

From: [Peter Tonkes](#)
To: [Maurice Sheehan](#)
Cc: [Neil Beck](#)
Subject: RE: Proposed Subdivision - Lot 2 on SR 431, Craiglie.
Date: Wednesday, 19 February 2020 4:19:27 PM
Attachments: [image001.png](#)
[image002.png](#)
[image003.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.jpg](#)

Maurice,

Thanks for the information provided, do you have a timeline for when it is anticipated that stage 7 would be developed? It is likely to be some years based on past experience in the region and as such it will present far more problems to council waiting until stage 7 is developed before completing the water supply loop via extending the 300mm main along Captain Cook Highway.

As such we will still require the 300mm main extended as part of stage 3 development to provide the double point of entry to the development for water quality and main maintenance obligations.

On the wastewater side, we are still concerned about the low flows from the new pump station into the 300mm rising main at Beor St for stage 1 and possibly stage 2. Is there a timeline when it is expected stage 2 would be at least 50% occupied? With the low EP supplying sewage to the new large SPS the likelihood of the line, particularly the 300 rising main, becoming septic is significant. We have already experienced this issue when the SPS (PP1) on Milman Dr was connected to the same 300 rising main and council spent considerable time and money servicing the main and subsequently redirecting the rising main to accommodate the low flows. Request a well washer be installed on the pump station to assist with low flows and maintenance, council will likely have to supplement the low volume of sewage with water to prevent issues in the 300 rising main. So with this in mind I would like to explore some options to stage the sewer mains.

The new pump station to remain as planned. For an initial period where there are low flows in the network, possibly stage 1 & 2, connect the pump station to the gravity main at the corner of Milman Dr & Wabul or to the existing pump station PP2 at Jiwal Jiwal St. As stage 3 is developed, as with the 300 water main, install the rising main from the new pump station to the 300mm rising main at Beor St. I understand you can check the capacities of PP2 to accommodate this additional load.

Other notes for the sewer:

- Specify Flygt pumps, Siemens flow meters, Schneider VSD
- At the scour points on the rising main are there pits? Not apparent on the drawings. Also prefer air release in a pit for function and serviceability.

Cheers,
Pete

Regards,

Peter Tonkes | Manager Water & Wastewater

Water & Wastewater | Douglas Shire Council

P: 07 4099 9439 | **M:** 0448 157 794

E: peter.tonkes@douglas.qld.gov.au | **W:** douglas.qld.gov.au

Mail: PO Box 723, Mossman Q 4873 | **Office:** 64-66 Front St, Mossman Q 4873

From: Maurice Sheehan <maurice.sheehan@cardno.com.au>

Sent: Thursday, 13 February 2020 11:07 AM

To: Peter Tonkes <Peter.Tonkes@douglas.qld.gov.au>

Cc: Gary Patterson <Gary.Patterson@cardno.com.au>; Sunil Simkhada <sunil.simkhada@cardno.com.au>; Neil Beck <Neil.Beck@douglas.qld.gov.au>; Rob Wheeler <robert.wheeler@cardno.com.au>; Jarred Doyle <Jarred.Doyle@cardno.com.au>

Subject: RE: Proposed Subdivision - Lot 2 on SR 431, Craiglie.

Hi Peter,

As discussed at the conference call on Friday last, we have reviewed the water modelling for the proposed Craiglie Subdivision with consideration of the requirement for the 300mm Watermain in the eastern verge of the Captain Cook Highway.

I have attached the new updated water reticulation plan for council discussion. The following information was derived from the modelling results:

- Stage 1 can be supplied by connecting the new DN150 main to the mains along Milman Drive to the north (First connection).
See as-constructed Watermains plan for the final stage of the Port Pacific Development attached.
- With the pipe sizes shown in the attachment, the first connection can supply up to and including Stage 6 (See Staged masterplan drawing attached)
- The second connection (DN300) is needed to supply Stage 7 of the development and also to supply any future development on the southern side.
- In the event of any breaks in the first connection, the second connection (DN300 via Andreassen Rd) can supply the development by maintaining the design standard.
- Being a looped supply from both ends, there should not be any problem with stagnant water in DN300 or in any mains when the properties are occupied.

Please advise if Council support this proposal or if there are any further queries.

We will then proceed to finalise the report and model and update the internal reticulation to suit.

Please give me a call to discuss if you have any queries or require any further information.

Maurice Sheehan

SENIOR CIVIL ENGINEER
CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522

Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO



Cardno's management systems are certified to ISO9001 (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: Maurice Sheehan

Sent: Friday, 7 February 2020 12:01 PM

To: Peter.Tonkes@douglas.qld.gov.au

Cc: Gary Patterson <Gary.Patterson@cardno.com.au>; Sunil Simkhada <sunil.simkhada@cardno.com.au>

Subject: RE: Proposed Subdivision - Lot 2 on SR 431, Craiglie.

Hi Peter,

See attached Civil Subdivision design for reference.

These were not included in the previous email.

Please give me a call on 0475 422 458 if you are having issues with dialling in to the conference call.

Maurice Sheehan

SENIOR CIVIL ENGINEER

CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522

Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO    

Cardno's management systems are certified to ISO9001 (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: Maurice Sheehan

Sent: Monday, 3 February 2020 4:46 PM

To: Peter.Tonkes@douglas.qld.gov.au

Cc: Neil Beck <Neil.Beck@douglas.qld.gov.au>; Gary Patterson <Gary.Patterson@cardno.com.au>

Subject: Proposed Subdivision - Lot 2 on SR 431, Craiglie.

Hi Peter,

I am writing in relation to a proposed subdivision in Craiglie on Lot 2 SR431 to the east of the Captain Cook Highway.

Councils reference number for the Operational Works Application is 2019_3370/1.

We have received some RFI's for the application. See attached. RFI's #16-22 relate to the Sewer and Water Services.

The Sewer RM and Trunk Water Infrastructure upgrade drawings and related report are attached.
The original ROL Decision Notice is also attached.

Are you free this week to have a conference call to go through these queries?

Maurice Sheehan

SENIOR CIVIL ENGINEER

CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522

Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO    

Cardno's management systems are certified to ISO9001 (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: [Peter Tonkes](#)
To: [Maurice Sheehan](#)
Cc: [Peter White](#)
Subject: RE: Interim Sewer Connection for proposed Craiglie Subdivision
Date: Monday, 23 March 2020 2:43:30 PM
Attachments: [image001.png](#)
[image002.png](#)
[image003.png](#)
[image004.png](#)
[image005.png](#)
[image006.png](#)
[image007.png](#)

Maurice,

I can confirm we are happy with the proposal for the interim wastewater connection, as a solution to the low flows that would be experienced in the early stages of the development, as detailed below with the ultimate solution as previously detailed to be implemented when appropriate for the capacity of the network.

Regards,

Peter Tonkes | Manager Water & Wastewater

Water & Wastewater | Douglas Shire Council

P: 07 4099 9439 | **M:** 0448 157 794

E: peter.tonkes@douglas.qld.gov.au | **W:** douglas.qld.gov.au

Mail: PO Box 723, Mossman Q 4873 | **Office:** 64-66 Front St, Mossman Q 4873

From: Maurice Sheehan <maurice.sheehan@cardno.com.au>
Sent: Monday, 23 March 2020 11:12 AM
To: Peter White <Peter.White@douglas.qld.gov.au>
Cc: Peter Tonkes <Peter.Tonkes@douglas.qld.gov.au>
Subject: RE: Interim Sewer Connection for proposed Craiglie Subdivision

Thanks Peter,

Can Council please confirm that they would like us to finalise the wastewater documentation utilising the interim wastewater connection as described in the below email.

Maurice Sheehan

SENIOR CIVIL ENGINEER
CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522
Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO    



Cardno acknowledges the Traditional Owners of the land upon which we live and work and we pay our respects to their Elders past, present and emerging.

Cardno's management systems are certified to ISO9001- (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: Peter White <Peter.White@douglas.qld.gov.au>
Sent: Monday, 23 March 2020 11:07 AM
To: Maurice Sheehan <maurice.sheehan@cardno.com.au>
Cc: Peter Tonkes <Peter.Tonkes@douglas.qld.gov.au>
Subject: RE: Interim Sewer Connection for proposed Craiglie Subdivision

Hi Maurice, At this stage none of the works outlined in the MWH report have been completed or are scheduled.

Regards,

**Peter White | Coordinator Water & Wastewater
Operations | Douglas Shire Council**
P: 07 4099 9466
M: 04 2714 9966
E: Peter.White@douglas.qld.gov.au **W:** www.douglas.qld.gov.au
Mail: PO Box 723, Mossman Q 4873 | **Office:** 64-66 Front Street, Mossman Q

From: Maurice Sheehan <maurice.sheehan@cardno.com.au>
Sent: Monday, 23 March 2020 10:07 AM
To: Peter Tonkes <Peter.Tonkes@douglas.qld.gov.au>
Cc: Peter White <Peter.White@douglas.qld.gov.au>
Subject: RE: Interim Sewer Connection for proposed Craiglie Subdivision

Hi Peter,

Can you please advise regarding a response to the below queries.
We are preparing a response to the previous RFI's and would like to incorporate the agreements regarding the interim wastewater servicing strategy.

Maurice Sheehan

SENIOR CIVIL ENGINEER
CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522
Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO    



Cardno acknowledges the Traditional Owners of the land upon which we live and work and we pay our respects to their Elders past, present and emerging.

Cardno's management systems are certified to ISO9001- (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

From: Maurice Sheehan

Sent: Wednesday, 11 March 2020 8:57 AM

To: Peter.Tonkes@douglas.qld.gov.au

Cc: Gary Patterson <Gary.Patterson@cardno.com.au>; Sunil Simkhada <sunil.simkhada@cardno.com.au>; Peter.White@douglas.qld.gov.au

Subject: Interim Sewer Connection for proposed Craiglie Subdivision

Hi Peter,

As discussed with Peter White last week, we have reviewed alternative scenarios for the interim sewer connection for the proposed Craiglie Subdivision.

We have also reviewed the sewer model provided by Stantec against the "as constructed" information we had for the previous stages of the Port Pacific Development including the Jiwal Jiwal Pump Station and the 2017 PDPP pressure main diversion works in the vicinity of the Beor St and Downing St Intersection. We have made various updates to the Sewer Model.

The updated sewer model was analysed for 2026 scenario by discharging the Stage 1 and Stage 2 Craiglie development to gravity network of Jiwal Jiwal PS catchment (4L/s).

The result is shown in following Table:

Scenario	Catchment	Interim discharge to Jiwal Jiwal Catchment
2026 (Stage 1 and 2 Craiglie Development)	Jiwal Jiwal Catchment	No augmentations needed
	PDPP Catchment	Construction of approximately 165m DN80 RM between PDPP and Beor St / Downing St Intersection.
	Craiglie Development	Revise pump design (and switchboard) to discharge 4L/s. (Will need to be upgraded for Stage 3) Revise RM design to discharge to existing gravity system at Wabul St / Milman Dr Intersection. (Will need to be constructed as per the ultimate design (via 150mm RM along Captain Cook Highway) for Stage 3

The augmentations described above can handle up to 7 L/s of flow from Craiglie development (without any further external augmentations).

This accounts Stage 1 to 3 plus about half of Stage 4 development (approx. 136lots).

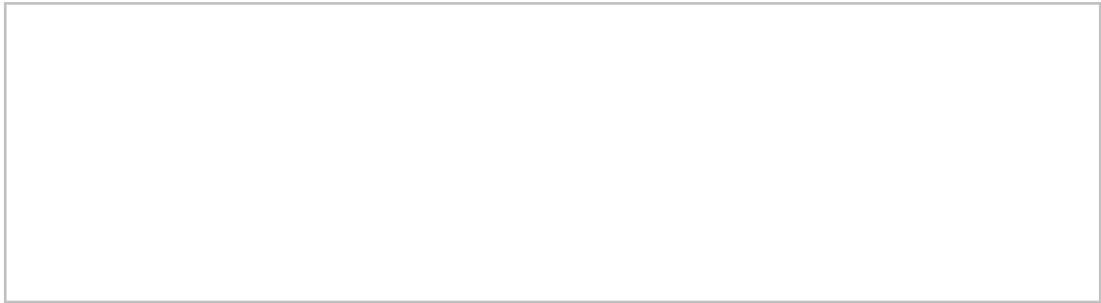
4L/s cater for PWWF for approx. 69 lots (stage 1&2). 7L/s caters for PWWF for approx. 136 lots.

It would be prudent to design the Craiglie pump station for 7L/s discharge delaying future upgrades for as long as possible should Council prefer this solution.

The above advice does not include the recommendations of the 2013 report by MWH or the subsequent 2016 report by Cardno. These reports recommended the following upgrades in the vicinity of the proposed Craiglie Development.

- The rising main directly downstream of PDL1 (approximately 205m length) is proposed to be upgraded to a 150mm diameter RM (existing 100mm). This is labelled as "AUG_PDL1_RM001" in the 2013 MWH Report.
- The gravity main directly upstream of PDL1 was advised to be upgraded to a 225mm diameter main at various stages (existing 150mm). This is labelled as "AUG_PDL1_GM001 to GM004" in the MWH Report

The following is clipped from the MWH Report:



- Can Council please advise if any of the above upgrades have been constructed.

Attachment 1 provides the HGL profile for the "AUG_PDL1_GM001 to GM004" gravity main for the following scenarios:

- With Stage 1 & 2 Craiglie discharge into PDL1 Pump station.
- Existing case (no Craiglie load added to PDL1 Pump station)

For this exercise we have assumed none of the upgrades recommended in the MWH report have been constructed to date. ("AUG_PDL1_RM001" or "AUG_PDL1_GM001 to GM004").

As can be seen from the HGL longsection provided there is a slight increase in the HGL at the PDL1 Wetwell and the first manhole upstream when the Craiglie load is added to the system however under both scenarios the system overflows without the PDL1 proposed upgrades.

Based on the "existing case" sewer model it is recommended, at a minimum, the following also be upgraded:

- AUG_PDL1_RM001
- AUG_PDL1_GM001 to GM002

These are already over capacity and will be further over capacity if additional load from Craiglie is added.

Please give me a call to discuss if you need any further information to make a decision on Councils preferred interim sewer connection or would like to discuss further.

Maurice Sheehan

SENIOR CIVIL ENGINEER
CARDNO



Phone +61 7 4034 0500 Direct +61 7 4034 0522

Address 15 Scott Street, Parramatta Park, Cairns, Queensland 4870 Australia

Email maurice.sheehan@cardno.com.au Web www.cardno.com

CONNECT WITH CARDNO    



Cardno acknowledges the Traditional Owners of the land upon which we live and work and we pay our respects to their Elders past, present and emerging.

Cardno's management systems are certified to ISO9001- (quality) and AS4801/OHSAS18001 (occupational health and safety)

This email and its attachments may contain confidential and/or privileged information for the sole use of the intended recipient(s). All electronically supplied data must be checked against an applicable hardcopy version which shall be the only document which Cardno warrants accuracy. If you are not the intended recipient, any use, distribution or copying of the information contained in this email and its attachments is strictly prohibited. If you have received this email in error, please email the sender by replying to this message and immediately delete and destroy any copies of this email and any attachments. The views or opinions expressed are the author's own and may not reflect the views or opinions of Cardno.

Port Douglas Estate, Captain Cook Highway Craiglie

Development Application for Water
and Sewerage Services

Q184103

Prepared for
Port Douglas Land Developments Pty Ltd

24 March 2020



Contact Information

Cardno (Qld) Pty Ltd

ABN 57 051 074 992

Level 11, North Tower
515 St Paul's Tce
Fortitude Valley QLD 4006Telephone: 3369 9822
Facsimile: 3369 9722
International: +61 7 3369 9822cardno@cardno.com.au
www.cardno.com.au**Author(s):**Sunil Simkhada
Project Engineer**Approved By:**Matt Walsh
Technical Lead

Document Information

Prepared for	Port Douglas Land Developments Pty Ltd
Project Name	Development Application for Water and Sewerage Services
File Reference	CraiglieDev-Report-v06.docx
Job Reference	Q184103
Date	24 March 2020

Version Number	7
----------------	---

Effective Date	14 October 2019
----------------	-----------------

Date Approved:	14 October 2019
----------------	-----------------

Document History

Version	Effective Date	Description of Revision	Prepared by:	Reviewed by:
1	18/07/2019	Draft	Sunil Simkhada	Matt Walsh
2	19/08/2019	Comments incorporated after review	Sunil Simkhada	
3	26/08/2019	Appendix D changed to show the existing Pump Station catchments	Sunil Simkhada	
4	28/08/2019	Additional water and sewage network at northern side included in the analysis	Sunil Simkhada	
5	16/09/2019	Report amended upon review from Cardno Cairns Office	Sunil Simkhada	
6	14/10/2019	"Draft" watermark removed	Sunil Simkhada	
7	24/3/2020	Water and sewerage service strategy modified upon discussion with Council	Sunil Simkhada	

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document

Table of Contents

1	Introduction	5
2	Assumptions	6
2.1	Design Criteria	6
2.2	Development Population	6
2.3	Water Supply Demand	6
2.4	Sewage Flow	6
3	Network Planning	7
3.1	Water Supply	7
3.1.1	Existing Infrastructure	7
3.1.2	Future Infrastructure	7
3.1.3	Hydraulic Modelling	7
3.1.4	Maximum Hour Results – Existing Scenario	8
3.1.5	Fire Flow Results – Existing Scenario	10
3.1.6	Maximum Hour Results – Ultimate Scenario	13
3.1.7	Fire Flow Results – Ultimate Scenario	15
3.2	Sewerage Infrastructure	17
3.2.1	Existing Infrastructure	17
3.2.2	Future Infrastructure	17
3.2.3	Hydraulic Modelling	17
3.2.4	Model Set-Up	18
3.2.5	Model Results	18
4	Conclusions	24
4.1	Water Supply	24
4.2	Sewerage	25

Appendices

Appendix A	Development Layout Plans
Appendix B	FNQROC Design Criteria
Appendix C	Water Servicing Strategy
Appendix D	Sewerage Servicing Strategy

Tables

Table 2-1	Estimated Development Water Demand and Sewage Load	6
Table 2-2	Estimated Total Water Supply Demand	6
Table 2-3	Estimated Total Sewage Flow	6
Table 3-1	Initial Stages Results – RM - Unaugmented	20
Table 3-2	Initial Stages Results – RM - Augmented	22

Figures

Figure 1-1	Location Plan of Development Site at Captain Cook Highway, Craiglie QLD 4877	5
Figure 3-1	Existing - Peak Hour Pressure Map Without the Craiglie Development Demand and Milman Drive Demand	8
Figure 3-2	Existing - Peak Hour Pressure Map With Stage 1 Craiglie Development Demand and Milman Drive Demand	9
Figure 3-3	Existing – Fire-flow Pressure Map Without the Development Demand and Milman Drive Demand	10
Figure 3-4	Existing – Fire-flow Pressure Map With the Stage 1 Craiglie Development Demand and Milman Drive Demand - Unaugmented	11
Figure 3-5	Existing – Fire-flow Pressure Map With the Stage 1 Craiglie Development Demand and the Milman Drive Demand – Augmented	12
Figure 3-6	Ultimate - Peak Hour Pressure Map Without the Craiglie Development Demand	13
Figure 3-7	Ultimate - Peak Hour Pressure Map With the Craiglie Development Demand	14
Figure 3-8	Ultimate – Fire-flow Pressure Map Without the Craiglie Development Demand	15
Figure 3-9	Ultimate – Fire-flow Pressure Map With the Craiglie Development Demand	16
Figure 3-10	Initial Stages Results – Gravity Network and Wet Well Levels - Unaugmented	20
Figure 3-11	Initial Stages Results – Gravity Network and Wet Well Levels – Augmented	22

1 Introduction

Port Douglas Land Developments Pty Ltd commissioned Cardno to undertake a water supply and sewerage analysis for the proposed Stage 1 development at Lot 2 Captain Cook Highway, Craiglie 4877 near Port Douglas. The development is situated on Lot 2 SR 431 and will consist of 32 freehold residential lots in Stage 1. Other stages will be developed in the future and will consist of 285 residential lots in total.

The development site is shown in Figure 1-1 below.



Figure 1-1 Location Plan of Development Site at Captain Cook Highway, Craiglie QLD 4877

Douglas Shire Council (DSC) invited Stantec to undertake the fire-flow performance assessment for Mossman and Whyanbeel water supply areas (WSA). Cardno received the water model and fire-flow assessment report from Stantec upon Council's request. This model was used for the analysis.

2 Assumptions

The following section details the assumptions used to assess this development.

2.1 Design Criteria

The water supply and sewerage design criteria have been adopted from the *FNQROC Development Manual Design Manual Version No. 03/17 – D6 for Water Reticulation and D7 for Sewerage System*. Appendix B details the extracts from this code that have been used to calculate EP loadings, associated water & sewerage demands and the level of service standard for the development.

2.2 Development Population

DSC adopts an Equivalent Population (EP) as the basis for water supply and sewerage infrastructure planning which represents the water supply and sewerage load associated with the proposed development. The development EP was calculated by converting the corresponding number of dwellings with the conversion rate specified in the *Design Manual* shown in Appendix B. The development lot plans for Stage 1 are detailed in Appendix A. Appendix A also depicts the Master Plan Layout for overall development. The estimated water and sewerage load in EPs for the development are shown in Table 2-1, which is 90 EP for Stage 1 (1A & 1B) and 798 EP overall.

Table 2-1 Estimated Development Water Demand and Sewage Load

Development Type	Stage	Lot Count	Development Unit	Water Demand (EP)	Sewage Load (EP)
Residential Lots	1 (1A & 1B)	32	2.8 EP/connection ¹	89.6	89.6
Residential Lots	Overall	285	2.8 EP/connection ¹	798	798

¹ For Single Family Residential (401m² to 900m²)

2.3 Water Supply Demand

DSC previously adopted 400L/EP/d as the average daily consumption rate for water for ultimate scenario analysis as this was evident in Stantec's fire-flow report for Mossman and Whyanbeel WSA. This analysis also assumes 400 L/EP/d as average daily water consumption rate to derive the peak day and peak hour flow in ultimate scenario.

