The Rural City of Murray Bridge

Murray Bridge East CWMS Concept Design

OPTIONS REPORT

WGA231738

WGA231738-RP-CV-0001_B

16 April 2024

Revision History

REV	DATE	ISSUE	ORIGINATOR	CHECKER	APPROVER
A	22 February 2024	Council Review	NJ	MOF	DH
B	16 April 2024	Draft for Council Briefing	NJ	MOF	NS

CONTENTS

1 INTRODUCTION ... 1
1.1 Report Purpose ... 1
1.2 Background ... 1
1.2.1 Township Population and Infrastructure ... 1
2 BASIS OF DESIGN ... 4
2.1 Reference Documents ... 4
2.2 General Design Criteria ... 4
2.2.1 Standards ... 4
2.2.2 Flow Rates and Peaking Factors ... 4
2.2.3 Organic and Solids Load ... 5
2.3 Design Life ... 5
3 DESIGN OVERVIEW ... 6
3.1 Hydraulic Loads ... 6
3.1.1 Peak Flows ... 6
3.1.2 Pump Station Flows ... 7
3.2 Topography and Soil Conditions ... 7
3.3 Flood Risk ... 10
3.4 Wastewater Collection ... 10
3.4.1 Overview ... 10
3.4.2 Connection Depth ... 10
3.4.3 Rising Main Sizes ... 11
3.4.4 System Description ... 11
3.4.5 Connections ... 12
3.4.6 Gravity vs Pressure System ... 12
3.5 Wastewater Treatment ... 16
3.5.1 Overview ... 16
3.5.2 Facultative Lagoons ... 17
3.5.3 Facultative/Maturation Lagoon Sizing ... 17
3.5.4 SA Water Connection ... 18
3.5.5 Mechanical Treatment Plant (RBC) ... 18
3.6 Recycled Water Storage and Disposal ... 19
3.6.1 Water Balance ... 19
3.6.2 Recycled Water Storage and Disposal ... 20
4 COST ESTIMATES ... 21
4.1 Capital Costs ... 21
4.1.1 Wastewater Collection ... 21
4.1.2 Wastewater Treatment ... 21
4.1.3 Irrigation/Disposal ... 22
4.1.4 Capital Cost Summary ... 23
4.2 Whole of Life Costs (WOL) ... 23
4.2.1 Whole of Life Assumptions ... 24
4.3 SA Water Connection ... 25
5 CONCLUSIONS & RECOMMENDATIONS ... 26

Figures

Figure 1: Murray Bridge East Township 3
Figure 2: Rubbly Calcrete Scattered on Ground Surface (near BH10, Facing North) 8
Figure 3: Outcropping Limestone in an Eroded Cliff Face (near BH4, Facing South) 8
Figure 4: Outcropping Limestone on a Near Vertical Cliff Slope (near BH5, Facing Southwest) 9
Figure 5: Extremely Weathered Calcrete on a Cut Batter (near BH12, Facing Northwest) 9
Figure 6: Storage and Disposal Area 10
Figure 7: Pump System Schematic 11
Figure 8: Typical Pressure Sewer Layout (Source: Hunter Water) 13
Figure 9: Typical Gravity Sewer Construction 15
Figure 10: Typical Pressure Sewer Construction 15
Figure 11: Typical Facultative Lagoon Layout (extract from Waste Stabilisation Pond Design Manual, PWC (2011)) 17
Figure 12: Proposed Connection Point to SA Water 18
Figure 13: Typical RBC layout (shown for information) 19

Tables

Table 1: 2021 Census Data 1
Table 2: CWMS Flow - Residential 6
Table 3: CWMS Flow - Commercial 6
Table 4: Pump Station Flow Summary 7
Table 5: Relative Advantages and Disadvantages of Each Option 14
Table 6: WWTP Options Comparison 16
Table 7: Capital Cost Estimate Collection System 21
Table 8: Lagoon Treatment and Storage 21
Table 9: Mechanical Treatment and Storage 22
Table 10: Irrigation 22
Table 11: Capital Cost Summary 23
Table 12: Whole of Life Costs – Lagoon Option 23
Table 13: Whole of Life Costs – Mechanical WWTP Option 23
Table 14: Capital Cost and WOLC Summary 26

Appendices

Appendix A CONCEPT DESIGN DRAWINGS
Appendix B COST ESTIMATES AND WHOLE OF LIFE COSTINGS
Appendix C GEOTECHNICAL REPORT

1 INTRODUCTION

1.1 Report Purpose

This report has been prepared to summarise the design criteria, assumptions and options considered for the Community Wastewater Management System (CWMS) Concept Design for the township of Murray Bridge East for Rural City of Murray Bridge (Council).

The purpose of this report is to provide a level of detail that is suitable for preliminary costings (both capital and whole of life) to inform a decision about whether the scheme should proceed. This report is not intended to represent an endorsement of the scheme but instead a technical report about the design basis behind the Concept Design and outlining the assumptions and limitations of the work completed to date.

The Concept Design consists of this report and the Concept Drawings. The drawings are included as Appendix A.

The Concept Design is based on a gravity collection network with pumped allotments where required.

The Concept Design has assumed a full-sewer layout with a lagoon-based treatment system. Discussions with SA Water about the feasibility of a connection to the Murray Bridge sewage network are ongoing at the time of writing (refer Section 0). No response is currently available from SA Water.

1.2 Background

1.2.1 Township Population and Infrastructure

Murray Bridge East is a small town located on the eastern bank of the Murray River across from Murray Bridge, which is located approximately 70km south-east of Adelaide. Part of Riverglades, a northern suburban locality of Murray Bridge East is also included in the CWMS scheme.

The 2021 Census data indicated that the population of Murray Bridge East was 1,196 (permanent residents). Based on discussions with Council. the area is not a common holiday destination and hence the population is not expected to fluctuate significantly across the year. Some holiday fluctuations would be expected at the caravan park, however.

The 2021 Census data for the township is provided in the following table.

Table 1: 2021 Census Data

AREA	POPULATION	OCCUPIED DWELLINGS	UNOCCUPIED DWELLINGS	OCCUPATION RATE (PERSONS/DWELLING)
Murray Bridge East	1196	449	42	2.7
Riverglades	856	331	25	2.6
Avoca Dell	166	55	0	3.0
TOTAL	**2218**	**835**	**67**	**2.67**

The commercial premises include two service stations (Ampol and OTR) and an RSL club with a maximum capacity of 260 people. The Avoca Dell Caravan Park with capacity of up to 306 people is located north in the township and has also been included in the scheme.

Figure 1 shows the key commercial premises within the township.

Wastewater generated in Murray Bridge East is currently disposed on-site via individual systems, which consist of a combination of septic and soakage systems (88%), aerobic wastewater treatment systems (11%) and holding tanks (1%) (Asbourne Consulting, 2021).

The Eastside Onsite Wastewater Systems study 2021-2022 by Ashbourne Consulting completed a review of approximately 900 properties within Murray Bridge East. The report found:

- 38% of properties were below 1,200m^2 in area (335 allotments). This is the minimum allotment area that is typically required for on-site disposal.
- 89% of septic and soakage systems installed prior to June 1988 were in poor or failing condition (318 allotments).
- 50% of these failing systems have insufficient reserve area available to upgrade to current standards (159 allotments).
- 284 allotments do not have sufficient reserve area to upgrade to current standards (including the 159 pre-1988 systems). These are shown in and Appendix A.

A project start-up meeting was undertaken with both Council and Local Government Association (LGA) representatives on Thursday 5 October 2023 and it was agreed that the scheme would initially focus on four key priority areas as identified in Appendix A. These four priority areas of high housing concentration were identified where lots have insufficient disposal area, meaning that even if the failing system were replaced, there is insufficient reserve area available to meet current effluent disposal standards.

The total number of residential allotments included in the scheme is **527**. Refer Appendix A.

Where topography allows, gravity mains have been extended as far as practical to avoid creating additional pump stations outside of the priority areas. Where a gravity main has been designed adjacent a property and a connection has been deemed feasible, this property has been included in the scheme regardless of whether it has sufficient disposal area. The rationale behind the priority areas was to focus on the most problematic areas of the township and to optimise the total scheme cost, while providing flexibility for future extensions to the scheme.

