Box grassy tall woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
MUNDARLO
NANGUS
GUNDAGAI
Goldenfields Water
Vegetation Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-14 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GIS-015-VegetationOD.P.mxd 03
Aerial Imagery supplied by DFSI (2017)
PCT names have been shortened to fit legend


Goldenfields Water
Vegetation Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
18km
17km
16km
15km
14km
13km
NANGUS ROAD
OAK CREEK
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
289: Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest
347: White Box - Blakelys Red Gum shrub/grass woodland
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-14 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-015-VegetationODP.mxd 03
Aerial Imagery supplied by DFSI (2017)
PCT names have been shortened to fit legend


Goldenfields Water
Vegetation Page 7
NANGUS, NSW
Legend
Major Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
12km
11km
10km
9Km
8Km
NANGUS ROAD
MURRUMBIDGEE RIVER
LONG TUNNEL CREEK
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
278: Riparian Blakelys Red Gum - box - shrub - sedge - grass tall open forest
289: Mugga Ironbark - Inland Scribbly Gum - Red Box shrub/grass open forest
347: White Box - Blakelys Red Gum shrub/grass woodland
796: Derived grassland
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-14 :Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-015-VegetationDDP.mxd 03
Aerial Imagery supplied by DFSI (2017)
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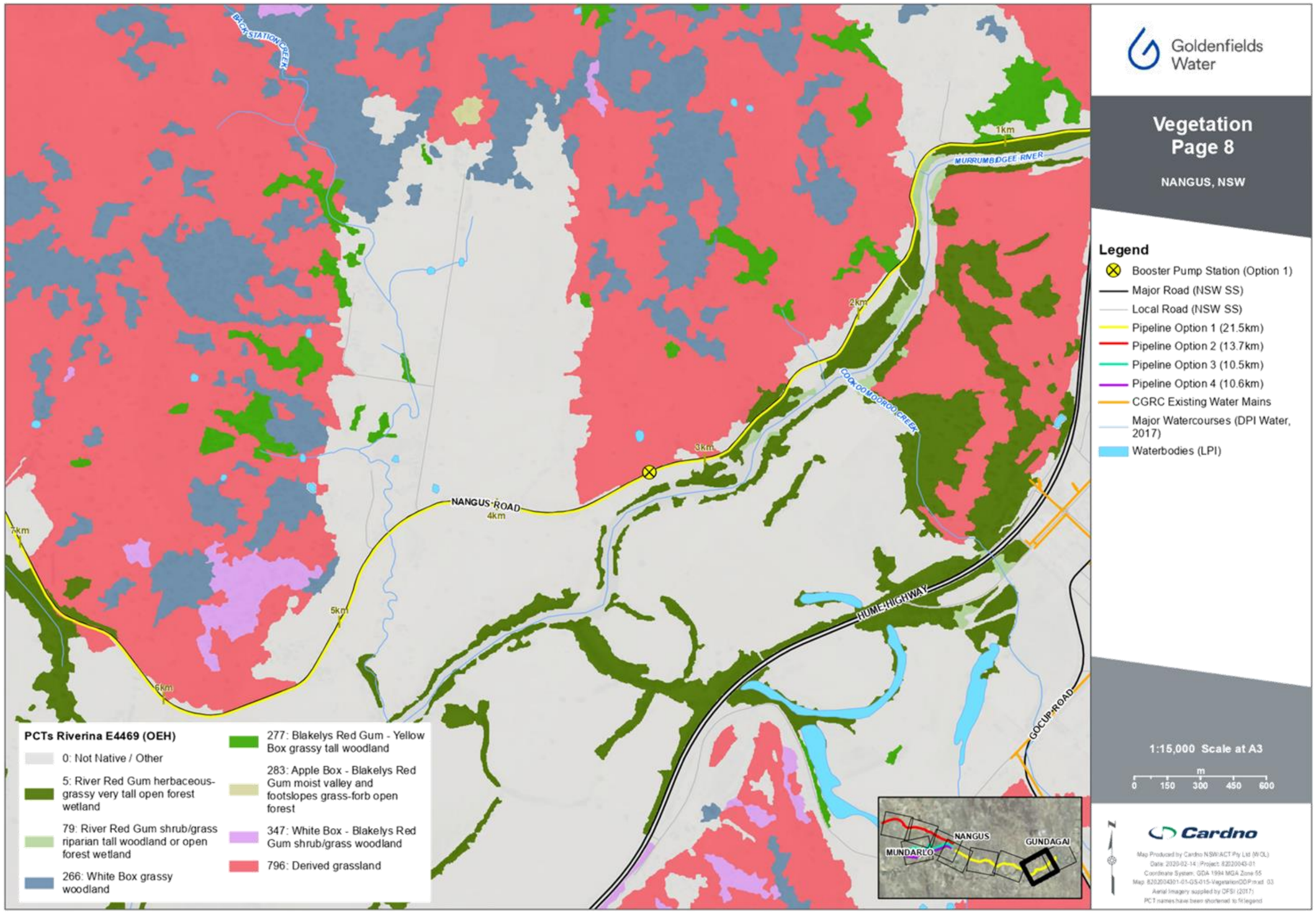
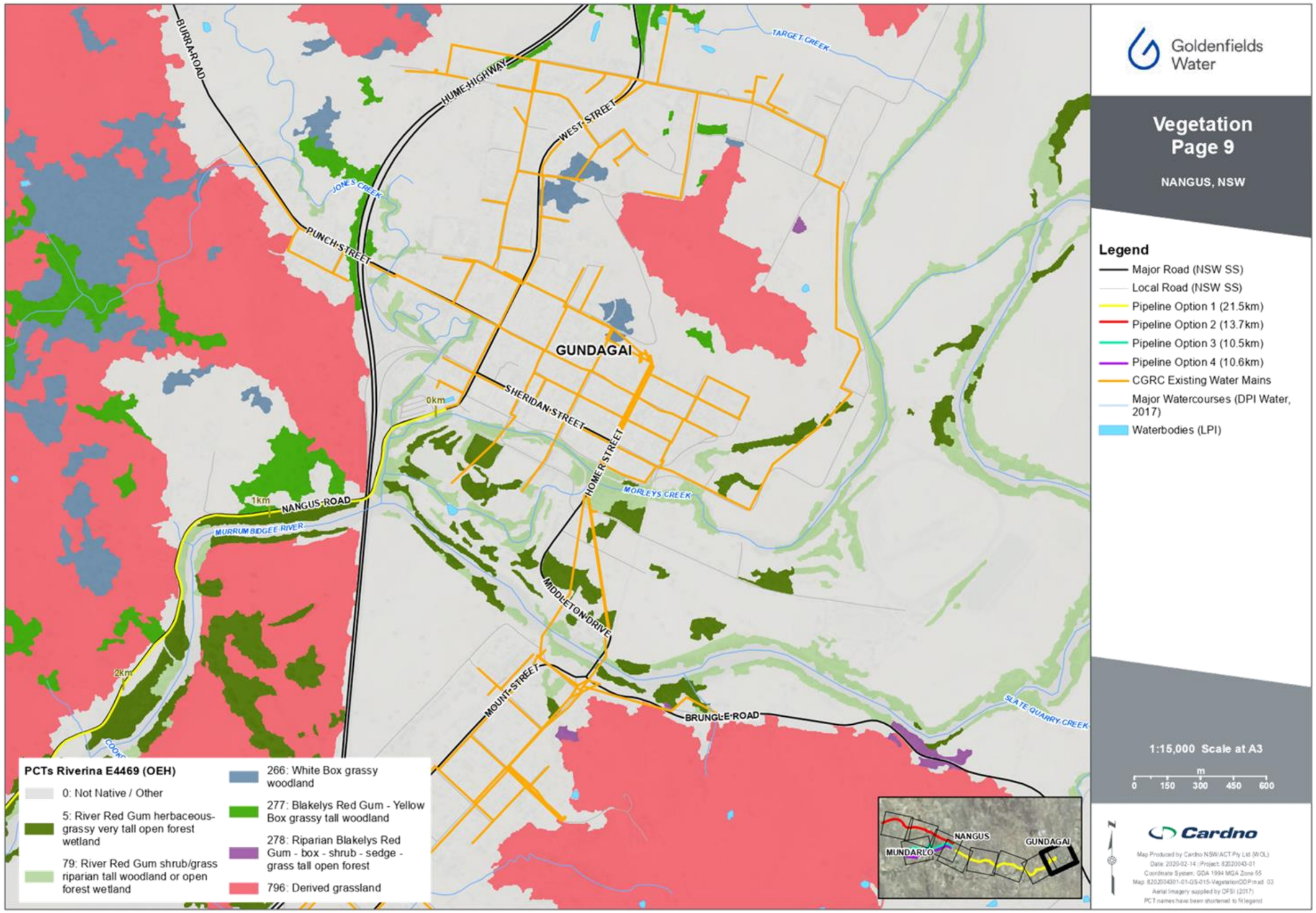
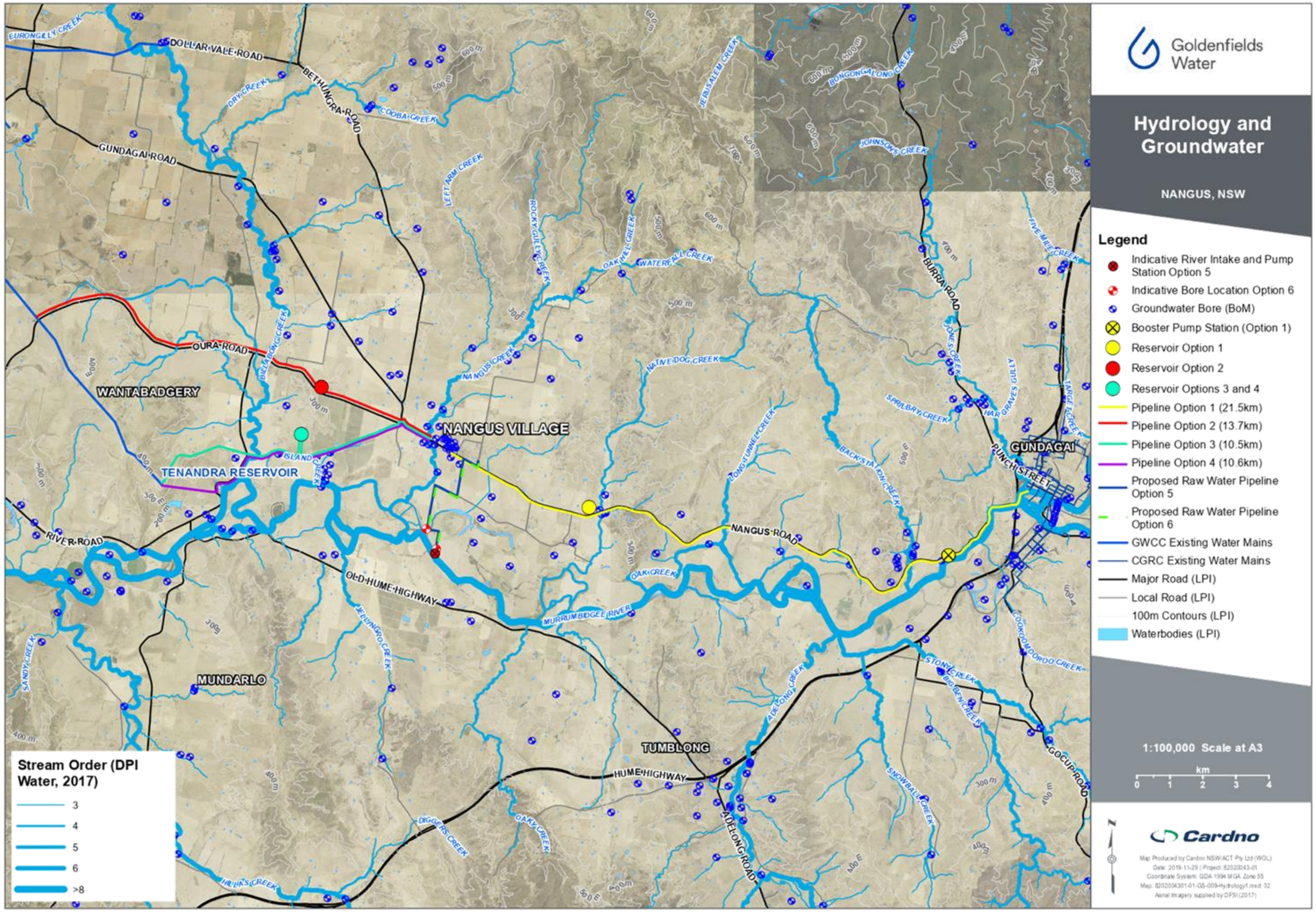
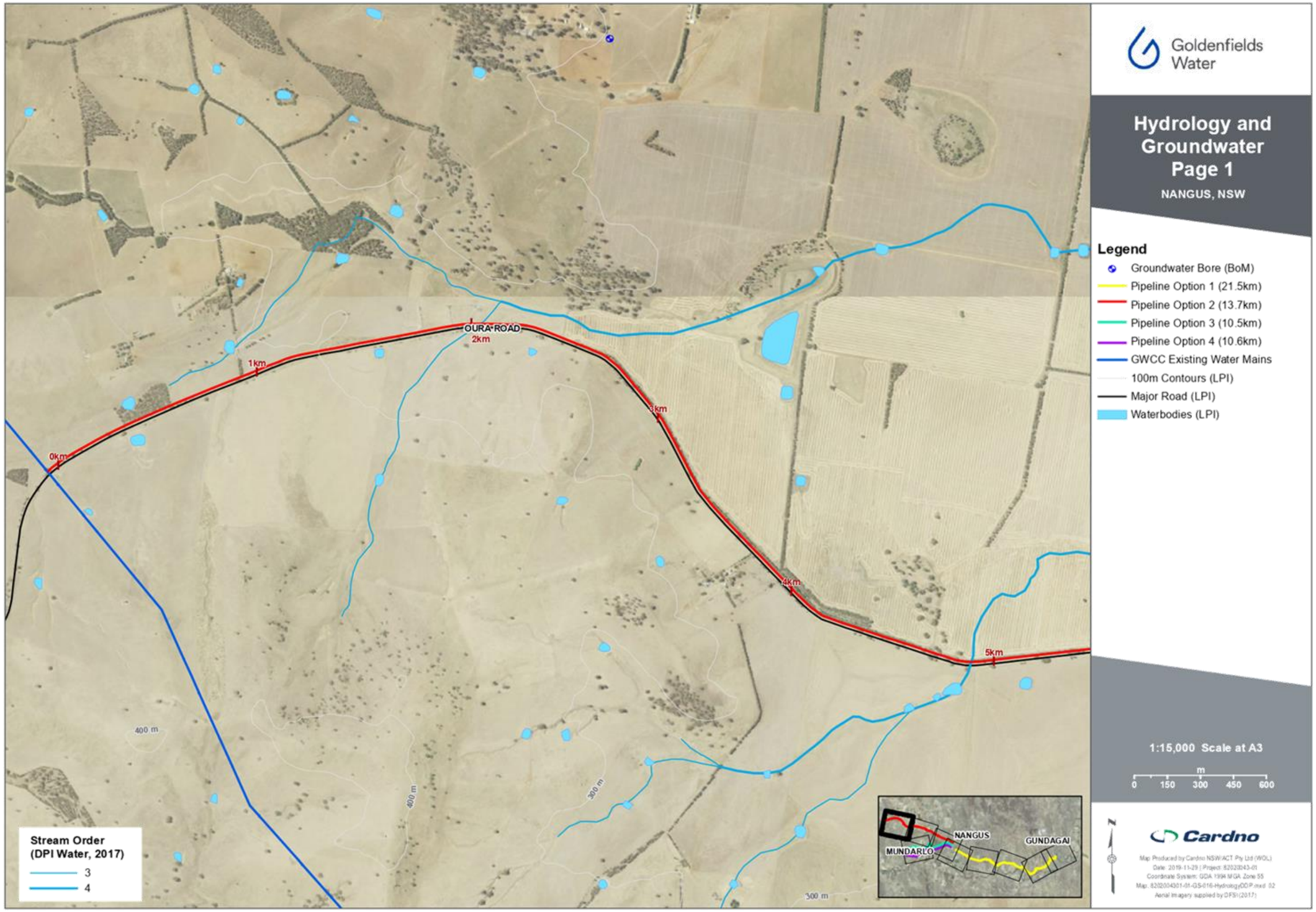
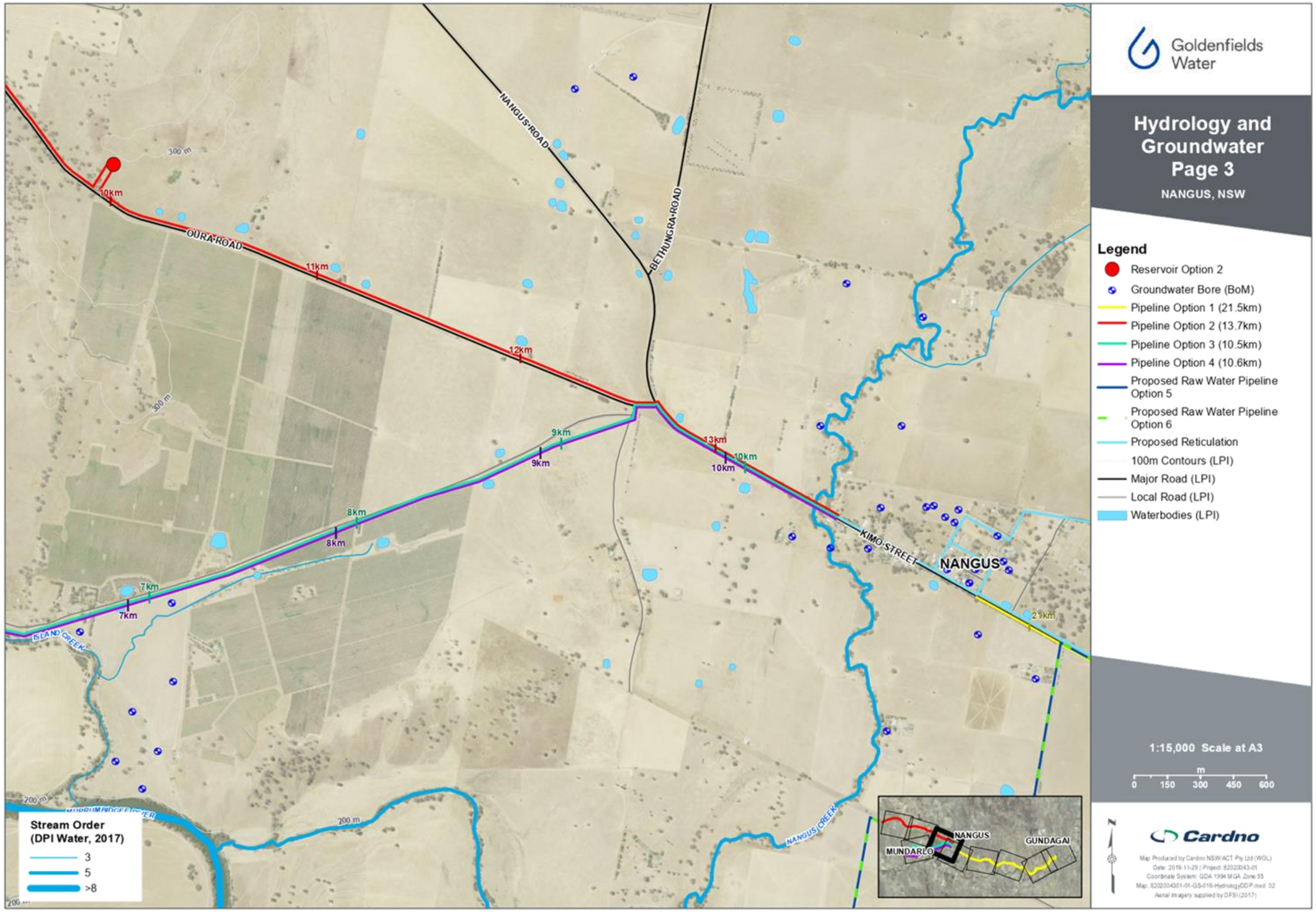

Goldenfields Water
Vegetation Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
283: Apple Box - Blakelys Red Gum moist valley and footslopes grass-forb open forest
347: White Box - Blakelys Red Gum shrub/grass woodland
796: Derived grassland
BACK STATION CREEK
MURRUMBIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
0 150 300 450 600
Cardno

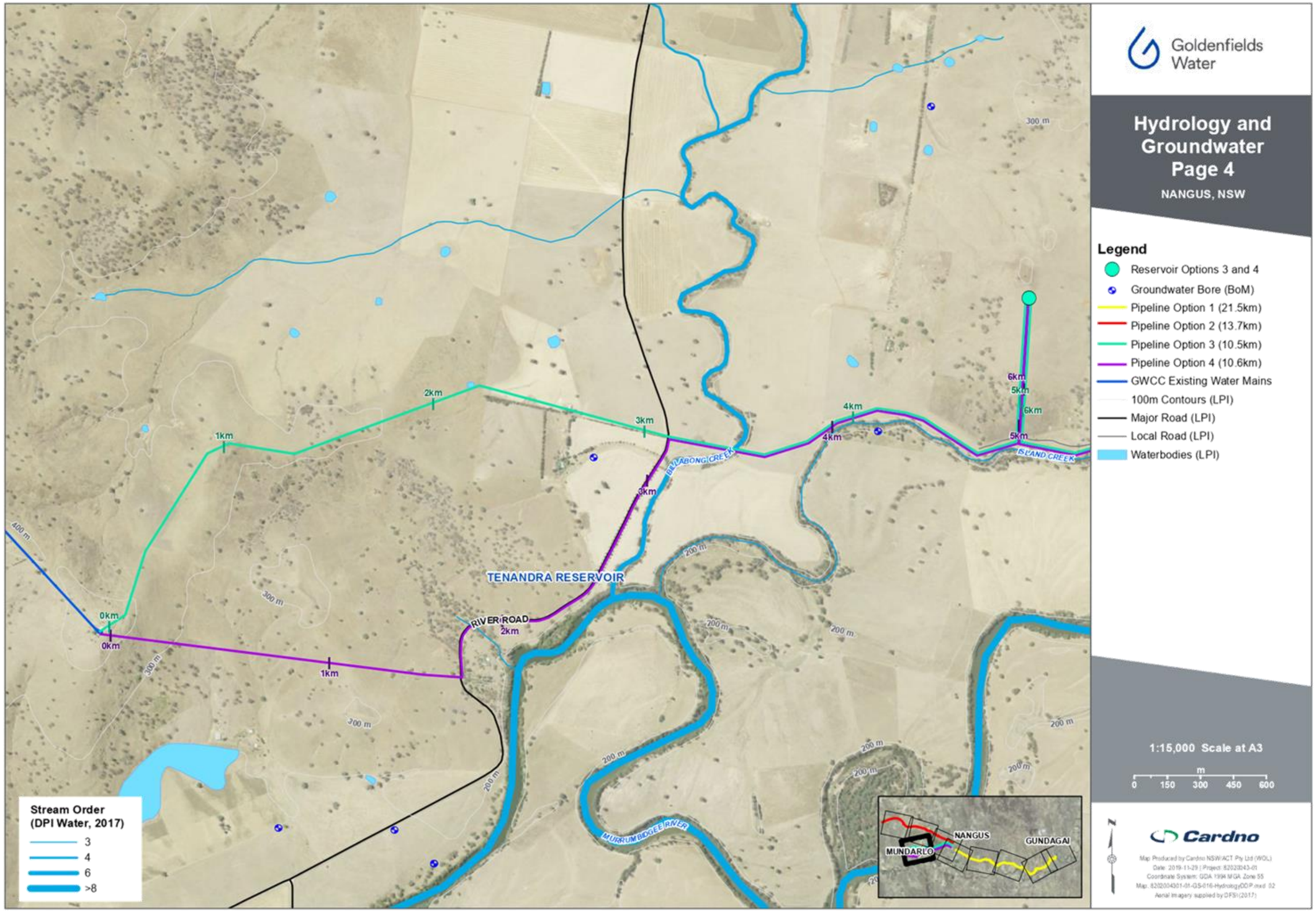

Goldenfields Water
Vegetation Page 9
NANGUS, NSW
Legend
Major Road (NSW SS)
Local Road (NSW SS)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
BURRA ROAD
HUME HIGHWAY
WEST STREET
TARGET CREEK
JONES CREEK
PUNCH STREET
GUNDAGAI
0km
SHERIDAN STREET
HOMER STREET
MORLEYS CREEK
1km
NANGUS ROAD
MURRUMBIDGEE RIVER
MIDDLETON DRIVE
MOUNT STREET
BRUNGLE ROAD
SLATE QUARRY CREEK
2km
PCTs Riverina E4469 (OEH)
0: Not Native / Other
5: River Red Gum herbaceous-grassy very tall open forest wetland
79: River Red Gum shrub/grass riparian tall woodland or open forest wetland
266: White Box grassy woodland
277: Blakelys Red Gum - Yellow Box grassy tall woodland
278: Riparian Blakelys Red Gum - box - shrub - sedge - grass tall open forest
796: Derived grassland
NANGUS
GUNDAGAI
MUNDARLO
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2020-02-14 :Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Aerial Imagery supplied by OFSI (2017)
PCT names have been shortened to fit legend

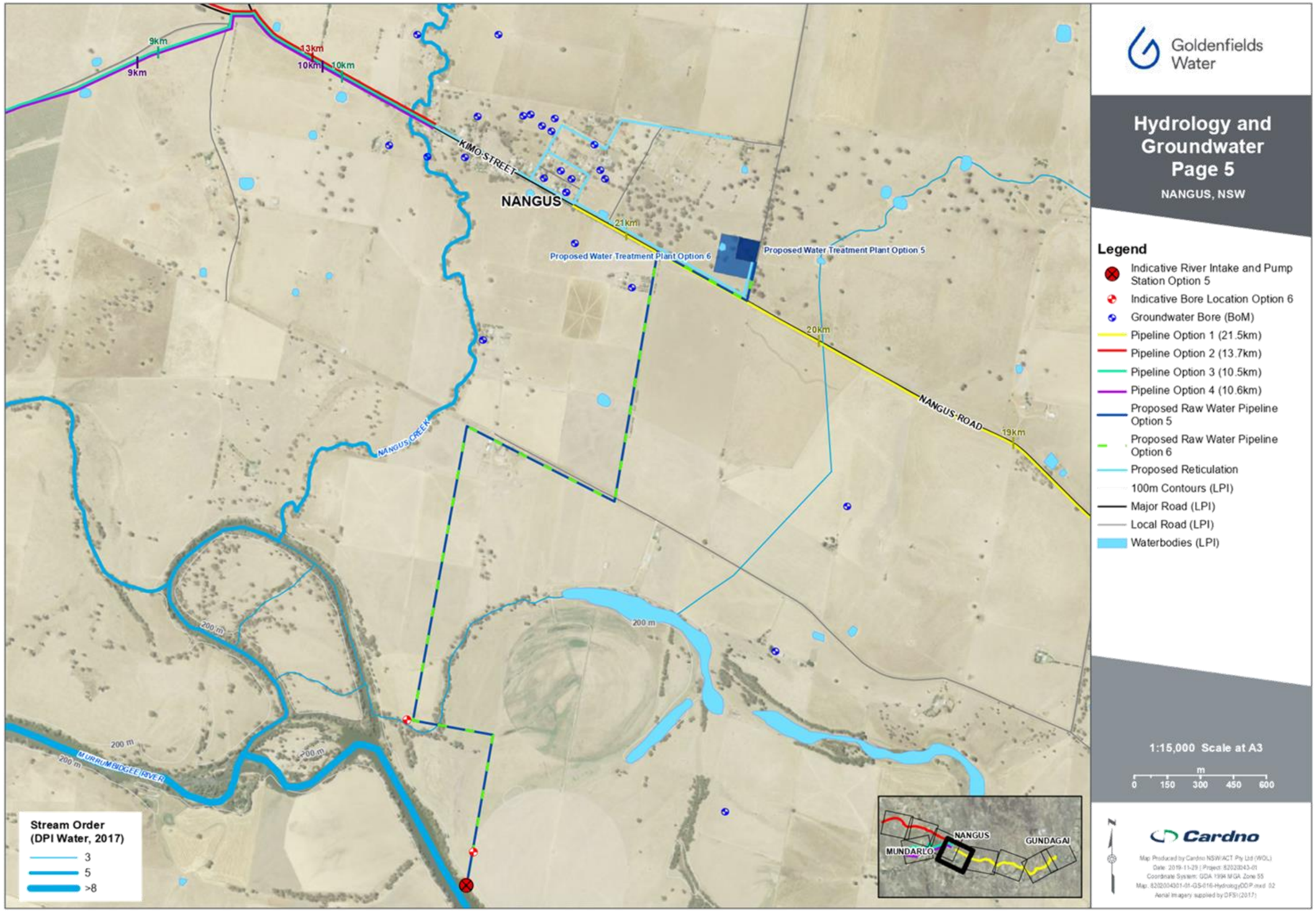

Goldenfields Water
Hydrology and Groundwater
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Groundwater Bore (BoM)
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
100m Contours (LPI)
Waterbodies (LPI)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Stream Order (DPI Water, 2017)
3
4
5
6
>8
NANGUS VILLAGE
WANTABADGERY
TENANDRA RESERVOIR
MUNDARLO
TUMBLONG
GUNDAGAI
DOLLAR VALE ROAD
BETHUNGRA ROAD
GUNDAGAI ROAD
OURA ROAD
RIVER ROAD
OLD HUME HIGHWAY
HUME HIGHWAY
NANGUS ROAD
BURRA ROAD
PUNCH STREET
GOCUP ROAD
ADELONG ROAD
MURRUMBIDGEE RIVER
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAK HILL CREEK
WATERFALL CREEK
NANGUS CREEK
NATIVE DOG CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
FIVE MILE CREEK
JONES CREEK
SPRILBRY CREEK
HAR GRAVES GULLY
TARGET CREEK
BACK STATION CREEK
LONG TUNNEL CREEK
OAK CREEK
ISLAND CREEK
BILLABONG CREEK
JELLINGRO CREEK
SANDY CREEK
DIGGERS CREEK
OAKY CREEK
HILLAS CREEK
ADELONG CREEK
STONY CREEK
BIG BEN CREEK
SNOWBALL CREEK
COOKOOMOOROO CREEK

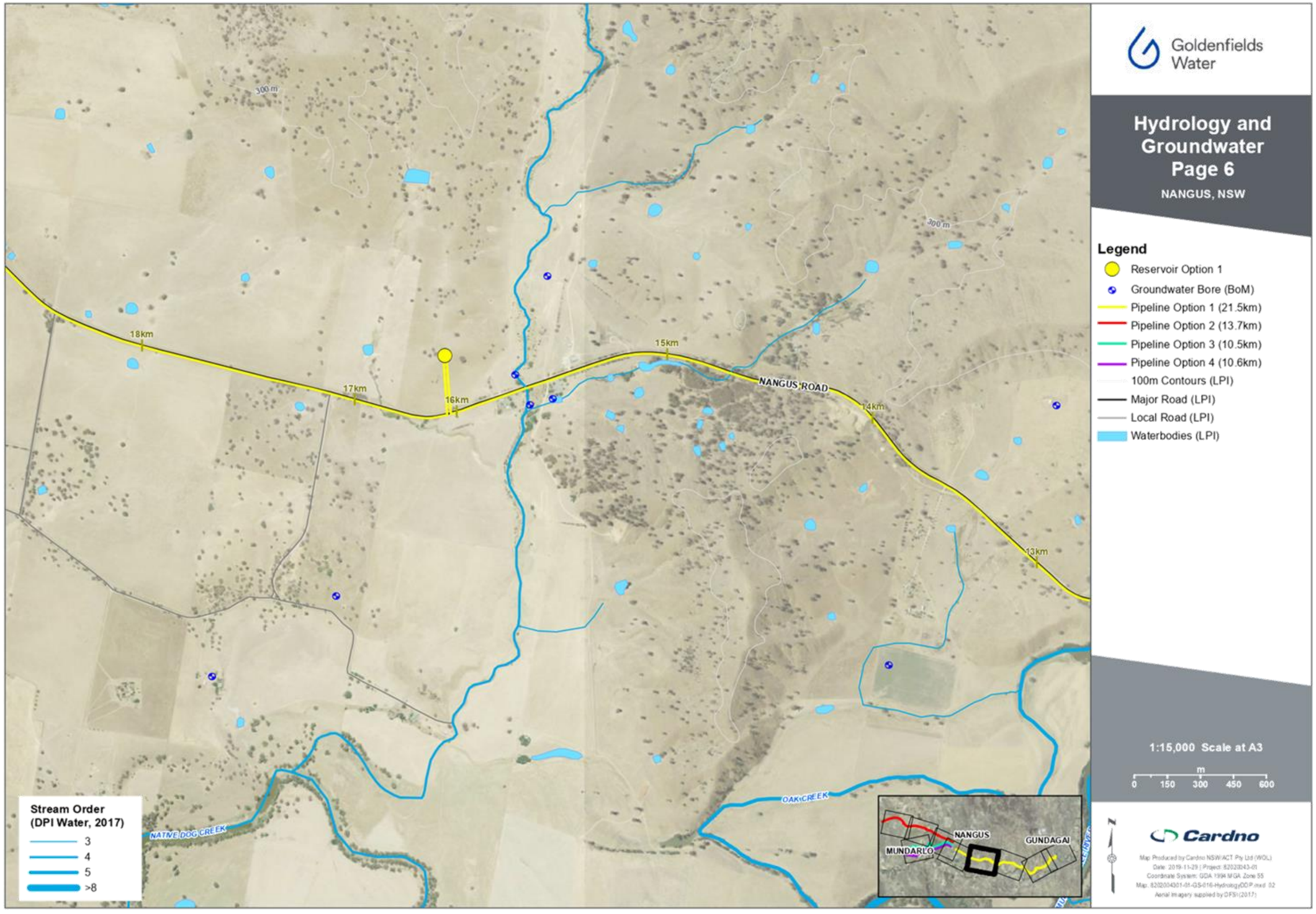

Goldenfields Water
Hydrology and Groundwater Page 1
NANGUS, NSW
Legend
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Waterbodies (LPI)
OURA ROAD
0km
1km
2km
3km
4km
5km
400 m
400 m
300 m
300 m
Stream Order (DPI Water, 2017)
3
4
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82023043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-016-HydrologyDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)

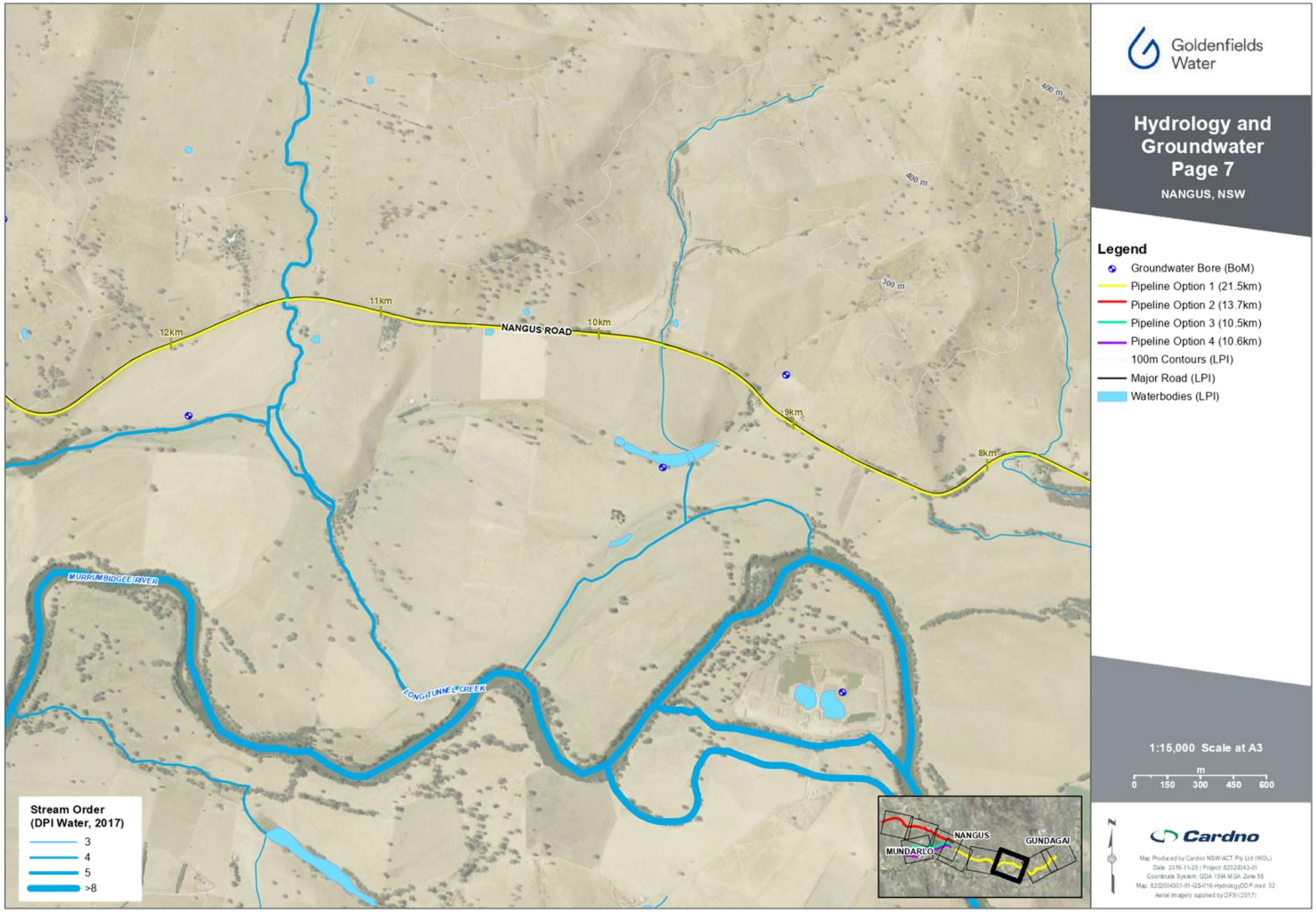
Goldenfields Water
Hydrology and Groundwater Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
BULLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km
300 m
Stream Order (DPI Water, 2017)
3
4
6
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 (Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-016-HydrologyDDP.mxd 02
Aerial imagery supplied by DFSI (2017)

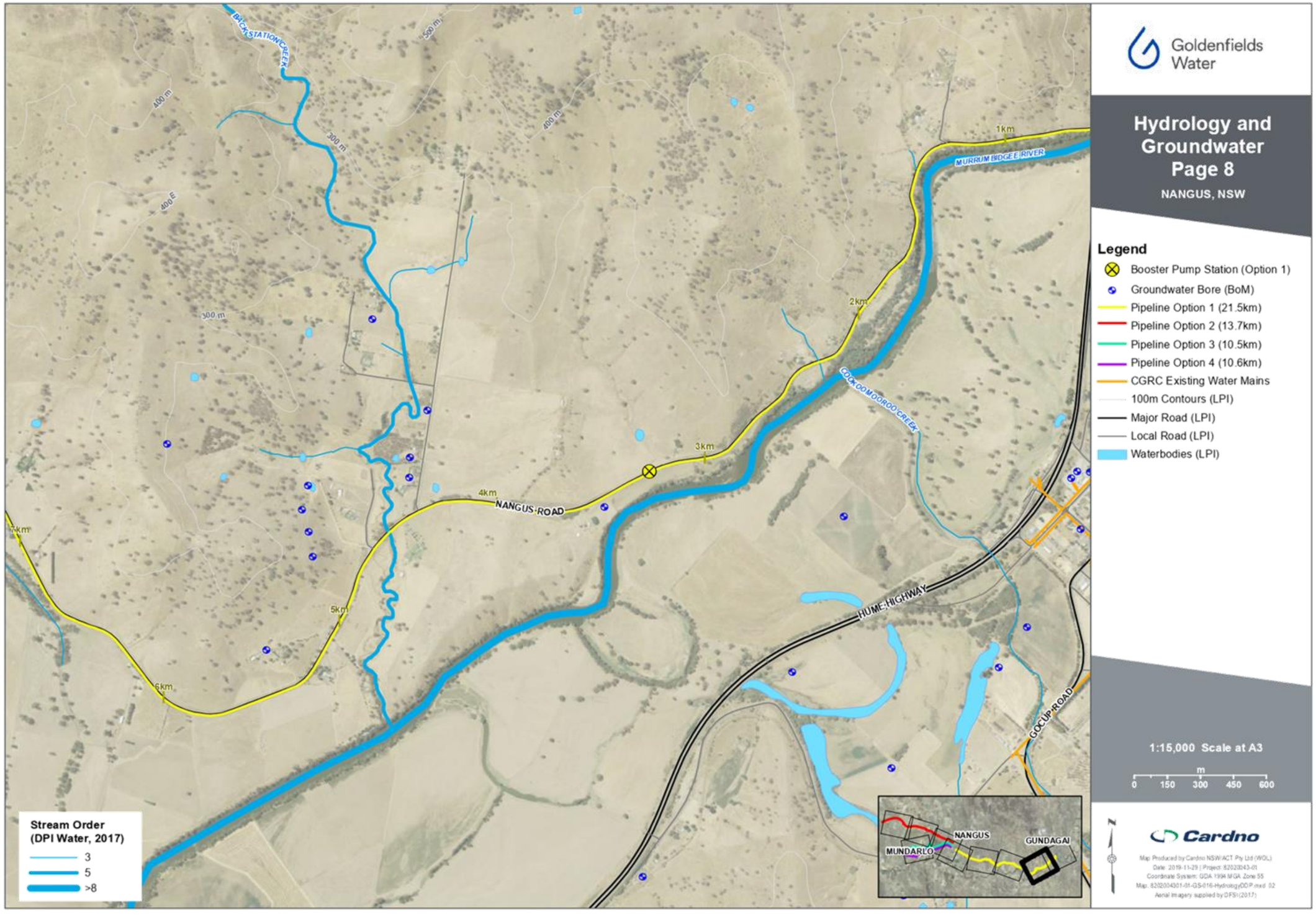

Goldenfields Water
Hydrology and Groundwater Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
Stream Order (DPI Water, 2017)
3
5
>8
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
NANGUS
GUNDAGAI
MUNDARLO
NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
BLAND CREEK
NANGUS CREEK
10km
11km
12km
13km
9km
8km
7km
21km
300 m
200 m