Based on the adopted design criteria, the table below shows a summary of the projected water supply demand for the proposed development.

Table 2-2 Estimated Total Water Supply Demand

Stage	Water Demand (EP)	Average Day (L/s)	Max Day (L/s)	Max Hour (L/s)
1 (1A & 1B)	89.6	0.4	0.9	1.9
Overall	798	3.7	8.3	16.6

2.4 Sewage Flow

Based on the adopted design criteria, the table below shows a summary of the projected sewage flows for the proposed development.

Table 2-3 Estimated Total Sewage Flow

Stage	Sewer Demand (EP)	Average Dry Weather Flow (L/s)	Peak Wet Weather Flow, PWWF (L/s)
1 (1A & 1B)	89.6	0.3	2.1
Overall	798	2.5	13

3 Network Planning

This section details the existing and proposed water supply and sewerage infrastructure required to service the development while maintaining FNQROC's Design Criteria.

3.1 Water Supply

The water supply analysis was undertaken in H2OMap Water software using the Stantec supplied model. The hydraulic analysis was undertaken for existing (2016) and ultimate planning horizons for both Maximum Hour and Fire Flow simulations. All the assumptions in the model remain unchanged in this analysis. The scope of this analysis includes assessing the water supply zone where this development exists.

3.1.1 Existing Infrastructure

The development site is located beside Captain Cook Highway. There are existing water supply network on the north and west of the development site supplied from Craiglie Reservoir. The reservoir is located to the north-west of the site near Captain Cook Highway.

There are three potential water supply connection points near the development site. The first connection point is to the 100mm diameter main at Wabul Street (Off Milman Drive) north of the development site. The second connection point is to the 300 mm main located on Captain Cook Highway near Beor Street. The third connection point is to the 150 mm diameter main located on Captain Cook Highway located to the west of the site. This 150 mm main is a dedicated main to supply the reservoir on the south and DSC has also suggested not using this main as a supply main. Hence, the third connection is ruled out. The existing water supply infrastructure near the development is shown in Appendix C.

3.1.2 Future Infrastructure

The network in the development will consist of DN150 and DN100 pipes to serve the future lots. The Stage 1 development will be served by a proposed DN150 main along Milman Drive, connected to the 100 mm main. When other stages are developed, then the second connection point will come in place by connecting to the existing 300mm main at Captain Cook Highway near Beor Street to serve the entire 285 lots. The first connection can handle up to 623 EP (222 lots). Appendix C shows the future connection mains shown in existing (2016) and ultimate planning horizons.

3.1.3 Hydraulic Modelling

3.1.3.1 *Water Model*

Late last year, Stantec carried out Whyanbeel and Mossman Fire Flow Assessment for DSC using H2OMap Water model. Stantec provided Cardno the same model to undertake the analysis. However, the model did not include the water network along Milman Drive immediate north of the development. The model is:

> V15_Fireflow_Assessment.H2O

3.1.3.2 *Model Set-Up*

In the above model, the following updates are done:

Existing Scenario:

- Stantec's model is updated by adding the missing water network to the north of the property along Milman Drive. The demands generated there are allocated in the model.
- 90 EP is distributed to various nodes in the water network in Stage 1
- The water connection is made to existing DN100 network located at Wabul Street (Off Milman Drive), north of the development shown in Appendix C Figure 1.

Ultimate Scenario:

- The remaining 708 EP is distributed to the nodes in other stages

- The second water connection is made to the existing DN300 network located at Captain Cook Highway near Beor Street, north-west of the development in Appendix C Figure 3.

3.1.4 Maximum Hour Results – Existing Scenario

The result is analysed without the Stage 1 development in Stantec's original model, which also don't have the demands from the missing lots in Milman Drive. Stantec's model is then modified to add demands from the Stage 1 development along with the demands from missing lots in Milman Drive.

The hydraulic analysis indicates that the additional demand from the proposed development and the missing Milman Drive lots do not result in any failures under maximum hour flow conditions in existing planning horizon. All the nodes have pressures above 22m. Appendix C, Figure 1 shows the minimum pressures at the nodes in the development site in existing planning horizon.

The following figures Figure 3-1 and Figure 3-2 show the pressure map in the relevant water supply zone in existing scenario without and with the development demand plus the demand from the missing lots respectively.

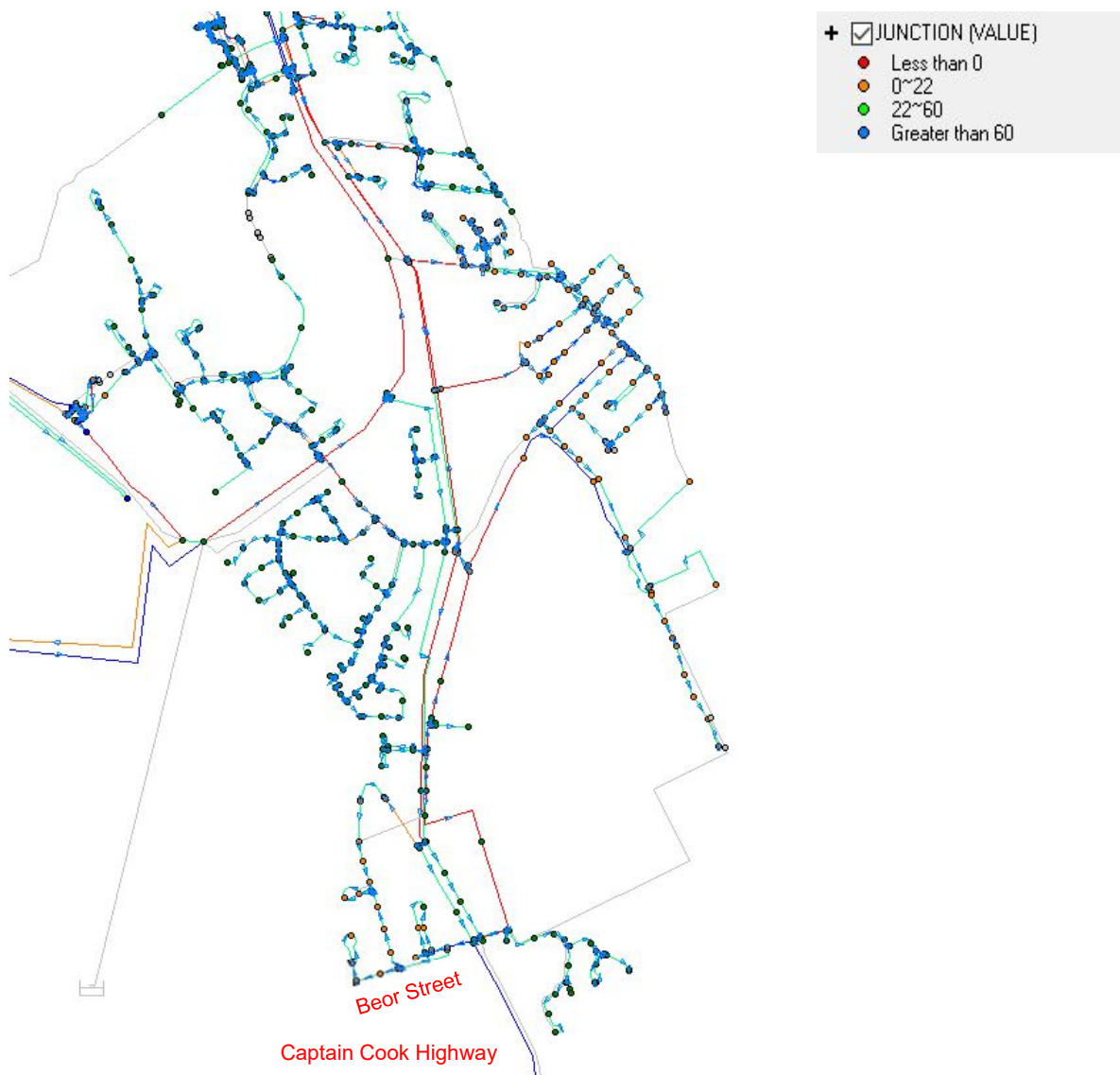


Figure 3-1 Existing - Peak Hour Pressure Map Without the Craiglie Development Demand and Milman Drive Demand

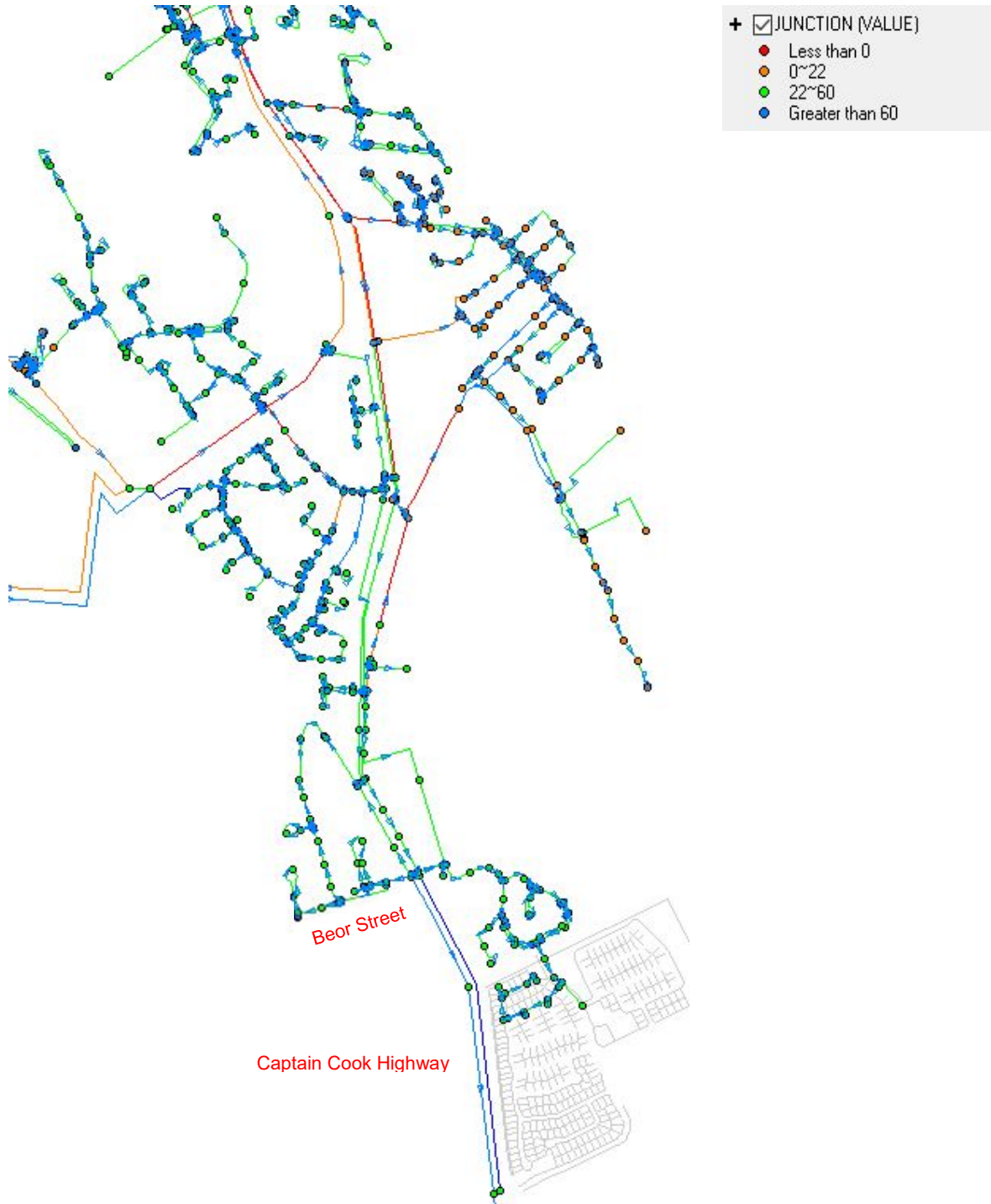


Figure 3-2 Existing - Peak Hour Pressure Map With Stage 1 Craiglie Development Demand and Milman Drive Demand

As can be seen, the addition of Craiglie development demand and demands from missing lots in Milman Drive hardly changes or worsen the minimum pressure regime in the water supply zone. To improve the flow to the industrial area (west of the Captain Cook Highway and north-west of the development site, a 21 m long DN150 augmentation (CW_295) is recommended at Beor Street/Captain Cook Highway intersection. This main was already present in the model but was inactive. This pipe is shown in Appendix C Figure 1 inset.

3.1.5 Fire Flow Results – Existing Scenario

FNQROC has designated 15 L/s flow for fire-flow simulation in this area. The analysis confirms that in existing scenario with Stage 1 development and with missing lots in Milman Drive, the minimum residual pressure of 12 m is maintained at all active nodes in the development area, shown in Appendix C Figure 2.

Figure 3-3 shows the fire-flow pressure map obtained from Stantec's original model without the Stage 1 demand and the demand from the missing lots in Milman Drive. Similarly, Figure 3-4 shows the fire-flow pressure map with the development demand plus the demand from the missing lots in Milman Drive.

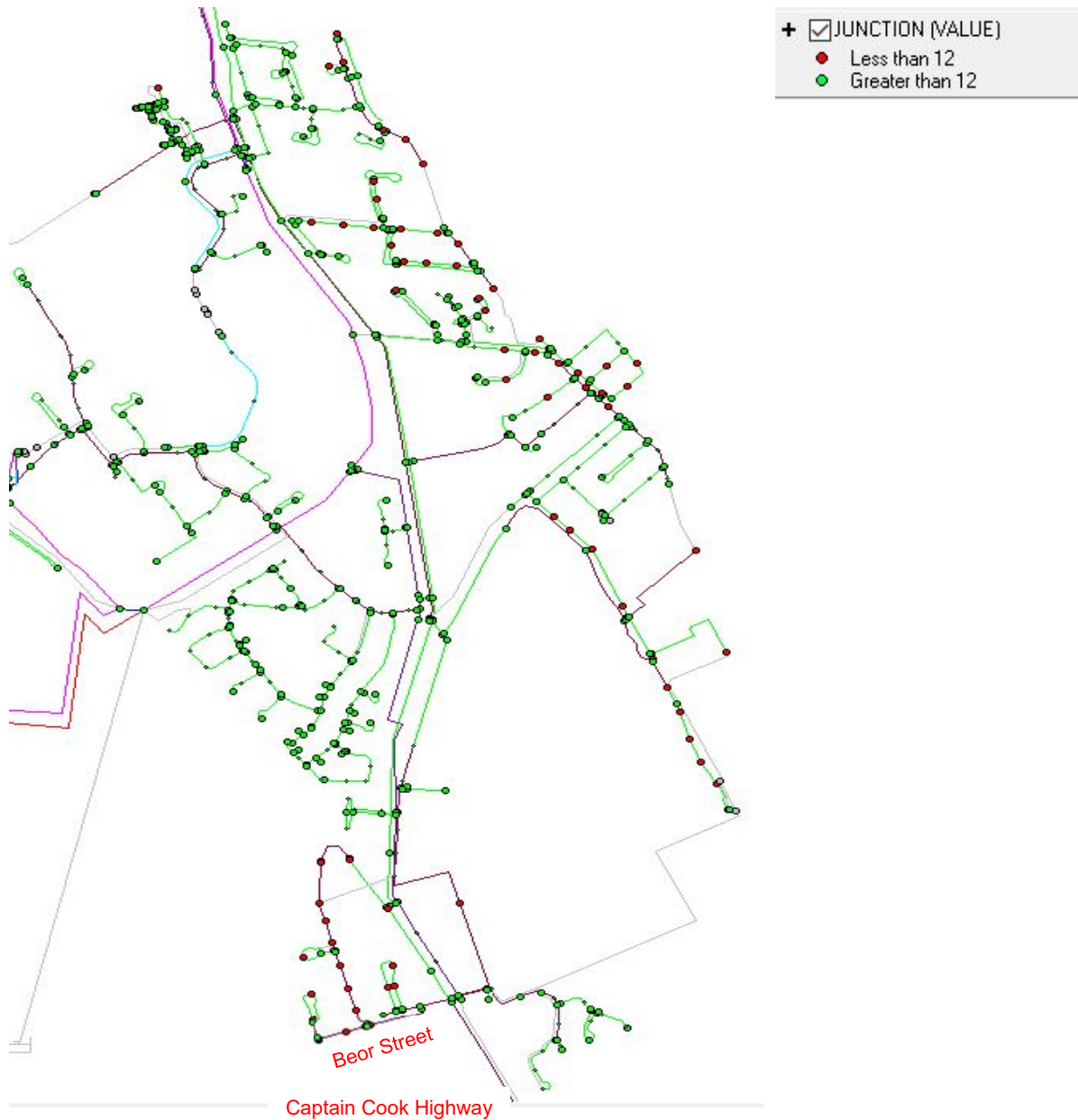


Figure 3-3 Existing – Fire-flow Pressure Map Without the Development Demand and Milman Drive Demand

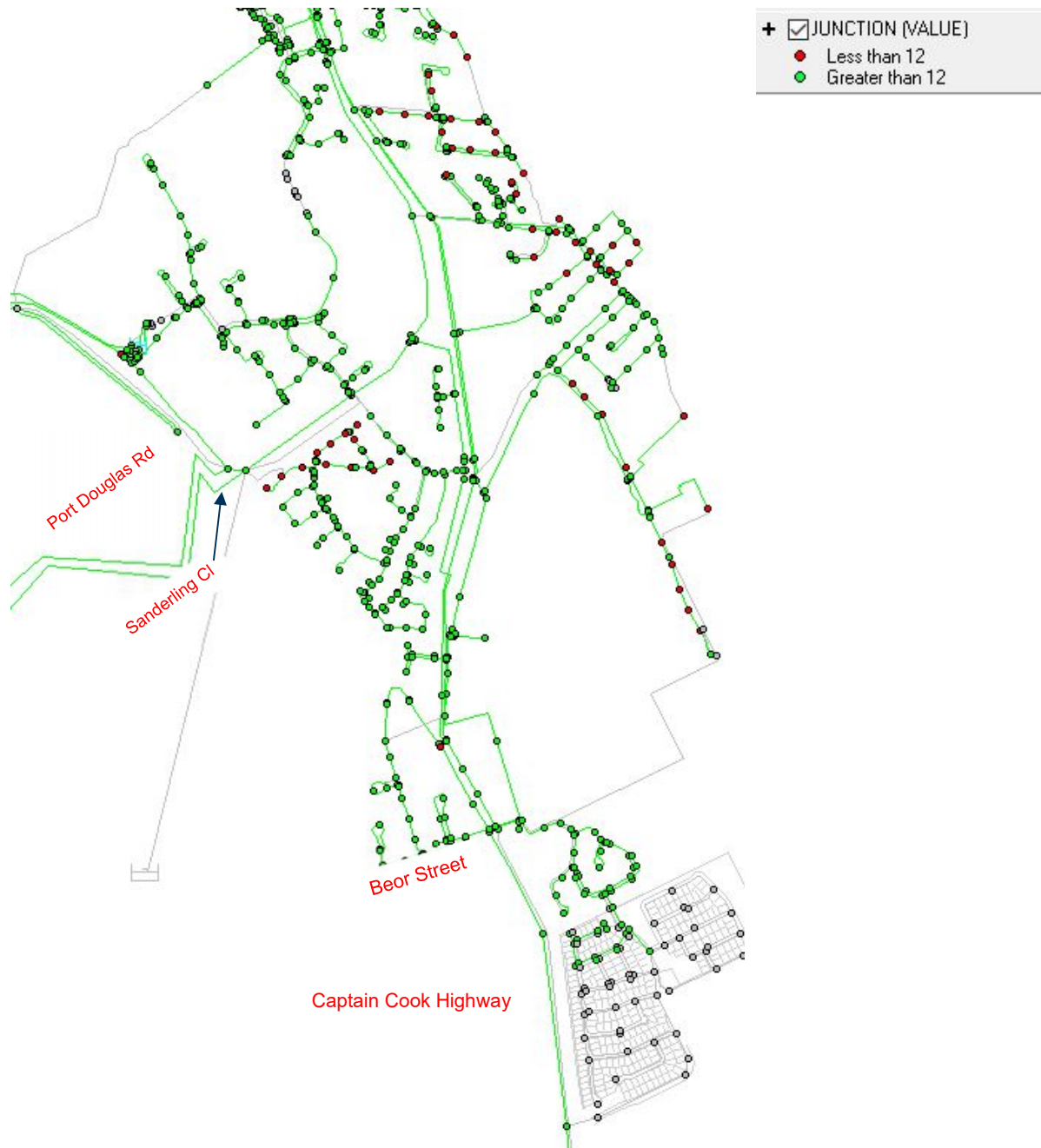


Figure 3-4 Existing – Fire-flow Pressure Map With the Stage 1 Craiglie Development Demand and Milman Drive Demand - Unaugmented

As can be seen, the addition of Craiglie development demand and missing lots in Milman Drive Demand hardly change or worsen the available fire-flow pressure regime in the water supply zone except the area around Sanderling Close south of Port Douglas Road, shown in Figure 3-4. The residual pressure in this area reduces below 12 m.

Hence, to improve the fire-flow pressure to this area, a 168 m long DN100 augmentation (CW_609), shown in Appendix C Figure 2 is recommended. The fire-flow pressure after the augmentation is shown in following Figure 3-5. This shows the improved pressure in that area.



Figure 3-5 Existing – Fire-flow Pressure Map With the Stage 1 Craiglie Development Demand and the Milman Drive Demand – Augmented

3.1.6 Maximum Hour Results – Ultimate Scenario

The second water connection is made to the existing DN300 network on Captain Cook Highway/Beor Street, north-west of the development as mentioned in Section 3.1.2. The connection is made along Andreassen Road. It is assumed the entire development will happen by ultimate planning horizon. DSC has suggested constructing this second connection in Stage 3 itself due to operational and security of supply reasons. This results additional work for the developer as this connection is required only in Stage 7.