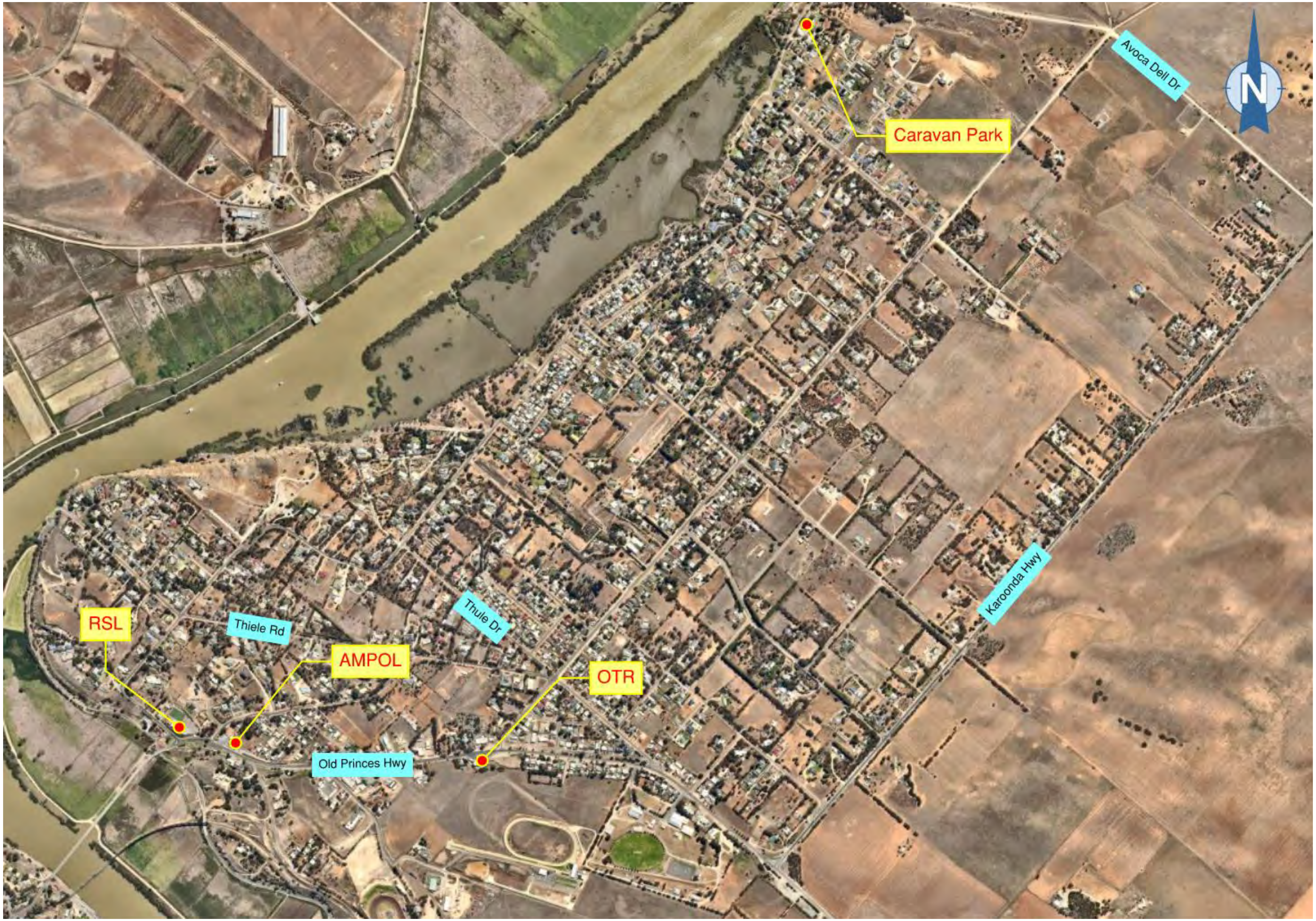

Figure 1: Murray Bridge East Township

2 BASIS OF DESIGN

2.1 Reference Documents

- Eastside Onsite Wastewater Systems Study – Assessment of existing on-site wastewater systems, Ashbourne Consulting, 2021-2022.
- SA Health Approval WWI-10908 for septic tank, balance tank and soakage system servicing club house and toilet block at Lot 55 Siesta Drive, Murray Bridge East.
- SA Health Approval WWI-10510 for septic tank and soakage system servicing the Avoca Dell Caravan Park.
- Future development Structure Plan, Holmes Dyer (Document Reference 1448-021 Structure Plan Areas – LAYERED).

2.2 General Design Criteria

2.2.1 Standards

The design criteria have been adopted taking into consideration the following relevant standards, guidelines and codes:

- South Australian Community Wastewater Management System Design Criteria (LGA, 2019) (CWMS Guidelines).
- On-site Wastewater Systems Code (SA Health, 2013) (On-site Code).
- Waste Stabilisation Pond Design Manual, Power and Water Corporation (2011).
- Australian Guidelines for Water Recycling (Phase1), 2006.
- AS 1547 On-site Domestic Wastewater Management.
- AS/NZS 3500 Plumbing and Drainage.
- AS/NZS 2566 Buried flexible pipelines Part 1 and Part 2.
- Water Services Association of Australia:
  - WSA 02-2014 Gravity Sewerage Code
  - WSA 04-2005 Sewage Pumping Station Code
  - WSA 07-2007 Pressure Sewerage Code

2.2.2 Flow Rates and Peaking Factors

The following criteria were adopted to determine flows:

- Residential effluent discharge rate: 170 L/person/day.
- Occupation rate: 2.6 persons/household based on the LGA 2019 CWMS Design Criteria. Note that this generally aligns with Table 1.
- Non-residential effluent discharge rate: in accordance with On-site Wastewater Systems Code including:
  - Caravan park resident: 100 L/person/d with a maximum occupancy of 306 persons
  - Take away: 5 L/meal
  - Public toilet 5 L/person
- Diurnal peak flow factor for reticulation network and pump duties: 3 (annual mean rainfall 349mm/annum based on Murray Bridge Weather Station (ID: 024521)).
- Hydraulic design load (HDL) peaking factor (PF) for pump station emergency storage: 1.0.
- Pump station emergency storage capacity: 50% of HDL.
- HDL PF for wastewater treatment: 0.75 (lagoon treatment).

Peak flow is estimated (refer Section 3) for all residential housing fully occupied and all caravan park accommodation also fully occupied.

2.2.3 Organic and Solids Load

Organic and solids loads in based on typical full sewer loads per Equivalent Person (EP):

- BOD 60 g/EP/d
- SS 50 g/EP/d

2.3 Design Life

The system is designed for serviceable life and the following design lives have been assumed based on the LGA criteria:

- Gravity sewers and civil components 70 years
- Maintenance structures 70 years
- Pump Stations (civil) 50 years
- Pumping equipment (mechanical and electrical) 15 years

It is noted that the WSA code gives a design life of 100 years for gravity sewers. 70 years is typically used by the LGA for whole of life calculations.

Manufacturer's warranty for lagoon liners is typically 20 years. This has been used for the whole of life calculations.

3 DESIGN OVERVIEW

3.1 Hydraulic Loads

3.1.1 Peak Flows

The residential flows have been based on an occupancy rate of 2.6 p/lot and a generation rate of 170L/p/day.

Table 2: CWMS Flow - Residential

NUMBER OF CONNECTIONS	EQUIVALENT PERSONS	AVERAGE DAILY FLOW KL/DAY
527	**1,370**	**233**

Table 3: CWMS Flow - Commercial

DESCRIPTION	NUMBER	USERS	FLOW RATE PER USER L/USER/DAY	AVERAGE DAILY FLOW KL/DAY	HYDRAULIC DESIGN LOAD RETICULATION NETWORK (L/S)
Service Station – OTR	1	300	10	3	0.1
Service Station - AMPOL	1	300	10	3	0.1
RSL	1	260	On site code clubs 15	3.9	0.1
Caravan Park	1	306	On site code caravan park 100	30.6	1.1
TOTAL	4			**40.5**	**1.4**

Table 2 shows the predicted flow from residential housing with all occupied lots included.Table 3 shows predicted peak flow from commercial premises.

Council advised that properties not connected to the scheme would continue to use existing aerobic systems and on-site disposal.