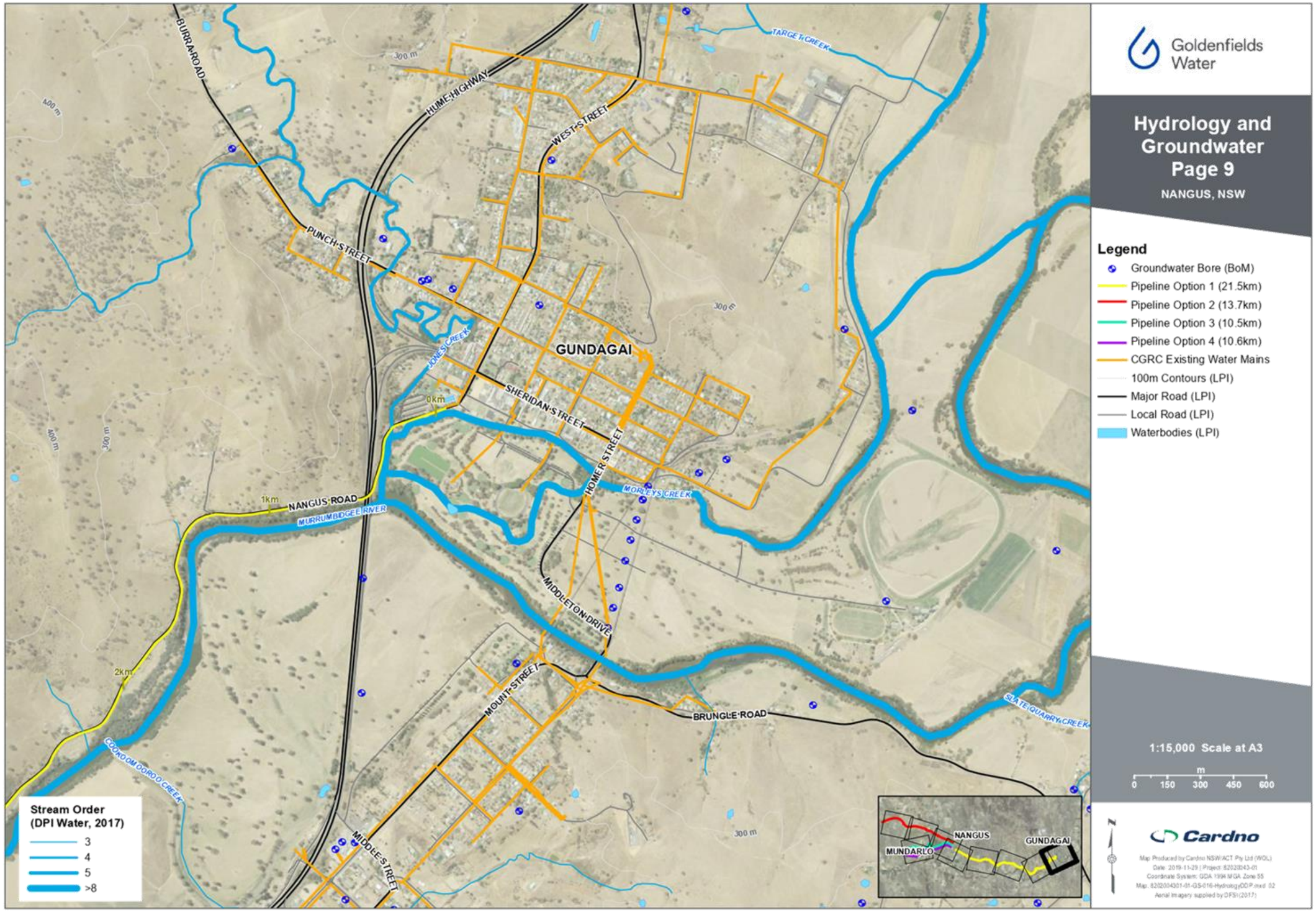

Goldenfields Water
Hydrology and Groundwater Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
TENANDRA RESERVOIR
RIVER ROAD
BILLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
1km
2km
3km
4km
5km
6km
0km
Stream Order (DPI Water, 2017)
3
4
6
>8
1:15,000 Scale at A3
0 150 300 450 600
MUNDARLO
NANGUS
GUNDAGAI
Cardno

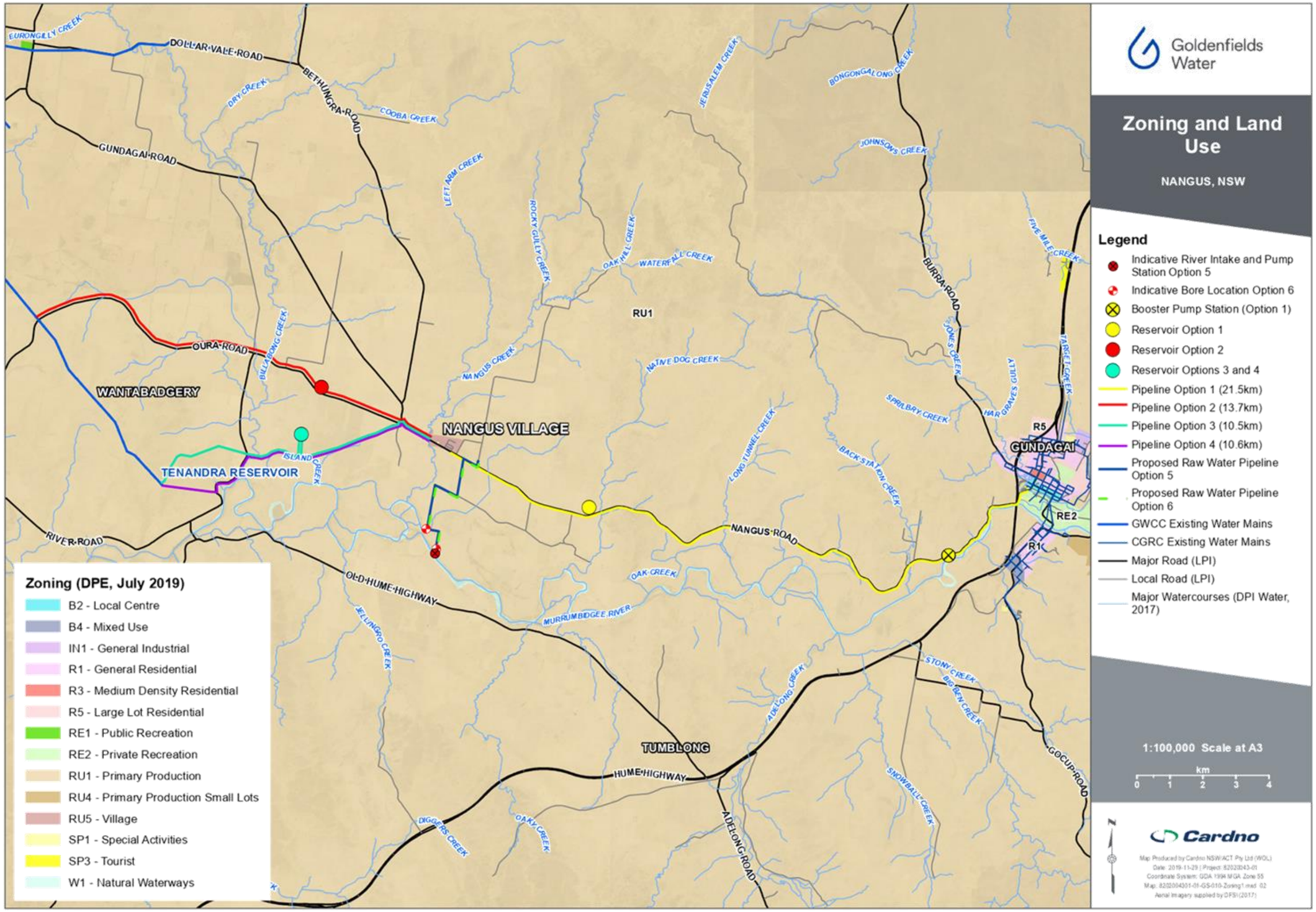

Goldenfields Water
Hydrology and Groundwater Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Stream Order (DPI Water, 2017)
3
5
>8
NANGUS
KIMO STREET
NANGUS ROAD
NANGUS CREEK
MURRUMBIDGEE RIVER
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
9km
13km
10km
10km
21km
20km
19km
200 m
MUNDARLO
GUNDAGAI
Cardno

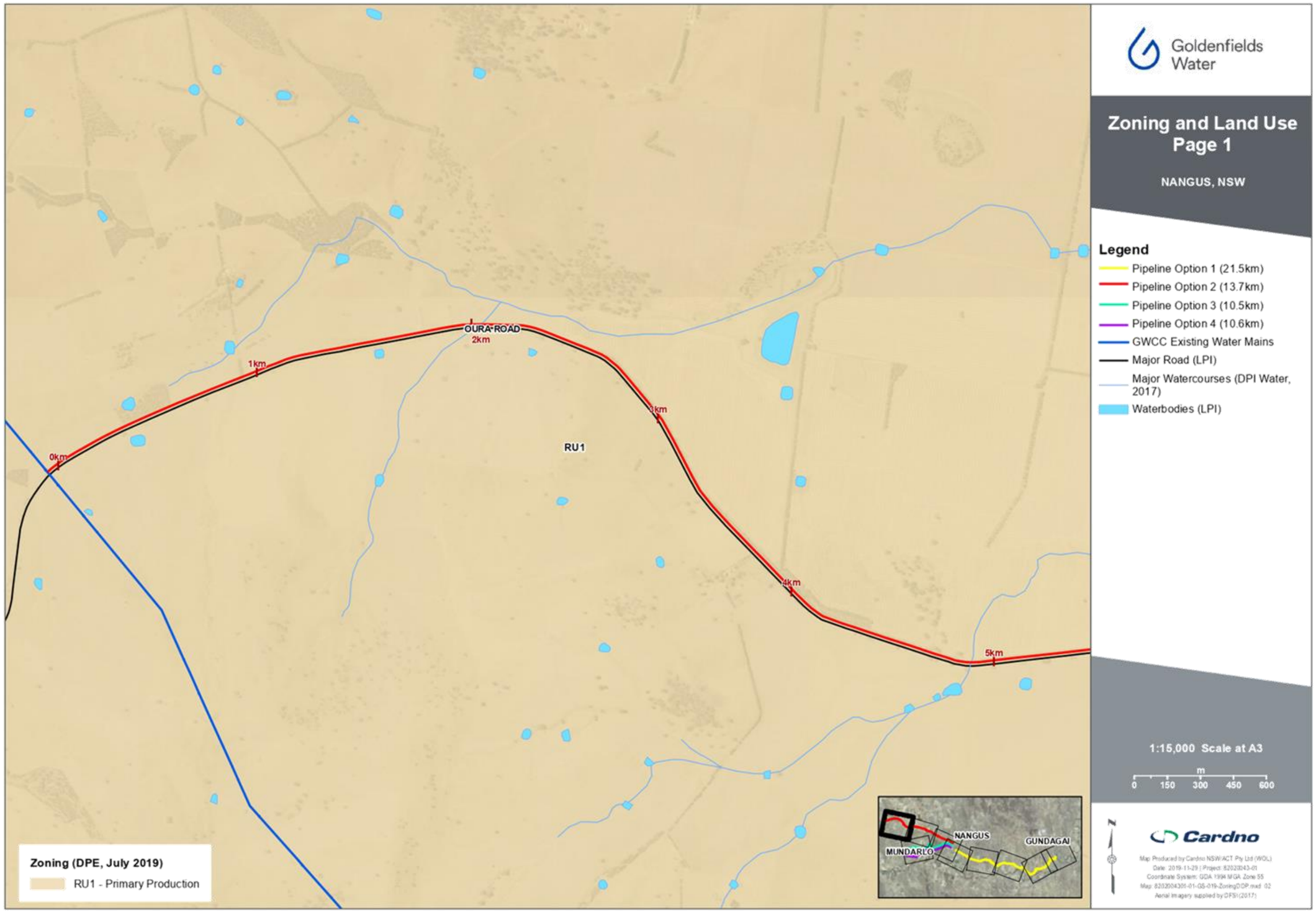

Goldenfields Water
Hydrology and Groundwater Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
18km
17km
16km
15km
14km
13km
NANGUS ROAD
300 m
Stream Order (DPI Water, 2017)
3
4
5
>8
NATIVE DOG CREEK
OAK CREEK
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno

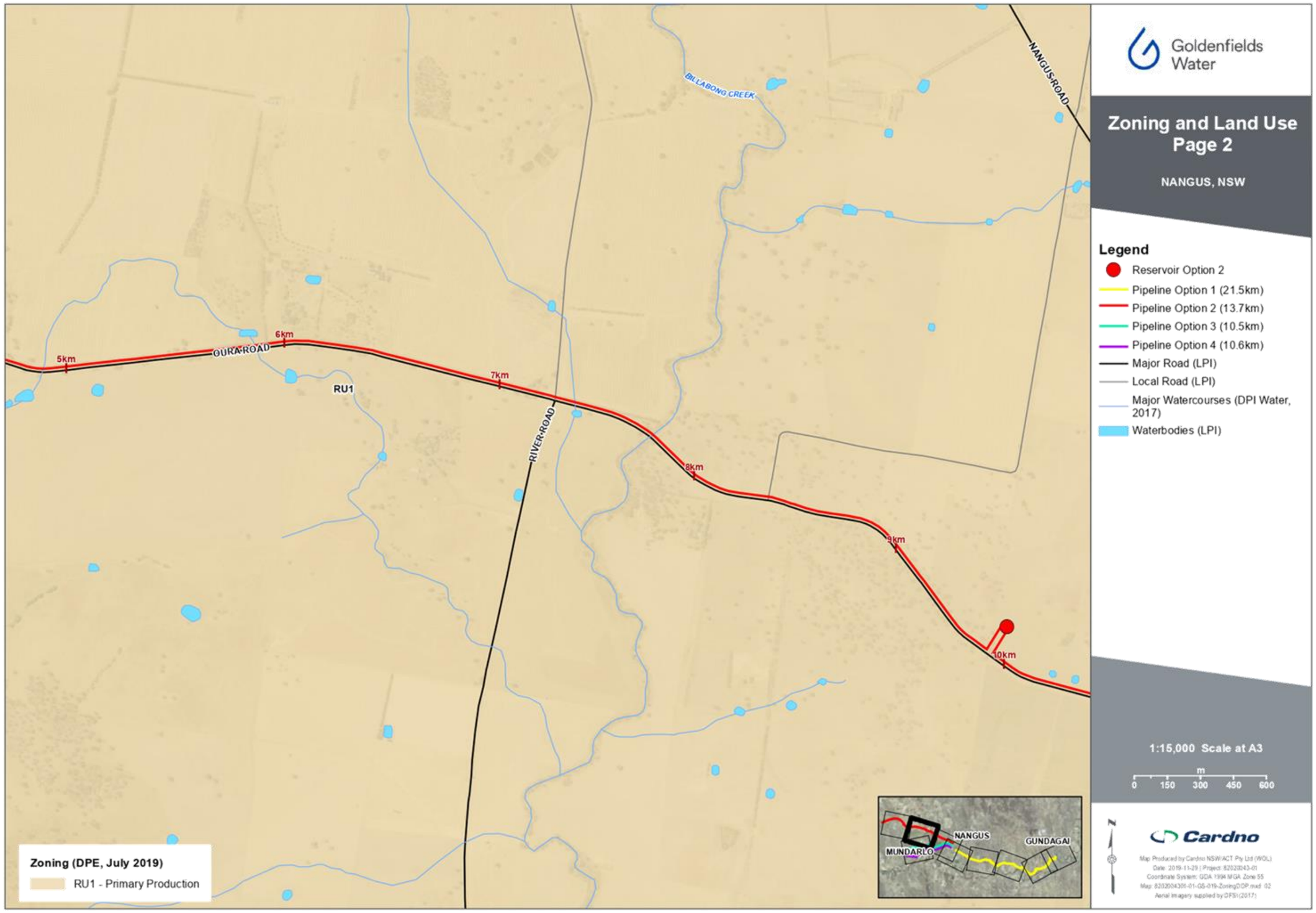

Goldenfields Water
Hydrology and Groundwater Page 7
NANGUS, NSW
Legend
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Waterbodies (LPI)
NANGUS ROAD
12km
11km
10km
9km
8km
400 m
400 m
300 m
MURRUMBIDGEE RIVER
LONGTUNNEL CREEK
Stream Order (DPI Water, 2017)
3
4
5
>8
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-016-HydrologyDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)

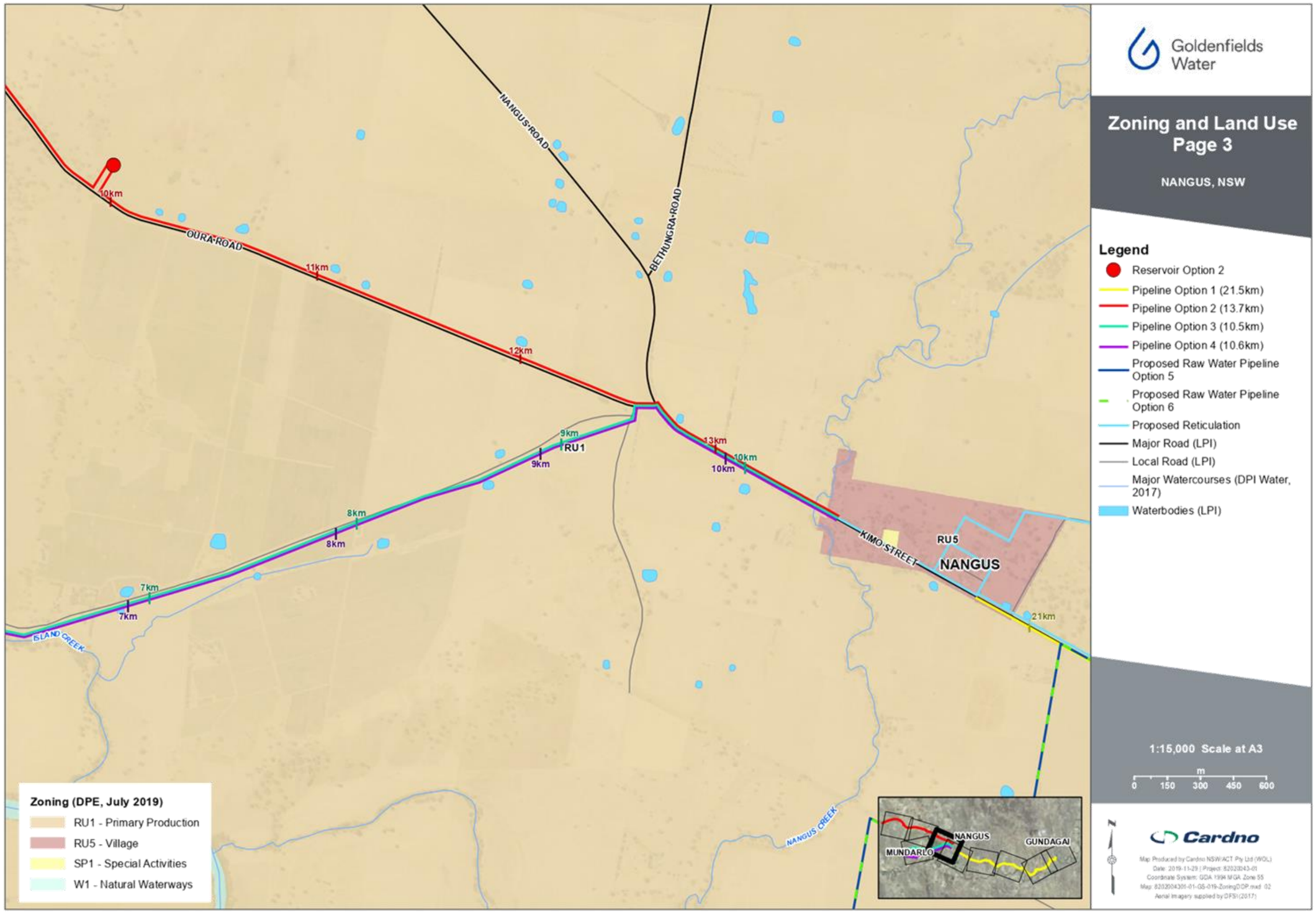

Goldenfields Water
Hydrology and Groundwater Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
BACK STATION CREEK
MURRUMBIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
400 m
500 m
300 m
Stream Order (DPI Water, 2017)
3
5
>8
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno

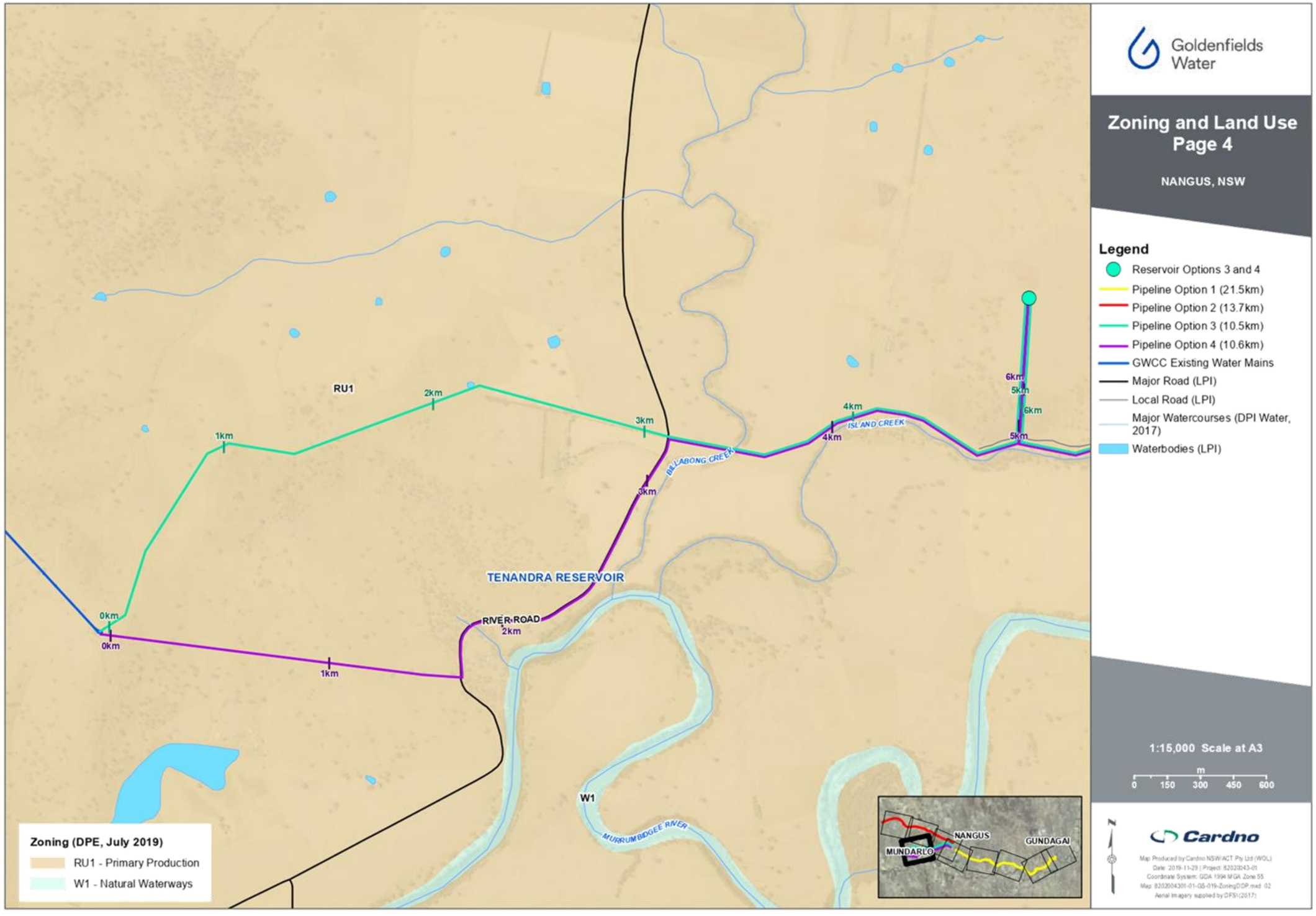

Goldenfields Water
Hydrology and Groundwater Page 9
NANGUS, NSW
Legend
Groundwater Bore (BoM)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Stream Order (DPI Water, 2017)
3
4
5
>8
GUNDAGAI
NANGUS
MUNDARLO
BURRA ROAD
HUME HIGHWAY
WEST STREET
PUNCH STREET
SHERIDAN STREET
HOMER STREET
NANGUS ROAD
MURRUMBIDGEE RIVER
MOREYS CREEK
MIDDLETON DRIVE
MOUNT STREET
BRUNGLE ROAD
MIDDLE STREET
JONES CREEK
TARGET CREEK
SLATE QUARRY CREEK
COOKOM DOORO CREEK
Cardno

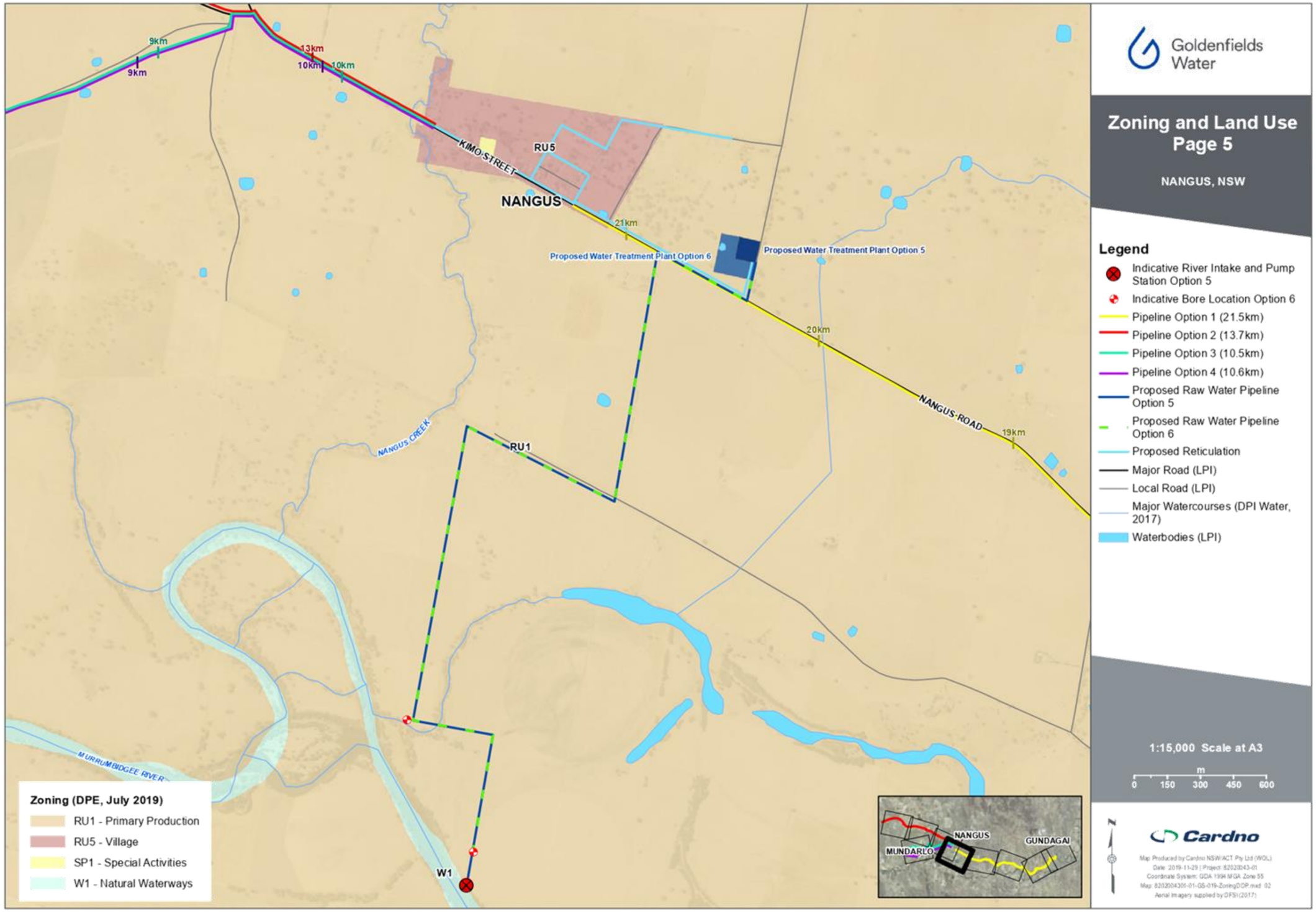

Goldenfields Water
Zoning and Land Use
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Zoning (DPE, July 2019)
B2 - Local Centre
B4 - Mixed Use
IN1 - General Industrial
R1 - General Residential
R3 - Medium Density Residential
R5 - Large Lot Residential
RE1 - Public Recreation
RE2 - Private Recreation
RU1 - Primary Production
RU4 - Primary Production Small Lots
RU5 - Village
SP1 - Special Activities
SP3 - Tourist
W1 - Natural Waterways
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
NANGUS VILLAGE
WANTABADGERY
TENANDRA RESERVOIR
GUNDAGAI
TUMBLONG
DOLLAR VALE ROAD
GUNDAGAI ROAD
BETHUNGRA ROAD
OURA ROAD
NANGUS ROAD
OLD HUME HIGHWAY
HUME HIGHWAY
BURRA ROAD
GOCUP ROAD
ADELONG ROAD
RIVER ROAD
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAK HILL CREEK
WATERFALL CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
FIVE MILE CREEK
BILLABONG CREEK
NANGUS CREEK
NATIVE DOG CREEK
JONES CREEK
HARGRAVES GULLY
TARSET CREEK
SPRILBRY CREEK
ISLAND CREEK
LONG TUNNEL CREEK
BACK STATION CREEK
OAK CREEK
MURRUMBIDGEE RIVER
JELLINGRO CREEK
ADELONG CREEK
STONY CREEK
BIG BEN CREEK
SNOWBALL CREEK
DIGGERS CREEK
OAKY CREEK
RU1
R5
RE2
R1

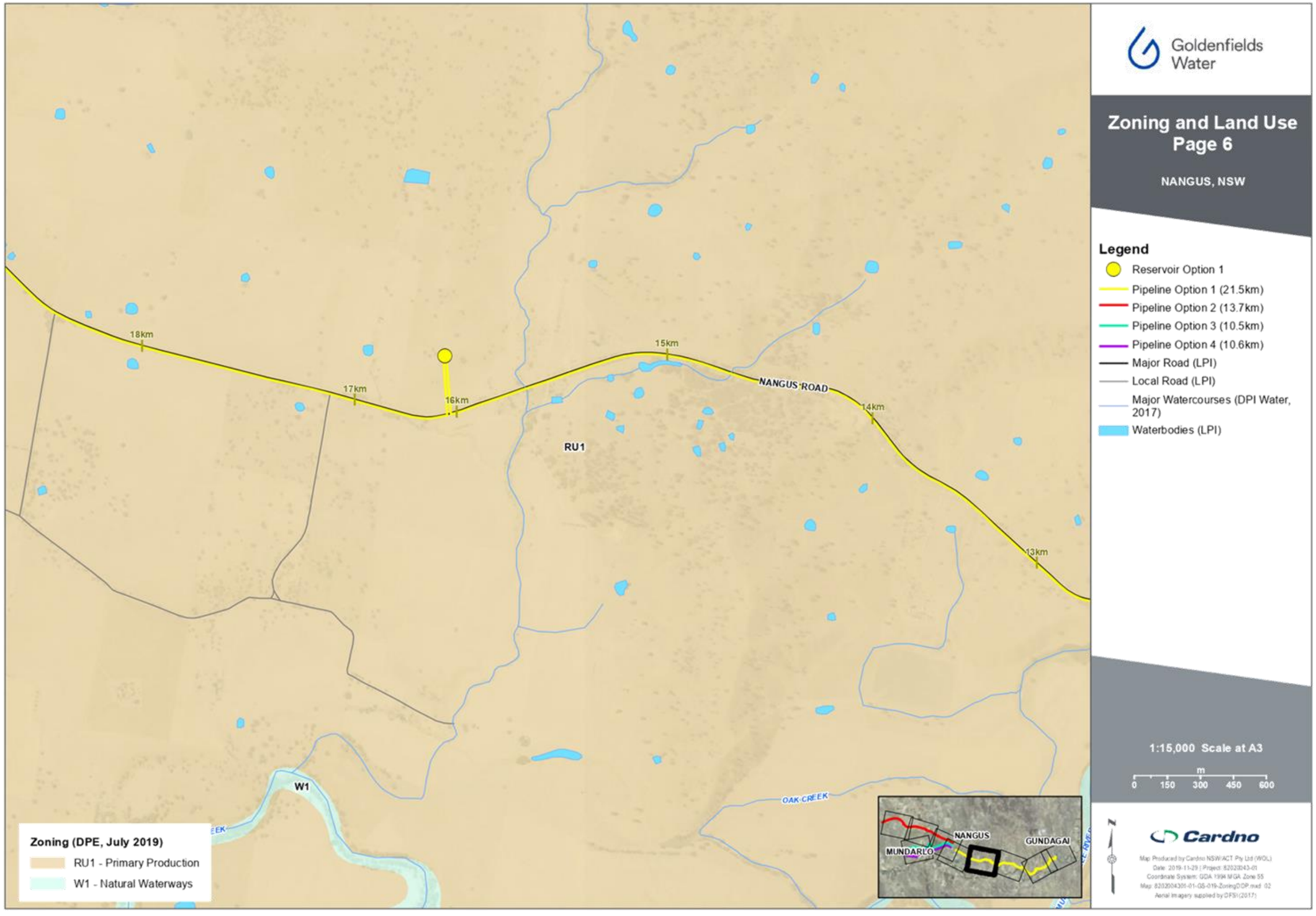

Goldenfields Water
Zoning and Land Use Page 1
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
OURA ROAD
0km
1km
2km
3km
4km
5km
RU1
Zoning (DPE, July 2019)
RU1 - Primary Production
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno

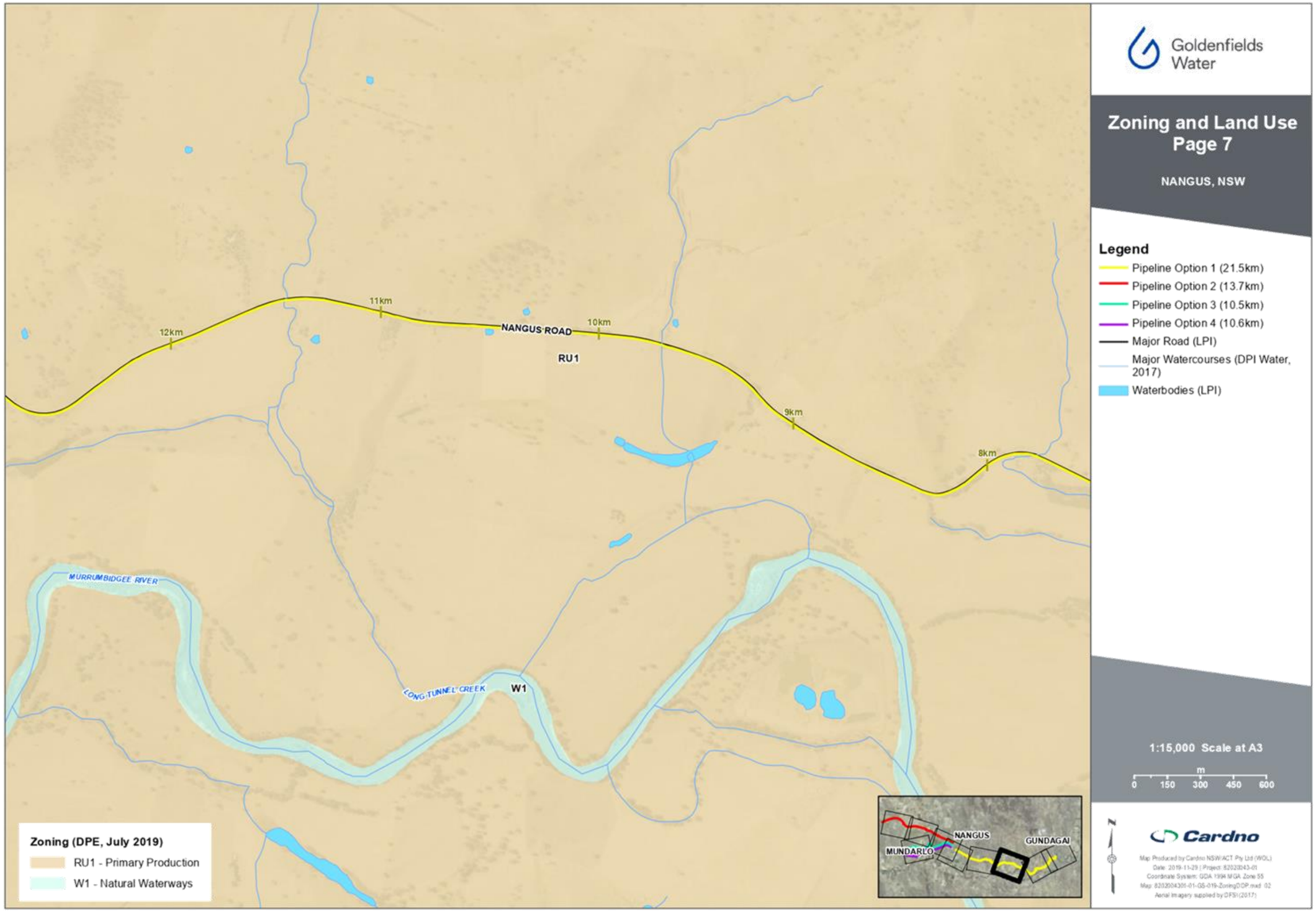

Goldenfields Water
Zoning and Land Use Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
RU1
5km
6km
7km
8km
9km
10km
Zoning (DPE, July 2019)
RU1 - Primary Production
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GIS-019-ZoningDOP.mxd 02
Aerial Imagery supplied by DFSI (2017)

