MIPP2

Expansion of Toursim Within the Shire

Normanton Raw Water Irrigation

CARPENTARIA SHIRE
Outback by the Sea®

PREPARED BY

ERSCON
CONSULTING ENGINEERS

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1. Raw Water Reticulation Network

1.1. Background

Normanton's rainfall is extremely seasonal with approximately 90% of rainfall in the four months of the wet season (December – March). Seasonal flooding is very common in these months followed by a very long and dry period in the middle of the year.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
Mean Rain (mm)	265.4	215.1	141.9	32.2	5.9	4.6	3.4	1.1	6.4	6.7	46.7	138.2	**851.2**

Raw water is supplied from the Glenore Weir on the Norman River for both Normanton and Karumba. The Glenore Weir has recently been upgraded to increase storage capacity throughout the dry season. Historically, water supply has been inadequate and the town has permanent water restrictions. The additional storage available means there is an opportunity to increase supply however the existing raw water pipe network from the Glenore Weir to Normanton is very old with some sections of the pipe reducing in size significantly and restricting the flow to the Water Treatment Plant (WTP).

Landscaping designs including beautification of Normanton have been completed as part of the Normanton Town Areas of Interest report. Green areas including grassed areas and trees form a large part of the landscape designs. To ensure the green areas of Normanton are kept at a high standard, a raw water irrigation system is proposed to allow watering throughout the year without significant additional cost to Council for water treatment costs.

1.2. Project Details

A raw water irrigation system has been designed to supply untreated water to key businesses and public areas within the central district of Normanton. The purpose of the project is to reduce the volume of water to be treated at the Normanton WTP and therefore reduce operational costs including chemicals, electricity etc.

The project includes installation of a ring main from the Normanton WTP throughout the central district of Normanton with property connection branches to key identified businesses. Locations eligible for connection to the network have been selected based on historic water consumption and providing benefit to the largest number of tourists and locals as possible. These include Normanton State School, Gulf Christian College, The Albion Hotel, The Central Hotel, The Purple Pub, the Council chambers, the police station/courthouse, and public parks/open spaces.

The businesses selected have significant excess water consumption and will provide the largest savings to Council. There are many other businesses not included in this project which would provide a mutual benefit for future stages are discussed in further detail in Section 2.2. Success of the project will be evaluated during the maintenance period of Stage 1 and feedback will be sought before future funding is sought for future stages.

The project will allow these key businesses access to additional water for irrigation at a reduced rate with the aim to improve public green spaces. Design of the first stage has been completed and is provided in Appendix B. Funding has also been secured for Stage 1 with construction expected to be complete by the end of 2020.

The raw water will still be charged to businesses however be at a significantly discounted rate than current excess water charges. The rate for raw water supply should be enough to cover ongoing operating costs of the system (maintenance, depreciation, and electricity costs).

1.3. Water Usage in Normanton

It is estimated that of the current usage, one-third is used for human consumption and about two-thirds is used for gardening and other non-human consumption purposes. This is evident when assessing usage on a month to month basis throughout the year. Water usage is at its highest during September-December immediately before the wet season and outside of the peak tourism period (June-August).

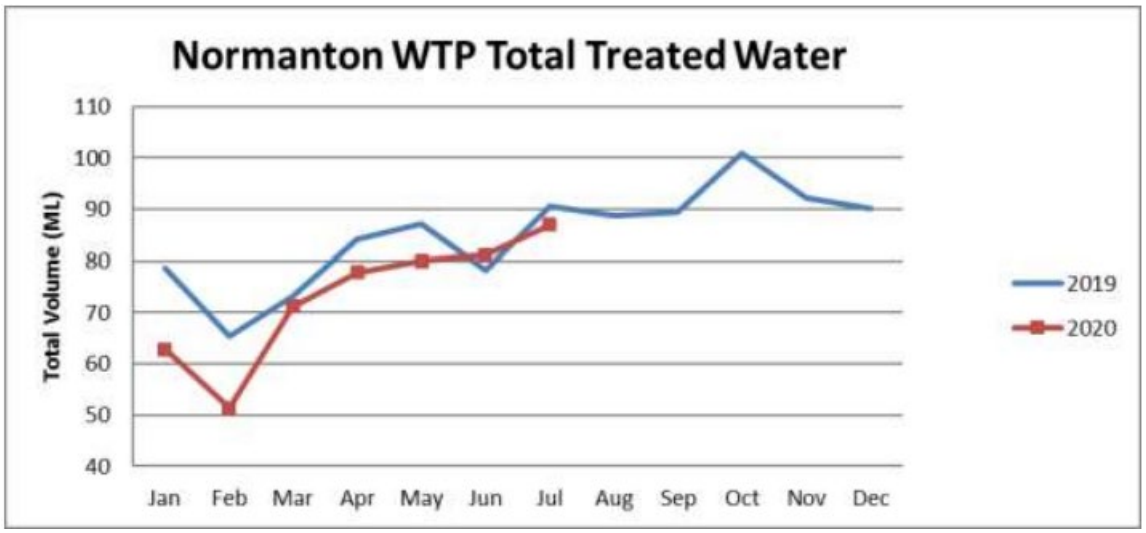

Figure 1: Water Treated at Normanton WTP

1.4. Operating and Maintenance Costs

Operating costs of the WTP are a significant cost to Council with major costs including chemical and electricity costs. A primary benefit of the raw water reticulation is the reduction in water treatment costs directly incurred by Council. Reducing the volume to be treated by the WTP will also allow future growth in the Shire (both permanent and temporary) without the need for major water infrastructure improvements.

When considering the cost to increase the capacity of the WTP for future use it is very evident that it is much more cost effective to provide a raw water network. A benefit cost analysis of construction of the raw water network has been completed by Cummings Economics in 2019 and is provided in Appendix A and summarised below.

<u>Expanding the Potable Water System</u>

- Capital Cost $2million
- NPV Additional Operating Cost $1.75million
- NPV Total Cost **$3.75million**

<u>Raw Water Reticulation Network</u>

- Capital Cost $0.95million
- NPV Savings in Operation and Maintenance (-$1.2million)
- NPV Total Cost **(-$0.25million)**

2. Future Planning

2.1. Extension of Reticulation Network

Stage 1 of the raw water network is a starting point for the proposed beautification of Normanton and will provide the key infrastructure (tanks, pumps etc) to allow future expansion of the system at a lower cost. The tanks and pumps designed for Stage 1 will have capacity to supply to additional areas around Normanton. An alternating watering allocation should be implemented similar to current water restrictions rotating between Karumba and Normanton. Under current water restrictions watering is permitted 4 days per week and a similar system could be implemented with Stage 1 businesses (Monday, Wednesday, Friday and Sunday) and Stage 2 businesses (Tuesday, Thursday, Saturday and Sunday) to ensure raw water demand is met.

The following additional businesses have been identified as potential expansion in future stages of the network.

- Sport and Recreation Centre
- Burns Philp Building
- Bowls Club
- Football fields
- Railway station
- Bakery
- Gallagher Butcher
- Gulfland Motel

To ensure the project provides a value for money outcome to both businesses and Council, a review period during the 12-month maintenance period of Stage 1 should be implemented. This will allow any issues to be identified before design of Stage 2 commences.

Further detail on Normanton beautification is provided in the Normanton Town Areas of Interest strategic plan.

2.2. School Dam

As part of the beautification of Normanton the School Dam is another key tourism area which has been identified for improvement. The beautification of the School Dam is detailed further in the Normanton Town Areas of Interest report.

As part of the beautification there will be grassed areas and newly planted trees. To keep these alive and thriving throughout the dry season (peak tourism season) irrigation is required which can be fed directly from the School Dam. A suction line with pumps and intake on the Dam is an option that will reduce the need for a pump station shed around the Dam restricting public space. The pumps and intake can be removed and stored for the wet season to prevent damage when irrigation is not required. See Figures 2 and 3 below.

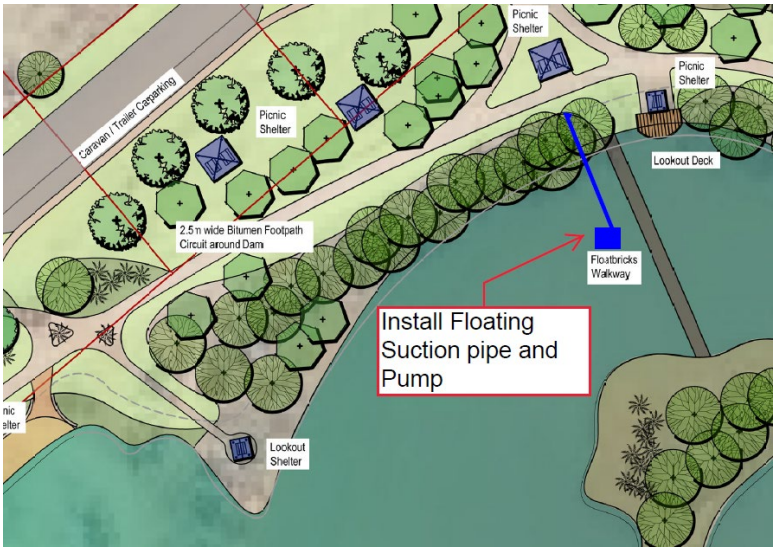

Figure 2: Proposed Location of Intake and Pumps

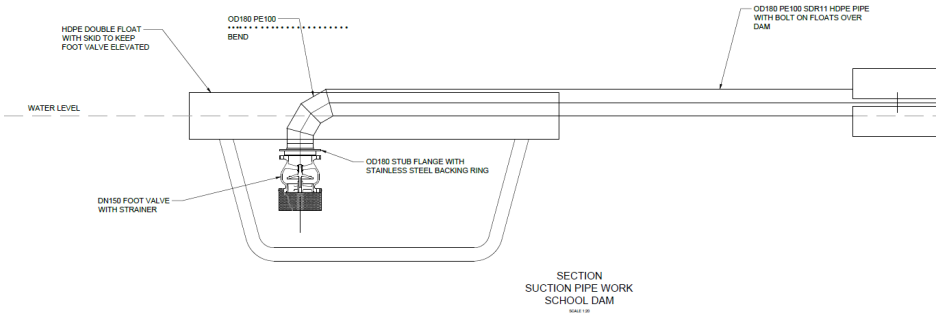

Figure 3: Floating Intake

To ensure adequate water levels in the School Dam for aesthetics and to supply irrigation there is an opportunity to install an offtake of the raw water main at the intersection of Thompson and Woodward Street (Figure 4 below) and install a flow valve to allow raw water to discharge into the School Dam. The discharge volume can be altered throughout the year to keep levels consistent throughout the dry season. See Figure 5 and 6 for connection details.

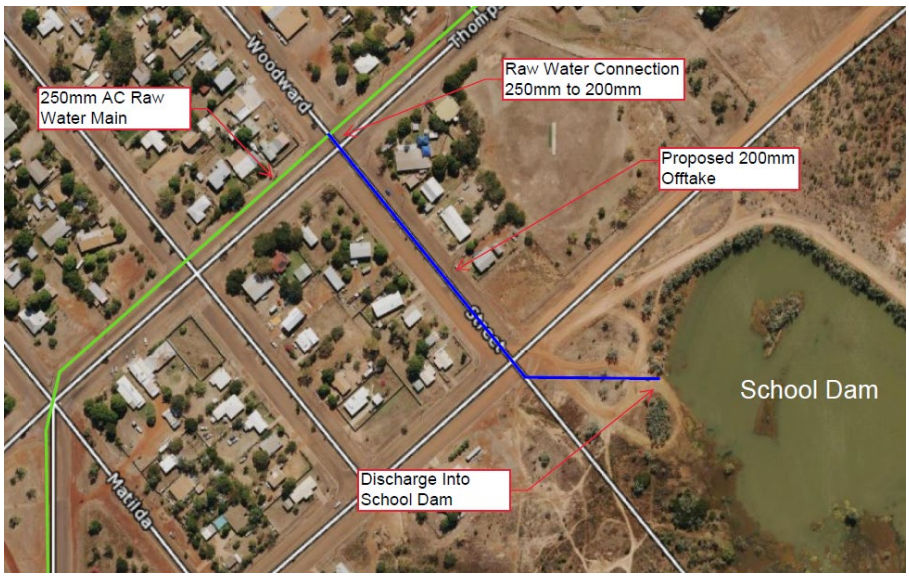

Figure 4: Raw Water Offtake to School Dam

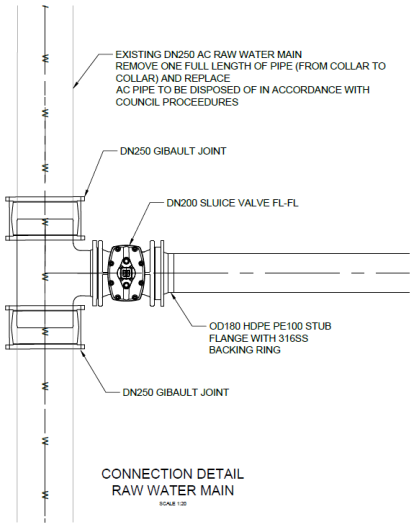

Figure 5: Raw Water Offtake Option 1

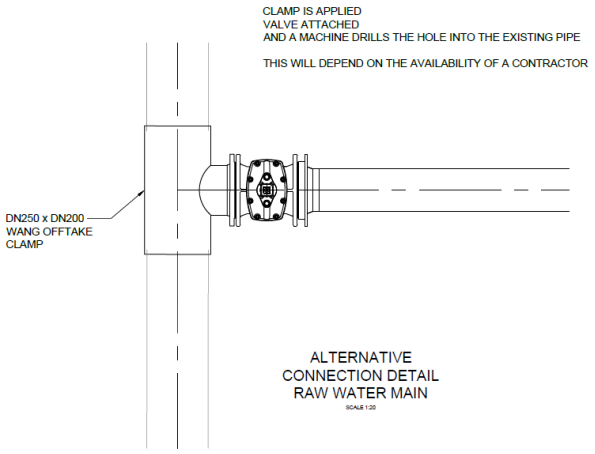

Figure 6: Raw Water Offtake Option 2

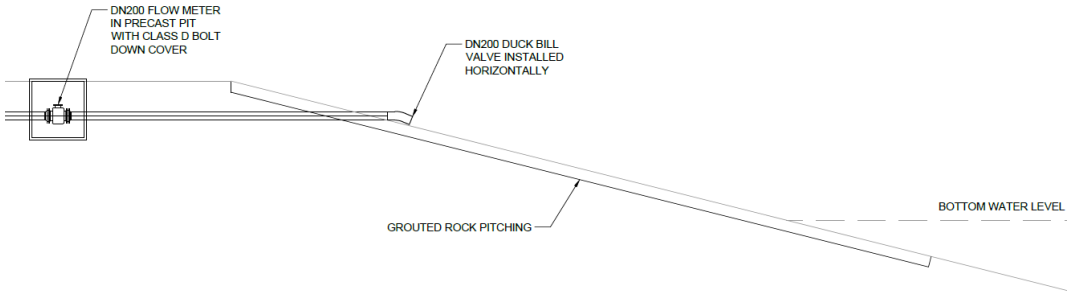

Figure 7: Discharge to School Dam

2.3. Supply Network – Glenore Weir to Water Treatment Plant

The current network transporting raw water from the Glenore Weir to the WTP has been identified recently as an area of concern which needs to be improved as demand for water increases in Normanton and Karumba.

Recent investigation including survey and potholing has uncovered several changes in pipe size between the weir and the WTP. The pipeline varies between 300mm AC down to 150mm AC in sections which is significantly restricting flow to the WTP.

The raw water main is approximately 23km long and currently supplies a maximum of approximately 40L/s to the WTP.

$$Max\ flow = 40\frac{L}{s}$$

$$Max\ Water\ treated\ per\ month = 30days\ \times \frac{24hours}{day} \times\ 60\frac{mins}{hr} \times 60\frac{seconds}{minute} \times 40\ L/s$$

$$= approx\ 104ML\ per\ month$$

The maximum total volume of water which can be treated per month is approximately 104ML. As seen in Figure 1, historical data from 2019 saw treated water per month peak at approximately 100ML in September.

The pumps at the Glenore Weir must operate at maximum capacity 24 hours per day to keep up with peak demand. There is minimal redundancy in the event of pump breakdown, water main burst or maintenance.

To improve the volume of raw water to the WTP there are some steps which can be taken in stages to significantly improve flow.

1. Extend duplicated raw water main from current end point to the WTP.
2. Locate extent of 150mm section in primary raw water main.
3. Remove 150mm pipe and replace with 250mm PVC pipe.

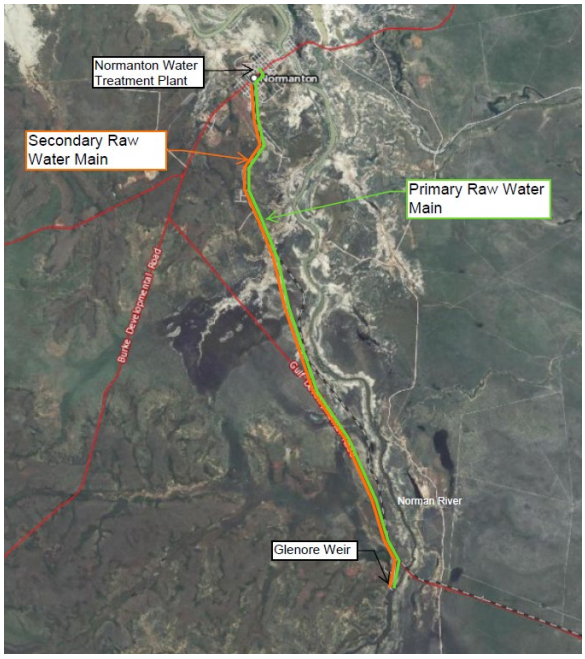

Figure 8: Raw Water Mains

2.3.1 Secondary Raw Water Duplication

There are currently two raw water pipelines running from the Glenore Weir to Normanton. The secondary pipe (250mm AC) joins directly to the primary pipeline approximately 1.5km from the water treatment plant. See Figure 9 and 10 below.

Figure 9: Merge of Raw Water Mains

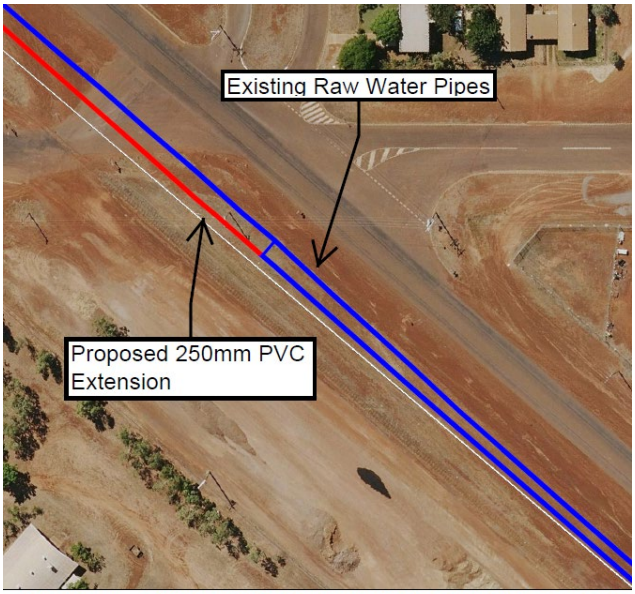

Figure 10: Extension of Secondary Raw Water Line

To increase the volume of raw water to the WTP and to add in a redundancy backup the second raw water line should be extended from the current location offset from the existing line which will double the current supply.

Length – 1250m

Pipe Size – 250mm PVC

Estimated Rate – $200/m

Estimated Total Cost – $250,000

The extension is currently being priced by a contractor to confirm the estimated price.

2.3.2 Replace Restricted Section of Primary Main

After installation of the secondary raw water main the bottleneck of the primary main should be replaced. The full extent of the 150mm section of pipe is currently unknown and potholing needs to be undertaken to determine the extent.

Once the full extent is known the extent can be exposed and isolated for replacement with the secondary main feeding the WTP.

APPENDIX A

Cummings Economics Strategic Development Plan

CARPENTARIA SHIRE COUNCIL

CARPENTARIA SHIRE
Outback by the Sea®

OVERARCHING STRATEGIC DEVELOPMENT PLAN

Project – Normanton Raw Water Project

Economic Impact/ Benefit Cost Analysis

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1. INTRODUCTION

1.1 General

Cummings Economics was commissioned by Carpentaria Shire Council to prepare a Benefit Cost, Economic and Social Impact Analysis of the proposal to develop a Raw Water systemetwork supply system for Normanton.

1.2 Methodology

Benefit Cost Analysis for this type of project is normally looked at in two ways:

- Economic Efficiency
- Economic Impact.

Economic Efficiency analysis looks at the efficiency benefits and costs of supplying a specific need, in this case, the supply of water for Normanton's community needs.

A "Project Case" (ie. the proposed project), is compared against a "Base Case" (ie. a continuation of the current method of supply).

Once the efficiency is achieved, Economic Impact looks at how this will impact on the economy including social aspects.

A project period of 30 years is used with benefits and costs discounted in future years by a cumulative discount rate of 4% real (ie. without inflation).

In this case, the identification of economic and social impacts required an amount of surveying among major water users who initially would be supplied with the raw water.

1.3 Timing

Main information collection was carried out during the month of June 2019. Analysis is in 2019 values.

2. THE PROJECT

Normanton is located in a relatively low average rainfall area and on a low "red ridge" above surrounding plains that can be subject to heavy seasonal flooding. This means that it has a relatively high need for water supply.

In addition, most rainfall comes during the annual wet season and the town experiences a long annual very low rainfall (drought) period during the winter months and early summer. In addition, soils on the "red ridge" have low fertility.

The water supply for Normanton is drawn from a weir on the Norman River at Glenore. The supply to Normanton also extends to the township of Karumba. The pondage has recently been increased. The water is treated to drinkable requirements.

Traditionally, the water supply has been inadequate and the town has strong permanent water restrictions. The additional storage available means there is an opportunity to increase supply. However, the existing pipe system is old and restricted in capacity and parts would need to be replaced with larger capacity pipes at substantial cost.

Instead of replacing the existing system, it is proposed to install a second system of "raw" untreated water for non-human consumption purposes, initially to larger water users.

It is estimated that of the current usage, one-third is actually used for human consumption and about two-thirds is used for gardening and other non-human consumption purposes.

The old system would thus have adequate capacity to deliver all drinking water needs for Normanton and all water uses for Karumba even if an expansion of population occurred.

The raw water for gardening and other non-human consumption purposes would not require treatment resulting in operational savings.

3. BACKGROUND ON NORMANTON

3.1 Normanton - Geographical & Historical

Normanton was first established in the 1870s as a port at the head of navigation in the Norman River to service pastoral industry settlement expanding into the extensive flat Flinders grass and savannah woodland plains surrounding the Gulf of Carpentaria and to service southwards to newly discovered copper deposits around Cloncurry and gold discoveries to the east of Croydon.

The gold fields around Croydon faded by the 1920s and today the railway line is used only for tourist experience – the Gulflander Railmotor.

With mining fading and the railway from Townsville reaching Cloncurry, Normanton tended to decline during the 1920s to 1950s.

The 1960s saw a major new phase of economic growth commence. The beef roads programme saw the road from Cloncurry sealed and the Gulf Developmental Road sealed in from the east to the Gilbert River crossing and improved, although not sealed from the Gilbert River across to Normanton. The Burke Developmental Road from Normanton north to Dunbar Station on the Mitchell River and thence east into the Mungana railhead was improved although not sealed. During the 1960s, extensive prawn resources were discovered in the Gulf and Karumba developed as a fishing industry base.

Road improvements into the area saw visitor numbers increasing – especially touring grey nomads and recreation fishermen visiting Karumba.

The development of substantial Century Zinc deposits to the south-west saw a slurry pipeline developed to Karumba in the 1990s with barge shipments to bulk carriers standing offshore.

By 2000, the Gulf Developmental Road sealing had reached Normanton.

For a time, live cattle shipments commenced via Karumba and shipping ex Karumba to Weipa.

3.2 The Current Economy

Today, Normanton fulfils a role as the leading government, administrative and commercial centre for the Gulf region as well as Carpentaria Shire administrative centre.

Apart from being the centre for the largest shire in the region, Normanton also has the main aerodrome in the region (serviced by flights out of Cairns), the main police station (Queensland Government Agency Program), the main hospital (health centre), a State Primary and High School (to Grade 9) and small TAFE campus, a Queensland Department of Housing Office and the main post office in the area.

The town acts as the main retail, banking, hotel and accommodation centre in the area.

The following Table #1 indicates that Normanton's population has been relatively static over the past 10 years.

Table #1: Estimated Residential Population – Normanton Urban Centre Locality

Year	No.
2008	1,218
2009	1,264
2010	1,279
2011	1,283
2012	1,288
2013	1,287
2014	1,278
2015	1,279
2016	1,267
2017	1,231
2018	1,219

Source: Cummings Economics from Australian Bureau of Statistics.

In addition to residents, Census 2016 data indicated the presence of a large number of visitors from within Australia (336), ie. swelling the population on-the-ground from about 1,100 residents to over 1,400, ie. by over 30%.

The population lives almost entirely in separate dwellings (92%) (cf Queensland 76.8%).

4. BENEFIT COST ANALYSIS (EFFICIENCY)

4.1 General

Daily water consumption from the current system with water restrictions is as follows.

Current Daily Consumption

Normanton Total 1.8ML

Est potable uses 0.6ML

Est non-potable uses 1.2ML

Karumba Total 1.2ML

Overall Total 3.0ML

Constraints of the system and water restrictions mean that use is suppressed.

It is estimated that with the raw water system, daily use will rise to 4ML, ie. by 1ML a day.

Capital cost of the raw water system is estimated at $0.95m.

To achieve a similar expansion of capacity with the existing system would require a much larger expenditure. Much of the pipe system would need to be replaced with larger pipes and the treatment system expanded. Cost has not been estimated accurately but it is believed would be over $2m.

An advantage of the raw water system is that it will save treatment costs. The existing system will be quite capable of supplying all the potable water needs and there will be a saving in treatment costs as the raw water system, apart from catering for expanded usage, will also reduce the amount of water that needs to be treated.

Annual saving in operating and maintenance costs is estimated as follows.

Table #2: Estimated Operating & Maintenance Costs

	Operating costs	Maintenance costs	Total costs
Existing system	$1.20 m	$0.40 m	$1.60 m
Existing system with raw water	$1.10 m	$0.40 m	$1.50 m
Raw water system	$0.02 m	$0.01 m	$0.03 m

4.2 Operational Perspective

Thus, apart from providing the additional water, the raw water system will enable a saving in operating and maintenance costs of about $70,000 per annum on current levels.

Net Present Value of these savings over a 30-year project period at a 4% real discount rate, no growth, would total $1.2m, ie. more than the capital cost of the scheme.

From an operational perspective, we thus have an extra 1.0ML of water a day supplied at no additional cost and, in fact, a Net Present Value of savings of about $250,000 ($1.20m minus $0.95m).

4.3 Benefit Cost Against Alternative

Expanding the existing potable water system including replacing smaller pipes with larger pipes and expanding treatment capacity has not been accurately assessed, but is believed to be at least $2m. Additional operating cost of treatment is estimated at about $100,000 per annum.

The following compares the cost of expanding the system to supply the same level of additional water with all water treated as against the "raw water" project alternative.

a) Expanding potable water system

Capital cost $2.00m

NPV Additional operating cost estimate $1.75m

($100,000 per annum)

NPV Total Cost $3.75m

b) Raw Water System

Capital cost $0.95m

NPV of savings in operating & maintenance costs..... (-$1.20m)

NPV Total Cost ..... (-$0.25m)

Thus, compared with expanding the current system, the raw water project will have a major benefit estimated to have a Net Present Value of the order of $4m.

5. ECONOMIC IMPACT

Due to a remote location and low population, Normanton already records substantially higher costs to operate businesses and organisations and costs of living for residents that impact negatively on the economy. Limited water availability adds to these costs, both directly and through social costs of lack of ambience and attractions as a place to live.

To help establish the benefits of a larger supply of water, interviews were carried out of seven major water users in Normanton (see interview track Appendix 1).

The interviews explored first the additional costs of operating businesses/organisations in Normanton and then the specific benefits of additional raw water supply being available.

Cost of businesses were affected by the following ranked in order of importance.

	Average Rating of Importance
• Additional cost on inputs because of freight costs	1.4
• Additional cost of inputs because of local prices	2.3
• Costs of business to access key services	3.4
• A need to provide higher renumeration directly and through benefits like housing	4.1
• Low sales volume	4.6
• Additional costs caused by high employee turnover	4.8

Respondents were asked to estimate how much these factors of remoteness and small population added to their operating costs.

	Range	Average
• Overall	20% - 60%	36%
• Extra amounts having to be paid to attract staff to live and work in Normanton	5% - 30%	20%
• Extra costs due to high staff turnover	5% - 30%	18%

The survey indicated rating of benefits for operations from the water supply being improved through the proposed "raw water" project.

	Average Rating of Importance
Reduced operating costs for your business through reduction in restrictions/ Time saved in watering, etc.	1.8
• Improved ambience of your operation	1.8
• Greater willingness of visitors to stay due to the town being more attractive	2.5
• Reduced costs of attracting and holding staff due to town being more attractive	3.8

Respondents generally found it difficult to put a dollar figure on the overall benefits from the proposed raw water project except for the tourist operators of caravan park/ camping grounds who identified that it would improve ambience, especially during the dry season, and result in more/longer visitor stays and longer tourist season.

Amounts recorded for these potential revenue increases totalled more than $200,000 a year.

Net Present Value of a discounted flow of additional income of $200,000 a year over the project period of 30 years at a 4% real discount rate, no growth, would, alone, come to $3.45m.

6. CONCLUSIONS

Clearly, Normanton's economy is burdened by high additional operational costs due to remoteness and small population. Clearly, restraints on water supply add to those costs directly and through impacts on ambience in a difficult environment of long annual drought periods and poor soil conditions for plant growth.

The indications are that the cost efficiencies of the "raw water" scheme in lowering operational costs while expanding supply will alone justify the costs.

Certainly, it is a much more cost-efficient way of expanding water supply than expanding the "treated" water supply.

The economic and social benefits of supplying additional water are difficult to measure. However, the indications are that the additional future community income generated by making Normanton a more desirable place to stay for tourists will, alone, exceed the initial capital costs by a large margin.

Project – Normanton Raw Water Project

Appendix – Survey Questionnaire

APPENDIX – Interview Track

CUMMINGS ECONOMICS

Normanton Raw Water Project – Survey Questionnaire

Business Agencies

We have been asked by Carpentaria Shire to prepare a benefit cost analysis on the proposed Normanton water expansion project. We are seeking views from the community about the project's benefits.

The Project

Instead of expanding the current system at a cost estimated at about $- - - -, it is proposed to keep the existing system for drinking and bathing water purposes and parallel it, at low cost of installation, of a raw water system for other purposes such as watering gardens and washdowns. This will save costs of treatment

The project aims to give Normanton an upgraded water supply system that will reduce the need for water restrictions.

The Australian Productivity Commission is currently carrying out an inquiry into Remote Area Taxation Zone allowances and some of the questions will also help provide information to this enquiry.

Overall Costs of Remoteness

Businesses and government operations face higher costs operating in remote areas. Which of the following applies to your operation?

	Applies	Rating
A need to provide higher remuneration directly and through benefits like housing to compensate for higher living costs of employees		
Additional costs caused by high employee turnover		
Additional costs on inputs because of freight costs		
Additional costs of inputs due to higher local prices		
Costs of the businesses accessing key services		
Low sales volume		

Are there any others?

_____

Which do you believe contributes most to making your cost of operation higher?

2nd most? 3rd most? 4th most?

How much a year do you believe these factors of remoteness and small population add to your operation?

0-5% ☐ 6 – 10% ☐ 11 – 20% ☐ 21 – 40% ☐ 41 – 60% ☐ 61 – 100% ☐ Other_____

And about what proportion of those extra costs is due to:

- Extra amounts having to be paid to attract staff to live and work in Normanton? _____%
- Extra costs due to staff turnover? _____%

Benefits of Adequate Water Supply

Turning now to water supply. Having an adequate water supply is obviously very important to a town that has a long dry season each year.

The following lists some potential benefits for your operation from the water supply being improved through the proposed project.

	Rating
Reduced costs of attracting and holding staff due to town being a more attractive place to live in	
Greater willingness of visitors to stay due to the town being more attractive	
Reduced operating costs for your business, eg. through reduction in restrictions/time saved in watering, etc. water bill.	
Improved look/ambience of your operation	
Other_____	

Which would you rate as the most important? - 2nd most? 3rd most? 4th most?

And can you make a rough estimate of the annual benefit in dollar terms $_____each year?

Finally, what proportion of your staff are not long-term residents of Normanton (say less than 10 years)? _____

Do you have any other comments or suggestions that might help us quantify the benefits of the proposed system?

_____

Thank you for your assistance.

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"The Northern Professionals"

28th May 2019
Ref: J3233

Normanton Raw Water Project – Survey Questionnaire

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Additional costs caused by high employee turnover		
Additional costs on inputs because of freight costs		
Additional costs of inputs due to higher local prices		
Costs of the businesses accessing key services		
Low sales volume		

Are there any others?

_____

Which do you believe contributes most to making your cost of operation higher?

2nd most? 3rd most? 4th most?

How much a year do you believe these factors of remoteness and small population add to your operation?

0-5% ☐ 6 – 10% ☐ 11 – 20% ☐ 21 – 40% ☐ 41 – 60% ☐ 61 – 100% ☐ Other_____

Benefits of Adequate Water Supply

Turning now to water supply. Having an adequate water supply is obviously very important to a town that has a long dry season each year.

The following lists some potential benefits for your operation from the water supply being improved through the proposed project.

	Rating
Reduced costs of attracting and holding staff due to town being a more attractive place to live in	
Greater willingness of visitors to stay due to the town being more attractive	
Reduced operating costs for your business, eg. through reduction in restrictions/time saved in watering, etc.	
Improved look/ambience of your operation	
Other_____	

Which would you rate as the most important? - 2nd most? 3rd most? 4th most?

And can you make a rough estimate of the annual benefit in dollar terms $_____each year?

And about what proportion of those extra costs is due to:

- Extra amounts having to be paid to attract staff to live and work in Normanton? _____%
- Extra costs due to staff turnover? _____%

Finally, what proportion of your staff are not long-term residents of Normanton (say less than 10 years)? _____

Do you have any other comments or suggestions that might help us quantify the benefits of the proposed system?

_____

Thank you for your assistance.