The result is analysed for ultimate scenario in Stantec's original model, which does not include the Craiglie development demand but includes the demands from the missing lots in Milman Drive (though the network in Milman is not shown in the original model). The pressure map for this original model is shown in Figure 3-6. The result is also analysed for ultimate scenario in the updated model with the entire Craiglie development. The pressure map for this updated model is shown in Figure 3-7.

The hydraulic analysis indicates that the additional demand from the entire Craiglie development and the Milman drive development do not result any failures under maximum hour flow conditions in ultimate planning horizon. All the nodes have pressures above 22 m as shown in Appendix C Figure 3.

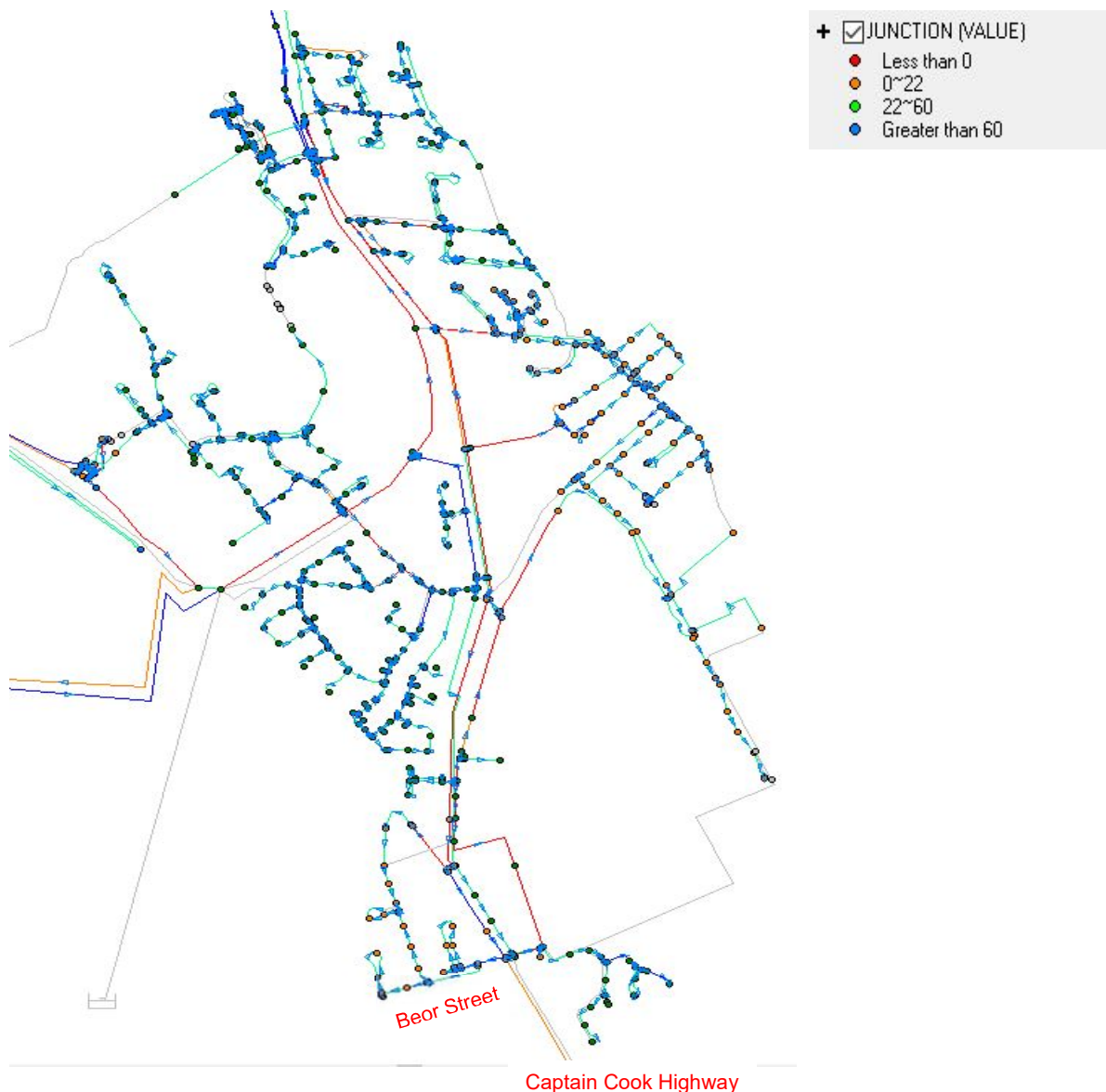


Figure 3-6 Ultimate - Peak Hour Pressure Map Without the Craiglie Development Demand



Figure 3-7 Ultimate - Peak Hour Pressure Map With the Craiglie Development Demand

As can be seen, the addition of Craiglie development and the demands from missing lots in Milman Drive do not change the minimum pressure regime in the water supply zone.

3.1.7 Fire Flow Results – Ultimate Scenario

The analysis confirms that in the ultimate planning horizon with the entire development in place and the demands from the missing lots in Milman Drive, the minimum residual pressure of 12 m is maintained at all nodes in the development area, shown in Appendix C Figure 4.

The following figures Figure 3-8 and Figure 3-9 compare the fire-flow pressure map in the relevant water supply zone obtained from Stantec's original model's ultimate scenario without and with the entire demand in the updated model respectively.

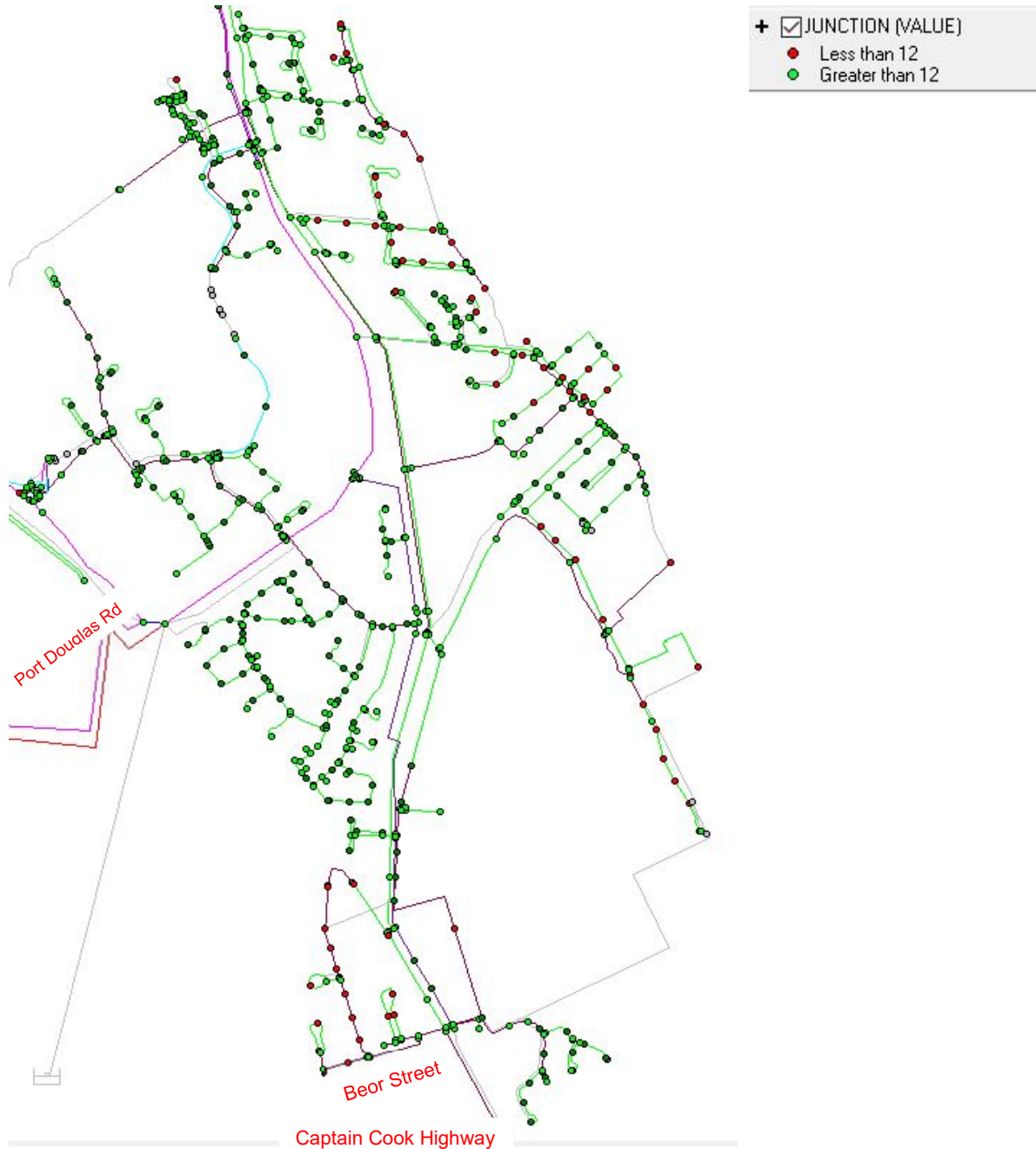


Figure 3-8 Ultimate – Fire-flow Pressure Map Without the Craiglie Development Demand



Figure 3-9 Ultimate – Fire-flow Pressure Map With the Craiglie Development Demand

As seen, the addition of Craiglie development demand does not worsen the fire-flow pressure in the water supply zone.

3.2 Sewerage Infrastructure

This section details the future sewerage infrastructure required to discharge the sewage flow from the development to the existing network whilst maintaining FNQROC's Design Criteria.

3.2.1 Existing Infrastructure

The development site is within the catchment of Port Douglas Wastewater Treatment Plant (PDWWTP) located about 6km north-west from the development site. There is existing sewerage network near the development area. A gravity sewer network exists north of the development site. This network is in a pump station (PS) Jiwai Jiwai catchment. The Jiwai Jiwai PS discharges to the gravity network of PDPP catchment through the rising main (RM). The RM from PDPP then discharges to PDL1 wet well. On the western side of the development, there is a DN80 RM running along Captain Cook Highway.

There is also a DN300 trunk RM about 700 m north of the development site at the intersection of Captain Cook Highway and Beor Street (Junction ID: 69246). All other existing pump stations inject to this trunk DN300 RM which transfers sewage direct to PDWWTP. The existing sewerage network near the development site and these existing pump catchments are shown in Appendix D Figure 1.

3.2.2 Future Infrastructure

The topography of the development area is such that the land falls towards north from the south. Hence, a future PS (Craiglie PS) is proposed at the Stage 1 location on the northern side of the development area. The sewage generated from the entire development area will gravitate to this PS.

In the ultimate scenario, when the entire 285 lots are developed, It is recommended the sewage from Craiglie PS be inject into the DN300 rising main at Beor Street and Captain Cook Highway intersection through RM through 680 m long RM, the size of which will be discussed in Section 3.2.5.2.

In the initial stages (Stage 1 and Stage 2) of the development, DSC has suggested, the sewage from proposed Craiglie PS be discharge to the DN150 gravity network of Jiwai Jiwai PS through 174m long DN100 RM. Any augmentations needed in the downstream PS/RM will be discussed in Section 3.2.5.

The characteristics of the wet well for the proposed pump station is as follows:

ITEM		LEVEL (A.H.D.)	HEIGHT FROM BASE (m)
A	TOP OF SLAB	4 m	6.55
B	GRAVITY MAIN INLET	-0.9 m	1.65
C	DUTY START	-1.2 m	1.35
D	PUMP STOP	-1.7 m	0.85
E	FLOOR SLAB	-2.55 m	
F	PUMP STATION DEPTH	N/A	
H	EXISTING GROUND LEVEL	3.95 m	6.5
J	HIGH LEVEL ALARM	-0.95 m	1.6
K	OVERFLOW LEVEL	3.7 m	6.25
L	PRE-OVERFLOW ALARM	3.4 m	5.95
M	Q100 LEVEL	3.5 m	6.05

3.2.3 Hydraulic Modelling

3.2.3.1 Sewerage Model

Stantec provided Cardno the sewage model to complete the sewerage assessment. However, the model did not include the sewerage network along Milman Drive immediate north of the development. The model is:

> Mossman and Port Douglas Sewer Model_V9.HSM

3.2.4 Model Set-Up

Stantec's model is updated by adding the sewerage infrastructure (gravity sewer, PS and RM) for Jiwal Jiwal PS catchment. The sewage loads from the catchment lots are also added in the model.

Due to different servicing philosophy, hydraulic analysis is undertaken for initial and ultimate planning horizons. The scope of the work is to analyse the infrastructure required to discharge the flow from the development area to the existing sewerage network and the impacts of this additional load to existing development. It does not include the analysis of the internal reticulation in the proposed development.

The proposed wet well is updated with above levels and the PWWF – 7 L/s & 13 L/s generated from the Stage 1 to 3 development and ultimate development respectively.

3.2.5 Model Results

3.2.5.1 *Initial (Stage 1 to 3) Development*

2026 scenario in the model is considered the best scenario for initial phase of development. As discussed in Section 3.2.2, the sewage from Stage 1 to 3 development is proposed to discharge at gravity network of Jiwal Jiwal PS catchment through DN100 RM. Due to low flow, DN100 RM is suggested from Craiglie PS. The flow sequence from Craiglie PS to the treatment plant is shown below:

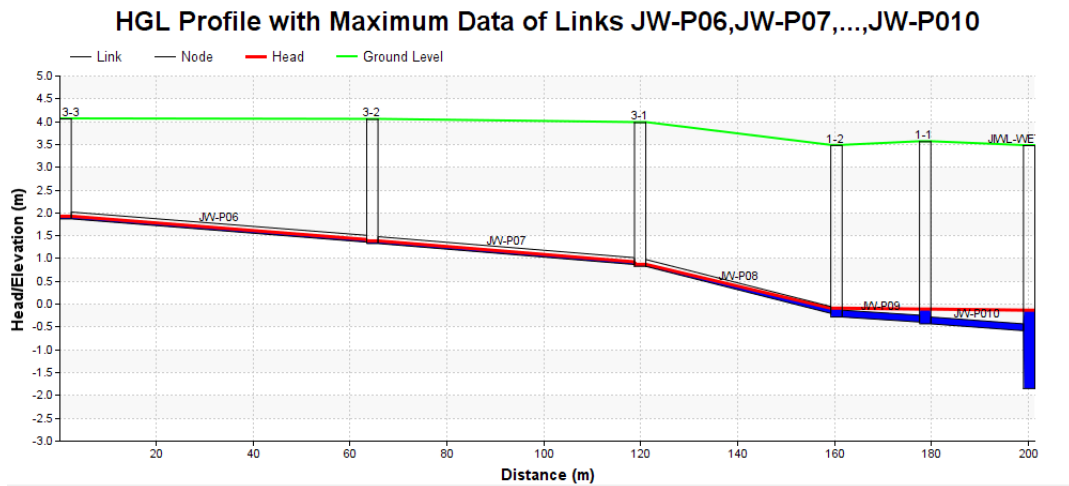


In 2026 scenario, some augmentations are already active in the model, refer Appendix D, Figure 2. Council has advised none of these upgrades have been completed to date. The DN100 RM is already over capacity on the existing case, hence the RM (downstream of PDL1 PS) upgrade is recommended to DN150 as soon as practicable. These augmentations are all in PDL1 catchment and they are:

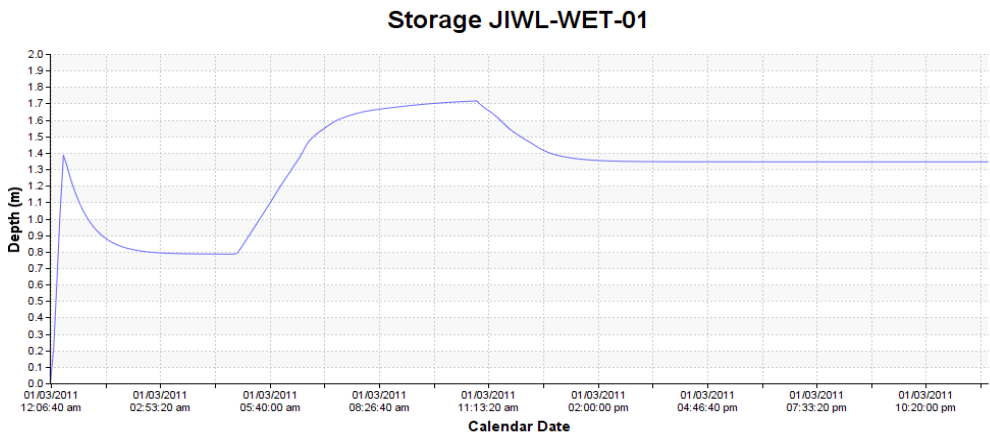
- DN225 gravity sewer AUG_PDL1_GM001
- DN225 gravity sewer AUG_PDL1_GM002
- DN225 gravity sewer AUG_PDL1_GM003
- DN225 gravity sewer AUG_PDL1_GM004
- DN225 gravity sewer AUG_PDL1_GM005
- DN150 RM AUG_PDL1_RM001 downstream of PDL1 PS

The results from the modelling analysis are shown below in Figure 3-10 and Table 3-1. The results show that DN50 RM (ID: 40212), downstream of PDPP PS has excess velocity, refer Table 3-1. This has caused PDPP wet well and upstream gravity main to surcharge, refer Table 3-1. The RMs in Table 3-1 are shown in Appendix D, Figure 1 and Figure 2.

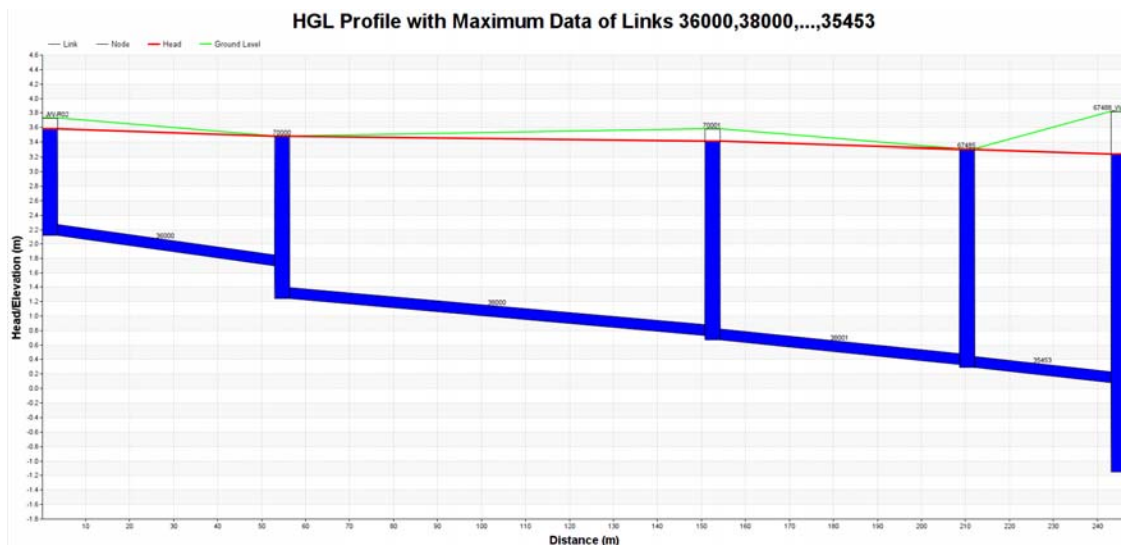
Jiwal Jiwal - Gravity Network



Jiwal Jiwal - Wet Well



PDPP - Gravity Network



PDPP – Wet Well

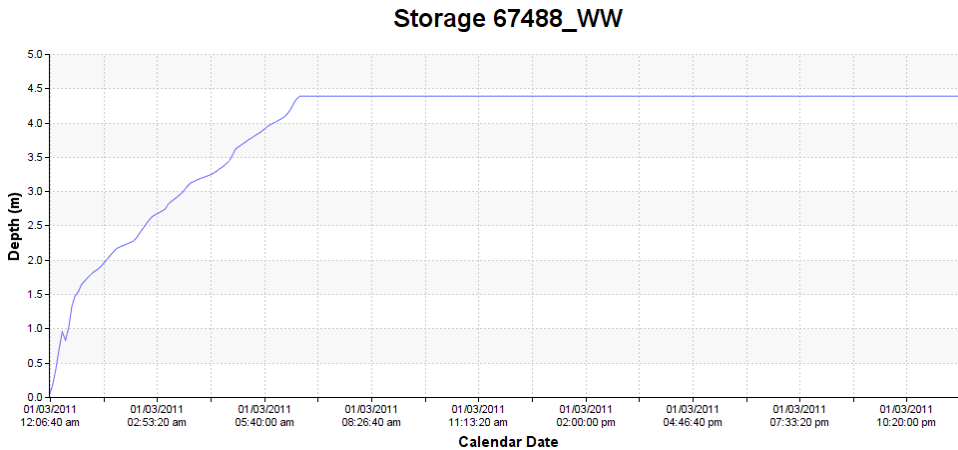


Figure 3-10 Initial Stages Results – Gravity Network and Wet Well Levels - Unaugmented

Table 3-1 Initial Stages Results – RM - Unaugmented

RM ID	Diameter, mm	Velocity, m/s	Pass or Fail
J-RM01 – Downstream of Jiwal Jiwal PS	80	1.04	Pass
40212– Downstream of PDPP PS	50	3.36	Fail
CDT-19– Downstream of PDPP PS	100	0.88	Pass
AUG_PDL1_RM001– Downstream of PDL1 PS	150	1.65	Pass

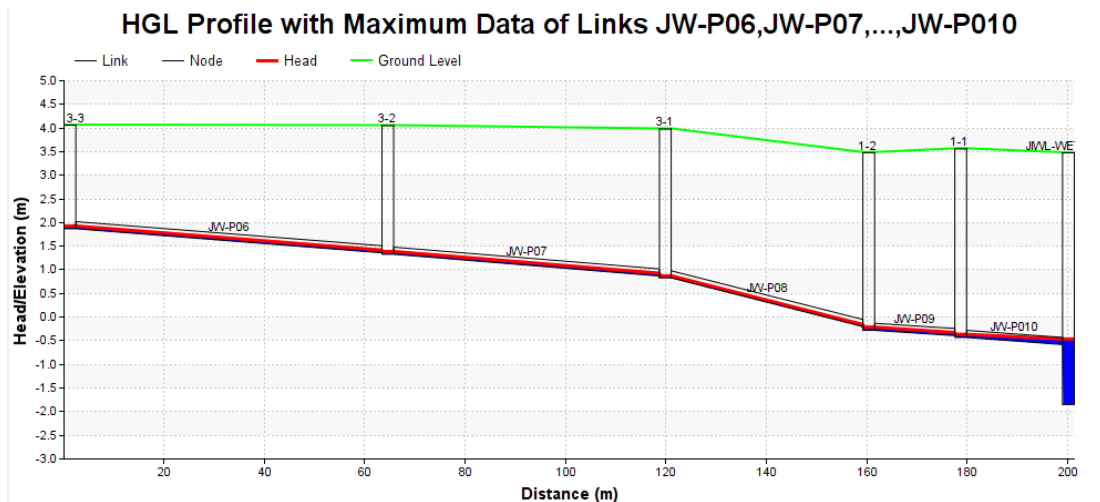
7 L/s is approximately equivalent to the first 3 stages and approximately half of Stage 4 of the proposed development. Following upgrades are recommended to cater 7 L/s from the proposed development:

- 165 m long DN80 RM augmentation (ID: AUGPDPP-CRAIGRM_001) immediately downstream of PDPP PS
- DN150 RM (ID: AUG_PDL1_RM001) downstream of PDL1 PS – This RM is already over capacity

The modelling results show there will be adequate infrastructure capacity following the completion of these augmentations. Please see Figure 3-11 and Table 3-2.