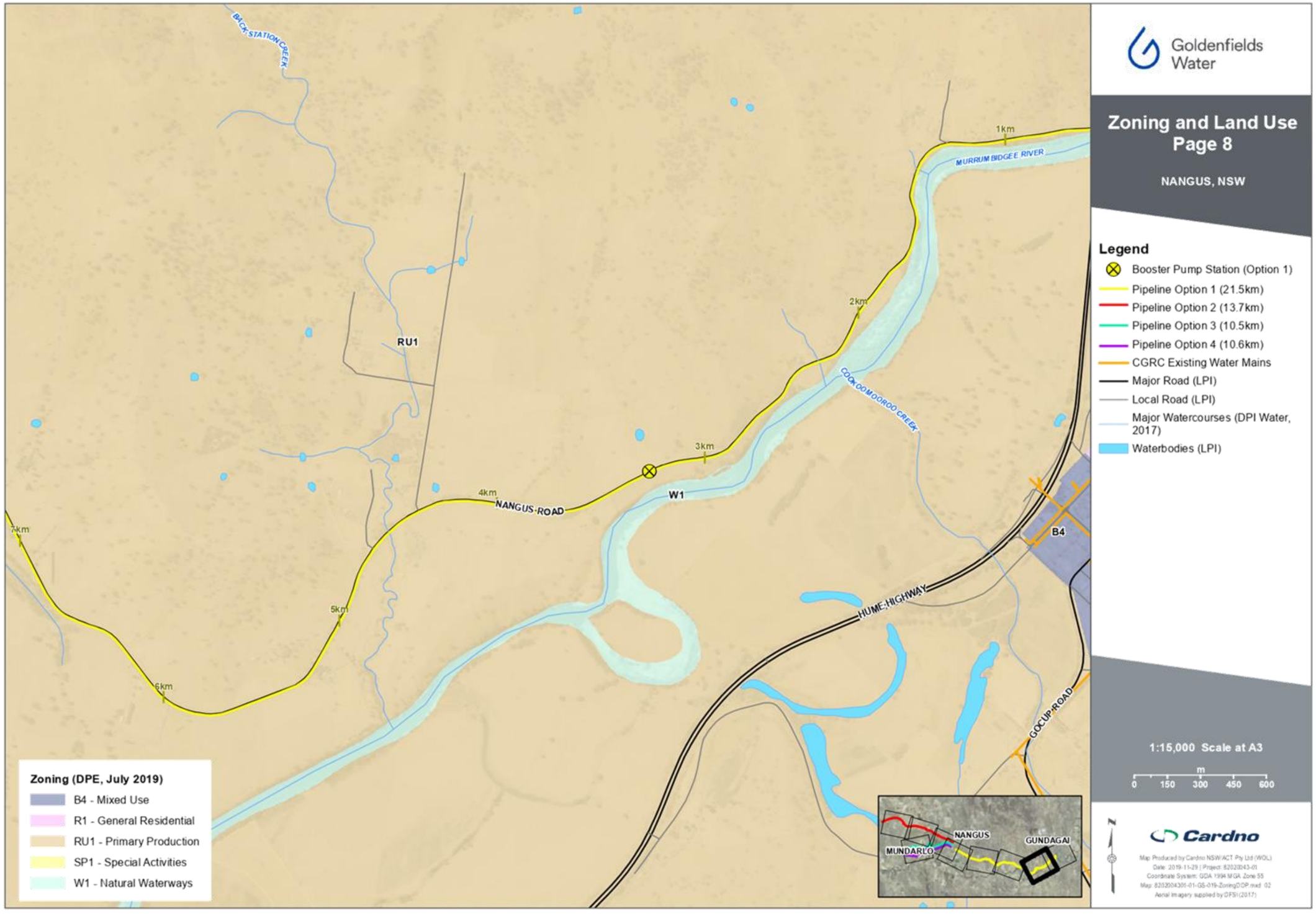

Goldenfields Water
Zoning and Land Use Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
ISLAND CREEK
NANGUS CREEK
10km
11km
12km
13km
10km
9km
9km
RU1
8km
8km
7km
7km
RU5
NANGUS
21km
MUNDARLO
NANGUS
GUNDAGAI
Zoning (DPE, July 2019)
RU1 - Primary Production
RU5 - Village
SP1 - Special Activities
W1 - Natural Waterways
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-019-ZoningDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)


Goldenfields Water
Zoning and Land Use Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
RU1
W1
TENANDRA RESERVOIR
RIVER ROAD
BILLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
0km
1km
2km
3km
4km
5km
6km
Zoning (DPE, July 2019)
RU1 - Primary Production
W1 - Natural Waterways
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno


Goldenfields Water
Zoning and Land Use Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Zoning (DPE, July 2019)
RU1 - Primary Production
RU5 - Village
SP1 - Special Activities
W1 - Natural Waterways
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GIS-019-ZoningDOP.mxd 02
Aerial imagery supplied by DFSI (2017)
9km
13km
10km
10km
KIMO STREET
RU5
NANGUS
21km
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
20km
NANGUS ROAD
19km
NANGUS CREEK
RU1
MURRUMBIDGEE RIVER
W1


Goldenfields Water
Zoning and Land Use Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
18km
17km
16km
15km
14km
13km
NANGUS ROAD
RU1
W1
OAK CREEK
Zoning (DPE, July 2019)
RU1 - Primary Production
W1 - Natural Waterways
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno


Goldenfields Water
Zoning and Land Use Page 7
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
12km
11km
10km
9km
8km
NANGUS ROAD
RU1
W1
MURRUMBIDGEE RIVER
LONG TUNNEL CREEK
Zoning (DPE, July 2019)
RU1 - Primary Production
W1 - Natural Waterways
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-019-ZoningDDP.mxd 02
Aerial imagery supplied by DFSI (2017)


Goldenfields Water
Zoning and Land Use Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Zoning (DPE, July 2019)
B4 - Mixed Use
R1 - General Residential
RU1 - Primary Production
SP1 - Special Activities
W1 - Natural Waterways
BACK STATION CREEK
MURRUMBIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS-ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
RU1
W1
B4
NANGUS
MUNDARLO
GUNDAGAI
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
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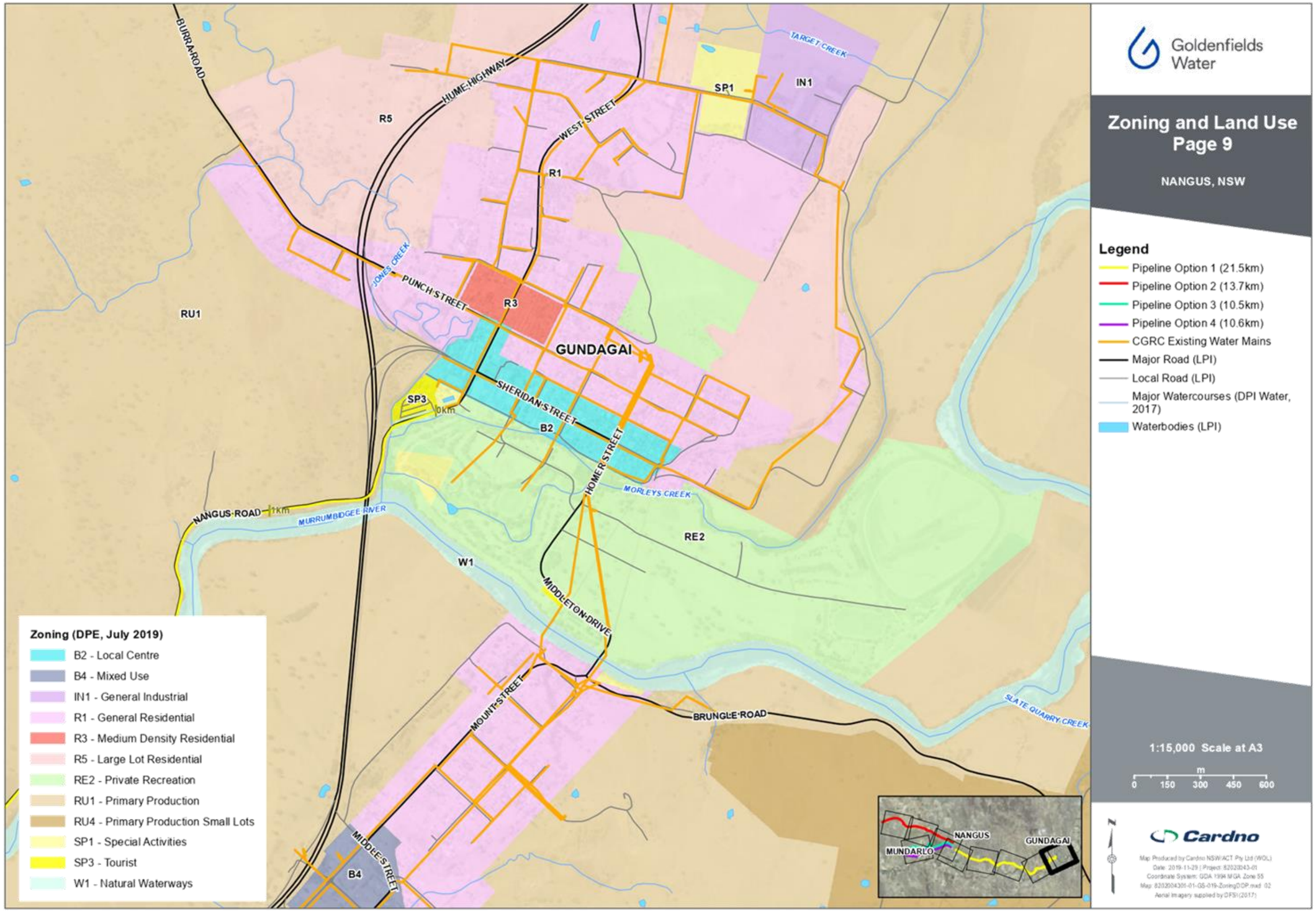
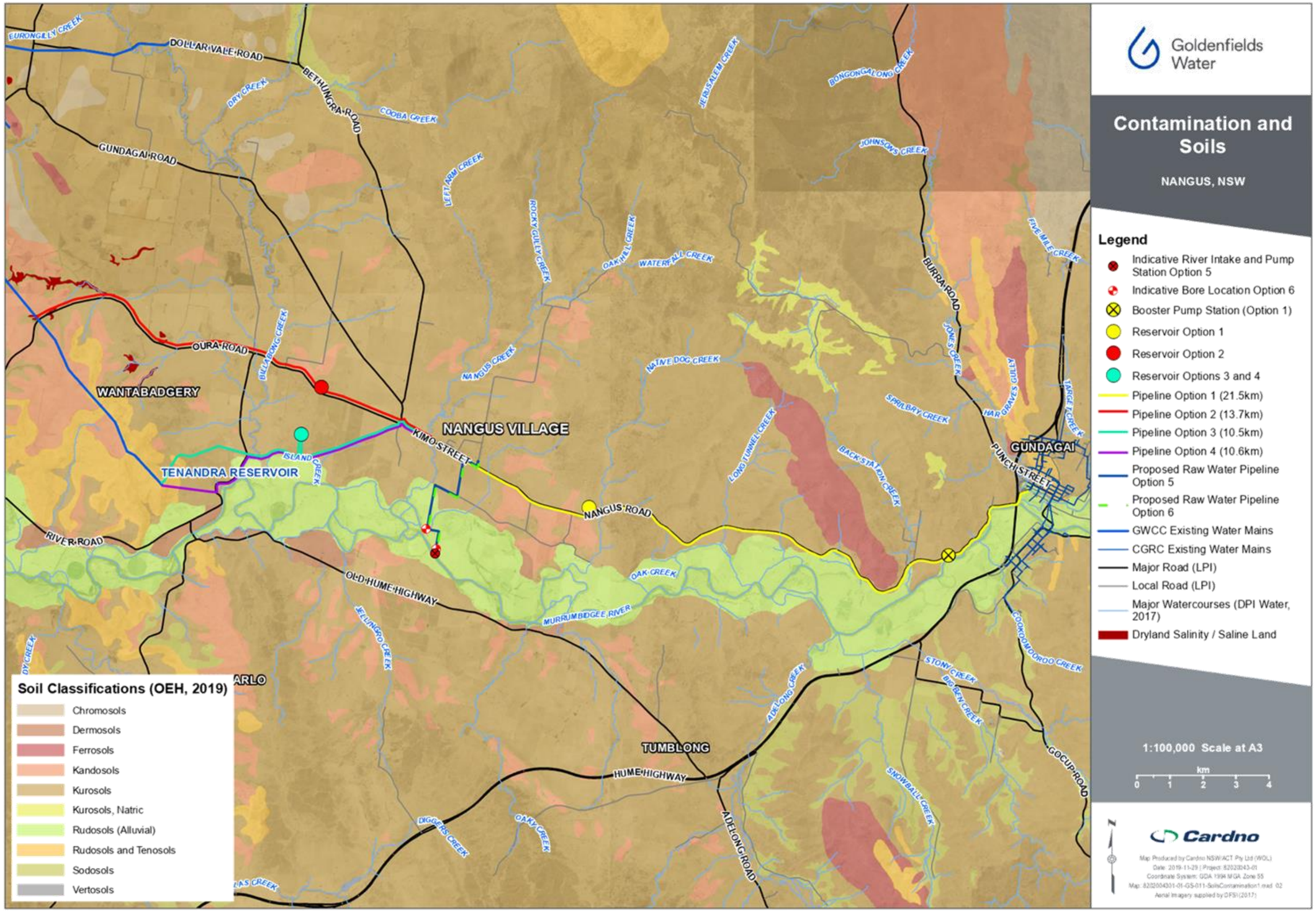
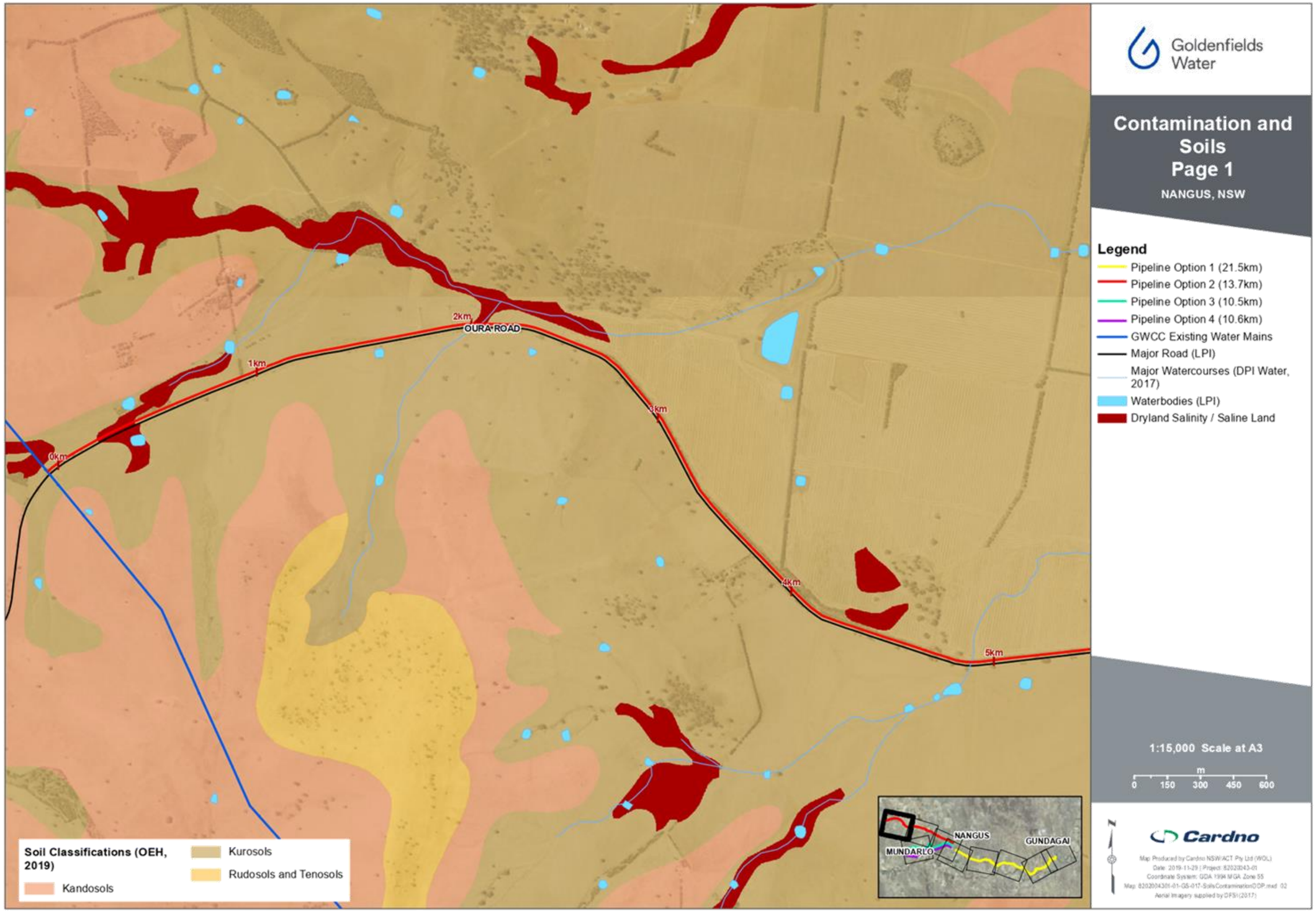
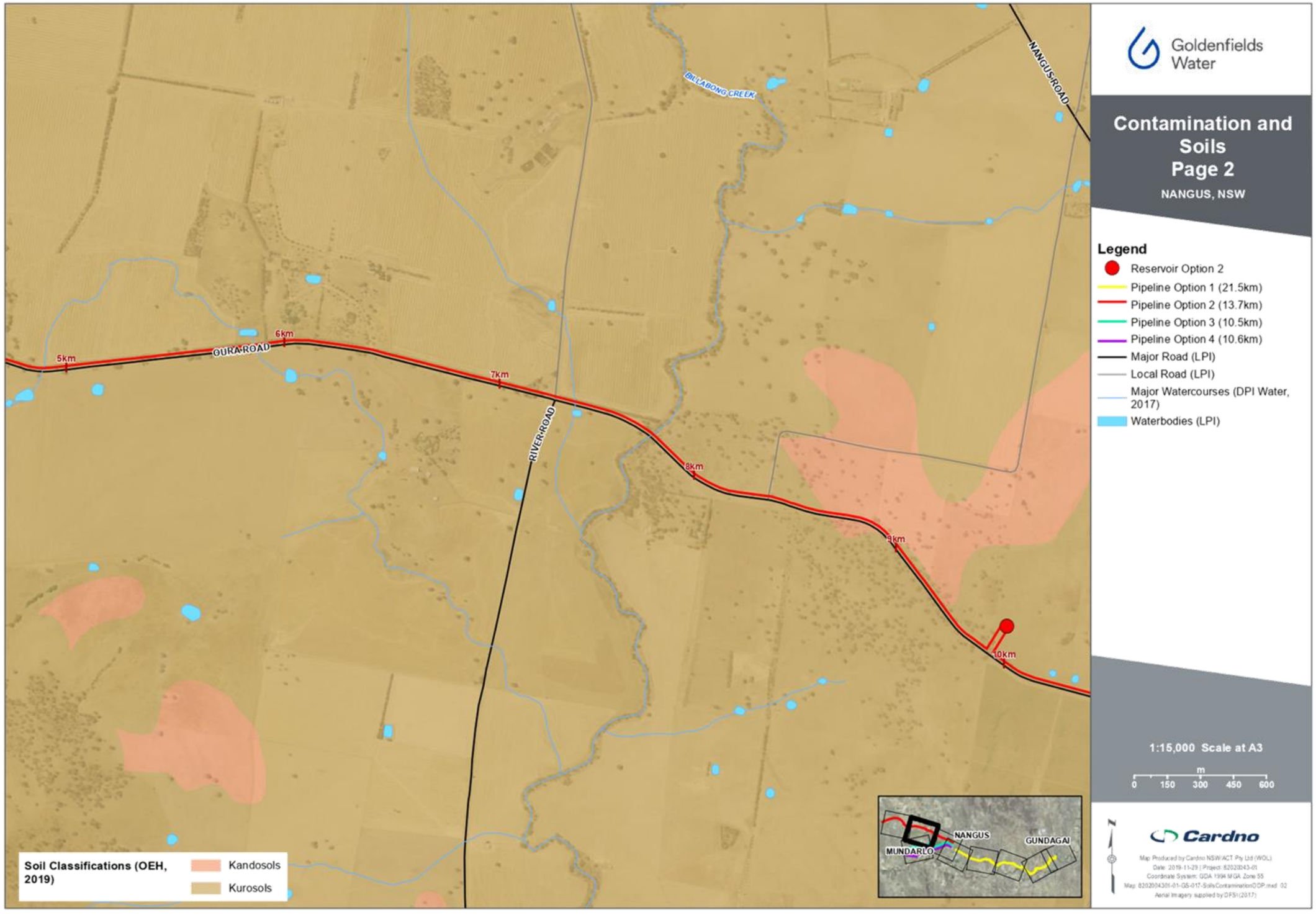
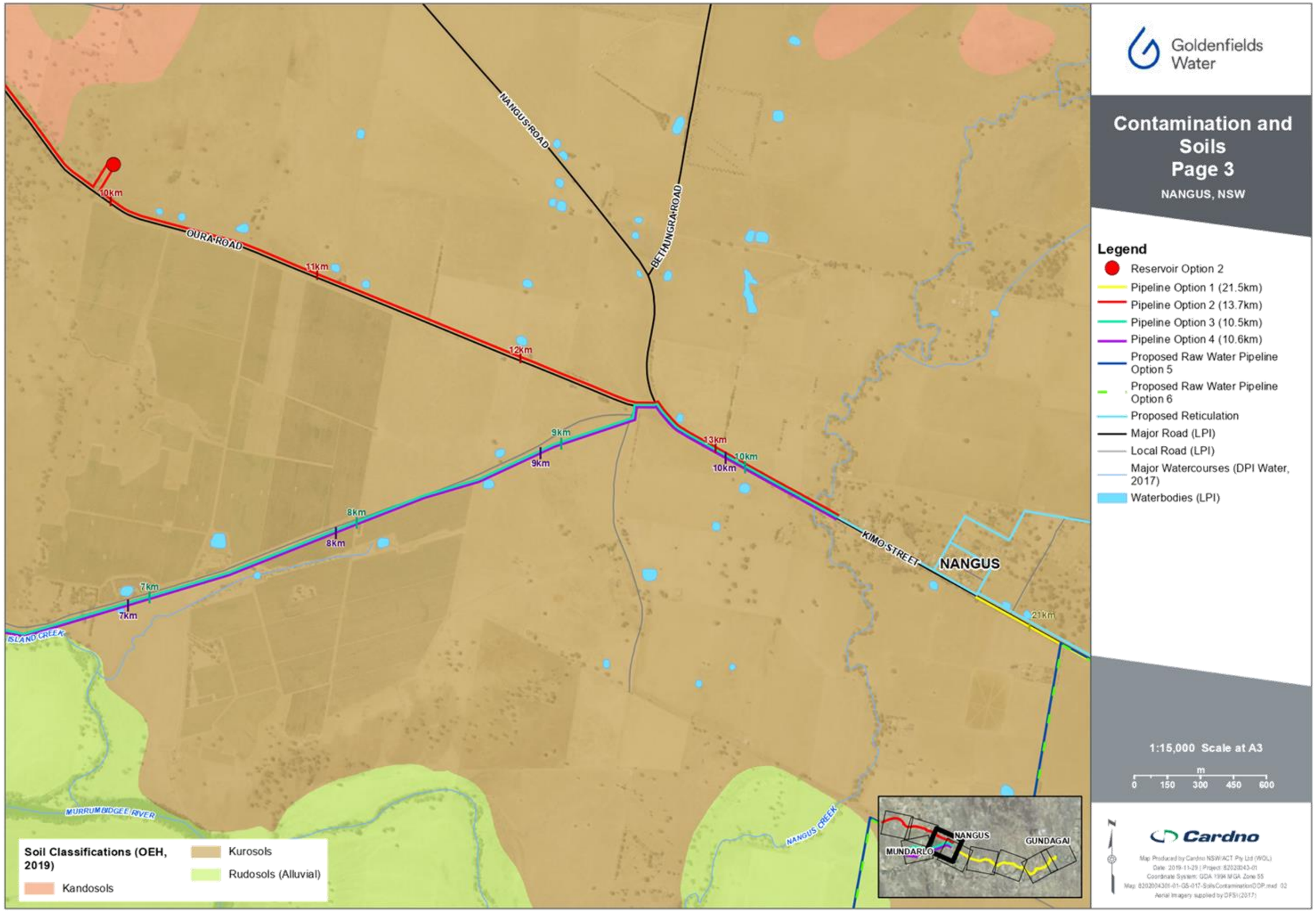
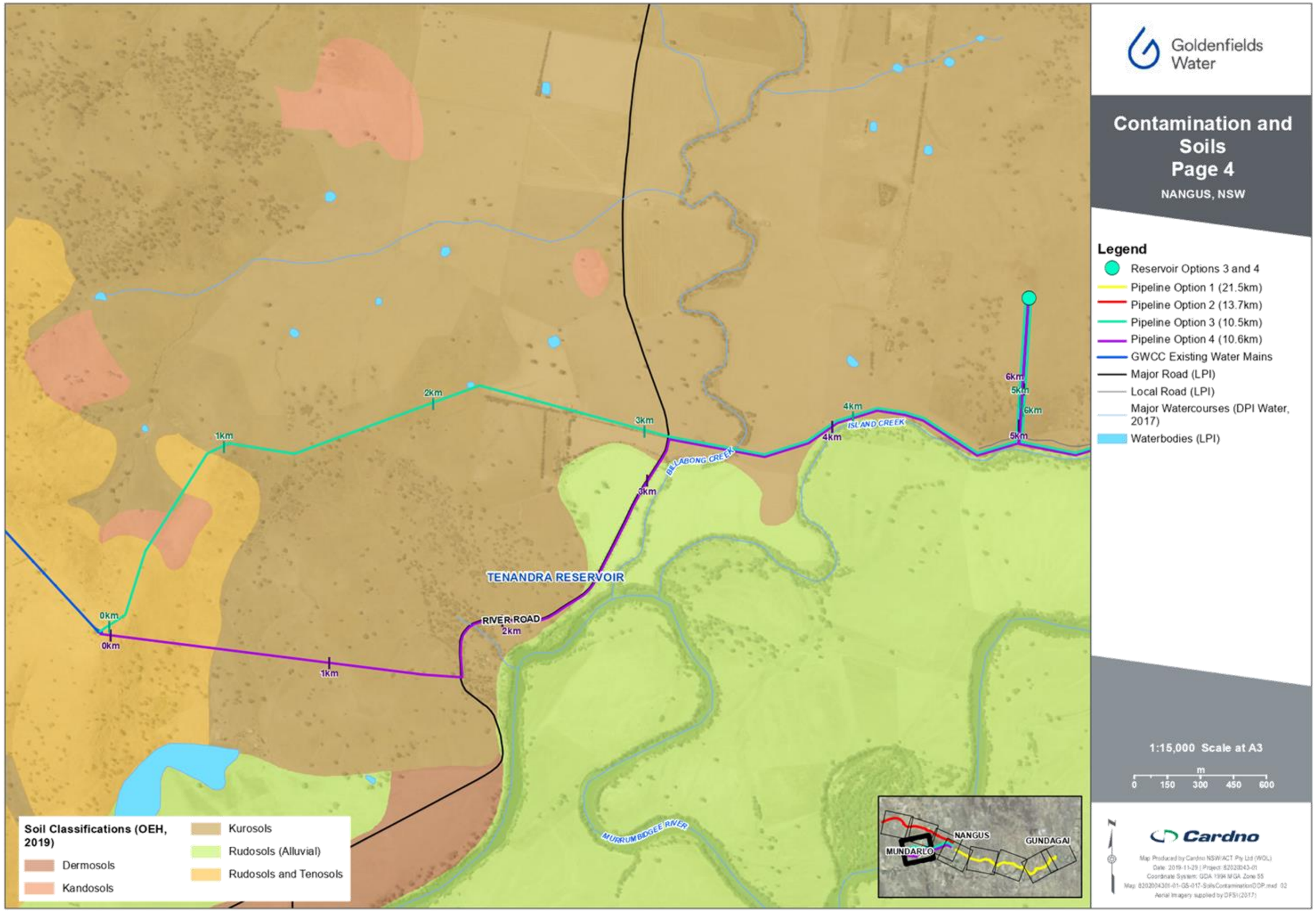

Goldenfields Water
Zoning and Land Use Page 9
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Zoning (DPE, July 2019)
B2 - Local Centre
B4 - Mixed Use
IN1 - General Industrial
R1 - General Residential
R3 - Medium Density Residential
R5 - Large Lot Residential
RE2 - Private Recreation
RU1 - Primary Production
RU4 - Primary Production Small Lots
SP1 - Special Activities
SP3 - Tourist
W1 - Natural Waterways
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043301-01-GIS-019-ZoningDOP.mxd 02
Aerial imagery supplied by DFSI (2017)
BURRA ROAD
HUME HIGHWAY
WEST STREET
TARGET CREEK
SP1
IN1
R5
R1
JONES CREEK
PUNCH STREET
R3
RU1
GUNDAGAI
SHERIDAN STREET
SP3
0km
B2
HOMER STREET
MORLEYS CREEK
NANGUS ROAD
1km
MURRUMBIDGEE RIVER
RE2
W1
MIDDLETON DRIVE
MOUNT STREET
BRUNGLE ROAD
SLATE QUARRY CREEK
MIDDLE STREET
B4
NANGUS
GUNDAGAI
MUNDARLO


Goldenfields Water
Contamination and Soils
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Dryland Salinity / Saline Land
Soil Classifications (OEH, 2019)
Chromosols
Dermosols
Ferrosols
Kandosols
Kurosols
Kurosols, Natric
Rudosols (Alluvial)
Rudosols and Tenosols
Sodosols
Vertosols
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-011-SoilsContamination1.mxd 02
Aerial Imagery supplied by DFSI (2017)
DOLLAR VALE ROAD
BETHUNGRA ROAD
GUNDAGAI ROAD
OURA ROAD
WANTABADGERY
NANGUS VILLAGE
KIMO STREET
TENANDRA RESERVOIR
NANGUS ROAD
RIVER ROAD
OLD HUME HIGHWAY
TUMBLONG
HUME HIGHWAY
ADELONG ROAD
BURRA ROAD
PUNCH STREET
GUNDAGAI
GOCUP ROAD
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAKWELL CREEK
WATERFALL CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
FIVE MILE CREEK
BULLABONG CREEK
NANGUS CREEK
NATIVE DOG CREEK
JONES CREEK
HAR GRAVES GULLY
SPRILBRY CREEK
LARGE CREEK
LONG TUNNEL CREEK
BACK STATION CREEK
ISLAND CREEK
OAK CREEK
MURRUMBIDGEE RIVER
JELLINGROO CREEK
DIGGERS CREEK
SNOWBALL CREEK
STONY CREEK
BIGGEN CREEK
COOKSAMPOOROO CREEK


Goldenfields Water
Contamination and Soils Page 1
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Dryland Salinity / Saline Land
0km
1km
2km
3km
4km
5km
OURA ROAD
Soil Classifications (OEH, 2019)
Kandosols
Kurosols
Rudosols and Tenosols
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-017-SoilsContaminationDP.mxd 02
Aerial imagery supplied by DFSI (2017)


Goldenfields Water
Contamination and Soils Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km
Soil Classifications (OEH, 2019)
Kandosols
Kurosols
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020843-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020843-01-GS-017-SoilsContaminationDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)


Goldenfields Water
Contamination and Soils Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
NANGUS
ISLAND CREEK
MURRUMBIDGEE RIVER
NANGUS CREEK
10km
11km
12km
13km
9km
8km
7km
21km
Soil Classifications (OEH, 2019)
Kandosols
Kurosols
Rudosols (Alluvial)
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno


Goldenfields Water
Contamination and Soils Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
TENANDRA RESERVOIR
RIVER ROAD
BILLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
0km
1km
2km
3km
4km
5km
6km
Soil Classifications (OEH, 2019)
Dermosols
Kandosols
Kurosols
Rudosols (Alluvial)
Rudosols and Tenosols
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
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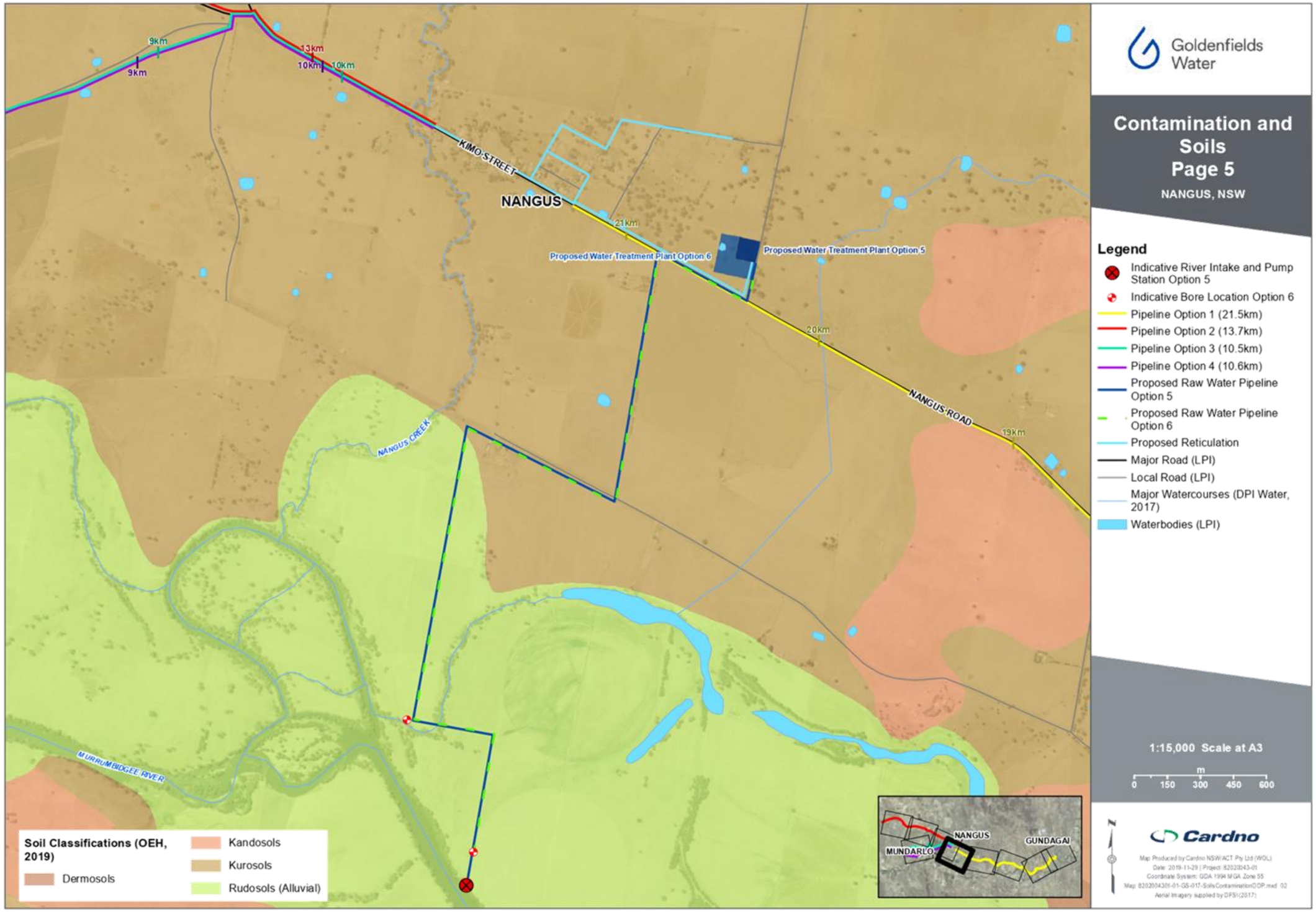
9km
9km
13km
10km
10km
KIMO STREET
NANGUS
21km
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
20km
NANGUS ROAD
19km
NANGUS CREEK
MURRUMBIDGEE RIVER
Soil Classifications (OEH, 2019)
Dermosols
Kandosols
Kurosols
Rudosols (Alluvial)
MUNDARLO
NANGUS
GUNDAGAI
Goldenfields Water
Contamination and Soils
Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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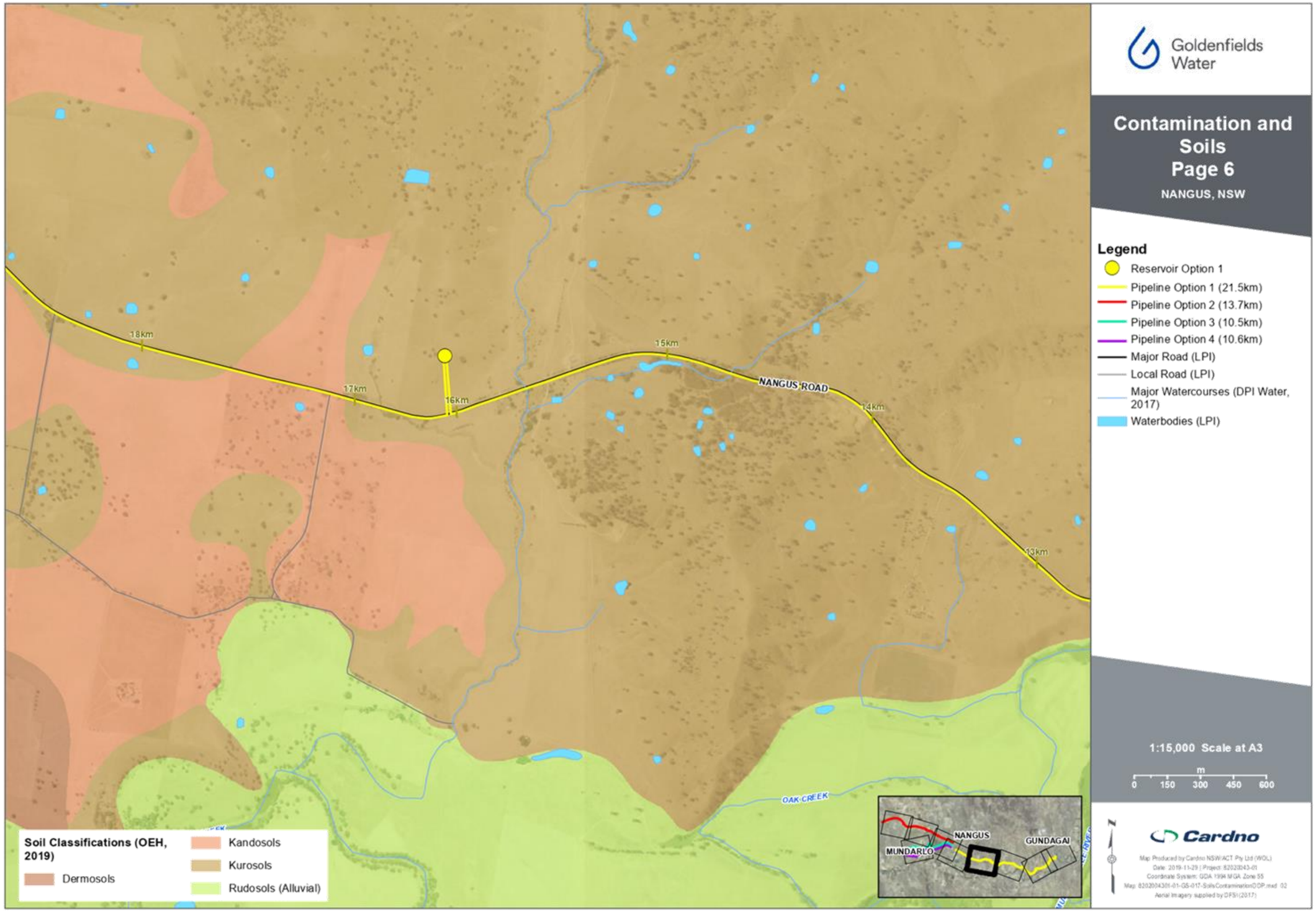
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-017-SoilsContaminationDDP.mxd 02
Aerial Imagery supplied by DPSI (2017)