Survey Results

	Remuneration	Turnover	Freight	Local Prices	Services	Sales		Remuneration	Turnover	Freight	Local Prices	Services	Sales		% Increase	% Attract Staff	% Staff Turnover		Staff retention	Tourist staying longer	Reduced Operating Costs	Look ambience of operation		Dollar Benefit	Proportion staff not long term	Number Staff	Other Comment
Tourist Park	0	0	1	1	1	1				1	2	3	4		20%				4	3	1	2		$175,000	100%		Bore located on park, council if access activity during wet season. Upgrade existing pumps at the wier
School	1	1	1	1	1	1		1	4	2	3	5	6		25%	25%	25%		4	3	1	2		5%	50%		Excess water costs is the major issue.
School	1	1	1	1	1	1		1	5	2	3	4	6		60%	30%	30%		3	2	4	1			80%		
Hotel	1	1	1	1	1	1		5	6	1	2	2	4		25%	25%	25%		4	2	1	3		10%	90%		Staff Australian Backpackers. Reduction in Water Rates fees higher on everything. Way too expensive. Time is a massive factor. Gambling machines can wait weeks for a registered repairer. (City 3 days)
Hotel	1	1	1	1	1	1		5	4	1	2	3	6		25%	5%	5%										$36,000 water rates, reduce water bills.
Hotel	1	1	1	1	1	1		5	6	1	3	4	2		40%	5%	5%		4	3	1	2		50%	20%		Adjust how businesses are billed for water. Pay $16,000 2 x year.
Motel/ Tourist Park	1	1	1	1	1	1		6	5	3	2	4	1		50%	10%	10%		4	2	3	1		$50,000	75%		Water rates too high, have water tank but little to use
Council Section	1	1	1	1	1	1		5	4	1	2	3	6		40%	30%	20%								30%	118	Order from woolworths online delivered to door. Operations remote delays time factors, delays out of sight out of mind. Not same service. Absenteeism of employees a factor. Cultural factors.
Council Section	1	1	1	1	1	1		5	4	1	2	3	6		40%	30%	20%								30%	118	Biggest issue with retaining workers Boarding school fees people leave town Normanton only year 9. Travel Costs for Children. Do Shopping in Mt Isa
	0.9	0.9	1	1	1	1		4.1	4.8	1.4	2.3	3.4	4.6		36%	20%	18%		3.8	2.5	1.8	1.8			59%		

APPENDIX B

Stage 1 Construction Drawings

NORTH

FOR CONSTRUCTION

TOPO.

NORMANTON RAW WATER PROJECT

PROJECT 19-0118

SITE OF WORKS

NOT TO SCALE

COUNCIL - CARPENTARIA SHIRE COUNCIL

DRAWING LIST:

D00 - COVER SHEET
D01 - PROJECT NOTES
D02 - TYPICAL TRENCHING DETAILS SHEET 1
D03 - TYPICAL TRENCHING DETAILS SHEET 2
D04 - TYPICAL PIPE WORK DETAILS
D05 - PROJECT GENERAL ARRANGEMENT
D06 - LAYOUT PLAN SHEET 1
D07 - LAYOUT PLAN SHEET 2
D08 - LAYOUT PLAN SHEET 3
D09 - LAYOUT PLAN SHEET 4
D10 - LAYOUT PLAN SHEET 5
D11 - SETOUT CO-ORDINATES
D12 - CLASH DETECTION CO-ORDINATES
D15 - PIPE WORK DETAILS SHEET 1
D16 - PIPE WORK DETAILS SHEET 2
D17 - PIPE WORK DETAILS SHEET 3
D18 - PIPE WORK DETAILS SHEET 4
D19 - PIPE WORK DETAILS SHEET 5
D20 - BOOSTER PUMP STATION GENERAL ARRANGEMENT
D21 - BOOSTER PUMP STATION DETAILS
D22 - BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 1
D23 - BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 2
D24 - BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 3
D25 - BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 4

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
C	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020

RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: COVER SHEET

PROJECT No: 19-0118 | DRAWING No: D00 | REVISION: D

GENERAL

G1. READ THESE NOTES IN CONJUNCTION WITH OTHER ENGINEERING DRAWINGS AND SPECIFICATIONS, AND WITH SUCH OTHER WRITTEN INSTRUCTIONS AS MAY BE ISSUED. IN CASE OF DISCREPANCY, PRECEDENCE IS GIVEN TO DRAWINGS, THEN NOTES, THEN SPECIFICATION.

G2. NOMINATION OF PROPRIETARY ITEMS DOES NOT INDICATE EXCLUSIVE PREFERENCE BUT INDICATES THE REQUIRED PROPERTIES OF THE ITEM. SIMILAR ALTERNATIVES HAVING THE REQUIRED PROPERTIES MAY BE OFFERED FOR APPROVAL. INSTALL PROPRIETARY ITEMS IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS AND RECOMMENDATIONS.

G3. REFER ANY DISCREPANCY TO THE SUPERINTENDENT BEFORE PROCEEDING WITH THE WORK.

G4. OBTAIN NECESSARY PERMITS AND APPROVALS FROM RELEVANT AUTHORITIES BEFORE COMMENCING WORK ON SITE.

G5. NOTIFY RELEVANT SERVICE AUTHORITIES BEFORE COMMENCING WORK ON SITE.

G6. GIVE TWO WORKING DAYS' (48 HOURS) NOTICE SO THAT INSPECTION MAY BE MADE OF CRITICAL STAGES OF WORK.

G7. DO NOT OBTAIN DIMENSIONS BY SCALING FROM THE DRAWINGS.

G8. DIMENSIONS ARE IN MILLIMETRES AND LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.

G9. DATUM FOR LEVELS IS AHD (AUSTRALIAN HEIGHT DATUM). FOR HORIZONTAL DATUM AND SURVEY CONTROL REFER SURVEYOR'S DRAWING 190541/DTM/01.

G10. PROJECT SETTING OUT UNDERTAKEN BY A REGISTERED SURVEYOR.

G11. THE CONTRACTOR SHALL PROTECT FROM DAMAGE AND SUPPORT ALL SERVICES THAT MAY BE AFFECTED BY THESE WORKS.

G11. THE CONTRACTOR SHALL RETAIN AND PROTECT ALL SIGNIFICANT TREES UNLESS WRITTEN INSTRUCTIONS ARE ISSUED BY THE SUPERINTENDENT.

G12. ALL SERVICES SHOWN ON THE DRAWINGS ARE INDICATIVE ONLY. PRIOR TO CONSTRUCTION IT IS THE CONTRACTOR'S RESPONSIBILITY TO ACCURATELY LOCATE:-

- ALL EXISTING SERVICES WHICH CROSS THE PATH OF THE NEW MAIN AND ALL EXISTING NEARBY SERVICES WHICH MAY BE AFFECTED BY THE PROPOSED CONSTRUCTION.
- EXISTING SERVICES TO WHICH THE NEW WORKS CONNECT.

G13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING THE STRUCTURE AND NEIGHBOURING STRUCTURES IN A SAFE AND STABLE CONDITION DURING CONSTRUCTION. NO PART SHALL BE OVERSTRESSED. TEMPORARY BRACING SHALL BE PROVIDED TO KEEP THE WORKS SAFE AT ALL TIMES. WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE BUILDING CODE OF AUSTRALIA, THE BUILDING ACT OF QUEENSLAND AND ALL RELEVANT AUSTRALIAN STANDARDS.

G14. PIPE LEVELS AND GRADES SHALL BE ADJUSTED AS REQUIRED TO AVOID EXISTING SERVICES AND TO ALLOW FOR REQUIRED FITTINGS.

G15. CONCRETE ELEMENTS INCLUDING KERBS, FOOTPATHS, MEDIANS, DRIVEWAYS ETC. SHALL BE SAW CUT TO ALLOW TRENCHING AND SHALL BE REINSTATED WITH MATCHING SURFACE TEXTURE AND TREATMENT AS ADJOINING SURFACES. NEW SURFACE SHALL MATCH SMOOTHLY WITH ADJOINING SURFACES.

G196. WORKMANSHIP AND MATERIALS TO COMPLY WITH REQUIREMENTS OF SAA CODES, BUILDING CODE OF AUSTRALIA AND BY-LAWS AND ORDINANCES OF RELEVANT BUILDING AUTHORITIES. ALL CODES REFERRED TO ARE THOSE CURRENT (AS AMENDED) AT COMMENCEMENT OF CONTRACT.

G17. THESE DRAWINGS DO NOT DETAIL TEMPORARY WORKS. CONSTRUCTION METHODS AND TEMPORARY WORKS ARE RESPONSIBILITY OF THE CONTRACTOR.

G18. HAVE TESTING PERFORMED BY AN INDEPENDENT NATA (NATIONAL ASSOCIATION OF TESTING AUTHORITIES) ACCREDITED AUTHORITY, AND PROVIDE TEST REPORTS TO SUPERINTENDENT.

G19. BUILD, FABRICATE AND PROCURE ONLY FROM DRAWINGS 'ISSUED FOR CONSTRUCTION'.

G20. KEEP ON SITE A COMPLETE SET OF CONTRACT DOCUMENTS (INCLUDING DRAWINGS AND SPECIFICATIONS) AND SITE INSTRUCTIONS.

SITE PREPARATION

SP1. PRIOR TO EXCAVATION, THE CONTRACTOR SHALL REMOVE THE TOPSOIL OR SURFACE MATERIAL TO A MINIMUM DEPTH OF 100mm FROM THE SITE OF ALL EXCAVATIONS AND SITE EARTHWORKS AND STOCKPILE, AS DIRECTED BY THE SITE SUPERINTENDENT, FOR LATER RE-SPREADING. TOPSOIL IS DEFINED AS THE SURFACE LAYER OF SOIL INCLUDING FINE ROOTS, VEGETATION AND OVERLAYING GRASS AND IS CHARACTERIZED BY A PRESENCE OF ORGANIC MATTER. THIS MATERIAL SHALL BE KEPT SEPARATE FROM THE GENERAL EXCAVATION MATERIAL AND SHALL BE RE-SPREAD OVER THE DISTURBED AREA AFTER ANY NECESSARY BACKFILLING.

SP2. ALL EXCAVATIONS SHALL BE TAKEN OUT ACCURATELY TO THE LINES AND LEVELS SHOWN IN THE DRAWINGS. ALL SURFACES TO RECEIVE CONCRETE FOUNDATIONS, FLOORS OR SLOPING WALLS, SHALL BE NEATLY TRIMMED AND CLEANED OF ALL LOOSE MATERIALS. ALL EXCAVATIONS TAKEN BEYOND THE LEVELS SHOWN ON THE DRAWINGS SHALL BE REFILLED WITH MATERIALS FURNISHED AND PLACED BY THE CONTRACTOR BY A METHOD APPROVED BY THE SUPERINTENDENT. THE MATERIAL SHALL BE BLINDING CONCRETE WHERE THE ADJACENT STRUCTURE IS CONCRETE. ELSEWHERE THE MATERIAL SHALL BE SELECTED MATERIAL FROM THE EXCAVATIONS COMPACTED TO THE STANDARD AS GIVEN FOR FILLING AROUND STRUCTURES. MATERIAL TAKEN FROM SITE SHALL CONFORM TO MINIMUM FILL STANDARDS AS PER THE SPECIFICATION

SP3. WHERE FILLING IS REQUIRED UNDER STRUCTURES, THE FILLING SHALL BE PLACED IN UNIFORM LAYERS AND BE COMPACTED. THE MATERIAL SHALL COMPLY WITH THE FOLLOWING STANDARDS OF COMPACTION AS DETAILED IN VARIOUS PARTS OF AS 1289, METHODS OF TESTING SOILS FOR ENGINEERING PURPOSES:

- SAND - THE DENSITY INDEX MEASURED IN ACCORDANCE WITH AS 1289.5.6.1 CLAUSE 4B SHALL NOT BE LESS THAN 75%
- MATERIAL OTHER THAN SAND - THIS MATERIAL SHALL ACHIEVE A COMPACTIONOF NOT LESS THAT 98% OF THE MAXIMUM DRY DENSITY USING STANDARD COMPACTION AS DETERMINED BY AS 1289.5.1.1 - STANDARD COMPACTION.

ENVIRONMENTAL

EN1. CONSTRUCTION SHALL COMPLY WITH ALL REQUIREMENTS AS SPECIFIED IN ANY RELEVANT REF OR EIS.

EN2. SILT-STOP FENCES OR STRAW BALE FILTERS SHALL BE INSTALLED DOWNSTREAM OF ALL WORKS PRIOR TO ANY CONSTRUCTION ACTIVITIES. THEY SHALL BE EFFECTIVELY MAINTAINED AND ARE NOT TO BE REMOVED UNTIL THE SITE OF WORKS HAS BEEN REVEGETATED OR RESTORED TO THE SATISFACTION OF THE SUPERINTENDENT.

EN3. THE EXTENT OF CLEARING OF VEGETATION SHALL BE KEPT TO THE ABSOLUTE MINIMUM NECESSARY TO UNDERTAKE THE WORKS.

EN4. SILTATION CONTROLS, SITE VEGETATION AND ENVIRONMENTAL REQUIREMENTS SHALL BE ALL CARRIED OUT TO THE SATISFACTION OF THE SUPERINTENDENT.

EN5. CONSTRUCTION ACTIVITIES SHALL BE ISOLATED FROM THESE WATERWAYS AND DAMS IN SUCH A WAY THAT EROSION RUN-OFF AND SILTATION IS CONTAINED TOTALLY WITHIN THE CONSTRUCTION ZONE.

EN6. ALL EROSION AND SILTATION CONTROL MEASURES, INCLUDING REVEGETATION AND STORAGE OF SOIL AND TOPSOIL, SHALL BE IMPLEMENTED TO THE STANDARDS OF THE LOCAL AUTHORITY AND ANY RELEVANT STATE GOVERNMENT AUTHORITIES.

EN7. EROSION AND SILTATION CONTROL DEVICES SHALL BE INSTALLED PRIOR TO THE COMMENCEMENT OF WORKS ON EACH SITE. UNDER NO CIRCUMSTANCE SHALL WORK COMMENCE ON EACH SITE UNTIL THE INSTALLATION OF THE EROSION AND SILTATION CONTROL DEVICES HAS BEEN APPROVED BY THE SUPERINTENDENT ON SITE.

EN8. SITE DISTURBANCES SHALL BE MINIMISED AT ALL TIMES.

EN9. ALL AVAILABLE TOPSOIL FROM WITHIN THE AREA OF DISTURBANCE SHALL BE STOCKPILED FOR THE PURPOSE OF REVEGETATION.

EN10. STOCKPILES OF SOIL MATERIALS SHALL NOT BE PLACED ON NATURE STRIPS, FOOTPATHS, ROADWAYS, KERBS, ACCESSWAYS OR WITHIN WATERWAYS OR WETLANDS.

EN11. TURF STRIPS SHALL BE PLACED ON THE DOWN SLOPE SIDE OF THE SEDIMENT FENCE WHERE THERE IS NO EXISTING VEGETATION COVER.

EN12. ALL EROSION AND SEDIMENT CONTROL DEVICES SHALL BE MAINTAINED UNTIL COMPLETE REHABILITATION OF THE DISTURBED AREA IS ACHIEVED. ALL SEDIMENT TRAPPING DEVICES SHALL BE CLEANED WHEN THE STRUCTURES ARE A MAXIMUM OF 60% FULL OF SOIL MATERIALS.

EN13. THE CONTRACTOR SHALL UNDERTAKE CONTROL DEVICE MAINTENANCE AFTER EVERY RAINFALL EVENT. THE SUPERINTENDENT SHALL INSPECT AND APPROVE ANY MAINTENANCE CARRIED OUT AFTER A RAINFALL EVENT. CONSTRUCTION WORK, ON SITE SHALL NOT CONTINUE UNTIL REMEDIAL WORK ON CONTROL DEVICES IS COMPLETED TO THE SATISFACTION OF THE SUPERINTENDENT ON SITE.

EN14. ALL DISTURBED AREAS SHALL BE VEGETATED AS SOON AS THE RELEVANT WORKS ARE COMPLETE.

EN15. NO TEMPORARY SEDIMENT TRAPPING STRUCTURES SHALL BE REMOVED UNTIL ALL DISTURBED AREAS ARE STABILISED.

EN16. ALL SEDIMENT CONTROL STRUCTURES SHALL BE INSPECTED AND MAINTAINED DAILY BY THE CONTRACTOR.

EN17. THE CONTRACTOR SHALL PROVIDE A FABRIC FILTER FENCE ON THE DOWN SLOPE SIDE OF ALL EXPOSED BATTERS AND AROUND ALL STOCKPILES OF MATERIAL ON SITE.

EN18. WHERE EXISTING STORMWATER CATCHPITS ARE LOCATED WITHIIN THE SITE, THE CONTRACTOR SHALL PROVIDE AN APPROVED SEDIMENT TRAP AROUND THE FULL CIRCUMFERENCE OF THE CATCHPIT TO ENSURE NO SEDIMENT RUN-OFF ENTERS THE CATCHPIT.

EN19. WHERE SPOIL IS APPROVED FOR STORING ON SITE BY THE SUPERINTENDENT, A SILT FENCE SHALL BE PLACED AROUND THE FULL CIRCUMFERENCE OF THE SPOIL.

TEMPORARY WORKS

TW1. THE CONTRACTOR SHALL CONSTRUCT ALL TEMPORARY WORKS AS PART OF THE PROJECT AND SHALL INCLUDE THE COST OF SUCH WORKS IN THE LUMP SUM PRICE FOR THE PROJECT.

TW2. THE CONTRACTOR SHALL SUBMIT A WORK METHOD STATEMENT AND DATE SCHEDULE FOR EACH INDIVIDUAL TEMPORARY WORK ITEM TO THE SUPERINTENDENT FOR APPROVAL 1 WEEK PRIOR TO CONSTRUCTION OF THE TEMPORARY WORK. THIS SHALL INCLUDE:

- A PLAN OF THE PROPOSED LOCATION OF THE TEMPORARY WORKS
- A RISK ASSESSMENT PREPARED IN CONJUNCTION WITH OPERATIONAL STAFF INCLUDING CONTINGENCY PLANS
- IMPACTS OF THE WORK ON THE SITE EMP

TW3. TEMPORARY WORKS INCLUDE, AS A MINIMUM, THE FOLLOWING:

- GROUND SUPPORT FOR STRUCTURES AND PIPEWORK BOTH EXISTING AND NEW
- GROUND WATER PUMPING AND OTHER DEWATERING MEASURES
- TEMPORARY ACCESS ROADS
- TEMPORARY POWER SUPPLY.

TW4. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DESIGN, INSTALLATION AND REMOVAL OF ALL TEMPORARY WORKS.

TW5. ALL DESIGN WORK SHALL BE CERTIFIED BY AN RPEQ OR CPENG. DESIGN DRAWINGS AND CERTIFICATION SHALL BE SUBMITTED TO THE SUPERINTENDENT PRIOR TO CONSTRUCTION OF THE TEMPORARY WORK COMMENCING.

TW6. WHEN CONNECTING TO AN EXISTING STRUCTURE OR PIPELINE THE CONTRACTOR SHALL ARRANGE WITH THE SUPERINTENDENT TO HAVE THE FLOW INTERRUPTED. SUCH INTERRUPTIONS SHALL BE LIMITED TO THE TIME AND DURATION APPROVED BY THE SUPERINTENDENT IN WRITING.

TW7. PRIOR TO WORK COMMENCING ON ANY EXISTING STRUCTURE OR PIPELINE THE CONTRACTOR SHALL CLEAN THE INTERIOR OF THE STRUCTURE OR PIPELINE ADJACENT TO THE AREA OF WORKS BY REMOVING ALL MATERIAL AND WATER BLASTING, OR THE LIKE

PIPEWORK

P1. PIPE LENGTHS TO BE DETERMINED BY CONTRACTOR.

P2. THE CONTRACTOR SHALL PROTECT FROM DAMAGE AND SUPPORT ALL SERVICES THAT MAY BE AFFECTED BY THESE WORKS.

P3. DESIGN LEVELS TO BE CONFIRMED BY CONTRACTOR PRIOR TO COMMENCING CONSTRUCTION. CONTRACTOR TO ENSURE MINIMUM COVER OF 750mm IS MAINTAINED TO ALL PIPEWORK, MINIMUM COVER UNDER ROADWAYS SHALL BE 1500mm AND 2000mm FOR BORED PIPEWORK.FOR TRENCH DETAILS REFER DRAWING D03.

P4. FOR PIPELINE CONSTRUCTION TRENCH TYPES REFER TO DETAIL DRAWING NUMBER D03 AND THE SPECIFICATION.

P5. ALL FLANGED JOINTS TO HAVE STAINLESS STEEL BOLTS, NUTS AND WASHERS (GRADE 316) COMPLYING WITH AS 4087. ANTI SEIZING PASTE TO BE USED IN ASSEMBLY.

P6. ALL PE PIPEWORK TO BE INSTALLED AS PER WSA 01-2004, POLYETHYLENE PIPELINE CODE, COLOURED G21 JADE SOLID, STRIPED OR SLEEVED. COLOUR SHALL BE IN ACCORDANCE WITH AS1345. ALL WELDS TO BE BUTT FUSION WELDED WITH INTERNAL WELDS DE-BEADED. WHERE IT IS NOT PRACTICABLE, ELECTOFUSION JOINTS MAY BE USED WITH APPROVAL FROM THE SUPERINTENDENT. PE PIPES MAY BE COLD BENT (MIN 20° C) TO A MINIMUM RADIUS OF 50 x OD. ALL BACKING RINGS SHALL BE STAINLESS STEEL (GRADE 316) AND BOLTING COMPATIBILITY - PN16 IN ACCORDANCE WITH AS 4087, UNO. WRAP 3 LAYERS OF PE SHEETING AROUND PIPE AND FITTINGS WHERE PE PIPEWORK IS IN CONTACT WITH CONCRETE.

P7. PE WELDS TO BE PRE-QUALIFIED AS PER WSA 01-2004 SECTION 2.12. AT LEAST ONE BUTT WELD / ELECTROFUSION JOINT TO BE TESTED AT THE START OF EACH DAY OF WELDING. THE SITE ENGINEER CAN AT ANY TIME REQUEST FOR A RECENT WELD TO BE CUT OUT AND TESTED. TESTING AND COMMISSIONING OF THE PE PIPELINE TO CONFORM TO WSA 01-2004 SECTION 2.13.

PIPELINE CONSTRUCTION

P8. ALL MAINS TO BE FLUSHED, AND PRESSURE TESTED AS PER SPECIFICATION.

P9. THE ALIGNMENT OF ALL PIPES SHALL BE MARKED BY A 75mm WIDE TAPE BURIED 300mm ABOVE THE TOP OF THE PIPE OR 150mm BELOW FINISHED SURFACE PROFILE WHICHEVER IS THE SHALLOWEST. THE TAPE SHALL CONTAIN A CONTINUOUS METAL STRIP AND COLOURED AS APPROPRIATE.

P10. EMBEDMENT MATERIAL AND TRENCH FILL MATERIAL SHALL MEET THE REQUIREMENTS OF THE SPECIFICATION. MATERIALS SHALL BE SUBMITTED TO THE SUPERINTENDENT FOR APPROVAL PRIOR TO USE.

P11. APPROVED BEDDING, SURROUND, SELECT FILL AND TRENCH BACKFILL SHALL COMPLY WITH THE FOLLOWING MINIMUM COMPACTION REQUIREMENTS:

- COHESIONLESS MATERIALS SHALL BE COMPACTED TO 60% DENSITY INDEX DETERMINED IN ACCORDANCE WITH AS1289.5.6.1 IN NON TRAFFICABLE-AREAS. THE DENSITY INDEX SHALL BE INCREASED TO 70% IN TRAFFICABLE AREAS.
- COHESIVE MATERIALS SHALL BE COMPACTED TO 90% STANDARD DRY DENSITY RATIO DETERMINED IN ACCORDANCE WITH AS1289.5.4.1 BASED ON THE FIELD DRY DENSITY AS PER AS1289.5.3.2 OR AS1289.5.8.1 AND THE MAXIMUM DRY DENSITY AS PER AS1289.5.1.1 IN NON-TRAFFICABLE AREAS. THE DRY DENSITY RATIO SHALL BE INCREASED TO 95% IN TRAFFICABLE AREAS.

STAINLESS STEEL

SS1. ALL STAINLESS STEEL (SS) SHALL BE GRADE 316L IN ACCORDANCE WITH ASTM A240 UNLESS NOTED OTHERWISE.

SS2. ALL WELDS SHALL BE 6mm CONTINUOUS FILLET OR FULL PENETRATION BUTT WELDS ALL ROUND IN ACCORDANCE WITH AS 1554.6 UNLESS NOTED OTHERWISE.

SS3. STAINLESS STEEL SURFACES SHALL HAVE THE SCALE REMOVED BY PICKING AND SHALL BE PASSIVATED OR SURFACE TREATED TO PLACE THE ALLOY NEAR THE CATHODIC END OF THE GALVANIC SERIES. ALL AREAS OF STAINLESS STEEL WHICH ARE SUBSEQUENTLY MACHINED, GROUND OR WORKED IN ANY MANNER WHICH TENDS TO DESTROY THE ORIGINAL PASSIVATED CONDITION SHALL AGAIN BE PASSIVATED AS A FINAL CLEANING OPERATION. AFTER PASSIVATING, THE SURFACES SHALL BE FREE FROM PITTING OR SURFACE DEFECTS. SS4.ALL STAINLESS STEEL BOLTS AND FIXINGS SHALL BE A4/70 TO ISO 3506.

SS4. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO THE SUPERINTENDENT FOR APPROVAL PRIOR TO FABRICATION.

SS5. GRIND OFF ALL SHARP EDGES AFTER FABRICATION.

FOR CONSTRUCTION

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020

RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

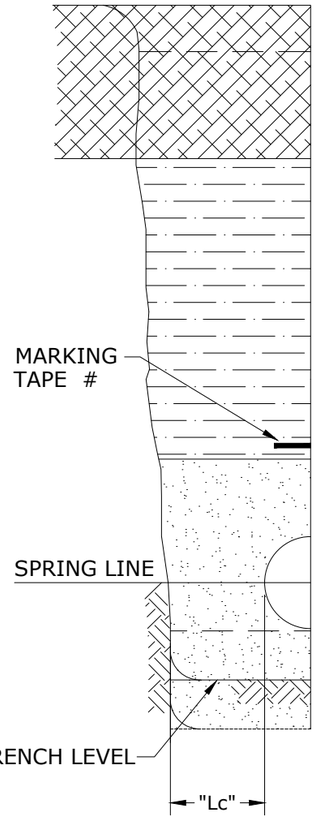
DRAWING TITLE: PROJECT NOTES

PROJECT No: 19-0118 | DRAWING No: D01 | REVISION: B

MATERIAL		ZONE	
ROAD SURFACE	VERGE & TRACK		
ROAD SURFACE LAYER	TO MATCH EXISTING	SURFACE COURSE	
TO MATCH EXISTING ROAD BASE OR TO ROAD OWNER'S REQUIREMENTS		ROAD BASE	
TO ROAD OWNER'S REQUIREMENTS OR INORGANIC FILL WITH 75 MAXIMUM STONE SIZE	TO ROAD OWNER'S REQUIREMENTS OR INORGANIC FILL WITH MAXIMUM 75 STONE SIZE	TRENCH FILL	
EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS. WHERE APPROVED BY SEQ-SP BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND		OVERLAY	EMBEDMENT
		SIDE SUPPORT	
		BEDDING	
		OVER-EXCAVATION	

PIPE COVER

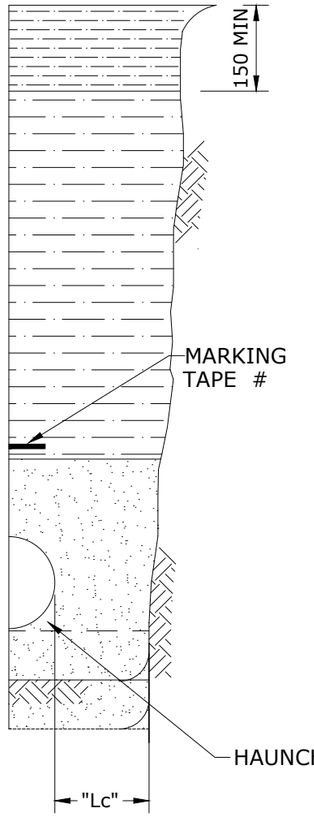
VEHICULAR LOADING



LOCATION	MINIMUM
PRIVATE RESIDENTIAL PROPERTY AND PUBLIC LAND NOT SUBJECT TO VEHICULAR LOADING	600
FOOTWAYS, NATURE STRIPS, INDUSTRIAL PROPERTY, SEALED ROAD PAVEMENTS OTHER THAN ARTERIAL ROADS SUBJECT TO VEHICULAR LOADING	800
UNSEALED ROAD CARRIAGEWAYS	900
ARTERIAL ROAD CARRIAGEWAYS	1500
ARTERIAL ROAD CARRAIGEWAYS BORED PIPEWORK	2000

NO VEHICULAR LOADING

(INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLES LOADINGS OCCUR EG. PARKLANDS, FOOTWAYS)



ZONE		MATERIAL
TOPSOIL OR FOOTWAY SURFACE		ORIGINAL MATERIAL OR IMPORTED MATERIAL OF EQUAL QUALITY
TRENCH FILL		INORGANIC FILL WITH 75 MAXIMUM STONE SIZE
EMBEDMENT	OVERLAY	EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND SEQ-SP REQUIREMENTS. WHERE APPROVED BY SEQ-SP BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND.
	SIDE SUPPORT	
	BEDDING	
OVER-EXCAVATION		

NOTES

1. ALL DIMENSIONS IN MILLIMETRES.
2. BEDDING - SPECIAL BEDDING SHALL BE SPECIFIED TO SUIT THE CONDITIONS IF THE TRENCH FLOOR HAS:
   - IRREGULAR OUTCROPS OF ROCK.
   - AHBP OF <50 kPa, OR
   - UNCONTROLLED GROUND WATER HAS DISTURBED THE FLOOR OF THE TRENCH.
3. EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENTS OF WSA-02 PART 3.
4. SIDES OF EXCAVATION TO BE KEPT VERTICAL TO AT LEAST 150 ABOVE THE PIPE.
5. THIS DRAWING IS BASED ON WSAA STANDARD DRAWING WAT-1201-V.

SPRING LINE TRENCH CLEARANCE

NOMINAL DIAMETER (DN)	MINIMUM CLEARANCE "Lc" TO AS/NZS 2566.1
≤300	150
>300-≤450	200
>450-≤900	300
>900-≤1500	350

TRENCH WIDTH TO BE SUFFICIENT TO SAFELY LAY THE PIPE AND COMPACT THE SIDE SUPPORT ZONE.

FOR CONSTRUCTION

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

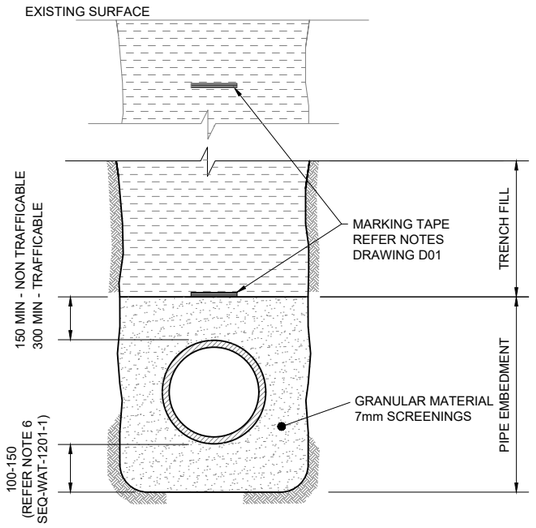
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED)

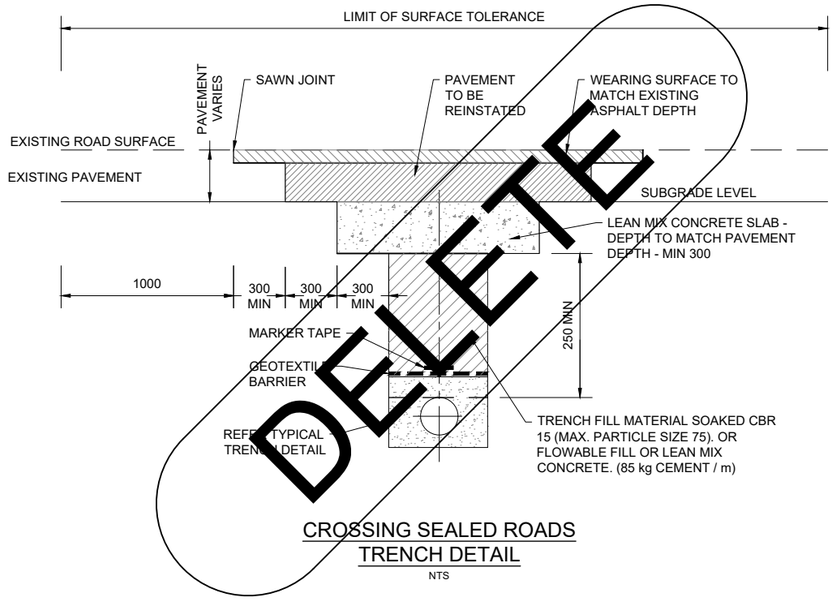
PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: TYPICAL TRENCHING DETAILS SHEET 1
PROJECT No: 19-0118 | DRAWING No: D02 | REVISION: B