Experience from similar towns indicates that flow generated from residential allotments could be reduced due to delays of a wastewater connection. In Murray Bridge East several properties use an aerobic system. The design has allowed for the connection of these properties to the CWMS.

It is estimated that during a peak day with all houses fully occupied, vacant lots included, the caravan park fully operating at its peak, wastewater flow will be up to 273kL/day into the WWTP. No seasonal loading factor has been considered as this is reflected in the occupancy figures adopted for the approach outlined above (e.g. fully occupied homes and caravan park).

The design allows for 20% additional flow capacity of pumping systems to accommodate growth within the township. The treatment system is designed for the Average Daily Flow as calculated above and no additional capacity is included at this stage. However, a space allowance has been included for the ultimate loading from the township.

3.1.2 Pump Station Flows

Table 4: Pump Station Flow Summary

PUMP STATION	ADF (KL/DAY)	HDL (L/S)	MINIMUM DUTY FLOW (L/S)	EMERGENCY STORAGE (KL)
1A	120	4.2	7.2*	24
1B	22	0.8	1.5	4
2	66	2.7	3.2	13
3	35	1.2	1.5	7
4	44	1.5	1.8	9
CARAVAN PARK	31	1.1	1.5	6
TOTAL HDL INTO WWTP			15.2	

***Includes pumped upstream flows**

3.2 Topography and Soil Conditions

The site is located on the eastern riverbank of the Murray River, separated from the main township of Murray bridge across the river.

The majority of the site is located on a plateau, which is about 30 m to 50 m above the flood plain, with a mixture of steep cliff slopes and more gentle slopes down to the river level. The regional topography is largely undulating with a slopes down to the river to the north and south.

A detailed geotechnical investigation report has been included as Appendix C.

The geotechnical investigations revealed fine to coarse gravel to cobble sized rubbly calcrete was present on the natural ground surface beyond the pavement, as shown in Figure 2. Outcropping calcrete/limestone was also evident on the cliff slopes at the western-most section of Thiele Road near borehole BH4 and near the eastern bridge abutment of Murray Bridge near borehole BH5. Extremely weathered limestone was evident at higher elevation on the cut batters along either side of Michell Avenue near borehole BH12. Photographs of outcropping calcrete/limestones are shown in Figure 3 to Figure 5.

Figure 2: Rubbly Calcrete Scattered on Ground Surface (near BH10, Facing North)

Figure 3: Outcropping Limestone in an Eroded Cliff Face (near BH4, Facing South)

Figure 4: Outcropping Limestone on a Near Vertical Cliff Slope (near BH5, Facing Southwest)

Figure 5: Extremely Weathered Calcrete on a Cut Batter (near BH12, Facing Northwest)

The storage and disposal areas are located in a paddock to the east of town. The site has a slope down to the north, with a natural valley sloping down to the west through the northern corner of the site. The ground surface was sandy with minimal fines and required 4WD to traffic locally. A panoramic photograph of the area, taken from the high point in the south corner is shown in Figure 6.

Figure 6: Storage and Disposal Area

3.3 Flood Risk

Pump Station infrastructure has been located outside of the 1956 River Murray Flood Extent. It is likely that groundwater will be encountered in excavations and trenches closer to the river level.

3.4 Wastewater Collection

3.4.1 Overview

This Concept Design adopts the recommendations from the start-up meeting (held 5 October 2023) that a full sewer CWMS be implemented. A gravity network has been predominantly chosen with low-pressure sewer for 39 allotments which are unable to connect by gravity due to topography. This is discussed further in Section 3.4.6.

3.4.2 Connection Depth

WGA has used available LiDAR data (Dataset number 2625, Elevation – River Murray LiDAR 2021) to inform the concept design. The accuracy of the data is as follows:

- Vertical accuracy +/- -4.4cm – 6.5cm (95% confidence interval)
- Horizontal accuracy +/- 0cm (95% confidence interval)
- Vertical datum: AHD (Ausgeoid2020)

The following connection depths have been assumed at the property boundary. This depth typically provides sufficient fall from the internal fixtures to the connection point assuming an allotment that is flat or sloping towards the road. A 1.6 m connection depth was adopted in design. The 1.4 m criteria is typically used by SA Water for new connections. WSA 02 requires that the connection sewer soffit depth be at least 1.2 m. Higher depth adopted here will reduce a risk of property not achieving required connection fall.

Where the fall of the property is away from the road, deeper connection depths could be required. Some properties are proposed to be serviced by a sewer located in an easement at the back of allotments.

The depths of connections, requirements for easements or requirements for individual pumping units will be confirmed at the detailed design stage following a detailed engineering survey. Properties that are likely to require an individual pumping unit have been highlighted on the concept plans; however, this is subject to detailed design survey. Checking depth of the property sewer may need to be undertaken in some locations to confirm the connection requirement and depth.

It is recommended that a detailed septic tank survey be undertaken as part of the detailed design phase should the scheme proceed.

3.4.3 Rising Main Sizes

All new rising mains are designed to be polyethylene PN12.5 pressure rating.

Scour velocity in the rising mains will be 0.9 m/s. A minimum pipe size of DN90 has been adopted for pump station rising mains. Although the HDL at some of the smaller pump stations may justify a smaller pipe size, a larger pipe has been adopted as it is less prone to blockages and typically requires less maintenance with full sewer connections. The pump duties at the pump stations have been designed to maintain a minimum scour velocity of 0.9m/s in the rising mains.

3.4.4 System Description

Each pressure connected allotment will be fitted with an underground pump chamber and submersible pump. Pumps will then discharge to the sewer main.

5 main pump stations are proposed for the scheme and 1 minor station catering for the caravan park.

The pump system schematics for the considered option is shown in **Figure 7**.

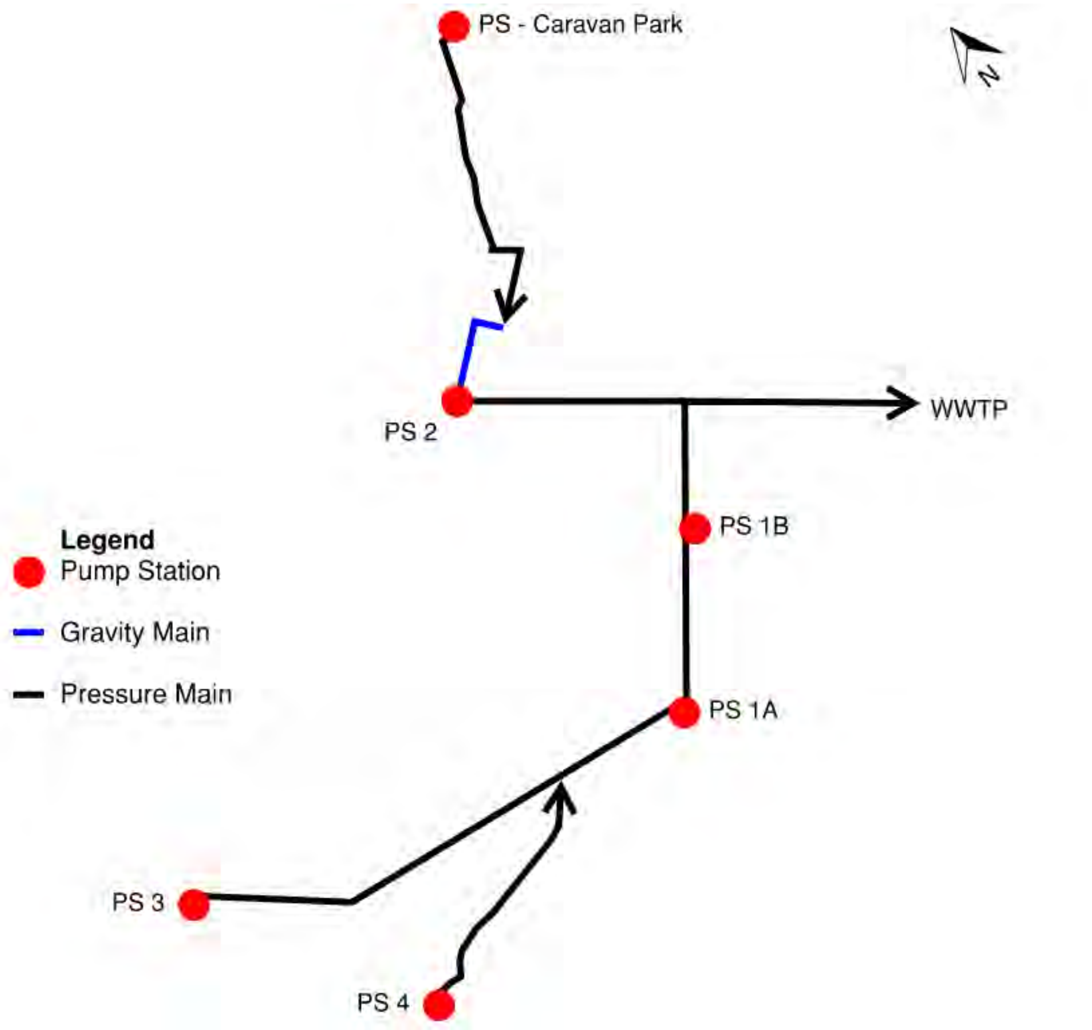

Figure 7: Pump System Schematic

Design drawings for the entire collection network are included in Appendix A.