Goldenfields Water
Contamination and Soils
Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
18km
17km
16km
15km
14km
13km
NANGUS ROAD
OAK CREEK
Soil Classifications (OEH, 2019)
Dermosols
Kandosols
Kurosols
Rudosols (Alluvial)
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
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Date: 2019-11-29 (Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
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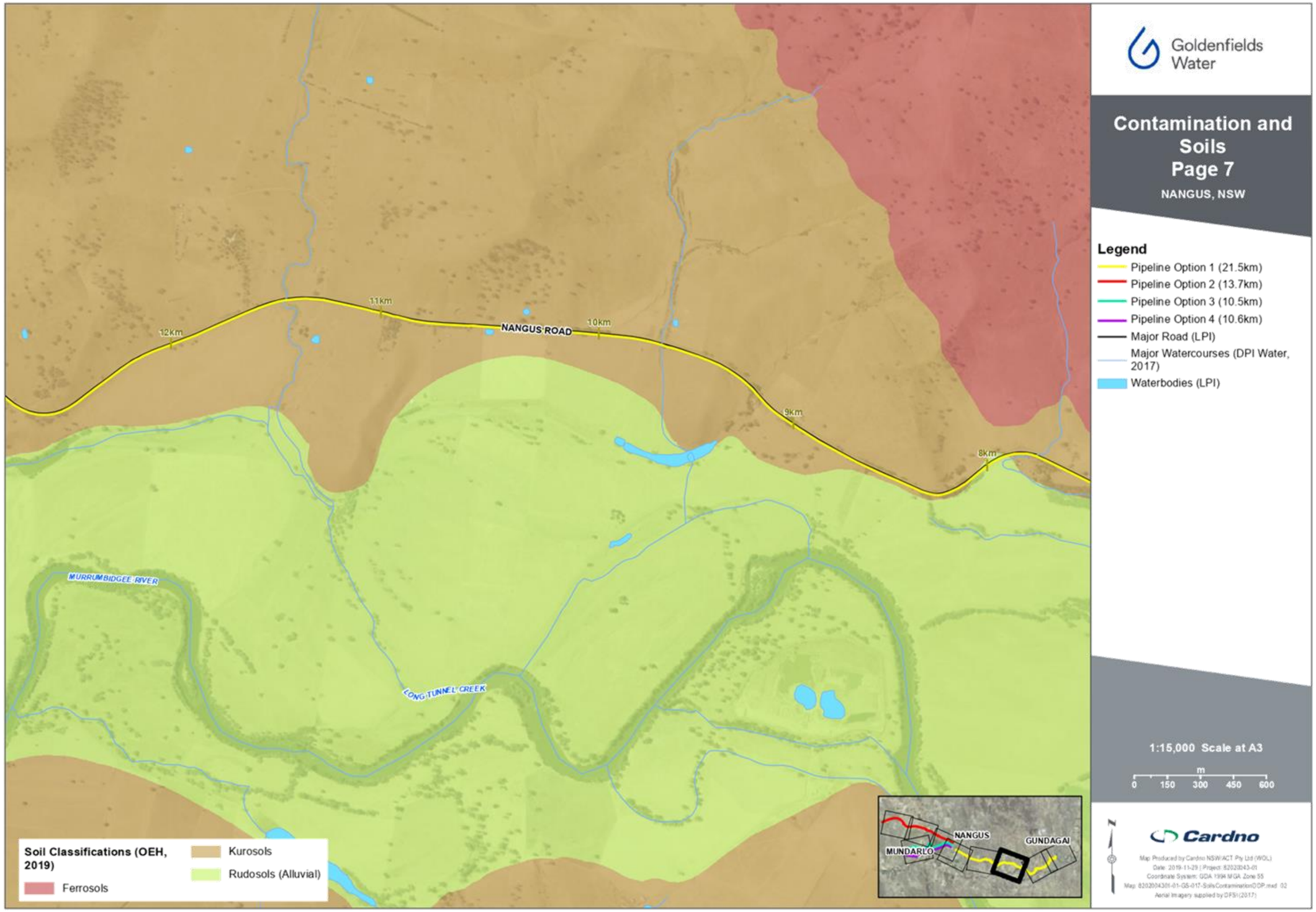
Goldenfields Water
Contamination and Soils
Page 7
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
NANGUS ROAD
12km
11km
10km
9km
8km
MURRUMBIDGEE RIVER
LONG TUNNEL CREEK
Soil Classifications (OEH, 2019)
Ferrosols
Kurosols
Rudosols (Alluvial)
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
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Cardno
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Date: 2019-11-29 | Project: 82020343-01
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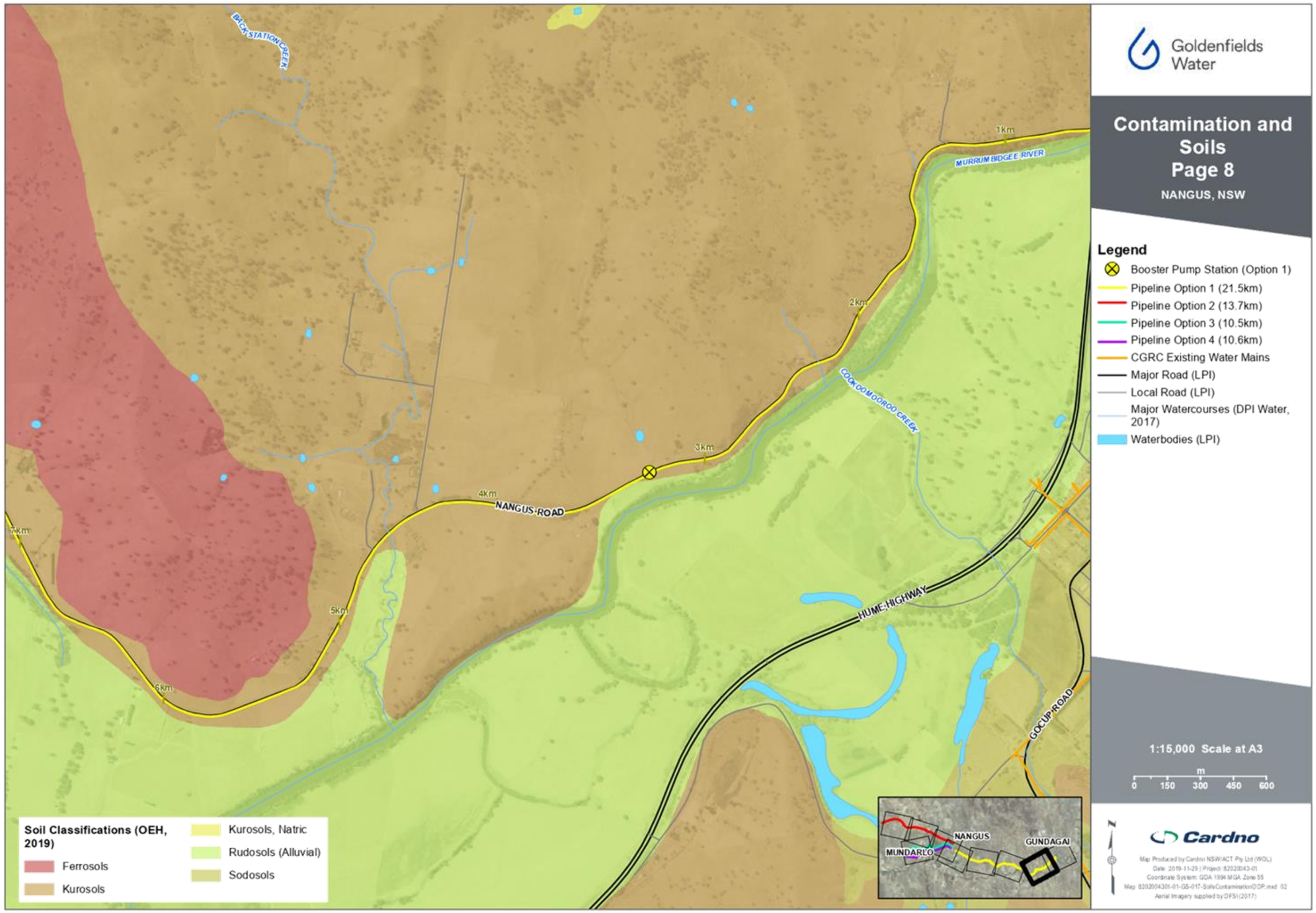
Aerial Imagery supplied by DFSI (2017)


Goldenfields Water
Contamination and Soils
Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
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Cardno
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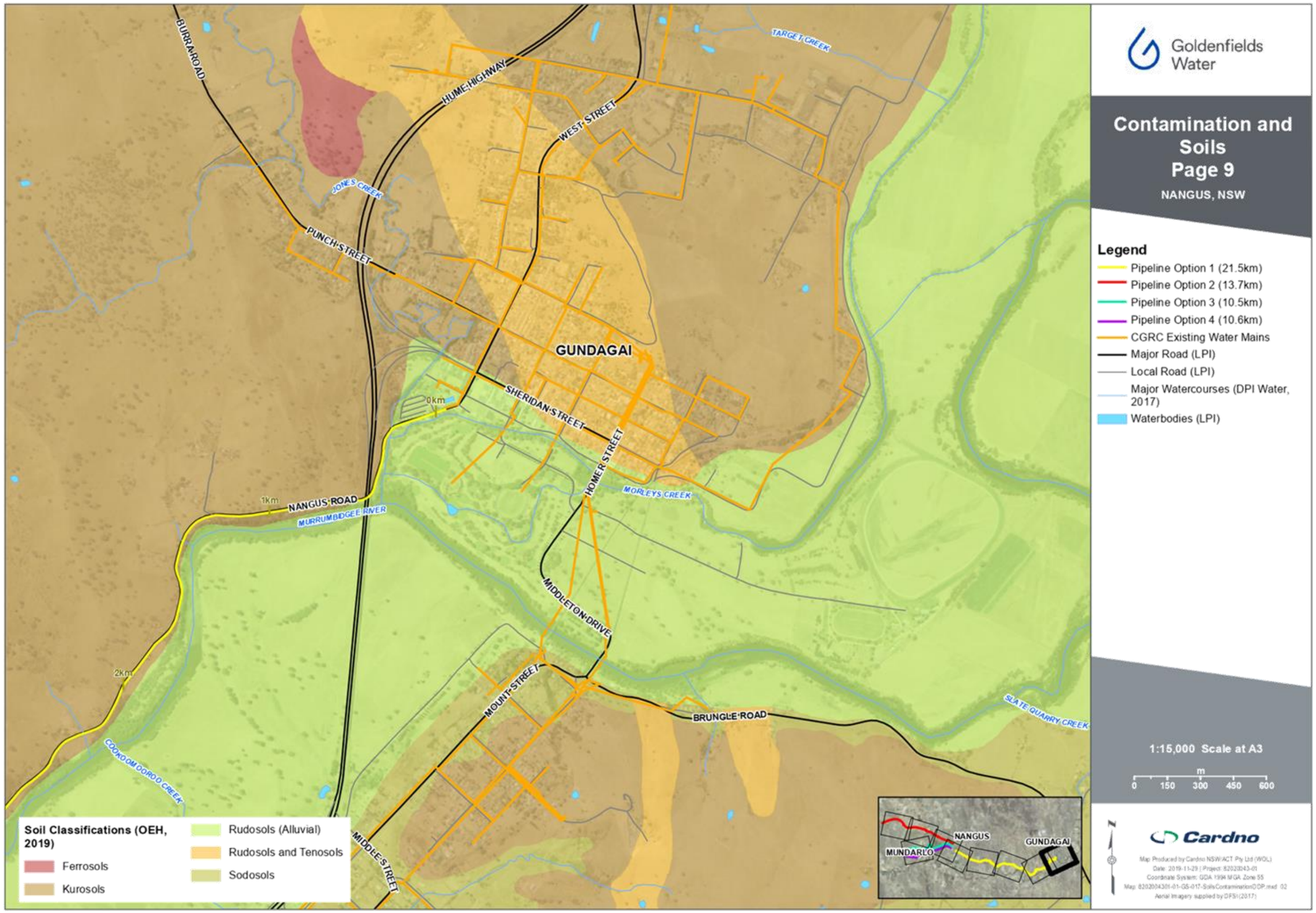
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043-01-GS-017-SoilsContaminationDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)
BACK STATION CREEK
MURRUMBIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
NANGUS
MUNDARLO
GUNDAGAI
Soil Classifications (OEH, 2019)
Ferrosols
Kurosols
Kurosols, Natric
Rudosols (Alluvial)
Sodosols


Goldenfields Water
Contamination and Soils
Page 9
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
Soil Classifications (OEH, 2019)
Ferrosols
Kurosols
Rudosols (Alluvial)
Rudosols and Tenosols
Sodosols
GUNDAGAI
BURRA ROAD
HUME HIGHWAY
WEST STREET
PUNCH STREET
SHERIDAN STREET
HOMER STREET
NANGUS ROAD
MURRUMBIDGEE RIVER
MIDDLETON DRIVE
MOUNT STREET
BRUNGLE ROAD
MIDDLE STREET
TARGET CREEK
JONES CREEK
MORLEYS CREEK
SLATE QUARRY CREEK
COOKOOMDOROO CREEK
0km
1km
2km
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
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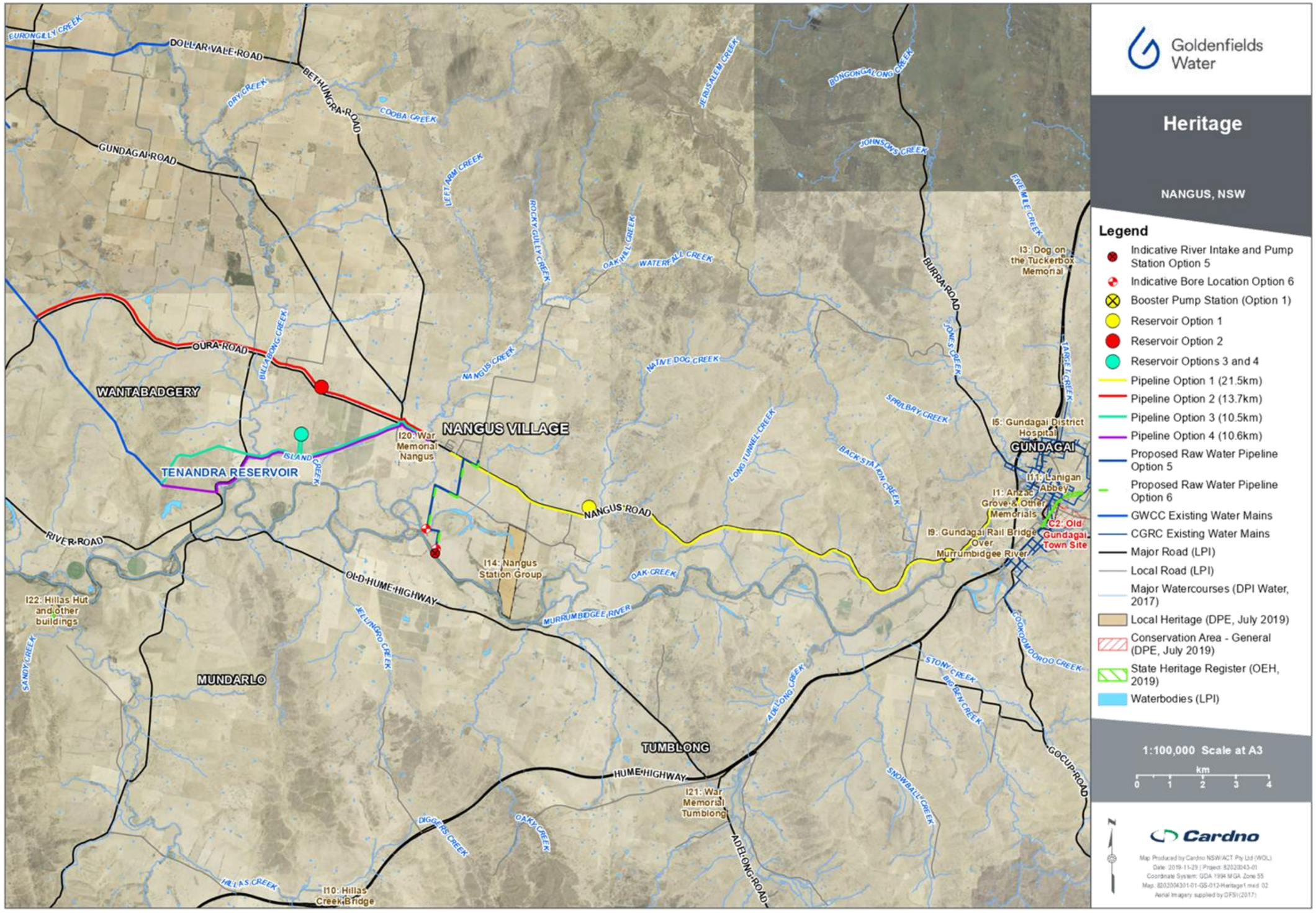
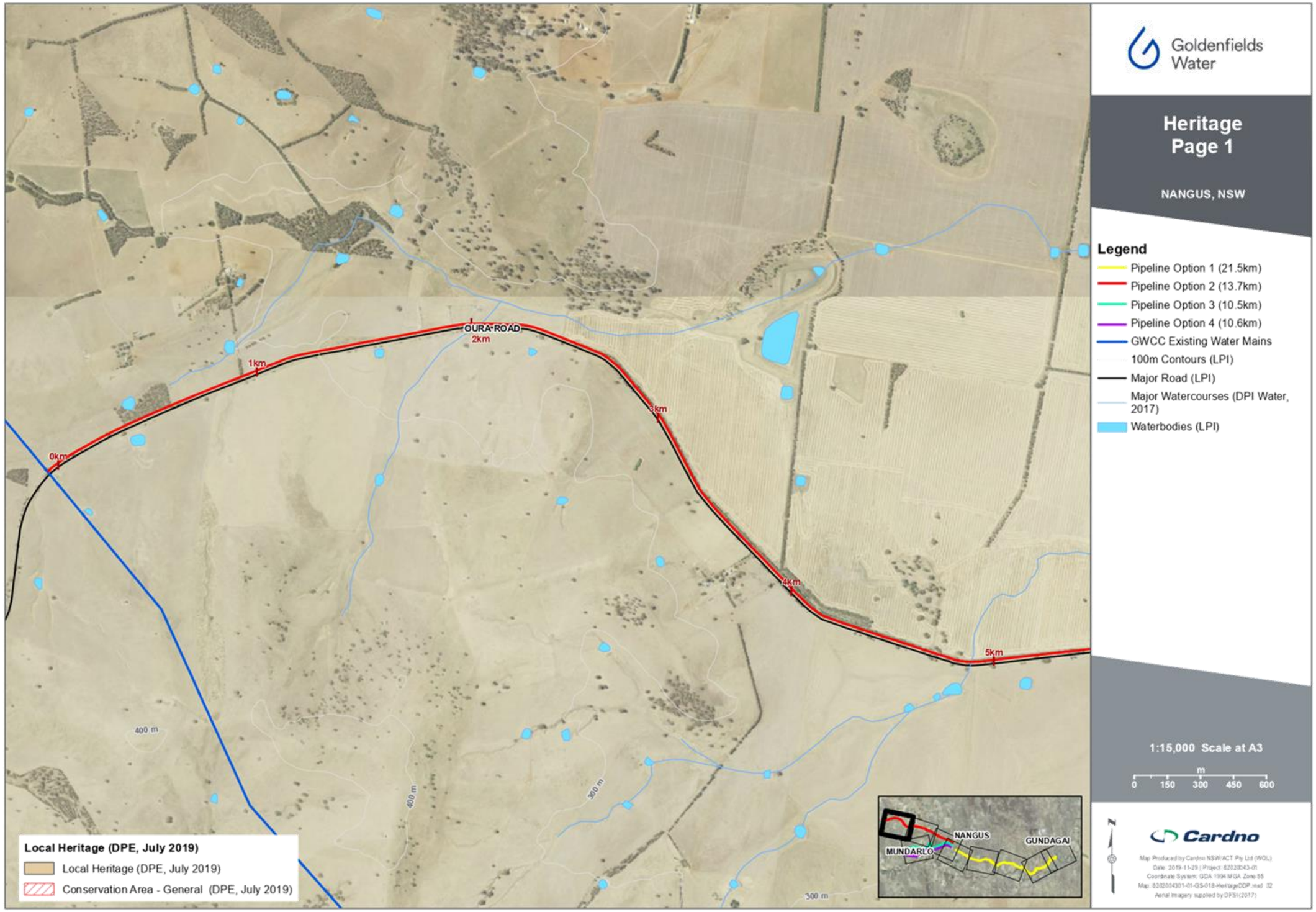
Map: 82028043-01-GS-017-SoilsContaminationDDP.mxd 02
Aerial Imagery supplied by DFSI (2017)


Goldenfields Water
Heritage
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Booster Pump Station (Option 1)
Reservoir Option 1
Reservoir Option 2
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
GWCC Existing Water Mains
CGRC Existing Water Mains
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
State Heritage Register (OEH, 2019)
Waterbodies (LPI)
1:100,000 Scale at A3
km
0 1 2 3 4
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020043301-01-GS-012-Heritage1.mxd 02
Aerial Imagery supplied by DFSI (2017)
WANTABADGERY
NANGUS VILLAGE
TENANDRA RESERVOIR
MUNDARLO
TUMBLONG
GUNDAGAI
DOLLAR VALE ROAD
BETHUNGRA ROAD
GUNDAGAI ROAD
OURA ROAD
NANGUS ROAD
RIVER ROAD
OLD HUME HIGHWAY
HUME HIGHWAY
BURRA ROAD
GOCUP ROAD
ADELONG ROAD
EURONGILLY CREEK
DRY CREEK
COOBA CREEK
LEFT ARM CREEK
ROCKY GULLY CREEK
OAKHILL CREEK
WATERFALL CREEK
JERUSALEM CREEK
BONGONGALONG CREEK
JOHNSONS CREEK
FIVE MILE CREEK
NANGUS CREEK
NATIVE DOG CREEK
JONES CREEK
LARGE LT CREEK
SPRILBRY CREEK
LONG TUNNEL CREEK
BACK STATION CREEK
BULLABONG CREEK
ISLAND CREEK
SANDY CREEK
JELUNGRO CREEK
MURRUMBIDGEE RIVER
OAK CREEK
ADELONG CREEK
STONY CREEK
BIGGEN CREEK
COOMBOOROO CREEK
SNOWBALL CREEK
DIGGERS CREEK
OAKY CREEK
HILLAS CREEK
I1: Anzac Grove & Other Memorials
I2: Old Gundagai Town Site
I3: Dog on the Tuckerbox Memorial
I5: Gundagai District Hospital
I9: Gundagai Rail Bridge Over Murrumbidgee River
I10: Hillas Creek Bridge
I11: Lanigan Abbey
I14: Nangus Station Group
I20: War Memorial Nangus
I21: War Memorial Tumblong
I22: Hillas Hut and other buildings


Goldenfields Water
Heritage Page 1
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
OURA ROAD
0km
1km
2km
3km
4km
5km
400 m
400 m
300 m
300 m
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
MUNDARLO
NANGUS
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
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Coordinate System: GDA 1994 MGA Zone 55
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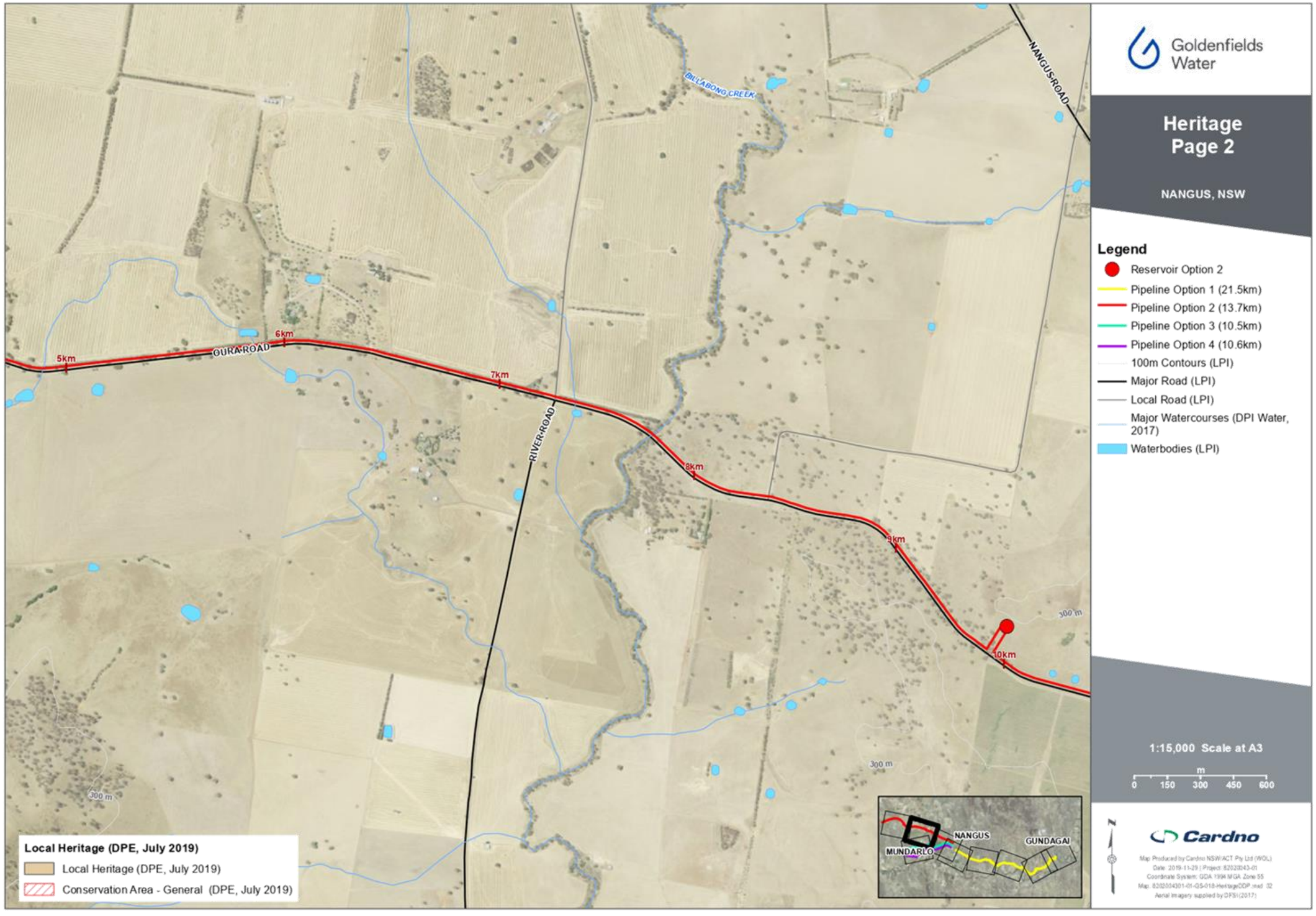
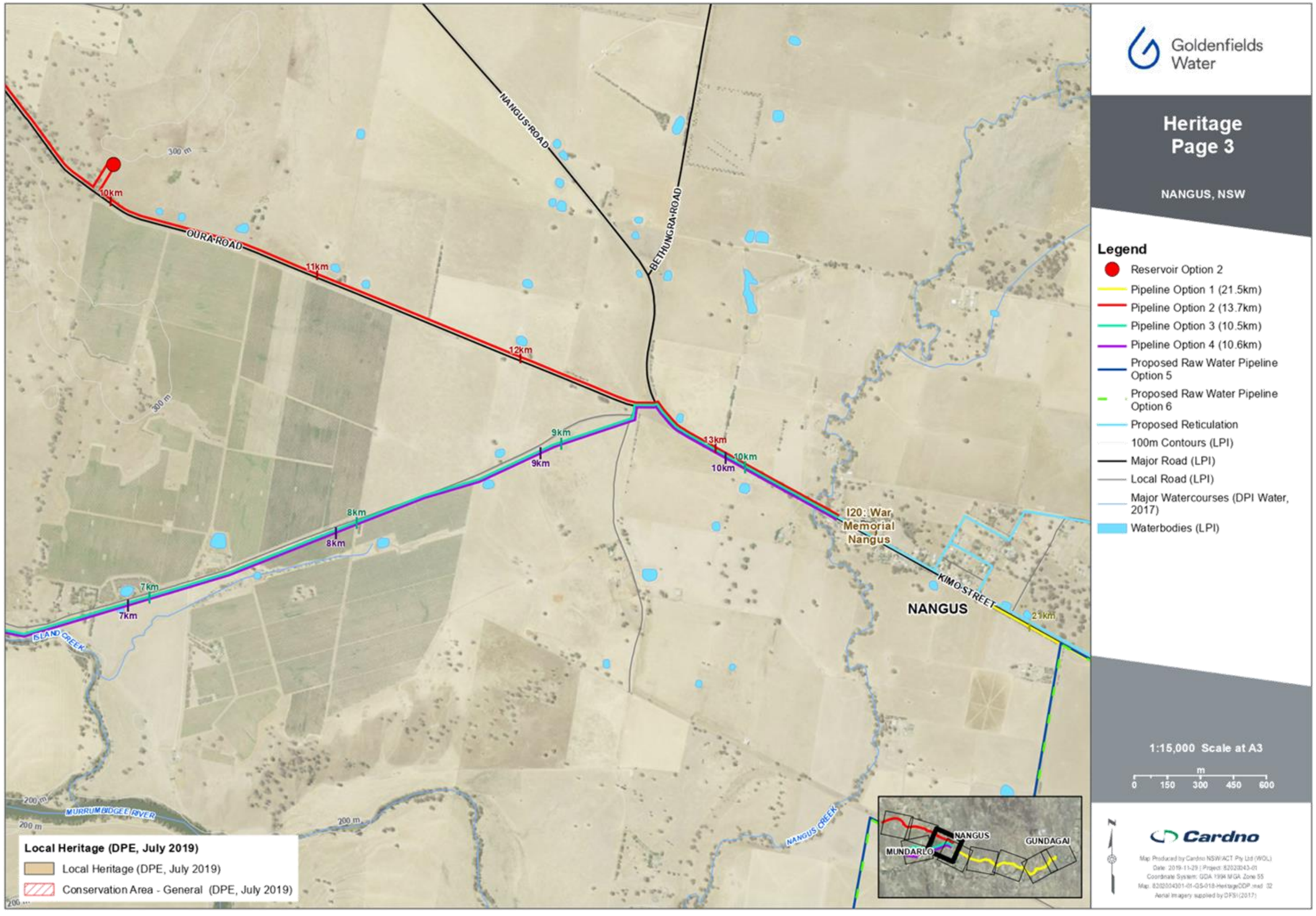
Aerial imagery supplied by DFSI (2017)


Goldenfields Water
Heritage Page 2
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 (Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-018-HeritageDDP.mxd 32
Aerial imagery supplied by DFSI (2017)
BILLABONG CREEK
NANGUS ROAD
OURA ROAD
RIVER ROAD
5km
6km
7km
8km
9km
10km
300 m
MUNDARLO
NANGUS
GUNDAGAI
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)


Goldenfields Water
Heritage Page 3
NANGUS, NSW
Legend
Reservoir Option 2
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
NANGUS ROAD
BETHUNGRA ROAD
OURA ROAD
KIMO STREET
ISLAND CREEK
MURRUMBIDGEE RIVER
NANGUS CREEK
NANGUS
I20: War Memorial Nangus
10km
11km
12km
13km
9km
8km
7km
21km
300 m
200 m
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
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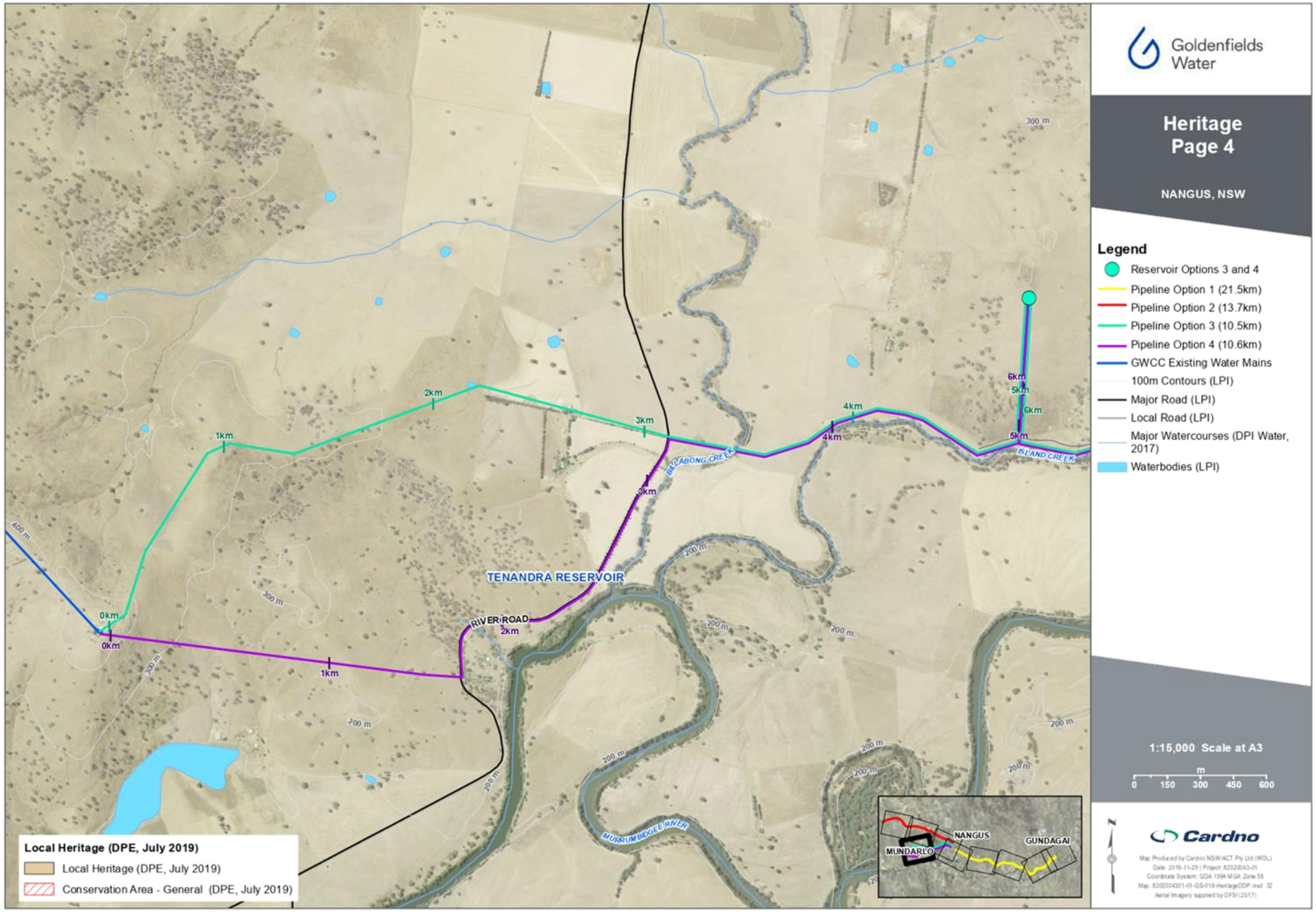
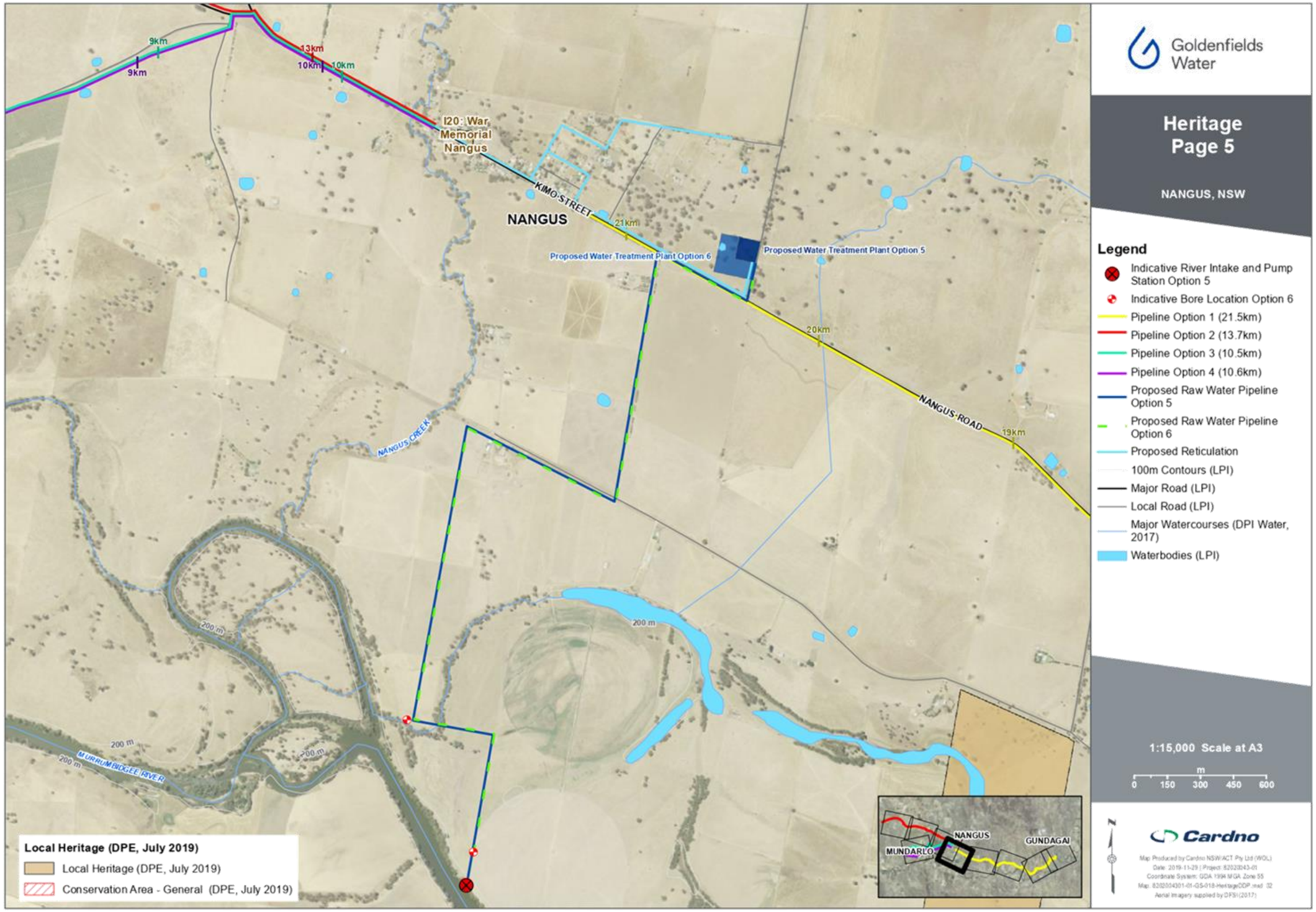

Goldenfields Water
Heritage Page 4
NANGUS, NSW
Legend
Reservoir Options 3 and 4
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
GWCC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
TENANDRA RESERVOIR
RIVER ROAD
BELLABONG CREEK
ISLAND CREEK
MURRUMBIDGEE RIVER
0km
1km
2km
3km
4km
5km
6km
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)