FOR CONSTRUCTION



TYPICAL TRENCH DETAIL

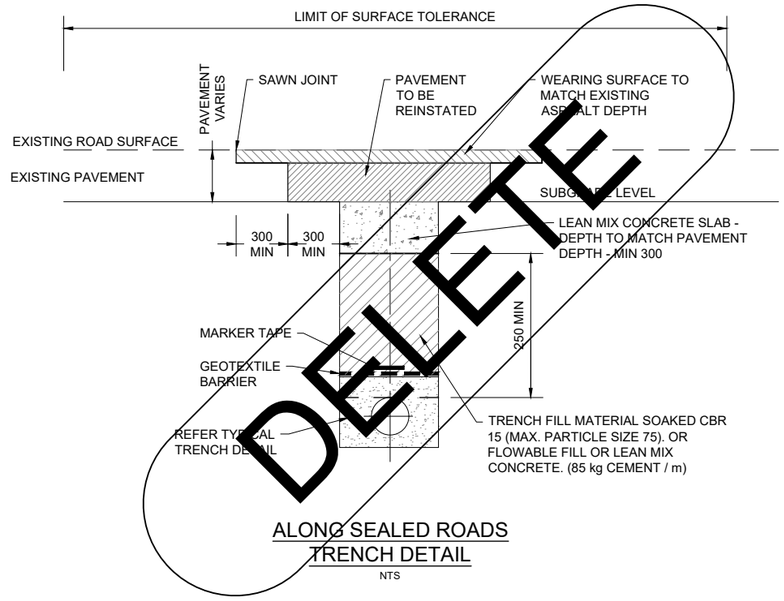
NTS



DELETE

CROSSING SEALED ROADS
TRENCH DETAIL

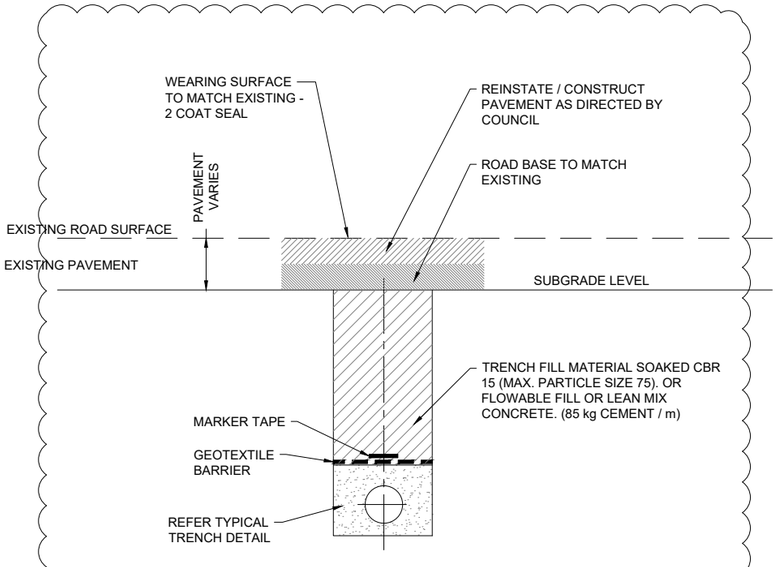
NTS



DELETE

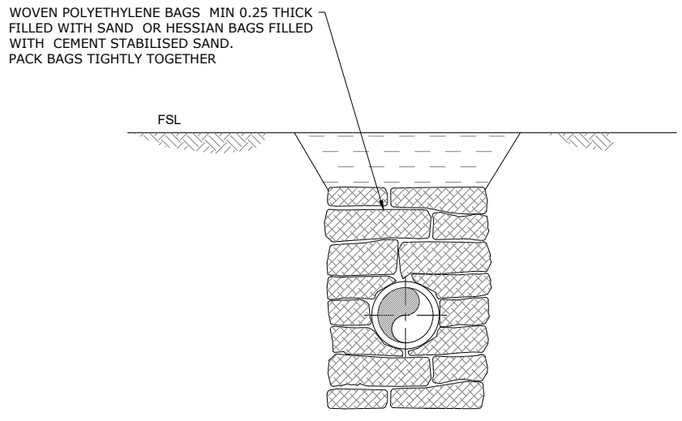
ALONG SEALED ROADS
TRENCH DETAIL

NTS



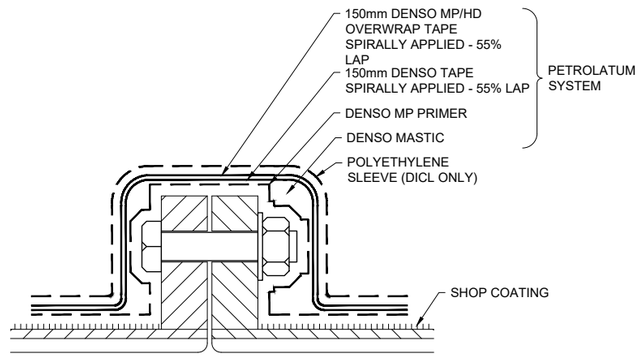
CROSSING AND ALONG
ROADS AND SHOULDERS
TRENCH DETAIL

NTS



TYPICAL PIPE RESTRAINT
DETAIL

NTS



BURIED FLANGED JOINTS

NTS

ALSO APPLIES TO GIBAULTS AND
BLANK FLANGES

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

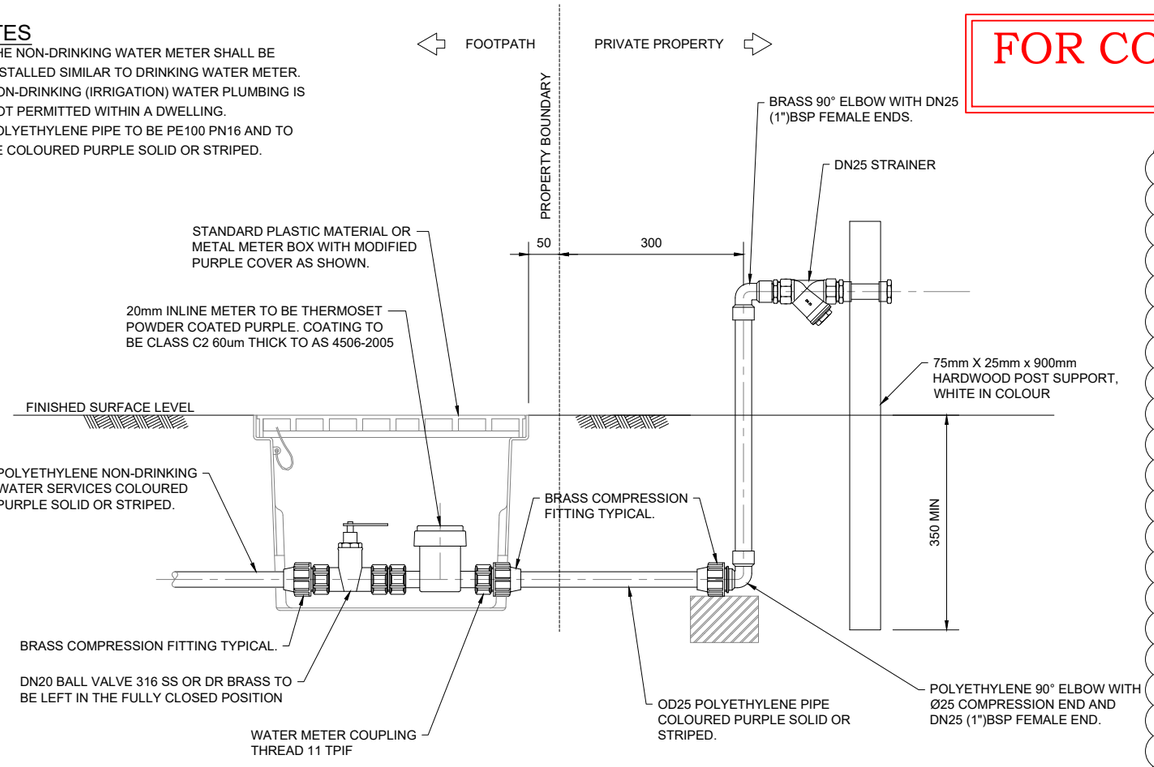
DRAWING TITLE: TYPICAL TRENCHING DETAILS SHEET 2

PROJECT No	DRAWING No	REVISION
19-0118	D03	B

FOR CONSTRUCTION

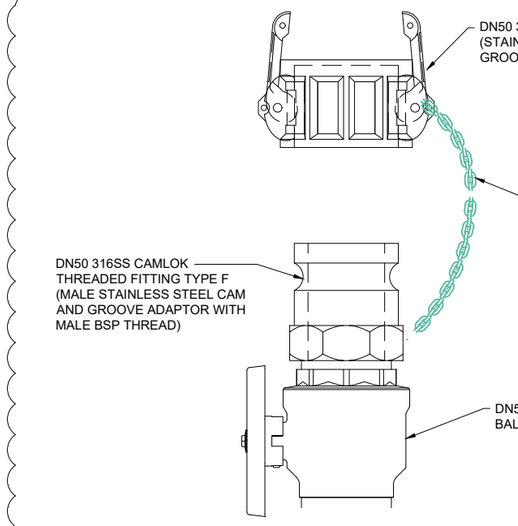
NOTES

1. THE NON-DRINKING WATER METER SHALL BE INSTALLED SIMILAR TO DRINKING WATER METER.
2. NON-DRINKING (IRRIGATION) WATER PLUMBING IS NOT PERMITTED WITHIN A DWELLING.
3. POLYETHYLENE PIPE TO BE PE100 PN16 AND TO BE COLOURED PURPLE SOLID OR STRIPED.



WATER METER AND BOUNDARY CONNECTION DETAIL

NTS

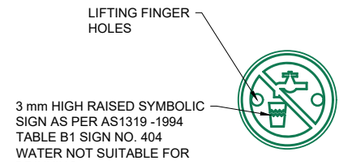


TYPICAL DETAIL CAMLOK DUST CAP

NTS

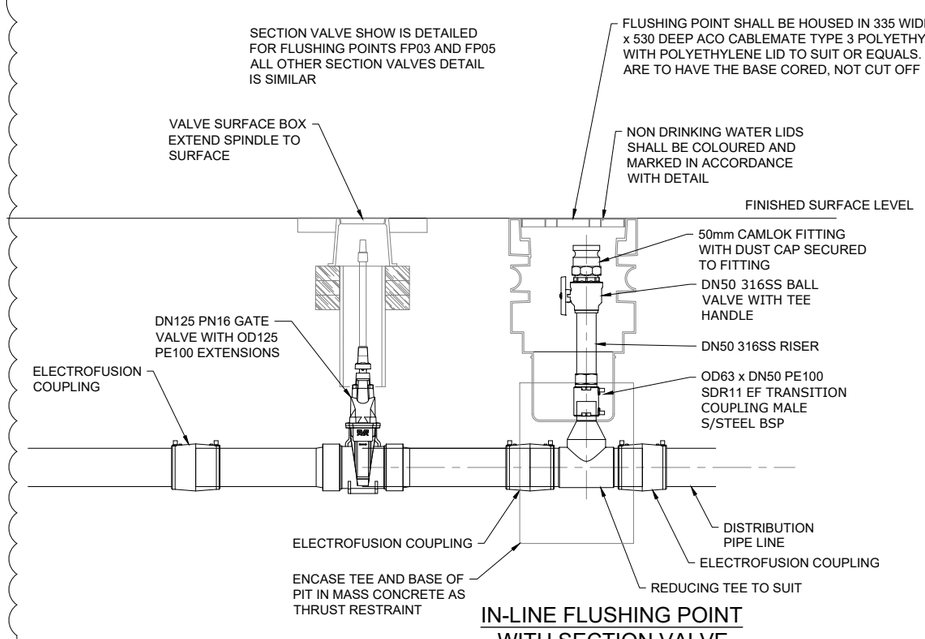
NON DRINKING WATER METER BOX COVER

DIMENSIONS OF COVER TO MATCH WATER METER BOX
COLOUR FINISH
G21 JADE FOR RAW WATER



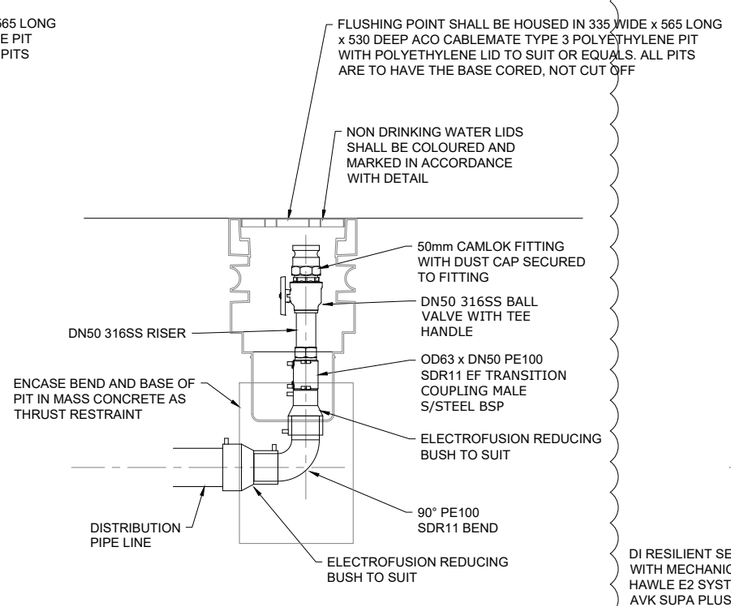
NON DRINKING WATER VALVE BOX COVER

COLOUR FINISH
G21 JADE FOR RAW WATER



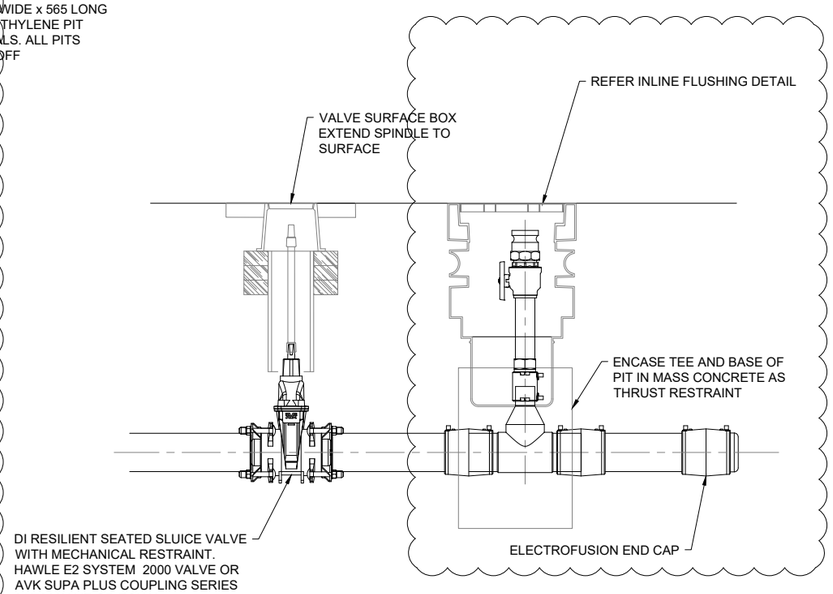
IN-LINE FLUSHING POINT WITH SECTION VALVE PIPEWORK DETAIL

NTS



END OF LINE PIPEWORK DETAIL

NTS



FUTURE CONNECTION PIPEWORK DETAIL

NTS

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

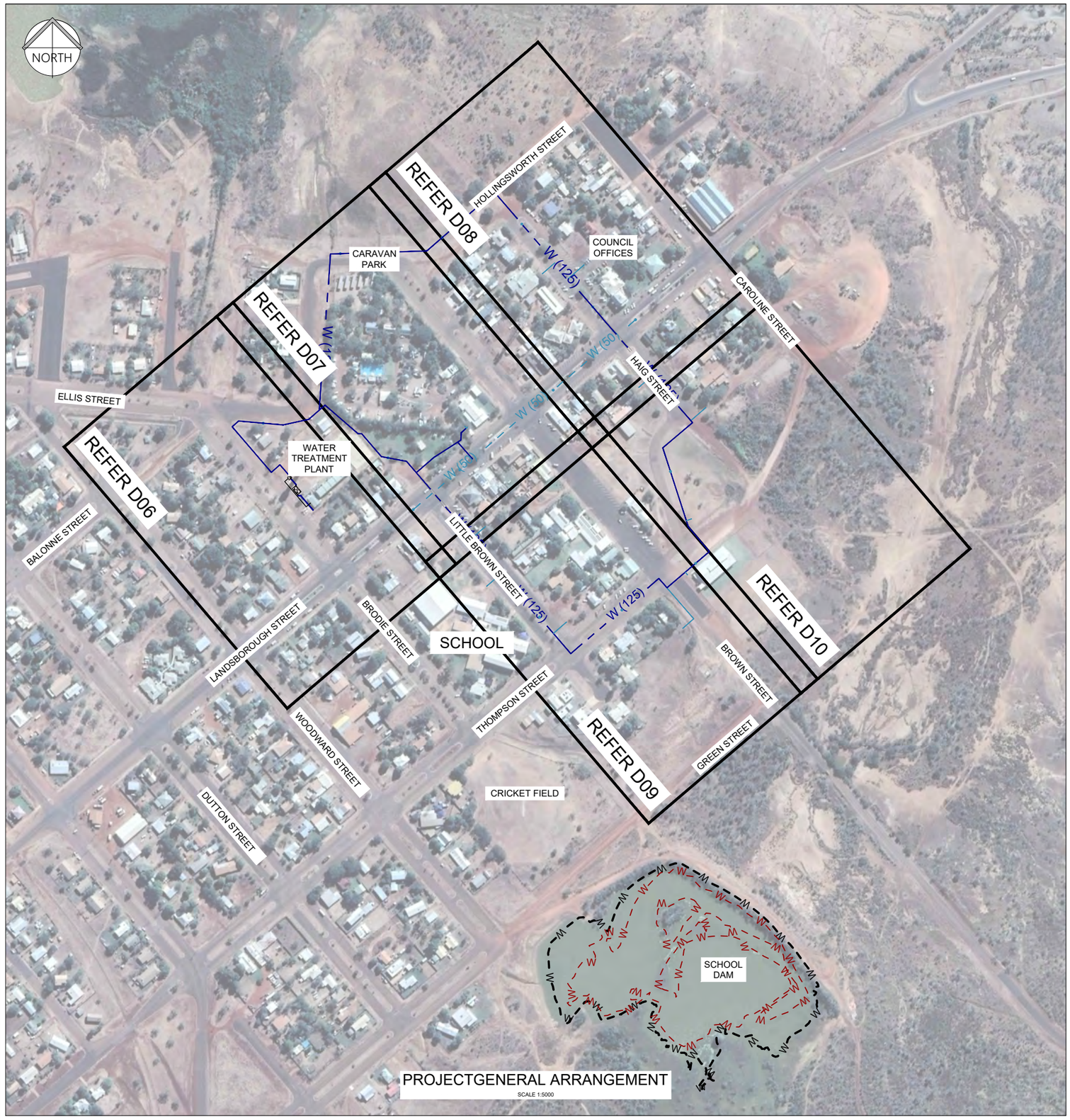
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: TYPICAL PIPEWORK DETAILS

PROJECT No	DRAWING No	REVISION
19-0118	D04	B

FOR CONSTRUCTION



PROJECTGENERAL ARRANGEMENT

SCALE 1:5000

LEGEND :

DESIGN SERVICES

- W (180) — WATER RAW - OD180 PE100 SDR 11
- W (180) — WATER IRRIGATION - OD180 PE100 SDR 11
- W (125) — WATER IRRIGATION - OD125 PE100 SDR 11
- W (50) — WATER IRRIGATION - OD50 PE100 SDR 11

EXISTING SERVICES

- W — WATER RETICULATION
- S — SEWERAGE RETICULATION
- P — POWER RETICULATION
- T — TELSTRA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
D	ISSUE FOR TENDER	TC	10/08/2020

0 100

SCALE 1:5000

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

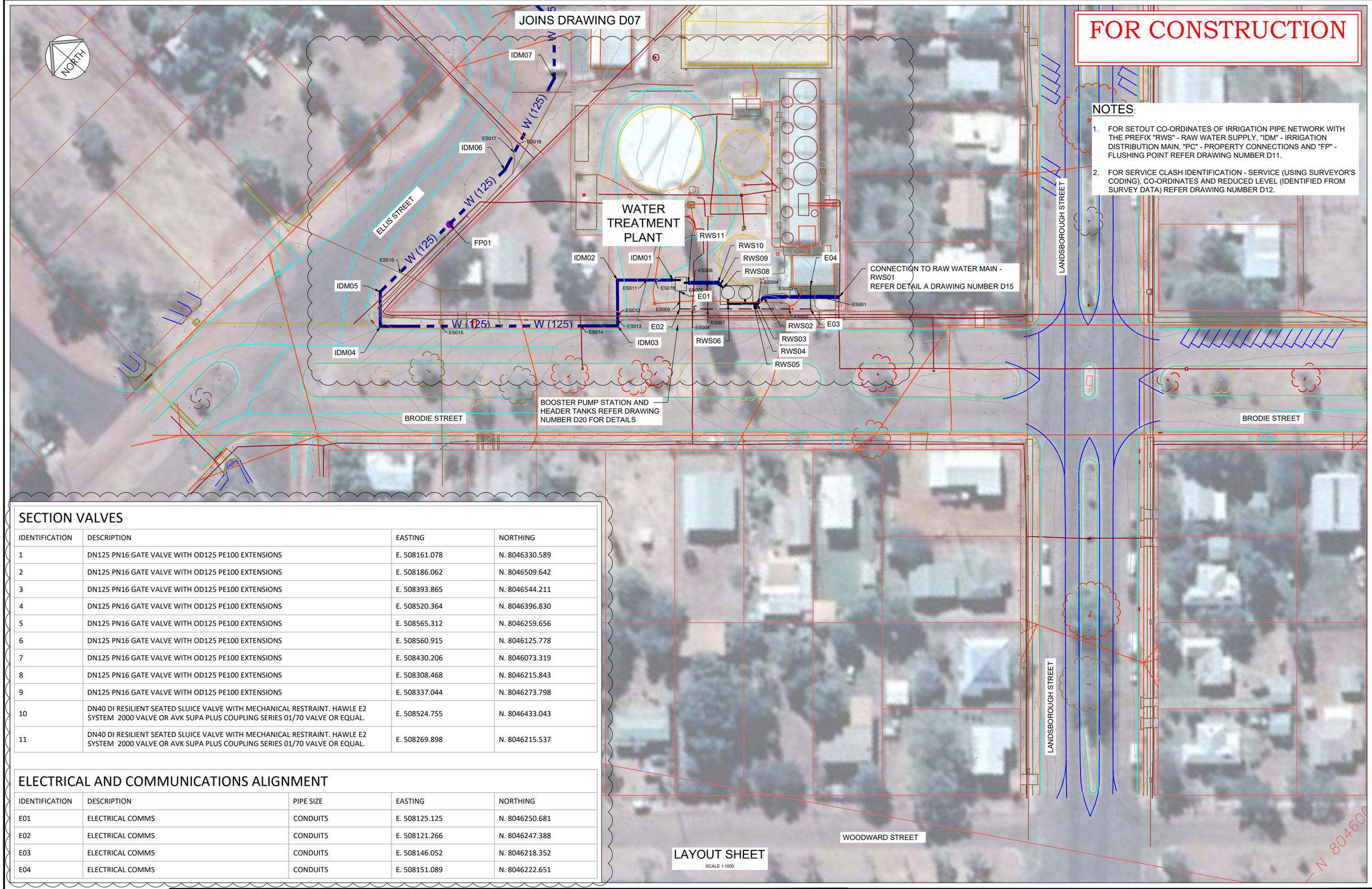
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: PROJECT GENERAL ARRANGEMENT

PROJECT No	DRAWING No	REVISION
19-0118	D05	E

FOR CONSTRUCTION



NOTES:

1. FOR SETOUT CO-ORDINATES OF IRRIGATION PIPE NETWORK WITH THE PREFIX "RWS" - RAW WATER SUPPLY, "IDM" - IRRIGATION DISTRIBUTION MAIN, "PC" - PROPERTY CONNECTIONS AND "FP" - FLUSHING POINT REFER DRAWING NUMBER D11.
2. FOR SERVICE CLASH IDENTIFICATION - SERVICE (USING SURVEYOR'S CODING), CO-ORDINATES AND REDUCED LEVEL (IDENTIFIED FROM SURVEY DATA) REFER DRAWING NUMBER D12.

SECTION VALVES

IDENTIFICATION	DESCRIPTION	EASTING	NORTHING
1	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508161.078	N. 8046330.589
2	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508186.062	N. 8046509.642
3	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508393.865	N. 8046544.211
4	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508520.364	N. 8046396.830
5	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508565.312	N. 8046259.656
6	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508560.915	N. 8046125.778
7	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508430.206	N. 8046073.319
8	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508308.468	N. 8046215.843
9	DN125 PN16 GATE VALVE WITH OD125 PE100 EXTENSIONS	E. 508337.044	N. 8046273.798
10	DN40 DI RESILIENT SEATED SLUICE VALVE WITH MECHANICAL RESTRAINT. HAWLE E2 SYSTEM 2000 VALVE OR AVK SUPA PLUS COUPLING SERIES 01/70 VALVE OR EQUAL.	E. 508524.755	N. 8046433.043
11	DN40 DI RESILIENT SEATED SLUICE VALVE WITH MECHANICAL RESTRAINT. HAWLE E2 SYSTEM 2000 VALVE OR AVK SUPA PLUS COUPLING SERIES 01/70 VALVE OR EQUAL.	E. 508269.898	N. 8046215.537

ELECTRICAL AND COMMUNICATIONS ALIGNMENT

IDENTIFICATION	DESCRIPTION	PIPE SIZE	EASTING	NORTHING
E01	ELECTRICAL COMMS	CONDUITS	E. 508125.125	N. 8046250.681
E02	ELECTRICAL COMMS	CONDUITS	E. 508121.266	N. 8046247.388
E03	ELECTRICAL COMMS	CONDUITS	E. 508146.052	N. 8046218.352
E04	ELECTRICAL COMMS	CONDUITS	E. 508151.089	N. 8046222.651

LAYOUT SHEET
SCALE 1:1000

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
E	ISSUE FOR CONSTRUCTION	TC	22/09/2020
D	ISSUE FOR TENDER	TC	10/08/2020

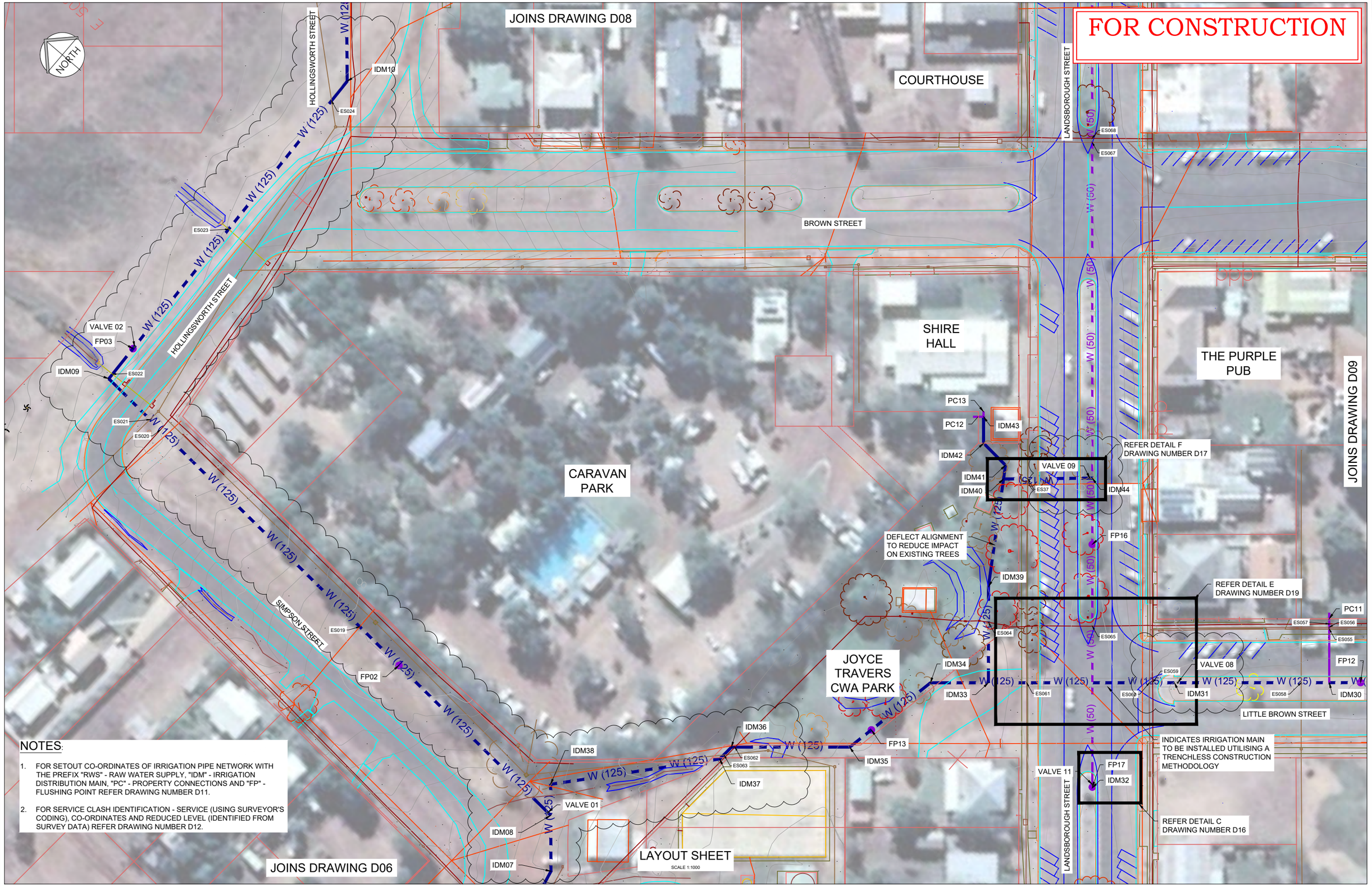
0 20
SCALE 1:1000
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: LAYOUT SHEET 1
PROJECT No: 19-0118 | DRAWING No: D06 | REVISION: E

FOR CONSTRUCTION



NOTES:

1. FOR SETOUT CO-ORDINATES OF IRRIGATION PIPE NETWORK WITH THE PREFIX "RWS" - RAW WATER SUPPLY, "IDM" - IRRIGATION DISTRIBUTION MAIN, "PC" - PROPERTY CONNECTIONS AND "FP" - FLUSHING POINT REFER DRAWING NUMBER D11.
2. FOR SERVICE CLASH IDENTIFICATION - SERVICE (USING SURVEYOR'S CODING), CO-ORDINATES AND REDUCED LEVEL (IDENTIFIED FROM SURVEY DATA) REFER DRAWING NUMBER D12.

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
F	ISSUE FOR CONSTRUCTION	TC	22/09/2020
E	ISSUE FOR TENDER	TC	10/08/2020

0 20
SCALE 1:1000
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: LAYOUT SHEET 2
PROJECT No: 19-0118 | DRAWING No: D07 | REVISION: F

FOR CONSTRUCTION

NORTH

LANDSBOROUGH STREET

SIMILAR DETAIL C
DRAWING NUMBER D16

COUNCIL OFFICES

IDM15

FP14

ES032

PC02

ES030

ES029

VALVE 10

JOINS DRAWING D10

VALVE 03

FP05

IDM11

ES026

IDM12

ES028

IDM13

FP06

ES031

IDM14

ES034

IDM16

IDM17

VALVE 04

ES033

HAIG STREET

ES027

PC01

REFER DETAIL D
DRAWING NUMBER D18

ES070

ES069

PC03

INDICATES IRRIGATION MAIN TO BE INSTALLED UTILISING A TRENCHLESS CONSTRUCTION METHODOLOGY

THE CENTRAL HOTEL

HOLLINGSWORTH STREET

ES025

POLICE STATION

COURTHOUSE

FP04

FP15

LANDSBOROUGH STREET

W (125)

W (50)

JOINS DRAWING D07

LAYOUT SHEET
SCALE 1:1000

NOTES:

1. FOR SETOUT CO-ORDINATES OF IRRIGATION PIPE NETWORK WITH THE PREFIX "RWS" - RAW WATER SUPPLY, "IDM" - IRRIGATION DISTRIBUTION MAIN, "PC" - PROPERTY CONNECTIONS AND "FP" - FLUSHING POINT REFER DRAWING NUMBER D11.
2. FOR SERVICE CLASH IDENTIFICATION - SERVICE (USING SURVEYOR'S CODING), CO-ORDINATES AND REDUCED LEVEL (IDENTIFIED FROM SURVEY DATA) REFER DRAWING NUMBER D12.

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
E	ISSUE FOR CONSTRUCTION	TC	22/09/2020
D	ISSUE FOR TENDER	TC	10/08/2020

0 20
SCALE 1:1000
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: LAYOUT SHEET 3
PROJECT No: 19-0118 | DRAWING No: D08 | REVISION: E

FOR CONSTRUCTION

JOINS DRAWING D10

JOINS DRAWING D07

NORTH

GULF CHRISTIAN COLLEGE

THE PURPLE PUB

BROWN STREET

GREEN STREET

THOMPSON STREET

LITTLE BROWN STREET

NORMANTON STATE SCHOOL

PARK

FP09

FP10

FP11

FP12

IDM24

IDM25

IDM26

IDM27

IDM28

IDM29

IDM30

PC06

PC07

PC08

PC09

PC10

PC11

VALVE 06

VALVE 07

REFER DETAIL B
DRAWING NUMBER D15

W (125)

W (50)

ES038 ES039 ES040 ES041 ES042 ES043 ES044 ES045 ES046 ES047 ES048 ES049 ES050 ES051 ES052 ES053 ES054 ES055 ES056 ES057 ES058

LAYOUT SHEET
SCALE 1:1000

NOTES:

1. FOR SETOUT CO-ORDINATES OF IRRIGATION PIPE NETWORK WITH THE PREFIX "RWS" - RAW WATER SUPPLY, "IDM" - IRRIGATION DISTRIBUTION MAIN, "PC" - PROPERTY CONNECTIONS AND "FP" - FLUSHING POINT REFER DRAWING NUMBER D11.
2. FOR SERVICE CLASH IDENTIFICATION - SERVICE (USING SURVEYOR'S CODING), CO-ORDINATES AND REDUCED LEVEL (IDENTIFIED FROM SURVEY DATA) REFER DRAWING NUMBER D12.

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
E	ISSUE FOR CONSTRUCTION	TC	22/09/2020
D	ISSUE FOR TENDER	TC	10/08/2020

0 20
SCALE 1:1000
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: LAYOUT SHEET 4
PROJECT No: 19-0118 | DRAWING No: D09 | REVISION: E

FOR CONSTRUCTION

NOTES:

1. FOR SETOUT CO-ORDINATES OF IRRIGATION PIPE NETWORK WITH THE PREFIX "RWS" - RAW WATER SUPPLY, "IDM" - IRRIGATION DISTRIBUTION MAIN, "PC" - PROPERTY CONNECTIONS AND "FP" - FLUSHING POINT REFER DRAWING NUMBER D11.
2. FOR SERVICE CLASH IDENTIFICATION - SERVICE (USING SURVEYOR'S CODING), CO-ORDINATES AND REDUCED LEVEL (IDENTIFIED FROM SURVEY DATA) REFER DRAWING NUMBER D12.