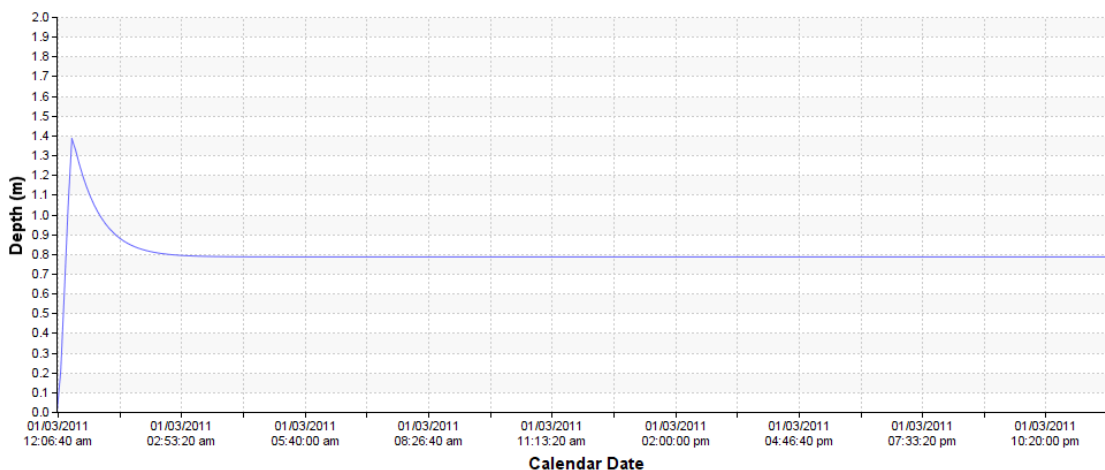
The gravity main upgrades proposed in Catchment PDL1, which are overdue, are not affected by the proposed development.

Jiwal Jiwal - Gravity Network

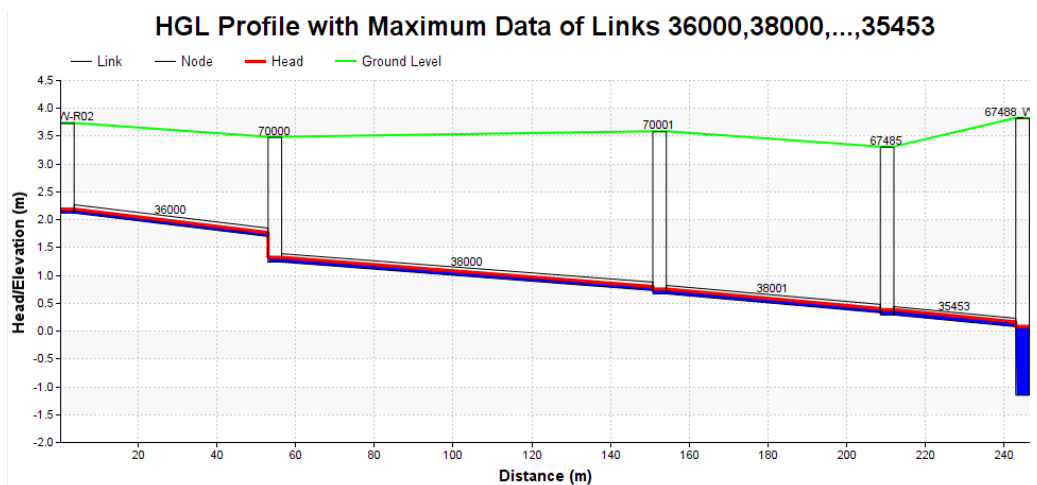


Jiwal Jiwal - Wet Well

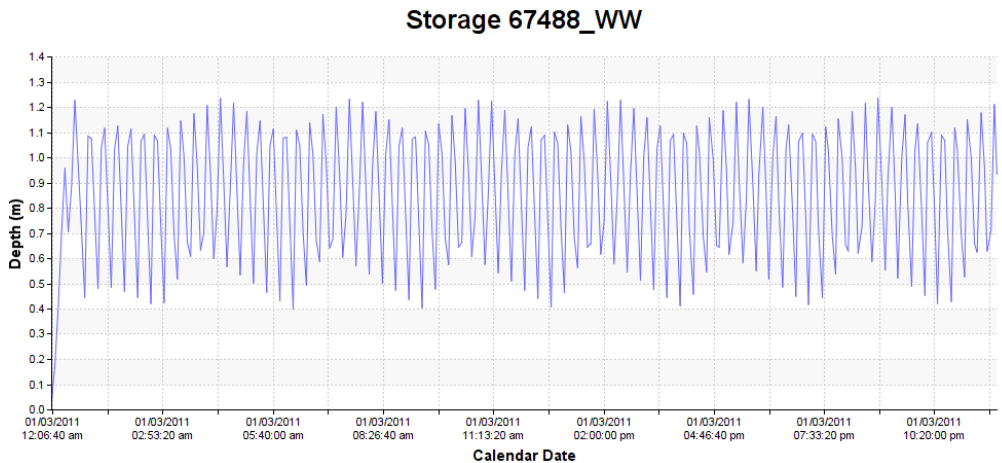
Storage JIWL-WET-01



PDPP - Gravity Network



PDPP – Wet Well



PDL1 – Wet Well

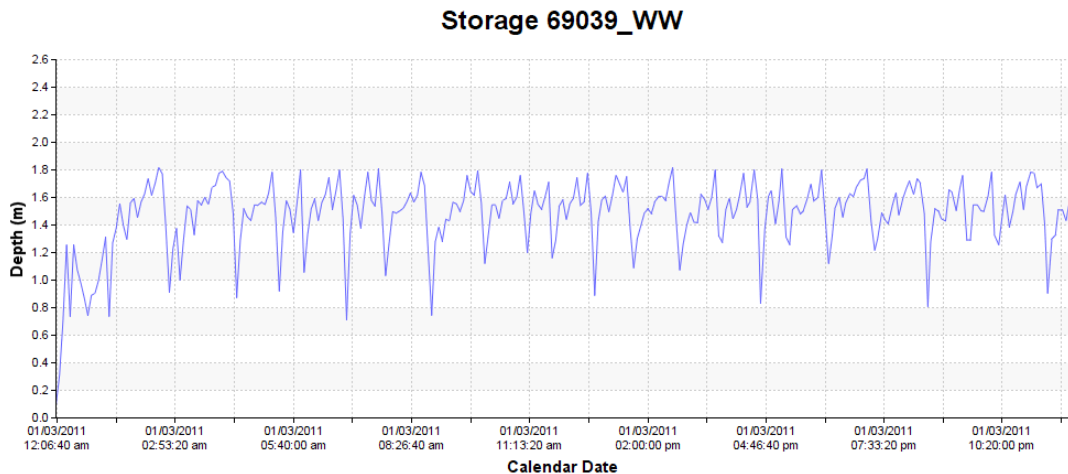


Figure 3-11 Initial Stages Results – Gravity Network and Wet Well Levels – Augmented

Table 3-2 Initial Stages Results – RM - Augmented

RM ID	Diameter, mm	Velocity, m/s	Pass or Fail
J-RM01 – Downstream of Jiwal Jiwal PS	80	1.05	Pass
AUGPDPP-CRAIGRM_001 – Downstream of PDPP PS (<i>Augmented RM</i>)	80	1.7	Pass
CDT-19– Downstream of PDPP PS	100	1.4	Pass
AUG_PDL1_RM001– Downstream of PDL1 PS	150	2.72	Pass

3.2.5.2 Ultimate Development

It is expected that entire Craiglie development will take place in the ultimate scenario generating 13 L/s. Craiglie PS is proposed to inject the generated flow into the existing DN300 RM at the intersection of Captain Cook Highway and Beor Street through RM, refer Appendix D Figure 2.

The flow sequence from Craiglie PS to the treatment plant is shown below:



Some other augmentations are already active in the model in PDL1 catchment in addition to the augmentations mentioned in Section 3.2.5.1, refer Appendix D, Figure 2. These additional augmentations are:

- DN225 gravity sewer AUG_PDL1_GM006
- DN225 gravity sewer AUG_PDL1_GM007
- Pump augmentation at PDL1 PS

In terms of proposed RM for ultimate scenario, we analyse the network with two (2) options – DN100 and DN150 when all existing pump stations are running simultaneously.

Option 1 – DN100 rising main

The first option is using DN100 rising main. Upon modelling, the following results are observed:

- Head gained = 82.3m
- Velocity = 1.53m/s

Option 2 – DN150 rising main

The second option is using DN150 rising main. Upon modelling, the following results are observed:

- Head gained = 65.8m
- Velocity = 0.74m/s

The head gained in Option 1 is very high due to increased head loss in DN100. Hence, Option 2 with bigger rising main (DN150) is selected as it gives comparatively lower head for the proposed pumps to overcome.

We also analyse the network with DN150 rising main when other existing pumps are not working except the proposed pumps. The idea is to find the range of the head the proposed pumps need to overcome. The findings are given below:

- Head gained = 10.7m
- Velocity = 0.74m/s

Hence, the future pumps selected at the development area must have variable frequency drive (VFD) to discharge the flow at variable head between from 10.7m to 65.8m. The future proposed sewer infrastructure is shown in Appendix D Figure 2.

Impact on Existing Pump Stations

The wet well levels of existing individual pump stations injecting into the DN300 rising main are analysed to see if the proposed demand from this development have any detrimental effects on the wet well levels as the development demand is also injected into this rising main. The analysis shows, all the pumps operate without any problem.

4 Conclusions

The following conclusions are made from the water supply and sewerage assessment.

- > The proposed development will have a total water supply demand of 798 EP contributing Maximum Hour Demand of 16.6 L/s. In Stage 1, water supply demand is 90 EP with 1.9 L/s of Maximum Hour Demand
- > The proposed development will generate a sewage load of 798 EP contributing PWWF of 13 L/s.
- > An assessment of the existing water supply and sewerage network was undertaken using Stantec's water and sewer model, which were updated with the water demand and sewerage load from the missing lots in Milman Drive constructed approximately 5 years ago.

4.1 Water Supply

- > The internal reticulation main in the development area will consist of DN150 and DN100 mains
- > The Stage 1 development will be serviced by a proposed DN150 main connecting to the DN100 network located at Wabul Street (Off Milman Drive), north of the development
- > A DN150 augmentation (CW_295) is proposed at the time of Stage 1 development to maintain the residual pressure in the industrial area (west of the Captain Cook Highway and north-west of the development site)
- > A 168m long DN100 augmentation (CW_609) is proposed at the time of Stage 1 development to improve the fire-flow in the area around Sanderling Close south of Port Douglas Road (north-west of the development site)
- > All Stage 1 development junctions will meet the minimum pressure and fire-flow requirements
- > In the ultimate when all stages are developed, the second connection will be made to existing DN300 main on the Captain Cook Highway near Beor Street. This second connection will come in place when the development EP exceeds 623 EP (222 lots).
- > All junctions in the entire development area will satisfy the minimum pressure criteria and fire-flow criteria. The surrounding areas will not be impacted by our development.

4.2 Sewerage

- > The development site is within the catchment of Port Douglas Wastewater Treatment Plant.
- > The topography of the lot is such that the site falls towards north from the south. Hence, a pump station (Craigie PS) is proposed at the Stage 1 location on the northern side of the development area.
- > At present, gravity network exists to the north of the proposed site and DN80 rising main running along Captain Cook Highway to the west of the proposed site. Also, DN300 trunk rising main exists at the intersection of Captain Cook Highway and Beor Street, about 700m north of the development which conveys sewage directly to Port Douglas Wastewater Treatment Plant.
- > In the initial stages of the development (Stage 1-3), the sewage generated from the development area is recommended to discharge into the existing Jiwai Jiwai PS catchment through 174 m long DN100 RM.
- > To service the first stage of this development, the following external infrastructure upgrades are recommended:
 - Upgrade to a 165 m long DN80 RM downstream of PDPP PS (AUG_PDPP-CRAIGRM_001)
 - Upgrade to a 206 m long DN150 RM downstream of PDL1 PS (AUG_PDL1_RM_001)
- > In the ultimate, the sewage generated from the development area is recommended to discharge into the existing DN300 RM located north-west through 680m long DN150 RM.
- > The proposed pumps at the development site have to work between 10.7m and 65.8m head depending whether other existing pumps are running or not. Hence, variable frequency drive pumps are preferred.
- > The additional load from the proposed development does not impact on the performance of existing pumps

Development Application for Water and Sewerage Services

APPENDIX

A

DEVELOPMENT LAYOUT PLANS

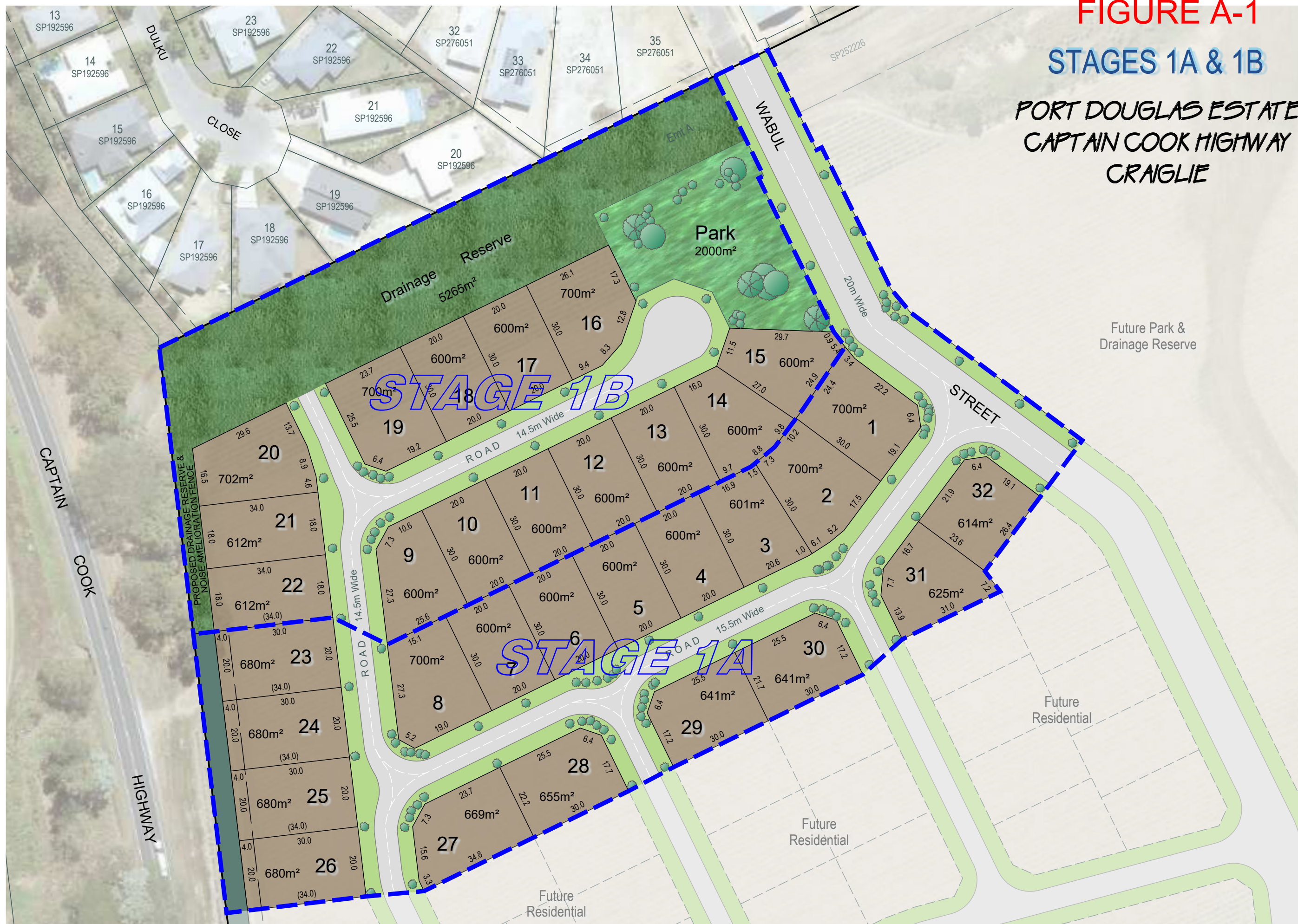
Figure A-1 Stage 1 Development (Stage 1A + Stage 1B)
Figure A-2 Port Douglas Estate Master Plan



FIGURE A-1

STAGES 1A & 1B

PORT DOUGLAS ESTATE
CAPTAIN COOK HIGHWAY
CRAIGLIE





MASTER PLAN

FIGURE A-2

PORT DOUGLAS ESTATE CAPTAIN COOK HIGHWAY CRAIGLIE



Development Application for Water
and Sewerage Services

APPENDIX

B

FNQROC DESIGN CRITERIA

Figure B-1
Figure B-2

Water Design Criteria
Sewerage Design Criteria

B-1: WATER DESIGN CRITERIA

D6.07 DESIGN CRITERIA ^{CRC}

1. Flow Parameters

Unless advised otherwise by Council, the Average Daily consumption and peaking factors for the design of Water Supply Schemes shall be as follows:

Average Daily Consumption (AD)	400 litre/EP/day for Cairns Regional Council 500 litre/EP/day for all other Councils
Mean Day max Month (MDMM)	1.50 x AD
Peak Day (PD)	2.25 x AD
Peak Hour (PH)	1/12 x PD

In the absence of specific flow consumption data the Average Daily Consumption shall be calculated using the equivalent demands shown in Table 6.1.

Table 6.1 Equivalent Demands

Description	Equivalent Persons (EP)/Connection
Single Family Dwelling	
Lot > 1500m ²	3.7
Lot 1101m ²	3.4
Lot 901m ² to 1100m ²	3.1
Lot 401m ² to 900m ²	2.8
Lot < 400m ²	2.5

2. Pressure Parameters

a) Minimum Service Pressure (excluding fire fighting)

Minimum Pressure	22 metres head at peak hourly consumption
Minimum Pressure Location	For lots at or below road reserve level at the property boundary. For lots above the road reserve level at a nominated level practical building site. Or in the absence of a natural or benched building site the mean lot level shall be used.
Minimum Pressure Network Condition (for modelling from a reservoir).	Based on the reservoir level for Peak Hour of the third day of three consecutive Peak Day events (for dynamic models). In the absence of dynamic model results the minimum reservoir level shall be assumed at 15% of storage height. Liaise with Council to confirm minimum pressure constraints available at the connection to the existing system.

Note 1: The minimum pressure in the table is for the purpose of design and is not a guaranteed minimum pressure. Refer to the service providers Customer Service Standards.

Note 2: Where building envelope pressure is less than 30m, a notation will be placed on the rates file advising the owner that any booster pump required to augment pressures to the building is to be supplied, installed, maintained and replaced at the property owners expense.

b) Maximum Pressure

Maximum Pressure	60 metres head, see Note 1
Maximum Pressure Location	At the building pad
Maximum Pressure Network Condition (for modelling from a reservoir).	Based on reservoir level at 95 percent of top water level

Note 1: Where the pressure in a main exceeds 600 kPa, Council may require the installation of Pressure Reducing Valves (PRV) that may (at Council's discretion) include telemetry control. Prior to proceeding with any design, Council shall be provided with details of the area affected and the number of lots involved.

3. Fire Fighting Parameters

Category	Fireflow Requirement	Number & Duration
Residential (i.e. Residential dwellings of a maximum of 3 storeys)	15 L/s for 2 hours	1 @ 2 hours
Commercial (i.e. Shop and office accommodation of a maximum of 3 storeys) and Industrial	30 L/s for 4 hours	1 @ 4 hours
High Risk (i.e. A development where there is a probability of a fire occurring or there is a high cost of resultant damage (personal injury or property))	[To be determined in consultation with council. Alternative methods of provision may be required (i.e. on-site storage).	Adopt a special hazard or risk fire
Residual pressure is to be 12m minimum at an adjacent hydrant at the required background demand time, assuming that the elevation of the supply point is equal to the ground elevation at the hydrant. 6m minimum residual pressure is to be retained in the mains for all other areas of the water supply zone at the required background demand time. Positive residual pressures must exist at peak hour, within the reticulation during the fire event.		