Goldenfields Water
Heritage Page 5
NANGUS, NSW
Legend
Indicative River Intake and Pump Station Option 5
Indicative Bore Location Option 6
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
Proposed Raw Water Pipeline Option 5
Proposed Raw Water Pipeline Option 6
Proposed Reticulation
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
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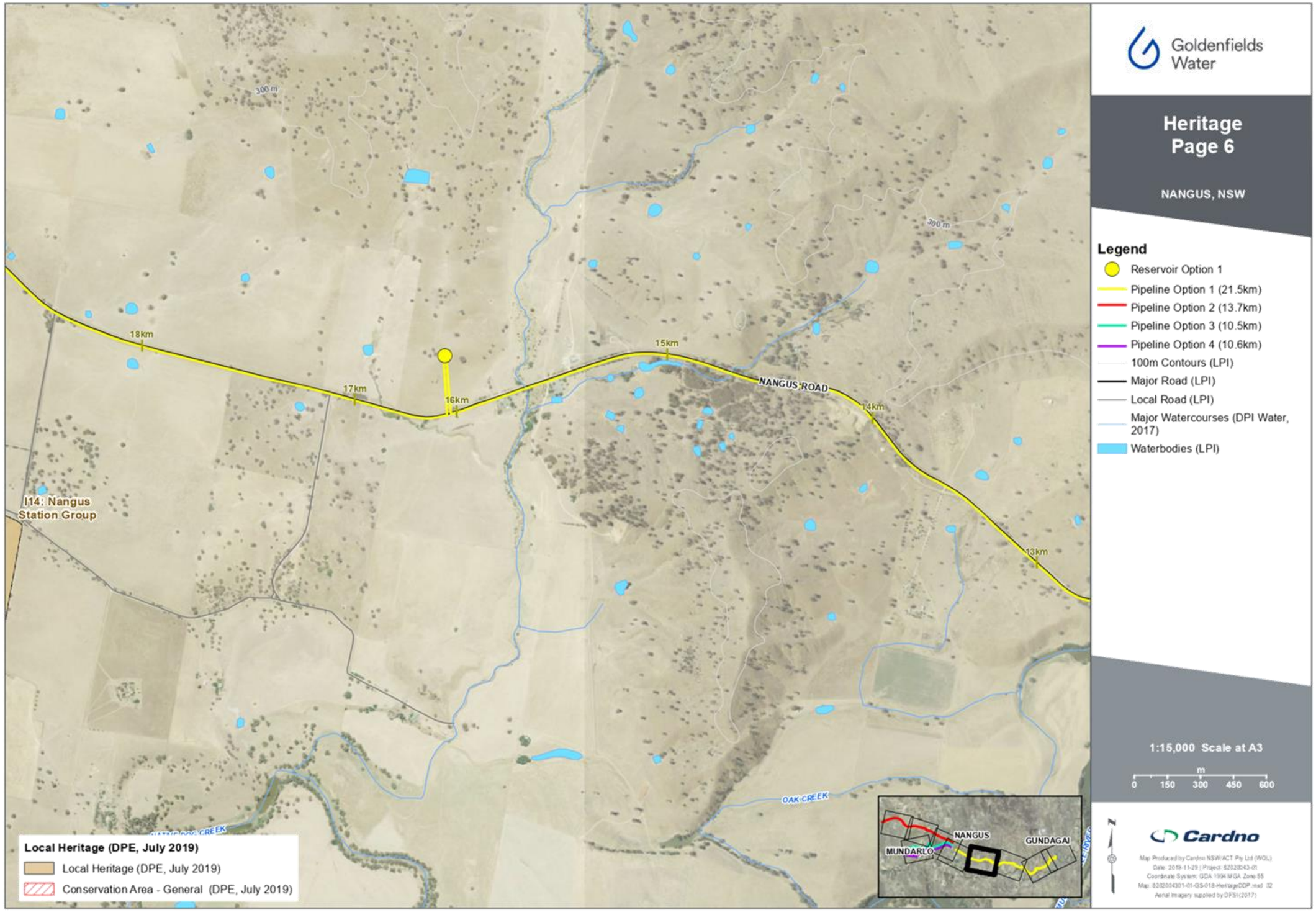
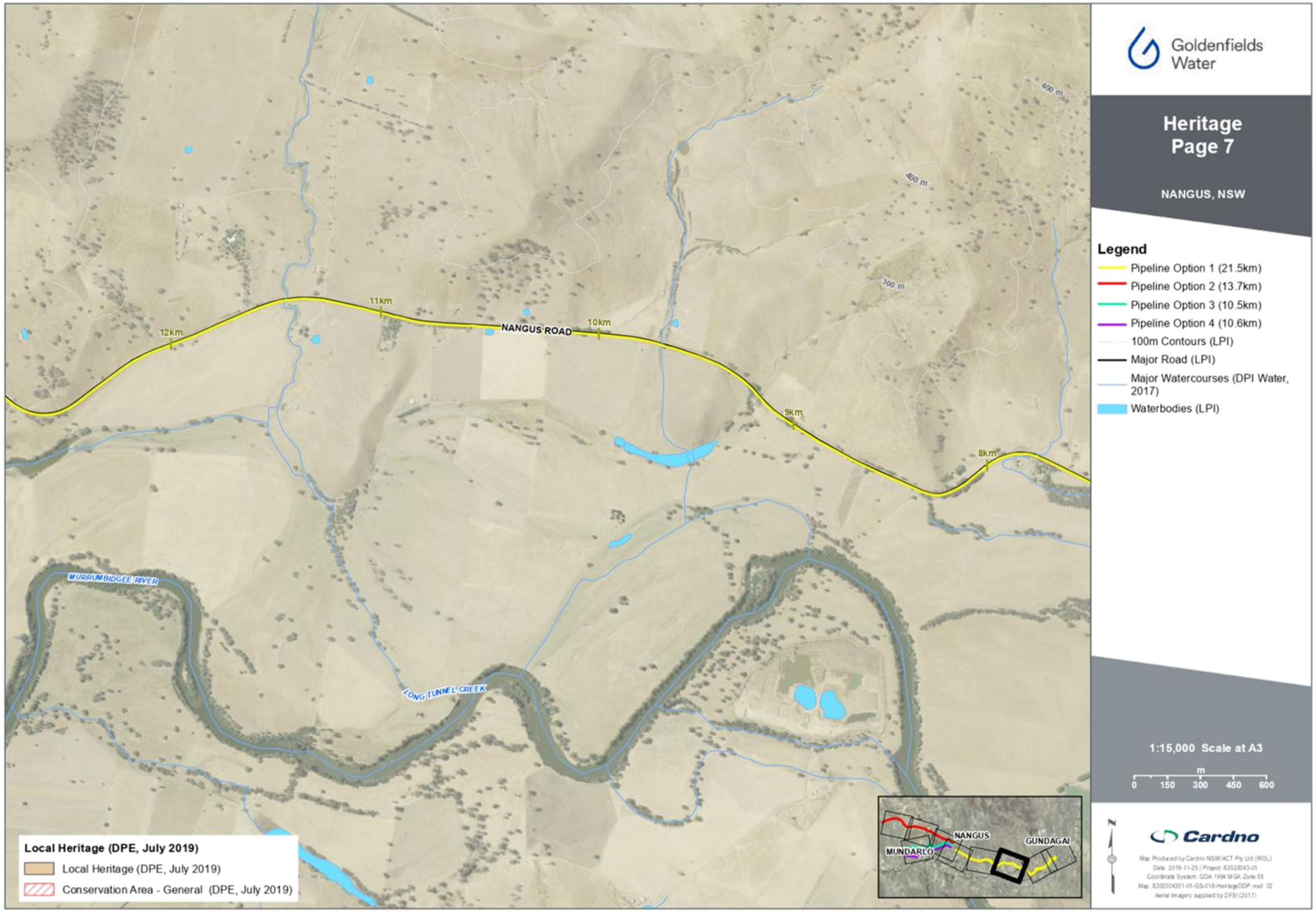
Coordinate System: GDA 1994 MGA Zone 55
Map: 82023043-01-GIS-018-HeritageDDP.mxd 32
Aerial Imagery supplied by DPSI (2017)
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
NANGUS
KIMO STREET
NANGUS ROAD
NANGUS CREEK
MURRUMBIDGEE RIVER
Proposed Water Treatment Plant Option 6
Proposed Water Treatment Plant Option 5
I20: War Memorial Nangus
9km
13km
10km
10km
21km
20km
19km
200 m
MUNDARLO
NANGUS
GUNDAGAI


Goldenfields Water
Heritage Page 6
NANGUS, NSW
Legend
Reservoir Option 1
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
18km
17km
16km
15km
14km
13km
NANGUS ROAD
OAK CREEK
I14: Nangus Station Group
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
NANGUS
MUNDARLO
GUNDAGAI
Cardno


Goldenfields Water
Heritage Page 7
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
100m Contours (LPI)
Major Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
NANGUS ROAD
12km
11km
10km
9km
8km
400 m
300 m
MURRUMBIDGEE RIVER
LONG TUNNEL CREEK
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
NANGUS
MUNDARLO
GUNDAGAI
1:15,000 Scale at A3
m
0 150 300 450 600
N
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GS-018-HeritageDOP.mxd 32
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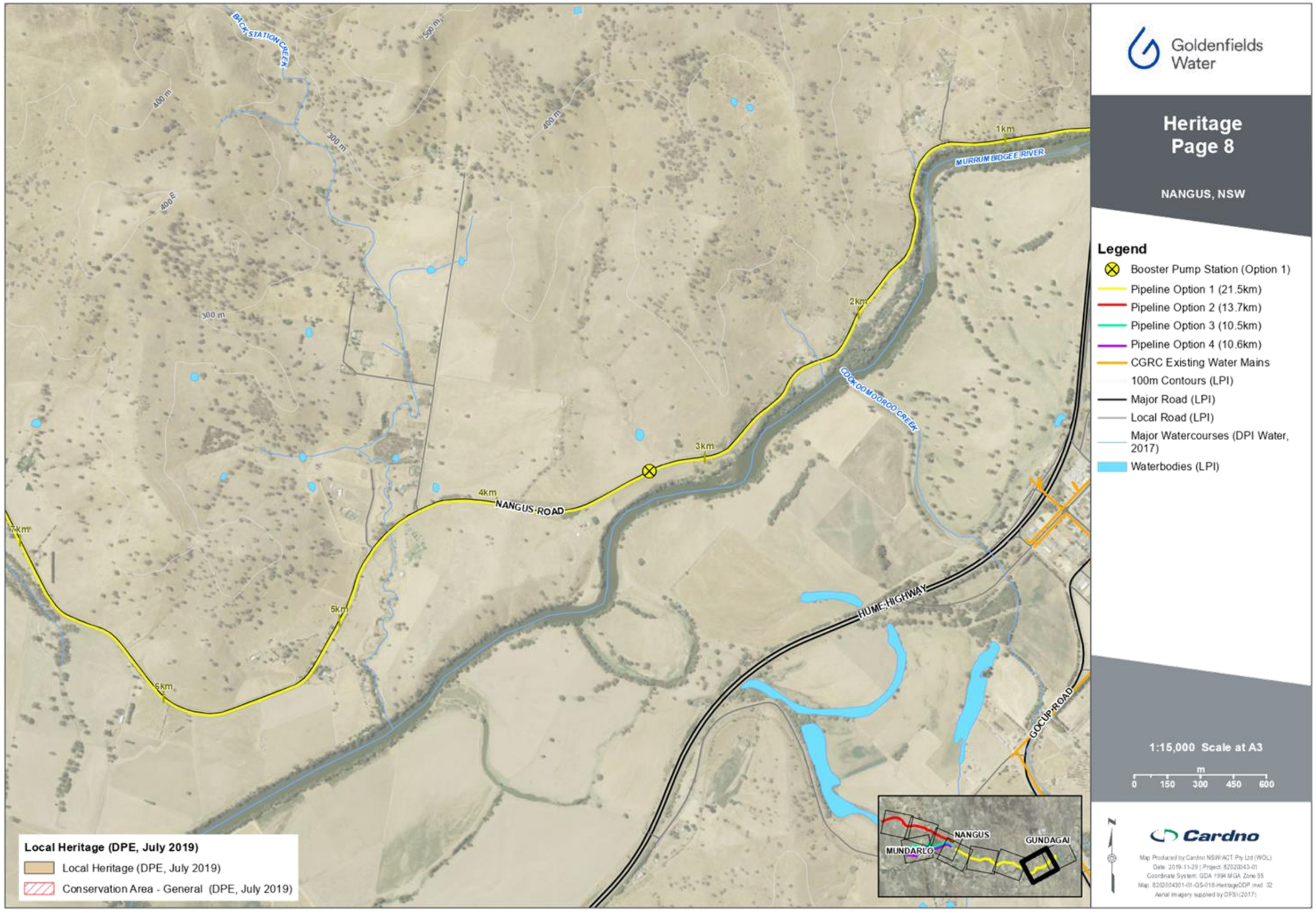
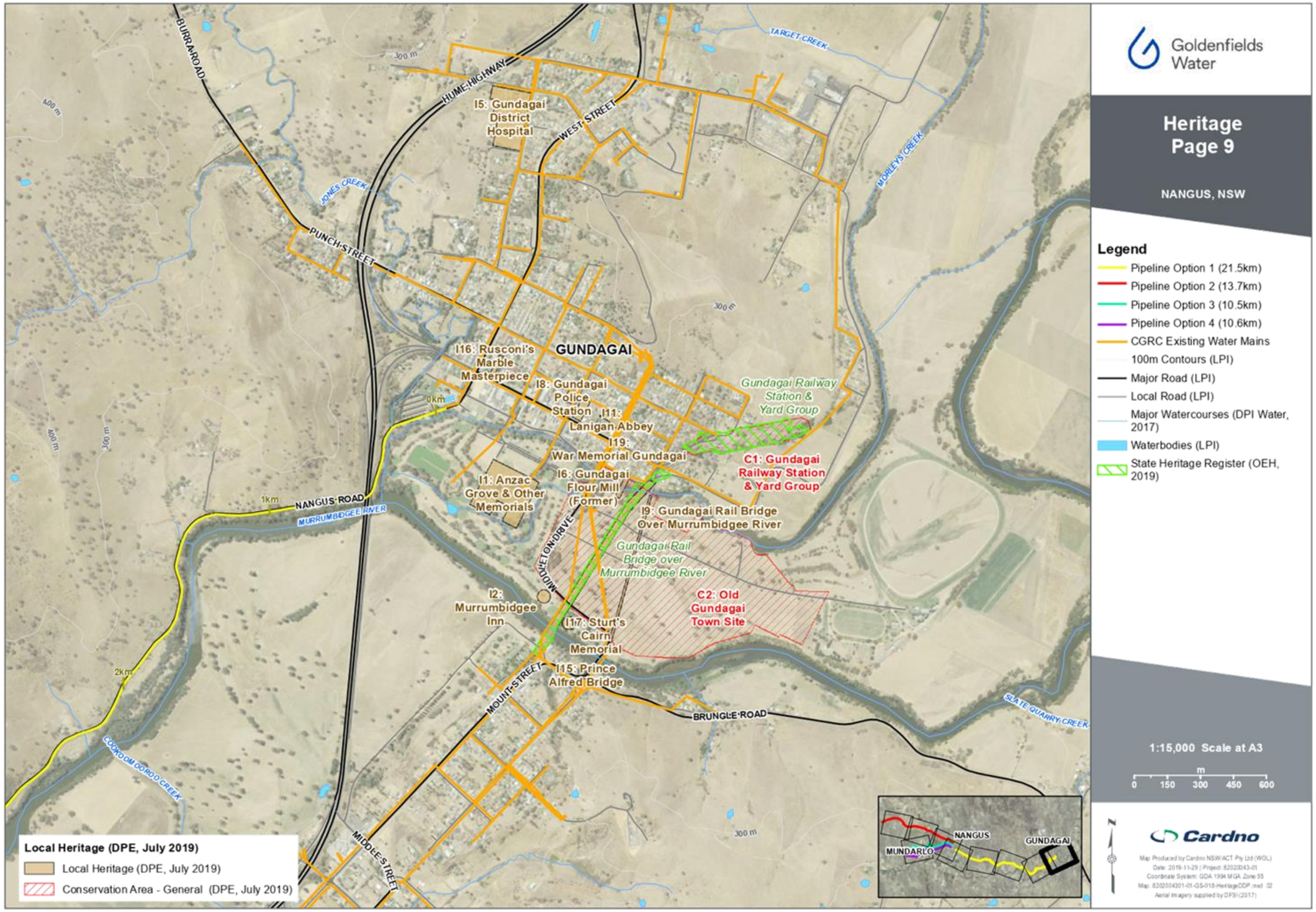

Goldenfields Water
Heritage Page 8
NANGUS, NSW
Legend
Booster Pump Station (Option 1)
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82020343-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82020343-01-GIS-018-HeritageDDP.mxd 32
Aerial imagery supplied by DFSI (2017)
BACK STATION CREEK
MURRUMBIDGEE RIVER
COOKOOMOOROO CREEK
NANGUS ROAD
HUME HIGHWAY
GOCUP ROAD
1km
2km
3km
4km
5km
6km
7km
400 m
300 m
500 m
NANGUS
MUNDARLO
GUNDAGAI
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)


Goldenfields Water
Heritage Page 9
NANGUS, NSW
Legend
Pipeline Option 1 (21.5km)
Pipeline Option 2 (13.7km)
Pipeline Option 3 (10.5km)
Pipeline Option 4 (10.6km)
CGRC Existing Water Mains
100m Contours (LPI)
Major Road (LPI)
Local Road (LPI)
Major Watercourses (DPI Water, 2017)
Waterbodies (LPI)
State Heritage Register (OEH, 2019)
1:15,000 Scale at A3
m
0 150 300 450 600
Cardno
Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-11-29 | Project: 82028043-01
Coordinate System: GDA 1994 MGA Zone 55
Map: 82028043-01-GS-018-HeritageDPE.mxd 32
Aerial Imagery supplied by DFSI (2017)
BURRA ROAD
HUME HIGHWAY
TARGET CREEK
WEST STREET
MORLEYS CREEK
JONES CREEK
PUNCH STREET
I5: Gundagai District Hospital
GUNDAGAI
I16: Rusconi's Marble Masterpiece
I8: Gundagai Police Station
I11: Lanigan Abbey
I19: War Memorial Gundagai
Gundagai Railway Station & Yard Group
C1: Gundagai Railway Station & Yard Group
I1: Anzac Grove & Other Memorials
I6: Gundagai Flour Mill (Former)
I9: Gundagai Rail Bridge Over Murrumbidgee River
Gundagai Rail Bridge over Murrumbidgee River
MIDDLETON DRIVE
I2: Murrumbidgee Inn
C2: Old Gundagai Town Site
I17: Sturt's Cairn Memorial
I15: Prince Alfred Bridge
MOUNT STREET
BRUNGLE ROAD
SLATE QUARRY CREEK
NANGUS ROAD
MURRUMBIDGEE RIVER
COOROOMOOROO CREEK
MIDDLE STREET
0km
1km
2km
300 m
400 m
Local Heritage (DPE, July 2019)
Local Heritage (DPE, July 2019)
Conservation Area - General (DPE, July 2019)
NANGUS
GUNDAGAI
MUNDARLO

APPENDIX C

WATER TREATMENT OPTIONS

Surface and Groundwater Treatment Options

Nangus Water Supply Feasibility Study

8202004301-R02-V01

Prepared for
Goldenfields Water County Council

29 November 2019

Cardno

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Document Information

Prepared for	Goldenfields Water County Council
Project Name	Nangus Water Supply Feasibility Study
File Reference	Nangus Water Supply Treatment Options V01.docx
Job Reference	8202004301-R02-V01
Date	29 November 2019
Version Number	V01

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Effective Date 27/11/2019

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Date Approved 27/11/2019

Document History

Version	Effective Date	Description of Revision	Prepared by	Reviewed by
V01	27/11/2019	V01 for Client Review	PG	JK

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1 Introduction

Cardno has evaluated two standalone water source and treatment options as part of the Nangus Water Supply Feasibility Study.

Option 5 proposes a treatment plant designed to extract water from the Murrumbidgee River and treat it to provide potable water to Nangus that meets the Australian Drinking Water Guidelines and the draft Heath-based Targets (NHRMC, 2018).

Option 6 proposes a treatment plant designed to take water from local groundwater bores and treat it to provide potable water to Nangus that meets the Australian Drinking Water Guidelines and the draft Heath-based Targets (NHMRC, 2018). It is noted that further hydrogeological investigation will be needed to confirm the viability of extraction from local groundwater sources.

2 Source Water Demand Assumptions

The average annual produced water demand is estimated at 80kL/day (29.2ML/yr). The peak daily demand is estimated at 400kL/day.

Process losses in a treatment plant can range from 2% to 30% depending on the type of treatment processes that are employed to achieve the target water quality. This means that there will be greater demand on the source in terms of total and instantaneous flows. The estimated source demands for each of the options is included with each specific source assessment.

3 Source Water Quality Assumptions

3.1 Microbiological Risks– Health Based Treatment Targets

The microbiological risks of drinking water sources and the treatment requirements to mitigate those risks are described in the draft Chapter 5 of the Australian Drinking Water Guidelines (NHMRC, 2018) and the Water Services Association of Australia (WSAA) – Manual for the Application of Health Based Targets for Drinking-Water Safety (September 2015).

Table 3-1 is reproduced from the 'draft Chapter 5 Microbial Quality of Drinking Water' of the ADWGs (NHMRC, 2018), and provides descriptions of the Category classifications and treatment requirements for various types of raw water sources.

Table 3-1 Treatment targets for protozoa, bacteria and viruses given the source water type and *E. coli* results (NHMRC, 2018)

Source water category classification	Source water type	Maximum *E. coli* results from raw water monitoring (number/100mL)	LRV target to achieve 10^{-6} DALYs per person per year (1)			Indicative specified treatment technologies (Assuming well designed, highly controlled, managed and monitored system)
			Protozoa	Virus	Bacteria	
Category 1	Fully protected surface water or groundwater	<20 (*E. coli* band 1)	0	0	4	Chlorination
Category 2	Groundwater or surface water with moderate levels of protection	20 to 2000 (2) (*E. coli* band 2)	3	4	4	Direct filtration and chlorination
Category 3	Groundwater or surface water with poor levels of protection		4	5	5	Conventional filtration and chlorination
Category 4	Unprotected surface water	2001 to 20,000 (*E. coli* band 3)	5	6	6	Conventional filtration and UV and chlorination

(1) Note that these values are based on estimation from first principles using QMRA

(2) Maximum E. coli results for raw water monitoring for source water Categories 2 and 3 are within the same range and distinguishing between these two categories is confirmed based on the results of a vulnerability assessment.

3.1.2 Murrumbidgee River Surface Water Source

The Murrumbidgee River would be the most suitable source in the locality to provide a reliable surface water supply to Nangus.

While a formal source categorisation has not been carried out, we have assumed the Murrumbidgee River is an unprotected surface water source with a microbiological risk assessment of Category 4. Within the catchment upstream of the river from Nangus there is a significant level of human habitation, including the presence of sewered and unsewered areas, along with discharge of treated sewage and the potential for sewer overflows. The catchment also includes the potential for intensive animal husbandry. These are noted as features of a Category 4 catchment in Table 5.2 of the draft Chapter 5 of the Australian Drinking Water Guidelines (NHMRC, 2018).

3.1.3 Nangus Groundwater Source

The Desktop Hydrogeological Review (Cardno, 2019) has investigated the viability of groundwater resources within a 5km radius around Nangus. Ground water is expected to be found in alluvial aquifers at depths ranging from 5m to 19m.

The Draft Chapter 5 Microbial Quality of Drinking Water (NHMRC, 2018) states that for groundwater a starting point for classification of the source is to "assume a groundwater resource is unprotected until objective, credible scientific evidence can conclusively demonstrate otherwise". In the worst case, if information is not available, the aquifer should be considered to be the same category as the surface water that recharges the aquifer.

Based on evidence that existing bores in the locality are shallow, the recharge source is likely to be the Murrumbidgee River and surface rainfall/runoff. There is not yet any water quality monitoring of the particular source therefore a conservative approach needs to be taken. For these reasons and for the purposes of this feasibility study the groundwater sources within the study area have been given a preliminary microbiological risk assessment of Category 4. With further assessment of an actual source it is possible that the result could be a Category 3 classification.

3.2 Chemical Risks

3.2.1 Murrumbidgee River – Surface Water Source

GWCC has provided Cardno with operational data from the Jugiong Water Treatment Plant which sources water from further upstream on the Murrumbidgee River. Raw water quality for 2018/19 collected by on-line instrumentation is presented in Appendix A. The results are summarised in Table 3-2.

Table 3-2 Raw Water Quality in the Murrumbidgee River at Jugiong 2018/19

Parameter	Units	Number of Samples	Minimum	Maximum	Median
Turbidity	NTU	365	1.8	2500	6
Colour	Hazen	365	15	303	40
pH	pH Units	365	7.32	8.20	7.72
Temperature	deg C	365	7	29	19
Fluoride	mg/L	365	0.08	0.33	0.20

The raw water, as is typical of a surface water, has variable, and elevated levels of turbidity and colour. A suitable water treatment process will need to address these issues.

From separate single samples taken at the Jugiong WTP hardness is typically around 100-120mg/L as $CaCO_3$ and therefore is within the acceptable range of the ADWG. Iron and Manganese can be elevated at times above the aesthetic guideline values therefore an oxidation process to address these parameters will be required.

Raw water quality from the specific location would need to be assessed to determine if any other water quality issues also need to be addressed.

3.2.2 Nangus Groundwater Source

The Desktop Hydrogeological Review (Cardno, 2019) has investigated existing bores in the vicinity of Nangus. Recent data on groundwater quality is very limited. From historic data that is available from when the bores were developed it appears that total dissolved solids are elevated ranging from 800-4200mg/L (based on converting electrical conductivity measurements to TDS). According to the ADWG this degree of salinity would be poor to unacceptable quality, with TDS required to be below 600mg/L to be aesthetically acceptable. It is also common that groundwater in the regional aquifers have elevated iron and manganese. Therefore, it is highly likely that a suitable groundwater treatment process will have to address iron, manganese and TDS.

4 Option 5 – Murrumbidgee River Extraction and Treatment

4.1 Option 5 Description

A schematic of Option 5 is shown in Figure 4-1. Option 5 has the following proposed components:

- A surface water intake, taking water from the Murrumbidgee River
- Powdered activated carbon dosing
- pH control dosing
- Coagulant dosing and rapid mixing
- Polymer dosing and slow mixing
- Solids settling
- Clarified water storage
- Filtration using ultrafiltration membranes
- Ultraviolet disinfection
- pH Correction
- Chlorine dosing for disinfection
- Fluoridation
- Treated water reservoir (250 kL) and Booster Pumping
- Backwash settling and evaporation

Each of these processes is described in more detail in the following sections.

4.2 Surface Water Intake and Pumping

Raw water would be sourced from the Murrumbidgee River with a river intake and transfer pumps to the treatment plant site.

A produced flow of 400 kL/d has been proposed for the water supply. Given that surface water treatment plants typically have 5%-10% of losses, the treatment plant will need to be capable of processing up to 420 kL/d of raw water. Assuming that this can be achieved over a period of approximately 20 hours the plant will need to be sized for approximately 500 kL/d (6 L/s).

A typical surface water intake would comprise a wedgewire screen – e.g. a Johnson type screen, to prevent course solids and to ensure that fish are protected. This would be surrounded by a reinforced concrete structure to protect the screen and channel floor. A pumping station on the shore would transfer the raw water to the treatment plant. It is noted that the actual configuration would need to be determined based on a detailed investigation of the river conditions and adjacent flood plain.

The Murrumbidgee River is approximately 5,000m from the proposed WTP location. Assuming a velocity of 1.0m/s in the pipeline an estimated pipe diameter of 100mm diameter would be required.

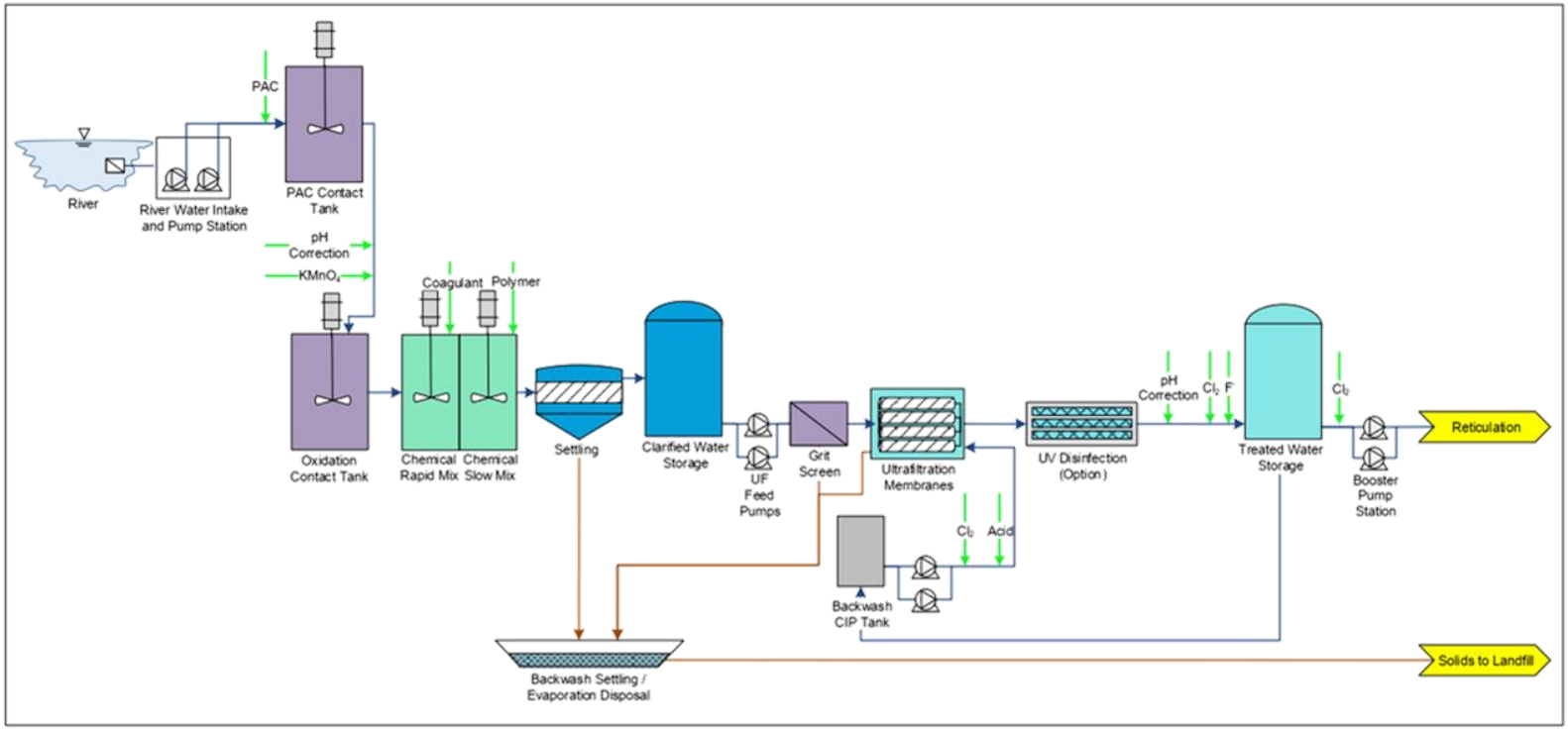


Figure 4-1 Option 5 – Process Schematic

4.3 Microbiological Barriers (Viral, Protozoal, and Bacteriological)

Both the draft Chapter 5 of the ADWG and the WSAA HBT Manual recommend similar treatment technologies to achieve the log reduction value (LRV) targets. Cardno has undertaken an assessment of Option 5 and the results are shown in Table 4-1.

For this assessment Cardno has used the HBTs manual as it is more explicit in assigning specific and measurable Process Critical Limits to each LRV.

Based on the source risk, the minimum required health-based targets for pathogen LRVs are: Virus 6.0, Protozoa 5.0, and Bacteria 6.0.The sum of process unit LRVs are greater than the risks therefore the proposed treatment process will provide sufficient barriers under the multi-barrier approach.

Table 4-1 Recommended LRVs for the Option 1 Water Treatment Process

Treatment Process	Log reduction value			Process Critical Limits
	Virus	Protozoa	Bacteria	
Coagulation, Flocculation, and Sedimentation	1.0	0.5	1.0	Under-float or settled water turbidity < 2 NTU for 95% of month. Alternate target is 70% reduction in turbidity on average over the month where raw water turbidity is very high, the key being consistent quality pre filtration
Ultra-Filtration (UF)	2.5	3.0	3.0	Individual filter turbidity <0.1 NTU for 95% of month and not > 0.15 NTU for > 15 consecutive minutes.
Ultraviolet Disinfection	0.5	4.0	4.0	UV dose > 40mJ/cm^2 Feedwater Turbidity <1.0 NTU UVT% > Manufacturers specifications
Chlorine (Cl_2) Disinfection	4	0	4.0	Ct > 15 mg- min/L with pH < 8.5 at all water temperatures Feed water turbidity < 1.0 NTU
Total achievable	**8.0**	**7.5**	**12.0**	
Log reduction required	**6.0**	**5.0**	**6.0**	
Gap	**0.0**	**0.0**	**0.0**	

4.4 Taste and Odour Control

Powdered activated carbon (PAC) is added for adsorption of taste and odour causing compounds. PAC will be dosed directly to the raw water. The earlier the PAC can be dosed the more effective it will be. A separate PAC contact tank may be required. To achieve a contact time of 15mins the contact tank will have an estimated volume of 6m^3.

4.5 Oxidation for Iron and Manganese Removal

Pre-oxidation with potassium permanganate is recommended to achieve iron and manganese removal. Permanganate will oxidise both iron and manganese as long as adequate contact time, typically 15mins, for the oxidation reaction is provided. The contact tank will have an estimated volume of 6m^3.

4.6 pH Control

pH control is undertaken to ensure that the coagulation pH conditions are consistent and optimal for the coagulant. Because coagulants are typically weak acids, pH correction for this size of plant typically takes the form of caustic soda or soda ash dosing.

4.7 Coagulation, Flocculation and Sedimentation

Coagulation, flocculation, and sedimentation is required to reduce the turbidity load from the raw water prior to filtration. To claim the 1-log microbiological credits associated with the sedimentation process it must be supported by coagulation and flocculation to achieve the turbidity reduction target.

The coagulant chemical could be Alum, ACH or PACl depending on the treatability, handling and cost. Rapid mixing is required to ensure the coagulant is effectively mixed. The volume of the coagulation zone should allow for at least 5 minutes of flash mixing time.

Dosing of polyelectrolyte and associated slow mixing would occur after the rapid mixing to ensure floc development. Although floc size development is often not as critical where clarification is followed by membrane filtration, it is still important if the microbiological barrier is to be claimed. Modern chemical mixing systems usually incorporate structured floc growth tanks prior to the settling process. A 2 or 3-stage floc growth system with 20 minutes flocculation time at peak flow is recommended. The first and second stage would have contact time of approximately 7.5 minutes. The third stage would have a contact time of approximately 5.0 minutes. Mixing would become progressively less intense at each stage.

This will require new coagulant and polymer make-up, storage and dosing facilities. Settling could be achieved by conventional sedimentation (or alternatively by dissolved air flotation [DAF]). A variety of clarifiers are able to be designed or are available from suppliers with either rectangular or circular configuration and in some instances with proprietary technologies, for example ballasting (e.g. Veolia Actiflo), lamella plates or tube settlers which can reduce the footprint by achieving a much higher loading rate. Conventional rectangular hopper clarifiers are capable of maximum rise rates in the order of 2 m/hr.

4.8 Clarified Water Storage and Transfer Pumping

Clarified water storage and transfer pumping provides flexibility to provide flow and pressure balancing to the downstream filtration process. An automatically backwashing strainer would provide additional protection to the filtration process against grit.

4.9 Membrane Ultrafiltration

Ultrafiltration membranes following clarification will provide a high quality of treated water with a low turbidity.

Regular backwashing includes water and air scouring. The treated water recovery rate is typically 90-98% depending on the feed water quality and UF configuration.

A clean in place (CIP) system is used to routinely clean the membranes with chemicals to control fouling. The cleaning chemicals are typically acids, alkalis and hypochlorite.

Package UF systems at this size (skid mounted) are available from a number of suppliers.

An alternative to membrane filtration would be multi-media filtration. However, the LRV's attributable to a conventional filtration process are lower and the treated water quality can be more inconsistent.

4.10 UV Disinfection

Ultraviolet disinfection will be required to provide 4-log reduction of protozoa and bacteria and 0.5-log reduction of viruses. This requires a validated unit, installed and monitored as per its validation requirements and providing an ultraviolet dose of >40 mJ/cm^2. At the same time the feed water turbidity must be <1.0NTU and the ultraviolet transmissivity greater than the manufacture's validation specifications.

There are a number of different suppliers who can meet these ultraviolet disinfection requirements relying on the pre-treatment process to achieve the requirements for turbidity and ultraviolet transmissivity.

4.11 pH Correction

pH Correction of the final water controls the aggressiveness of the water distributed to the consumers and ensures that chlorine disinfection is maintained within an optimal range. Typically treated water pH correction at this scale requires a slight increase in the pH using either caustic soda or soda ash dosing.

4.12 Chlorine Dosing

Chlorine dosing and a chlorine contact tank can provide 4-log each of virus and bacteria reduction. This requires a C.t >15mg/L. C.t values are calculated based on the chlorine residual at the outlet, multiplied by the tank volume and the baffling factor and divided by the treated water flow rate.

4.13 Fluoridation

The NHMRC strongly recommends community water fluoridation as a safe, effective and ethical way to help reduce tooth decay across the population. NHMRC supports Australian states and territories fluoridating their

drinking water supplies within the range of 0.6 to 1.1 mg/L. For these reasons fluoridation has been included as a treatment step after filtration.

4.14 Treated-Water Storage and Reticulation Booster Pumping

Treated water storage and pumping provides flexibility to provide flow and pressure control to meet instantaneous demand in the reticulation. The proposed reservoir storage volume is 250 kL, in line with GWCC's requirements for three days storage at average day flow.

4.15 Residual Solids Management

Liquid and solid waste streams will be produced from the grit strainer, clarifier wasting, and filter backwashing processes. The clarifier sludge stream will be much more concentrated than the filter waste stream.

The primary option for waste handling is to construct sludge lagoons. Downstream of the filters it is proposed that there would be a waste water balance tank to buffer the high backwash flows received off the filters to avoid scouring within the lagoons which would be counterproductive to the lagoon settlement process. A decant tank or thickener could be used at this stage of the process to return waste water supernatant to the head of the plant.

Evaporation or environmental discharge would be the best disposal route for the sludge lagoon supernatant and underdrainage from the perspective of managing public health risks and operational costs. It is estimated that there would need to be two lagoons each with a size of 25m long x 15m wide x 1.5m deep. The total volume of these lagoons would be approximately 1125 kL. We have assumed that excess sludge lagoon supernatant or underdrainage could be discharged to Nangus Creek.

If no environmental disposal route is available, then it may be necessary to return the lagoon supernatant to the head of the plant. If this is the case, then the return stream would need to be filtered and disinfected with UV and chlorine to avoid concentrating the microbiological risk through this waste stream.

4.16 Capital Cost Estimate

A rough order capital cost estimate for this option is $5.43M. A more detailed breakdown of this estimate is included in Appendix B.

4.17 Indicative Layout

Indicative layouts for this option are included in Appendix C.

5 Option 6 - Groundwater Extraction and Treatment

5.1 Option 6 Description

A schematic of Option 6 is shown in Figure 5.1. Option 6 has the following proposed components:

- Groundwater bores and pumping
- Groundwater storage and transfer pumping
- Iron and Manganese oxidation and filtration
- Chlorine neutralisation
- Reverse Osmosis
- Recarbonation / pH Correction
- Chlorine dosing for disinfection
- Fluoridation
- Treated water reservoir (250 kL) and Booster Pumping
- Backwash settling and evaporation
- Brine storage and evaporation

Each of these processes is described in more detail in the following sections.

5.2 Groundwater Bores and Pumping

Raw water would be sourced from local groundwater bores. To achieve the design flow and to manage risk it is anticipated that a minimum of two bores would be required. Each bore would require a bore pump, surface well head to prevent contamination and backflow, and an electrical supply.

A peak produced flow of 400kL/d has been proposed for the water supply. Given that groundwater treatment plants that include reverse osmosis typically have up to 20% of losses (range 15-35%) through solids and brine management requirements, the treatment plant will need to be capable of processing up to 480kL/d of raw water. Assuming that this can be processed over a period of approximately 20 hours the plant will need to be sized for approximately 600 kL/d (7 L/s).

5.3 Microbiological Barriers (Viral, Protozoal, and Bacteriological)

Both the draft chapter 5 of the ADWG and the WSAA HBT Manual recommend similar treatment technologies to achieve the microbiological log reduction value (LRV) targets. Cardno has undertaken an assessment of Option 6 and the results are shown in Table 5-1.

For this assessment Cardno has used the HBTs manual as it is more explicit in assigning specific and measurable Process Critical Limits to each LRV, with guidance from the ADWG draft HBTs on the application of reverse osmosis.

Based on the source risk, the minimum required health-based targets for pathogen LRVs are: Virus 6.0, Protozoa 5.0, and Bacteria 6.0. The sum of process unit LRVs are greater than the risks therefore the proposed treatment process will provide sufficient barriers under the multi-barrier approach.

Table 5-1 Recommended LRVs for the Option 2 Water Treatment Process

Treatment Process	Log reduction value			Process Critical Limits
	Virus	Protozoa	Bacteria	
Reverse Osmosis (TDS reduction)	2.5	3.0	3.0	Note 1.
Ultraviolet Disinfection	0.5	4.0	4.0	UV dose > 40mJ/cm^2 Feedwater Turbidity <1.0 NTU UVT% > Manufacturers specifications
Chlorine (Cl_2) Disinfection	4	0	4.0	Ct > 15 mg- min/L with pH < 8.5 at all water temperatures Feed water turbidity < 1.0 NTU
Total achievable	**7.0**	**7.0**	**11.0**	
Log reduction required	**6.0**	**5.0**	**6.0**	
Gap	**0.0**	**0.0**	**0.0**	

(1) Reverse osmosis systems would routinely achieve greater log reduction values in practice than those that can be routinely and readily validated. As a result, LRVs of the order 1 to 2 log are all that can be routinely validated where on-line operational monitoring of Electrical Conductivity or Total Organic Carbon forms the critical parameter. LRVs of 2.5-4.0 can be achieve where on-line or off-line operational monitoring of sulphate or fluorescent dyes forms the critical limit parameter. For this purposes of this assessment it is assumed that the LVRs for reverse osmosis are similar to those for ultrafiltration.