NORTH

JOINS DRAWING D08

THE ALBION HOTEL

PC04

ES036

W (50)

IDM17

FP07

W (125)

IDM19

IDM18

HAIG STREET

ES035

PC03

W (125)

IDM20

ES037

VALVE 05

FP08

PARK

THOMPSON STREET

PC05

IDM21

IDM22

IDM23

GULF CHRISTIAN COLLEGE

JOINS DRAWING D09

LAYOUT SHEET
SCALE 1:1000

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
E	ISSUE FOR CONSTRUCTION	TC	22/09/2020
D	ISSUE FOR TENDER	TC	10/08/2020

0 20
SCALE 1:1000
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020
RPEQ / SIGNATURE (IF REQUIRED):

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: LAYOUT SHEET 5
PROJECT No: 19-0118 | DRAWING No: D10 | REVISION: E

SETOUT CO-ORDINATES

RAW WATER SUPPLY (35.1m - HDPE TOTAL PLAN LENGTH)

IDENTIFICATION	DESCRIPTION	PIPE SIZE	EASTING	NORTHING
RWS01	RAW WATER CONNECTION	OD180 PE100 SDR11	E. 508154.062	N. 8046214.209
RWS02	RAW WATER 45 DEG SWEEP BEND	OD180 PE100 SDR11	E. 508139.842	N. 8046231.017
RWS03	RAW WATER 45 DEG SWEEP BEND	OD180 PE100 SDR11	E. 508137.031	N. 8046231.239
RWS04	RAW WATER END OF HDPE	OD180 PE100 SDR11	E. 508136.616	N. 8046231.725
RWS05	RAW WATER RISER - START OF DICL MAIN	DN150 DICL	E. 508136.432	N. 8046231.941
RWS06	90 DEG BEND FL-FL (IP)	DN150 DICL	E. 508131.565	N. 8046237.642
RWS08	RAW WATER MAIN TANK OUTLET	DN150 PIPE	E. 508134.174	N. 8046241.664
RWS09	RAW WATER START OF HDPE	OD180 PE100 SDR11	E. 508134.273	N. 8046242.918
RWS10	RAW WATER 45 DEG SWEEP BEND	OD180 PE100 SDR11	E. 508134.346	N. 8046243.838
RWS11	RAW WATER END OF HDPE	OD180 PE100 SDR11	E. 508128.716	N. 8046250.433

PROPERTY CONNECTIONS (567m TOTAL PLAN LENGTH)

IDENTIFICATION	DESCRIPTION	PIPE SIZE	EASTING	NORTHING
PC01	PROP CONNECTION COURTHOUSE	OD50 PE100 SDR11	E. 508419.013	N. 8046487.429
PC02	PROP CONNECTION COUNCIL OFFICES	OD50 PE100 SDR11	E. 508465.040	N. 8046495.671
PC03	PROP CONNECTION CENTRAL HOTEL	OD50 PE100 SDR11	E. 508530.434	N. 8046357.043
PC04	PROP CONNECTION ALBION HOTEL	OD50 PE100 SDR11	E. 508605.286	N. 8046331.515
PC05	PROP CONNECTION PARK	OD50 PE100 SDR11	E. 508588.483	N. 8046203.926
PC06	PROP CONNECTION GULF CHRISTIAN COLLEGE	OD50 PE100 SDR11	E. 508584.238	N. 8046141.093
PC07	90 DEG SWEEP BEND	OD50 PE100 SDR11	E. 508592.293	N. 8046089.374
PC08	PROPERTY CONNECTION PARK	OD50 PE100 SDR11	E. 508581.483	N. 8046080.057
PC09	PROP CONNECTION GULF CHRISTIAN COLLEGE	OD50 PE100 SDR11	E. 508444.803	N. 8046084.748
PC10	PROP CONNECTION NORMANTON STATE SCHOOL	OD50 PE100 SDR11	E. 508354.874	N. 8046127.862
PC11	PROP CONNECTION PURPLE PUB	OD50 PE100 SDR11	E. 508351.128	N. 8046194.403
PC12	PROP CONNECTION CARAVAN PARK	OD50 PE100 SDR11	E. 508329.616	N. 8046310.057
PC13	PROP CONNECTION SHIRE HALL	OD50 PE100 SDR11	E. 508331.713	N. 8046309.798

MAIN FLUSHING POINTS

IDENTIFICATION	DESCRIPTION	PIPE SIZE	EASTING	NORTHING
FP01	FLUSHING POINT	PE100 SDR11	E. 508096.523	N. 8046314.437
FP02	FLUSHING POINT	PE100 SDR11	E. 508165.500	N. 8046391.178
FP03	FLUSHING POINT	PE100 SDR11	E. 508185.313	N. 8046509.619
FP04	FLUSHING POINT	PE100 SDR11	E. 508302.602	N. 8046528.122
FP05	FLUSHING POINT	PE100 SDR11	E. 508394.351	N. 8046543.639
FP06	FLUSHING POINT	PE100 SDR11	E. 508475.988	N. 8046448.321
FP07	FLUSHING POINT	PE100 SDR11	E. 508557.312	N. 8046354.052
FP08	FLUSHING POINT	PE100 SDR11	E. 508565.542	N. 8046258.942
FP09	FLUSHING POINT	PE100 SDR11	E. 508594.588	N. 8046153.293
FP10	FLUSHING POINT	PE100 SDR11	E. 508509.578	N. 8046099.531
FP11	FLUSHING POINT	PE100 SDR11	E. 508414.715	N. 8046091.415
FP12	FLUSHING POINT	PE100 SDR11	E. 508342.958	N. 8046175.461
FP13	FLUSHING POINT	PE100 SDR11	E. 508240.314	N. 8046274.653
FP14	FLUSHING POINT	PE100 SDR11	E. 508525.325	N. 8046433.530
FP15	FLUSHING POINT	PE100 SDR11	E. 508430.472	N. 8046352.578
FP16	FLUSHING POINT	PE100 SDR11	E. 508322.916	N. 8046260.785
FP17	FLUSHING POINT	PE100 SDR11	E. 508269.328	N. 8046215.050

SETOUT CO-ORDINATES

IRRIGATION DISTRIBUTION MAIN (1865m TOTAL PLAN LENGTH)

IDENTIFICATION	DESCRIPTION	PIPE SIZE	EASTING	NORTHING
IDM01	CONNECTION TO BOOSTER PUMP STATION	OD125 PE100 SDR11	E. 508126.446	N. 8046254.287
IDM02	90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508115.890	N. 8046266.653
IDM03	90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508105.790	N. 8046257.942
IDM04	90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508060.774	N. 8046310.528
IDM05	45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508068.436	N. 8046317.068
IDM06	17 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508119.019	N. 8046312.483
IDM07	29 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508148.708	N. 8046318.820
IDM08	SIMPSON STREET 45 DEG WYE	OD125 PE100 SDR11	E. 508160.991	N. 8046329.392
IDM09	HOLLINGSWORTH STREET 85 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508174.120	N. 8046509.280
IDM10	HOLLINGSWORTH STREET 40 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508284.719	N. 8046512.636
IDM11	HAIG STREET 90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508362.914	N. 8046580.351
IDM12	OFFTAKE CROSS COUNCIL OFFICES COURTHOUSE	OD125 PE100 SDR11	E. 508432.567	N. 8046499.018
IDM13	OFFTAKE CROSS COUNCIL OFFICES COURTHOUSE	OD125 PE100 SDR11	E. 508447.950	N. 8046481.058
IDM14	HAIG ST RECEPTION PIT	OD125 PE100 SDR11	E. 508486.968	N. 8046435.501
IDM15	END LANDSBOROUGH STREET	OD50 PE100 SDR11	E. 508525.515	N. 8046433.693
IDM16	HAIG ST LAUCH PIT	OD125 PE100 SDR11	E. 508519.717	N. 8046397.581
IDM17	OFFTAKE TEE TO CENTRAL HOTEL	OD125 PE100 SDR11	E. 508544.447	N. 8046369.025
IDM18	OFFTAKE TEE ALBION HOTEL	OD125 PE100 SDR11	E. 508588.888	N. 8046317.493
IDM19	90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508590.984	N. 8046315.063
IDM20	70 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508556.722	N. 8046286.313
IDM21	OFFTAKE TEE TO PARK	OD125 PE100 SDR11	E. 508583.759	N. 8046202.404
IDM22	22.5 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508585.928	N. 8046195.673
IDM23	90 DEG SWEEP BEND	OD180 PE100 SDR11	E. 508610.303	N. 8046166.624
IDM24	OFFTAKE TEE GULF CHRISTIAN COLLEGE	OD125 PE100 SDR11	E. 508582.550	N. 8046143.082
IDM25	90 DEG TEE	OD125 PE100 SDR11	E. 508561.438	N. 8046125.172
IDM26	90 DEG SWEEP BEND	OD180 PE100 SDR11	E. 508552.234	N. 8046135.850
IDM27	90 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508450.630	N. 8046049.343
IDM28	OFFTAKE TEE GULF CHRISTIAN COLLEGE	OD125 PE100 SDR11	E. 508430.735	N. 8046072.719
IDM29	OFFTAKE TEE NORMANTON STATE SCHOOL	OD125 PE100 SDR11	E. 508371.498	N. 8046142.063
IDM30	OFFTAKE TEE PURPLE PUB	OD125 PE100 SDR11	E. 508337.049	N. 8046182.375
IDM31	LITTLE BROWN STREET LAUNCH PIT	OD125 PE100 SDR11	E. 508307.866	N. 8046216.688
IDM32	END LANDSBOROUGH STREET	OD50 PE100 SDR11	E. 508269.138	N. 8046214.888
IDM33	JOYCE TRAVERS CWA PARK RECEPTION PIT 90 DEG TEE	OD125 PE100 SDR11	E. 508272.764	N. 8046257.662
IDM34	JOYCE TRAVERS CWA PARK 45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508261.834	N. 8046270.464
IDM35	JOYCE TRAVERS CWA PARK 45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508232.417	N. 8046276.190
IDM36	JOYCE TRAVERS CWA PARK 45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508210.121	N. 8046302.310
IDM37	45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508205.295	N. 8046302.688
IDM38	82 DEG TEE	OD125 PE100 SDR11	E. 508167.832	N. 8046335.280
IDM39	10 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508294.027	N. 8046275.787
IDM40	90 DEG BEND	OD125 PE100 SDR11	E. 508320.619	N. 8046292.704
IDM41	45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508324.021	N. 8046294.868
IDM42	45 DEG SWEEP BEND	OD125 PE100 SDR11	E. 508324.750	N. 8046303.859
IDM43	90 DEG TEE	OD125 PE100 SDR11	E. 508330.589	N. 8046308.840
IDM44	90 DEG TEE	OD50 PE100 SDR11	E. 508337.521	N. 8046273.249

FOR CONSTRUCTION

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: SETOUT CO-ORDINATES

PROJECT No	DRAWING No	REVISION
19-0118	D11	B

CLASH DETECTION CO-ORDINATES

IDENTIFICATION	EXISTING SERVICE (SURVEYOR'S LAYER NAME)	EASTING	NORTHING	IDENTIFIED LEVEL
ES001	WAT_HV_UGROUND	E. 508154.14	N. 8046214.27	RL7.79
ES002	EL_HV_UGROUND	E. 508146.67	N. 8046223.01	RL8.15
ES003	EL_HV_UGROUND	E. 508141.96	N. 8046222.94	RL8.11
ES004	EL_HV_UGROUND	E. 508137.64	N. 8046231.19	RL8.30
ES005	WAT_HV_UGROUND	E. 508132.35	N. 8046246.17	RL7.84
ES006	WAT_HV_UGROUND	E. 508129.78	N. 8046249.18	RL7.69
ES007	WAT_HV_UGROUND	E. 508126.63	N. 8046241.23	RL7.73
ES008	WAT_HV_UGROUND	E. 508123.74	N. 8046244.62	RL7.67
ES009	EL_HV_UGROUND	E. 508122.92	N. 8046248.69	RL7.75
ES010	EL_HV_UGROUND	E. 508123.04	N. 8046258.27	RL7.51
ES011	TEL_HV_UGROUND	E. 508121.45	N. 8046260.14	RL7.49
ES012	WAT_HV_UGROUND	E. 508107.93	N. 8046259.79	RL7.41
ES013	TEL_HV_UGROUND	E. 508107.10	N. 8046259.07	RL7.33
ES014	WAT_HV_UGROUND	E. 508098.82	N. 8046266.09	RL6.87
ES015	SEWER_UGROUND	E. 508072.28	N. 8046297.09	RL4.06
ES016	SEWER_UGROUND	E. 508076.41	N. 8046316.35	RL4.80
ES017	TEL_HV_UGROUND	E. 508124.53	N. 8046313.66	RL6.86
ES018	WAT_HV_UGROUND	E. 508127.55	N. 8046314.30	RL7.03
ES019	EL_HV_UGROUND	E. 508166.66	N. 8046407.12	RL7.49
ES020	WAT_HV_UGROUND	E. 508172.59	N. 8046488.25	RL4.76
ES021	SEWER_UGROUND	E. 508172.90	N. 8046492.50	RL2.11
ES022	RCP_INVERT	E. 508175.82	N. 8046509.33	RL4.38
ES023	RCP_INVERT	E. 508229.73	N. 8046510.97	RL4.94
ES024	SEWER_UGROUND	E. 508277.48	N. 8046512.42	RL2.91
ES025	SEWER_UGROUND	E. 508318.26	N. 8046541.68	RL2.53
ES026	WAT_HV_UGROUND	E. 508364.40	N. 8046578.62	RL5.04
ES027	TEL_HV_UGROUND	E. 508420.52	N. 8046488.72	RL7.24
ES028	WAT_HV_UGROUND	E. 508441.56	N. 8046488.52	RL6.87
ES029	TEL_HV_UGROUND	E. 508463.29	N. 8046494.17	RL7.27
ES030	WAT_HV_UGROUND	E. 508463.84	N. 8046494.65	RL6.79
ES031	TEL_HV_UGROUND	E. 508491.86	N. 8046429.84	RL6.93
ES032	WAT_HV_UGROUND	E. 508519.71	N. 8046428.73	RL6.98
ES033	TEL_HV_UGROUND	E. 508514.61	N. 8046403.50	RL6.98
ES034	WAT_HV_UGROUND	E. 508515.61	N. 8046402.34	RL6.91
ES035	WAT_HV_UGROUND	E. 508532.32	N. 8046358.65	RL6.40
ES036	WAT_UGROUND	E. 508604.15	N. 8046330.54	RL0.32
ES037	SEWER_UGROUND	E. 508561.71	N. 8046270.84	RL0.00
ES038	TEL_HV_UGROUND	E. 508583.35	N. 8046081.67	RL4.99
ES039	WAT_HV_UGROUND	E. 508582.08	N. 8046080.58	RL5.04
ES040	SEWER_UGROUND	E. 508580.71	N. 8046079.39	RL0.08
ES041	RCP_INVERT	E. 508545.66	N. 8046130.25	RL2.88
ES042	RCP_INVERT	E. 508544.04	N. 8046128.87	RL0.00
ES043	WAT_HV_UGROUND	E. 508542.45	N. 8046127.52	RL6.74
ES044	SEWER_UGROUND	E. 508525.86	N. 8046113.39	RL5.19
ES045	WAT_HV_UGROUND	E. 508521.89	N. 8046110.01	RL7.21
ES046	WAT_HV_UGROUND	E. 508496.44	N. 8046088.34	RL7.32

IDENTIFICATION	EXISTING SERVICE (SURVEYOR'S LAYER NAME)	EASTING	NORTHING	IDENTIFIED LEVEL
ES047	WAT_HV_UGROUND	E. 508478.01	N. 8046072.65	RL7.94
ES048	WAT_HV_UGROUND	E. 508464.97	N. 8046061.56	RL7.03
ES049	TEL_HV_UGROUND	E. 508463.47	N. 8046060.27	RL7.37
ES050	TEL_HV_UGROUND	E. 508443.21	N. 8046083.38	RL7.90
ES051	WAT_HV_UGROUND	E. 508444.44	N. 8046084.44	RL7.92
ES052	TEL_HV_UGROUND	E. 508406.17	N. 8046101.42	RL8.75
ES053	WAT_HV_UGROUND	E. 508377.53	N. 8046134.96	RL8.54
ES054	WAT_HV_UGROUND	E. 508352.36	N. 8046164.44	RL8.18
ES055	TEL_HV_UGROUND	E. 508348.90	N. 8046192.50	RL8.54
ES056	TEL_HV_UGROUND	E. 508349.26	N. 8046192.81	RL8.49
ES057	WAT_HV_UGROUND	E. 508350.01	N. 8046193.45	RL8.48
ES058	SEWER_UGROUND	E. 508331.75	N. 8046188.58	RL5.98
ES059	WAT_HV_UGROUND	E. 508303.72	N. 8046221.41	RL8.06
ES060	TEL_HV_UGROUND	E. 508303.12	N. 8046222.11	RL7.95
ES061	TEL_HV_UGROUND	E. 508279.98	N. 8046249.21	RL8.17
ES062	WAT_UGROUND	E. 508210.78	N. 8046301.54	RL0.00
ES063	SEWER_UGROUND	E. 508206.93	N. 8046302.56	RL1.12
ES064	WAT_UGROUND	E. 508286.12	N. 8046269.04	RL8.80
ES065	WAT_HV_UGROUND	E. 508304.85	N. 8046245.37	RL8.34
ES066	TEL_HV_UGROUND	E. 508325.27	N. 8046287.35	RL8.14
ES067	TEL_HV_UGROUND	E. 508411.66	N. 8046336.52	RL7.56
ES068	WAT_HV_UGROUND	E. 508412.54	N. 8046337.28	RL7.41
ES069	TEL_HV_UGROUND	E. 508491.72	N. 8046404.85	RL7.14
ES070	WAT_HV_UGROUND	E. 508491.90	N. 8046405.00	RL7.27

FOR CONSTRUCTION

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/2020

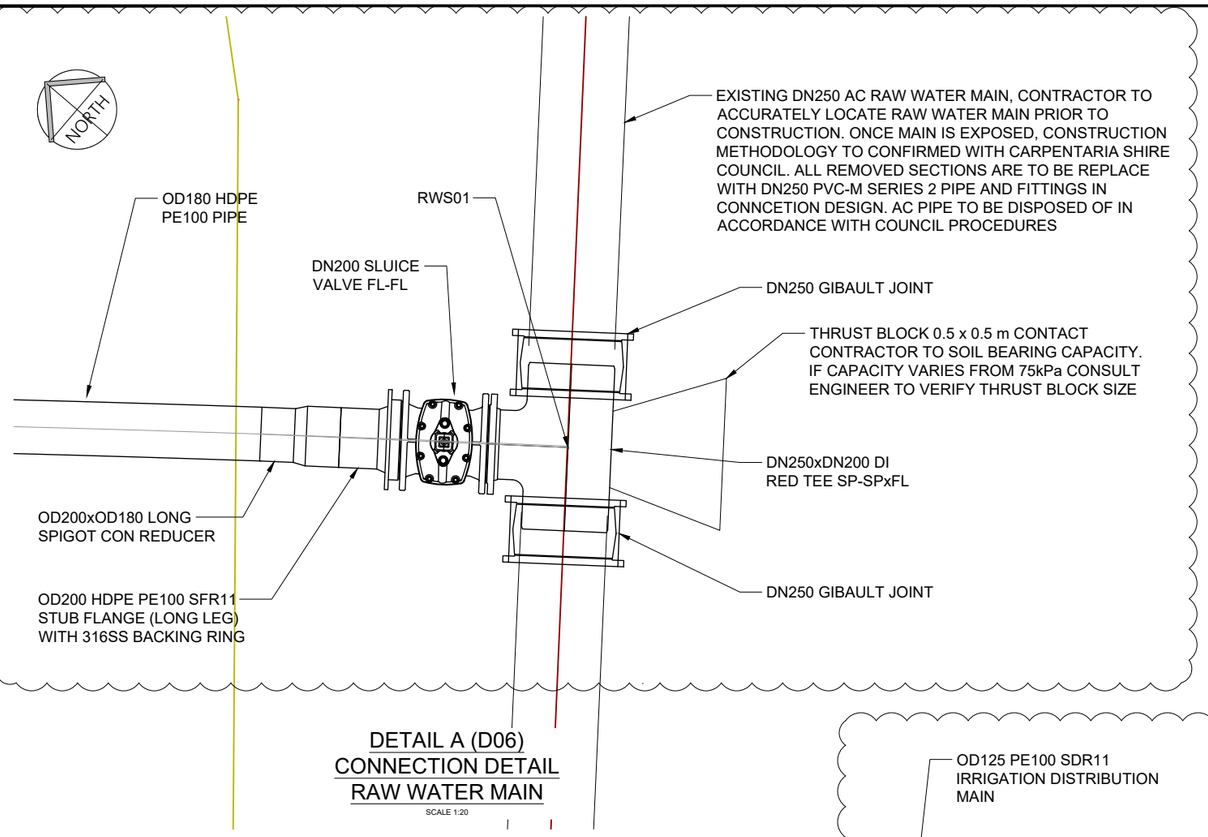
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

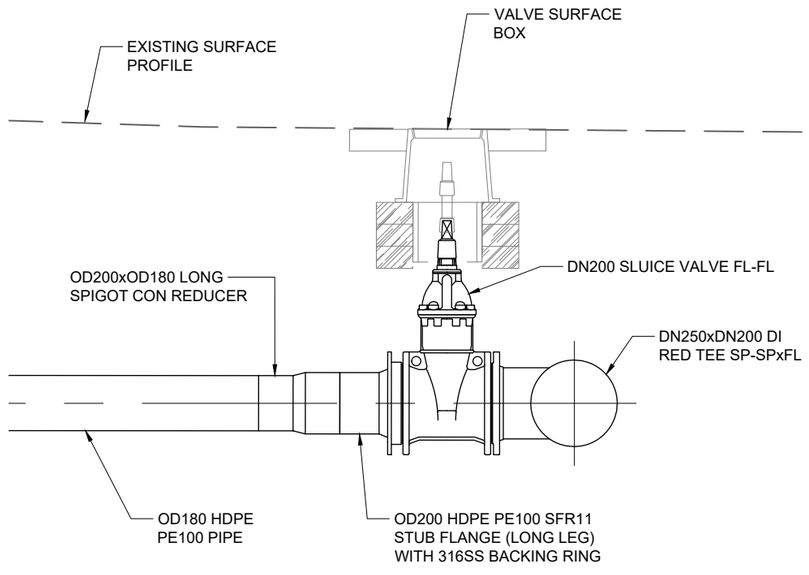
DRAWING TITLE: CLASH DETECTION CO-ORDINATES

PROJECT No: 19-0118 | DRAWING No: D12 | REVISION: B

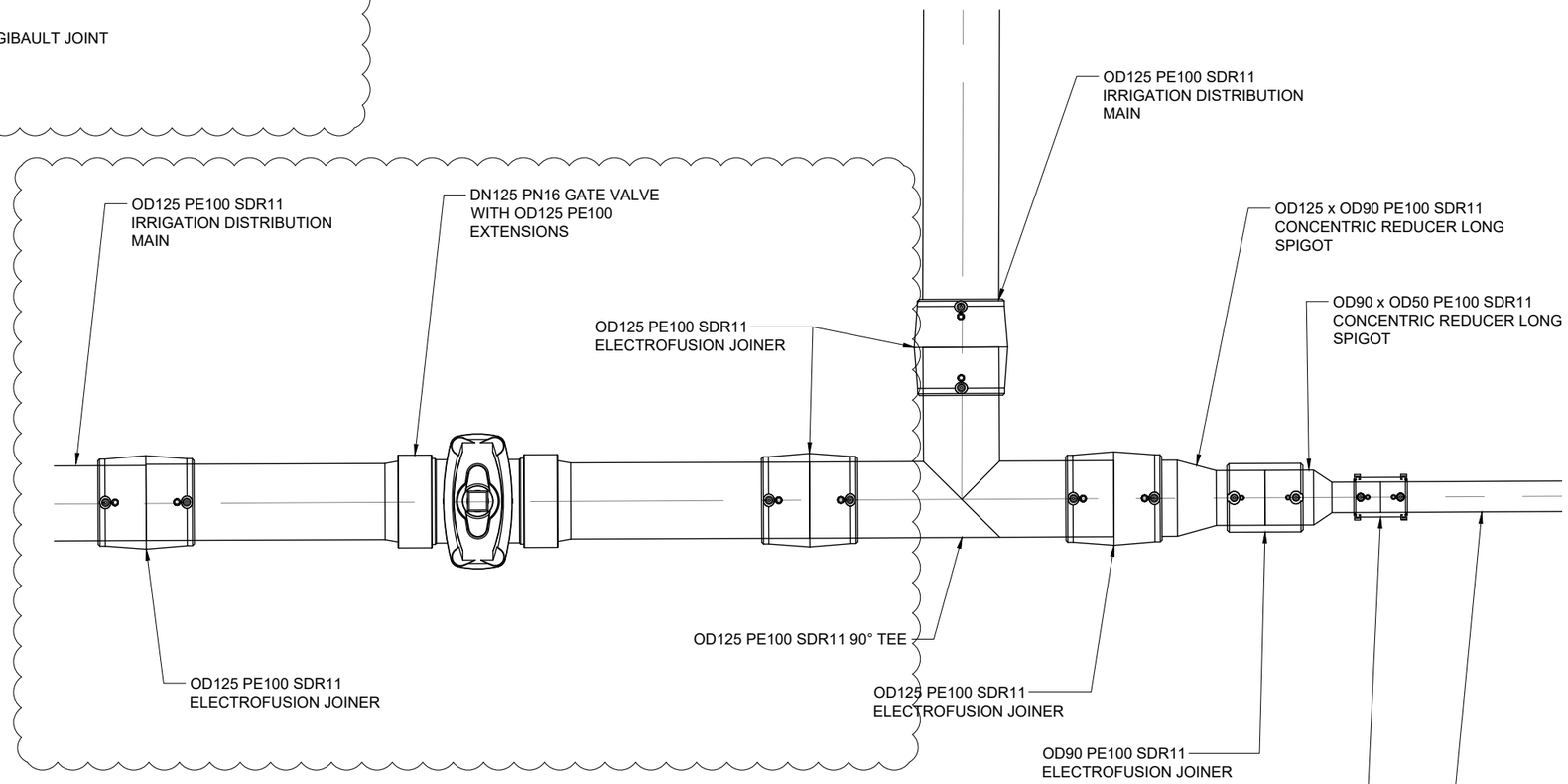
FOR CONSTRUCTION



DETAIL A (D06)
CONNECTION DETAIL
RAW WATER MAIN
SCALE 1:20



SECTION CONNECTION DETAIL
RAW WATER MAIN
SCALE 1:20



DETAIL B (D09)
TYPICAL CONNECTION
OD125 TO OD50
SCALE 1:10

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

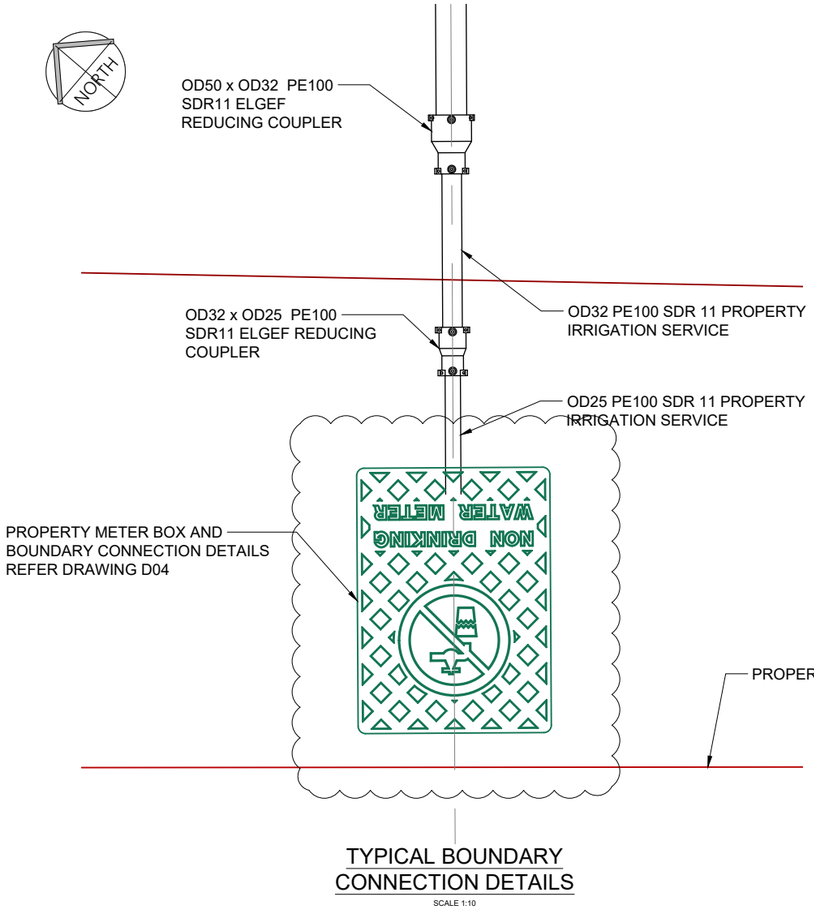
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: PIPE WORK DETAILS SHEET 1

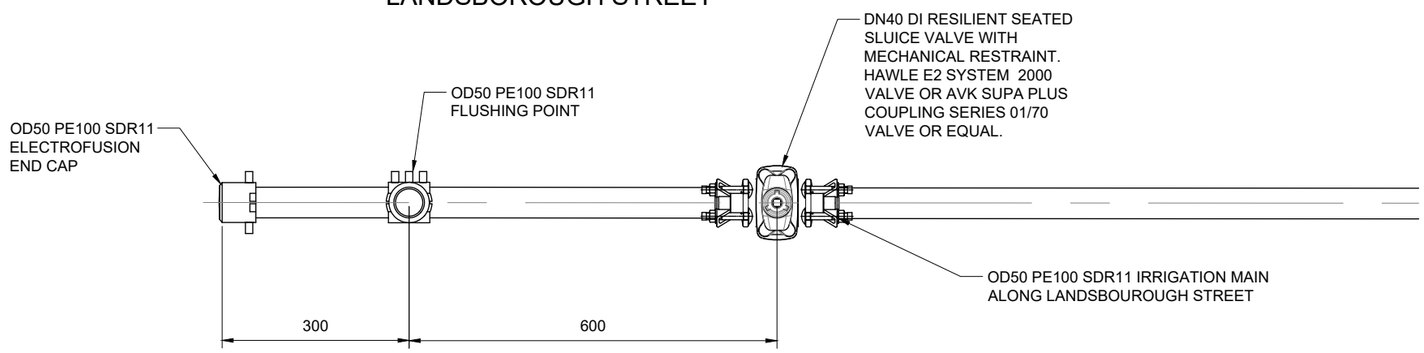
PROJECT No	DRAWING No	REVISION
19-0118	D15	B

FOR CONSTRUCTION

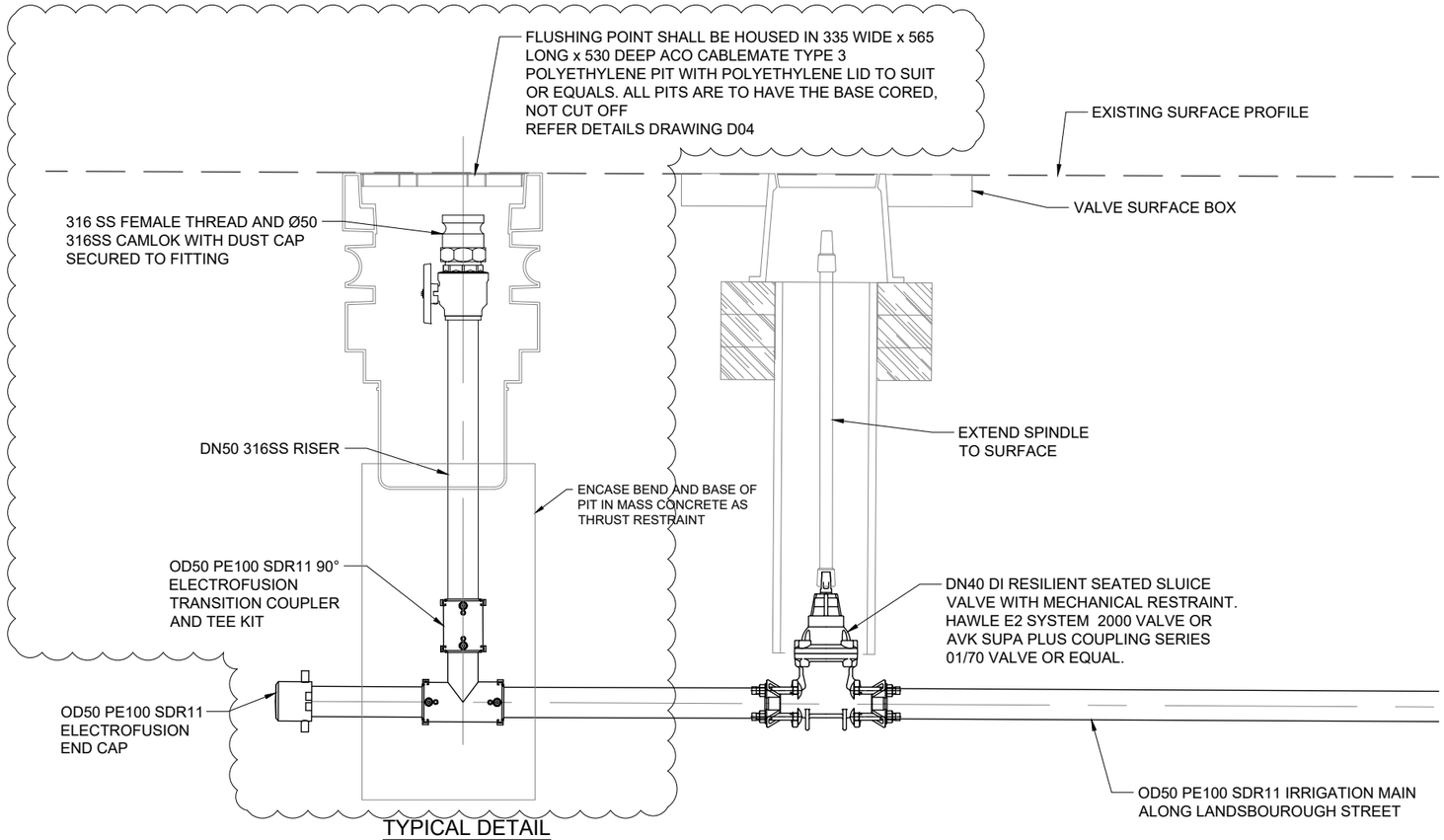


TYPICAL BOUNDARY
CONNECTION DETAILS

SCALE 1:10



PLAN VIEW



TYPICAL DETAIL
FLUSHING POINTS
FP14 TO FP17

DETAIL C (D07 AND D08)
SECTION VIEW

SCALE 1:10

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/2020
A	ISSUE FOR TENDER	TC	10/08/2020

0 0.2
SCALE 1:10
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SHIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/2020

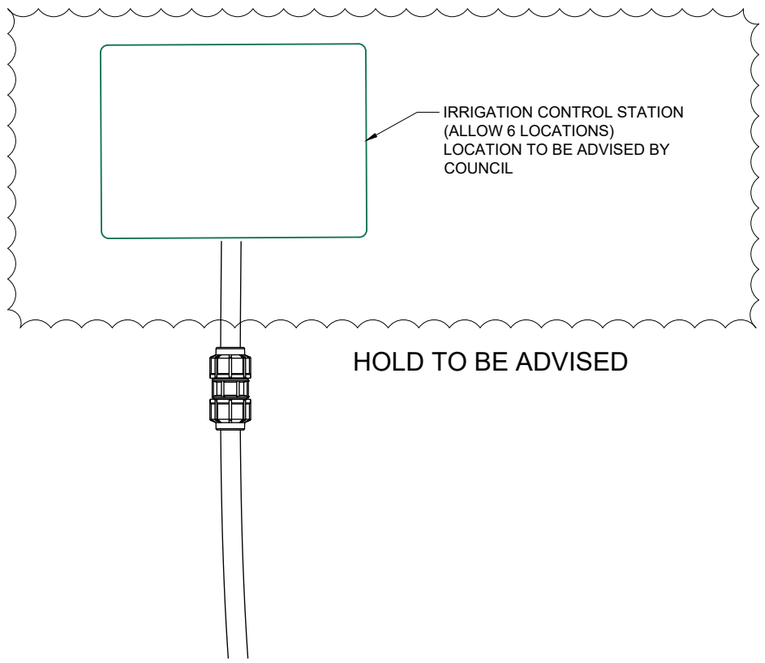
RPEQ / SIGNATURE (IF REQUIRED)