The Caravan Park pump station will pump into the gravity catchment, which feeds PS2.

PS3 and PS4 will discharge into a common main discharging to PS1A, which will be fitted with additional emergency storage. This also allows the pumps at PS3 and PS4 to run with much less head as they will not have to pump all the way to the WWTP or compete with the other pump stations in the network. A bypass may be considered to allow PS3 and PS4 to pump into the common network should PS1A be offline.

PS1A, PS1B and PS2 will connect into a common rising main that pumps to the WWTP. Further hydraulic modelling will be required as part of the detailed design phase to confirm pump duties.

Isolation valves will be provided where rising mains merge to enable single rising main isolation in the case of pipe failure and to ease maintenance. Air valves and scour valves will also be provided and nominated as part of the detailed design phase.

3.4.5 Connections

The concept design shows a total of 527 connections.

The connection number has been based on discussions with Council and the LGA. A single connection has been provided to amalgamated allotments unless specifically advised otherwise by Council.

3.4.6 Gravity vs Pressure System

The preliminary designed is based on a gravity full-sewer network with low-pressure pump stations provided where grades do not allow a connection via gravity or the cost of another pump station is considered high.

The key differences between gravity and low-pressure systems are explained below.

3.4.6.1 Gravity System

A gravity system collects wastewater from all properties via gravity and as such the connection point must be deep enough to drain the site. In steep terrain where land slopes away from the main drains, this can result in deep excavations for individual property owners.

Gravity systems grade downhill from the top of the catchment to the lowest point. A pump station is generally located at this point to pump the wastewater to a treatment facility, either directly or indirectly via other catchments.

The system consists of a network of main drains and individual property connections. An Inspection Point (IP) is located at all property boundaries, with the property owner being responsible for plumbing within the property and the authority for all drains downstream of the connection IP. The main drains may be in public land such as road reserves or within easements through private property.

At all significant changes of direction and regular spacings along straight runs, flushing points are installed. Flushing points take the form of maintenance holes, inspection openings, or access chambers for full sewer systems.

Pump stations are used at low points in the catchment to lift the effluent to the treatment plant or to ensure the depth of the gravity drains is minimised. Placement of pumping stations is at the discretion of the designer and is dependent on the local conditions, which may limit the viability of installing deep gravity drains.

3.4.6.2 Pressure Sewer System

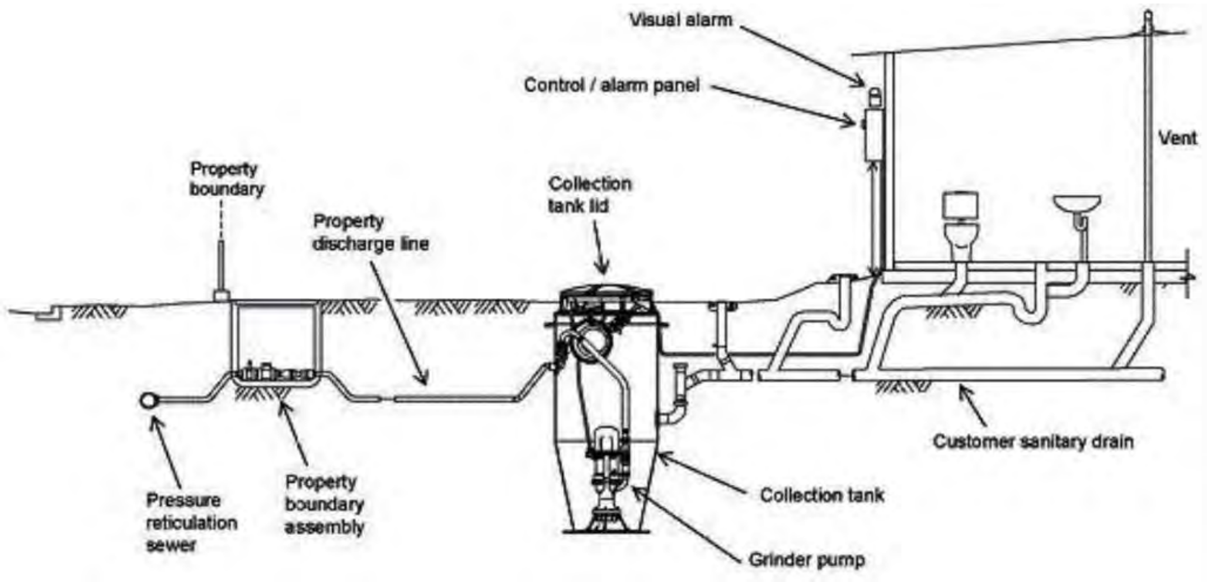

Figure 8: Typical Pressure Sewer Layout (Source: Hunter Water)

For the pressure sewerage systems, a single grinder or cutter pump is installed in the collection tank to pump the wastewater from the property to the network. The network of drains may either deliver directly to a treatment facility or may pump to a main pumping station, which then transfers the wastewater to the treatment facility. Generally, where the treatment site is either elevated or a long distance from the network (i.e. high pumping heads) a transfer pumping station will be required. Over the past few years there have been significant developments in domestic pump units and several are now capable of duties approaching 50m head.

Each property connection consists of a 32mm connection line from the pump chamber to the main drain. There is also a valve pit located at the property boundary containing isolation valves and non-return valves.

Pressure systems allow for the use of smaller bore drains than gravity systems and can be laid at shallower depths, as they do not require a minimum downhill grade. They can be laid to the contour of the land.

Most of the pump supply companies in South Australia now market a package system suitable for installation in domestic situations. The quality and capability of each of the systems varies and needs to be assessed for the particular application.

Pump selection is a critical component of the design of a pressure network. Utilising pumps with performance curves that differ from that of the design can adversely impact on the system performance. Ensuring that the pumps specified in the design are actually installed requires vigilant monitoring and control. Most landowners will substitute the specified pump for cheaper alternatives if the installation is not monitored and strict controls placed on pump installation.

The reticulation network in a pressure system generally remains full of wastewater. Each time an individual property pumps into the system it forces wastewater in at the top end of the catchment and consequently out of the system at the outlet end. In large networks significant volumes of wastewater can be retained within the pipe network for long periods of time.

The period of time that the wastewater remains in the network depends on the volume of the pipes within it and the volume of wastewater being pumped into it. The biochemical reaction occurring in the sewage/effluent quickly uses all available oxygen in the process. Once this occurs, anoxic conditions are established, which causes septicity to occur, a by-product of this process is hydrogen sulphide which is highly corrosive, toxic and at low concentrations has an unpleasant odour.

The potential for hydrogen sulphide generation within the systems will impact on the system design. The location of air valves needs to be considered carefully so as not to position them in areas likely to be sensitive to odours. Head works at the treatment plant need to be designed to cater for the higher hydrogen sulphide load as it is highly corrosive. The gas can also be highly toxic, so safety of operators needs to be considered in the design. In addition to this the treatment process itself needs to account for the septic conditions particularly when calculating oxygen demands.