5.4 Groundwater Storage and Transfer Pumping

Bore water storage and transfer pumping provides flexibility to provide flow and pressure balancing to the downstream processes. An automatically backwashing strainer would provide additional protection to the downstream processes against grit.

5.5 Oxidation and Removal of Iron and Manganese

The removal of iron and manganese requires oxidation and then filtration of the oxidised solids. Manganese is more difficult to oxidise than iron therefore the use of chlorine and a catalytic media filter (e.g. greensands or similar) is an effective way to achieve this. For the size of plant proposed, this can be achieved using pressure media filters with automatic flow and backwashing control valves. It is assumed that coagulant and flocculent dosing is not required.

Oxidation by aeration has been disregarded as it has the potential to introduce air-borne pathogens into the water. Additionally, the effectiveness of oxidation by aeration is limited to iron and has no performance controls. It is assumed that the raw water does not have elevated levels of carbon dioxide or hydrogen sulphide which may require gas stripping. If it does, then aeration may still be necessary.

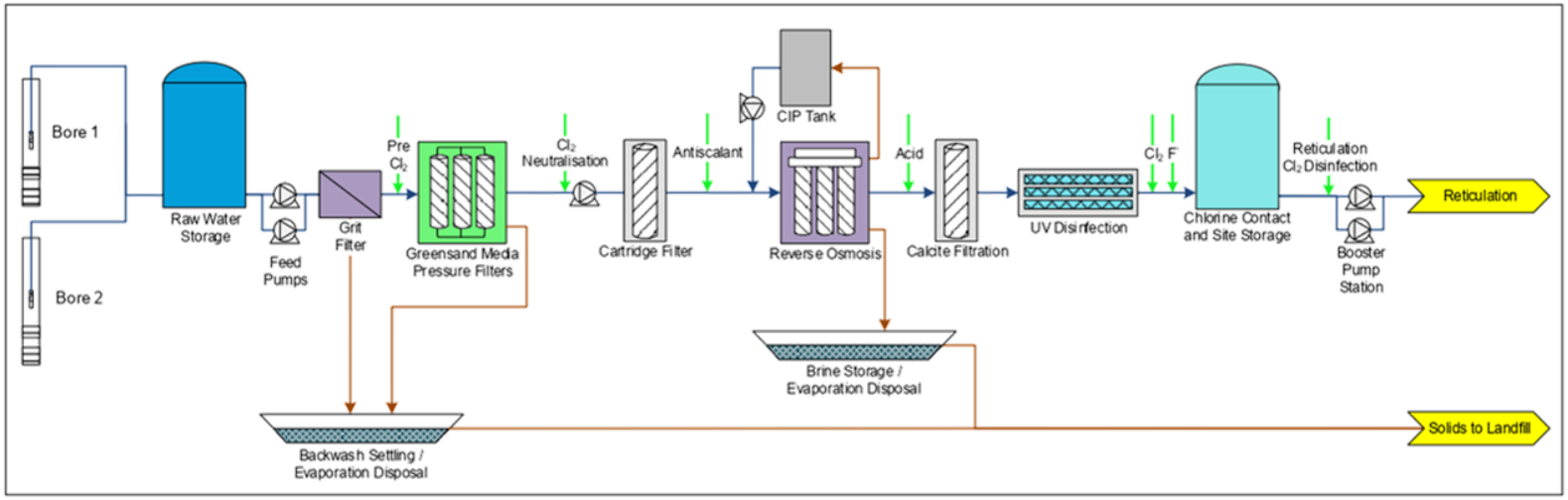


Figure 5-1 Option 6 – Process Schematic

5.6 Reverse Osmosis

Reverse osmosis (RO) would be required to reduce the total dissolved solids (TDS) content from up to 5,000mg/L to potable quality. It is assumed that the TDS will be mostly due to sodium and chloride ions. Reverse osmosis will also provide a pathogen barrier, as noted in Table 5-1.

Prior to reverse osmosis, neutralisation of excess chlorine from the prior oxidation process would be required with the objective of protecting the membranes chemically, and the flow would need to pass through cartridge filtration (5 and 1 micron) to protect the membranes physically. Antiscalant is dosed to inhibit the formation of scale on the RO membranes.

A high pressure pump is required to pump through the membranes and overcome the osmotic pressure of the membranes. The treated water out of the membranes with reduced total dissolved solids is referred to as permeate. The waste stream from the membranes with an elevated salt content is the reject or brine. For a RO system designed to treat a brackish water quality the recovery rate of permeate typically ranges from 60-85% depending on the water quality and RO configuration. As noted in Section 5.2, we have assumed 80% recovery.

A clean in place (CIP) system is used to routinely clean the membranes with chemicals to further control fouling. The cleaning chemicals are typically acids and alkalis.

Skid mounted RO systems are available from a number of suppliers.

5.7 Recarbonation / pH Correction

Reverse osmosis permeate can be aggressive because calcium and magnesium ions are removed through the membranes. The pH needs to be neutralised and hardness increased. One way to do this is by passing the permeate through a calcite filter which provides remineralisation and neutralises the pH. The lower the pH of the permeate the more hardness is added by the filter therefore by adding acid upstream of the filter the dissolution of calcite can be controlled.

5.8 Ultraviolet Disinfection

Ultraviolet disinfection will be required to provide 4-log reduction of protozoa and bacteria and 0.5-log reduction of viruses. This requires a validated unit, installed and monitored as per its validation requirements and providing an ultraviolet dose of >40 mJ/cm^2. At the same time the feed water turbidly must be <1.0NTU and the ultraviolet transmissivity greater than the manufacture's validation specifications.

There are a number of different suppliers who can meet these ultraviolet disinfection requirements relying on the pre-treatment process to achieve the requirements for turbidity and ultraviolet transmissivity.

5.9 Chlorine Disinfection

Chlorine dosing and a chlorine contact tank can provide 4-log each of virus and bacteria reduction. This requires a C.t >15mg/L. C.t values are calculated based on the chlorine residual at the outlet, multiplied by the tank volume and the baffling factor and divided by the treated water flow rate.

5.10 Fluoridation

The NHMRC strongly recommends community water fluoridation as a safe, effective and ethical way to help reduce tooth decay across the population. NHMRC supports Australian states and territories fluoridating their drinking water supplies within the range of 0.6 to 1.1 mg/L. For these reasons fluoridation has been included as a treatment step after filtration.

5.11 Treated-Water Storage and Reticulation Booster Pumping

Treated water storage and pumping provides flexibility to provide flow and pressure control to meet instantaneous demand in the reticulation. The proposed reservoir storage volume is 250 kL, in line with GWCC's requirements for three days storage at average day flow.

5.12 Residual Solids Management

Liquid and solid waste streams will be produced by the grit strainer and filter backwashing processes.

The primary option for waste handling is to construct sludge lagoons. Downstream of the filters it is proposed that there would be a waste water balance tank to buffer the high backwash flows received off the filters to

avoid scouring within the lagoons which would be counterproductive to the lagoon settlement process. A decant tank or thickener could be used at this stage of the process to return waste water supernatant to the head of the plant.

Evaporation or environmental discharge would be the best disposal route for the sludge lagoon supernatant and underdrainage from the perspective of managing public health risks and operational costs. It is estimated that there would need to be two lagoons each with a size of 15m long x 10m wide x 1.5m deep. The total volume of these lagoons would be approximately 450 kL. We have assumed that excess sludge lagoon supernatant or underdrainage could be discharged to Nangus Creek.

If no environmental disposal route is available, then it may be necessary to return the lagoon supernatant to the head of the plant. If this is the case, then the return stream would need to be filtered and disinfected with UV and chlorine to avoid concentrating the microbiological risk through this waste stream.

5.13 Brine Management

The reject stream from the RO membranes contains a high total dissolved solids content. The primary option for brine management is to construct evaporation lagoons. Based on an annual average flow of 80 kL/d and a reject ratio of 20% approximately 16-20 kL/day (5,840 kL/yr – 7,300 kL/yr) of brine will be produced. Brine cannot be returned to the plant.

Based on the closest available historical climate data for rainfall (Bureau of Meteorology station 'GUNDAGAI (NANGUS RD)' - 073141) and evaporation (Bureau of Meteorology station 'WAGGA WAGGA AMO' - 072150) a water balance has been prepared to estimate the required size of the brine evaporation ponds.

A total evaporation surface area of approximately 0.8 ha is required to provide sufficient evaporation to balance the inflows (rainfall and brine) during a 90 percentile rainfall year (i.e. a year wetter than 90% of years on record). This would require 2 x 100m long x 40m wide evaporation lagoons.

5.14 Capital Cost Estimate

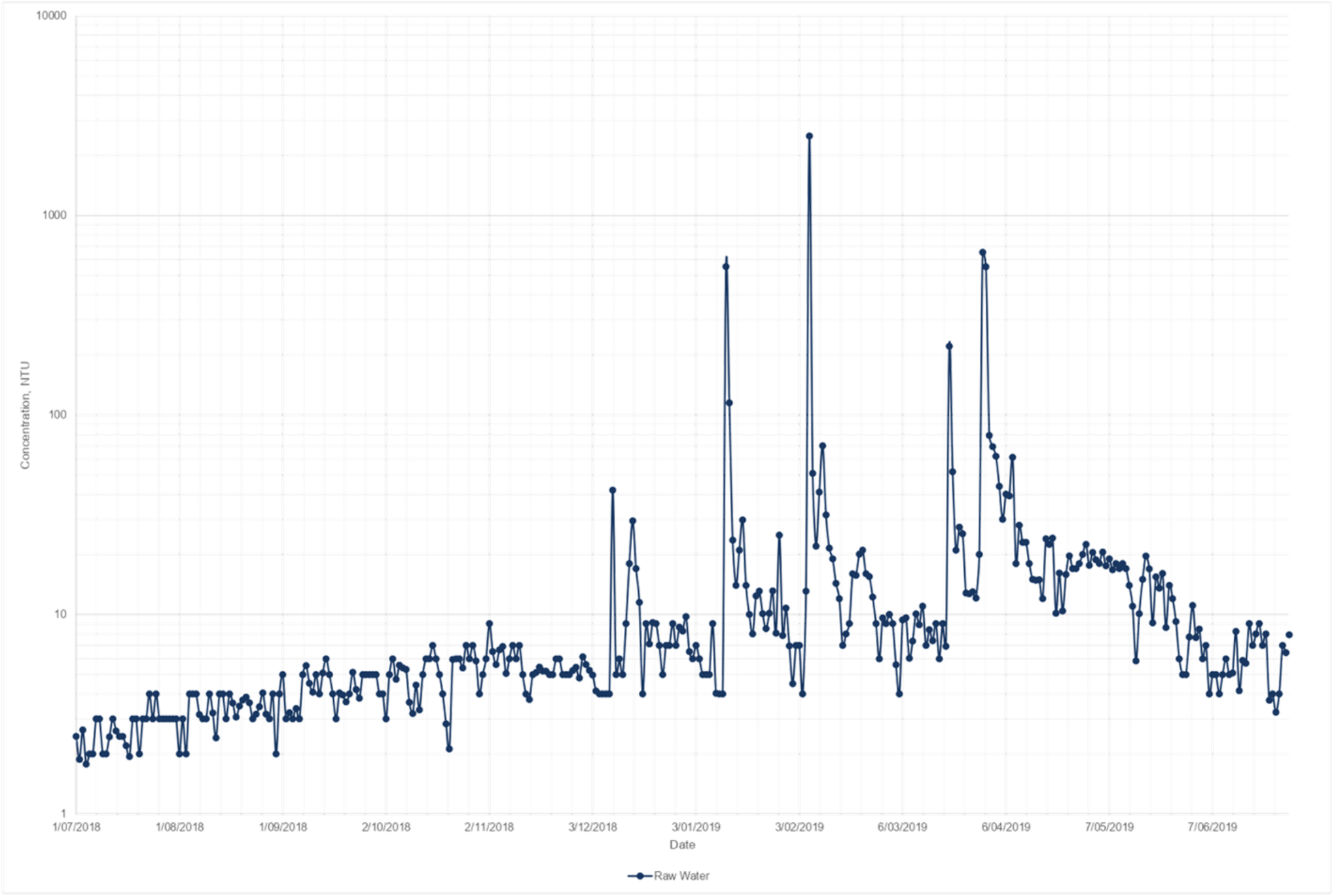
A rough order capital cost estimate for this option is $5.26M. A more detailed breakdown of this estimate is included in Appendix B.

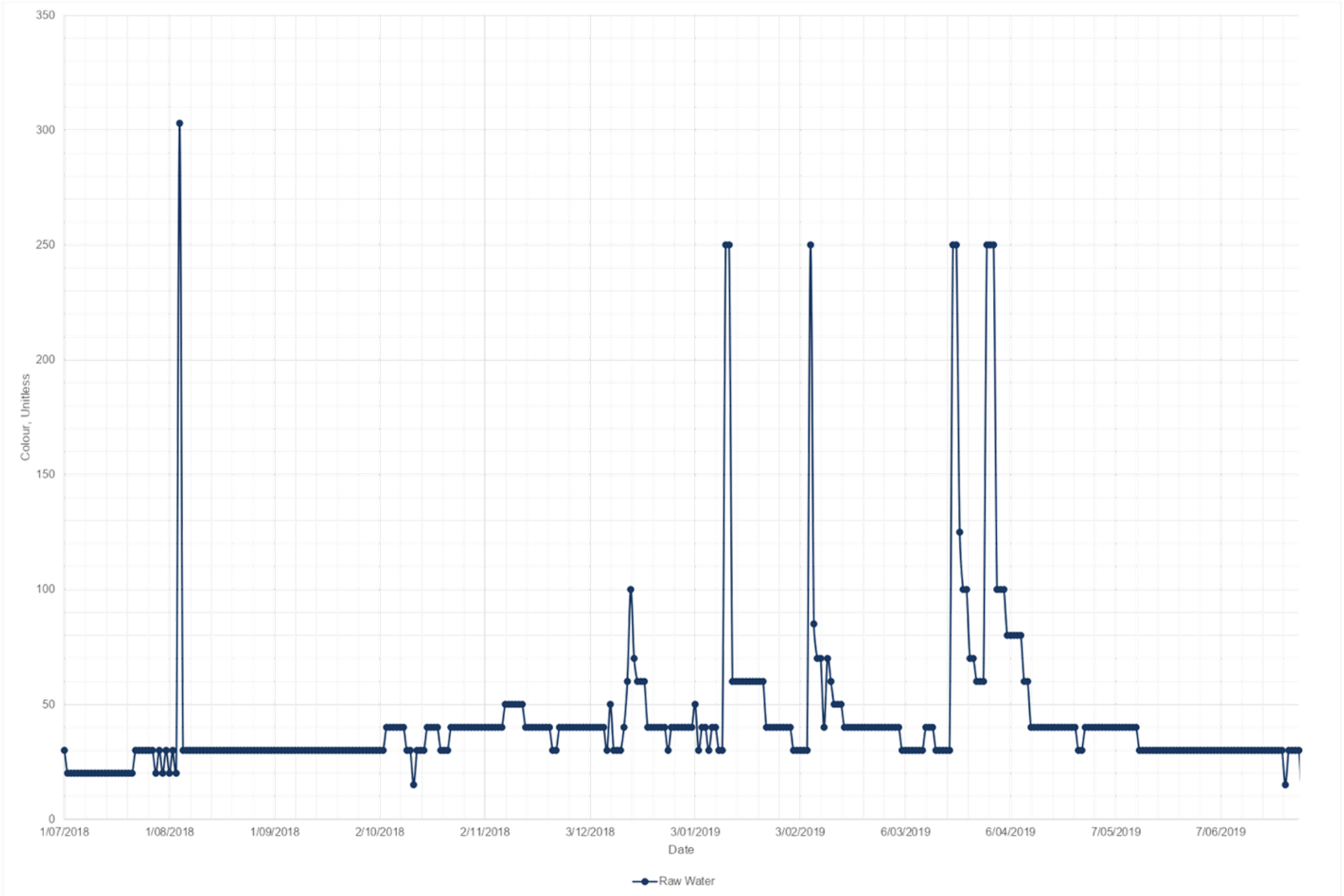
5.15 Indicative Layout

An indicative layout for this option is included in Appendix C.

APPENDIX A

MURRUMBIDGEE RIVER WQ DATA


10000
1000
100
10
1
Concentration, NTU
1/07/2018
1/08/2018
1/09/2018
2/10/2018
2/11/2018
3/12/2018
3/01/2019
3/02/2019
6/03/2019
6/04/2019
7/05/2019
7/06/2019
Date
Raw Water


350
300
250
200
150
100
50
0
Colour, Unitless
1/07/2018
1/08/2018
1/09/2018
2/10/2018
2/11/2018
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3/02/2019
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6/04/2019
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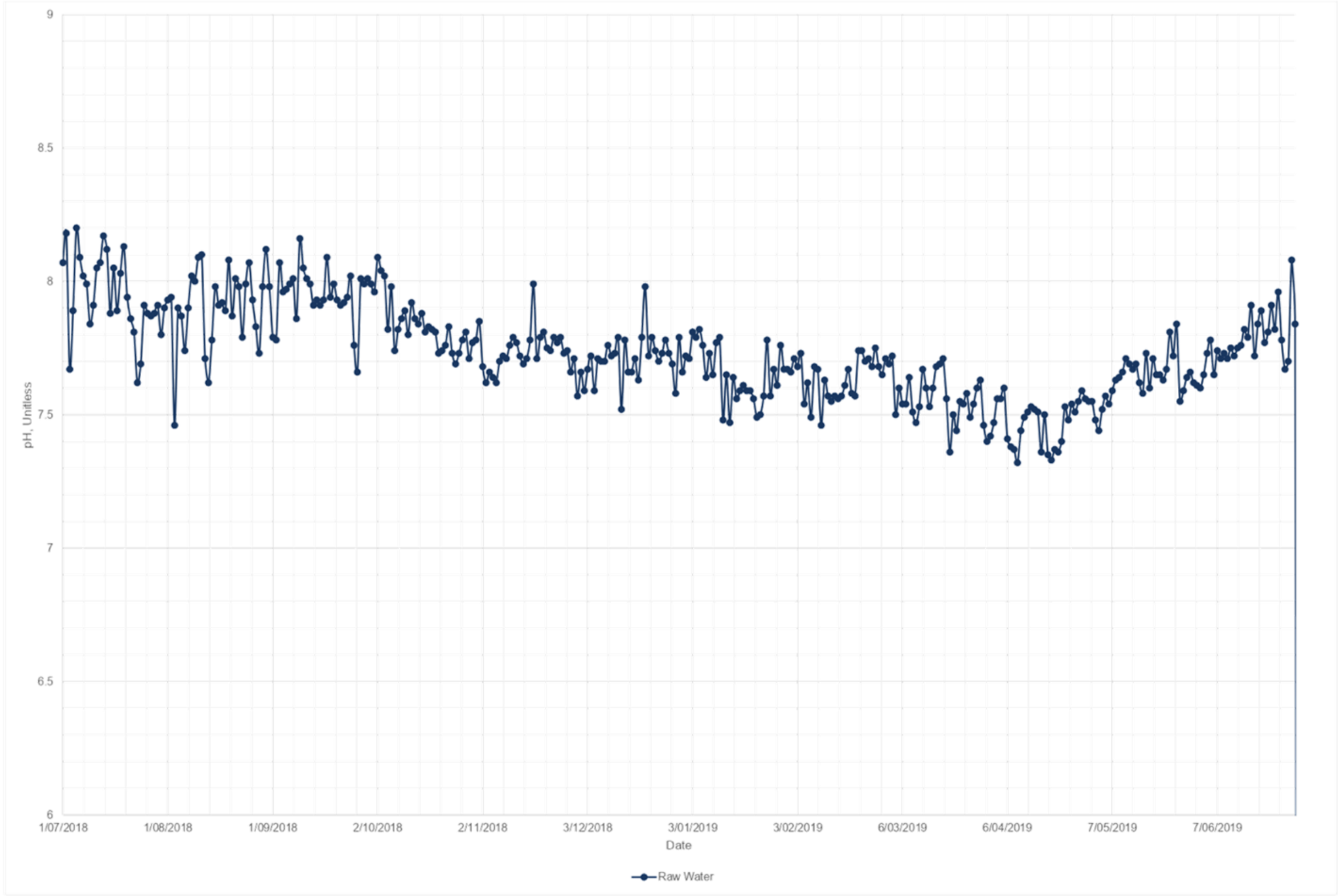
7/06/2019
Date
Raw Water


9
8.5
8
7.5
7
6.5
6
pH, Unitless
1/07/2018
1/08/2018
1/09/2018
2/10/2018
2/11/2018
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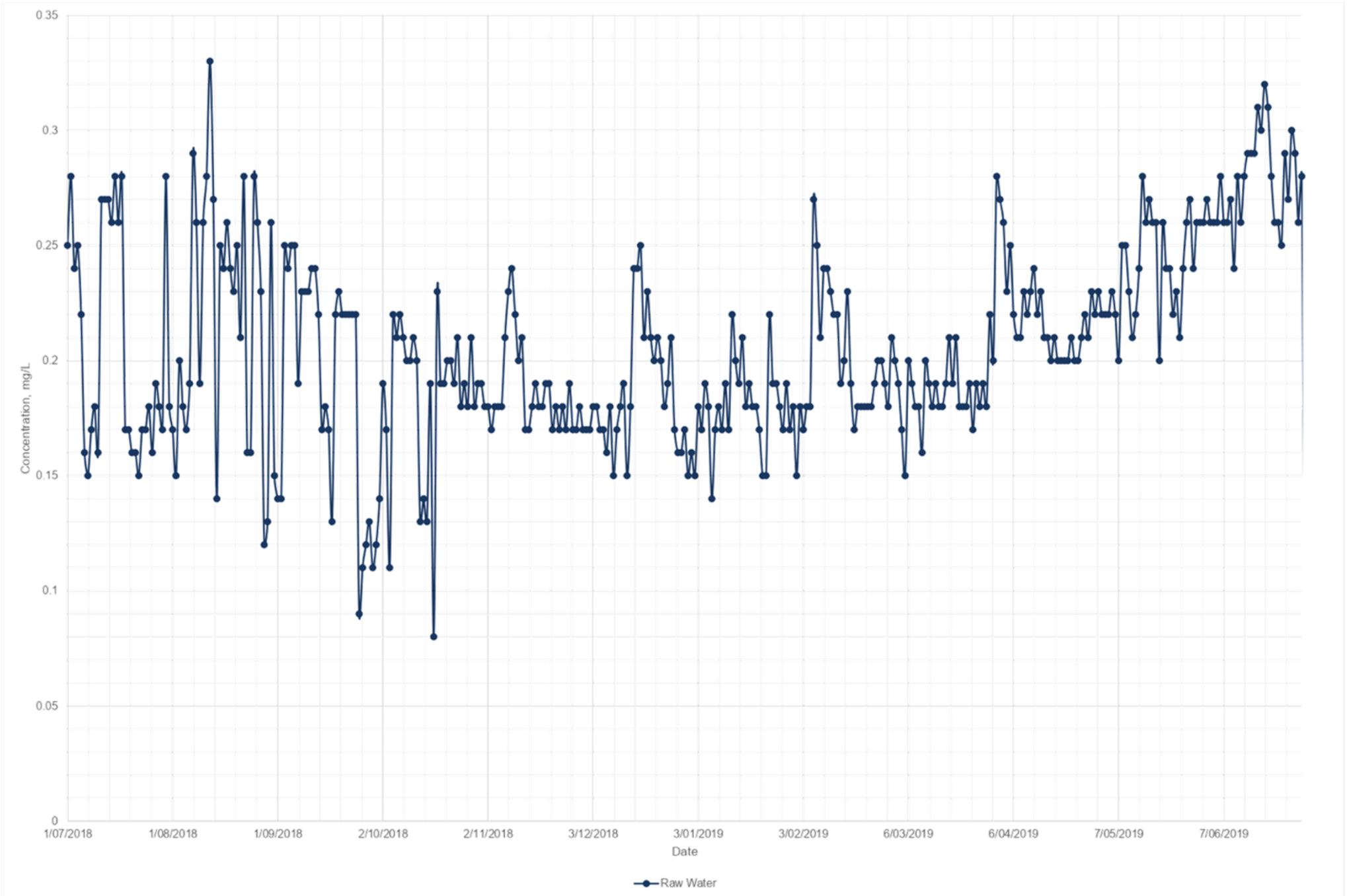
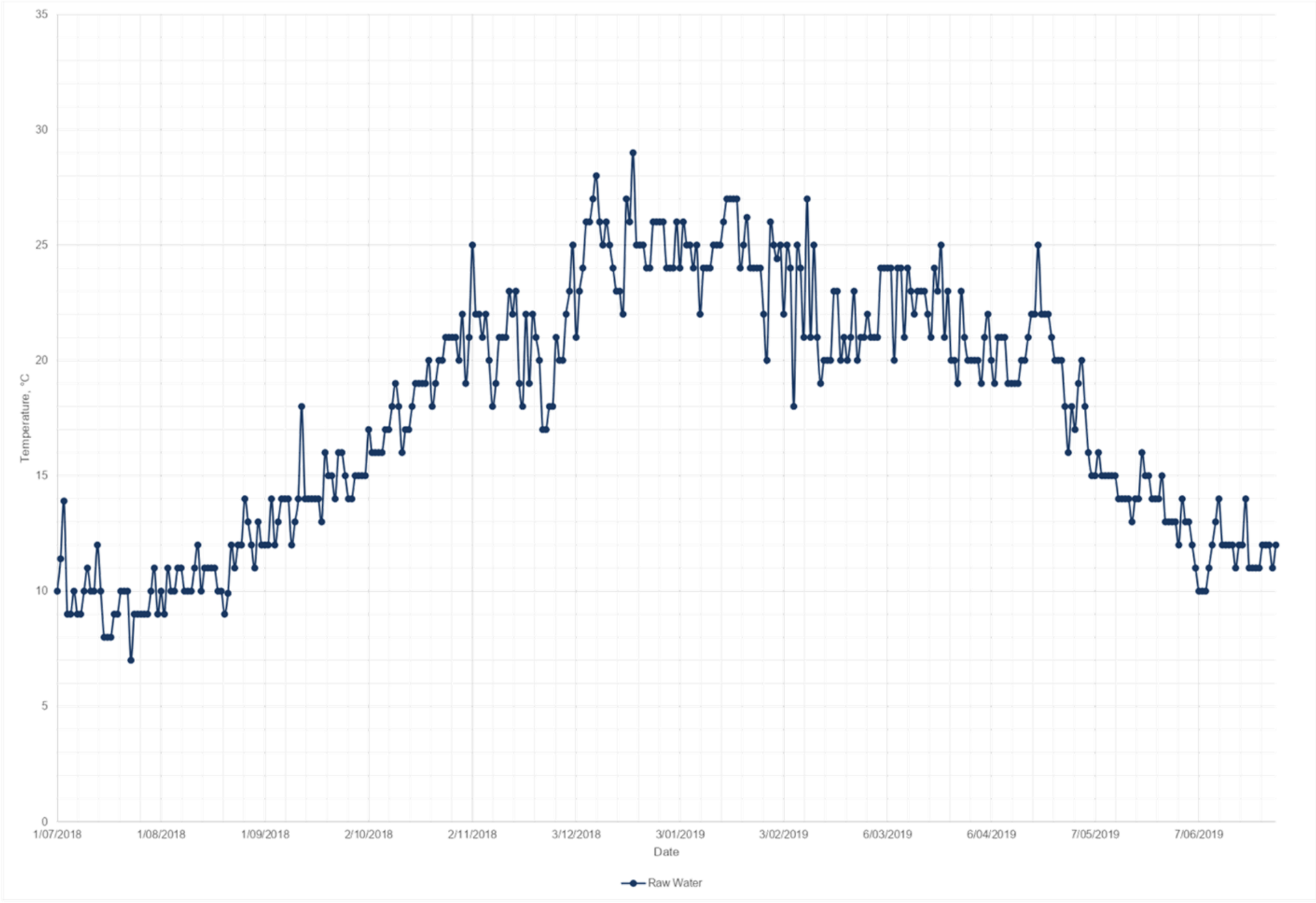
3/01/2019
3/02/2019
6/03/2019
6/04/2019
7/05/2019
7/06/2019
Date
Raw Water


0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Concentration, mg/L
1/07/2018
1/08/2018
1/09/2018
2/10/2018
2/11/2018
3/12/2018
3/01/2019
3/02/2019
6/03/2019
6/04/2019
7/05/2019
7/06/2019
Date
Raw Water


35
30
25
20
15
10
5
0
Temperature, °C
1/07/2018
1/08/2018
1/09/2018
2/10/2018
2/11/2018
3/12/2018
3/01/2019
3/02/2019
6/03/2019
6/04/2019
7/05/2019
7/06/2019
Date
Raw Water

APPENDIX B

CAPITAL COST ESTIMATES

Rough Order Cost Estimate

Nangus 400kL Surface Water Source and Treatment Plant

Cardno

Date 27/11/2019
Job No. 8202004301
Prepared By P Garrity
Checked By J Knudsen

Area	Description	Unit	Quantity	Unit Cost	Total
Siteworks	Site Clearance / Earthworks	LS	1	$ 20,000	$ 20,000
	Roading / Access	LS	1	$ 30,000	$ 30,000
	Fencing	LS	1	$ 30,000	$ 30,000
	Landscaping	LS	1	$ 20,000	$ 20,000
	Stormwater	LS	1	$ 15,000	$ 15,000
	Sewer	LS	1	$ 25,000	$ 25,000
	Telecoms	LS	1	$ 10,000	$ 10,000
					$ 150,000
Taste, Odour, Iron and Manganese	PAC contact tank	LS	1	$ 12,000	$ 12,000
	PAC contact tank equipment	LS	1	$ 6,000	$ 6,000
	PAC contact tank pipework	LS	1	$ 10,000	$ 10,000
	Oxidation contact tank	LS	1	$ 12,000	$ 12,000
	Oxidation contact tank equipment	LS	1	$ 6,000	$ 6,000
	Oxidation contact tank pipework	LS	1	$ 10,000	$ 10,000
	Electrical (local) and instrumentation (minor)	LS	1	$ 6,000	$ 6,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 67,000
Coagulation. Flocculation,and Sedimentation	Clarification civil and structural	LS	1	$ 40,000	$ 40,000
	Coagulation tank, equipment and pipework	LS	1	$ 80,000	$ 80,000
	Flocculation tank equipment and pipework	LS	1	$ 140,000	$ 140,000
	Settling tank, equipment and pipework	LS	1	$ 360,000	$ 360,000
	Electrical (local) and instrumentation (minor)	LS	1	$ 30,000	$ 30,000
	Commissioning	LS	1	$ 25,000	$ 25,000
					$ 675,000
Clarified Water Storage	New water storage tank - structural and civil	LS	1	$ 120,000	$ 120,000
	New water storage tank - equipment	LS	1	$ 10,000	$ 10,000
	New storage tank - pipework	LS	1	$ 30,000	$ 30,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 175,000
Ultrafiltration	New transfer pumps (UF feed pumps)	ea	2	$ 10,000	$ 20,000
	Automatic grit screen	LS	1	$ 10,000	$ 10,000
	Ultrafiltration Membrane Filtration - structure and civil	LS	1	$ 20,000	$ 20,000
	Ultrafiltration Membrane Filtration - equipment	LS	1	$ 150,000	$ 150,000
	Ultrafiltration Membrane Filtration - pipework	LS	1	$ 100,000	$ 100,000
	Air-scour blowers	LS	1	$ 15,000	$ 15,000
	Backwash water tank	LS	1	$ 10,000	$ 10,000
	Backwash water pump	LS	1	$ 5,000	$ 5,000
	Backwash water pipework	LS	1	$ 10,000	$ 10,000
	CIP Tank	LS	1	$ 5,000	$ 5,000
	Electrical and instrumentation	LS	1	$ 80,000	$ 80,000
	Commissioning	LS	1	$ 30,000	$ 30,000
					$ 455,000
UV Disinfection (Bacteria and Protozoa)	UV disinfection - equipment	ea	2	$ 25,000	$ 50,000
	UV disinfection - pipework	LS	1	$ 15,000	$ 15,000
	Electrical and instrumentation	LS	1	$ 20,000	$ 20,000
	Commissioning	LS	1	$ 10,000	$ 10,000
					$ 95,000
Powdered Activated Carbon Storage, Make-Up and Dosing (Tastes and Odours)	PAC dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	PAC dosing - equipment	LS	1	$ 80,000	$ 80,000
	PAC - pipework	LS	1	$ 15,000	$ 15,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 115,000
Permanganate Dosing (Iron and Manganese)	Permanganate dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Permanganate dosing - equipment	LS	1	$ 80,000	$ 80,000
	Permanganate dosigin - pipework	LS	1	$ 15,000	$ 15,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 115,000
Coagulant Storage and Dosing (Turbidity)	Coagulant dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Coagulant dosing - equipment	LS	1	$ 60,000	$ 60,000
	Coagulant dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 95,000
Polymer Storage Make-Up and Dosing (Turbidity)	Polymer dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Polymer dosing - equipment	LS	1	$ 80,000	$ 80,000
	Polymer dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000

Rough Order Cost Estimate

Nangus 400kL Surface Water Source and Treatment Plant

Cardno

Date 27/11/2019
Job No. 8202004301
Prepared By P Garrity
Checked By J Knudsen

Area	Description	Unit	Quantity	Unit Cost	Total
					$ 115,000
Caustic Soda Storage and Dosing (pH Correction)	Caustic soda dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Caustic soda dosing - equipment	LS	1	$ 60,000	$ 60,000
	Caustic soda dosing - pipework	LS	1	$ 30,000	$ 30,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 10,000	$ 10,000
					$ 110,000
Citric Acid Storage and Dosing (CIP)	Citric acid dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Citric acid dosing - equipment	LS	1	$ 40,000	$ 40,000
	Citric acid dosing - pipework	LS	1	$ 10,000	$ 10,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 65,000
Chlorine Storage and Dosing (Bacteria and Virus)	Chlorine dosing - structural and civil	LS	1	$ 20,000	$ 20,000
	Chlorine dosing - equipment	LS	1	$ 150,000	$ 150,000
	Chlorine dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 205,000
Fluoride Storage, Make-Up and Dosing	Fluoride dosing - structural and civil	LS	1	$ 30,000	$ 30,000
	Fluoride dosing - equipment	LS	1	$ 120,000	$ 120,000
	Fluoride - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 185,000
Polymer Dosing (for Sludge Settling)	Polymer dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Polymer dosing - equipment	LS	1	$ 80,000	$ 80,000
	Polymer dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 120,000
Backwash Settling / Evaporation Disposal	Washwater Buffer Tank	LS	1	$ 30,000	$ 30,000
	Sludge settling pond - civil works, earthworks	LS	1	$ 90,000	$ 90,000
	Sludge settling pond - pipework	LS	1	$ 10,000	$ 10,000
	Electrical (local) and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 145,000
Plant Electrical & Controls	Electrical and Controls	LS	1	$ 350,000	$ 350,000
	VSDs				
	Soft Starters				
	Cable Containment				
	DB`s				
	Cable VSD				
	Cable Mains (AL)				
	Cable (other CU)				
	SCADA and Software				
	Standby generator				
	Installation				
	Testing and Commissioning				
					$ 350,000
Treatment Plant Building	Treatment Plant Building	LS	1	$ 600,000	$ 600,000
	Electrical room				
	Control Room				
	Lunch/ meeting room				
	Office space				
	Operator and ablutions areas				
	Laboratory area				
	Building services				
	Fire protection				
					$ 600,000
Process Services	Plant process water system	LS	1	$ 60,000	$ 60,000
	Plant process air	LS	1	$ 30,000	$ 30,000
	Information network	LS	1	$ 20,000	$ 20,000
					$ 110,000
SUB-TOTAL					$ 3,947,000
Preliminary and General	Contractors Preliminary and General	%	7.5%	$ 3,947,000	$ 296,025
Works Contingency	Allowances for changes to scope of works	%	15.0%	$ 3,947,000	$ 592,050

Rough Order Cost Estimate

Nangus 400kL Surface Water Source and Treatment Plant

Cardno

Date 27/11/2019
Job No. 8202004301
Prepared By P Garrity
Checked By J Knudsen

Area	Description	Unit	Quantity	Unit Cost	Total
Design & Management Fees	Professional Services	%	15.0%	$ 3,947,000	$ 592,050
TOTAL					$ 5,427,125

Excludes
Land Purchase
Consents and Easements
Mains Power Supply
Surface Water Intake and Transfer Pumping and Pipelines
Treated Water Storage and Pumping and Reticulation

Rough Order Cost Estimate

Nangus WTP 400kL Ground Water Source and Treatment Plant

Cardno

Date 27/11/2019
Job No. 8202004301
Prepared By P Garrity
Checked By J Knudsen

Area	Description	Unit	Quantity	Unit Cost	Total
Siteworks	Site Clearance / Earthworks	LS	1	$ 20,000	$ 20,000
	Roading / Access	LS	1	$ 30,000	$ 30,000
	Fencing	LS	1	$ 30,000	$ 30,000
	Landscaping	LS	1	$ 20,000	$ 20,000
	Stormwater	LS	1	$ 15,000	$ 15,000
	Sewer	LS	1	$ 25,000	$ 25,000
	Telecoms	LS	1	$ 10,000	$ 10,000
					$ 150,000
Bore Water Storage	Bore water storage tank - structural and civil	LS	1	$ 120,000	$ 120,000
	Water storage tank - equipment	LS	1	$ 10,000	$ 10,000
	Storage tank - pipework	LS	1	$ 30,000	$ 30,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 175,000
Media Pressure Filters	Media pressure filters - structure and civil	LS	1	$ 30,000	$ 30,000
	Feed pumps	ea	2	$ 10,000	$ 20,000
	Automatic Grit Screen	LS	1	$ 10,000	$ 10,000
	Greensand media pressure filters - equipment (filter and media)	ea	3	$ 30,000	$ 90,000
	Greensand media pressure filters - pipework	LS	1	$ 60,000	$ 60,000
	Electrical and instrumentation	LS	1	$ 45,000	$ 45,000
	Commissioning	LS	1	$ 20,000	$ 20,000
					$ 275,000
Cartridge Filters	Cartridge filter - structure and civil	LS	1	$ 5,000	$ 5,000
	Cartridge filter housing	ea	2	$ 25,000	$ 50,000
	Cartridge filter - pipework	LS	1	$ 40,000	$ 40,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 110,000
Reverse Osmosis	RO system - structural and civil	LS	1	$ 30,000	$ 30,000
	RO system - equipment	LS	1	$ 450,000	$ 450,000
	RO system - pipework	LS	1	$ 100,000	$ 100,000
	Clean in place system (CIP tank)	LS	1	$ 10,000	$ 10,000
	Clean in place system (CIP transfer pump)	LS	1	$ 5,000	$ 5,000
	Electrical and instrumentation	LS	1	$ 80,000	$ 80,000
	Commissioning	LS	1	$ 30,000	$ 30,000
					$ 705,000
Calcite Filtration	Calcite filtration system - structural and civil	LS	1	$ 5,000	$ 5,000
	Calcite filtration system - equipment (filter and media)	ea	2	$ 30,000	$ 60,000
	New calcite filtration system - pipework	LS	1	$ 40,000	$ 40,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 120,000
UV Disinfection (Bacteria and Protozoa)	UV disinfection - equipment	ea	2	$ 25,000	$ 50,000
	UV disinfection - pipework	LS	1	$ 15,000	$ 15,000
	Electrical and instrumentation	LS	1	$ 20,000	$ 20,000
	Commissioning	LS	1	$ 10,000	$ 10,000
					$ 95,000
Chlorine Storage and Dosing (Bacteria and Virus)	Chlorine dosing - structural and civil	LS	1	$ 20,000	$ 20,000
	Chlorine dosing - equipment	LS	1	$ 150,000	$ 150,000
	Chlorine dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 205,000
Chlorine Neutralisation Storage and Dosing	SMBS dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	SMBS chemical dosing - equipment	LS	1	$ 40,000	$ 40,000
	SMBS chemical dosing - pipework	LS	1	$ 10,000	$ 10,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 65,000
Membrane Antiscalant Storage and Dosing	Antiscalant dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Antiscalant dosing - equipment	LS	1	$ 40,000	$ 40,000
	Antiscalant dosing - pipework	LS	1	$ 10,000	$ 10,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 65,000
Citric Acid Storage and Dosing (pH Correction)	Citric acid dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Citric acid dosing - equipment	LS	1	$ 40,000	$ 40,000
	Citric acid dosing - pipework	LS	1	$ 10,000	$ 10,000
	Electrical and instrumentation	LS	1	$ 5,000	$ 5,000
	Commissioning	LS	1	$ 5,000	$ 5,000