(Refer: "Planning Guidelines for Water Supply and Sewerage")

a. Background Demand

The following minimum criteria should be adopted for background demand during a fire event:

- **Predominantly Residential Areas**
 - The minimum residual pressure specified should be exceeded with a background demand of 2/3 Peak Hour demand
 - A check should be undertaken at Peak Hour demand to ensure that pressures in the network remain positive.
 - The calculated background demand should not be less than Average Day demand.
- **Predominantly Commercial / Industrial Areas** – In this case, the following scenarios should be investigated with the worst case being adopted:
 - At Peak Hour demand of the Commercial / Industrial area (e.g. between 10am to 4pm). The intent of this scenario is to assess the local reticulation performance.
 - At 2/3 Peak Hour demand of the water supply zone (e.g. around 6pm). The intent of this scenario is to assess the zone trunk performance.
- **Mixed Residential / Commercial / Industrial Areas** – In such cases a combination of background demand conditions similar to the Predominantly Commercial / Industrial Areas above should be examined.

B-2: SEWERAGE DESIGN CRITERIA

D7.08 DESIGN CRITERIA

1. Capacity

- a. Population estimates shall be based on those equivalent demands detailed in Table 7.1

Table 7.1 Equivalent Demands

Description	Equivalent Persons/Connection
Single Family Dwelling	
Lot > 1500m ²	3.7
Lot 1101m ² to 1500m ²	3.4
Lot 901m ² to 1100m ²	3.1
Lot 401m ² to 900m ²	2.8
Lot < 400m ²	2.5
Multi Unit Accommodation	
Units > 3 bedrooms	0.4 +(0.6 x no. bedrooms)
Units = 3 bedrooms	2.2
Units = 2 bedrooms	1.6
Units < 2 bedrooms	1.0
Caravan Parks	
Van Site / Camping Site	1.2
Shops / Offices	
Per 90m ² GFA	1.0

Notes:

- Based on 2.8 Equivalent Persons / Equivalent Domestic Connection (EP/EDC), with 1 EDC equivalent to a single residential dwelling on a standard size allotment (401m² to 900m²).
- For undeveloped land equivalent populations shall be calculated in accordance with the maximum allowable population density in the Planning Scheme for that land use, or estimation of maximum allowable density agreed with Council prior to design

- b. The minimum pipe capacity shall be based on the criteria detailed in Table 7.2

Table 7.2 Sewerage Loading

1	Average Dry Weather Flow (ADWF)	270 L / EP / d	Based upon analysis of pump station flows and STP inflow records during dry weather
2	Peak Wet Weather Flow (PWWF)	5 x ADWF or C ₁ x ADWF whichever is greater	C ₁ Peaking Factor = 15 x (EP) ^{-0.1587} Minimum Value C ₁ to be 3.5
3	Peak Dry Weather Flow (PDWF)	C ₂ x ADWF	C ₂ Peaking Factor = 4.7 x (EP) ^{-0.105}
4	Vacuum Sewer Peak wet weather flow (PWWF)	4xADWF	Peaking factor of 4
5	Smart Sewer Peak wet weather flow (PWWF)	4xADWF	Peaking factor of 4

2. Pipe Velocity

- a. Pipe velocities shall be based on the details shown in Table 7.3

Table 7.3 Pipe Velocities

Design Criteria	Recommended value
Mannings 'n' (PVC)	0.0128
Mannings 'n' (Poly)	0.0128
Minimum velocity @ PWWF	0.7 m/s
Minimum velocity @ PDWF	0.3 m/s
Depth of Flow @ PWWF – Proposed sewers	Max Flow depth shall not exceed ¾ pipe full

3. Minimum Grades

- a. Minimum grades for sewer reticulation mains are to be as summarised in Table 7.4.

D7.19 PRESSURE MAINS

1. For detailed design of sewer pressure mains (rising mains) the requirements of Design Manual D6 Water Reticulation should be noted and the mains shall be designed as per the procedures relevant to Water Supply Mains with the exception of the following:
 - a. Air release valving should be provided to high points as required.
 - b. Scour valving should be provided to low points as required. Scouring must be to a scour manhole or adjacent gravity sewer system.
 - c. Thrust Block and Trenching Details shall be as per the Standard Drawings S2015 and S2016.
 - d. Line valves, scours and air valves are to be provided as required to reduce scour volume.
2. Consideration needs to be given to the potential for sulphide generation in pressure mains.
3. Sewer pressure mains shall be a minimum 100mm uPVC Class 12 unless approved otherwise by Council. Sewer pressure mains shall be colour 'cream'.
4. All Discharge manholes shall be fitted with a HDPE or wound PVC manhole liner suitable for exposure to sewerage. Where the discharge manhole is an existing manhole, the manhole internal surfaces shall be adequately dried and then coated with an approved epoxy coating.
5. Sewer pressure mains shall be designed in accordance with the minimum specific design criteria shown in Table 7.15 and WSA 04-2005.

Table 7.15 Pressure Main Design

Item	Description	Adopted Design Parameter	Comments
1	Flow Equation	Darcey-Weisbach formula	
2	Minimum Diameter	100mm – unless approved otherwise by Council.	
3	Friction Factors	Refer Item 10 in Table 7.14	
4	Minimum Velocity (on a daily basis)	0.75m/s	To prevent the deposition of solid material such as grit
5	Preferred Minimum Velocity	1.5 m/s	To provide for slime stripping on a regular basis
6	Maximum Velocity	2.5 m/s	To prevent damage to pipe lining
7	Configuration	Pressure Mains should be sized to optimise the balance between reduction of detention times and life cycle cost. Factors to be considered include but not be limited to: • Population growth • Staging • Operational features to provide for	

Development Application for Water and Sewerage Services

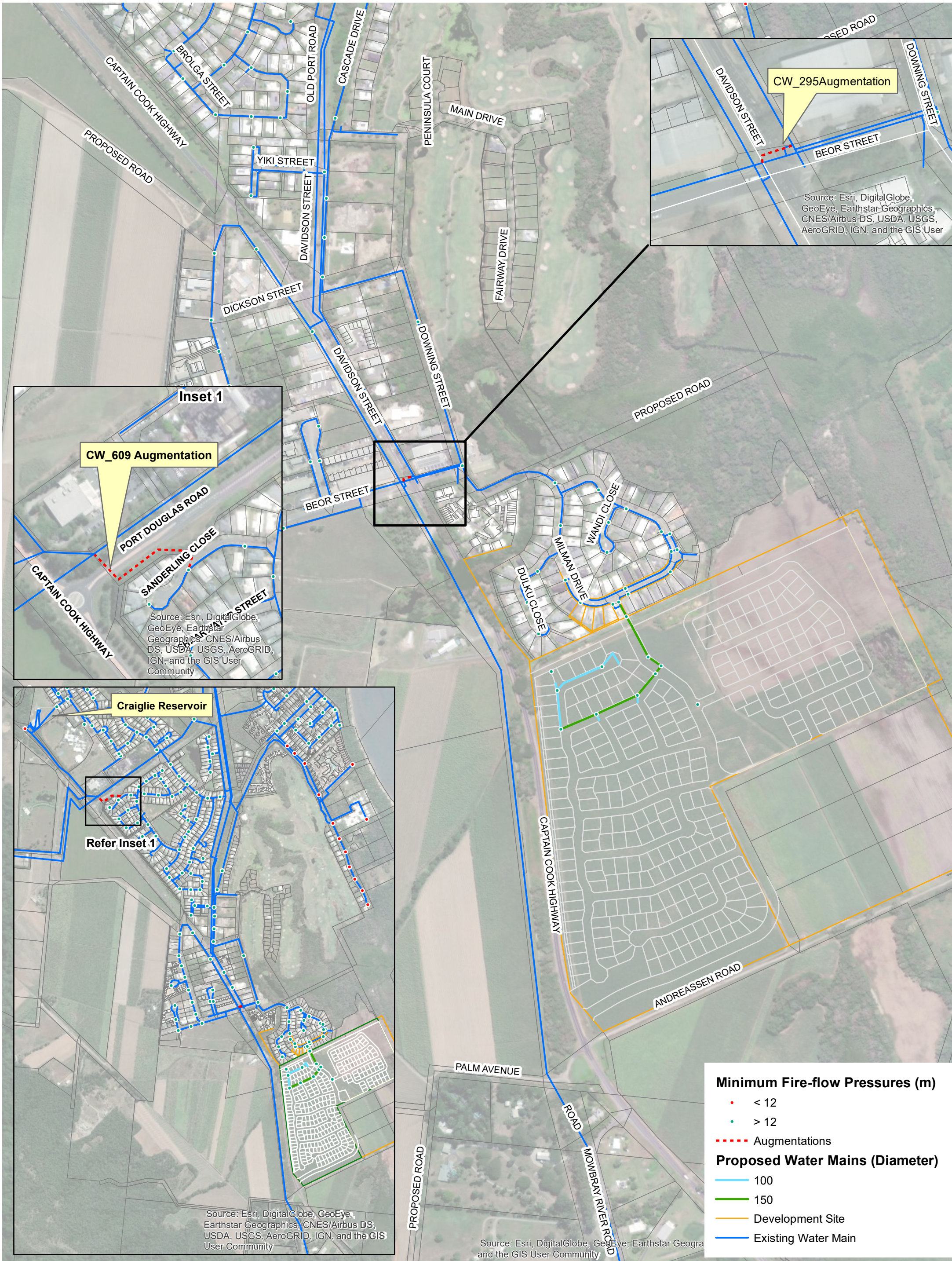
APPENDIX

C

WATER SERVICING STRATEGY

Figure 1
Figure 2
Figure 3
Figure 4

Stage 1 Minimum Pressures
Stage 1 Minimum Fire-flow Pressures
All Stages Minimum Pressures
All Stages Minimum Fire-flow Pressures



FILE: M:\Q184103 - Craiglie Water and Sewerage Design\Project material\GIS\ESRI\Figures mxd\Water-A3-FIGURE_P.mxd



Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

DATE PLOTTED: 19/03/2020 10:29:49 AM BY: SUNIL.SMKHADA

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Date
19/03/2020

Size
A3

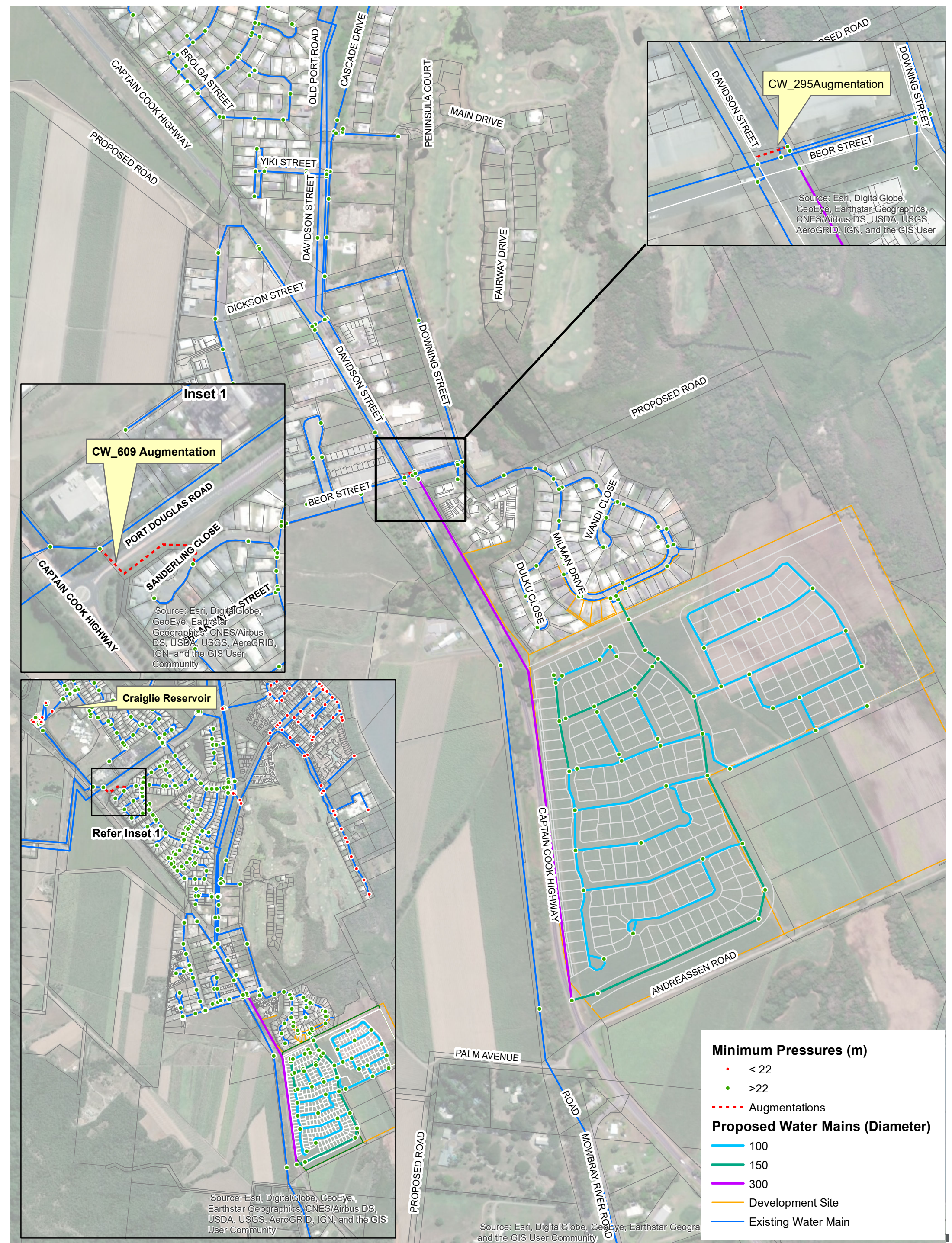
0 37.5 75 150 225 300
Meters

CRAIGLIE WATER AND SEWER PLANNING WATER SUPPLY - MINIMUM FIRE-FLOW PRESSURES

STAGE1

FIGURE 2

WATER-A3-FIGURE_P



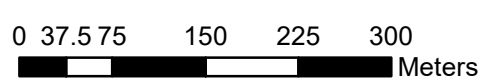
FILE: M:\Q184103 - Craiglie Water and Sewerage Design\Project material\GIS\ESRI\Figures mxd\Water-A3-FIGURE_P.mxd



Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

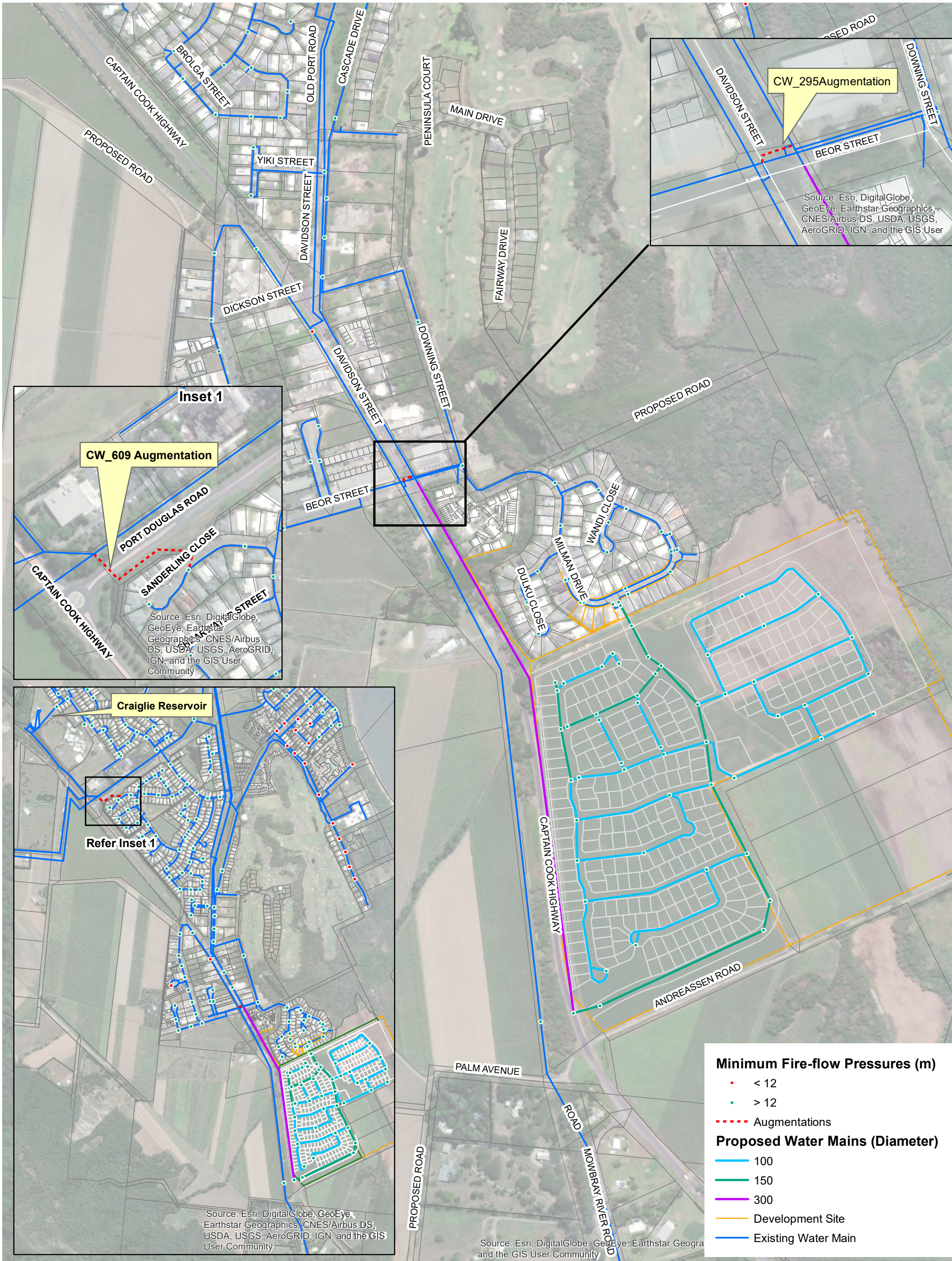
Date
19/03/2020
Size
A3



CRAIGLIE WATER AND SEWER PLANNING

WATER SUPPLY - MINIMUM PRESSURES

ULTIMATE
FIGURE 3
WATER-A3-FIGURE_P



FILE: M:\Q184103 - Craiglie Water and Sewerage Design\Project material\GIS\ESRI\Figures mxd\Water-A3-FIGURE_P.mxd



Cardno

Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

DATE PLOTTED: 19/03/2020 10:47:45 AM BY: SUNIL.SMKHADA

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Date
19/03/2020

Size
A3

0 37.5 75 150 225 300 Meters

CRAIGLIE WATER AND SEWER PLANNING

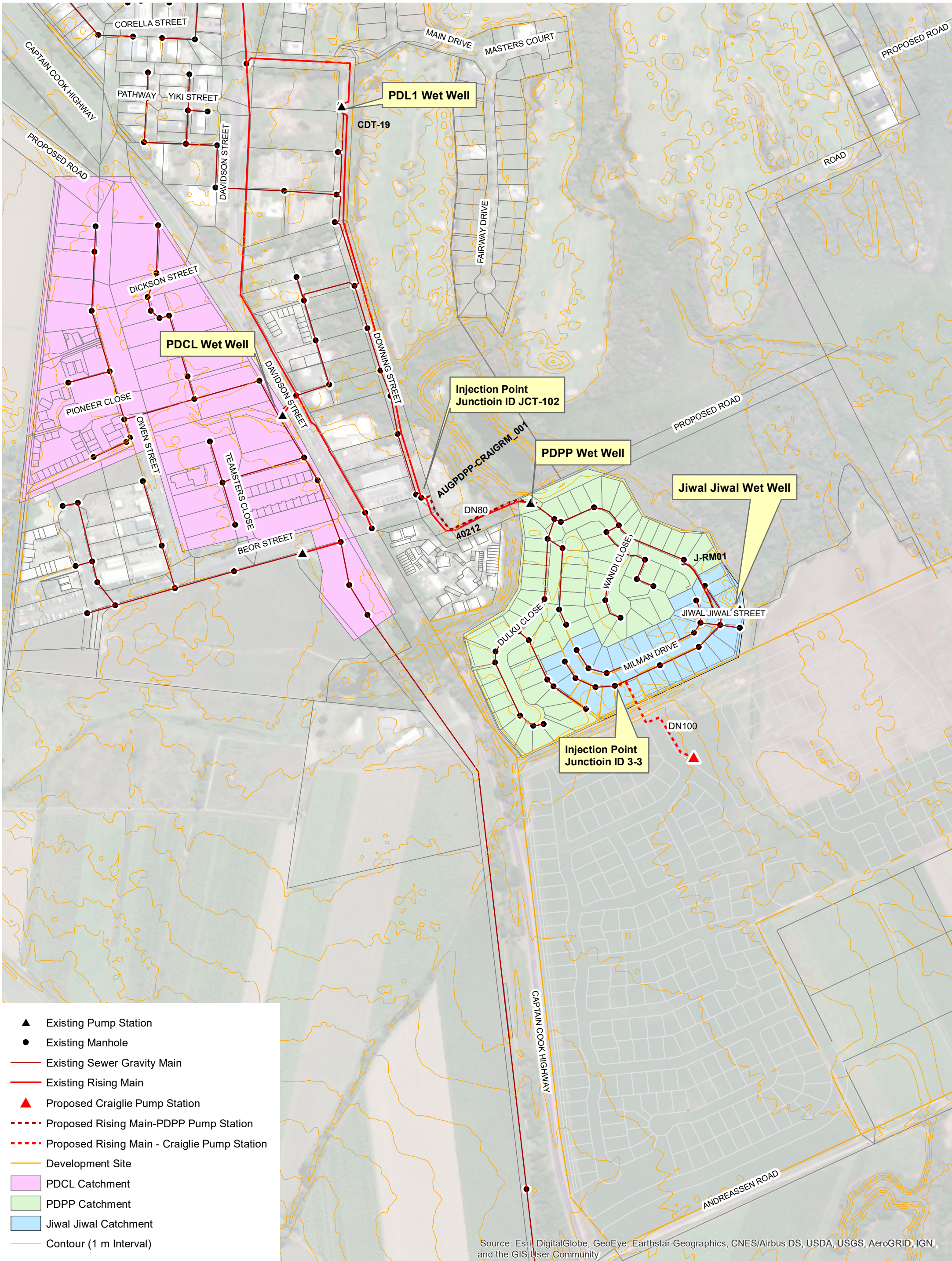
WATER SUPPLY - MINIMUM FIRE-FLOW PRESSURES