If the pressure option is adopted, it is important for Council to consider who will be responsible for installing and maintaining the property pumps. While it may represent an overall saving in terms of WOLC, the ongoing cost such as regular servicing and pump replacement needs to be considered.

It is strongly recommended that Council manage the servicing of the property pumps. Experience in other schemes has shown that if left up to the resident, the pumps that are originally specified will be eventually "swapped-out" for cheaper ones, which can negatively impact the hydraulics and performance of the system. Recent experience has also shown that residents typically do not maintain and service the pump units as frequently as required.

Table 5 summarises the relative advantages and disadvantages of each option.

Table 5: Relative Advantages and Disadvantages of Each Option

SYSTEM	ADVANTAGES	DISADVANTAGES
Gravity System with Pump Stations	Low maintenance for gravity connections. Minimal infrastructure required on each property.	Presence of rock and ground water will significantly affect cost and construction time, as a gravity system needs to be deeper and requires a wide trench. Subject to topography large pump stations are typically required, which are costly and can cause both odour and amenity issues.
Pressure System	Can follow the surface profile so excavation depth is significantly reduced. Faster construction timeframe Less disruption and reinstatement due to narrower trench and smaller pipe size. Horizontal Directional Drill is possible, which will further reduce reinstatement cost. Less risk of encountering groundwater. Capital cost is typically less than gravity system.	Pumps typically have a design life of 10-15 years so will require replacement. Gas entrapment could prevent the network from efficient operation. Some sections of network could require frequent flushing to remove solids.

Figure 9 and Figure 10 show the typical difference in construction footprint between a gravity sewer (above) and pressure sewer (below).

Figure 9: Typical Gravity Sewer Construction

Figure 10: Typical Pressure Sewer Construction

3.5 Wastewater Treatment

3.5.1 Overview

A facultative lagoon WWTP has been proposed for the concept design. Discussions with Council indicate that there is limited internal labour capacity to operate a mechanical treatment plant and a lagoon-based system provides the simplest, low-maintenance solution.

A second option involving connecting to SA Water's sewer network with a rising main over the road bridge to Murray Bridge is being investigated. As of the time of writing this report, SA Water has not completed their assessment of the connection feasibility. As this is an interim report, future work will be undertaken to explore this option further once correspondence from SA Water is received.

A third option involving a more compact mechanical treatment plant has also been considered. WGA has considered a Rotating Biological Contactor (RBC) for the mechanical treatment plant.

The RBC was considered over a traditional Sequence Batch Reactor (SBR) for the following reasons:

- Simplicity. RBCs are simpler in design and operation with fewer moving parts compared to SBRs, resulting in potentially lower maintenance and operational complexity.
- Lower energy consumption. RBCs typically require lower energy consumption compared to SBRs since they do not involve pumping between different stages and aeration.
- Less sludge production. RBCs typically produce less sludge compared to SBRs, leading to potential savings in sludge handling and disposal costs.

A comparison of treatment plant types is summarised in the below table:

Table 6: WWTP Options Comparison

SYSTEM	ADVANTAGES	DISADVANTAGES
Facultative lagoons	- Easy to operate - Very low energy consumption - Operate fine with flow and load fluctuations - Robust treatment during power failure at WWTP site.	- Buffer zone is 350 m (>1000EP), which is more than mechanical plant - Larger area of land required for construction - More water loss due to evaporation - Require cut and fill to build earthen water storages. Poor soil conditions (rocks) and high ground water could significantly increase construction costs
SA Water Connection	- Council has no responsibility for maintenance or operation of treatment plant facilities. - No land acquisition costs for WWTP and disposal.	- Strict trade waste restrictions generally apply for non-residential connections. - Subject to SA Water advice, may be a much costlier option. - Rising main over the bridge presents a key operational network risk for Council. May result in additional network storage depending on Council's risk appetite. - Council could be subject to future SA Water rate rises outside of its control.
Rotating Biological Contactor (RBC)	- Compact design and footprint - Low energy consumption - Buffer zone is 200m (>1000EP) – less than lagoons - Low sludge production compared with activated sludge systems	- Maintenance requirements to ensure proper functioning of rotating disks and associated mechanical components. - Vulnerability to fouling. Rotating disks can be susceptible to fouling from fats, oils and grease (FOG), which can reduce treatment efficiency and necessitate more frequent cleaning.
Sequencing Batch Reactor SBR	- Small footprint - Buffer zone is 200 m (>1000EP) – less than lagoons - Greater control of water quality	- Requires skilled operators - Mechanical equipment could fail - More energy consumption - Needs additional operator intervention to optimise due to flow and load fluctuation. - Greater impact during power failure

3.5.2 Facultative Lagoons

For full sewer application the lagoons are typically preceded by screens and an anaerobic lagoon to remove solids and to reduce the organic load. Facultative lagoons are typically earthen storages 1.2 – 1.5 m in depth and are not mechanically mixed or aerated. The layer of water near the surface contains sufficient oxygen from atmosphere to support the growth of aerobic and facultative bacteria that oxidize and stabilize wastewater organics. The bottom layer of a facultative lagoon includes sludge deposits that are decomposed by anaerobic bacteria.

The long retention time of 36 days at the facultative lagoon and 30 days in maturation lagoons provides a buffer to average out peak flows and loads. For full-sewer systems an anaerobic lagoon is typically placed at the front end of the plant. This is a deeper pond that can break down organic sewage without the presence of oxygen. The bottom part of the anaerobic lagoon stores grit and organic sludge for slow anaerobic digestion.

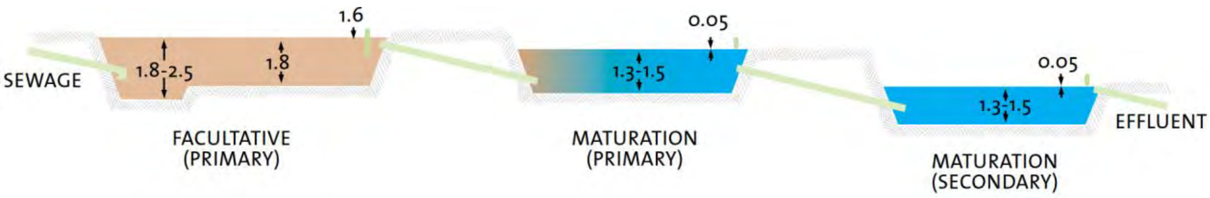

Figure 11: Typical Facultative Lagoon Layout (extract from Waste Stabilisation Pond Design Manual, PWC (2011))

WGA has been involved in similarly sized facultative lagoons on several projects and is familiar with the general requirements and market pricing. Geotechnical conditions will be reviewed following the results from the geotechnical investigations. The construction cost should be then verified by the industry and contractors familiar with the site condition and earthworks requirements at Murray Bridge East.

The following buffer distances have been achieved based on the EPA Evaluation distances for effective air quality and noise management (2016).

- Facultative Lagoons – 150m evaluation distance (less than 1000 people).
- Mechanical Wastewater Plants – 100m evaluation distance (less than 1,000 people).

In order to future-proof the site, a separation distance of 350m (recommended for between 1000 and 5000 people) has been selected for the treatment lagoons. This will also reduce the risk of nuisance of odours to the surrounding community.

3.5.3 Facultative/Maturation Lagoon Sizing

The ultimate lagoon footprint has been sized for 1,000 connections with a total ADF of 442kL/day (based on 170L/p/day and 2.6 persons/lot).

The ADF from the current number of connections is 273kL/day, which includes full capacity at the caravan park.

For areas with annual rainfall less than 400mm/year such as Murray Bridge east, the system peaking factor is 0.75 for lagoon treatment systems (due to increased evaporation).

The HDL for the lagoon systems is therefore:

- Initial HDL = 205kL/day
- Ultimate HDL = 332kL/day

A staged layout has been shown on the plan that includes only what is required for the current ADF but with space provisions allowed for future lagoons as the scheme expands. There is also the option to increase the depth of the facultative lagoons to take additional flow.

3.5.4 SA Water Connection

At the time of writing, SA Water has not completed their assessment of the connection feasibility. The proposed connection point to SA Water's network would be the existing DN225 gravity sewer main on East Tce as shown in Figure 12.

This option would involve the construction of 600m of rising main over the original Murray Bridge on the Karoonda highway.

At this stage, the SA water headworks/augmentation requirements are unknown.