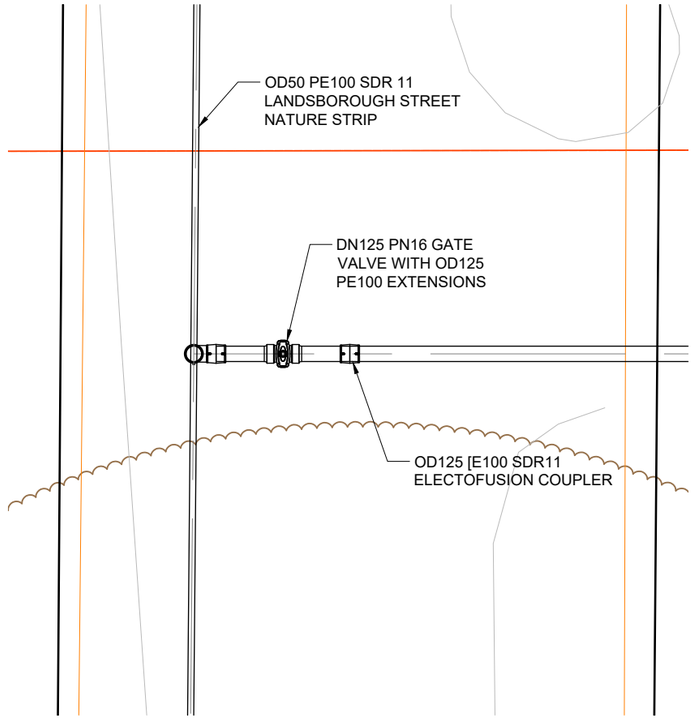
PROJECT: NORMANTON RAW WATER PROJECT

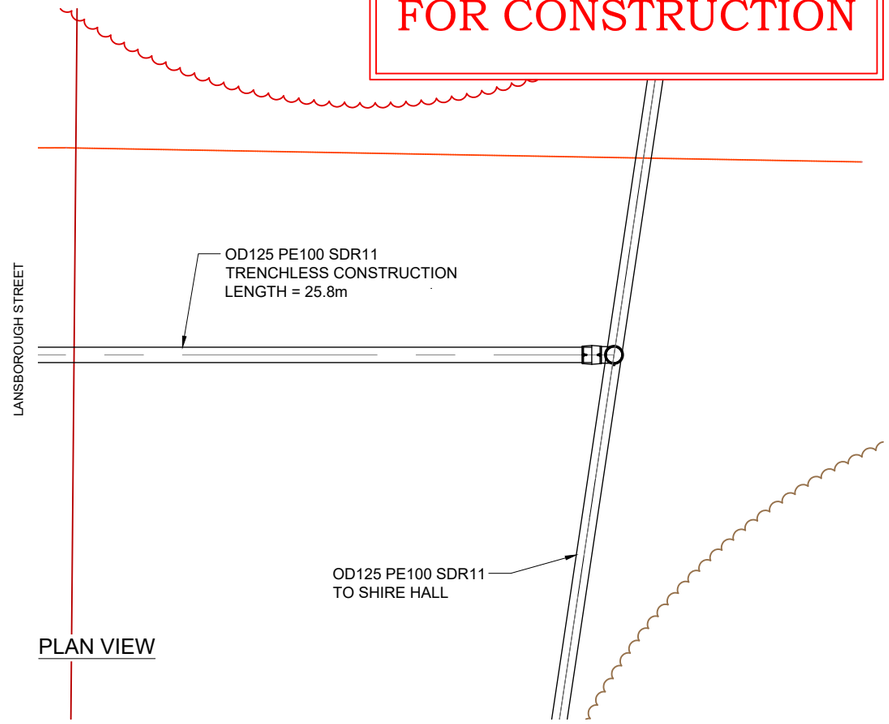
DRAWING TITLE: PIPE WORK DETAILS
SHEET 2

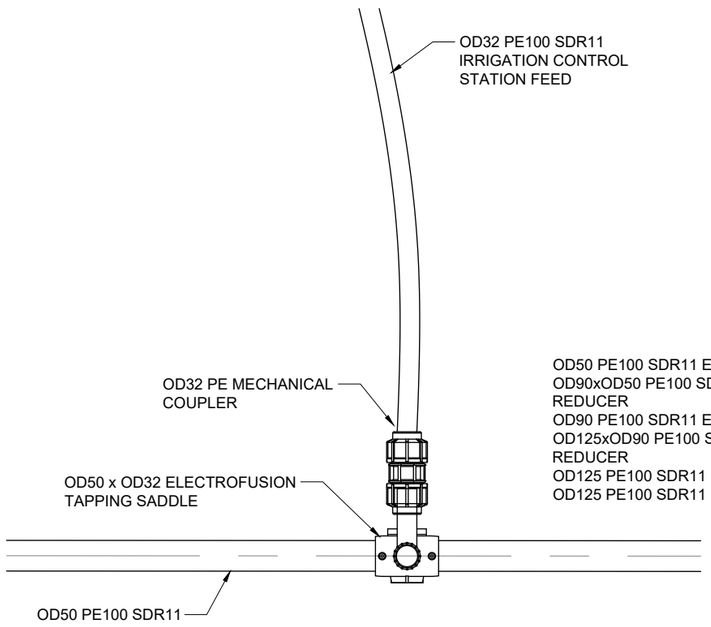
PROJECT No	DRAWING No	REVISION
19-0118	D16	B

FOR CONSTRUCTION



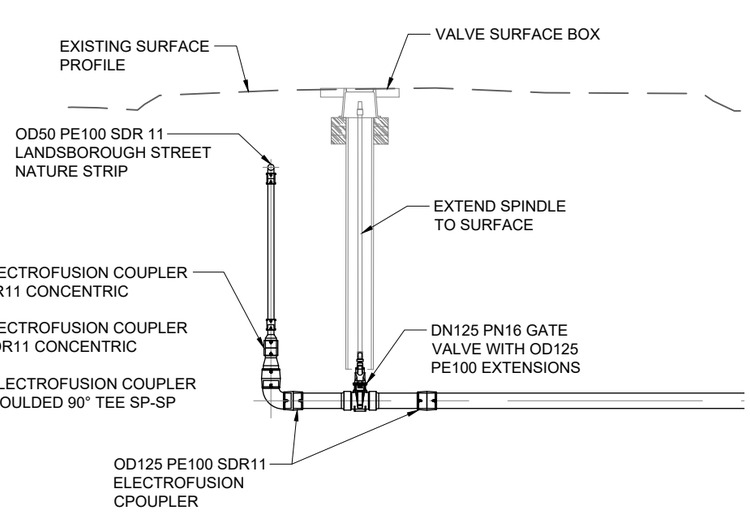


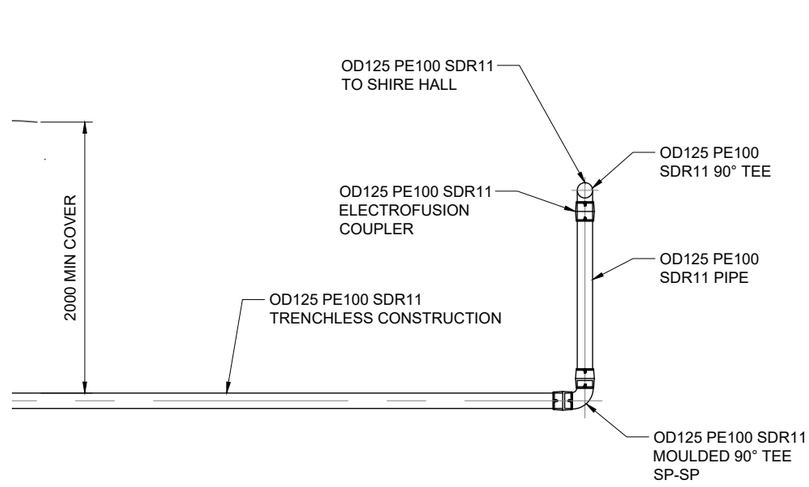




TYPICAL IRRIGATION CONTROL STATION SUPPLY
LANDSBOROUGH STREET NATURE STRIP

SCALE 1:10





DETAIL C (D07 AND D08)
SECTION VIEW

SCALE 1:50

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	10/08/20

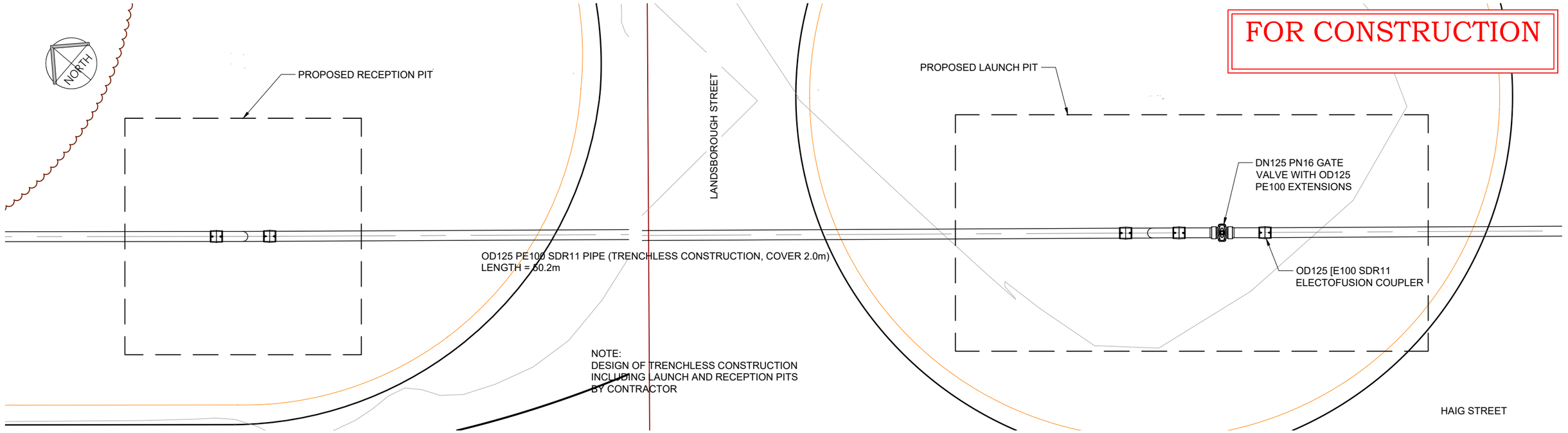
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

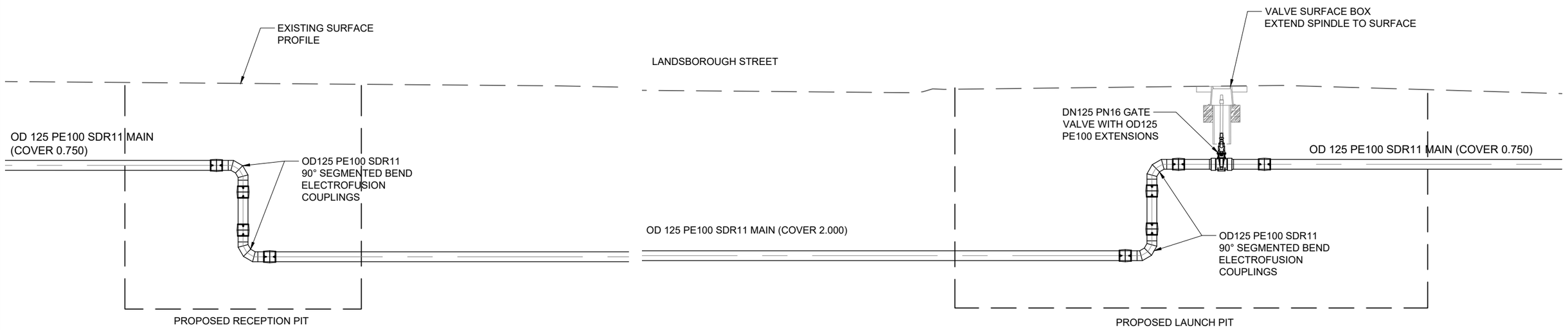
DRAWING TITLE: PIPE WORK DETAILS
SHEET 3

PROJECT No	DRAWING No	REVISION
19-0118	D17	B

FOR CONSTRUCTION



PLAN VIEW



DETAIL D (D08)
SECTION VIEW
SCALE 1:50

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

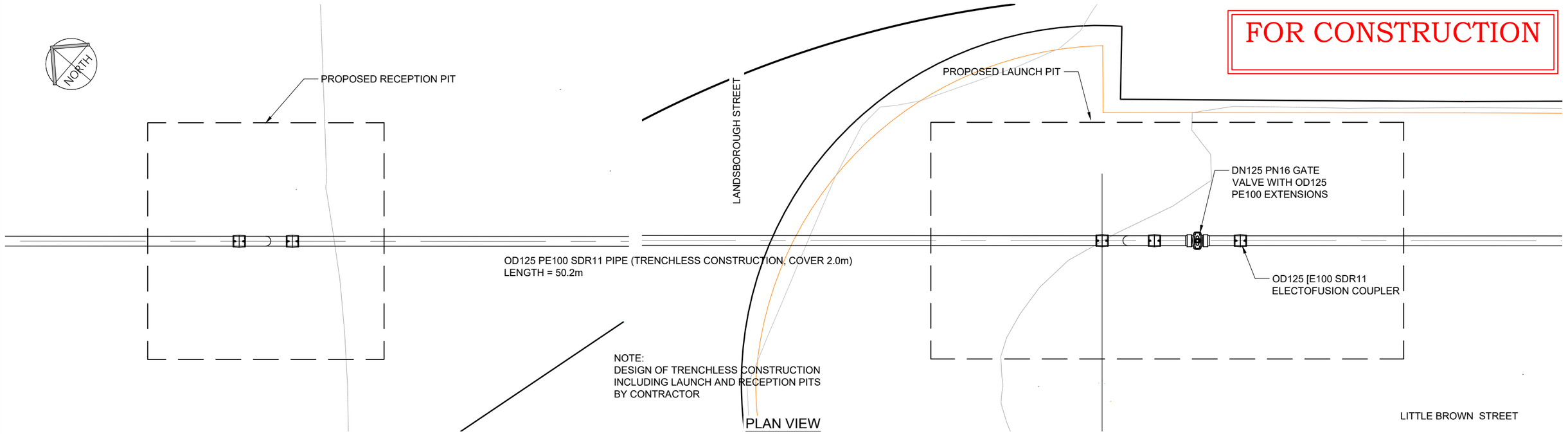
0 1.0
SCALE 1:50
A3

ISSUED FOR CONSTRUCTION

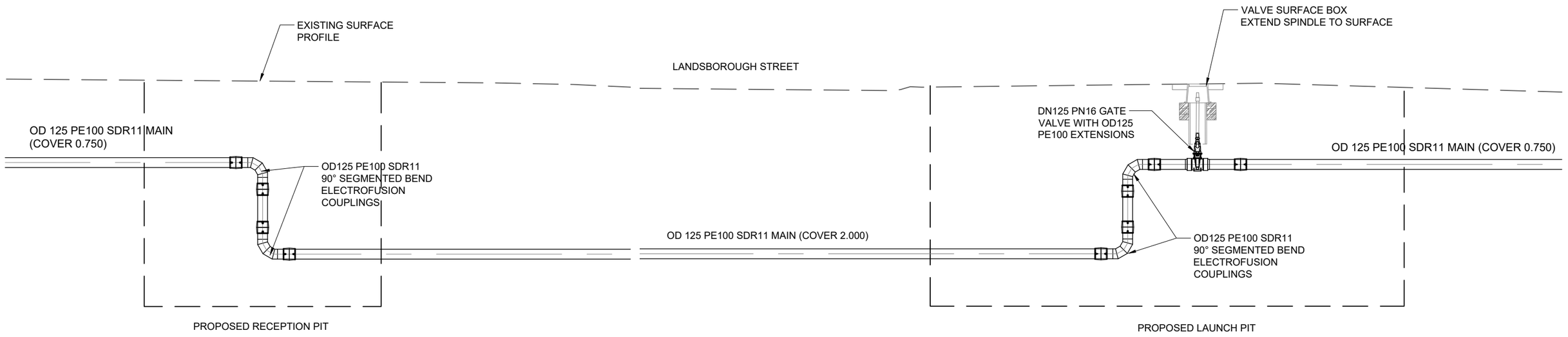
CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: PIPE WORK DETAILS SHEET 4
PROJECT No: 19-0118 | DRAWING No: D18 | REVISION: B

FOR CONSTRUCTION



PLAN VIEW



DETAIL D (D07)
SECTION VIEW

SCALE 1:10

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

0 1.0
SCALE 1:50
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: PIPE WORK DETAILS SHEET 5
PROJECT No: 19-0118 | DRAWING No: D19 | REVISION: B

FOR CONSTRUCTION

NORTH

SUPPLY AND LAY COMMS CONDUIT WITH 2 CABLE PULL STRINGS OR AS DIRECTED BY COUNCIL

RAW WATER SUPPLY MAIN TO HEADER TANKS FREER DETAILS DRAWING NUMBER D24

ELECTRICAL PIT FOR POWER AND COMMS

E. 508136.13
N. 8046232.01

E. 508134.81
N. 8046233.84

E. 508131.57
N. 8046237.64

RWS03

RWS02

150 THICK REINFORCED CONCRETE SLAB

OVERFLOW

TANK 1

TANK 2

CENTER
E. 508134.02
N. 8046239.74

CENTER
E. 508137.27
N. 8046235.94

550

208

OD180 PE100 SDR11 RAW WATER SUPPLY MAIN

E. 508134.14
N. 8046242.80

CROSS CONNECTION PIPE WORK REFER DETAILS DRAWING NUMBER D23

5000

225

9500

HEADER TANKS - DETAILS TO BE CONFIRMED BY SUPPLIER

2 OFF 20kL POLY TANKS
Ø3860 x 3.15mHIGH

INLET	2.175m HIGH
OUTLET	0.150m HIGH
OVERFLOW	2.500m HIGH

TO BE ADVISED BY TANK SUPPLIER

EXTERNAL ELECTRICAL CONNECTION

200 HIGH UPSTAND WIDTH TO SUIT SHED DESIGN

SWITCHBOARD BY OTHERS

E. 508126.67
N. 8046249.57

MINIMUM 150 THICK COMPACTED ROAD BASE RAMP TO ROLLER DOOR

SECURE LOUVRES

FALL

1800 x 3000 ROLLER DOOR

3500

850

OD125 PE100 SDR11 DISTRIBUTION MAIN

GHV30-15SV BOOSTER PUMP SET WITH SST VALVES, INTERGRAL SURGE TANK AND PRESSURE SUSTAINING TANK

CONNECTION TO IRRIGATION NETWORK REFER DETAILS DRAWING NUMBER D23

SECURE LOUVRES

500

3000

E. 508127.38
N. 8046254.12

NOTE:

REFER DRAWING NUMBER D25 FOR BOOSTER PUMP STATION FITTING SUMMARY

BOOSTER PUMP STATION GENERAL ARRANGEMENT

SCALE 1:100

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

0 2.0
SCALE 1:100
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20

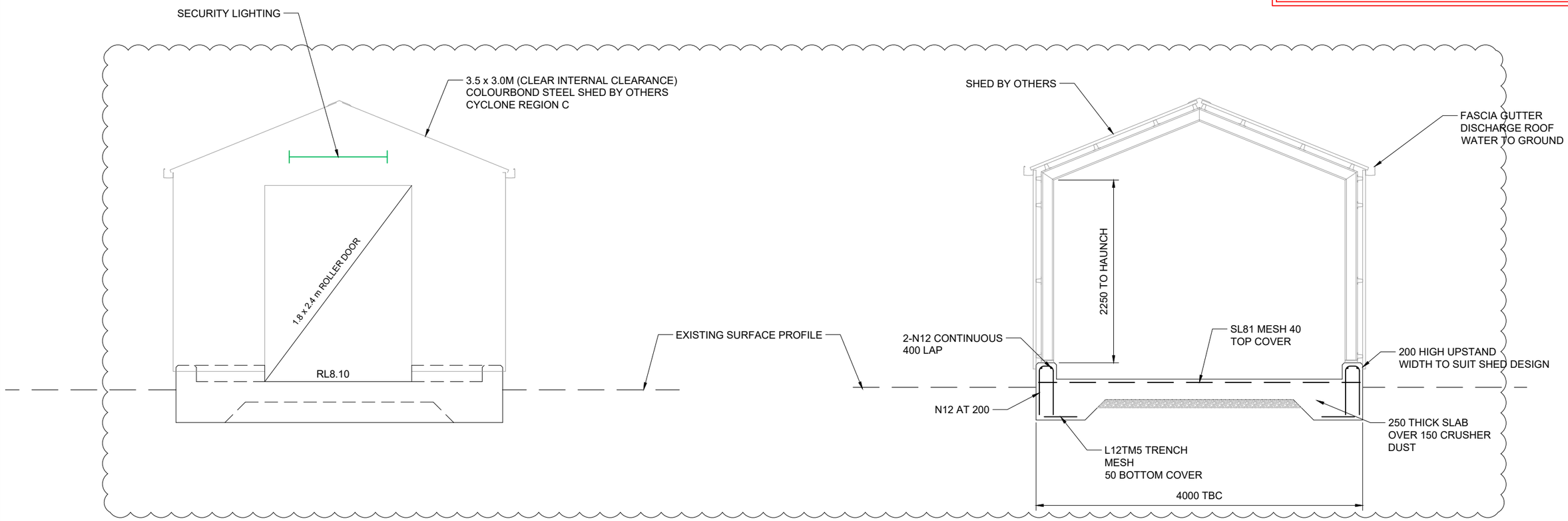
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: BOOSTER PUMP STANTION GENERAL ARRANGEMENT

PROJECT No: 19-0118 | DRAWING No: D20 | REVISION: B

FOR CONSTRUCTION



BOOSTER PUMP STATION
NORTH ELEVATION

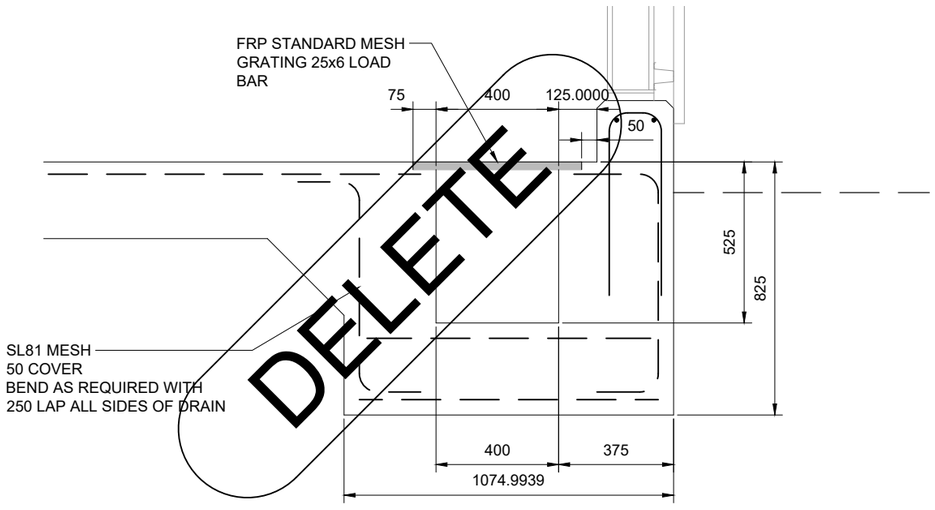
SCALE 1:50

PUMP SHED:

DESIGN	CYCLONE REGION C
FRAME	GALVANISED STEEL PORTAL FRAME - 2850 TO HAUNCH
CLADDING	COLOURBOND ROOF AND WALL SHEETING - COLOUR TO BE CONFIRMED
WALL FRAMING	GALVANISED STEEL GIRTS
ROOF	15° PITCH (OR AS SUPPLIER SPECIFIES)
ACCESS	1 OFF 1.8 x 2.4m COLOURBOND ROLLER SHUTTER DOOR 1 OFF STAND ACCESS DOOR
VENTILATION	2 OFF 0.6m WIDE x 1.2m DEEP LOUVRE WINDOWS FIXED IN OPEN POSITION WITH INTEGRAL SECURITY BARS VENT- A-ROOF RIDGE VENT FOR FULL LENGTH OF SHED RIDGE
LIGHTING	1 OFF INTERNAL LED FITTINGS 2 OFF EXTERNAL SECURITY LED FITTINGS OVER EACH ACCESS

BOOSTER PUMP STATION
TYPICAL SECTION

SCALE 1:50



BOOSTER PUMP STATION
GRATED DRAIN

SCALE 1:20

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20

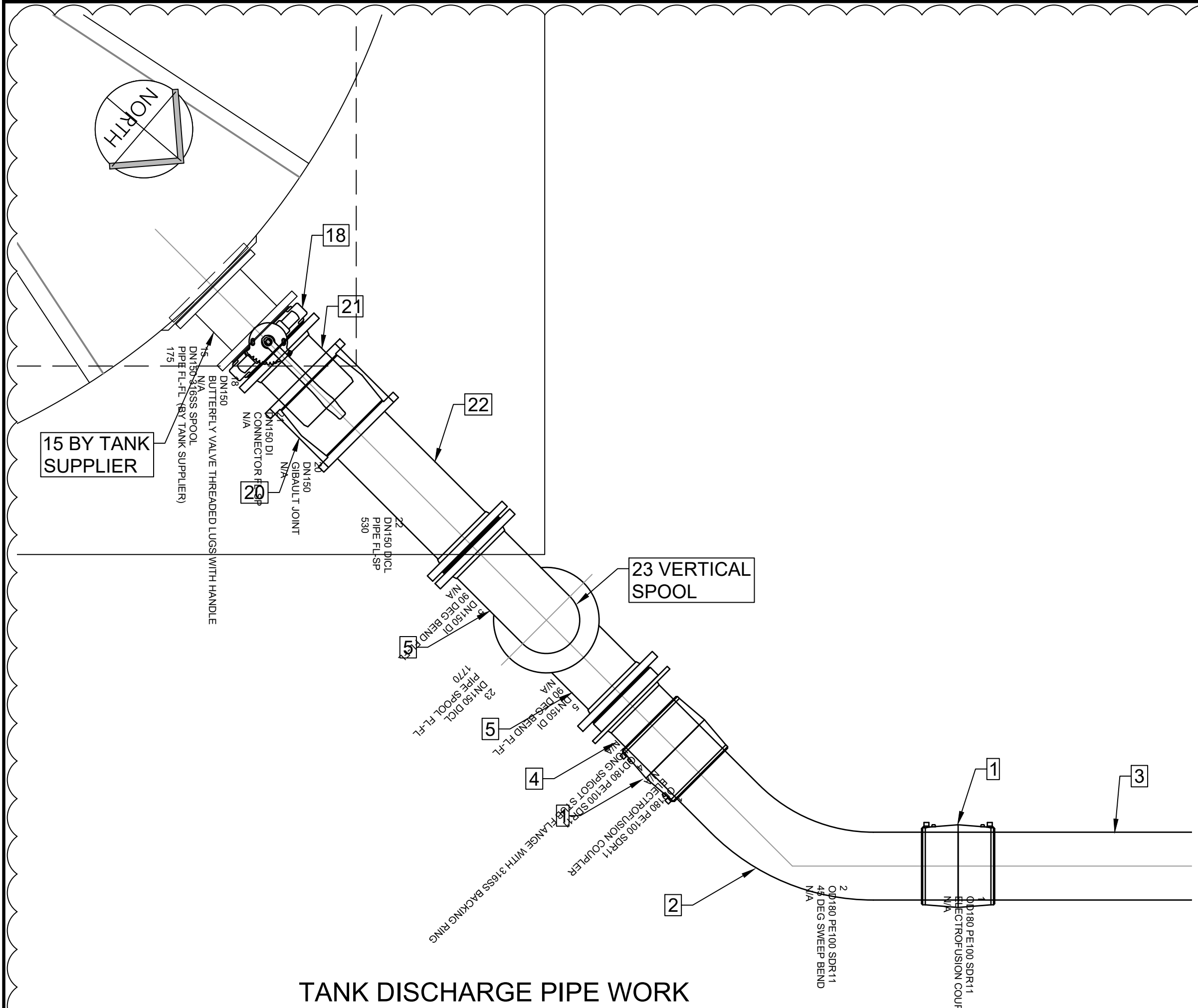
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: BOOSTER PUMP STATION DETAILS

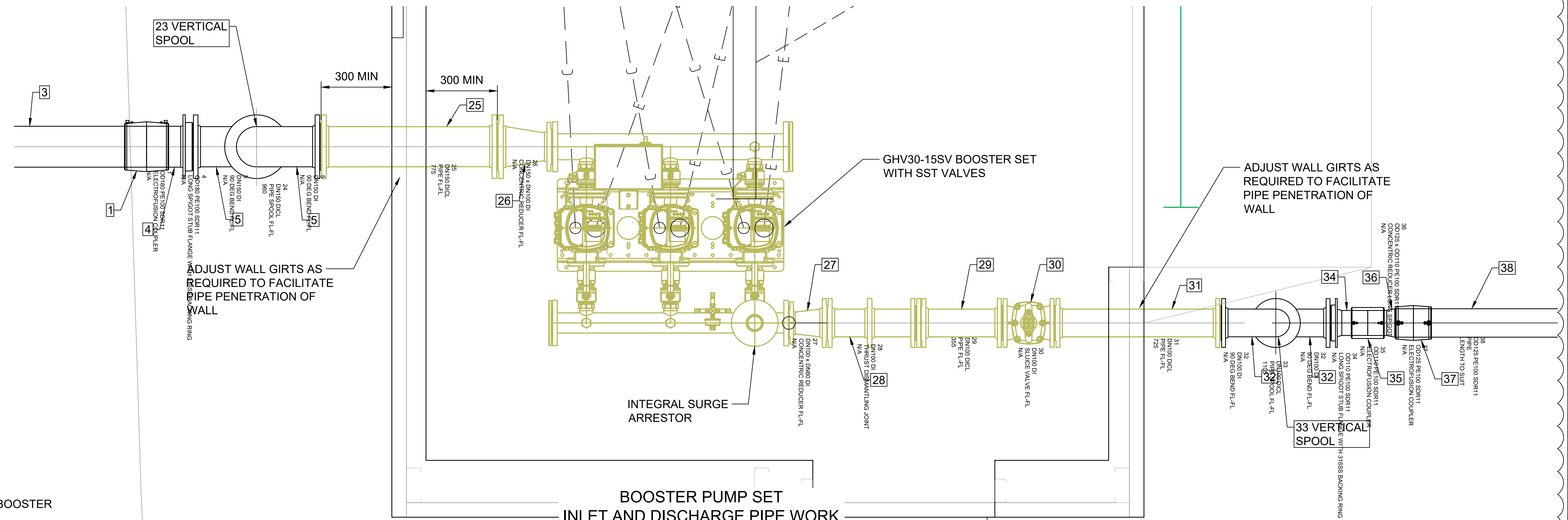
PROJECT No: 19-0118 | DRAWING No: D21 | REVISION: B

FOR CONSTRUCTION



TANK DISCHARGE PIPE WORK

SCALE 1:20



BOOSTER PUMP SET
INLET AND DISCHARGE PIPE WORK

SCALE 1:20

NOTE:

REFER DRAWING NUMBER D25 FOR BOOSTER PUMP STATION FITTING SUMMARY

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

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SCALE 1:20
A3

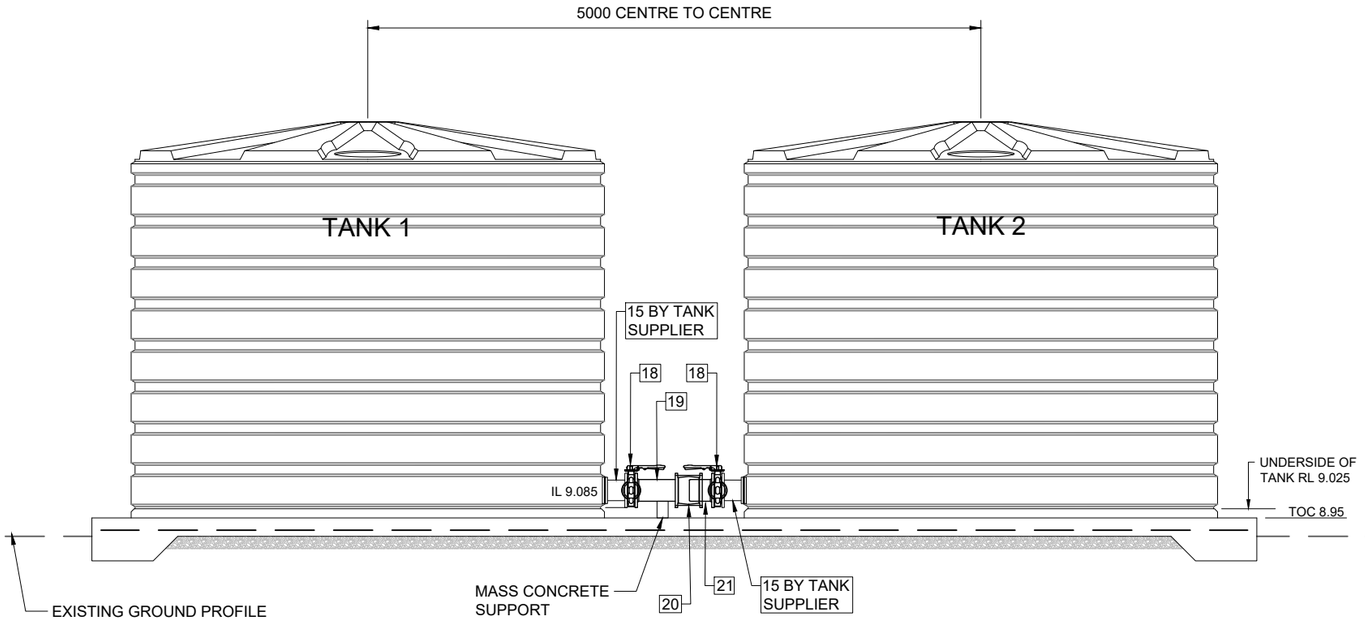
ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 1
PROJECT No: 19-0118 | DRAWING No: D22 | REVISION: B

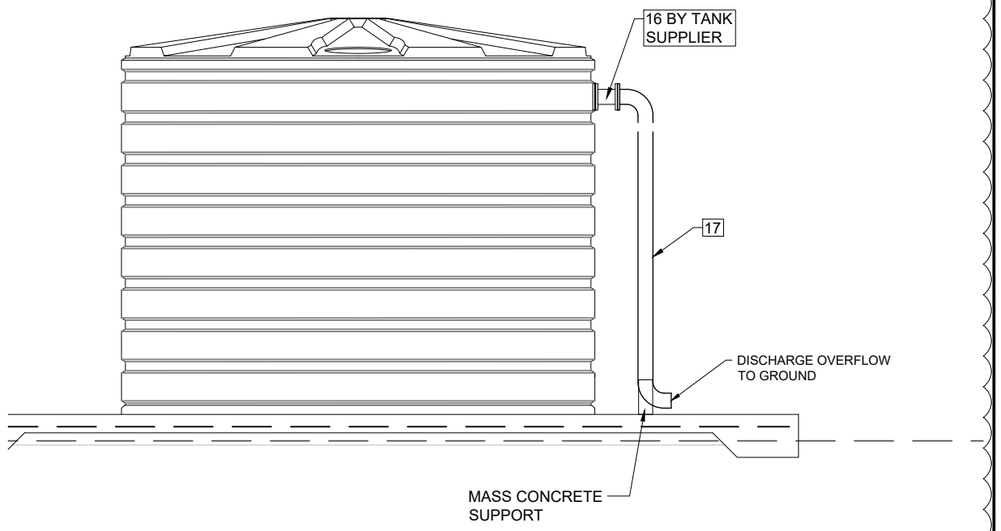
NOTE:

REFER DRAWING NUMBER D25 FOR BOOSTER PUMP STATION FITTING SUMMARY



TANK INTERCONNECTION PIPE WORK

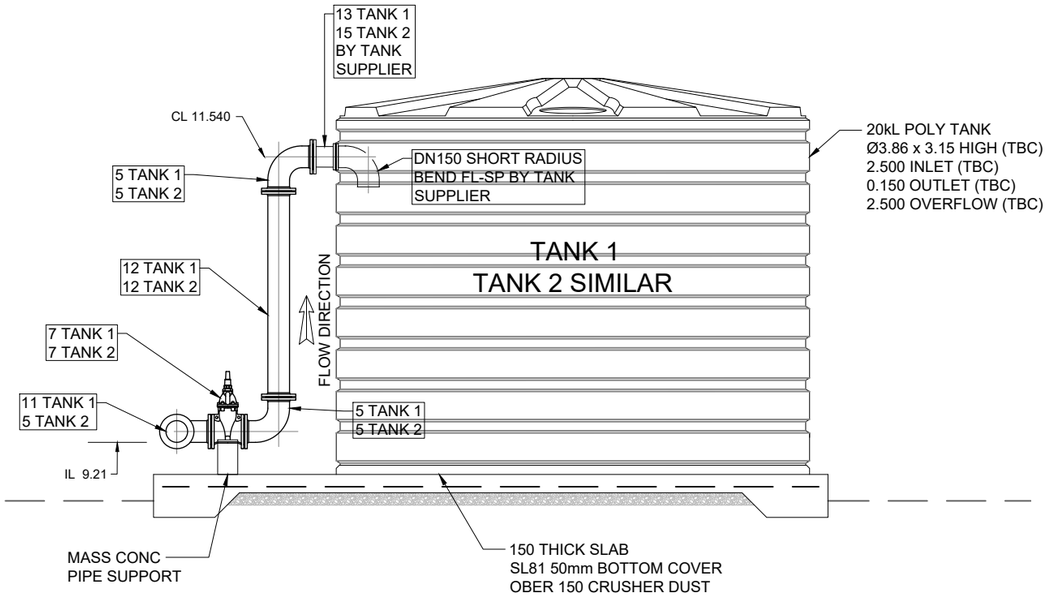
SCALE 1:50



TANK OVERFLOW PIPE WORK

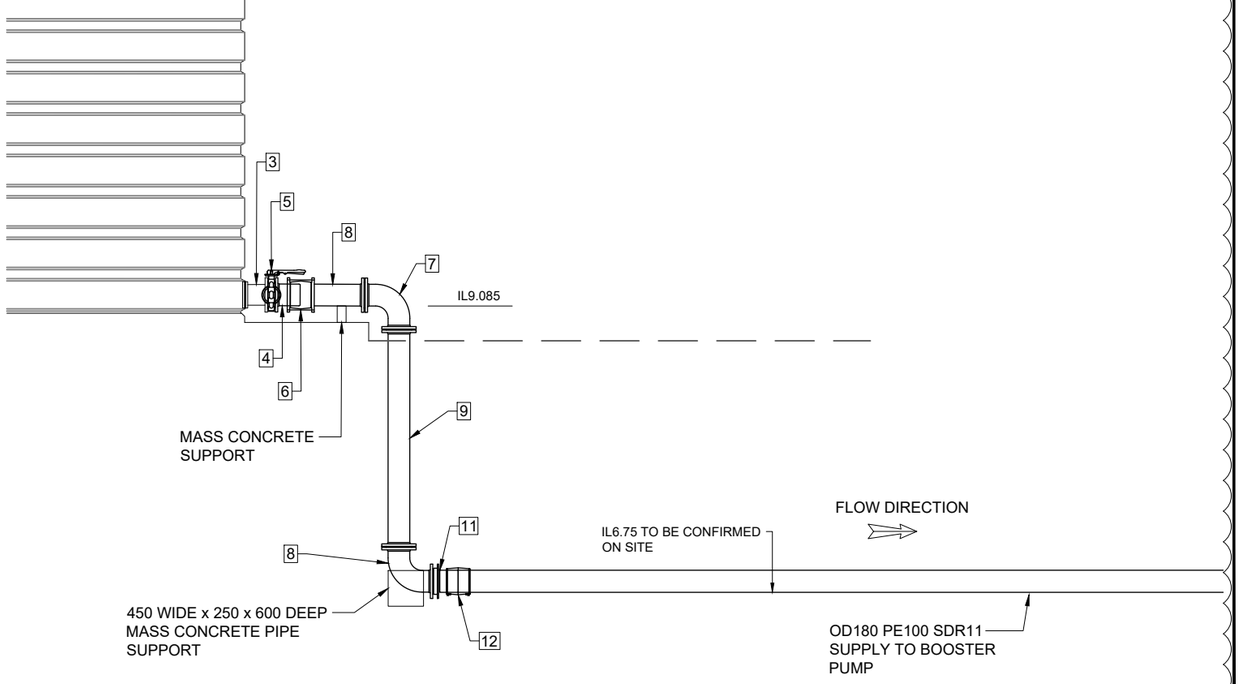
SCALE 1:50

FLOW DIRECTION



HEADER TANK INLET PIPE WORK

SCALE 1:50



DISCHARGE PIPE WORK

SCALE 1:50

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

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SCALE 1:50

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20

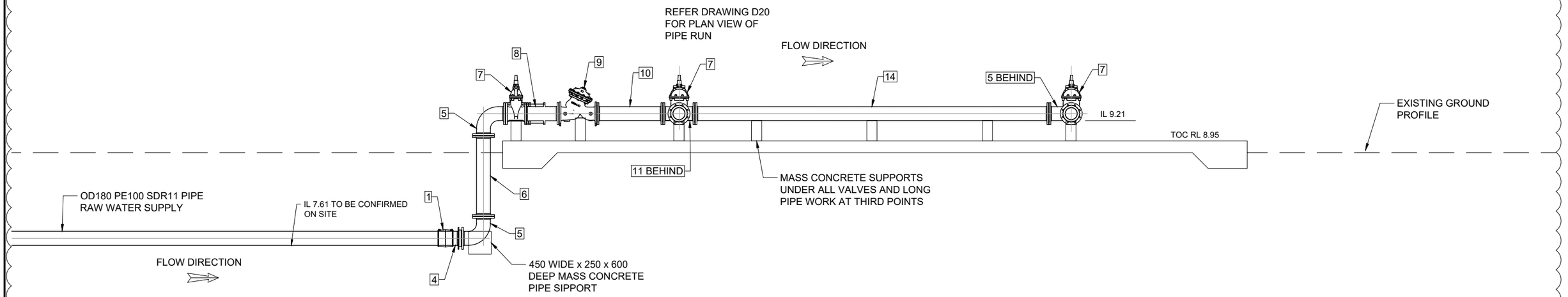
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: BOOSTER PUMP STATION PIPE WORK DETAILS SHEET 2

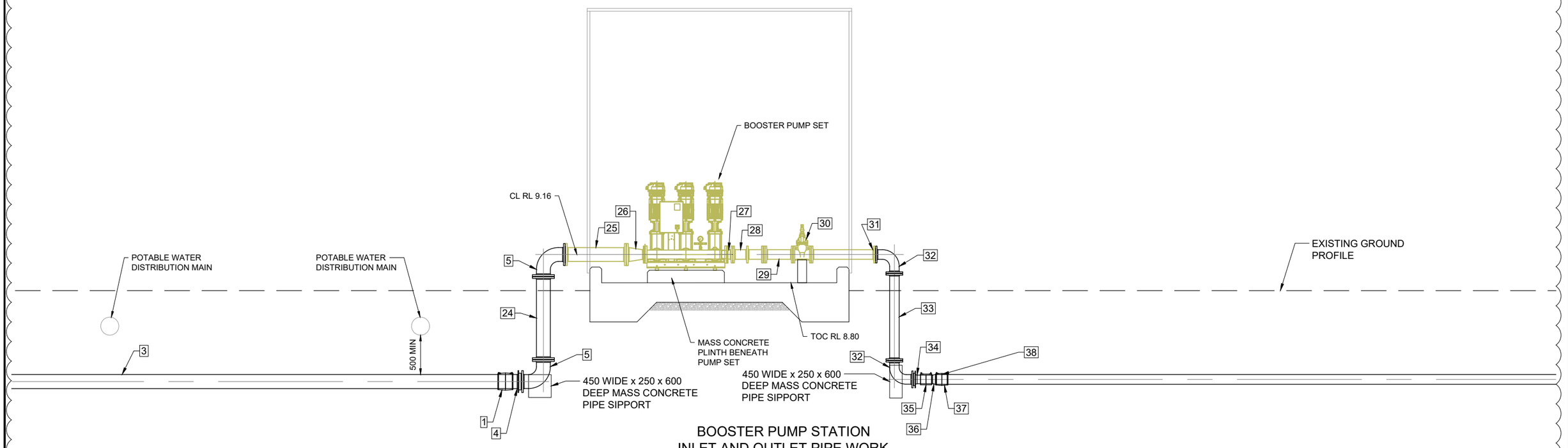
PROJECT No: 19-0118 | DRAWING No: D23 | REVISION: B

FOR CONSTRUCTION



RAW WATER SUPPLY
PIPE WORK

SCALE 1:50



BOOSTER PUMP STATION
INLET AND OUTLET PIPE WORK

SCALE 1:50

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
B	ISSUE FOR CONSTRUCTION	TC	22/09/20
A	ISSUE FOR TENDER	TC	10/08/20

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SCALE 1:50
A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL
DRAWN: PJM | DESIGNED: PJM | DATE: 10/08/20
RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT
DRAWING TITLE: BOOSTER PUMP STATION
PIPE WORK DETAILS SHEET 3
PROJECT No: 19-0118 | DRAWING No: D24 | REVISION: B

BOOSTER PUMP STATION FITTING SUMMARY

FOR CONSTRUCTION

ITEM No.	FITTING MATERIAL	FITTING DESCRIPTION	LENGTH (mm)	No. OFF
1	OD180 PE100 SDR11	ELECTROFUSION COUPLER	N/A	7
2	OD180 PE100 SDR11	45 DEG SWEEP BEND	N/A	3
3	OD180 PE100 SDR11	PIPE	LENGTH TO SUIT	2
4	OD180 PE100 SDR11	LONG SPIGOT STUB FLANGE WITH 316SS BACKING RING	N/A	3
5	DN150 DI	90 DEG BEND FL-FL	N/A	11
6	DN150 DICL	PIPE SPOOL FL-FL	1025	1
7	DN150 DI	SLUICE VALVE FL-FL	N/A	3
8	DN150 DI	THRUST DISMANTLING JOINT	N/A	1
9	DN150 DI	WW750-66-Sigma EN ES LEVEL CONTROL VALVE WITH VERTICAL BI LEVEL FLOAT, WITH FLOAT CONTROL IN TANK 1	N/A	1
10	DN150 DICL	PIPE FL-FL	840	1
11	DN150 DI	EQUAL TEE FL-FLxFL	N/A	1
12	DN150 DICL	PIPE FL-FL	1675	2
13	DN150 316SS SPOOL	PIPE FL-FL (BY TANK SUPPLIER)	250	1
14	DN150 DICL	PIPE FL-FL	4512	1
15	DN150 316SS SPOOL	PIPE FL-FL (BY TANK SUPPLIER)	175	4
16	DN100 316SS SPOOL	PIPE FL-FL (BY TANK SUPPLIER)	175	2
17	OD110 PE100 SDR11	OVER FLOW PIPE	TO SUIT	2
18	DN150	BUTTERFLY VALVE THREADED LUGS WITH HANDLE	N/A	3
19	DN150 DICL	PIPE FL-SP	455	1
20	DN150	GIBAULT JOINT	N/A	2
21	DN150 DI	CONNECTOR FL-SP	N/A	2
22	DN150 DICL	PIPE FL-SP	530	1
23	DN150 DICL	PIPE SPOOL FL-FL	1770	1
24	DN150 DICL	PIPE SPOOL FL-FL	960	1
25	DN150 DICL	PIPE FL-FL	775	1
26	DN150 x DN100 DI	CONCENTRIC REDUCER FL-FL	N/A	1
27	DN100 x DN80 DI	CONCENTRIC REDUCER FL-FL	N/A	1
28	DN100 DI	THRUST DISMANTLING JOINT	N/A	1
29	DN100 DICL	PIPE FL-FL	355	1
30	DN100 DI	SLUICE VALVE FL-FL	N/A	1
31	DN100 DICL	PIPE FL-FL	725	1
32	DN100 DI	90 DEG BEND FL-FL	N/A	2
33	DN100 DICL	PIPE SPOOL FL-FL	1105	1
34	OD110 PE100 SDR11	LONG SPIGOT STUB FLANGE WITH 316SS BACKING RING	N/A	1
35	OD110 PE100 SDR11	ELECTROFUSION COUPLER	N/A	1
36	OD125 x OD110 PE100 SDR11	CONCENTRIC REDUCER LONG SPIGOT	N/A	1
37	OD125 PE100 SDR11	ELECTROFUSION COUPLER	N/A	1
38	OD125 PE100 SDR11	PIPE	LENGTH TO SUIT	1

NOTE:
PIPE LENGTHS INDICATED IN THE ABOVE TABLE, "BOOSTER PUMP STATION FITTING SUMMARY", ARE INDICATIVE ONLY. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONFIRM PIPE LENGTHS PRIOR TO FABRICATION.

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ISSUE FOR CONSTRUCTION	TC	22/09/20

A3

ISSUED FOR CONSTRUCTION

CLIENT: CARPENTARIA SIRE COUNCIL

DRAWN	DESIGNED	DATE
PJM	PJM	22/09/20

RPEQ / SIGNATURE (IF REQUIRED)

PROJECT: NORMANTON RAW WATER PROJECT

DRAWING TITLE: BOOSTER PUMP STATION
PIPE WORK DETAILS SHEET 4

PROJECT No	DRAWING No	REVISION
19-0118	D25	A

APPENDIX C

Stage 1 Raw Water Irrigation Design

NORMANTON
RAW WATER IRRIGATION NETWORK
DESIGN REPORT

CLIENT: CARPENTARIA SHIRE COUNCIL

DOCUMENT NUMBER: R1431

VERSION: A

DATE: 01/09/2020

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1 INTRODUCTION

Topo Pty Ltd were commissioned by Carpentaria Shire Council (CSC) to undertake the detailed design of a raw water irrigation system for the town of Normanton, Queensland. The purpose of the irrigation network is to reduce loading on the existing Water Treatment Plant (WTP) and provide greenspaces within the township. The following key properties have been proposed for connection.

- School and sporting grounds
- Cricket oval
- Albion Hotel and Central Hotel
- Gulf Christian College
- CWA Park and Memorial Park
- Council grounds, police station and court house
- Local pub outdoor areas
- Caravan park
- Median strips

The overall design consisted of a connection to the DN250 raw water main supplying the Normanton Water Treatment Plant (WTP) and installing a new header tank and pump station to service the downstream irrigation system, comprising of PE50, PE125 and PE180 pipework. Refer Appendix 1 for a concept layout of the proposed network.

2 SCOPE OF WORKS

The scope of the engagement included the following design outcomes.

1. Undertaking of preliminary investigations and field surveys.
2. Provision of concept design drawings for review by CSC.
3. Hydraulic modelling and report to size infrastructure.
4. Provision of preliminary design drawings for review by CSC, including:
   - All civil and mechanical drawings for the connection to the AC DN250 raw water main, pump station, 2 x 20,000 L header tank, pipework and valves/fittings.
   - Detailed "Issued for Tender" and "Issued for Construction (IFC)" design drawings.
   - Note: Electrical design to be completed by Others
5. Engineering Design Report and Technical Specifications.

3 SPECIFICATIONS

The specifications adopted for the design of the pump station include.

- CSC's *FNQROC Development Manual Design Manual D6 - 03/17*.
- *Water Supply Code of Australia South East Queensland Service Providers Edition Version 1.3 (2019)*.
- *South East Queensland Water Supply and Sewerage Design and Construction Code* (2020).

4 TECHNICAL DATA AND HYDRAULIC CALCULATIONS

The Glenore Weir pumps delivery flow was adopted at 40 L/s @ 57 m head, as advised by CSC. The hydraulic model initially showed a delivery flow of 38 L/s and negative pressures downstream within the DN250 raw water main. The roughness coefficient was therefore increased from 110 to 120 to achieve the estimated pressures and pump duty flow commonly observed in the field (40 L/s). This reduction in pipe roughness was deemed acceptable as a 110 HW coefficient can be considered conservative for a DN250 pipe, and the flow rates through the pipeline should theoretically remain as per those observed in the field (40 L/s), i.e. the proposed irrigation system shouldn't increase water flow rates/consumption, it will merely redirect existing irrigation demands to the header tanks, as opposed to the WTP.

For the design process of the irrigation network, the internal pipe diameter of OD50 PE, OD125 PE and OD180 PE pipework was adopted at 40mm, 100 mm and 150 mm respectively. The Hazen Williams pipe roughness was adopted at '100' for an internal pipe diameter less than 150 mm and '110' for pipe diameter at or above 150 mm. Total pipe lengths are estimated at 440 m for PE50, 1,570 m for PE125 and 275 m for PE180.

For the proposed pump station at the WTP, the peak flow delivery was estimated at approximately 10 L/s @ 43 m, in order to achieve CSC's design standards and provide adequate service pressures for head loss across property connections, meter assemblies and internal irrigation pipework (estimated at 8 to 10 m). The irrigation demands were based on the assumption of 2 x hoses operating at 20 L/minute, per connection. The hydraulic model presented the following outcomes based on these demands.

- Minimum network pressure of 30.0 m, located at node J88 (RL 9 m).
- Maximum network pressure of 35.7 m, located at node J92 (RL 6 m).
- Maximum pipe velocity of 0.9 m/s, located on the western boundary of Joyce Travers CWA park on pipe P173.

Note the "head loss per km" design standard was largely excluded from the modelling assessment as higher pipe flow velocities was adopted to potentially remove settled organics within the network.

The pump skid level was adopted at RL 9 m AHD and upstream header tanks operating at 1 m water level, i.e. RL 10 m AHD. The header poly tanks were sized at 2 x 20 kL to provide storage redundancy, operational flexibility and adequate NPSH for the proposed pumps. The proposed pumps are the Lowara GHV series booster set, consisting of 3 x parallel pumps.

5 TECHNICAL SPECIFICATIONS

The technical specifications for the project have been included as Appendix 3. These include the design drawings.

6 CONTROL PHILOSOPHY AND PUMP SELECTION

The control philosophy adopted is a triple pump duty/assist arrangement, with pressure control, i.e. a single pump operates at low flows to maintain downstream pressures, where each consecutive pump operates as flow increases and pressure maintenance is required. The pumps will run on rotating cycles to ensure an even lifecycle of all pumps.

The pumps selected are the Lowara GHV triplex booster set. The GHV series is equipped with e-SV vertical multistage pumps, each one fitted with a Hydrovar Variable Frequency Drive (VFD), pressure transmitters and mounted on a Stainless Baseplate. The GHV series can communicate with a BMS system via Modbus or BACnet. Further specifications and pump curves are as follows.

- STD (Watermarked Valves)
- Pumps: eSV 304SS (AS 4020 Approved), 4kw 415V
- Hydrovars: Version 5 415V
- Valves: Watermarked
- Manifolds: 316SS
- 16 Bar Rated
- Pressure Transducers: 0-16 Bar
- Lowara Hydrobox Standard Control Panel: mains isolator, circuit breaker per pump, surge protection, 4 x terminals per pump, earth bar and IP55 enclosure.

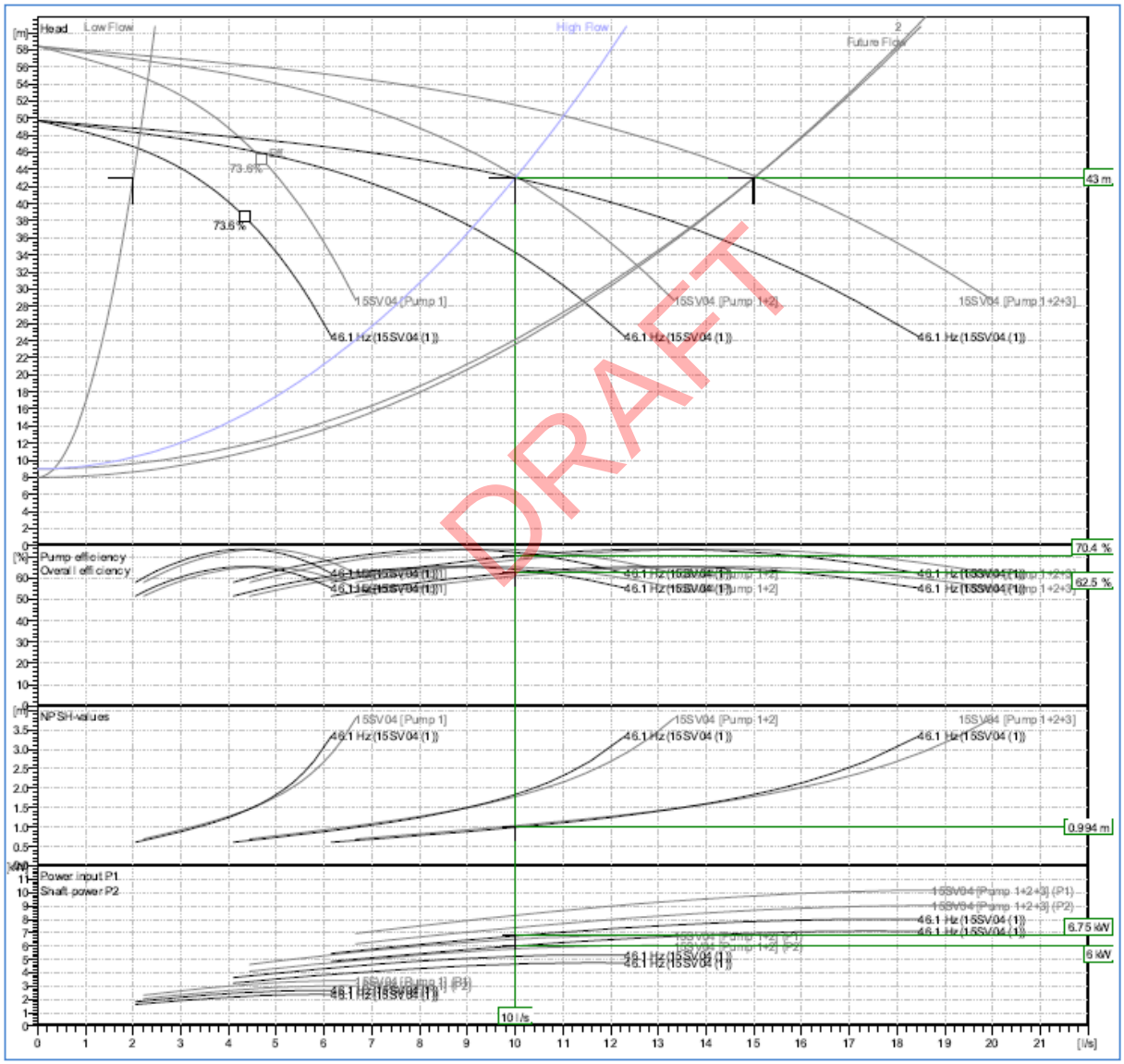


Figure 1. Lowara GHV triplex booster set pump curves

7 DESIGN CONSIDERATIONS

7.1. CONNECTION TO AC DN250 RAW WATER MAIN

Ideally, the removal and replacement with DN250 PVC-M, of a full pipe length is recommended. Once the pipe is exposed the contractor will be required to discuss the connection procedure with both the designing engineers and council representatives and will be performed with the Councils Safe Working Method Statement for handling of Asbestos Pipe.

7.2. PUMP STATION AND TANKS

Located within the Water Treatment Plant on the eastern side of the existing water tank and consists of the following infrastructure.

- 2 x 20kL poly tanks
- Installed on concrete slab
- Diameter 3860 x 3150 mm high (to be confirmed by tank supplier)
- Inlet height 2175, outlet height 150 and overflow 2500 (to be confirmed by tank supplier)
- The tank supplier will provide DN100 316SS spool for connecting external pipework and DN100 316SS inlet bend secured to the tank prior to delivery, flanges to be drilled to PN16 AS2129 and orientated to facilitate pipe fitting connections
- Raw water supply to the tanks is provided from treatment plant supply via OD180 PE100 SDR11 pipe (laid underground)

- The supply pipe exits the ground transitioning to DN100 DICL pipework which is secured to the slab on mass concrete plinths
- The water level in the tanks is controlled by an altitude valve and a two way modulating horizontal float i.e. Bermad WW750-60-Sigma EN ES Level control valve with modulating horizontal float or approved equivalent
- All valves and 90 degree bends of the inlet pipework to have mass concrete supports including 316SS strapping, and all pipe lengths to be supported to ensure that if valve is removed pipework remains in a stable condition
- The two tanks are connected by DN100 pipe work with DN100 butterfly valve with thread lugs and handle installed to facilitate the removal of the connecting pipe for maintenance without empting tanks
- Connection to the pump station is similar to the cross connection between the tanks

Pump station

- Approx. 6.0 x 4.0m pump shed
- Cyclone region C
- Galvanised steel frame (2850 to haunch of frame)
- Galvanised steel roof purlins and wall girts
- Colourbond roof and wall sheeting (colour to be confirmed)
- 1 off 3.0 x 3.0m colourbond roller door
- 1 off standard colourbond personal access door (keyed to council requirements)
- 3 off fixed 600 wide x 1200 deep fixed louvre windows with integral security bars
- Vent-a-Roof ridge roof vent (full length of ridge) https://ventaroof.com.au/new-commercial/
- 2 off internal LED light fittings secured to roof faming with light switch inside of personal access door
- 2 off external LED security lights (one of over each access point). Personal access door light to be fitted with motion sensor. Both lights to have switches inside of the personal access door.
- Fixed to concrete slab refer engineering drawings. Holding down design by shed provider
- Switchboard and electrical design by others
- Booster pump set as described in Section 5 connected to OD125 PE100 SDR11 distribution network.

7.3. PIPEWORK AND FITTINGS

Distribution network consists of OD125 PE100 SDR11 high density polyethylene pipework connected using electrofusion joins. The pipework, fittings, joining, laying and storage shall be in accordance with the recommendations of the Plastic Industry Pipe Association of Australia (PIPA) https://pipa.com.au

POP001	8.0	January, 2019	Electrofusion Jointing of PE Pipe and Fittings for Pressure Applications
POP003	7.0	June, 2018	Butt Fusion Jointing of PE Pipes and Fittings – Recommended Parameters
POP004	22	May, 2020	Polyethylene Pipe and Fittings Compounds
POP004A	1.12	July, 2019	Supplementary List – Materials Specific to Electrofusion and Moulded Fittings
POP005	7.0	April, 2019	Packaging, Handling and Storage of Polyethylene Pipes and Fittings
POP006	5.2	May, 2015	Derating Requirements for Fittings
POP007	2.6	November, 2018	Metal Backing Flanges for Use with Polyethylene (PE) Pipe Flange Adaptors

Property connections will consist of.

- In meter box with non-drinking water warning lit
  - Isolation ball valve
  - Inline meter
- In the property
  - Brass connections with a strainer installed above ground
  - Owner to connect to this connection

- Above ground pipe to be supported by 50 x 25mm recycled plastic wood (colour - white), secured 350 into ground, backfill with cement stabilised backfill

+ Provide flushing points as detailed on drawing D04 at a maximum of 60m spacing or as indicated on drawing D06 to D11.

7.4. SWITCHBOARD, TELEMETRY AND SCADA

Design completed by others.

7.5. COMPOUND FENCING AND SITE VEHICLE ACCESS

Compound fencing and site vehicle access as per existing Water Treatment Plant.

7.6. FLOOD LEVELS

Information supplied by Carpentaria Shire Council indicates that the main infrastructure (pump station) is above Q100 flood modelling and therefore was not considered during the design.

8 SAFETY IN DESIGN

Under the existing Workplace Health and Safety Regulation 2011, it is the legal obligation of designers to provide a safe design process.

Safe Design is defined in the Australian Safety and Compensation Council publication "Guidance on the Principles of Safe Design for Work" as the integration of hazard identification and risk assessment methods early in the design process to eliminate or minimise the risks of injury throughout the life of the product being designed, constructed, operated and demolished.

For this project it includes works associated with the open trench pipe laying activities, heavy load manoeuvring, electrical installation and connection to the existing Asbestos Raw Water Main. The safe design principles implemented for this project include:

+ Identifying, eliminating or minimising the workplace health and safety hazards for construction activities by implementing/proposing control measures at the design stage of the project.
+ Identification and minimising risks during both the concept and detailed design stages.
+ Managing risks on site during construction, operation and maintenance stages; and
+ Reviewing the effectiveness of control measures following commissioning.

8.1. METHODOLOGY FOR THIS PROJECT

The safe design method that has been adopted on this project was to:

+ Consult with all relevant parties involved.
+ Define the relevant safety hazards; and
+ Apportion the risk to the parties best suited to manage them.

All efforts have been made to reduce risks involved to as low as reasonably practicable. Further safe design considerations that have been adopted include:

+ Persons with control: persons who make decisions affecting the design of products, facilities or processes are able to promote health and safety at the source.
+ Product lifecycle: safe design applies to every stage in the lifecycle, from conception through to disposal. It involves eliminating hazards or preventing or minimising risks as early in the lifecycle as possible.
+ Systematic risk management: the application of hazard identification, risk assessment and risk control processes to achieve safe design.

- Safe design knowledge and capability: should be either demonstrated or acquired by persons with control over design.
- Information transfer: effective communication and documentation of design and risk control information between all persons involved in the stages of the lifecycle.

Topo Pty Ltd have conducted its own Safety in Design process and reviews. The purpose of these reviews is to identify any significant construction, operation and maintenance risks inherent in the design which could serve as a hazard in the workplace. The identification and understanding of these risks early in the project allow risk controls to be established to ensure that, where the risks cannot be eliminated by the design, they are as low as reasonably practicable by correct management and implementation of mitigation measures.

8.2. SAFETY GOALS FOR THIS PROJECT

The general health and safety goals for the project are:

- To provide a design that is safe to construct, maintain and operate over its whole life.
- To maintain a healthy and safe working environment for everyone who may be affected by the work activities being carried out and for those maintaining and operating the asset.
- To ensure the design of the works are such that construction can be completed incident free.
- To minimise the potential for environmental damage to any part of the work site.

8.3. RISK MANAGEMENT PROCESS

The adopted risk management process follows Code of Practice 'How to Manage Work Health and Safety Risks' and ISO 31000. A summary of the processes can be described through the diagram below sourced from the 'How to Manage Work Health and Safety Risks' Code of Practice (2011). This risk management process is a continual cycle that requires constant management by relevant parties until project completion.

8.3.1. STEP 1: IDENTIFY HAZARDS

A hazard is classified as something with the potential to cause harm, which generally arises from the following aspects of work and their interaction:

- Work design and management.
- Physical work environment.
- Equipment, materials and substances used; and
- Work tasks and how they are performed.

Numerous hazards exist in the design, construction and operation stages of a project, so it is important to identify hazards, so their significance can be assessed and dealt with accordingly. Hazards that have been identified as significant (hazards with severe consequences should the harm occur) include; working in trench/excavations, working at height, working in confined spaces, and working with heavy loads and working with wastewater.

8.3.2. STEP 2: ASSESS RISKS

A risk is classified as the likelihood that a consequence will occur from exposure to a hazard. Assessing identified risks will highlight their severity, and subsequently what action, if any, is required to eliminate or minimise the risk. The following risk assessment criteria has been developed and used to assess and prioritise the hazards and associated risks involved with the project:

Risk Rating Matrix

	Likelihood of Occurance				
Most Likely Consequence	5 - Very Likely	4 - Good Chance	3 - Likely	2 - Unlikely	1 - Very Unlikely
A - Disastrous	Extreme	Extreme	Extreme	Extreme	High
B - Critical	Extreme	Extreme	Extreme	High	High
C - Serious	Extreme	High	High	Moderate	Moderate
D - Significant	High	High	Moderate	Low	Low
E - Minor	Moderate	Moderate	Low	Low	Low

8.3.3. STEP 3: CONTROL RISKS

Control measures have been implemented to eliminate or minimise risks involved in the construction and operation stages of the project. The control measures adopted were chosen while considering the hierarchy of risk control, which ranks the control methods based on level of protection and reliability.

The Clients and the Contractor will be responsible for implementation of control measures identified at the design stage and to continue the risk management process throughout the construction and operation stages of the project. It is suggested that the following procedures are adopted:

- Review of safety and risks identified in the design stage.
- Make known the Hazards to all parties involved in construction and operation.
- Preparation of a Construction Safety Management Plan.
- Adhere to relevant standard procedures and safety standards.
- Preparation of Method Statements for construction works; and
- Continued monitoring of progress against safety goals set for the project.

8.3.4. STEP 4: REVIEW CONTROL MEASURES

It is important to continuously review the control measures put in place to mitigate risks throughout the life cycle of the project. This is to ensure that:

- The control measures are working as planned.
- The control measures have not introduced new problems.
- The frequency and severity of health and safety incidents are reducing over time; and
- If new legislation or new information becomes available, the current controls are still the most effective.

It is the Clients and the Contractors responsibility to review the control measures adopted during the construction and operation stages of the project. Review should be carried out at a frequency agreed upon at the start of construction, and in addition, when:

- A control measure is not effective in controlling the risk.
- Working conditions change, such that is likely to give rise to a new or different health and safety risk.
- A new hazard or risk is identified.
- The results of consultation indicate that a review is necessary; or
- A health and safety representative requests a review.

All review processes should be documented to ensure that safety matters are communicated to all relevant parties involved in the project.

8.4. OBLIGATIONS OF THE PARTIES

8.4.1. OBLIGATIONS OF THE DESIGNER

The obligation of the Designer under the Act is to ensure all elements of the design and subsequent construction are safe and without risk to health of the user. A designer must ensure that appropriate information about the safe use of plant is available. The responsibility for achieving a safe design incorporates any party in control of/or managing the design functions. This could extend to clients, developers, manufacturers, directors and managers in addition to the designer.

8.4.2. OBLIGATIONS OF THE CLIENT

The Act stipulates that if the client is aware of any information about hazards and risks relating to the site, at which the construction work is to be undertaken, the client must give this information to the designer, project manager or principal contractor. Also, the client (Carpentaria Shire Council) has an obligation to consult with:

The designer about how the construction work, in connection with the design, can be undertaken in a way that prevents or minimises all risks to health and safety; and

The construction delivery project manager or principal contractor about how the construction work can be planned and managed in a way that prevents or minimises all risks to health and safety.

8.4.3. OBLIGATIONS OF THE CONTRACTOR

Under the Act, the principal contractor is required to ensure that the construction work is planned and managed in a way that eliminates or minimises health and safety risks so far as is reasonably practicable. This includes ensuring workplace health and safety for:

- The workplace environment.
- Plant, equipment and substances being used at the workplace; and
- Work activities being performed at the workplace.

Contractors are also responsible to ensure that all employers are complying with the employer's workplace health and safety obligations.

8.5. OBLIGATIONS OF THE PROJECT MANAGERS

The Act provides that a project manager has an obligation to:

- Ensure the risk of disease or injury from a workplace is minimised for persons coming onto the workplace to work; and
- Ensure the risk of disease or injury from a workplace is minimised for all persons at or near the workplace during the construction work.

8.6. SAFETY IN DESIGN CONCLUSION

The following conclusions can be made regarding the Safety in Design for this project:

- Topo Pty Ltd have followed the following safe design procedures for this project governed by:
  - Code of Practice 'How to Manage Work Health and Safety Risks'; and
  - ISO 31000 risk management process;
  - The Australian Safety and Compensation Council publication – Guidance on the Principles of Safe Design for Work (2006);
- A design stage risk assessment has been undertaken and considers the proposed design, construction methodology for the proposed irrigation system in Normanton.

The Client and the Contractor will be responsible for implementation of control measures identified at the design stage and to continue the risk management process throughout the construction and commissioning stages of the project.

The Risk Register is provided in Appendix 2. The register captures the project risks and records the residual risks that will exist during construction, operation and ongoing maintenance of the project.