Rough Order Cost Estimate

Nangus WTP 400kL Ground Water Source and Treatment Plant

Cardno

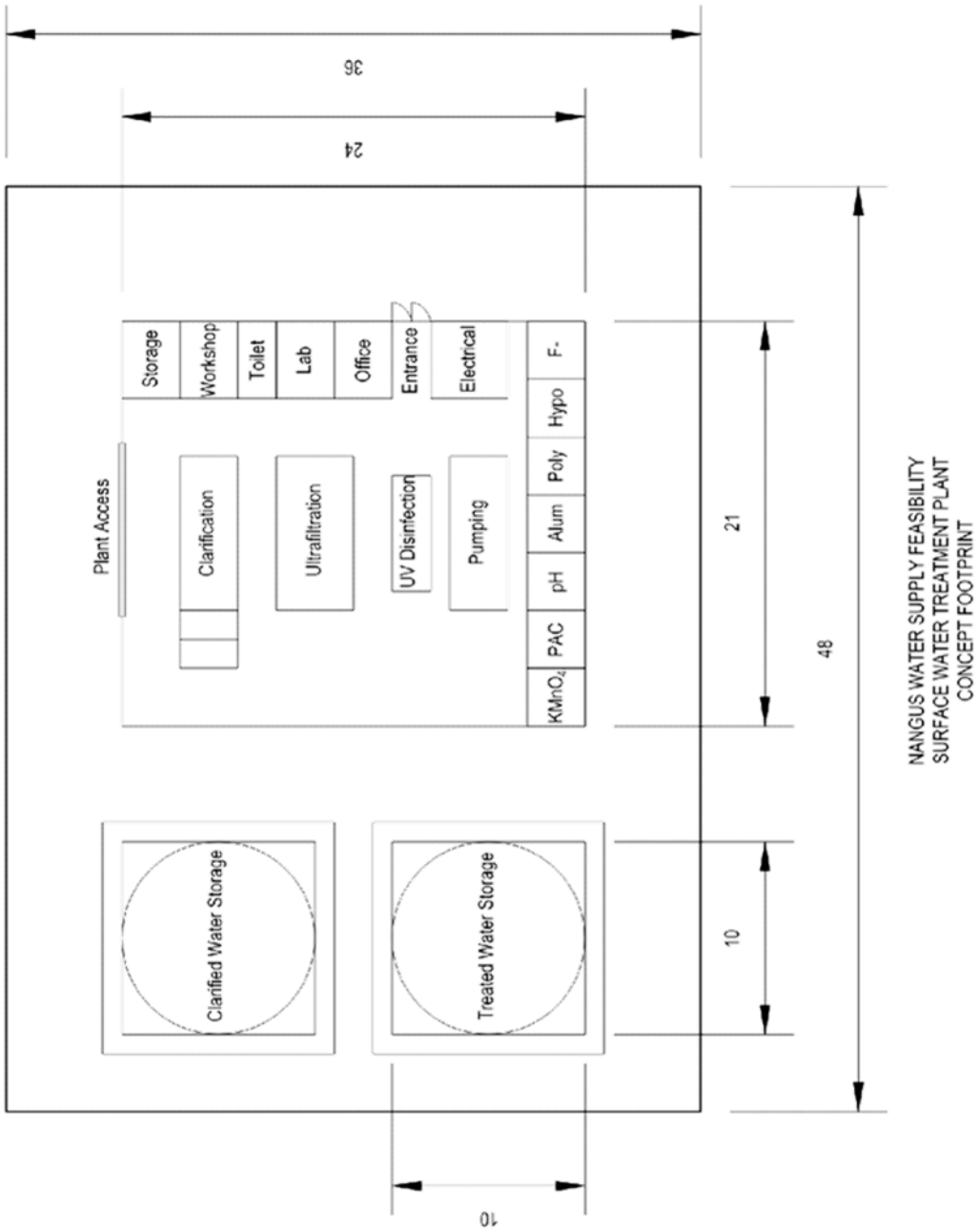
Date 27/11/2019
Job No. 8202004301
Prepared By P Garrity
Checked By J Knudsen

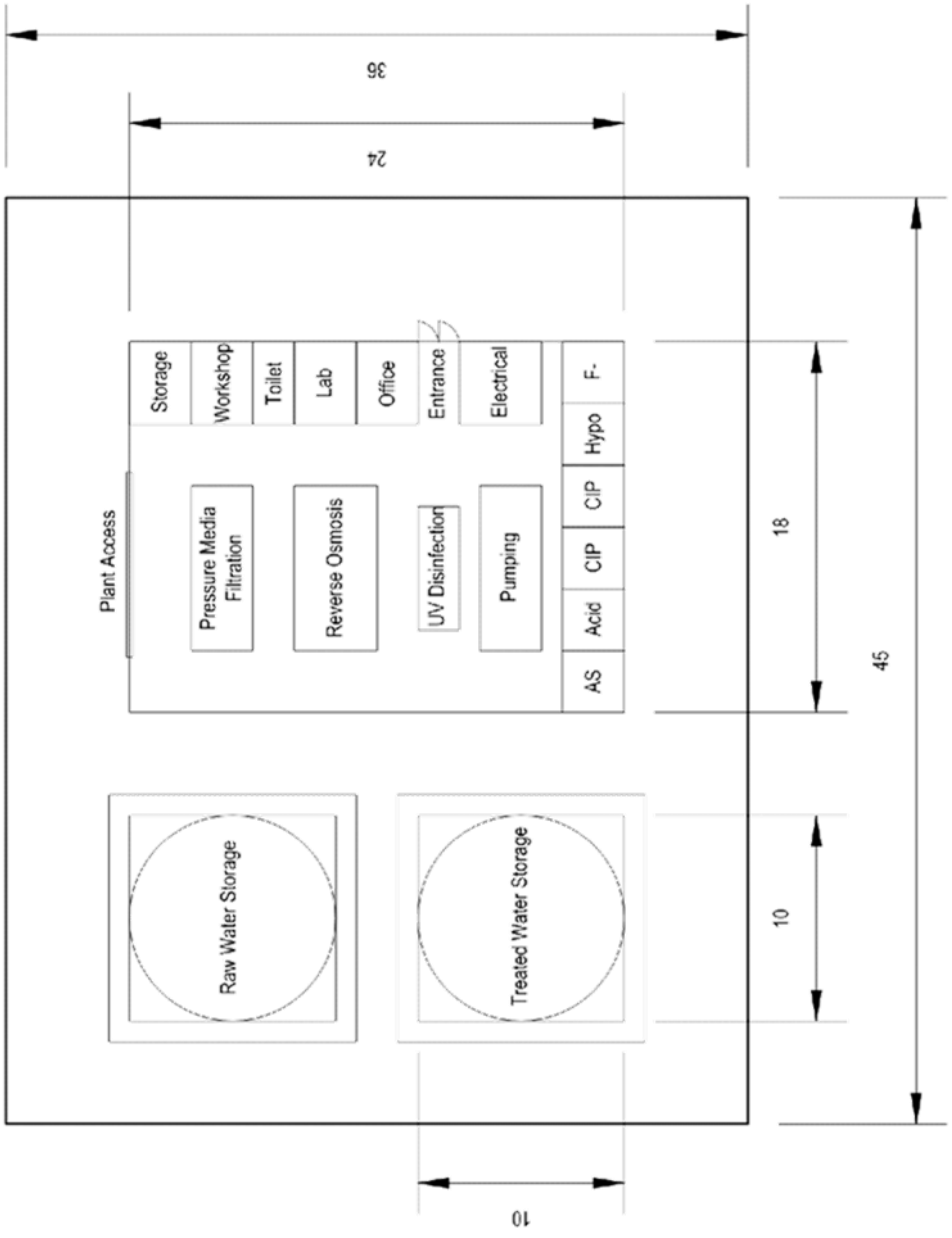
Area	Description	Unit	Quantity	Unit Cost	Total
					$ 65,000
Fluoride Storage, Make-Up and Dosing	Fluoride dosing - structural and civil	LS	1	$ 30,000	$ 30,000
	Fluoride dosing - equipment	LS	1	$ 120,000	$ 120,000
	Fluoride - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 185,000
Polymer Dosing (for Sludge Settling)	Polymer dosing - structural and civil	LS	1	$ 5,000	$ 5,000
	Polymer dosing - equipment	LS	1	$ 80,000	$ 80,000
	Polymer dosing - pipework	LS	1	$ 20,000	$ 20,000
	Electrical and instrumentation	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 5,000	$ 5,000
					$ 120,000
Backwash Settling / Evaporation Disposal	Washwater Buffer Tank	LS	1	$ 30,000	$ 30,000
	Sludge Settling Pond	LS	1	$ 90,000	$ 90,000
	Sludge settling pond - pipework	LS	1	$ 10,000	$ 10,000
	Brine Evaporation Pond	LS	1	$ 240,000	$ 240,000
	Brine Evaporation Pond - pipework	LS	1	$ 10,000	$ 10,000
	Electrical (local) and instrumentation (minor)	LS	1	$ 10,000	$ 10,000
	Commissioning	LS	1	$ 10,000	$ 10,000
					$ 400,000
Plant Electrical & Controls	Electrical and Controls	LS	1	$ 380,000	$ 380,000
	VSDs				
	Soft Starters				
	Cable Containment				
	DB`s				
	Cable VSD				
	Cable Mains (AL)				
	Cable (other CU)				
	SCADA and Software				
	Standby generator				
	Installation				
	Testing and Commissioning				
					$ 380,000
Treatment Plant Building	Treatment Plant Building (Upgrade Existing)	LS	1	$ 600,000	$ 600,000
	Electrical room				
	Control Room				
	Lunch/ meeting room				
	Office space				
	Operator and ablutions areas				
	Laboratory area				
	Building services				
	Fire protection				
					$ 600,000
Plant Services	Plant process water system	LS	1	$ 60,000	$ 60,000
	Plant process air	LS	1	$ 30,000	$ 30,000
	Information network	LS	1	$ 20,000	$ 20,000
					$ 110,000
SUB-TOTAL					$ 3,825,000
Preliminary and General	Contractors Preliminary and General	%	7.5%	$ 3,825,000	$ 286,875
Works Contingency	Allowances for changes to scope of works	%	15.0%	$ 3,825,000	$ 573,750
Design & Management Fees	Professional Services	%	15.0%	$ 3,825,000	$ 573,750
TOTAL					$ 5,259,375

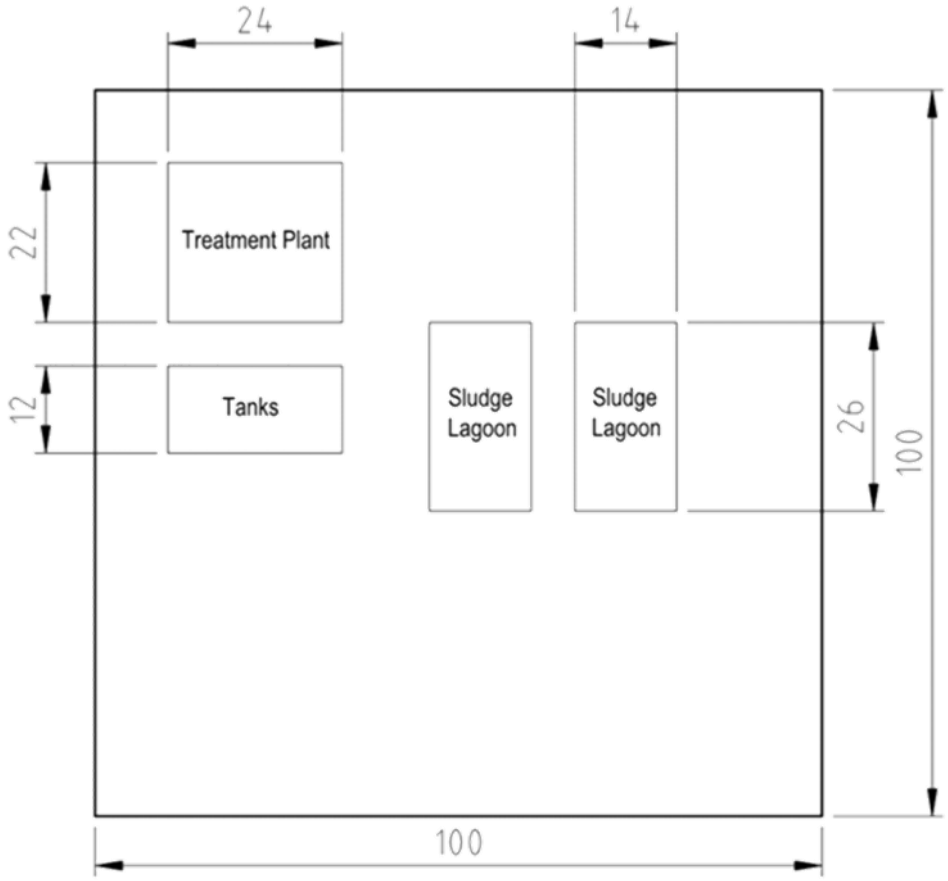
Excludes
Land Purchase
Consents and Easements
Mains Power Supply
Groundwater Bores
Groundwater Pumping and Pipelines
Treated Water Storage and Pumping and Reticulation

APPENDIX C

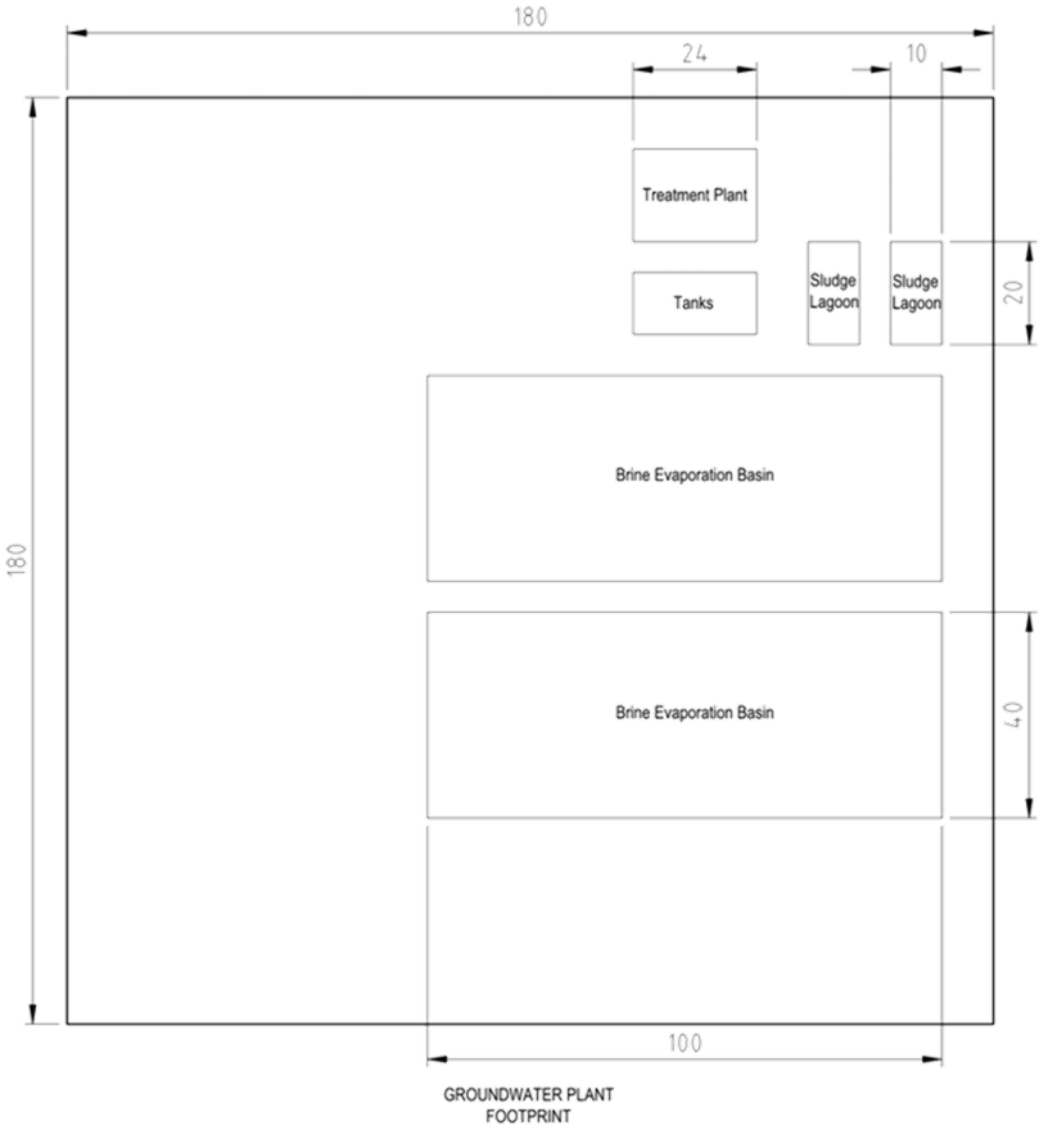
INDICATIVE LAYOUTS


36
24
Storage
Workshop
Toilet
Lab
Office
Entrance
Electrical
F-
Hypo
Poly
Alum
pH
PAC
KMnO4
Plant Access
Clarification
Ultrafiltration
UV Disinfection
Pumping
21
48
Clarified Water Storage
Treated Water Storage
10
10
NANGUS WATER SUPPLY FEASIBILITY
SURFACE WATER TREATMENT PLANT
CONCEPT FOOTPRINT


36
24
Storage
Workshop
Toilet
Lab
Office
Entrance
Electrical
F-
Hypo
CIP
CIP
Acid
AS
Plant Access
Pressure Media Filtration
Reverse Osmosis
UV Disinfection
Pumping
18
45
Raw Water Storage
Treated Water Storage
10
10
NANGUS WATER SUPPLY FEASIBILITY
GROUNDWATER TREATMENT PLANT
CONCEPT FOOTPRINT



SURFACE WATER PLANT
FOOTPRINT


180
24
10
Treatment Plant
Tanks
Sludge Lagoon
Sludge Lagoon
20
Brine Evaporation Basin
180
Brine Evaporation Basin
40
100
GROUNDWATER PLANT FOOTPRINT

APPENDIX

D

HYDROGEOLOGICAL REVIEW

Our Ref: NangusReport01.1

31 October 2019

Goldenfields Water
84 Parkes Street
Temora NSW 2666

Attention: Nigel Marion

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Level 4
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Dear Nigel,

Desktop Hydrogeological Review Nangus Study Area, NSW

1 Introduction

1.1 Background

Cardno was engaged by Goldenfields Water to carry out the Nangus Feasibility Study ("the feasibility study") with the aim of assisting with the provision of a potable water supply system for the town. Nangus is located in the Riverina area of New South Wales, approximately 18 km west of the town of Gundagai and about 2 km north of the Murrumbidgee River. It is understood that the Nangus water supply currently relies on private bores, water carting and roof water, and that the associated quality and security issues are potentially restricting residential and commercial growth in the area.

This Desktop Hydrogeological Review ("the review") forms an integral part of the feasibility study, investigating the viability of groundwater resources in the Nangus Study Area ("the study area"). The study area covers an approximate 5 km radius around Nangus.

1.2 Purpose & Objectives

The aim of the review is to investigate the viability of groundwater resources in the study area, with the objective of providing a water supply to the town of Nangus.

The specific objectives of the review are:

- Assess the hydrogeology of the study area with respect to groundwater occurrence and quality.
- Assess the potential of groundwater resources in the vicinity of the study area.

1.3 Scope of Review

Cardno carried out the following tasks in order to satisfy the purpose and objectives of this review.

- Reviewed publicly available geological and hydrogeological maps, reports and groundwater database records to evaluate local groundwater occurrence and quality.
- Prepared a Conceptual Hydrogeological Model based on available data and information.
- Evaluated the potential for groundwater resources to exist in the vicinity of Nangus.

Australia • Belgium • Canada • Ecuador • Germany • Indonesia • Italy • Kenya • New Zealand • Papua New Guinea • Peru • Tanzania • United Arab Emirates • United Kingdom • United States • Operations in 85 countries

> Recommended further investigations required to assess the suitability of potential groundwater resources identified.

Cardno notes that this is a desktop study and there have not been any visits to the site or its surrounds, or other site activities. An overview of environmental site assessments is included in Appendix C.

1.4 Data and Information Sources

Data and information contained in the following reports and documentation has been used by Cardno in the preparation of this report:

> NSW Department of Water and Energy (DWE), 2009, Mid Murrumbidgee Alluvium Groundwater Management Area 013: Groundwater Resources Status Report

> NSW Department of Primary Industries Water, May 2016, Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources – Background document for amended plan 2016

> Wagga Wagga Geological Map Series Sheet (S1 55-15)

> Bureau of Meteorology (BOM), accessed October 2019

> Water NSW database, accessed October 2019

2 Site Description and Setting

Table 2-1 summarises key details defining the study area for this review. Nangus is located on the north side of the Murrumbidgee River, approximately 18 km west of Gundagai and 50 km east of Wagga Wagga.

2.1 Site Definition and Description

Aspect	Findings
Study Area	5 km radius from Nangus town centre Area of approximately 80 km²
Local Government	Cootamundra Gundagai Regional Council (CGRC)
Land uses	Urban residential and commercial (Nangus) Farming (grazing / agricultural use) and rural residential located to the north, east, south and west
Topography	The town area itself is relatively flat at an elevation of approximately 220 m above mean sea level (amsl). The surrounding land consists of gently undulating plains and hills. Land elevations within the study area range from approximately 200 m amsl near the Murrumbidgee River to the south of Nangus to approximately 350 m amsl in the hills to the east of Nangus (Nearmap, October 2019).
Vegetation	Grassy paddocks with generally sparse trees that mainly occur along rivers and creeks, as well on hills and rises beyond the town.

The study area, with a radius of approximately 5 km, is presented in Figure 2-1.

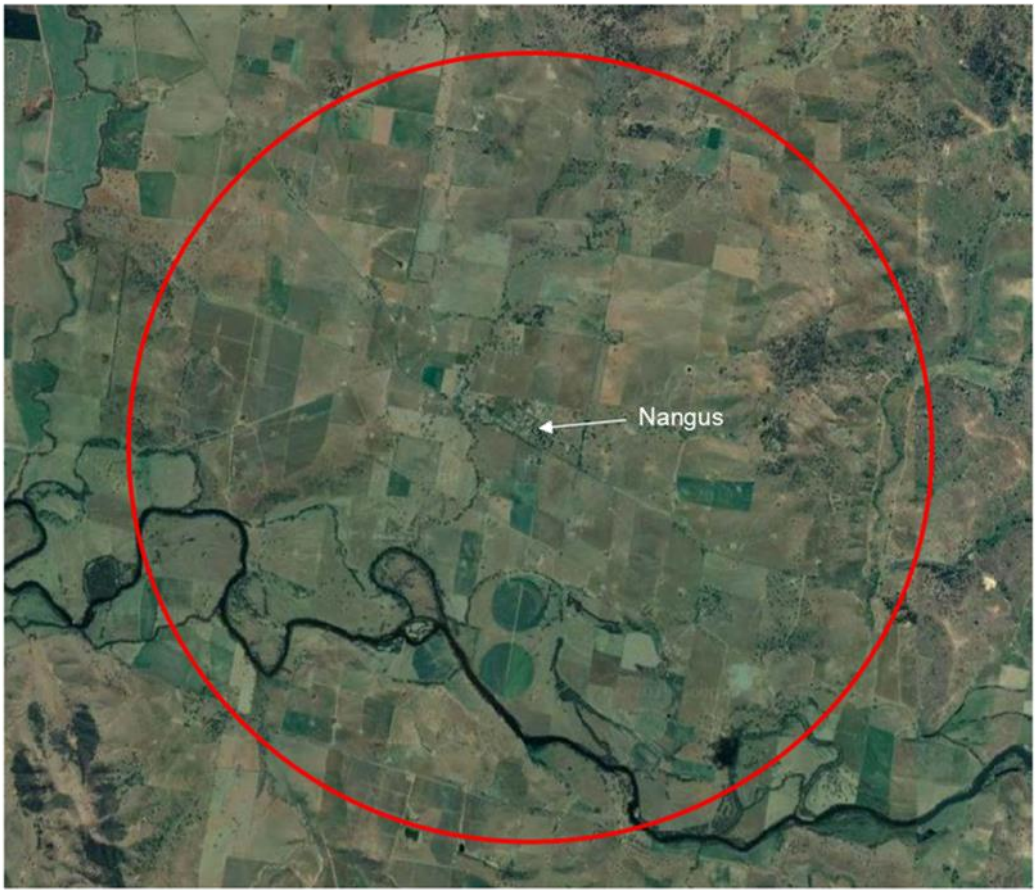

Figure 2-1: Nangus Study Area

3 Conceptual Hydrogeological Model

3.1 Introduction

This section presents Cardno's interpretation of the Conceptual Hydrogeological Model for the site in its regional context.

3.2 Climate Setting

The study area is located in a temperate area with hot, dry conditions in the summer months and cool, wet conditions during the winter months. Average annual rainfall is in the order of 550 mm (Bureau of Meteorology, October 2019). Rainfall statistics were obtained from the nearest weather station (Gundagai Station No. 073141).

Rainfall distribution during the year is relatively uniform with highest rainfall totals likely to occur from June to December, as shown in Figure 3-1.

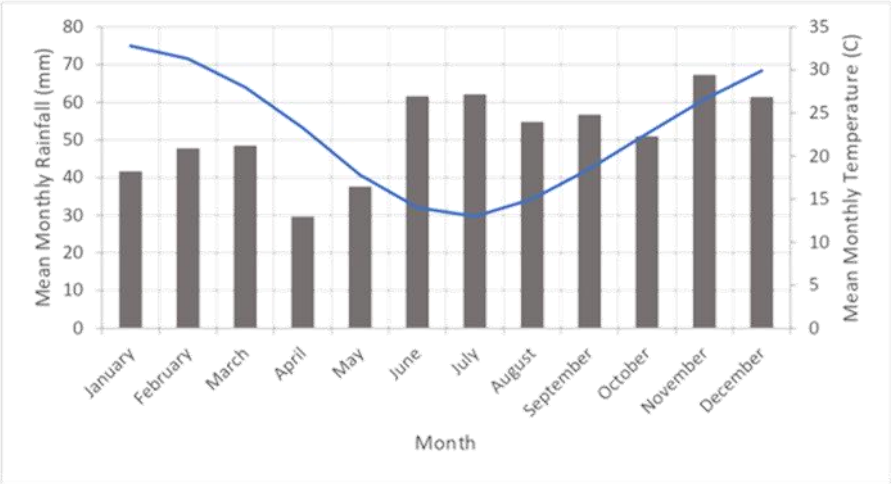

Figure 3-1: Mean Monthly Rainfall and Temperature 1995-2019

Figure 3-2 shows the total monthly rainfall from 1995 to 2019. High rainfall totals are noted during 2010, late 2011 to early 2012, and during 2016.

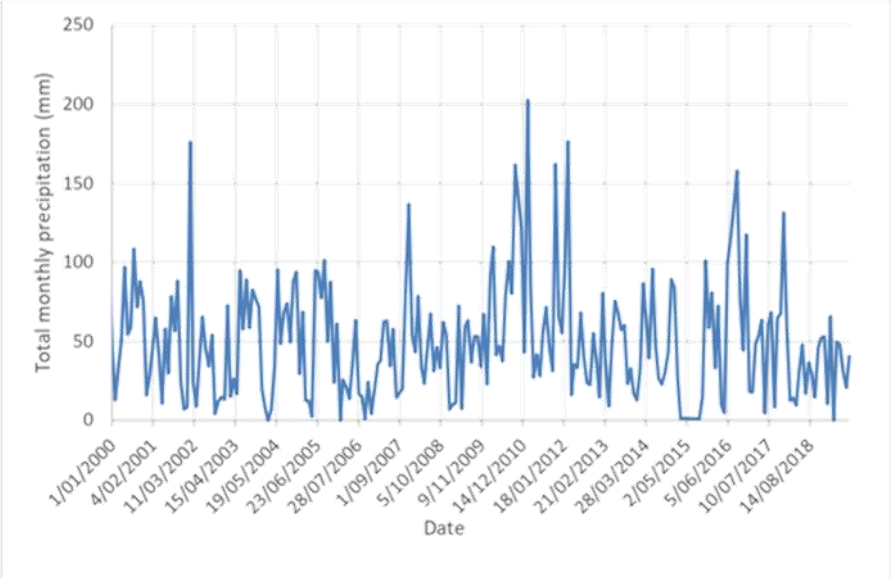

Figure 3-2: Total Monthly Rainfall 2000-2019

3.3 Geology and Aquifers

3.3.1 Regional Geology

The geology of the site in its regional setting has been ascertained from the following references:

- Wagga Wagga 1:250,000 Metallogenic Series Sheet (SI/55-15) - First Edition 1977
- Geological Survey of New South Wales - Geology Project Online Map - accessed 16 October 2019

The online Geological Survey plan (2019) was the main source used to reference geological units within and surrounding the study area. The regional geology is presented in Figure 3, Appendix A, and in Figure 3-3 below. Key geological units in the study area include the following:

- Quaternary aged sediments (Q), including alluvial and colluvial gravels, sands silts and clays.
- Silurian aged Bumbolee Creek Formation (Sufu), mainly comprising shale/ slate and sandstone, and also including conglomerate.
- Silurian aged Frampton Volcanics (Suff_m), including rhyolite, rhyodacite, dacite, as well as sandstone, siltstone and conglomerate.
- Ordovician aged Junawarra Volcanics (Olcj), mainly comprising andesite, but also including pyroclastics, latite, minor dacite and sedimentary rocks.

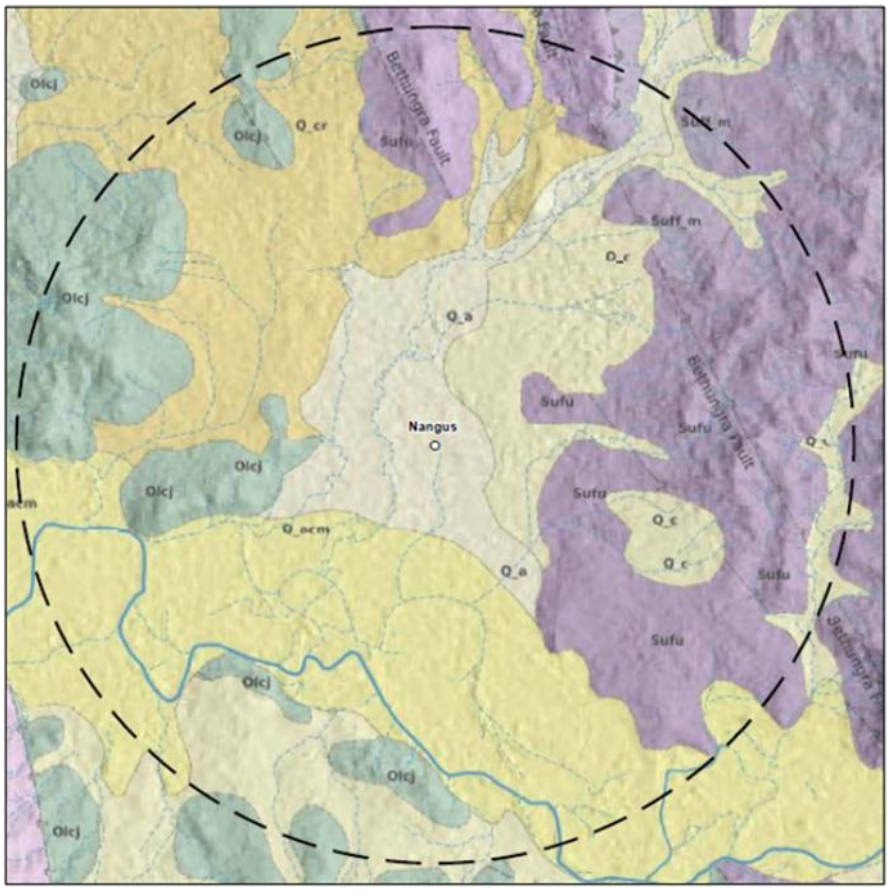

Figure 3-3: Geology - Nangus Study Area

3.3.2 Regional Aquifers

The study area is dominated by alluvial aquifers in the south and central parts, and by bedrock aquifers to the north-east and north-west. The alluvial aquifers include "channel" deposits of the Murrumbidgee River and fluvial deposits from a smaller drainage system to the north, as shown in Figure 3-3 above. The characteristics of the regional aquifer types are presented in Table 3-1. The "channel" alluvial deposits in the study area are understood to be part of the Cowra Formation which are reported to extend to depths of 25 m to 30 m. Regionally, the Cowra Formation overlies the Lachlan Formation, the latter occurring 'downstream', from near the town of Oura and extending to Narrandera. Groundwater quality and yield in the Cowra Formation are reportedly lower than in the Lachlan Formation.

Table 3-1: Aquifer Units

Aquifer	Occurrence	Geology	Yield	Water Quality
Porous Media	Southern to central parts of the study area, proximal to Murrumbidgee River (particularly on the northern bank) and extending north along a smaller drainage feature.	Sands, silts and gravels, with layers of clay.	High	High
Fractured Rock	Approximate north-east quadrant of study area.	Shales and sandstones of the Silurian aged Bumbolee Creek Formation.	Variable	Low to Moderate
	Approximate north-west quadrant of study area.	Andesites and pyroclastics of the Ordovician aged Junawarra Volcanics.	Variable	Low to Moderate

The regional extent of the aquifer types is shown in Figure 3-4 below. The figure represents a 'broad scale', simplified plan of the main aquifer types of the area.

Figure 3-4: Principal Aquifer Types (after Bureau of Meteorology, October 2019)

3.4 Groundwater Resources

A search of the Bureau of Meteorology and Water NSW databases identified 51 registered bores within the study area. The locations of the bores are presented in Figure 2, Appendix A, and tabulated bore information is provided in Appendix B. Where geology is reported, the lithologies indicate that the bores were installed and screened in Quaternary alluvial and/or colluvial deposits. These include silty to sandy clays and gravels in bores that typically range in depth, from 13 m to 20 m below ground surface.

The following groundwater uses were identified:

- Water Supply (26)
- Irrigation (12)
- Stock and Domestic (3)
- Monitoring (1)
- Other (1)
- Unknown (8)

3.5 Groundwater Occurrence and Flow Systems

3.5.1 Groundwater Levels and Flow Direction

Depth to groundwater is expected to vary considerably across the study area. A review of groundwater bores in the study area indicate that standing water levels occur at depths ranging from 5 m to 19 m below ground surface (Bureau of Meteorology, October 2019). Available standing water levels that have been reported are presented in Appendix B. They are all close to the town of Nangus, and are mainly for the bore use that is listed as "water supply". The deepest groundwater (19 m) was reported to be for "irrigation" use.

The Groundwater Resources Status Report for this area (NSW DWE, 2009) noted that declines in groundwater levels in the region have been observed since the early 1980s due to the use of groundwater for irrigation and lower rainfall.

Groundwater across the majority of the study area is expected to flow from north to south towards the Murrumbidgee River.

3.5.2 Groundwater Yields

The Bureau of Meteorology database reported groundwater yields for seven bores in the study area, with yields ranging from 0.76 L/s to 13 L/s, and an average of approximately 3 L/s. It noted that these yields are typically obtained from airlift tests during bore development and may not be accurate.

3.5.3 Groundwater Quality

A search of the BOM bore database provided salinity results for three of the bores in the study area, reporting Electrical Conductivity (EC) ranging from 1,200 µs/cm to 6,354 µs/cm. Using a factor of 0.65 to convert from EC to Total Dissolved Solids (TDS), the TDS concentration is estimated to range from 780 mg/L to 4,130 mg/L (refer to Appendix B). Table 3-2 below categorises this as fair to unacceptable quality drinking water. One other bore reported salinity as "good", but did not record a TDS concentration.

It is understood that the salinity of groundwater in the alluvial deposits along the Murrumbidgee River between Wagga Wagga and Gundagai in the Cowra formation is commonly less than 1,000 mg/L TDS, and that the salinity increases with distance from the river (NSW DWE, 2009).

The *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources – Background document for amended plan 2016* reports that iron levels in the Cowra formation are generally quite high. No data for iron were available within the study area.

3.5.4 Australian Drinking Water Guidelines

The NSW government has endorsed the *Australian Drinking Water Guidelines* (ADWG) 2011 which provide a framework for good management of drinking supplies. Groundwater quality based on TDS (mg/L) is outlined in Table 3-2.

Based on the available data, the groundwater in the alluvial aquifer around Nangus would be classified as between fair quality and unacceptable quality in terms of TDS.

Table 3-2: Australian Drinking Water Guideline Values TDS (mg/L)

TDS Aesthetic Guideline Value (mg/L)	Quality of drinking water
< 600	Good quality
600 - 900	Fair quality
900 – 1,200	Poor quality
> 1,200	Unacceptable drinking quality

4 Licensing Assessment

The assessment reviewed policy, regulation and legislation applied from the following sources:

- *Water Management (General) Regulation 2018* (NSW).
- *Water Management Act 2000* (NSW).

The licensing summary details are outlined in Table 4-1, and water sharing plan areas are shown in Figure 4, Appendix A.

Table 4-1: Licensing Details Summary

Aspect	Findings
Water Sharing Plan Area [1]	Murrumbidgee Unregulated and Alluvial Water Sources
Groundwater Management Area (GWMA) (NSW DWE, 2009)	013 Gundagai to Narrandera: Zone 1
Water Sources within Plan Area [1]	- Murrumbidgee Central (Burrinjuck to Gogeldrie) Water Source - Gundagai Alluvial Groundwater Source
Water Access Licence Exemptions	Yes (discussed in Section 6.2)
Proposed Water Use	Town Water Supply
Notes: 1. Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources (2012)	

4.1 Water Sharing Plans

Following the establishment of the *Water Management Act 2000* (NSW), water sharing plan areas have been progressively introduced across the state. The Nangus Study Area falls within the following water sharing plans:

- *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012*
- *Water Sharing Plan for the NSW Murray-Darling Basin Fractured Rock Groundwater Sources 2011*

Water sharing requirements applicable to groundwater extracted from alluvial aquifers are covered in *Water Sharing Plan for the Murrumbidgee Unregulated and Alluvial Water Sources 2012*, as shown in Figure 4, Appendix A. Under this plan, the study area falls within the following areas:

- Murrumbidgee Central (Burrinjuck to Gogeldrie) Water Source
- Gundagai Alluvial Groundwater Source

As part of the Water Sharing Plan (NSW DSE, 2009), the yield estimates calculated for Zone 1 are presented in Table 4-2.

Table 4-2: Sustainable Yield Estimates in GWMA 013 (NSW DWE, 2009)

Zone	Area (Ha)	Sustainable Yield Limit per annum (ML)	Total Entitlement per annum for 16 licences (ML)	No. Licences	No. Constructed Bores	2006/7 Usage per year (ML)	% Allocated	Intensity of Entitlement (ML/Ha)
1	22,767	19,038	1,684	16	16	51	8.6	0.07

Sustainable yield limit is how much can sustainably be extracted per year in Zone 1. **Total entitlement** refers to the annual volume of water entitled under the 16 existing licences, of which only 51 ML was extracted in 2006/07. The total existing entitlement represents 8.6% of the sustainable yield limit (**% allocated**). The existing total entitlement divided over the total area of Zone 1 represents an **intensity of entitlement** of 0.07ML/ha per year. This is well below the average sustainable intensity over the Groundwater Management Area (GMWA), calculated to be 0.7 ML/ha per year (NSW DWE, 2009).

Sustainable yield calculations provided in NSW DWE (2009) are established as a percentage of average annual recharge. The annual recharge to the Mid Murrumbidgee alluvial aquifer system is estimated to be about 127,000 ML/yr, incorporating Murrumbidgee River leakage and rainfall recharge over the GWMA. The long term average extraction limit of the groundwater system is approximately 70% of the average annual recharge, and is therefore estimated to be about 89,000 ML/yr. This correlates to an average entitlement of about 0.7 ML/ha over the main body of the GWMA 013 (Ross 1999).

4.2 Licensing Summary

Responsibilities for granting and managing water access licences are shared between the following administrations:

- NSW Department of Planning, Industry, and Environment (DPIE)
- Water NSW

DPIE handles licence applications from water utilities.