Should this option proceed, Council should consider its risk appetite in the event of a rising main failure/rupture over the bridge. Additional storage and controls may be required the pump stations to mitigate this risk in the event of an emergency.

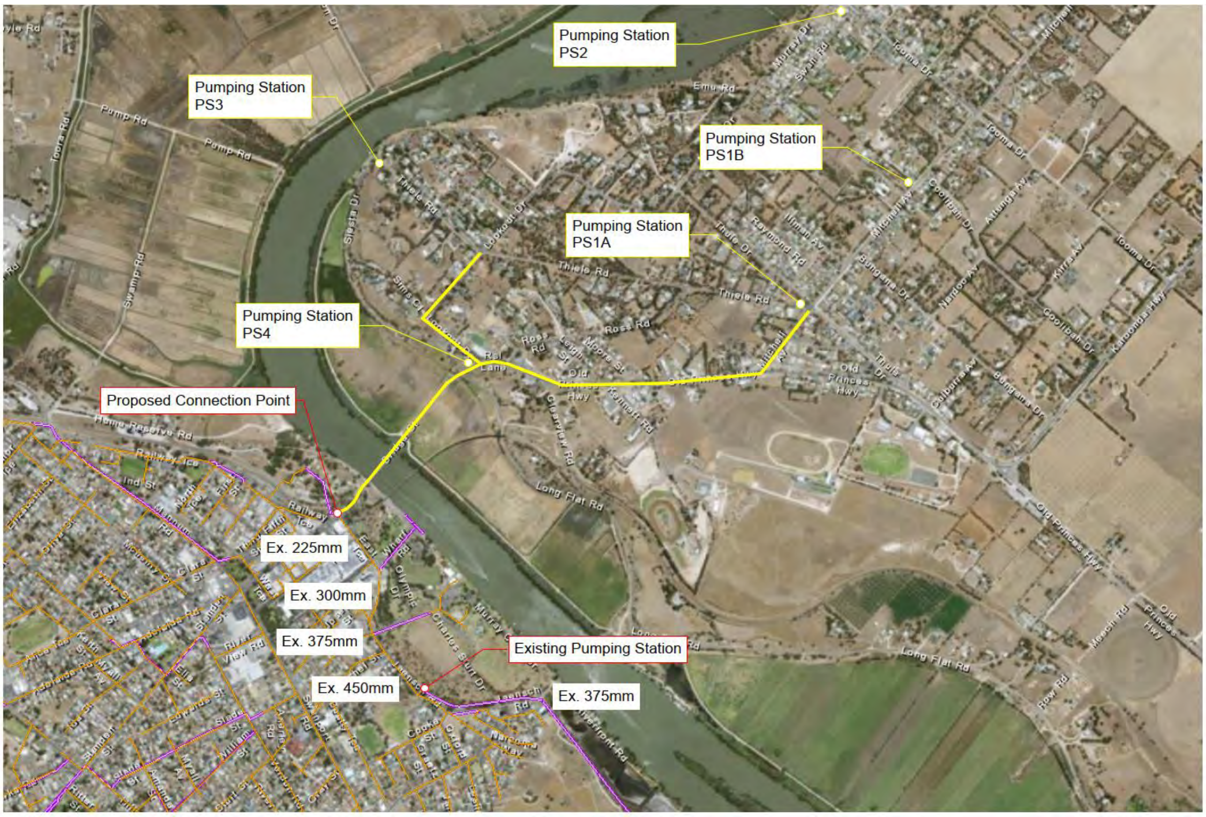

Figure 12: Proposed Connection Point to SA Water

3.5.5 Mechanical Treatment Plant (RBC)

WGA has approached a treatment plant supplier to consider an alternative design option to the facultative lagoon system.

The concept behind a Rotating Biological Contactor (RBC) is to utilise a series of rotating disks as a medium for microbial growth to treat wastewater. As the disks rotate, they come into contact with the wastewater, allowing microbial communities to attach and form biofilms on the disk surfaces. These microorganisms break down organic pollutants present in the wastewater, promoting biological treatment. The rotation of the disks ensures continuous exposure of the biofilm to the wastewater, enhancing treatment efficiency. Once treated, the wastewater is separated from the biofilm and discharged, while the biofilm continues to grow and degrade contaminants in subsequent cycles. This process facilitates the removal of organic matter, suspended solids, and other pollutants from the wastewater.

A typical layout of an RBC is shown in Figure 13. The footprint is approximately 30m x 30m, which is a factor of 10 times smaller than an equivalent lagoon system.

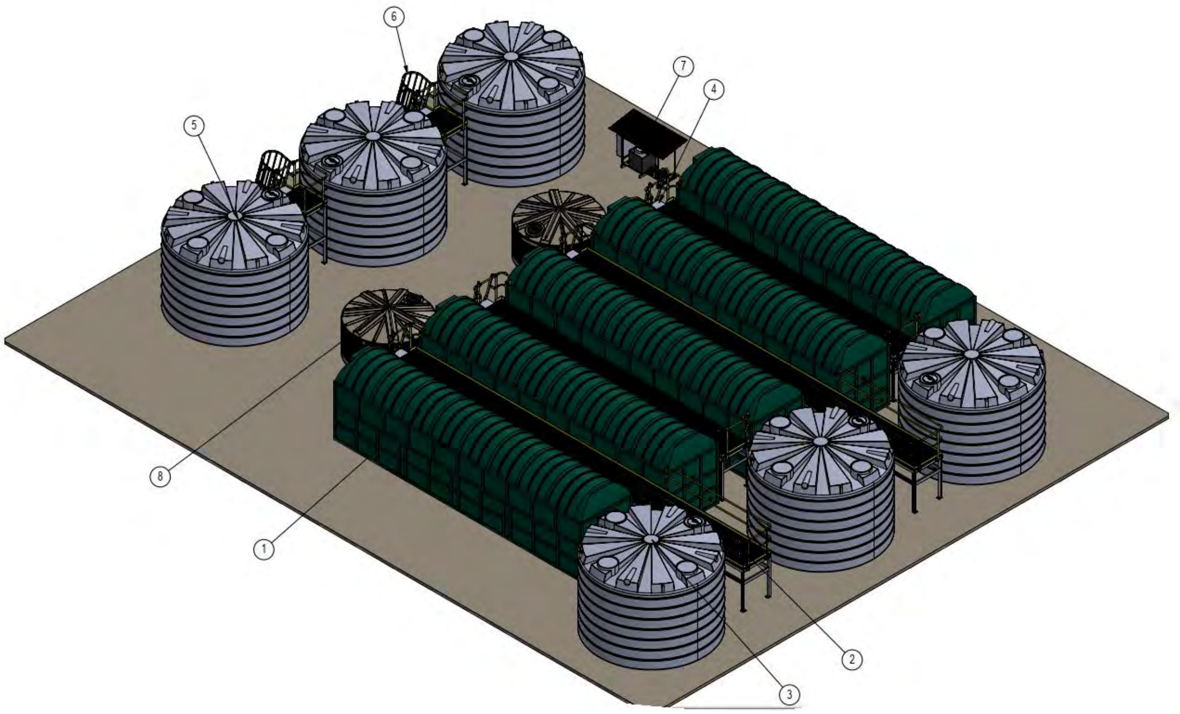

Figure 13: Typical RBC layout (shown for information)

3.6 Recycled Water Storage and Disposal

3.6.1 Water Balance

The total volume of treated water available for irrigation will be less than the volume of raw wastewater due to losses during the treatment process and evaporation. Ultimate annual inflows into the plant are estimated to be in the order of 85ML/a (based on 527 connections at 170L/p/day and 2.6p/lot). Typical evaporation losses for Murray Bridge East are 882mm/year (including offset from rainfall) based on Murray Bridge weather station data, which equates to approximately 35ML/a over the area of the lagoons, resulting in approx. 50ML/a available for irrigation. If a mechanical based WWTP is used, the volume available for irrigation will be closer to 60-70ML/a.

It should be noted that in the early stages of the scheme, there will be a lag in volumes of wastewater delivered to the WWTP as connections gradually come online. It is not unusual to have very little water available for irrigation during the first years of a scheme being built due to the time-lag associated with properties connecting.