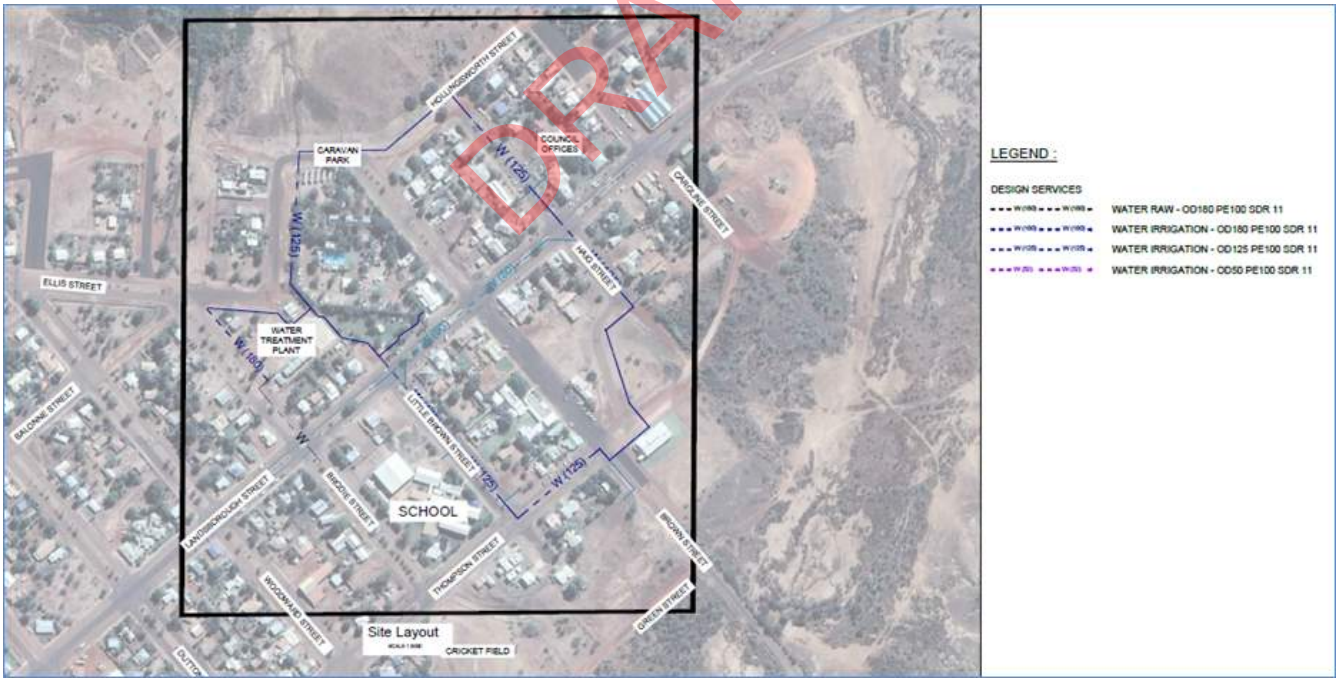
9 CONCLUSION

This report has been prepared by Topo Pty Ltd for Carpentaria Shire Council (CSC) to assist with the planning and tendering of the raw water irrigation system works at Normanton, QLD.

The information provided herein is based on information provided by CSC (Principal), Erscon Consulting Engineers (Superintendent) and Ausnorth Consultants (Surveyor).

APPENDIX 1

CONCEPT LAYOUT PROPOSED RAW WATER IRRIGATION SYSTEM



APPENDIX 2

RISK REGISTER FOR THE NORMANTON RAW WATER IRRIGATION SYSTEM

Safe Design Risk Register – Normanton, QLD Irrigation Network

Client	Carpentaria Shire Council			
Stakeholders	H2One Pty Ltd, Willow and Sparrow Pty Ltd	**Revision No.** 0		
Prepared By	Topo Pty Ltd	Project No.		
		Project Director Ronald Kleijn		

Risk Rating Matrix

	Likelihood of Occurance				
Most Likely Consequence	5 - Very Likely	4 - Good Chance	3 - Likely	2 - Unlikely	1 - Very Unlikely
A - Disastrous	Extreme	Extreme	Extreme	Extreme	High
B - Critical	Extreme	Extreme	Extreme	High	High
C - Serious	Extreme	High	High	Moderate	Moderate
D - Significant	High	High	Moderate	Low	Low
E - Minor	Moderate	Moderate	Low	Low	Low

Notes:

1. This risk register has been prepared to document the hazards and risks associated with project elements within design.
2. The construction (and commissioning), operation, maintenance phases of the project have been considered.
3. The risk register is associated with generic hazards and does not replace the need for other stakeholders to complete their own hazard identification and risk assessment for the project. The Construction Contractor must have their own risk assessment completed prior to commencing work.
4. The risk register assumes that the general public are isolated from the site by physical barrier fencing and locked during non-work hours. During working hours is assumed that the site supervised at all times.

IDENTIFY HAZARD				ASSESS RISK				IMPLEMENT RISK TREATMENT					
ID	**Risk Source (Hazard)**	**Event / Cause / Consequence**	**Persons Affected**	**Control Measure (Risk Treatment)**	**Likelihood**	**Consequence**	**Risk Rating**	**Risk Owner**	**Implement Control - Y/N?**	**Action / Comment (or justification if no action)**	**Action Owner(s)**	**Timing / Date**	**Status (Open / Closed)**
Design Phase													
1	Failure to communicate risks identified at the design stage to all parties involved	Personnel unaware of risks identified, Accidents or injuries during construction or operation stages	Client / designer / Contractor	Design stage risk assessment to be provided to all parties involved in construction and operation	2 - Unlikely	C - Serious	**Moderate**	Designer	Yes	Carry out Tool box talks and discuss risks involved with all parties - Implement control measure	Client / designer	During design	Open
2	Uncontrolled changes to scope during design or construction stages	Change elements not considered in design. Design decisions not recorded. Accidents or injuries during construction or operation stages resulting from changes	Client / designer / Contractor	Client/Contractor to obtain approval from designers for all proposed changes to design during construction stage	2 - Unlikely	B - Significant	**Low**	Designer	Yes	Carry out Tool box talks and discuss risks involved with all parties - Implement control measure	Client / designer	During design	Open
3	Information gathered for design is inaccurate or misrepresented	Errors carried through to construction and operation. Accident or injuries resulting from errors	Client / designer / Contractor	Cross checking of information provided against as constructed drawings or historical records. Verification of information through site walk over, services tracing on site and potholing, include in the design documents as a disclosure to other parties	2 - Unlikely	B - Significant	**Low**	Designer	Yes	Carry out Tool box talks and discuss risks involved with all parties - Implement control measure	Client / designer	During design	Open
Construction and Commissioning Phase													
1	Fall from height	Working over top of MH > 2m and Wet well >3m	Contractors, Supers-Rep, LCC inspectors	Work in pairs, exercise caution when inspecting and carrying out works, be aware of loose footing. Provide temporary guard rails or barrier fencing to close off area.	2 - Unlikely	C - Serious	**Moderate**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
2	Trench Collapse	Working in unsupported trench or un-benched trench > 1.5m deep	Contractors	Support Trench with trench box or provide benching/battering ensuring trench height is no greater than 1.5m. No site restrictions – one of the above must be used	2 - Unlikely	B - Critical	**High**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
3	Conflict with underground services/ underground service strike	Injury or death, loss of service	Contractors	Contractor to confirm location of underground services, via consideration of ground surface survey, DBYD, GIS, potholing data, and design alignment to be conflict free in horizontal and vertical planes. Contractor to confirm location of underground services prior to construction through new DBYD request, vacuum excavation adjacent to known crossings, exercising caution when excavating (i.e. be aware of signs of services such as marking tape)	3 - Likely	C - Serious	**High**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
4	Traffic/ Vehicle Access	Hit by vehicle	Contractors	Work in pairs, use traffic cones when working within roadway, liaise with local authorities when necessary, ensure designated drop off and parking zones are clearly marked	2 - Unlikely	C - Serious	**Moderate**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
5	Reptile/ Spider bites	Snake, Spider Bite	Contractors, Supers-Rep, LCC inspectors	Work in pairs, exercise caution when inspecting and carrying out works, wear PPE, contain emergency contact details on site at all times. Be particularly cautious of long grass, and warm dry places, under lids etc.	2 - Unlikely	C - Serious	**Moderate**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
6	Slips, trips, falls	Slips, trips, falls	Contractors,	Keep the site tidy, keep electrical wires	2 - Unlikely	D – Significant	**Low**	Contractor	Yes	Implement control measure	Contractor	During	Open

			Supers-Rep, LCC inspectors	above ground, ensure site is level and there are no holes, watch you step.								construction	
7	Sun exposure	Sun burn, heat exhaustion	Contractors, Supers-Rep, LCC inspectors	Where PPE, Sunscreen, drink regularly and stay hydrated, monitor outside temperatures and work only when fit to do so.	2 - Unlikely	D – Significant	**Low**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
8	Design changes made by the Contractor	Failure of design to meet requirements	Contractors	Follow the design at all times and consult with the Supers Rep/ design consultant should changes be required	2 - Unlikely	D – Significant	**Low**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
9	Exposure to hazardous substances	Burns, loss of site	Contractors, Supers-Rep, LCC inspectors	Store Hazardous substances in accordance with AS standards – no more than 20L of any chemical on site outside a bunded area. Use protective gear when transferring substances. Maintain MSDS on site for all substances.	2 - Unlikely	C - Serious	**Moderate**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
10	Exposure to raw water	Contact with raw water during live cut-in resulting in infection, illness	Contractors, Supers-Rep, LCC inspectors	Wash hands/body after exposure, utilize protective equipment and plan for cut-ins appropriately and liaise with the LCC prior to cut-in regarding the shutdown plan.	2 - Unlikely	C - Significant	**Low**	Contractor	Yes	Implement control measure	Contractor	During construction	Open
11	Electrocution	Contact with live electricity via contact with live mains or by generator from electrofusion welding	Contractors/ Subcontractors	Service Provider to organize electrical connection, keep all wiring isolated until connection is approved	1 – Very unlikely	B - Critical	**High**	Contractor/ Subcontractors	Yes	Implement control measure	Contractor	During construction	Open
12	Working with Asbestos Pipe	Exposure to Asbestos Fibers	Contractors/Subcontractors	Source Council Procedures for working with Asbestos Pipe	5 – Very Likely	B - Critical	**Extreme**	Contractor/ Subcontractors	Yes	Follow council procedures for handling asbestos pipe	Contractor	During construction	Open
13	Raw water supply to treatment plant	During the installation of the connection to the new booster pump station	CAC, contractor	Liaise with CSC to organize the best time to do this work	5 – Very Likely	B - Critical	**Extreme**	CSC	Yes	Liaise with CSC – best time for the disruption, how to shut down the flow to the plant, how to drain the pipe Contractor to have work plan to minimize time for the interruption of supply to treatment plant e.g. all materials at site etc	CSC Contractor	During Construction	Open

APPENDIX 3

TECHNICAL SPECIFICATIONS

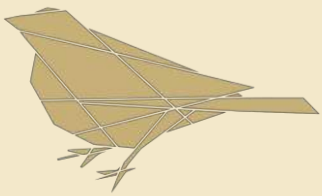
Willow + Sparrow

DRAFT

Technical Specification

Normanton Raw Water Supply Project

Prepared for: Carpentaria Shire Council



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Client name: Carpentaria Shire Council

Client's representative: Erscon Consulting Engineers

Approved for use by:

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ABBREVIATIONS

AC	Asbestos Cement
AHD	Australian Height Datum
AS	Australian Standard
CCTV	Closed-Circuit Television
CSC	Carpentaria Shire Council
DBYD	Dial Before You Dig
DICL	Ductile Iron Cement Line
DN	Nominal Diameter
HDD	Horizontal Directional Drilling
HDPE	High Density Polyethylene
MH	Maintenance Hole
NATA	National Association of Testing Authorities
PVC	Polyvinylchloride
QA	Quality Assurance

DEFINITIONS

In this Specification, unless inconsistent with the context, the following terms have the meanings indicated:

Contractor	The successful Tenderer as appointed by Council;
Contract	The legally binding agreement between two or more parties for doing or not doing something specified;
Contractor's Plant and Equipment	The vehicles, plant, implements, appliances and equipment used by the Contractor for carrying out its obligations under this Contract whether or not owned by the Contractor but specifically excluding Council's Plant and Equipment;
Council, **Principal, Client**	Carpentaria Shire Council;
Designer	A Registered Professional Engineer or qualified and certified expert within the construction method required who is appointed by the Contractor to carry out design and to issue instructions regarding standards, specification and techniques to be observed in the construction of this project;

Design Documentation	Drawings, Specifications and other Design Documentation prepared by the Designer for the purpose of the Horizontal Directional Drilling works under the Contract;
Drawings	Drawings prepared by the Designer(s) for the purpose of illustrating the design requirements for the works under the Contract;
Project Manager	A person nominated by the Contractor responsible for the construction of the contract;
Operator	Suitably trained, qualified and licensed (if applicable) person who operates machinery, an instrument, or other equipment;
Principal	An individual appointed by the Principal to perform two functions: Be the Principal's agent for the works under the Contract. Administer the Contract fairly and perform certain certifier requirements;
Principal's Representative	A person nominated by the Principal, to act on behalf of the Principal;
Specification	A document that specifies, in a complete, verifiable manner, the requirements, design, behaviour, or other characteristics of a system, component, product, result, or service;
Emergency Works	An incident, which endangers safety of general public;
Financial Schedules	Documents identified as such (which Schedules were completed by the Contractor and form part of the Tender Submission);
Innovative Work Practices	A change to methodologies which result in a demonstrated cost savings to Council and/or improvements to environmental issues;
Tender Submission	The document submitted by the Contractor to Council in response to Council's Invitation to Tender and is the document which Council relied on in selecting the Contractor as the successful Tenderer;
Works	The supply of works as specified in this document. Unless specified to the contrary in the Specification, words defined in this Contract will have the same corresponding meaning in the Specification;
Annular space / Annulus	The annular space is the space between the pipe and the existing ground conditions;

Bend Radius	The forward distance required for a drill string or pipe to make a 90-degree turn. It is an indication of how much bending the drill rod or pipe can handle without significant and possibly harmful stresses;
BHA	Bottom Hole Assembly. The combination of bit, downhole motor, subs, survey probe and nonmagnetic collars assembled at the leading edge of a drill string;
Butt Fusion	PE Welding technique where two ends of the pipes are joined using a flat heater plate under controlled temperature, time and fusion pressure;
Carrier Pipe	The pipe forming part of the permanent pipeline;
Casing Pipe	Pipe installed by Horizontal Directional Drilling or other Trenchless method to house the carrier pipe. Usually employed where the HDD process will risk damage to the carrier pipe due to the friction or pulling loads. (if applicable);
Casing Spacer	A band fitted around the carrier pipe at set spacing to prevent it making contact with the casing pipe. Usually dressed with runners that allow the carrier pipe to be pulled into place within the casing pipe;
Conductor Casing	A large casing usually installed at the entry or exit points of the HDD alignment to provide borehole support in weak or granular geological strata;
Contingency Plan	A plan for backup procedures, emergency response, and post-disaster recovery;
Cover	The distance between the top of the pipe and the surface level;
Debeading	The process of removing the molten bead formed in HDPE butt welding. The bead can be internal or external;
Entry and Exit Pit	Used as a start and finish location for the HDD under bore. Also use to contain drill slurry for the removal to a more suitable and appropriate site or recycled through a purpose-built recycling system;
Frac-out (Hydrofracture)	Inadvertent drilling fluid release through the geological strata to the surface and usually through the path of less resistance.
Hydro-lock	Is a condition that occurs when the circulation from the bore is lost and the formation is resistant to fracturing or absorption of the drilling fluid, creating a hydraulic cylinder in the ground;

Guidance System	A survey system that will accurately guide the drill head along the entire bore path. The system shall have a minimal capability of measuring lateral position, depth, rotated drill head position and gradient of the bore path;
Orientation / tool face	The rotational orientation of the drilling tool. Zero corresponds to the 12-o'clock position;
Permit	A document that controls an activity that is considered high and not able to be commenced without completing important requirements;
Pitch / Inclination	The angular deviation from true vertical;
Radius of Curvature	The distance from the centre of the circular path or configuration to the perimeter;
Safe Work Method Statement	A document summarising the work required for an activity. This document summarises the hazards and the required measures to control minimise safety risk; and
Services	A pipe or cable through which electricity, gas, water, sewage, communications etc. is conveyed.

1. PURPOSE

This document prescribes the minimum technical requirements for the proposed pipeline, pump station and associated works to be undertaken for the Normanton Raw Water Project (#19-0118). Its purpose is to ensure the technical requirements concerning the safety, quality, environmental & design objectives of the proposed works are achieved.

2. GENERAL

Carpentaria Shire Council are undertaking a project to provide various areas within the business centre of Normanton with an irrigation network to supply the residents and businesses with raw water. Currently, this infrastructure does not exist, and its impact will create a positive amenity for the town. Figure 1 shows the layout of the site and the proposed works.

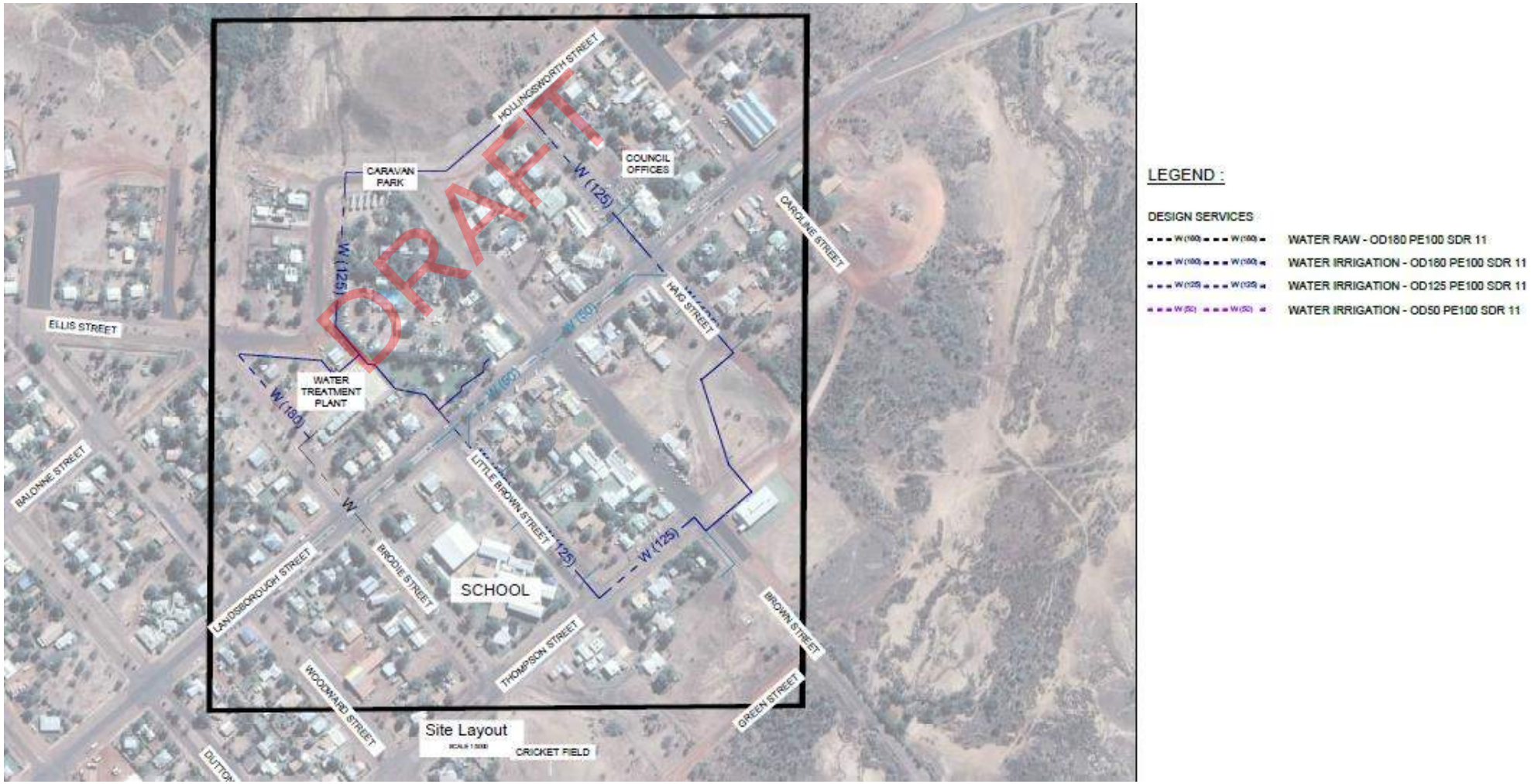
2.1. GOVERNING DOCUMENTS

The documents listed in the following table are the governing documents in relation to this Contract and describe the requirements by which the works must be undertaken.

Table 1 – Governing Documentation

Governing Documents	Description
Contract of the Works	AS4906 Minor Works Contract Conditions (Principal Administered). It defines the legal obligations under which both parties must adhere to during the undertaking of works.
Request for Quotation (RFT)	A document produced by the Client for interested parties to respond to with a conforming offer to complete the works.
Technical Specifications	Principal produced specifications (this document) are to govern the important quality and design elements of the works.
Detailed Design	The Detailed Design is produced by the Principal and is to be strictly adhered to by the Contractor. The detailed design is included with this specification.
Construction Environment Management Plan (CEMP)	A document to be supplied by the contractor communicating the minimum environmental standards to be met with respect to management, systems, qualifications, approval conditions and execution.
Safety Management Plan (SMP)	A document to be supplied by the contractor communicating the minimum safety standards to be met with respect to management, systems, qualifications, and execution.

Figure 1 – Site layout and extent of proposed Works



3. STANDARDS AND RELATED SPECIFICATIONS

Materials, workmanship and work practices, testing methods and reporting shall comply with the latest revisions of relevant standards, codes and guidelines of the following authorities and technical organisations. The proposed Works to which this Specification is applicable shall comply with, but not be limited to, the latest edition of the following codes and standards listed below.

3.1. CARPENTARIA SHIRE STANDARDS

- Water Supply Code of Australia Version 3.1(2011), Water Services Association of Australia
- Sewerage Pumping Station Code of Australia Version 2.1(2005), Water services Association of Australia
- Polyethylene Pipeline Code, Version 3.1 (2004), Water Services Association of Australia
- Far North Queensland Regional Organisation of The Principals standard drawings

3.2. INTERNATIONAL STANDARDS

- AS/NZS ISO 9001 Quality Management Systems – Requirements
- AS/NZS ISO 14000 Environmental Management Systems
- ANSI/API 5DP Specification for Drill Pipe

3.3. AUSTRALIAN STANDARDS

- AS 2566 - Buried Flexible Pipelines
- AS 4130 - Polyethylene (PE) Pipes for Pressure Applications
- AS 4020 - Testing of Product for use in contact with Drinking Water
- AS 4041 - Pressure Piping
- AS 2033 - Installation on Polyethylene Piping Systems
- AS 2032 – Installation of PVC Piping Systems

3.4. PLASTIC INDUSTRY PIPE ASSOCIATION OF AUSTRALIA LIMITED

- POP003 – Butt Fusion Jointing of PE Pipes and Fittings – Recommended Parameters
- POP005 – Packaging, Handling and Storage of Polyethylene Pipes and Fittings
- POP014 – Assessment of Polyethylene Welds
- POP202 – PVC and PE Pressure Pipe Installation on Curved Alignments

3.5. OTHER REFERENCES

- Work Health and Safety Regulation 2011 including Safe Design of Structures Code of Practice
- WAS 01 – 2004 – Polyethylene Pipeline Code
- NASTT (2008). Horizontal Directional Drilling Good Practices, 3rd Edition. Bennett, D. Ariaratnam, S.T. Como, C.E. 2004, Horizontal Directional Drilling Good Practices Guidelines, HDD Consortium, Virginia, USA.

3.6. ORDER OF PRECEDENCE

This Specification shall be read in conjunction with the scope of work, detailed drawings and datasheets referenced in the Contract. Should the Contractor propose any deviations from the specified requirements, such variations shall be submitted to the Principal in writing for approval.

3.7. PRINCIPAL DRAWINGS AND FINAL DESIGN

The Principal Drawings are RPEQ Certified Detailed Design plans (Issued for Tender) and are provided in **Appendix A**. They outline the Principal's project requirements and present a survey accurate alignment with start and end points for all proposed pipeline sections. The Contractor is to use these drawings to construct the proposed raw water pipeline and pump station infrastructure. The Principal's Drawings illustrate the following project elements:

- Site constraints.
- Survey accurate mapping of existing services limited to the locations in which potholing/survey was undertaken.
- Pipeline alignments and lengths for various pipeline sections.
- All connection and meter locations
- Trench and embedment details
- Required pit locations for trenchless pipeline installations.
- Booster pump station pump and pipework details
- Reinstatement requirements
- Trees to be retained and protected during the works

From this information the Contractor will be required to source all necessary materials to facilitate the works.

3.8. CHANGE MANAGEMENT

The Contractor may propose alternative methods, plant, equipment, or materials to complete the works under the contract provided that the proposal achieves:

- The minimum requirements to an approved alternative standard.

Any deviation from this Specification or a referenced document must be approved in writing by the Principal. The Contractor is to allow two weeks for approval of any change to this Specification.

4. SCOPE OF WORKS

MILESTONE 1: PROJECT PRELIMINARIES

This milestone must include the following aspects of the works, including but not limited to:

i. Prepare and issue program or works prior to mobilisation to site and progressively update monthly and provide to the Principal.

ii. Prepare and submit to the Principal for approval the following documentation. The Contractor shall allow a minimum of 2 weeks for review and approval by the Principal prior to implementation.

- Construction and Environmental Management Plan (CEMP) including proposed methodology
- Safety Management Plan (SMP) an associated project Safe Work Method Statements (SWMS)
- Quality Management Plan, including a set of all proposed project Information Test Plans (ITPs)
- Project Traffic Management Plan

iii. Obtain approvals for traffic management and working on the roads.

iv. Obtain all relevant permits and approvals as per Sections 7 and 8.

v. Carry out project planning requirements as per Section 9 and 10 including Pre-construction investigation, site survey works and location of all surface fittings and underground and / or overhead services.

vi. Pre-construction comprehensive site dilapidation survey by way of photographic record that covers the pipeline alignment and the area to be covered by the pump station building and storage facilities. Access and egress areas must also be covered by the survey.

vii. Carry out DBYD.

viii. Site mobilisation and provision of site barrier fencing and establishment of pedestrian corridors and public exclusion zones, signage etc.

MILESTONE 2: RAW WATER PIPELINE INSTALLATION

This milestone must include the supply of all plant, materials and labour to carry out the following aspects of works, including but not limited to:

i. Undertake service location via vacuum excavation for all necessary services to ensure adequate clearance is achieved.

ii. Installation via open trench construction of 237m of OD180 PE100 SDR11 raw water supply pipe around the existing water treatment plant located at 1 Brodie Street.

iii. Installation via open trench construction of approximately 1.3km of OD125 PE100 SDR11 irrigation distribution pipe throughout the centre of town between Brodie Street and Haig Street.

iv. Installation via trenchless methods (horizontal directional drilling).

v. Installation via open trench construction of approximately 350m of OD50 PE100 SDR11 pipe along the median strip of Landsborough Street from the intersection with Little Brown Street to Haig Street.

vi. Installation of various (No. 13) property connections totalling approximately 570m in length.

vii. Installation of 17 main flushing points on PE100 SDR11 mains of the following diameters:

- 1 x OD180
- 12 x OD125
- 4 x OD50

viii. Installation of all valve surface boxes and surface fixtures / markers etc.

ix. Carry out the following prior to carrying out connection to existing mains.

- Conduct third party NATA accredited hydrostatic testing of the pipeline. Test pressure shall be a minimum of 1.5 times the operating pressure, unless approved otherwise by the Principal.

x. Undertake connection works as per details in the Design Drawings in **Appendix A**. The contractor is responsible for coordinating all shutdown and connection activities with the Principal.

MILESTONE 3: BOOSTER PUMP STATION, STORAGE TANKS AND ASSOCIATED WORKS

This milestone must include the supply of all plant, materials, and labour to carry out the following aspects of works, including but not limited to:

i. Installation of three (3) Lowara multistage pumps with Hydrovars - Version 5 415V - eSV 304SS (AS 4020 Approved), 4kw 415V (or approved equivalent) with the following provisions:

- Valves – Watermarked
- Manifolds – 316SS
- 16 Bar rated
- 0-16 Bar Pressure transducers
- Lowara Hydrobox Standard Control Panel - Inclusions :Mains Isolator ,Circuit breaker per pump, Surge protection to suit number the number of pumps, 4 x terminals per pump, earth bar, IP55 enclosure
- A pressure vessel

ii. Installation of two 20kL poly storage tanks in accordance with the Design Drawings including:

- Sealed inlet/outlet pipe work at the appropriate levels and associated fittings and concrete support plinths
- Connection and Discharge pipework with associated valve arrangements
- A concrete support pad, footings and associated civil works

iii. Design and Installation of a pump shed building generally in accordance with the Design Drawings including, but not limited to:

- A concrete support pad, footings and associated civil works
- Vented wall and roof openings
- Swing and roller access doors
- Electrical service connections and penetrations and all associated electrical works to connect to the pump stations manufacturer switchboard/control panel.
- Water supply penetrations and associated fittings
- Grated drain with DN150 PVC-U drainage line to the Principals Nominated release location.
- Complete weather proofing, vermin, and insect proofing of the building. The Contractor shall provide proposals to close and seal all pipe and conduit penetrations to the Principal for Approval.
- The contractor shall liaise with the Principal and allow for the supply and installation of the Principals nominated locks and/or security systems.
- The colour of the building shall be confirmed with the Principal prior to fabrication and installation.

iv. Installation of all pipework and associated fittings to connect the raw water supply main to the storage tanks through to the pump building and continuation of the supply main from the pump building to the township.

v. All other civil, mechanical, and electrical works to undertake works in accordance with the Design Drawings.

vi. The contractor is to prepare an Operations and Maintenance (O&M) manual for the booster pump station and should cover all mechanical and electrical scheduled and non-scheduled maintenance for the life of the Asset.

MILESTONE 4: PROJECT COMPLETION

This milestone must include the following aspects of works, including but not limited to:

i. Provision of detailed drilling profiles from the specialist drilling contractor, quality control and verification documentation and as-built drawings in accordance with Section 13 and 19.

ii. Removal and appropriate disposal of all waste materials from site.

iii. Reinstatement of all disturbed areas including damage to pavements and kerbs. Road verges and disturbed areas directly adjacent to existing properties shall be turfed as directed by the Principals representative. All other areas shall be top soiled and seeded to the satisfaction of the Principals Representative.

iv. Site demobilisation.

Submission of the following documentation must be provided no later than 2 weeks after the contractor has demobilised from site:

i. Submission of all quality documentation as a complete package in ordered and labelled folders for various sections of the works.

ii. Submission of the booster pump station O&M Manual

iii. Submission of a complete set of red-line mark-up of the Design Drawings in .pdf.

iv. Submission of as-built drawings as per section 13.3 and 22.

5. HEALTH AND SAFETY

The contractor is to create and submit for approval a Safety Management Plan (SMP) specific to the work they will be undertaking. The SMP shall address the requirements of the Principal. The SMP shall include but not be limited to site specific risk assessments that also include plant risk assessments, plant operator training competencies and plant pre-start checks, SWMS, traffic control measures, site layout plan, site induction and emergency response. The SMP shall be submitted to the Principal for review and approval a minimum of 2 weeks prior to mobilization.

A risk assessment shall be undertaken by the Contractor as part of the SMP covering the mobilisation, set-up, drilling, and installation as a minimum. The risk assessment shall be conducted in accordance with AS/NZ ISO 31000:2009 Risk Management and shall identify the Health, Safety, Environmental, Quality, Community, and Project risks associated with the project and ensure adequate mitigation measures are in place.

6. ENVIRONMENT

The Contractor is to create and submit for approval a Construction Environmental Management Plan (CEMP) specific to the work they will be undertaking. The CEMP shall include but not be limited to a Drilling Fluid Management Plan, Sediment and Erosion Control Plan, Waste Management Plan to site specific risk assessments/Aspect Register, SWMS, chemicals and hazardous materials register, site induction and emergency response. The CEMP shall be submitted to the Principal for review and approval a minimum of 2 weeks prior to mobilization.

7. APPROVALS

Approvals are to be obtained in writing by the relevant authority prior to undertaking the activity in relation to aspects such as establishment, construction within roadways impacting on traffic, connection to existing water infrastructure, work outside normal operating hours e.g. weekends and nights, etc.

8. PROJECT DOCUMENTATION

Under the Act and Regulations, to ensure the worker's health and safety, the Contractor must provide the following:

- A safe system of work.
- Safe plant, equipment and structures.
- Safe access and egress and work environment,
- Training, information, instruction / supervision relating to the work.

Table 2 – Deliverables

Deliverable	Submission Time
Methodology	2 weeks before commencing work
SMP and CEMP	2 weeks before commencing work
ITP's – Welding, Hydrostatic Testing, concrete, pipe laying, road Reinstatement etc.	2 weeks before commencing work
As-Built documentation	2 weeks after completion of works

8.1. PERMITS

A Permit system is to be established by the Contractor to ensure appropriate control of the high-risk activities. The contractor is to ensure all work is started with the correct authority to begin work, including all SWMS and permits for the work, such as the following:

- Hot works (HDPE butt welding)
- Confined space work (if any)
- Excavation permit.
- Traffic management permit
- Drilling permit (Permit to Drill).

9. PROJECT PLANNING

The Contractor shall undertake adequate site investigations to verify feasibility of the trenchless installation for the two road crossings of Landsborough Street and provide data for engineering and execution. Site

investigations for all bores shall include site inspection/surface investigation, topographic survey, identification of existing services and geotechnical assessment.

Any site characterisation information provided to the Contractor by the Principal will be for information purposes only and the Contractor should confirm the accuracy of the information and if required, undertake their own investigations to inform their methodology. The Contractor should consult with geological professionals if they lack the required expertise, conduct further investigations, select an appropriate alignment and profile, and manage the risks associated with the characteristics and variability presented by the site conditions. The Contractor shall undertake a site investigation to identify:

- Site constraints.
- Property boundaries.
- Infrastructure and services.
- Potential layout and work areas.
- Access.
- Significant environmental features.
- Other relevant features.

10. DESIGN

The contractor shall verify the Principals proposed Detailed Design Drawings and provide details for delivering the works and if any deviations are required. If the contractor wishes to make changes to the RPEQ certified design drawings, the revised drawings must be approved for use by the Principal. As-Built survey of completed works must be provided in .dwg format for transfer into The Principals GIS system.

Subject to the written approval by the Principal, the Contractor may amend the detailed design where the Contractors plant or methodology necessitates this or where it provides increased benefit at no additional cost to the project.

10.1. SUPPORTIVE DOCUMENTATION

All project documentation shall be submitted to the Principal for review and approval before the commencement of site works. The Contractor shall allow sufficient time in their program for documents to be revised and resubmitted incorporating any comments that the Principal may have.