ULTIMATE
FIGURE 4
WATER-A3-FIGURE_P

APPENDIX

D

SEWERAGE SERVICING STRATEGY



FILE: M:\Q184103 - Craiglie Water and Sewerage Design\Project material\GIS\ESRI\Figures mxd\Sewer-A3-FIGURE_P.mxd



Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

DATE PLOTTED: 19/03/2020 3:40:09 PM BY: SUNIL SIMKHADA

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Date
19/03/2020

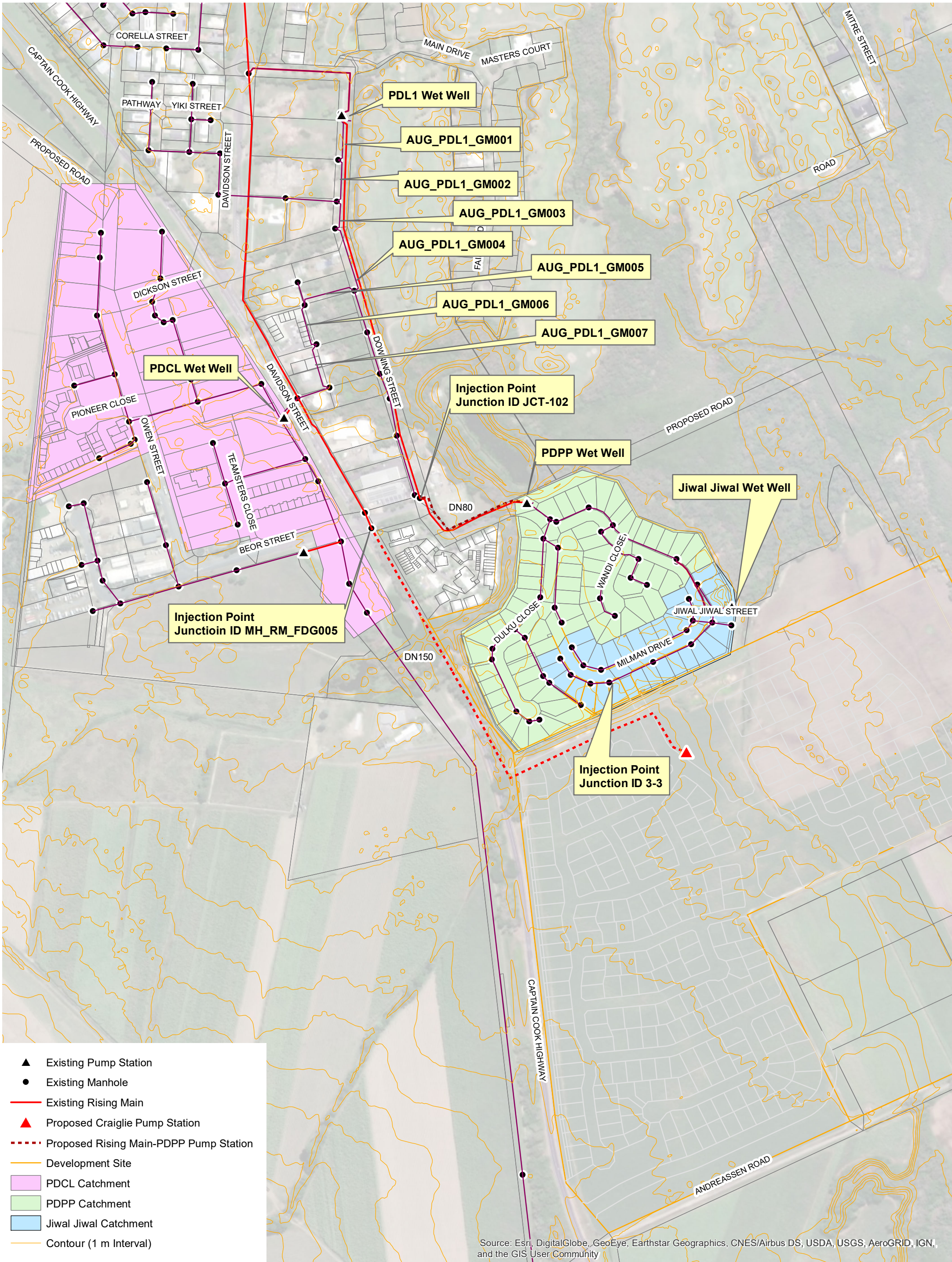
Size
A3

0 25 50 100 150 200
Meters

CRAIGLIE WATER AND SEWER PLANNING SEWER INFRASTRUCTURE

INTERIM - 2026 (STAGE 1 AND 2)

FIGURE 1
SEWER-A3-FIGURE_P



FILE: M:\Q184103 - Craiglie Water and Sewerage Design\Project material\GIS\ESRI\Figures mxd\Sewer-A3-FIGURE_P.mxd



Level 11, North Tower, 515 St Pauls Terrace
Locked Bag 4006, Fortitude Valley QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722

DATE PLOTTED: 19/03/2020 4:00:40 PM BY: SUNIL SIMKHADA

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Date
19/03/2020

Size
A3

0 25 50 100 150 200
Meters

CRAIGLIE WATER AND SEWER PLANNING SEWER INFRASTRUCTURE

ULTIMATE - (STAGE 3 AND ONWARDS)

FIGURE 2
SEWER-A3-FIGURE_P

DATE PLOTTED: 3 April 2020 2:20 PM BY: DAVID GRAY

XREFs: X-Q184103-Cadastre; X-Q184108-PR LOTs; X-RQ184103-CSD-BASE
CAD File: M-Q184103 - Craiglie Water and Sewerage Design; Project material\ACAD\Q184103-CI-001.dwg

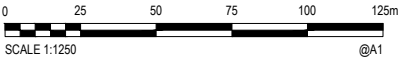
Rev.	Date	Description	Des.	Verif.	Appd.
4	3/04/2020	PRELIMINARY ISSUE	D.G.	G.P.	
3	30/09/2019	PRELIMINARY ISSUE	D.G.	G.P.	
2	28/08/2019	PRELIMINARY ISSUE	D.G.	G.P.	
1	21/08/2019	PRELIMINARY ISSUE	D.G.	G.P.	

PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES



LOCALITY PLAN
SCALE 1:1250

LOCALITY PLAN
SCALE 1:1250



SCHEDULE OF DRAWINGS	
DRAWING No.	DESCRIPTION
Q184103-CI-001	COVER SHEET
Q184103-CI-002	GENERAL NOTES
Q184103-CI-003	PUMP STATION SITE PLAN
Q184103-CI-004	PUMP STATION PLAN AND SECTION
Q184103-CI-005	FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 1
Q184103-CI-006	FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 2
Q184103-CI-007	FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 3
Q184103-CI-008	WATERMAIN CONNECTION DETAILS SHEET 1
Q184103-CI-009	WATERMAIN CONNECTION DETAILS SHEET 2
Q184103-CI-010	SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION
Q184103-CI-011	CULVERT CROSSING

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

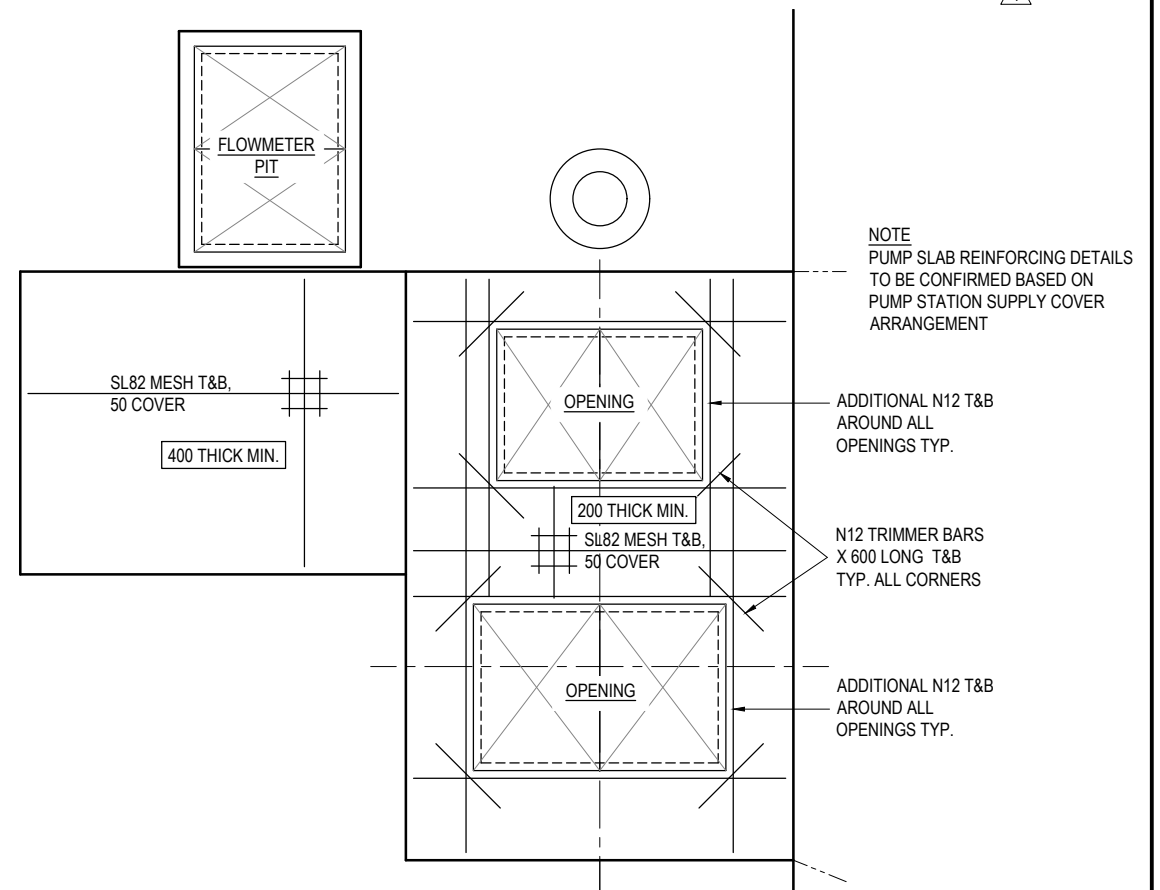


Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn	D.G.	Date	20/08/2019
Checked	G.P.	Date	20/08/2019
Designed	D.G.	Date	20/08/2019
Verified		Date	
Approved			

Client	PORT DOUGLAS SHIRE COUNCIL
Project	PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Title	COVER SHEET

Status	PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES			
DATUM	AHD	MGA	Scale AS SHOWN	Size A1
Drawing Number	Q184103-CI-001			Revision 4



REINFORCEMENT DETAIL
SCALE 1:25

-

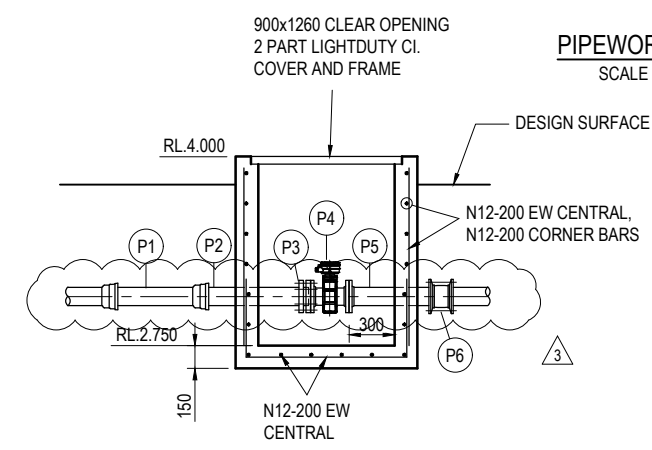
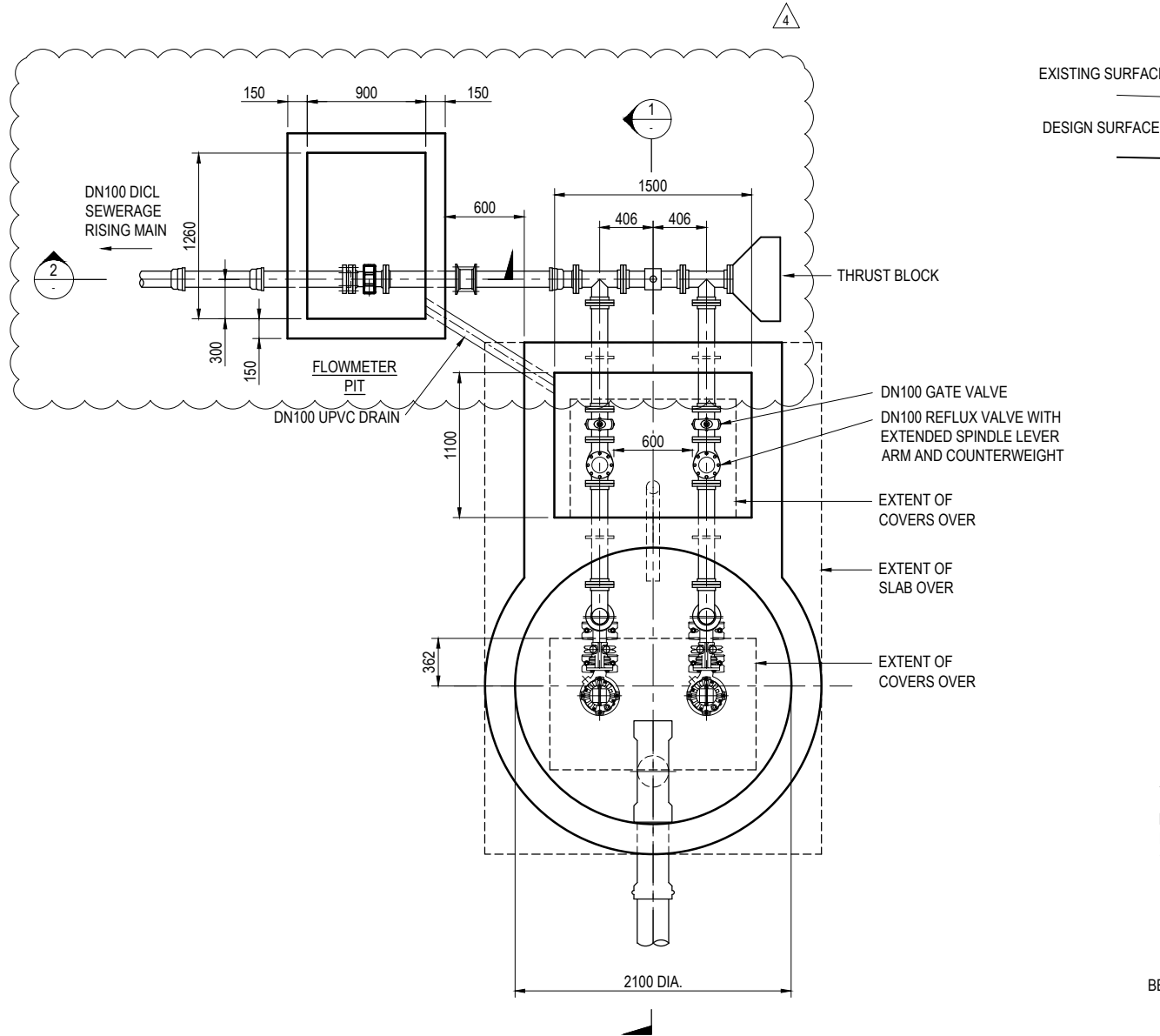
4	3/04/2020	PRELIMINARY ISSUE		D.G.	G.P	
3	30/09/2019	PRELIMINARY ISSUE		D.G.	G.P	
2	28/08/2019	PRELIMINARY ISSUE		D.G.	G.P	
1	21/08/2019	PRELIMINARY ISSUE		D.G.	G.P	
Rev.	Date	Description		Des.	Verif.	Appd.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

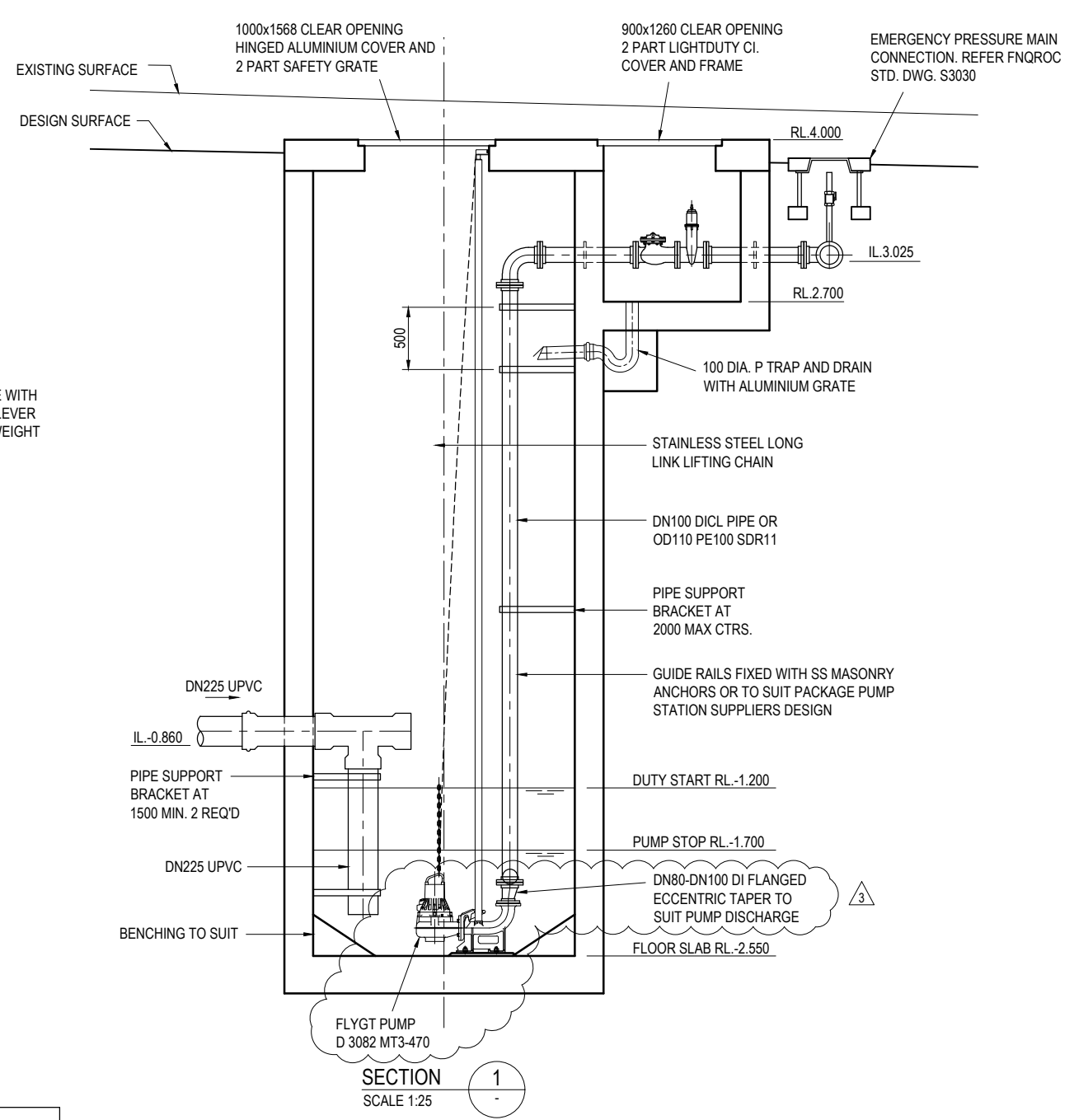


Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL								
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES								
Designed D.G.	Date 20/08/2019	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES								
Verified	Date	<table><tr><td>DATUM AHD</td><td>MGA</td><td>Scale AS SHOWN</td><td>Size A1</td></tr><tr><td colspan="3">Drawing Number Q184103-CI-003</td><td>Revision 4</td></tr></table>	DATUM AHD	MGA	Scale AS SHOWN	Size A1	Drawing Number Q184103-CI-003			Revision 4
DATUM AHD	MGA	Scale AS SHOWN	Size A1							
Drawing Number Q184103-CI-003			Revision 4							
Approved		Title PUMP STATION SITE PLAN								

DATE PLOTTED: 6 April 2020 12:07 PM BY: DAVID GRAY
XREFs: CAD File: M:\Q184\03 - Craiglie Water and Sewerage Design\Project material\ACAD\Q184103-CI-003-004.dwg

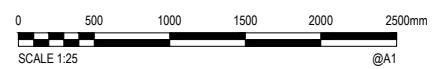


FLOWMETER PIPE SCHEDULE		
ITEM	DESCRIPTION	DIA.
P1	SP/SO DI CL PIPE X 600 LONG	DN100
P2	SP/SP DI CL PIPE X 750 LONG	DN100
P3	NON TRUST TYPE DISMANTLING JOINT	DN100
P4	ELECTROMAGNETIC FLOWMETER	DN100
P5	FL/SP DI CL PIPE X 600 LONG	DN100
P6	GIBAULT JOINT	DN100



PUMP DUTY		
	FLOW (L/s)	HEAD (m)
1	12.8	65.8
2	12.8	10.7

- NOTES
- PUMP WELL AND VALVE CHAMBER TYPICAL ONLY.
 - FINAL DETAILS OF WETWELL AND VALVE CHAMBER TO BE DETERMINED BY PACKAGE PUMP STATION DESIGNER/SUPPLIER
 - PACKAGE PUMP STATION TO COMPLY WITH PORT DOUGLAS SHIRE COUNCIL APPROVED SUPPLIERS LIST. OTHER SUPPLIERS ARE NOT ACCEPTABLE. REFER NOTES ON CI-002.