For the concept design, the storage lagoons have been based on a winter storage volume equal to 4 months of average daily flow (ADF) to account for the fact that generally no irrigation between the months of May and September. This results in a storage volume of 27ML for the 527 connections. It is recommended that this number is confirmed via a water balance at the detailed design phase.

The irrigation area has been based on a disposal rate of 10ML/hectare/annum, however, will be subject to site-specific investigations as part of the detailed design phase as discussed in Section 3.6.2.

3.6.2 Recycled Water Storage and Disposal

Discussions with Council indicated that due to the proximity of the river, there is currently little appetite for recycled water at any of the public spaces (e.g. greyhound racing track, or showgrounds). The potential location of the WWTP on Tooma Drive opens up the potential for future pumping to the SA Water irrigation sites or the Murray Bridge Training range to the southwest.

Typically, the irrigation application rate varies during the year and is adjusted to the plant moisture needs, nutrient needs and soil infiltration rates. Small rates or no application during winter allows for efficient water disposal and low risk of water pooling and run off.

For the recycled water irrigation to be sustainable, the amount of water, nutrients and chemicals that are applied should be evaluated to ensure that it is the optimal for the crop, the land use, the agronomic system employed, and site-specific factors such as climate, topography and soil.

Further investigation will be required to determine which potential irrigation areas are the most suitable and what application rates are to be used to ensure sustainable irrigation. The investigation is to verify soil specific conditions as well as the key risks of the irrigation scheme and the need for additional controls such as buffer zones, low impact irrigation zones, runoff controls, groundwater protection.

The concept design has included 5ha of irrigation area adjacent to the WWTP site. SA Water's Irrigated Public Open Space (IPOS) guidelines have been used to calculate a range of irrigation demands for site specific rainfall, evaporation and soil types. Based on an irrigation area of 5 hectares, BoM Region Murray Bridge, a distribution uniformity of 80%, warm turf type, clay soils (<5mm/h) and a 150mm root zone, the irrigation requirement ranges from 19ML/a (TQVS 4) to 61ML/a (TQVS 1). TQVS refers to the Turf Quality Visual Standard and is more based on sports fields where TQVS 1 is the highest quality sports field (e.g. Adelaide Oval) and TQVS 4 is passive recreational turf.

To ensure efficient and sustainable irrigation, winter storage is included in the scheme. The most cost-efficient storage is an earthen storage fitted with a synthetic liner. A water balance undertaken indicates that to avoid winter irrigation and to minimise disposal area an 27ML storage will be required for Murray Bridge East. Land area will be allocated for a second 27ML storage lagoon adjacent to allow for future growth within the township.

4 COST ESTIMATES

4.1 Capital Costs

4.1.1 Wastewater Collection

The cost comparison is summarised in Table 7. These costs exclude the return main and irrigation.

Table 7: Capital Cost Estimate Collection System

DESCRIPTION	COST
Preliminaries	$ 960,000.00
Gravity Collection system (excluding pumped lots)	$ 4,980,000.00
Pumped lots	$ 510,000.00
Pumping Stations and Rising Mains	$ 3,840,000.00
Miscellaneous	$ 230,000.00
Subtotal (rounded)	**$ 10,520,000.00**
Contingency 20%	$ 2,100,000.00
CITB Levy 2.5%	$ 30,000.00
TOTAL COST	**$ 12,660,000.00**

The following qualifications and exclusions apply to the above estimate:

- Figures have been rounded up to the nearest $10,000.00 for reporting purposes.
- SAPN has been approached for pump station connection costs.
- Relocation of existing services is excluded.
- Design fees and superintendency are excluded.
- Statutory fees are excluded.
- GST is excluded.

4.1.2 Wastewater Treatment

Table 8: Lagoon Treatment and Storage

DESCRIPTION	COST
Preliminaries & Engineering	$ 330,000.00
Treatment Lagoons	$ 2,220,000.00
Winter storage	$ 1,100,000.00
Subtotal (rounded)	**$ 3,660,000.00**
Contingency 20%	$ 740,000.00
CITB Levy 2.5%	$ 10,000.00
TOTAL COST	**$ 4,410,000.00**

The following qualifications and exclusions apply to the above estimate:

- Figures have been rounded up to the nearest $10,000.00 for reporting purposes.
- Assumed balance of cut and fill. No allowance for disposal of fill or imported material.
- Cut to fill rate of $50/m^3 assumed. This equates to approximately $1.5m in cut to fill across the lagoons. This rate does not allow for rock excavation. If rock is encountered this rate could easily be 2 or 3 times higher.
- Design fees and superintendency are excluded.
- Statutory fees are excluded.
- GST is excluded.

Table 9: Mechanical Treatment and Storage

DESCRIPTION	COST
Preliminaries & Engineering	$ 300,000.00
Mechanical WWTP	$ 1,870,000.00
Winter storage	$ 1,100,000.00
Subtotal (rounded)	**$ 3,270,000.00**
Contingency 20%	$ 650,000.00
CITB Levy 2.5%	$ 10,000.00
TOTAL COST	**$ 3,940,000.00**

The following qualifications and exclusions apply to the above estimate:

- Figures have been rounded up to the nearest $10,000.00 for reporting purposes.
- Based on 30m x 30m WWTP area.
- Based on budget costs for modular RBC mechanical WWTP including 3 x 50kL balance tanks, RBC units, platforms, pumps, connecting pipework and 3 x 50kL irrigation tanks.
- Assumed balance of cut and fill. No allowance for disposal of fill or imported material.
- Cut to fill rate of $50/m^3 assumed. This equates to approximately $0.6m in cut to fill across the lagoons. This rate does not allow for rock excavation. If rock is encountered this rate could easily be 2 or 3 times higher.
- Design fees and superintendency are excluded.
- Statutory fees are excluded.
- GST is excluded.

4.1.3 Irrigation/Disposal

Table 10: Irrigation

DESCRIPTION	COST
Preliminaries & Engineering	**$ 90,000.00**
Power Connection to Site	**$ 160,000.00**
Irrigation Pump Station and Chlorination	**$ 140,000.00**
Irrigation and Fencing	**$ 570,000.00**
Subtotal (rounded)	**$ 960,000.00**
Contingency 20%	$ 190,000.00
CITB Levy 2.5%	$ 10,000.00
TOTAL COST	**$ 1,160,000.00**

The following qualifications and exclusions apply to the above estimate:

- Figures have been rounded up to the nearest $10,000.00 for reporting purposes.
- Power connection fee is $160,000 based on Option 1 from SAPN which includes supply and instal of new 11kV connection to existing network and supply and install of 400m of HV overhead extension into private property, new pole mounted 63kVA transformer and supply and installation of 63A, 400V, 3-phase service.
- Design fees and superintendency is excluded.
- Statutory fees are excluded.
- GST is excluded.
- Land cost is excluded.

4.1.4 Capital Cost Summary

The summary of the capital costs comparing the lagoon-based option to the mechanical WWTP are summarised in Table 11.

Table 11: Capital Cost Summary

	CAPITAL COST	PER CONNECTION
Lagoon Option	$ 18,230,000.00	$ 34,592.00
Mechanical WWTP Option	$ 17,760,000.00	$ 33,700.00

4.2 Whole of Life Costs (WOL)

Whole life costing is a tool which assesses the total cost of an asset over its whole life. It takes account of the initial capital cost, as well as operational, maintenance, repair and upgrade costs. WGA has used the LGA CWMS Whole of Life Cost Model to determine the WOL cost for both the lagoon and mechanical WWTP option. The summaries are shown in Table 12 and Table 13 and the detailed output is included as Appendix B.

Table 12: Whole of Life Costs – Lagoon Option

Gross Present Value	**22,430,174**
Residual Values (Year 0)	**(1,287,040)**
Net Present Value (NPV)	**21,143,134**
based on Project Life = 50 years, and a	
discount rate = 4.00%.	

Table 13: Whole of Life Costs – Mechanical WWTP Option

Gross Present Value	**23,986,648**
Residual Values (Year 0)	**(1,267,454)**
Net Present Value (NPV)	**22,719,194**
based on Project Life = 50 years, and a	
discount rate = 4.00%.	