The Contractor shall prepare Plans and Procedures that demonstrates that they have undertaken sufficient engineering and planning to safely and efficiently undertake the works. Including the following:

a) Design confirmation
    i. Site characterisation.

ii. Geological conditions.
iii. Confirmation of location of existing services
iv. Required profile of the pipeline.
v. Entry and exit drill angle (trenchless works).
vi. Allowable radius of curvature.
vii. Drilling and steering accuracies (trenchless works).

b) Equipment and Personnel
   i. Description and size of plant and drilling equipment, and rig capacities, including maximum push/pull and rotational capabilities, maximum loads, etc.
   ii. Description of auxiliary equipment (type and capacity), including high pressure fluid pumps and fluid recirculation and cleaning system (trenchless works).
   iii. Manufacturer and type of survey and tracking systems, including accuracies and limitations (trenchless works).
   iv. Pilot hole, drill pipe, and reamer information (trenchless works).
   v. Pipe welding equipment information.
   vi. Proposed personnel and organisational structure.

c) Schedule and Procedures
   i. Schedule detailing sequence and durations of the individual drilling operations (trenchless works).
   ii. Drilling procedure including number of reaming passes and diameter of each pass, including the pilot hole (trenchless works).
   iii. Drilling Fluid Management Plan that details the drilling fluid system parameters including anticipated fluid composition with Safety Data Sheets (SDS) (trenchless works).
   iv. Recovery method in case of lodged drill string or pipe (trenchless works).
   v. Contingency procedures including fluid loss or spill, a hydrofracture event, drill pipe or bottom hole assembly failure, powerline or service strike (trenchless works).

11. EQUIPMENT AND RESOURCES

11.1. CONTRACTOR DRILL RIG AND ASSOCIATED EQUIPMENT

The HDD and underbore equipment shall conform to all relevant regulatory and statutory requirements and have a capacity compatible with the Contractors proposed construction procedures and method of working. The HDD and underbore equipment is to be of a good standard, well maintained and in good working order.

The drill rig must be adequately sized to achieve the loads (thrust, pull and torque) in the Principals design. It is generally recommended that the HDD Rig have a pull capacity at least 50% greater than the calculated pull loads. The Contractor is to ensure that the allowable bend radius of the drill pipe is not exceeded.

The Contractor shall ensure adequate communications are established at the site, including handheld radios to maintain positive communication between entry side and exit side at all times (mobile phones are not deemed suitable for operations where immediate communications are required).

11.2. PLANT

Contractor shall supply all plant and equipment required to perform the works that is in a good working order, cleaned and well maintained with service records available upon request.

The Contractor's management plans must detail a system for daily checking and resolving of issues with the supplied plant and equipment. The Contractor must supply key critical spares to ensure that the pipeline excavation and HDD drilling equipment achieves a 90% working availability target.

Lifting plant is to be appropriately employed by the Contractor. The Contractor is to ensure that experienced personnel with the required certificates operate the lifting equipment at all times. All crane operation is to be in accordance with AS 2550 Cranes, hoists and winches Safe Use.

In the case where the Contractor chooses to use an excavator to lift plant and materials the hydraulic cylinders must be fitted with burst protection valves to the Australian Standard: AS 1418 Cranes, Hoists and Winches.

11.3. WELDING PLANT AND EQUIPMENT

The Contractor shall ensure that the welding plant and equipment is suitable for the task and is clean, in good condition, serviced and calibrated. All equipment shall be used within the manufacturers specification / guidelines and these shall be available for inspection on site. All shall have current service and calibration logs and inspection records.

11.4. MATERIALS

The Contractor is to ensure that all chemicals and hydrocarbons used are in accordance with Carpentaria Shire's accepted environmental practices complete with control measures to mitigate risk. The Contractor is to ensure that all drilling fluids and chemicals are bunded and stored as per manufacturer's guidelines.

All construction materials must comply with the relevant design drawings and Australian Standards to ensure that the integrity of the works meet/exceed the minimum requirements set out by the Principal.

11.5. RESOURCES

Appropriately trained and experienced personnel are required for the delivery of the works. A HDD and underbore supervisor who is thoroughly knowledgeable of the equipment, drilling and HDD procedures is to be present at the job site during the two trenchless installations across Landsborough Street and be available to address immediate concerns, and health and safety issues.

12. GEOTECHNICAL DATA

A Geotechnical Report has not been generated for the project. As a result, the contractor is required to satisfy themselves prior to commencing the work that they understand the ground conditions to continue the works.

The Contractor shall be responsible for managing risks arising from the ground conditions and associated latent conditions such as non-rippable material or unstable trench walls requiring trench protection. This includes final installed alignment within boundary limits and hydraulic fracture.

13. SURVEY

13.1. SURFACE SURVEY AND CONNECTION

The Contractor must work to the specific tie-in points in the Principal's Detailed Design drawings. The Contractor is required to excavate and locate the exact tie-in point to enable connection. The Principal has specified an alignment of the main, however with specific regard to the sections to be installed via trenchless methodology, it will be up to the Contractor to confirm the proposed alignment with the Principal prior to the works commencing.

The Contractor is required to provide as-built survey of the completed Works as per Section 13.3. A topographic survey shall be conducted along the bore alignment to identify levels of all infrastructure, including any services along the route. These shall be clearly indicated on the profile as-built drawing and the proposed clearance to the final reamed bore size noted. Drawing datum shall be Australian Height Datum (AHD).

13.2. INFRASTRUCTURE AND SERVICES PROTECTION

The Contractor shall locate the proximity of the proposed alignment to all existing buried services. These services shall be potholed and left exposed until the required excavation or drilling has passed the potential conflict point. This will enable the Contractor to ensure that no damage has succumbed to the existing underground services. Specifically concerning the trenchless installations, appropriate clearances between the final borehole size and the existing services will be incorporated by the Contractor to preserve the integrity of all existing services. The Contractor is responsible for seeking approval from the relevant authorities for installing the pipeline in the vicinity of those services and ensuring the required clearances and appropriate safeguards are maintained

Potholing for final location of all underground services shall be completed by the Contractor. All the necessary risk mitigation procedures should be put in place to ensure any work does not adversely impact on the existing services. Rectification and costs associated with any impacts to existing services will be the responsibility of the Contractor.

13.3. AS-BUILT DRAWINGS

As-built drawings of the works shall be prepared, certified as to their accuracy, and submitted by the Contractor to the Principal.

The Contractor shall provide the Principal with a complete set of As-Built Plans showing all alignments and drilled bores (successful and failed) within two weeks of completing the works. The Contractor shall ensure that the plans are dimensionally correct and that copies of the Contract plans include roadway plans and profiles, cross-sections, boring locations and subsurface conditions as directed by the Principal. The plans must show appropriate elevations in terms of meters above/below Australian Height Datum (mAHD).

As-built plans shall be submitted in CAD (3D DXF/DWG), PDF, and hard copy forms.

Specifically, for the trenchless sections, the Contractor shall include bore notes on each plan stating the final bore path diameter, product diameter, drilling fluid composition, composition of any other materials used to fill the annular void between the bore path and the product, or facility placed out of service.

14. TRENCHLESS ALIGNMENT AND TOLERANCE

The Contractor is to confirm with the Principals representative the vertical alignment of the Horizontally Directionally Drilled (HDD) profiles prior to undertaking the works. The Contractor is to ensure that the HDD Profile meets the following requirements:

- Suitable entry and exit angles.
- Sufficient clearance to surface features and infrastructure (including allowances for settlement).
- Sufficient clearance to services (including allowances for steering accuracy, final hole size and settlement).
- Minimises unnecessary undulations in the bore profile.
- The profile is within the limits of the proposed drilling rig and equipment's capacity.

The HDD bore path must follow the approved designed alignment and conform to the allowable tolerances depicted in Table 3 below. The alignment shall be constructed on the project specific centre lines and agreed to by the Principal. If the proposed alignment cannot be constructed on the design alignment, they are to consult with the Principal to arrive at a suitable alternative.

Permanent works shall not be located outside of proposed easements or on private property.

Table 3 – General Horizontal Directional Drilling Tolerances

Horizontal Directional Drilling Alignment Tolerance	Allowable Deviation
Horizontal Tolerance from Designed Alignment	± 300mm
Vertical Tolerance from Designed Alignment	± 300mm
Gradient (including entry angle and exit angle)	± 2.5% (1.5 degrees)

15. GENERAL REQUIREMENTS

15.1. SITE SETUP

The Contractor is to mobilise to site and setup the site to best facilitate the works. The requirements shall be incorporated into the design plans submitted to the Principal for acceptance.

The Contractor shall ensure appropriate barricading and signage is placed around their work areas to restrict access and where necessary engage traffic controllers to manage traffic around the work site to

ensure public and worker safety. Open holes (including trenches or excavations) must be securely fenced not be left open or unattended unless appropriate precautions have been taken to secure and prevent unauthorised access to the excavation.

15.2. ON-SITE STOCKPILES

Only store sufficient materials on site as are necessary to allow timely and efficient progress of the work. Locate stockpiles of excavated or imported material where they cause no interference to the public, drainage routes or vehicular or pedestrian traffic.

Clear lines of sight for drivers must not be obstructed. Do not stack materials against structures, fences, trees or other property improvements. Leave a clear path at least 600mm wide between the edge of any excavation and the inner toe of any stockpile or spoil banks. The load due to stockpile of materials in the vicinity of any excavation shall be considered when planning the excavation methodology.

All excavated materials that are to be re-used should be protected from excessive drying or wetting during storage. Additionally, these materials should be excavated, stored, handled and laid so as to avoid contamination and loss of fines material.

Where stockpiling of topsoil is required, establish stockpiles in approved locations, to heights not exceeding 1.5m. Provide adequate drainage and erosion protection. Do not burn off to remove plant growth that may occur during storage. Do not allow traffic on stockpiles. If a stockpile of topsoil is to remain for more than four weeks, sow with temporary grass.

15.3. PIPE DAMAGE

When there is any indication that the installed pipe has sustained damage, the Contractor shall stop all work, notify the Principal and investigate the damage. The Contractor shall determine the nature of the damage and recommend a suitable remediation(s) if practicable. The Principal shall consider the investigation and its recommendations and instruct the Contractor on how to proceed within 24 hours of receipt of the investigation report.

If the pipe fails the hydrostatic test, the contractor shall be liable for all costs associated with any removal or repairs of the pipeline until it satisfactorily meets the requirements of this specification.

16. PIPELINE CONSTRUCTION

The Contractor shall maintain control of site operations at all times. The Contractor has ultimate

responsibility for site safety, the environment, quality workmanship and the satisfactory completion of the work as authorised under the Contract.

16.1. PIPE STRING FABRICATION

The Contractor shall establish the pipe welding facilities in accordance with their pre-approved site plant. Adequate arrangements shall be made to shield the welding operation during periods of high winds or inclement weather. Conduit pipes and rolls shall be stored and handled with care to prevent surface damage to the conduits. Lifting belt slings and protection of forks shall be used to minimise surface scarring of the conduit. Scores or scratches to a depth of more than 10% of the wall thickness shall be cut out and removed. The HDD pipe string shall be constructed as a single complete string.

Contractor shall procure and mobilise to site sufficient pipe including sparing to undertake the works from tie-in location to tie-in location as specified in the Scope of Works. Materials to be supplied by Contractor include:

- PE100 OD180/125/50 SDR11 PN16 (coloured purple solid or striped)
- Stub flanges with stainless steel backing rings to AS4087
- All required blanks and attachments for hydrostatic testing
- Stainless steel trace wire of adequate length and dimensions to withstand installation forces for drilled sections.
- All temporary construction aids including pulling heads to facilitate the works.

16.2. WELDING

Fusion Butt Welding shall be used only for all HDD installations. Electrofusion (EF) couplings may be used for all open trenched section of works. Any changes will need approval by the Principal. Welding activities shall be undertaken in accordance with the Polyethylene Pipeline Code, Version 3.1 (2004) and Water Services Association of Australia. Welders shall have the appropriate welding certifications (PMBWELD301B) and submit an ITP and proposed weld log prior to welding commencing. The Principal shall be notified of failed welds immediately. The completed ITP shall be sent to the Principal prior to installation.

The Contractor shall provide shelter at the welding area to prevent contamination of the heater plate and weld zone from dust, wind and rain. Welding shall not proceed when the wind or dust generated by the wind is detrimental to the quality of the welds.

Effort should be made to reduce wind effect inside the pipe by covering pipe ends to reduce contamination of heater plate and cooling of the heater plate in the fusion zone. Isopropyl wipes are to be used to clean the weld zone of the pipe prior to welding. Internal weld beads are required to be removed.

16.3. COVER

The minimum cover requirements for open trenched pipelines are to be 600mm within non-trafficable environments and 1.0m beneath roadways.

For trenchless installations beneath roadways, the minimum cover between the top of the reamed hole and surface features shall be 1.2m. Furthermore, the Contractor shall determine the risk of frac-out or inadvertent fluid returns from the bore subject to the methodology. Where there is deemed to be a risk of frac-out, calculation or modelling of the annular pressure shall be undertaken to confirm minimum cover and any other control requirements (e.g. casing). Calculated annular pressures during pilot hole drilling are lower near the entry side and direction of drilling may need to be incorporated into the design to minimise risk on exit.

16.4. LIMITS OF EXCAVATION

Keep the extent of excavation to the minimum possible to allow efficient construction of the Works while meeting the minimum requirements shown on the Design Drawings and the relevant Standard Drawings. Keep pipe trench widths within the maximum widths shown within the Design Drawings. Widening of the trench beyond the maximum specified in the drawings will increase the load carried by the pipe and will require a review of the pipe class and trench compaction method.

If the maximum width limits cannot be met, The Principals Representative shall be notified and an agreed solution between parties be made. The maximum length of trench open at any one time is 150m. An open trench is defined as any excavation that is below natural surface level. At the end of the shift the trench shall be made safe and barricaded off.

16.5. EXCAVATION ACROSS IMPROVED SURFACES

Where excavation is required across improved surfaces such as pavements, driveways and kerbs and gutters, where the surfaces cannot be satisfactorily reproduced and under existing concrete footway areas and concrete driveways, use tunnelling or boring techniques where possible. Ensure backfilling is to a standard to fully support the surface and any likely applied load.

If open excavations are used in improved surfaces, keep the excavation width to the minimum allowed. The Contractor shall provide all necessary Traffic Control to manage excavation across roads and shall minimise

the time required to complete the works. The Contractor shall provide alternative public vehicle and pedestrian access around all excavations in the roadway.

Before excavating trenches, saw cut existing concrete and bituminous surfaces to provide a straight even joint during the work. In road carriageway, saw cut at least 150mm clear of the trench walls. In road verge, saw cut at least 75mm clear of the trench walls. Position saw cut to coincide with any grooved pattern line or contraction joint or expansion joint in concrete paving, if the saw cutting is undertaken within 600mm of these elements.

Excavation along carriageways should wherever possible be located such that the edge of the opening is at least 1m from the edge of the carriageway. Lift and store unit paving by hand, clean them and set them aside for later reinstatement.

16.6. EXCAVATION IN ROOT ZONES

Ensure that no undue damage is caused to existing tree root systems as a result of excavation works. Do not cut tree roots larger than 25mm in diameter without the approval of the Principal.

Where necessary, prune roots using handsaw or secateurs, making a clean cut, and make as small a wound as possible.

16.7. SUPPORT OF EXCAVATIONS

Keep the sides of excavations for pipework vertical to at least 150mm above the pipe. Except where described in, or permitted in the Contract, the sides of excavations shall be supported at all times and shall not be battered

When removing, raising or withdrawing supports ensure that no damage, disturbance or displacement occurs to adjacent structures along with the pipes, fittings, geotextile filter fabric, pipe embedment and trench fill already installed. Ensure that compaction of pipe embedment and trench fill material occurs below such trench support and against native ground.

If the trench support system is to be left in place as permanent support, cut off the support system at a depth below ground surface that will satisfy the structural requirements of the site.

16.8. ADJACENT STRUCTURES AND SERVICES

The Contractor is responsible for locating, identifying and contacting the owner of any service within close proximity of the trench excavation.

Ensure that adjacent structures and services are not subject to disturbance by the excavation or by any

trench support system.

Ensure that adjacent services and services which cross the excavation are adequately supported and protected during trenching. The Contractor shall liaise with the owner of the services to coordinate trenching operations and any temporary isolation of the service which may be required.

16.9. DRAINAGE AND DEWATERING

Keep all excavations free of water. Provide, maintain and operate intercepting works to prevent surface water from entering the excavations; and all equipment necessary for dewatering the excavations and keeping the Works free from water. Lowering of the water table by well points or other external dewatering methods may only be used if no damage is likely to be caused to adjacent structures and services.

Ensure that all downstream works that are under construction, completed or in use are protected at all times against the effects of any drainage which is discharged or likely to be discharged from the work.

Maintain watercourses including land and/or road drainage within the Site in an effective working condition at all times. Take all practicable measures to prevent the deposition of silt or other material in, and the pollution of, or damage to, an existing watercourse, canal lake, reservoir, borehole, aquifer or catchment area arising out of construction operations and acts of vandalism.

Obtain approval for all temporary liquid discharges, crossings, or diversions to watercourses and comply with the CEMP and approval requirements.

16.10. DISPOSAL OF SURPLUS AND UNSUITABLE EXCAVATED MATERIAL

Promptly remove and dispose of excavated material which is unsuitable off site. No unsuitable material may be disposed of on site without permission from the Principal.

Suitable surplus material that is not required for reuse in the works is the property of the controlling authority or owner of the excavation site. The Contractor shall seek approval from the Principal on the location for disposal of surplus material. If directed by the Principal the Contractor shall dispose of surplus material off site.

16.11. NON-RIPPABLE MATERIAL

Non-rippable material is defined as rock that would experience hard digging with a CAT245 excavator or similar.

Encountering rock shall be a hold point, the Contractor shall obtain agreement from the Principal on the

extent of excavation.

Rock shall be excavated to reach the design trench levels as detailed on the Drawings. Avoid forming pockets of shattered material below the level of the excavation.

Remove all loose material. Any over excavation below the design level of the trench shall be filled to formation level with approved embedment material, free from perishable materials and resistant to washing. Compact all material in accordance with requirements for embedment material, trim the excavation to shed water. Blasting of rock is not be permitted under this Contract.

16.12. TRENCH FLOOR PREPARATION

Minimise the time the trench floor is exposed to prevent deterioration. Prior to placing the embedment, check that the proposed foundation is able to provide a firm foundation with a minimum bearing capacity of 50kPa at the required level.

Where a minimum bearing capacity of 50kPa cannot be achieved, a rock mattress, as detailed on design drawings, shall be installed at the base of the trench. The depth of the rock mattress shall be agreed with the Principal.

In locations where the installation of a rock mattress is not considered practical or suitable, unsuitable foundation material shall be removed and replaced. The Contractor shall obtain agreement from the Principal on the extent of unsuitable removal prior to starting work.

Excavate any localised unsuitable ground, soft spots or damaged surfaces below the formation level and then fill to formation level with approved embedment material, free from perishable materials and resistant to washing. Compact all material in accordance with requirements for embedment material.

16.13. GENERAL PIPELINE BEDDING

Provide pipe embedment and support as shown on the Drawings. Place embedment material uniformly along and around the whole length of the pipe barrel to provide a uniform density of side support and overlay without distortion, dislodgement or damage to the pipeline.

16.14. EMBEDMENT MATERIALS

The support comprises the embedment zone as detailed on the Design Drawings and as detailed in AS/NZS 2566.1. Suitable embedment materials are:

- Sand; or

- Processed aggregate (5-7mm)

Selection of embedment materials shall consider the risk of fines migration and shall be in accordance with WSA 03-2011. Products shall be quarried, processed and supplied under cover of a certified quality management system.

Embedment materials shall be submitted to the Principal for approval prior to placing material. Provide recent test certificates from a NATA registered laboratory demonstrating compliance with the following specifications.

16.15. PLACEMENT OF BEDDING

Provide bedding as shown on the Drawings.

Place and rake-in bedding to support the pipe uniformly along the length of the barrel with depressions where sockets, couplings and other appurtenances are located as required by the manufacturer's installation requirements. Spread bedding material across the full trench width to the depth required. Do not walk on the centre of the bedding either during or after placement.

16.16. EMBEDMENT COMPACTION

Following placement, compact embedment material in layers to achieve uniform compaction throughout the depth of each layer. The minimum compaction requirements are defined in Table 4.

Determination of compaction shall comply with the following requirements:

- Cohesionless materials shall be determined using density index in accordance with AS1289.5.6.1.
- Cohesive materials shall be determined using standard dry density ratio in accordance with AS1289.5.4.1 based on the field dry density as per AS1289.5.3.2 or AS1289.5.8.1 and the maximum dry density as per AS1289.5.1.1.

Table 4 – Minimum Embedment Compaction

	Cohesionless Materials (Density Index)	**Cohesive Materials (Standard Dry Density Ratio)**
Non- Trafficable Areas	60	90
Trafficable Areas	70	95

Following placement, compact embedment material in layers to achieve the specified density uniformly

throughout the depth of each layer shown on the Drawings.

To achieve the specified relative compaction, the compaction effort will depend upon the embedment material chosen.

Grade the bedding material to the specified tolerances and form pockets where required to ensure the pipeline is fully supported along the pipe barrels.

Place the side support and overlay material in a manner to ensure:

- Uniform distribution and compaction of embedment, especially under the haunches of the pipeline
- The relative compaction of the material is consistent with the design
- Pipeline distortion is minimised
- Pipeline coatings and any cathodic protection are not damaged.
- Material is brought up in layers evenly on each side of the pipe.

Do not commence mechanical compaction of the fill material directly above the pipeline until the total depth of cover to the top of the pipe is adequate to prevent damage (200mm min for handheld equipment).

Do not use jetting or flooding to compact material.

Table 5 – Frequency and Location of Embedment Compaction Tests

Surface	Frequency and Location
Non-trafficable Areas	1 test per two layers per 100 metres of pipeline. This shall include at least one test at the pipe spring line every 100 metres.
Trafficable Areas	1 test in each layer per road crossing. Test locations to be staggered in the vertical direction such that testing locations are not vertically coincident.

16.17. JOINING FLANGES

Flanges shall be torqued up in a progressive star pattern in accordance with manufacturer recommendations. Lubrication for nuts and bolts shall be in accordance with manufacturer recommendations.

All flanges shall have stainless steel bolts, nuts and washers Grade 316 complying with AS 4087.

16.18. MARKING SERVICES

Underground marking tape: To AS/NZS 2648.1. Lay plastic warning tape, 300mm above all buried piping, for the full length of the piping. Provide trench marker tape that clearly identifies the service below, coloured as appropriate. Type: Metal detectable tape equal to “Tapex” Fair Warning metal detectable tape.

16.19. TRENCH FILL

For the purposes of this specification, trench fill is defined as the refilling of trenches/excavations from the top of the pipe overlay (embedment) to ground level in non-trafficable areas and sub-grade level in trafficable areas.

Ensure all exposed surfaces of trenches/excavations are uniform and free of excessive gouging, overhangs, and cavities to enable uniform compaction of backfill.

Do not subject pipes to heavy static or impact loads capable of causing damage to the pipes during backfilling of trenches/excavations.

Use appropriate methods of compaction to achieve the requirements of the Drawings and the Specification.

Trafficable

Trafficable areas are all excavations with a pipeline centreline within 0.50m beyond each edge of the existing roadway/pavement area/back of kerb.

Non-trafficable

Non-trafficable areas are not included in the above.

16.20. MATERIAL REQUIREMENTS (NON-TRAFFICABLE)

Backfill material suitable for non-trafficable areas shall be excavated material, free of organic materials and rocks and clay lumps larger than 75mm nominal size and can be placed into a dense mass free of voids and cavities. Material for backfill under non-trafficable areas shall be excavated material or, where excavated material is unsuitable for backfill, imported suitable material. Excavated material (including clay/clayey soils) shall not be deemed unsuitable due to its moisture content, unless otherwise directed by the Principal.

16.21. MATERIAL REQUIREMENTS (TRAFFICABLE)

Choose backfill material to suit the permeability characteristics of the surrounding soil to ensure that the completed trench does not hold water nor obstruct existing drainage paths through the soil.

Granular

Granular fill for use as trench backfill under roads and other trafficable areas shall be a gravel or decomposed or broken rock, non-plastic open graded material or crusher run recycled concrete, CBR15, free from vegetable matter and lumps of clay with the following properties:

Table 6 - Granular Fill Grading

Metric	Percent passing by weight (%)
75mm	100
2.36mm	25 – 70
75µm	0 - 30

Miniature abrasion loss (passing 2.36mm sieve) not exceeding 15%.

For the material passing the 425µm sieve:

- Liquid limit 0 - 35
- Plasticity Index 0 - 12
- Linear shrinkage 0 - 8

The material retained on the 2.36mm sieve shall consist of sound stone.

Sand

Natural sand or manufactured sand or a blend of natural and manufactured sand, comprising hard durable particles with the following properties:

Table 7 – Sand Backfill Properties

Property	Natural Sand	Blended and manufactured sand
% by weight passing the 6.7 mm A.S. sieve	100	100
% by weight passing the 0.075 mm A.S. sieve	5 maximum	20 maximum
Plasticity index	5 maximum	10 maximum

16.22. COMPACTION OF TRENCH FILL

Compact each layer to not less than the specified dry density Ratio (RD) or Density Index (ID).

Compaction using jetting or flooding of the fill is not permitted. Following placement, compact trench fill material in layers to achieve uniform compaction throughout the depth of each layer.

The minimum compaction requirements are defined in Table 8.

Determination of compaction shall comply with the following requirements:

- Cohesionless materials shall be determined using density index in accordance with AS1289.5.6.1.
- Cohesive materials shall be determined using standard dry density ratio in accordance with AS1289.5.4.1 based on the field dry density as per AS1289.5.3.2 or AS1289.5.8.1 and the maximum dry density as per AS1289.5.1.1.

Table 8 – Minimum Trench Fill Compaction

	Cohesionless Materials (Density Index)	Cohesive Materials (Standard Dry Density Ratio)
Non-trafficable Areas	60	90
Trafficable Areas	70	95

Non Trafficable

Place backfill and compact in layers not exceeding 200mm loose thickness for cohesive materials or 300mm loose thickness for cohesionless material. The top 200mm of backfill material in grassed and garden areas shall be the topsoil removed during the stripping operation and shall be compacted to the density of the surrounding topsoil.

Trafficable Areas

Place at optimum moisture content +/- 2% in layers not exceeding 200mm loose thickness.

16.23. PROVISION FOR SETTLEMENT

Through other than pavements, lawn areas or other improved surfaces, place trench fill sufficiently high to compensate for expected settlement. Make good any settlement during the Defects Liability Period and at the end of the Defects Liability Period, trim back any excess material to conform to the adjacent surface.

Where reasonable convenience of persons requires trenches to be levelled off at the time of filling, make any subsequent settlement good as necessary by placing and compacting additional fill.

16.24. TRENCH FILL COMPACTION TESTING

Non Cohesive soils

Determine the Density Index (ID) in accordance with AS 1289.5.6.1, based on the maximum and minimum dry densities, determined in accordance with AS 1289.5.5.1 and the field dry density in accordance with AS 1289.5.3.1, AS 1289.5.3.2, AS 1289.5.8.1 or AS 1289.5.3.5 as appropriate.

Cohesive Soils

Determine the Dry Density Ratio (RD) in accordance with AS 1289.5.4.1, based on the field dry density in accordance with AS 1289.5.3.2 or AS 1289.5.8.1, and the maximum dry density in accordance with AS 1289.5.1.1. The Dry density Ratio determined in accordance with AS 1289.5.7.1 may be considered as being numerically equivalent to the dry density ratio.

Table 9 – Frequency and Location of Trench Fill Compaction Tests

Surface	Frequency and Location
Non-trafficable Areas	One test in each 900mm of fill per 100m of pipeline.
Trafficable Areas	1 test in each layer per road crossing. Test locations to be staggered in the vertical direction such that testing locations are not vertically coincident.

16.25. PIPELINE CONSTRUCTION TOLERANCES

Construct water mains to the lines and levels shown on the Drawings within the following tolerances:

Horizontal deviation from design alignment:

Horizontal departure from the design position of any point on the pipeline shall not exceed 100mm, unless otherwise noted on the Drawings.

Vertical deviation from design invert level:

Departure from the design level of any point shall not exceed 50mm, unless otherwise noted on the Drawings.

17. TRENCHLESS CONSTRUCTION

17.1. FLUID CONTROL

The Contractor is to use HDD drilling fluid to efficiently support the borehole and carry the cuttings away to the surface. The drilling fluid is to be water-based bentonite that is environmentally safe and conforms to the relevant legislation. All chemical fluid additives are to be inert to the environment and the Contractor is to maintain an up to date Chemical register and have SDS documents available onsite.

Fluid design, performance and monitoring are the responsibility of the Contractor. The Contractor is to record details of all fluid used in the system including quantities of each additive. This information shall be included in the drill log.

In the event that a drilling fluid fracture occurs, the Contractor shall cease drilling immediately, notify the Principal and the cause of the loss investigated. Drilling will only recommence once the cause has been identified and a procedure put in place to prevent it reoccurring. The contractor will seek approval from the Principal to seal up the fracture or drill another alignment. At all times a full and complete means to immediately contain and collect the fluid loss including vacuum truck, sediment fencing, sandbags, core logs and pumps and hoses as appropriate, shall be made available by the Contractor.

17.2. DRILLING, REAMING, CONDITIONING

The Contractor will incrementally perform drilling tasks to prepare the bore hole for the carrier pipe pull. The process should follow the following stages:

- Drill and steer the pilot hole along the approved alignment
- Ream the pilot hole out to the specified diameter as per the Principal's design and guide.
- Condition and clean the borehole until the Contractor and the Principal is satisfied that the hole is clean and ready for the carrier pipe pull as per the ITP.

17.3. PILOT HOLE

In the event that the pilot does deviate from the bore path by more than the tolerance limits identified in Table 3, the Contractor shall notify the Principal and the Principal may require the Contractor to pull-back and re-drill from the location along the proposed bore path prior to the deviation.

NOTE: where there is overhead and underground high voltage power or underground gas mains, the Contractor must verify that their method of guidance is sufficient and accurate before construction

commences.

One reading per rod as a minimum is required during the drilling of the pilot hole, registering inclination, azimuth, length and the orientation of the bent sub. This collected information is to be converted and plotted into a real time as-built alignment drawing referencing the actual position of the borehole compared with the designed alignment. This pilot is to be submitted to the Principal immediately for review prior to proceeding further.

17.4. REAMING

Upon successful completion of the pilot hole, the Contractor shall ream the bore hole, using the appropriate HDD tooling to suit the size of the carrier pipe. Reaming tools are to be appropriate for the ground conditions with the correct configuration of nozzles and teeth to prevent bit balling in clay, wash out of loose material in sand and allow for bi-directional use.

17.5. DOWNHOLE FAILURE / PRODUCT PIPE STUCK

If at any stage a borehole fails or collapses or during pipe installation the product pipe becomes stuck, the drilling process shall cease immediately, and the Principal notified. An investigation shall be undertaken to establish the cause of the failure and discussion held between Principal and contractor to move forward. Depending on the drills progress it may be deemed beneficial to abandon the borehole and begin a new pilot hole.

If it is deemed safe by both parties to continue drilling or begin retrieval of the stuck pipe, the following will be required but not limited to:

a) Compile a SWMS/JSA noting correct and safe working procedures.

b) Secure an exclusion zone of no personnel around the work area.

c) Ensure correct and effective communication is available at all times.

d) Undertake a toolbox meeting detailing works required to all personnel.

e) Utilise only correct equipment and machinery certified for this task.

18. HYDROSTATIC TESTING

Hydrostatic testing shall be undertaken in accordance with WSA03-2011 to a pressure of no less than 1.5 times the maximum operating pressure of the pipeline and be undertaken by a NATA Certified tester. The

Contractor shall be responsible for providing blanked flanges containing stainless steel backing rings for each stub end to facilitate the pressure test.

For all HDD sections, the pipe shall be hydrostatically tested before and after installation of the pipe. The open trench section of pipe shall be broken down and tested in section no greater than 1000m. The pipeline shall be tested with raw water, not potable water.

19. TIE-IN AND CONNECTION PIPE WORK

The Contractor is responsible for connecting the installed OD180 SDR11 PE100 pipework to the existing raw water main along Brodie Street. Connection details are provided in **Appendix A**. It is the Contractors responsibility to confirm this configuration is acceptable and aligns with existing pipework prior to undertaking the connection.

The Contractor shall be responsible for constructing the entry and exit pits and connecting the two underbores via open trench installation. The Contractor shall locate the pits as close as practicable to the tie-in locations subject to site constraints.

The Contractor shall ensure the connection points at the entry and exit holes are at the correct depth and horizontal alignment to carry out the tie-in.

20. RESTORATION

Following the installation of the pipeline, booster station and associated works including connection works, the Contractor will demobilise equipment and restore the worksite to its original condition. This includes reinstating any disturbed ground surface to its original standard. Any damage to local roads shall be remediated to at least the same condition as documented in the Site Condition Survey. Grassed areas shall be reinstated with turf as property fronts and with seed within the easements, or as directed by the Principals representatives pending appropriate weather conditions.

As a minimum all excavations will be backfilled and compacted to 95% Standard Compaction (AS1289). Landscaping will be restored to its original condition. All HDD and boring by-products including cuttings, slurry and drilling fluids shall be disposed of by the Contractor to approved sites.

In the event that the horizontal directional drilling operation affected, disturbed, damaged or destroyed undeveloped land or structures the Contractor is responsible to reinstate them to their original condition. This work is to conform to the authority's standards and the approval of the Principal.

21. QUALITY RECORDS AND HANDOVER DOCUMENTS

Throughout the construction of the project the Contractor is to complete and submit all records mentioned in the above sections of this document. In addition to these documents the Contractor is to submit the as-built package in both hard copy and electronic format.

The Contractor shall keep records of all the pipeline and horizontal directional drilling operations, and all such data as directed by the Principal. These records will form part of the as-built data.

The Contractor is required to submit as-built records in CAD format. The Contractor must also submit Red Line Drawings detailing all relevant as-built records. All submitted records are to be approved by the Principal.

During the HDD Works, the Contractor is to provide records as listed in Table 10 below.

Table 10 - Technical HDD Information Records

HDD Record / Report	Included Information	Handover Frequency / Details
Bore Log (Pilot, Reaming and Hole Conditioning)	Rod time. Torque and carriage forces. Geology and fluid comments (returns / losses).	Following day
Welding Logs	Welder, weld type, number, date.	Following day
Daily sign on sheet	Details of plant materials and labour	Following day
Settlement Logs	Any Details of settlement or heave along the HDD alignment.	Following day

21.1. INSPECTION TEST PLAN (ITP)

The Contractor is to submit to the Principal a complete set of ITPs for approval, adequately dealing with the key pipeline, booster station, building and storage tanks, and HDD work activities.

21.2. CLIENT REPRESENTATION

The works under the Contract will be delivered with a Principals Representative on site to ensure the works are executed safely, in an environmentally friendly manner and to an acceptable quality standard. The Principal or the Principals Representative shall be given full access to all gauges, instrumentation, readings

and measurements, and documentation as required to ensure the works are performed in compliance with the project requirements.

22. PRACTICAL AND FINAL COMPLETION

A certificate of Practical Completion shall be issued to the Contractor after the completion successful completion of Milestone 4. Practical completion will extend for a period or 12 months. Should no defects require rectification in this period and certificate of Final Completion will be issued to the contractor signifying that the Contractor has satisfied all requirements of the contract.