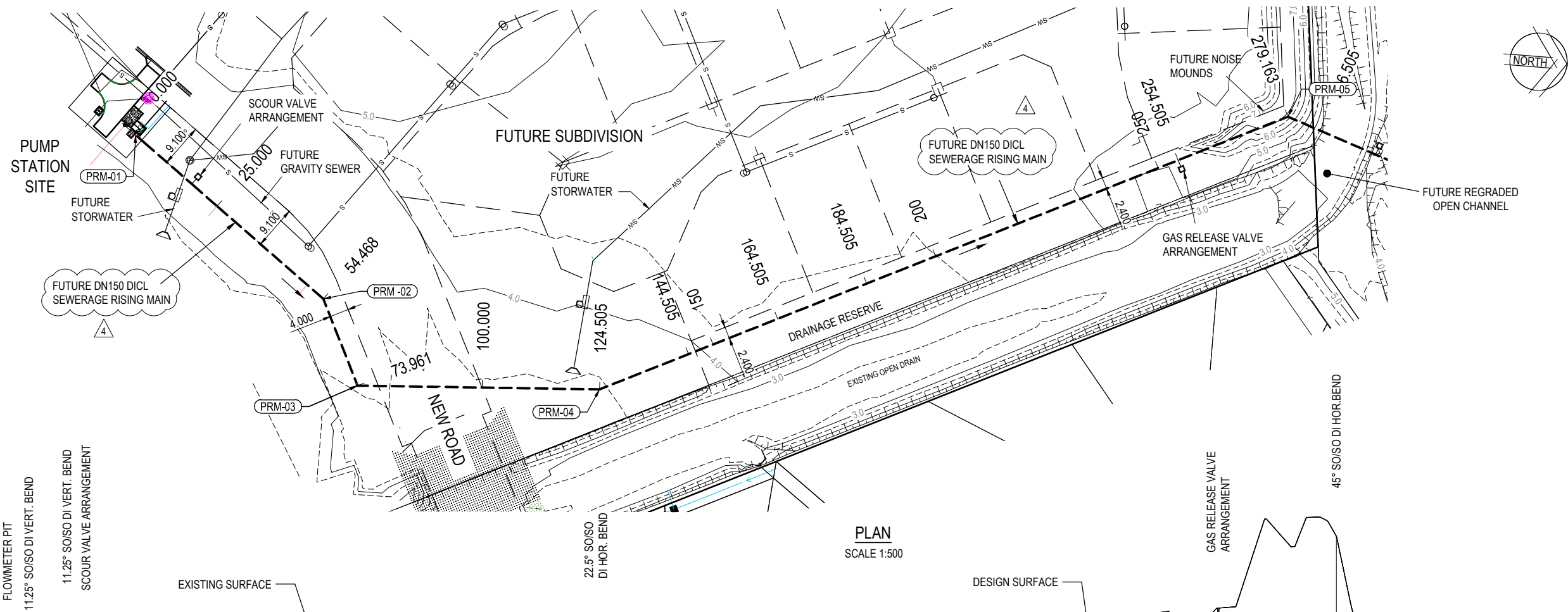


Rev.	Date	Description	Des.	Verif.	Appd.
3	3/04/2020	PRELIMINARY ISSUE		D.G.	G.P.
2	28/08/2019	PRELIMINARY ISSUE		D.G.	G.P.
1	21/08/2019	PRELIMINARY ISSUE		D.G.	G.P.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

Cardno
Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G. 20/08/2019	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P. 20/08/2019	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G. 20/08/2019	Date 20/08/2019	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Verified Date		DATUM AHD
Approved		MGA
		Scale AS SHOWN
		Size A1
		Drawing Number Q184103-CI-004
		Revision 3



PLAN
SCALE 1:500

DATUM: 1.000

DIA & CLASS

TRENCH TYPE

GRADE

LENGTH

	0.000	2.481	4.324	4.424	4.550	4.614	4.709	4.865	4.859	4.830	4.797	4.716	4.553	5.214	4.433	4.607
DESIGN SURFACE	3.793	3.793	3.779	3.745	3.729	3.730	3.808	3.477	3.461	3.951	4.171	4.358	5.214	6.719		
EXIST. SURFACE	4.324	4.424	4.550	4.614	4.709	4.865	4.859	4.830	4.797	4.716	4.553	5.214	6.719			
COVER TO DESIGN SURFACE			0.638	2.045	1.537	1.907	1.668	1.598	2.152	0.666	0.666	0.666	0.753	1.409	3.037	
INVERT LEVEL			2.985	1.545	1.537	1.907	1.907	2.055	2.282	2.650	3.150	3.350	3.450	3.650	3.527	
CHAINAGE	0.000	2.481	6.000	14.000	18.000	25.000	54.468	100.000	124.505	144.505	164.505	184.505	254.505	279.163		

LONGITUDINAL SECTION - PR-RISING MAIN

LONGITUDINAL SECTION
SCALE HOR. 1:500, VERT. 1:50

LEGEND

- T(D) — EXISTING TELSTRA/NBN
- W(C) — EXISTING WATER
- SR(C) — EXISTING SEWERAGE RISING MAIN
- v — EXISTING OVERHEAD ELECTRICITY / STAYWIRE
- sw — FUTURE STORMWATER
- s — FUTURE SEWER
- — FUTURE SEWERAGE RISING MAIN

NOTES

- FOR SCOUR ARRANGEMENT REFER WSA DWG. SPS-1602
- FOR GAS RELEASE ARRANGEMENT REFER WSA DWG. SPS-1602 EXCEPT SCOUR INVERT TEE INVERTED.
- REFER CI-007 FOR SETOUT.



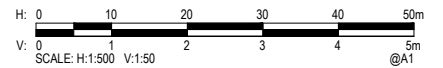
Rev.	Date	Description	Des.	Verif.	Appd.
4	3/04/2020	PRELIMINARY ISSUE		D.G.	G.P.
3	30/09/2019	PRELIMINARY ISSUE		D.G.	G.P.
2	28/08/2019	PRELIMINARY ISSUE		D.G.	G.P.
1	21/08/2019	PRELIMINARY ISSUE		D.G.	G.P.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G.	Date 20/08/2019	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Verified	Date	DATUM AHD
Approved	Date	MGA
		Scale AS SHOWN
		Size A1
		Drawing Number Q184103-CI-005
		Revision 4
		Title FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 1



4	3/04/2020	PRELIMINARY ISSUE	D.G.	G.P	
3	30/09/2019	PRELIMINARY ISSUE	D.G.	G.P	
2	28/08/2019	PRELIMINARY ISSUE	D.G.	G.P	
1	21/08/2019	PRELIMINARY ISSUE	D.G.	G.P	
Rev.	Date	Description	Des.	Verif.	Appd.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL			
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES		
Designed D.G.	Date 20/08/2019		DATING MGA Scale Size AHD AS SHOWN A1		
Verified	Date		Drawing Number Revision Q184103-CI-006 4		
Approved		Title FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 2			

DATE PLOTTED: 3 April 2020 9:44 AM BY: DAVID GRAY

XREFs: X: Q184103-Cadastre; X: Q184108-PR LOT5; XR-Q184103-CSD-BASE; XR-Q184103-CI-BASE
CAD File: M:Q184103 - Craiglie Water and Sewerage Design; Project material\ACAD\Q184103-CI-005-007.dwg

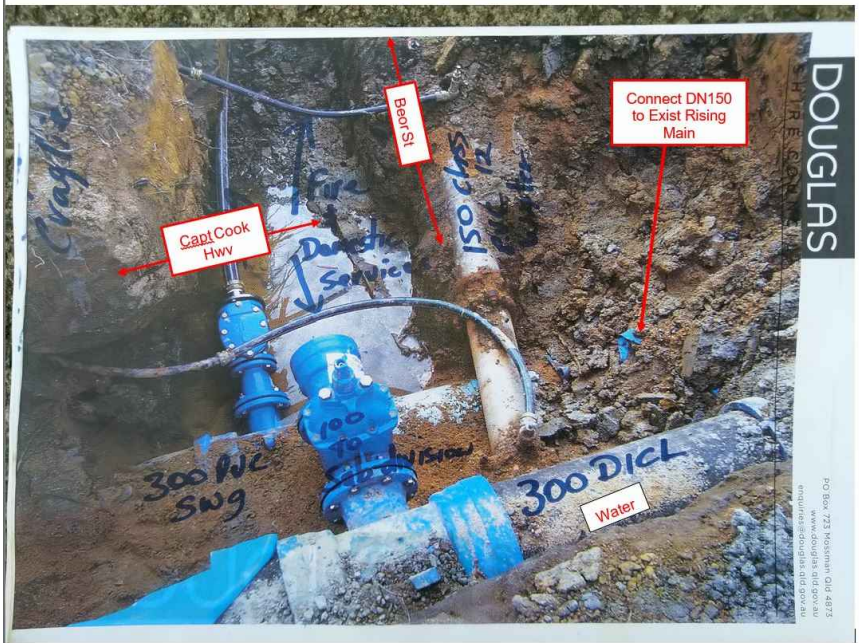
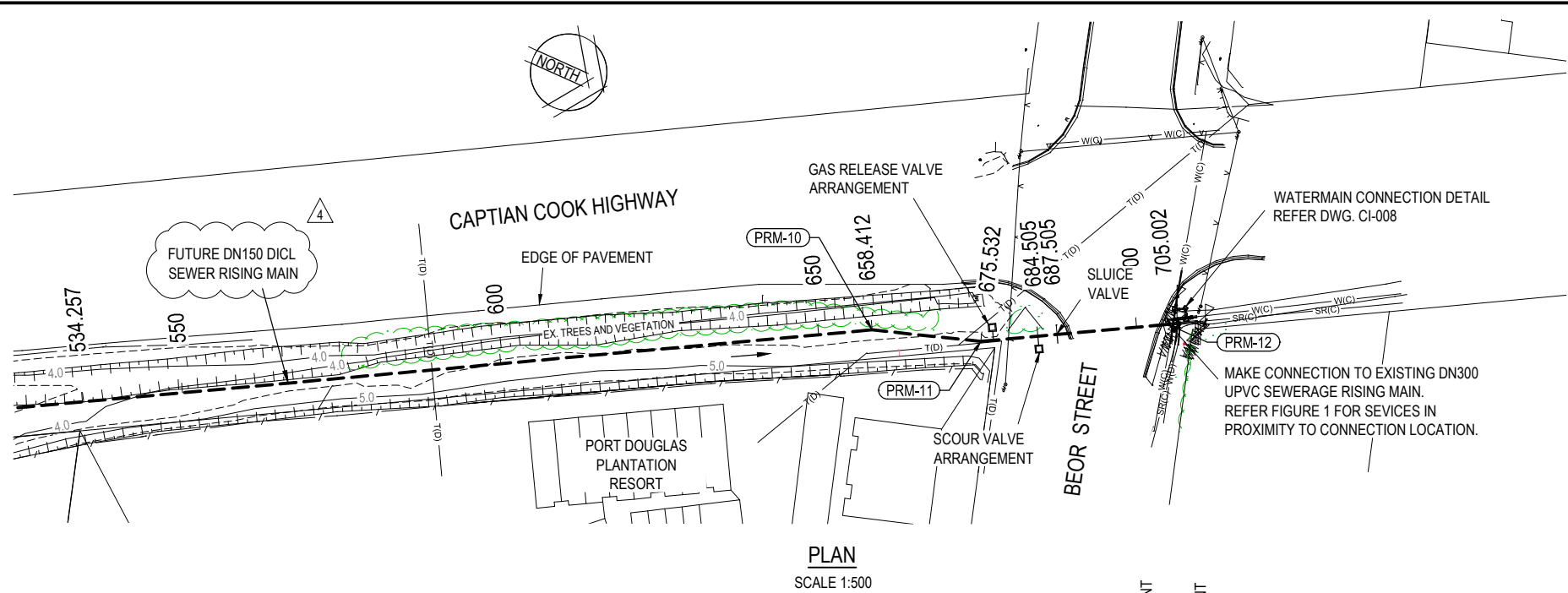
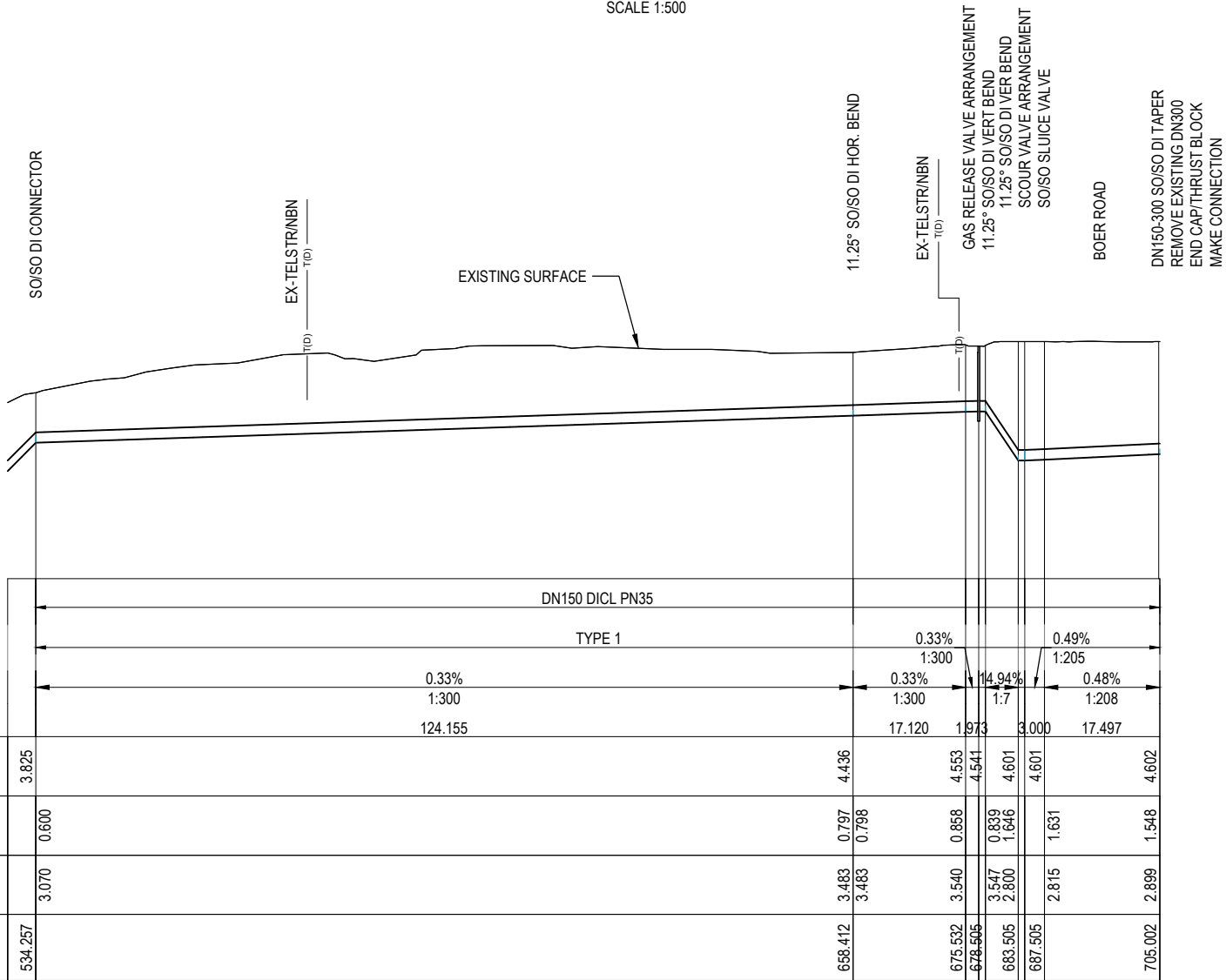


FIGURE 1



SETOUT - FUTURE RISING MAIN				
POINT	EASTING	NORTHING	CHAINAGE	DESCRIPTION
PRM-01	337129.527	8170549.600	2.481	FLOW METER PIT STUB
PRM-02	337087.823	8170580.638	54.468	22.5° SO/SO DI HOR. BEND
PRM-03	337079.250	8170598.146	73.961	45°-22.5° SO/SO DI HOR. BENDS
PRM-04	337028.806	8170594.982	124.505	22.5° SO/SO DI HOR. BEND
PRM-05	336889.904	8170526.970	279.163	45° SO/SO DI HOR. BEND
PRM-06	336867.212	8170534.744	303.150	45° SO/SO DI HOR. BEND
PRM-07	336828.217	8170621.866	398.601	SO/SO DI CONNECTOR
PRM-08	336792.571	8170685.352	471.409	11.25° SO/SO DI HOR. BEND
PRM-09	336785.529	8170693.604	482.257	11.25° SO/SO DI HOR. BEND
PRM-10	336699.286	8170847.202	658.412	11.25° SO/SO DI HOR. BEND
PRM-11	336693.978	8170863.479	675.532	11.25° SO/SO DI HOR. BEND
PRM-12	336679.550	8170889.175	705.002	DN300/150 SO/SO DI TAPER REMOVE EXISTING DEAD END AND MAKE CONNECTION

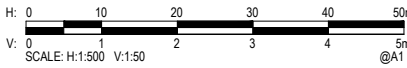
SETOUT-PR-DN100 WATER MAIN				
POINT	EASTING	NORTHING	CHAINAGE	DESCRIPTION
PRWM-01	335965.997	8172144.651	0.000	TIE INTO EXIST DN450 DI CL
PRWM-02	335969.720	8172139.379	6.454	BEND
PRWM-03	335985.391	8172096.915	51.717	BEND
PRWM-04	336003.979	8172070.619	83.920	TIE INTO EXIST DN100 UPVC

LEGEND

- T(D) — EXISTING TELSTRA/BNB
- W(C) — EXISTING WATER
- SR(C) — EXISTING SEWERAGE RISING MAIN
- V — EXISTING OVERHEAD ELECTRICITY / STAYWIRE
- SW — FUTURE STORMWATER
- S — FUTURE SEWER
- — — FUTURE SEWERAGE RISING MAIN

NOTES

- FOR SCOUR ARRANGEMENT REFER WSA DWG. SPS-1602
- FOR GAS RELEASE ARRANGEMENT REFER WSA DWG. SPS-1602 EXCEPT SCOUR INVERT TEE INVERTED.



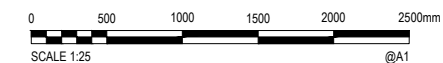
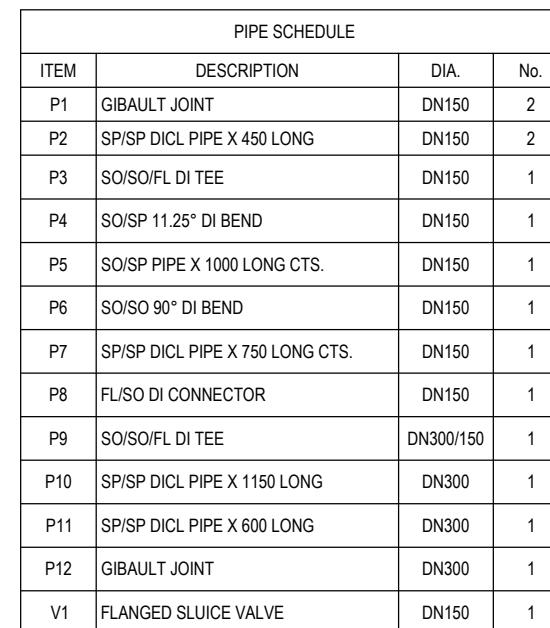
Rev.	Date	Description	Des.	Verif.	Appd.
4	3/04/2020	PRELIMINARY ISSUE	D.G.	G.P.	
3	30/09/2019	PRELIMINARY ISSUE	D.G.	G.P.	
2	28/08/2019	PRELIMINARY ISSUE	D.G.	G.P.	
1	21/08/2019	PRELIMINARY ISSUE	D.G.	G.P.	