5 Conclusions and Recommendations

As part of the Nangus Feasibility Study, Cardno has completed a Desktop Hydrogeological Review to investigate the viability of using groundwater to augment the town water supply. Based on the information gathered for this review, the following conclusions are made:

- Groundwater in the study area is likely be present in porous media alluvial aquifers or in fractured bedrock aquifers.
- Groundwater in alluvial aquifers may occur at depths ranging from approximately 5 m to 19 m below ground surface, based on existing bores near the town of Nangus. Depth of groundwater in bedrock aquifers is not known at this stage.
- Groundwater yields are reported to range from approximately 1 to 13 L/s in the alluvial aquifer in the study area, with an average yield of about 3 L/s. Bore yields are expected to be relatively high in the alluvial aquifers, but may not be sufficient for the peak daily requirement which is understood to be 4.6 L/s. Bore yields in the bedrock aquifers is expected to be variable, though generally lower.
- Groundwater quality, with respect to salinity, is expected to be fair to unacceptable in alluvial aquifers (based on available data) and poor to unacceptable in bedrock aquifers (based on our experience of bedrock aquifers).
- A total 51 registered groundwater bores have been identified within the study area. Groundwater uses mostly include water supply and irrigation, with minor stock/ domestic and monitoring uses. Potential impacts on existing registered bores would need to be considered if town supply bores were to be installed in the study area.
- Goldenfields Water may apply for a water access licence through the DPIE. The application is subject to the Minister's approval.

In summary, it is considered that there is potential for suitable groundwater resources to exist in the study area. However, further testing of bore yields and salinity is required to confirm this. Low yields may be addressed by using more than one bore for the groundwater supply. Poor groundwater quality can be addressed through the treatment of the groundwater prior to use as drinking water. Further, it is likely that groundwater salinity may be lower closer to the Murrumbidgee River, and groundwater investigations could target areas closer to the river.

Should Goldenfields Water wish to further assess potential groundwater resources in the study area, the following investigations are recommended:

- Exploratory drilling of one or more groundwater bores should be undertaken in selected locations in the alluvial aquifer(s) in the study area. This will provide an initial indication of bore yield and groundwater quality.
- Should water bearing units with indications of favourable groundwater quality and yield be identified in the alluvial aquifer(s), then more detailed investigations (including pumping tests) are recommended to assess the suitability of groundwater with respect to long-term bore production.
- If testing of bedrock aquifers is required, target locations (including fault and/or fracture zones) may be identified through detailed assessment of geological maps. As with the testing of alluvial aquifers, exploratory drilling should be undertaken to assess bore yield and groundwater quality. Should favourable results be achieved, more detailed investigations, such as pumping tests, would be required to assess the potential of the bedrock aquifer for long-term bore production.

With respect to budget estimates, exploratory drilling to assess bore yield and groundwater quality may be in the order $15,000.00 per location. This would include the installation of a groundwater monitoring bore, screening the target aquifer. For more detailed investigations, including the installation of a

pumping bore and an observation bore (for the purpose of conducting pumping tests) the cost would be in the vicinity of $80,000.00 per location.

The budget estimate costs stated above are approximate, based on available information.

Yours faithfully
Cardno

Michelle Agnew
Environmental Geoscientist

Approved:

David Louwrens
Senior Associate Hydrogeologist

Appendices

Appendix A..... 4 Pages
Figures
Figure 1: Nangus Study Area
Figure 2: Registered Groundwater Bore Search
Figure 3: Regional Geology
Figure 4: Water Sharing Plan

Appendix B..... 2 Pages
Summary of Registered Bores

Appendix C..... 3 Pages
About ESA Reports

Appendix A

4 Pages

Figures

Figure 1: Nangus Study Area
Figure 2: Registered Groundwater Bore Search
Figure 3: Regional Geology
Figure 4: Water Sharing Plan

NEW SOUTH WALES
Sydney
Site
Canberra
Melbourne
Nangus
Legend
5km Radius From Nangus (Study Area)
FIGURE 1
1:50,000 Scale at A3
Metres
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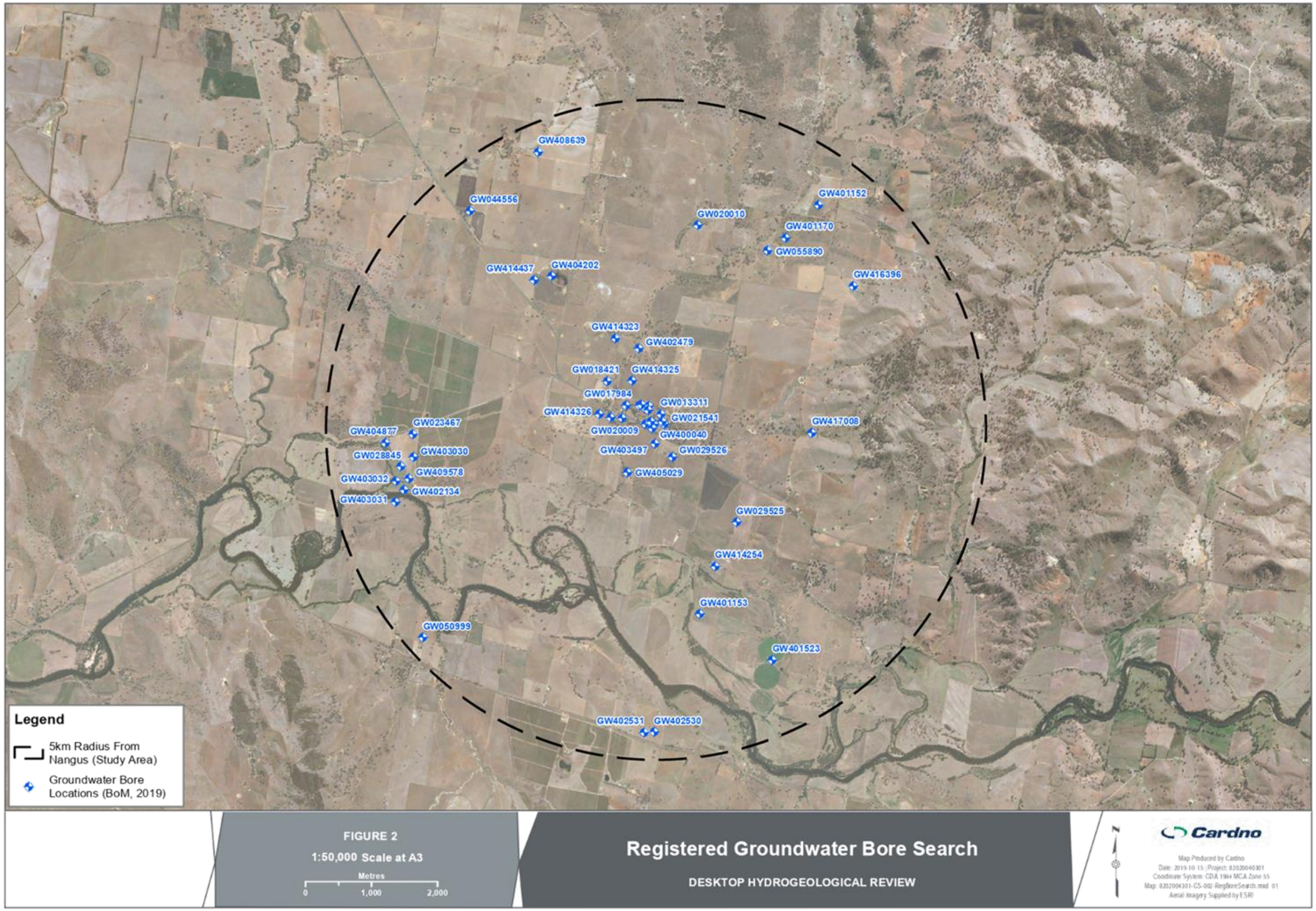
Nangus Study Area
DESKTOP HYDROGEOLOGICAL REVIEW
Cardno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GW405029
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GW402134
GW029525
GW414254
GW401153
GW050999
GW401523
GW402531
GW402530
Legend
5km Radius From Nangus (Study Area)
Groundwater Bore Locations (BoM, 2019)
FIGURE 2
1:50,000 Scale at A3
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Registered Groundwater Bore Search
DESKTOP HYDROGEOLOGICAL REVIEW
Cardno
Map Produced by Cardno
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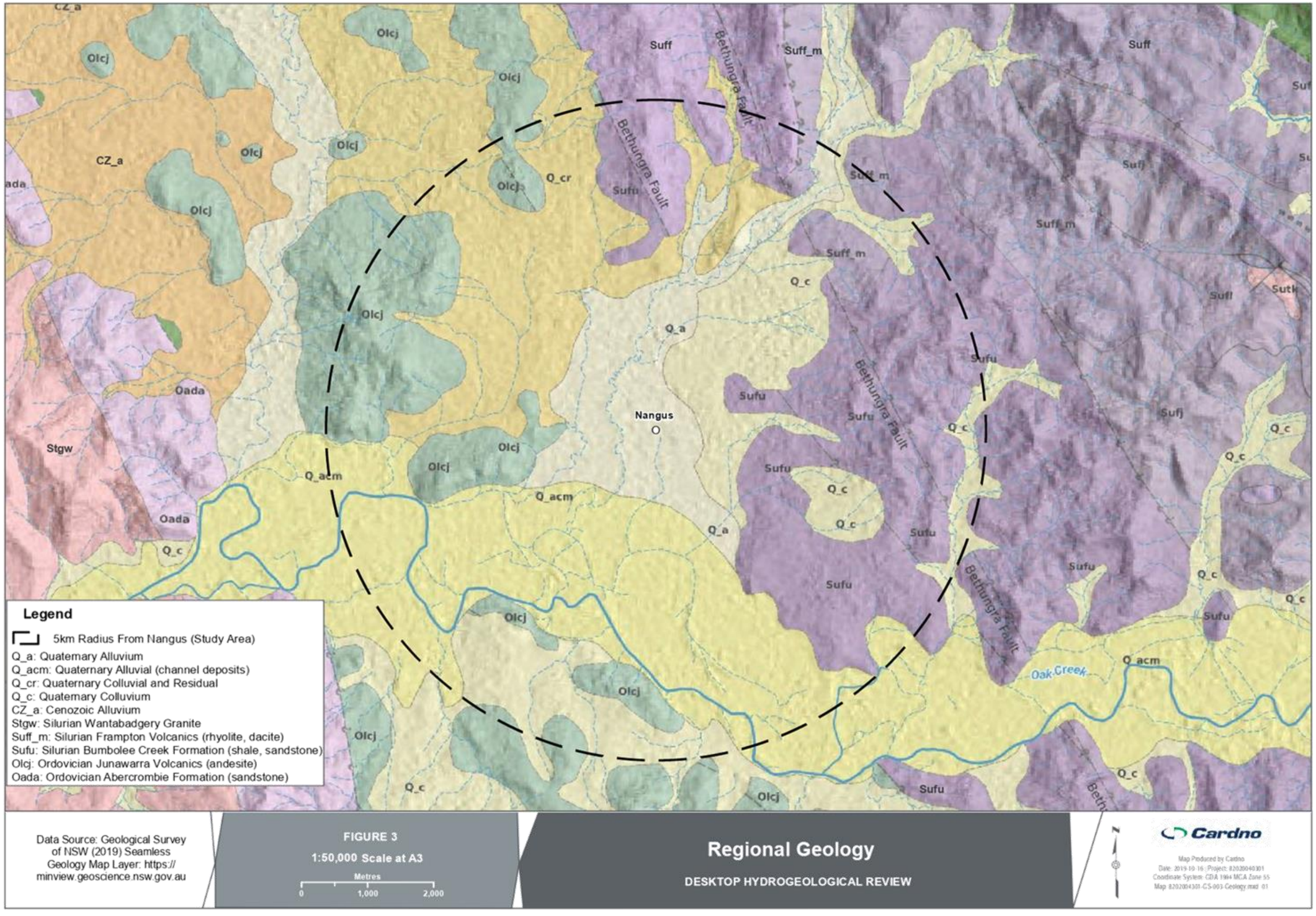
Map: 820200401-GS-002-RegBoreSearch.mxd 01
Aerial Imagery Supplied by ESRI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Q_cr
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Q_c
Q_a
Nangus
Oada
Stgw
Q_acm
Sufj
Sufl
Sutk
Oak Creek
Legend
5km Radius From Nangus (Study Area)
Q_a: Quaternary Alluvium
Q_acm: Quaternary Alluvial (channel deposits)
Q_cr: Quaternary Colluvial and Residual
Q_c: Quaternary Colluvium
CZ_a: Cenozoic Alluvium
Stgw: Silurian Wantabadgery Granite
Suff_m: Silurian Frampton Volcanics (rhyolite, dacite)
Sufu: Silurian Bumbolee Creek Formation (shale, sandstone)
Olcj: Ordovician Junawarra Volcanics (andesite)
Oada: Ordovician Abercrombie Formation (sandstone)
Data Source: Geological Survey of NSW (2019) Seamless Geology Map Layer: https://minview.geoscience.nsw.gov.au
FIGURE 3
1:50,000 Scale at A3
Metres
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Regional Geology
DESKTOP HYDROGEOLOGICAL REVIEW
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Map Produced by Cardno
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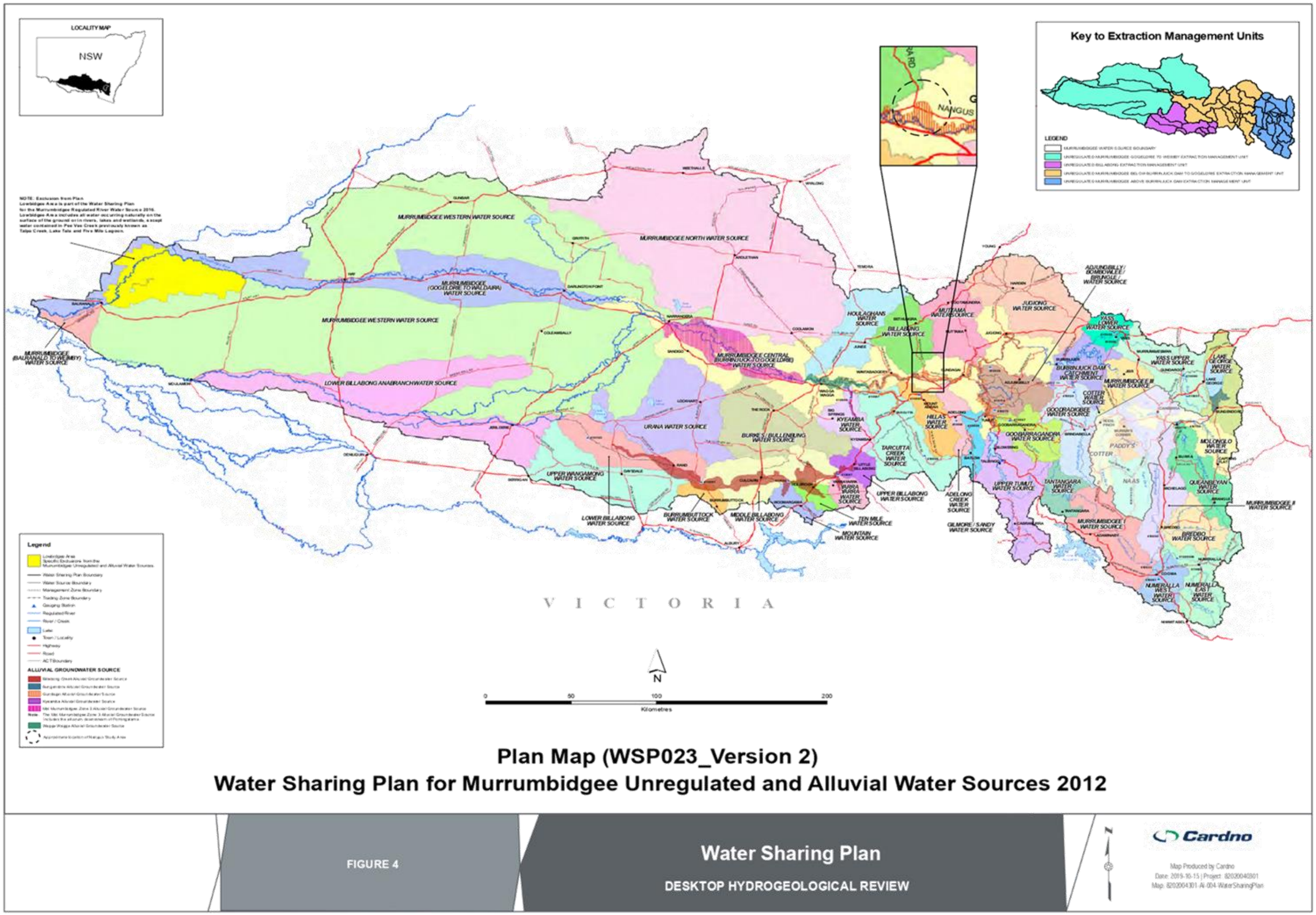
Map 82020040301-GS-003-Geology.mxd 01



Plan Map (WSP023_Version 2)

Water Sharing Plan for Murrumbidgee Unregulated and Alluvial Water Sources 2012

FIGURE 4

Water Sharing Plan

DESKTOP HYDROGEOLOGICAL REVIEW

Cardno

Map Produced by Cardno
Date: 2019-10-15 | Project: 82020040301
Map: 820200403 1-Al-004-WaterSharingPlan

Appendix B

2 Pages

Summary of Registered Bores

Appendix B: Groundwater Bores within 5km of Nangus Village

Bore ID	Bore Depth (m)	Drilled Date	Purpose	Status	Geology	Water Level (mbgl)	Yield	Salinity Description
GW409578	60	2004-10-01	Irrigation	Functioning	NR	NR	NR	NR
GW403030	23	2004-10-01	Irrigation	Unknown	NR	NR	NR	NR
GW028845	10.4	1968-03-01	Irrigation	Unknown	NR	NR	NR	NR
GW414323	27	2008-11-25	Irrigation	Functioning	NR	NR	NR	NR
GW414325	26	2008-11-25	Irrigation	Functioning	NR	NR	NR	NR
GW402134	14	2001-02-21	Irrigation	Unknown	NR	NR	NR	NR
GW414326	21	1990-01-01	Irrigation	Functioning	NR	19	6	NR
GW403031	29	2004-10-01	Irrigation	Unknown	NR	NR	NR	NR
GW404877	11.2	2008-12-23	Irrigation	Functioning	NR	NR	NR	NR
GW403032	14	2004-09-01	Irrigation	Unknown	NR	NR	NR	NR
GW402530	84	2003-09-06	Irrigation	Unknown	NR	NR	NR	NR
GW404202	36	2007-07-12	Irrigation	Functioning	NR	NR	NR	NR
GW402531	111	2003-09-04	Monitoring	Unknown	NR	NR	NR	NR
GW017984	18.9	1959-09-01	Other	Unknown	Unknown (0-6.4m) Rock (6.4-7.01) Unknown (7.01-1067m) Gravel (10.67-18.9m)	6.2	0.76	NR
GW417008	42	2018-08-07	Stock and Domestic	Functioning	NR	NR	NR	NR
GW050999	16.2	1980-02-01	Stock and Domestic	Unknown	NR	NR	NR	NR
GW020010	9.1	1962-03-01	Stock and Domestic	Functioning	NR	NR	NR	NR
GW029526	11.9	1948-01-01	Unknown	Non-functional	NR	NR	NR	3,490-4,130 mg/L
GW055890	4.3	1936-01-01	Unknown	Functioning	NR	NR	NR	NR
GW020009	13.4	1962-03-01	Unknown	Functioning	Unknown (0-9.14m), Clay (12.19-13.41m)	11	NR	NR
GW023467	13.4	1966-01-01	Unknown	Unknown	NR	NR	NR	NR
GW013311	21.3	1953-01-01	Unknown	Unknown	NR	NR	NR	NR
GW403625	20	2006-09-22	Unknown	Unknown	Clay (0-18.8m) Silty gravel (18.8-19.7, Sandy clay (19.7-20.3m)	11.5	NR	NR
GW013312	16.5	1928-02-01	Unknown	Non-functional	Unknown (0-13.72m) Gravel (13.72-16-46m)	NR	NR	NR
GW029525	11.4	1948-01-01	Unknown	Non-functional	NR	NR	NR	780-840 mg/L
GW408639	132	2006-01-24	Water Supply	Functioning	NR	NR	NR	NR
GW403701	19.4	2006-09-24	Water Supply	Unknown	Clay (0.3-3m), Gravel (3-3.6m), Clay (3.6-19m), Gravel (19-19.4m)	12.7	NR	NR
GW400040		1995-09-14	Water Supply	Unknown	Alluvial	5.48	NR	NR
GW405029	18	2009-08-27	Water Supply	Functioning	NR	NR	NR	NR
GW403942	20.6	2007-04-15	Water Supply	Unknown	Clay (0.3-6m), Gravel (6-6.6m), Clay (6.6-19.4m), Gravel (19.4-21.2m)	12.8	NR	NR
GW402479	28	2003-05-26	Water Supply	Unknown	NR	NR	NR	NR
GW060696	21.6	1984-11-01	Water Supply	Functioning	Clay (0-18.29m), Sandy Gravel (18.29-21.64m)	NR	0	NR
GW414437	35	2010-05-16	Water Supply	Functioning	NR	NR	NR	NR
GW400047	21.33	1996-01-09	Water Supply	Unknown	Alluvial	9.14	2.53	Good
GW403724	78	2007-01-12	Water Supply	Unknown	NR	NR	NR	NR
GW416108	20	2009-10-30	Water Supply	Functioning	NR	NR	1.5	NR
GW401523	7		Water Supply	Unknown	NR	NR	NR	NR
GW401152	15.24	2000-03-14	Water Supply	Unknown	NR	NR	NR	NR
GW401153	12.19	2000-03-29	Water Supply	Unknown	NR	NR	NR	NR
GW403497	21	2006-03-12	Water Supply	Unknown	Clay (1-6m), Shale (6-7m), Clay (7-12m), Shale (12-13m),Clay (13-17m), Shale (17-18m), Sandy Gravel (18-20m)	13	11	NR
GW416396	140	2014-01-08	Water Supply	Unknown	NR	NR	NR	NR

Appendix B: Groundwater Bores within 5km of Nangus Village

Bore ID	Bore Depth (m)	Drilled Date	Purpose	Status	Geology	Water Level (mbgl)	Yield	Salinity Description
GW403663	22	2006-05-15	Water Supply	Unknown	Hard red to brown (2-15m) sand and gravel (15-22m)	12	1.25	NR
GW021541	26.8	1964-02-01	Water Supply	Unknown	Clay (0-3.66m), Unknown (3.66-4.88m), Clay (4.88-19.2m), Gravel (19.2-26.82m), Clay (26.82-26.84m)	12.2	1.21	2,065-2,140 mg/L
GW416378	20.5	2009-01-20	Water Supply	Unknown	Clay (0.3-19.3m), Gravel (19.3-20.3m)	13	NR	NR
GW414254	18	2010-02-27	Water Supply	Functioning	NR	NR	NR	NR
GW403943	19.4	2007-11-26	Water Supply	Unknown	Clay (0.3-9m), Gravel (9-10.6m), Clay (10.6-18.8m), Gravel (18.8-19.4m)	12.2	NR	NR
GW401170	68.58	2000-03-24	Water Supply	Unknown	NR	NR	NR	NR
GW416146	128	2009-12-08	Water Supply	Functioning	NR	NR	NR	NR
GW018421	22.6	1960-01-01	Water Supply	Unknown	NR	NR	NR	NR
GW403700	18.5	2006-09-23	Water Supply	Unknown	Clay (0-18.1m), Sand (18.1-19m)	12	NR	NR
GW044556	97.5	1975-10-01	Water Supply	Functioning	NR	NR	NR	NR
AVERAGE						11.6	3.0	
MEDIAN						12.1	1.4	

NR- Not Recorded
Data Source: Bureau of Meteorology, Accessed October 2019

Appendix C
3 Pages

About ESA Reports

About Site Environmental Assessment Reports

1. Introduction

This document explains the Environmental Site Assessment (ESA) process and the context that applies to the use of Environmental Reports issued by Cardno.

2. What is an ESA?

Environmental Site Assessments (ESA) are undertaken for a range of purposes, specific to the brief issued by the client in each case. The scope may include one or a combination of any of the following:

- A factual report of the condition of a portion of the site or one aspect of an entire site.
- Assessment of the contamination levels in soil to be removed from a site – a waste classification assessment.
- Validation of the success of remediation of a site or a portion of a site.
- Provision of a professional opinion about the suitability of a site for one or more uses, in terms of its contamination status.

The scope of any ESA needs to be defined at the outset.

An ESA is not an Environmental Audit. Such audits are undertaken in accordance with the provisions of regulations enacted in various states of Australia, and are referred to as Site Audits in some jurisdictions. Statutory audits provide certification by EPA accredited auditors that a site is suitable for one or more uses. An ESA may provide similar advice but cannot be used in place of an audit if the latter is required by regulation in any instance. However in some circumstances and jurisdictions an ESA is sufficient to provide "environmental sign-off" of a site.

An ESA may be undertaken for due diligence purposes, to establish whether the site has been impacted to the extent that some beneficial uses of the site may be precluded. Due diligence audits in many cases may be completed as non-statutory Audits, although in some jurisdictions they can also be statutory audits, if defined as such at the outset.

3. The ESA Process

The Client generally initiates the ESA process by specifying a brief which identifies the specific objectives of the assessment. If not, it is the consultants' duty to so specify the ESA

In the case of an ESA to provide an opinion about the suitability of the site for use, it would be conducted in accordance with NEPM (Site Assessment). Such ESA would not commence until a thorough site history assessment (Phase 1 Assessment: to identify the potential for significant contamination at a site) is conducted. However, where the history is unclear, a broad screening of chemical parameters can be used to test environmental media. This normally includes a broad range of organic and inorganic compounds and elements, often referred to as an Environmental Screen.

(In the case of an ESA for a purpose other than to provide an opinion about the suitability of the site for use, it is not always necessary to undertake a Phase 1 assessment.)

The ESA requires sampling of soil at representative locations across the site. A NATA accredited laboratory performs the analysis of soil. It is impractical for all of the soil to be assessed. The ESA is often based on a statistical method of grid or random sampling, augmented by targeted sampling at locations known or suspected to be contaminated. Guidance on sampling strategy and density is provided in Australian Standard AS4482.1–2005. However, some considerable degree of judgement is still required in the application of any sampling and testing strategy. For example the blanket application of the "hot spot" method presented in this standard is often inappropriate given its limitations.

The field program also investigates the likelihood of contamination below the site surface. Field investigations must sample and test fill as well as the natural soils. If contamination is found then it is common for further work to be undertaken to characterise, to the extent practical, its vertical and horizontal extent. However, where fill is encountered and testing shows it to be uncontaminated, it must be realised that the heterogeneous nature of the material might mean that not all pockets of contaminated material can be detected using normal sampling regimes.

T6.01 About ESA Reports

EPA guidelines for auditors, that may be relevant for an ESA, indicate the need in all cases to consider the potential for groundwater contamination in any site. This does not mean all sites need to be drilled to sample groundwater, but it is most often the case. Most hydrogeological settings and groundwater conditions are complex and vary in space and time. The condition of groundwater is investigated to identify if any beneficial use or environmental value of groundwater is precluded due to contamination.

As previously stated for soil, all groundwater at the site cannot be tested. The environmental investigations are conducted in accordance with industry standards and guidelines (e.g. EPA Vic Pub 668). This provides a level of confidence that a sufficiently comprehensive assessment of the groundwater at the site is achieved.

Where an investigation shows that groundwater is polluted, consideration should be given to assessing the risks and the need for and practicality of any clean up.

4. Environmental Assessment Report

The ESA Report details the findings of the ESA. It provides summary information on the site definition, the reasons for the assessment and other relevant facts. It reviews the scope and quality of the site investigations, laboratory testing and data analyses undertaken. These reports also present a review of the contamination status of the site, the need for any further clean up, and an opinion on the suitability of the site for a range of beneficial uses and land uses such as "residential – low density", "commercial" etc, as appropriate.

However, as noted above, some ESA have a narrow scope such as for classification of waste soil for removal from site, and do not make conclusions on suitability of site for use.

The ESA Report generally includes copies of other documents and reports, necessary to support the assessment findings, presented as appendices. These can contain more detailed information than the body of the ESA Report. Care should be taken to also read the appended documents and the ESA report in full.

Cardno generally issues reports in electronic form (e-Report) on CD ROM. ESA Reports are issued in this format as Adobe Acrobat™ PDF files. However, a paper copy of the executive summary of the ESA Report is generally issued to the client, and others as required by the brief or by regulation.

T6.01 About ESA Reports

5. Limitations of Environmental Assessment Report

The ESA Report is prepared in a manner that can be easily read by a lay person with a legitimate interest in the contamination status of the site, such as the site owner or occupier, EPA and Local Planning Authority. The ESA report is not intended for use by other parties or for other purposes. Anyone who uses the assessment report for purposes other than specified in the report, does so at their own risk.

The site should only be used for one or more of the beneficial uses and land uses identified in the ESA as suitable.

The conditions and qualifications may apply to the suitability of the site for use, and it is the responsibility of the Client to be cognizant of and accept these in accepting the report. Cardno are only responsible for the issuing of the ESA report but accepts no liability for the costs incurred in the implementation of ESA findings.

The ESA provides a "snapshot" of the site conditions at the time of the site investigation. Consequently, the report may not be valid at a later time if there has been any change to the contamination status of the site in that time. Verification of the status of the site may be required in cases where a significant time has elapsed, or site conditions have changed since the assessment and audit.

The ESA is necessarily limited by constraints such as time, cost and available information; although normal professional practice at the time has been applied with all due care to prepare the report. A necessary requirement of this process is the horizontal and vertical interpolation of data from discrete locations. However, site conditions are generally not homogenous and some discrepancies will occur between the actual and predicted results at locations not directly sampled. There is a risk that contamination may occur at the site and not be identified by a competent investigation and assessment. The approach adopted in sampling (a combination of statistically based grid and judgmental sampling) seeks to reduce, but cannot eliminate, this risk.

Where unexpected occurrences of contamination arise, subsequent to the issue of the ESA Report, Cardno should be permitted to make an interpretation of these facts in relation to the ESA Report findings. Consequently, the Client should inform Cardno and seek their opinion. Cardno accepts no liability for costs incurred due to such

unexpected occurrences, given the inherent uncertainties in the assessment process.

Cardno uses information provided by other parties as the basis for the ESA, and reliance on this information is at the discretion of Cardno. However, however Cardno cannot guarantee any of the facts, findings or conclusions presented by other parties. Cardno will not be liable for the use of information, provided by others that is subsequently found to be intentionally misleading.

The ESA Report is not and does not purport to be anything other than a contaminated land ESA. It is not a geotechnical report and bore logs reproduced are for interpretation of the likely distribution of contamination. They are not intended for geotechnical interpretations and may not be adequate for this purpose.

The ESA Report is not intended to be a comprehensive analysis of the presence and associated risk of asbestos in buildings and services. Where asbestos in buildings and services is known or likely, the report may only caution that an appropriately qualified person be engaged to undertake demolition to avoid contamination of the site.

Cardno
13 August 2015

T6.01 About ESA Reports

APPENDIX E

COST ESTIMATES

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs
Option 1: Pipeline from CGRC Water Supply at Gundagai
Date: 5/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	PVC-O DN100 Trunk Main	m	16300	$82	$1,336,600
2.2	PVC-O DN150 Trunk Main	m	5200	$111	$577,200
2.3	PVC-O DN100 Reticulation	m	2500	$82	$205,000
2.4	Service connections (existing developments)	ea	30	$1,000	$30,000
2.5	Easements for trunk main	ha	17.2	$3,900	$67,080
2.6	Bridge creek crossings	ea	3	$15,000	$45,000
2.7	Open trench creek crossings	ea	7	$3,000	$21,000
3	**Reservoirs**				
3.1	Nangus Reservoir - Steel standpipe	LS	1	$445,480	$445,480
3.2	Land purchase	LS	1	$10,975	$10,975
3.3	Access road	LS	1	$22,500	$22,500
3.4	Fencing	m	120	$55	$6,600
4	**Booster Pump Station**				
4.1	Booster Pump Station	LS	1	$119,140	$119,140
4.2	Pump station building	LS	1	$15,000	$15,000
4.3	Land purchase	LS	1	$10,975	$10,975
4.4	Fencing	m	120	$55	$6,600
5	**Chlorine Booster**				
5.1	Chlorine Booster	LS	1	$59,050	$59,050
Sub Total					$3,278,200
Contingency - Inherent Risk				30%	$983,460
Contingency - Contingent Risk				10%	$327,820
Total (rounded)					$4,590,000

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs
Option 2: Pipeline from GWCC Water Supply – from Oura Road
Date: 5/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	DICL DN100 Trunk Main	m	9800	$104	$1,019,200
2.2	PVC-O DN150 Trunk Main	m	3900	$111	$432,900
2.3	PVC-O DN100 Reticulation	m	2500	$82	$205,000
2.4	Service connections (existing developments)	ea	30	$1,000	$30,000
2.5	Easements for trunk main	ha	11.0	$3,900	$42,744
2.6	Bridge creek crossings	ea	2	$15,000	$30,000
2.7	Open trench creek crossings	ea	4	$3,000	$12,000
3	**Reservoirs**				
3.1	Concrete reservoir - 250kL	LS	1	$141,000	$141,000
3.2	Land purchase	LS	1	$10,975	$10,975
3.3	Access road	LS	1	$6,300	$6,300
3.4	Fencing	m	120	$55	$6,600
4	**Pressure Reducing Valve**				
4.1	DN150 PRV and valve chamber	LS	1	$30,000	$30,000
5	**Chlorine Booster**				
5.1	Chlorine Booster	LS	1	$59,050	$59,050
Sub Total					$2,325,769
Contingency - Inherent Risk				30%	$697,731
Contingency - Contingent Risk				10%	$232,577
Total (rounded)					$3,260,000

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs

Option 3: Pipeline from GWCC water supply – from Tenandra Reservoirs following new route
Date: 11/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	DICL DN100 Trunk Main	m	5420	$104	$563,680
2.2	PVC-O DN150 Trunk Main	m	5000	$111	$555,000
2.3	Extra over for DN100 in steep, rocky terrain	m	2675	$38	$101,650
2.4	Extra over for DN150 in steep, rocky terrain	m	675	$41	$27,675
2.5	PVC-O DN100 Reticulation	m	2500	$82	$205,000
2.6	Service connections (existing developments)	ea	30	$1,000	$30,000
2.7	Easements for trunk main	ha	9.4	$3,900	$36,574
2.8	Bridge creek crossings	ea	1	$15,000	$15,000
2.9	Directional drilling of creek DN125 PE	ea	80	$445	$35,600
3	**Reservoirs**				
3.1	Concrete reservoir - 250kL	LS	1	$141,000	$141,000
3.2	Land purchase	LS	1	$10,975	$10,975
3.3	Access road	LS	1	$72,000	$72,000
3.4	Fencing	m	120	$55	$6,600
4	**Pressure Reducing Valve**				
4.1	DN150 PRV and valve chamber	LS	1	$30,000	$30,000
5	**Chlorine Booster**				
5.1	Chlorine Booster	LS	1	$59,050	$59,050
Sub Total					$2,189,804
Contingency - Inherent Risk				30%	$656,941
Contingency - Contingent Risk				10%	$218,980
Total (rounded)					$3,070,000

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs

Option 4: Pipeline from GWCC water supply – from Tenandra Reservoirs following existing easement
Date: 11/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	DICL DN100 Trunk Main	m	5600	$104	$582,400
2.2	PVC-O DN150 Trunk Main	m	5000	$111	$555,000
2.3	Extra over for DN100 in steep, rocky terrain	m	1650	$38	$62,700
2.4	Extra over for DN150 in steep, rocky terrain	m	675	$41	$27,675
2.5	PVC-O DN100 Reticulation	m	2500	$82	$205,000
2.6	Service connections (existing developments)	ea	30	$1,000	$30,000
2.7	Easements for trunk main	ha	9.5	$3,900	$37,206
2.8	Bridge creek crossings	ea	1	$15,000	$15,000
2.9	Directional drilling of creek DN125 PE	ea	80	$445	$35,600
2.10	Open trench creek crossing	ea	1	$3,000	$3,000
3	**Reservoirs**				
3.1	Concrete reservoir - 250kL	LS	1	$141,000	$141,000
3.2	Land purchase	LS	1	$10,975	$10,975
3.3	Access road	LS	1	$72,000	$72,000
3.4	Fencing	m	120	$55	$6,600
4	**Pressure Reducing Valve**				
4.1	DN150 PRV and valve chamber	LS	1	$30,000	$30,000
5	**Chlorine Booster**				
5.1	Chlorine Booster	LS	1	$59,050	$59,050
Sub Total					$2,173,206
Contingency - Inherent Risk				30%	$651,962
Contingency - Contingent Risk				10%	$217,321
Total (rounded)					$3,040,000

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs
Option 5: Murrumbidgee River extraction and treatment
Date: 5/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	PVC-O DN100 Raw Water Main	m	5000	$82	$410,000
2.2	Easements for raw water main	ha	4.0	$3,900	$15,600
2.3	PVC-O DN100 Reticulation	m	3640	$82	$298,480
2.4	Service connections (existing developments)	ea	30	$1,000	$30,000
2.5	Directional drilling of creek DN125 PE	ea	80	$445	$35,600
3	**Water Treatment Plant and Reservoir**				
3.1	Water Treatment Plant (refer to Surface and Groundwater Treatment Option report)	LS	1	$4,539,050	$4,539,050
3.2	Land purchase	ha	3.24	$9,750	$31,590
3.3	Fencing	m	720	$55	$39,600
3.4	Power supply	LS	1	$30,000	$30,000
3.5	Concrete reservoir - 250kL	LS	1	$141,000	$141,000
3.6	Water supply pump station	LS	1	$119,140	$119,140
3.7	Pump station building	LS	1	$15,000	$15,000
3	**Surface Water Intake**				
3.1	River intake pumping system - structural and civil	LS	1	$150,000	$150,000
3.2	River intake pumping system - screens	ea	1	$20,000	$20,000
3.3	River intake pumping system - pumps	ea	2	$20,000	$40,000
3.4	River intake pumping system - pipework	LS	1	$30,000	$30,000
3.5	Electrical and instrumentation	LS	1	$20,000	$20,000
3.6	SCADA/RTU	LS	1	$10,000	$10,000
3.7	Land purchase	LS	1	$10,975	$10,975
3.8	Access road	LS	1	$120,000	$120,000
3.9	Fencing	m	120	$55	$6,600
3.10	Power supply	LS	1	$100,000	$100,000
Sub Total					$6,512,635
Contingency - Inherent Risk				30%	$1,953,791
Contingency - Contingent Risk				10%	$651,264
Total (rounded)					$9,120,000

Nangus Water Supply Feasibility Study
Goldenfields Water County Council
Construction Costs
Option 6: Groundwater extraction and treatment
Date: 5/12/2019

Item	Description	Units	No.	Rate	Cost
1	**General**				
1.1	Preliminaries and General	LS	1	$300,000	$300,000
2	**Pipelines**				
2.1	PVC-O DN100 Raw Water Main	m	4900	$82	$401,800
2.2	Easements for raw water main	ha	3.9	$3,900	$15,288
2.3	PVC-O DN100 Reticulation	m	3640	$82	$298,480
2.4	Service connections (existing developments)	ea	30	$1,000	$30,000
2.5	Directional drilling of creek DN125 PE	ea	80	$445	$35,600
3	**Water Treatment Plant and Reservoir**				
3.1	Water Treatment Plant (refer to Surface and Groundwater Treatment Option report)	LS	1	$4,398,750	$4,398,750
3.2	Land purchase	ha	3.24	$9,750	$31,590
3.3	Fencing	m	720	$55	$39,600
3.4	Power supply	LS	1	$30,000	$30,000
3.5	Concrete reservoir - 250kL	LS	1	$141,000	$141,000
3.6	Water supply pump station	LS	1	$119,140	$119,140
3.7	Pump station building	LS	1	$15,000	$15,000
3	**Bores**				
3.1	Bores	ea	2	$51,800	$103,600
3.2	Wellhead protection	ea	2	$10,000	$20,000
3.3	Electrical and instrumentation	LS	2	$15,000	$30,000
3.4	SCADA/RTU	LS	2	$10,000	$20,000
3.5	Land purchase	LS	1	$20,975	$20,975
3.6	Access road	LS	1	$120,000	$120,000
3.7	Fencing	m	120	$55	$6,600
3.8	Power supply	LS	1	$100,000	$100,000
Sub Total					$6,277,423
Contingency - Inherent Risk				30%	$1,883,227
Contingency - Contingent Risk				10%	$627,742
Total (rounded)					$8,790,000