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G.	Date 20/08/2019	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Verified	Date	DATUM AHD
Approved	Date	MGA
		Scale AS SHOWN
		Size A1
		Drawing Number Q184103-CI-007
		Revision 4
		Title FUTURE SEWERAGE RISING MAIN PLAN AND LONGITUDINAL SECTION SHEET 3



1	28/08/2019	PRELIMINARY ISSUE	D.G.	G.P	
Rev.	Date	Description	Des.	Verif.	Appd.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

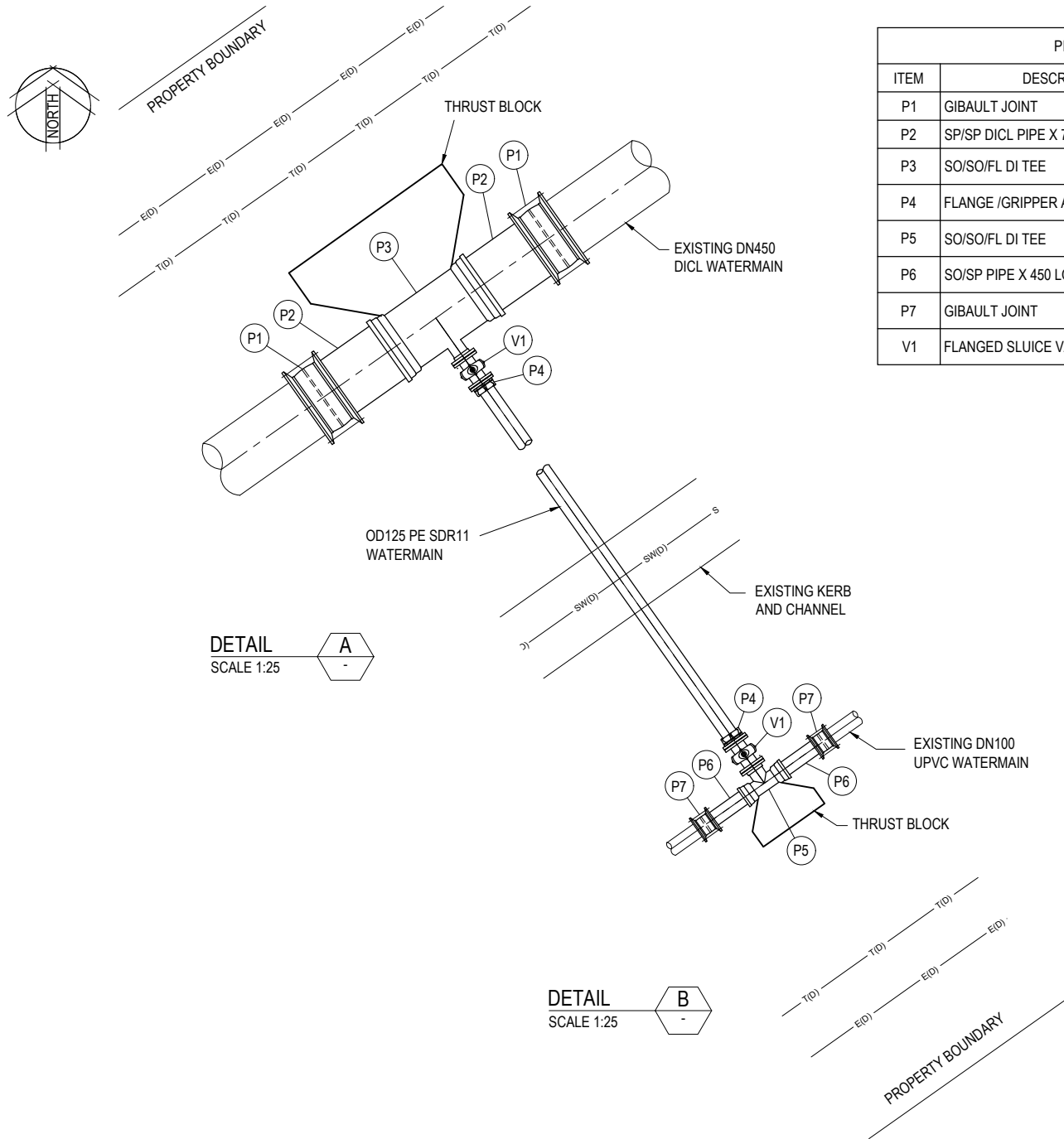


Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL	
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Designed Date D.G. 20/08/2019	Date 20/08/2019	Title WATERMAIN CONNECTION DETAILS SHEET 1	DATUM AHD
Verified Date	Date		MGA AS SHOWN
Approved		Drawing Number Q184103-CI-008	Size A1 Revision 1



PLAN
SCALE 1:250



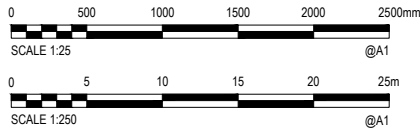
DETAIL
SCALE 1:25

DETAIL
SCALE 1:25

SETOUT-PR-DN100 WATER MAIN				
POINT	EASTING	NORTHING	CHAINAGE	DESCRIPTION
PRWM-01	335965.997	8172144.651	0.000	TIE INTO EXIST DN450 DICL
PRWM-02	335969.720	8172139.379	6.454	BEND
PRWM-03	335985.391	8172096.915	51.717	BEND
PRWM-04	336003.979	8172070.619	83.920	TIE INTO EXIST DN100 UPVC

LEGEND

- T(D) — EXISTING TELSTRA/NBN
- W(D) — EXISTING WATER
- E(D) — EXISTING UNDERGROUND ELECTRICITY
- SW(D) — EXISTING STORMWATER
- PROPOSED WATERMAIN



Rev.	Date	Description	Des.	Verif.	Appd.
1	28/08/2019	PRELIMINARY ISSUE	D.G.	G.P.	

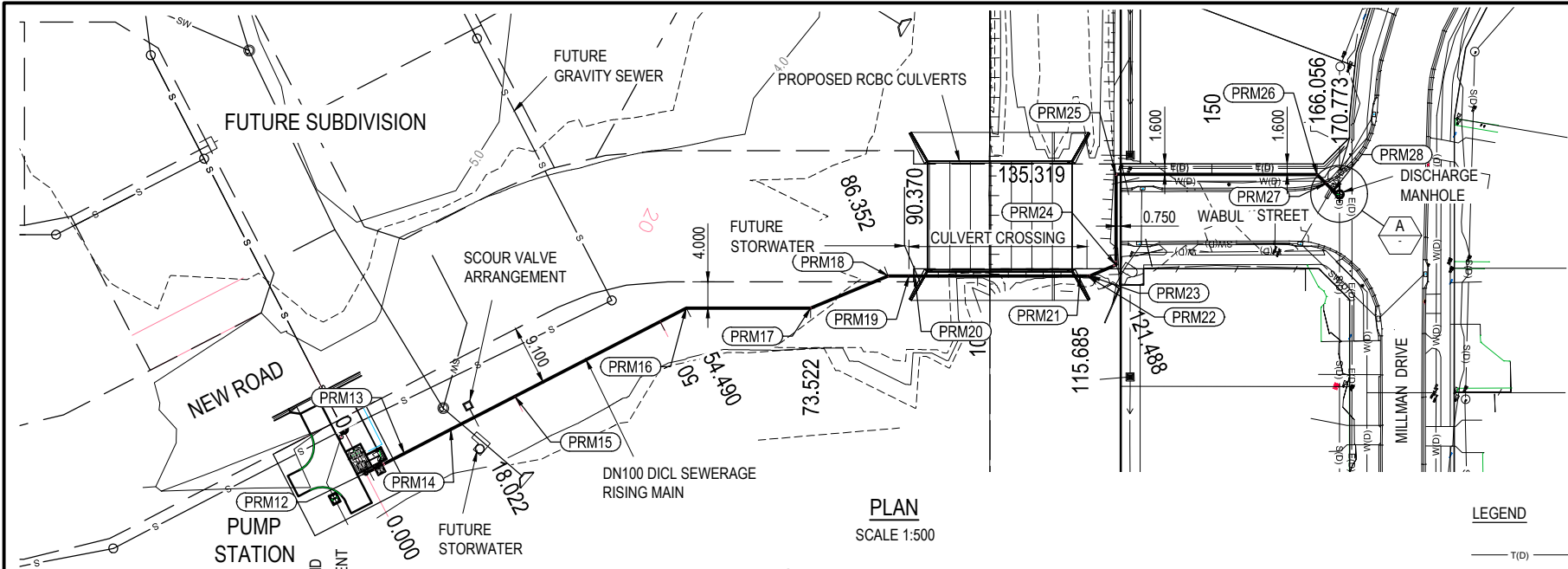
© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 20/08/2019	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G.	Date 20/08/2019	Title WATERMAIN CONNECTION DETAILS SHEET 2
Verified	Date	
Approved		
		Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
DATUM AHD	MGA	Scale AS SHOWN
Drawing Number Q184103-CI-009	Size A1	Revision 1

DATE PLOTTED: 6 April 2020 8:14 AM BY: DAVID GRAY
XREFs: X: Q184103-Cadastre; X: Q184108-PR LOT15; XR-Q184103-CSD-BASE; XR-Q184103-CI-BASE
CAD File: M:Q184103 - Craiglie Water and Sewerage Design; Project material:ACAD/Q184103-CI-005-007.dwg

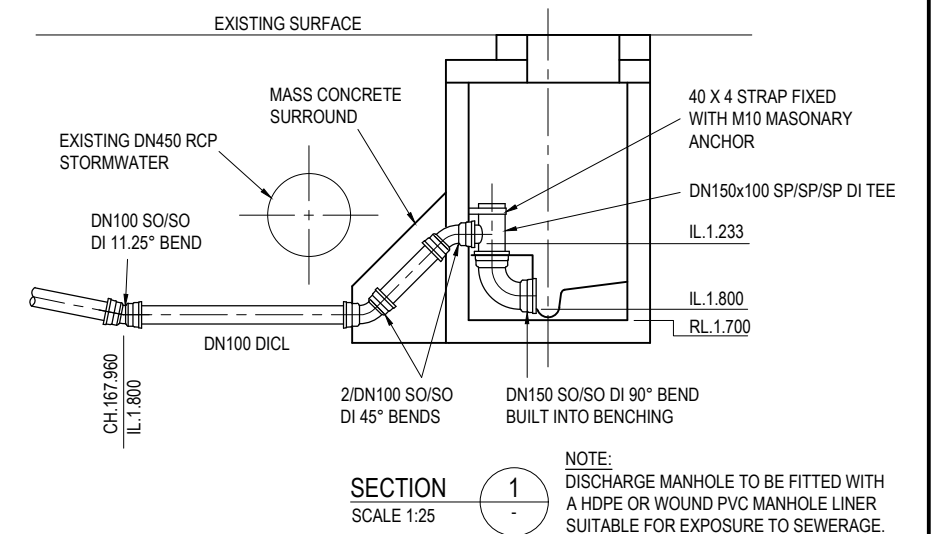
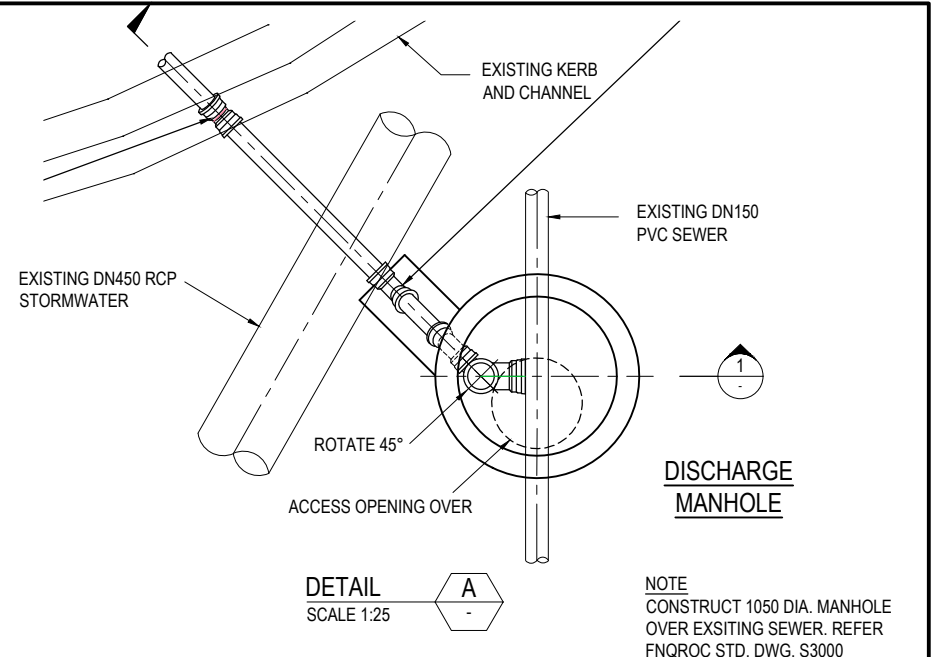


LEGEND

— T(D) —	EXISTING TELSTRA/NBN
— W(C) —	EXISTING WATER
— SR(C) —	EXISTING SEWERAGE RISING MAIN
— SW(D) —	EXISTING STORMWATER
— V —	EXISTING OVERHEAD ELECTRICITY / STAYWIRE
— SW —	FUTURE STORMWATER
— S —	FUTURE SEWER
— —	PROPOSED SEWERAGE RISING MAIN

NOTES

1. FOR SCOUR ARRANGEMENT REFER WSA DWG. SPS-1602
2. FOR GAS RELEASE ARRANGEMENT REFER WSA DWG. SPS-1602 EXCEPT SCOUR INVERT TEE INVERTED.



DATUM: 0.000

TRENCH TYPE

DIA & CLASS

GRADE

LENGTH

	0.000	2.461	6.022	14.022	18.022	54.490	73.522	86.352	90.370	115.685	121.488	135.319	166.056	170.773
DESIGN SURFACE	4.322	4.322	4.424	4.550	4.614	4.865	4.813	4.824	4.827	2.125	3.378	3.615	3.635	3.600
EXIST. SURFACE	4.322	4.424	4.550	4.614	4.614	4.865	4.813	4.824	4.827	2.125	3.378	3.615	3.635	3.600
COVER TO DESIGN SURFACE			0.683	2.095	2.079	1.191	1.191	0.883	0.878	0.284	1.047	1.096	1.453	
INVERT LEVEL			2.985	1.540	1.540	2.507	2.507	2.545	2.549	3.000	2.202	2.133	2.072	
CHAINAGE	0.000	2.461	6.022	14.022	18.022	54.490	73.522	86.352	90.370	115.685	121.488	135.319	166.056	170.773

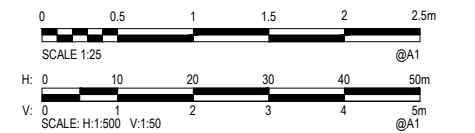
LONGITUDINAL SECTION - PR DN100 RISING MAIN

LONGITUDINAL SECTION

SCALE HOR. 1:500, VERT. 1:50

SETOUT-PR-RISING MAIN				
POINT	EASTING	NORTHING	CHAINAGE	DESCRIPTION
PRM12	337129.560	8170549.575	2.461	FLOW METER PIT STUB
PRM13	337126.704	8170551.701	6.022	11.25° SO/SO DI VERT. BEND
PRM14	337120.286	8170556.478	14.022	11.25° SO/SO DI VERT. BEND
PRM15	337111.462	8170563.045	25.000	Null Structure
PRM16	337087.823	8170580.638	54.490	22.5° SO/SO DI HOR. BEND
PRM17	337079.453	8170597.732	73.522	22.5° SO/SO DI HOR. BEND
PRM18	337069.831	8170606.218	86.352	22.5° SO/SO DI HOR. BEND
PRM19	337068.438	8170609.063	89.519	45° FL/FL DI VERT. BEND FL/SO DI CONNECTOR
PRM20	337068.064	8170609.828	90.370	45° FL/FL DI VERT. BEND
PRM21	337056.932	8170632.564	115.685	45° FL/FL DI VERT. BEND

SETOUT-PR-RISING MAIN				
POINT	EASTING	NORTHING	CHAINAGE	DESCRIPTION
PRM22	337056.464	8170633.519	116.749	45° FL/FL DI VERT. BEND FL/SO DI CONNECTOR
PRM23	337056.289	8170633.878	117.148	22.5° SO/SO DI HOR. BEND
PRM24	337053.024	8170636.737	121.488	45°+22.5° SO/SO DI HOR.BENDS
PRM25	337040.602	8170630.654	135.319	90° SO/SO DI HOR. BEND
PRM26	337027.104	8170658.269	166.056	45° SO/SO DI HOR. BEND
PRM27	337027.722	8170660.070	167.960	45° SO/SO VERT. BEND
PRM28	337028.257	8170661.628	169.608	2 x 45° SO/SO VERT. BEND



Rev.	Date	Description	Des.	Verif.	Appd.
1	2/04/2020	PRELIMINARY ISSUE		D.G.	G.P.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.

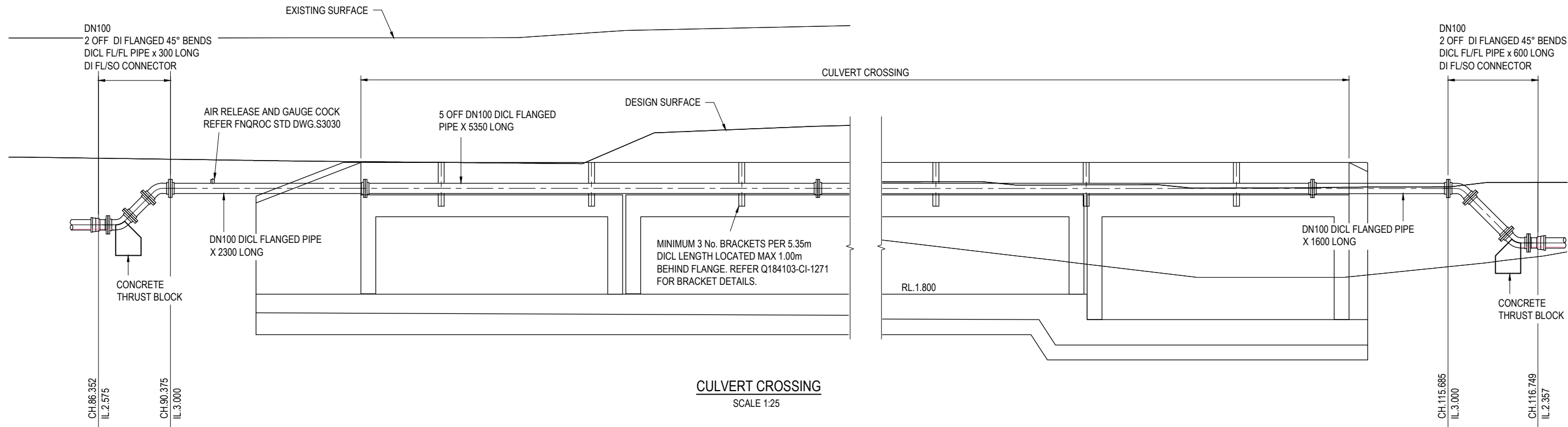


Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 2/04/2020	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G.	Date 2/04/2020	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Verified	Date	DATUM AHD
Approved		MGA
		Scale AS SHOWN
		Size A1
		Drawing Number Q184103-CI-010
		Revision 1

DATE PLOTTED: 6 April 2020 11:41 AM BY: DAVID GRAY

XREFs: X-Q184103-Cadastre; X-Q184108_PRL01S; XR-Q184103-CSD-BASE; XR-Q184103-CI-BASE
CAD File: M:Q184103 - Craiglie Water and Sewerage Design; Project material\ACAD\Q184103-CI-005-007.dwg



Rev.	Date	Description	Des.	Verif.	Appd.
1	2/04/2020	PRELIMINARY ISSUE		D.G.	G.P.

© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Cardno (Qld) Pty Ltd | ABN 57 051 074 992
Level 11, 515 St Paul's Terrace
Fortitude Valley, QLD 4006
Tel: 07 3369 9822 Fax: 07 3369 9722
Web: www.cardno.com.au

Drawn D.G.	Date 2/04/2020	Client PORT DOUGLAS SHIRE COUNCIL
Checked G.P.	Date 20/08/2019	Project PORT DOUGLAS ESTATE CRAIGLIE WATER AND SEWERAGE SERVICES
Designed D.G.	Date 2/04/2020	Title SEWERAGE RISING MAIN CULVERT CROSSING DETAIL
Verified	Date	Status PRELIMINARY NOT TO BE USED FOR CONSTRUCTION PURPOSES
Approved		DATUM AHD
		MGA
		Scale AS SHOWN
		Size A1
		Drawing Number Q184103-CI-011
		Revision 1



JOINS Q184103-CI-SK07

1	03.04.2020	ISSUED FOR INFORMATION	MC		MTS
Rev.	Date	Description	Des.	Verif.	Appd.



© Cardno Limited All Rights Reserved.
This document is produced by Cardno Limited solely for the benefit of and use by the client in accordance with the terms of the retainer. Cardno Limited does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by third party on the content of this document.



Cardno (QLD) Pty Ltd | ABN 57 051 074 992
15 Scott Street, Parramatta Park
Cairns QLD 4870
Tel: 07 4034 0500
Web: www.cardno.com.au

Drawn	Date
MCD	04.03.2020
Checked	Date
MTS	04.03.2020
Designed	Date
MC	04.03.2020
Verified	Date
Approved	
MTS	04.03.2020

Client **PORT DOUGLAS LAND DEVELOPMENTS PTY LTD**

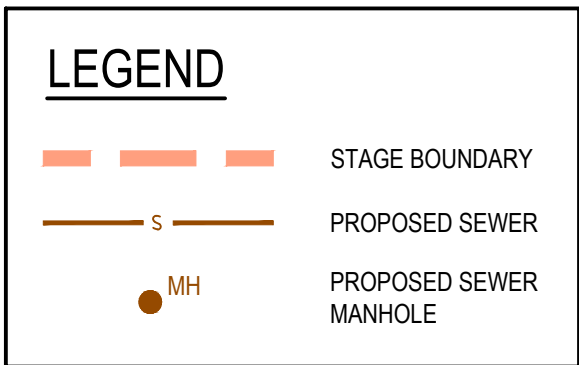
Project PORT DOUGLAS ESTATE - STAGE 1A & 1B

SUBDIVISION OF LOT 2 ON SR431
CAPTAIN COOK HIGHWAY, CRAIGLIE

Title	SEWER MASTERPLAN SHEET 1
-------	-----------------------------

Status **FOR INFORMATION ONLY**
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum AHD	Scale 1:1000	Size A1
Drawing Number Q184103-CI-SK06		Revision 1



Drawn	Date
MCD	04.03.2020
Checked	Date
MTS	04.03.2020
Designed	Date
MC	04.03.2020
Verified	Date
Approved	
MTS	04.03.2020

Status **FOR INFORMATION ONLY**
NOT TO BE USED FOR CONSTRUCTION PURPOSES

Datum AHD	Scale 1:1000	Size A1
Drawing Number Q184103-CI-SK07		Revision 1

Storage Required

Lots	Development Unit	Sewer Demand (EP)	Average Dry Weather Flow (L/s) (Per EP)	Average Dry Weather Flow (L/s) (Total Development)	Total Emergency Storage Required 4*ADWF (L)
285	2.8	798	0.003125	2.4938	35910

Design Storage Allowed

[illegible]