The following qualifications and exclusions apply to the above estimates:

- Discount rate of 4% applied (as per LGA guidelines).
- Based on 527 rateable connections.
- GST is excluded.
- Figures have been rounded up to the nearest $10,000.00 for reporting purposes.
- Design fees and superintendency is excluded.
- Land acquisition costs excluded.

Detailed breakdowns of the whole of life costs are included as Appendix B.

4.2.1 Whole of Life Assumptions

- For network pump stations, 80% of the capital cost has been assumed to be civil works with an asset life of 50 years. The remaining 20% is mechanical and electrical with an asset life of 15 years.
- Mechanical screen has an asset life of 25 years.
- Irrigation (Mech and Elec) has an asset life of 15 years.
- Irrigation Sprinkler heads have an asset life of 50 years.
- HDPE liners have an asset life of 20 years.
- Gravity sewer maintenance costs have been based on the following equation based on Hunter Water guidelines of:
  - $2872 - 1.13 x DN + 0.00024 x DN2 x L
  - Where DN is the nominal diameter of the pipeline and L is the length
  - A factor of 3 has been multiplied by this to account for the smaller nature of the CWMS compared with Hunter Water systems and the inflationary effects since the guidelines were published (2013).
- Rising mains maintenance costs have been based on the following equation based on Hunter Water guidelines of:
  - $700 + 0.0005 x DN2 x L
  - Where DN is the nominal diameter of the pipeline and L is the length
  - A factor of 3 has been multiplied by this to account for the smaller nature of the CWMS compared with Hunter Water systems and the inflationary effects since the guidelines were published (2013).
- Pump Station desludging costs assumed to be $1500/station/year.
- Property pump power costs based on $30/pump station per year with a maintenance cost of $50/station/year assuming that a contract can be managed across the property pump stations.
- Network pump station power costs have been based on a power cost of $0.35/kWh and a pump efficiency of 0.6, average head of 60m and that the flow ramps up linearly from zero to pump duty after 10 years.
- Screenings removal cost of $5,000/annum. The screenings and sludge removal for the mechanical WWTP option is $30,000/annum due to the fact that this would typically be recommended every 2-3 months.
- Pump station desludging cost of $1500/station/annum.
- Periodic flushing of rising mains assumed to occur every 5 years at $10,000.
- Assume 0.2FTE for CWMS operator for lagoon-based system at $90k/year full salary. Assume 1.0FTE for mechanical treatment plant system.
- Chlorine costs based on 3000L/annum of sodium hypochlorite which equates to $3500/annum.
- Lagoon power costs assumed to be running for an average of 4 hours per day. 10kW for lagoon-based system (screen and irrigation pump).
- Mechanical WWTP power costs assumed to be running for an average of 8 hours per day. 25kW for RBC system.
- Facultative lagoon desludging assumed to occur every 10 years. Cost of $670k based on relative area of lagoons compared to 2021 costs from Mt Barker lagoons. Assumes sludge survey, dredging lagoons and carting sludge 12km off-site.
- Assumed that 50% of mechanical WWTP capital cost is mech and elec with a 15-year asset life.

4.3 SA Water Connection

SA Water has been contacted to provide advice on the feasibility of a connection to the SA Water operated sewer in Murray Bridge, which ultimately discharges to the WWTP at Brinkley. No formal advice has been provided at the time of writing.

SA Water's published Pricing Schedule 2023-2024 (1 July 2023) for Common Effluent Sewerage in Other Areas is $131.00/connection per year. This cost is assumed to cover the ongoing maintenance and operation costs associated with treatment and disposal. It is important to note that this does not include any augmentation costs associated with capital upgrades. Assuming no discount rate and $131 per connection for 527 connections for 50 years is a total of $3.45m.

The calculated WOLC for treatment, storage and disposal is $7.7m for the facultative lagoon option and $9.3m for the mechanical WWTP option.

The break-even charge is $293/connection to balance the $7.7m in WOLC associated with treatment, storage and disposal should Council choose to build its own WWTP.

5 CONCLUSIONS & RECOMMENDATIONS

WGA has provided a concept design for the CWMS system for Murray Bridge East. Drawings are included as Appendix A and a detailed cost estimate and whole of life costs are included as Appendix B. The detailed geotechnical report is included as Appendix C.

The capital cost and Whole of Life Cost (WOLC) for each option is summarised in Table 14. Total costs have been rounded to the nearest $10,000 and per connection costs have been rounded to the nearest $10 for presentation.

Table 14: Capital Cost and WOLC Summary

	CAPITAL COST	CAPITAL COST PER CONNECTION	WOLC	WOLC PER CONNECTION
Lagoon Option	$ 18,230,000.00	$ 34,590.00	$21,140,000.00	$40,120.00
Mechanical WWTP Option	$ 17,760,000.00	$ 33,700.00	$22,720,000.00	$43,110.00

Final conclusions and recommendations are listed below:

1. The gravity scheme combined with the facultative lagoon option provides the lowest whole of life cost over the project timeframe.
2. A total of 527 connections have been included in the scheme based on the identification of priority areas where allotments were found to have insufficient disposal area for on-site systems.
3. A cut-fill rate of $50/m^3$ has been assumed for the lagoons. This does not allow for rock excavation. As a sensitivity analysis, the break-even point for where the WOLC for the lagoon option is equal to the WOLC for the mechanical WWTP is a cut-fill rate of approximately $120/m^3$, which is a risk factor of 2.4.
4. No allowance has been made for land acquisition or easement costs. Council may wish to seek external advice on this prior to any funding commitments.
5. No allowance has been made for market volatility. WGA has based the cost estimate on tendered rates for recent projects.
6. Some properties may not be able to be serviced via gravity and will require individual pumped connections. This will be determined during the detailed design phase once a detailed survey is conducted. However, we have nominated some of the likely properties on the drawings based on a combination site-visit observations, LiDAR data and review of Google Street View.
7. It has been assumed that the WWTP site will be used for effluent disposal. We have nominated a disposal area adjacent to the WWTP site as Council noted that there is limited demand for recycled water within the township.
8. SA Water has been contacted about a connection to the Murray Bridge scheme. At the time of writing, no formal advice has been provided.

APPENDIX A
CONCEPT DESIGN DRAWINGS

APPENDIX B
COST ESTIMATES AND WHOLE OF LIFE COSTINGS

Murray Bridge East CWMS

Construction Cost Opinion - Collection for Lagoon Option

Rural City of Murray Bridge

Consultant	Wallbridge Gilbert Aztec
Revision	B
Date	16/04/2024
Job No.	WGA231738
Eng	NJ
Chk	MOF

Ref Dwgs	WGA231738-SK-CV-0000_D WGA231738-SK-CV-0001_D WGA231738-SK-CV-0002_D WGA231738-SK-CV-0003_D WGA231738-SK-CV-0004_C

NO. CONNECTIONS	527

ITEM	DESCRIPTION	UNIT	RATE ($)	QUANTITY	AMOUNT ($)
1	**PRELIMINARIES**				
	Establishment	item			
	Service locations	item			
	Insurance	item			
	Quality control/site admin/safety	item			
	Survey	item			
	Site compound	item			
	Site supervisor	item			
	Site engineer	item			
					$ 960,000.00
2	**SEWER COLLECTION SYSTEM**				
	<2m Depth. Supply and lay DN150 PVC solvent welded pipe, sewer grade including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement	m	$ 270.00	6268	$ 1,692,360.00
	>2m Depth. Supply and lay DN150 PVC solvent welded pipe, sewer grade including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement	m	$ 320.00	3996	$ 1,278,720.00
	>2m Depth. Supply and lay DN225 PVC solvent welded pipe, sewer grade including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement	m	$ 370.00	57	$ 21,090.00
	Supply and install 1050 mm dia. concrete maintenance holes and 1050 mm dia. inlet hole including trafficable lids and frames, sand bedding and backfill, sealing of penetrations and shaping base etc	item	$ 4,400.00	38	$ 167,200.00
	Supply and install maintenance shaft. inlet hole including trafficable lids and frames, sand bedding and backfill, sealing of penetrations and shaping base etc	item	$ 1,200.00	93	$ 111,600.00
	Supply and lay DN100 PVC solvent welded sewer grade property connection pipe complete with risers, screw caps and top stones (from property boundary to collection drain), including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling and compaction and surface reinstatement.	item	$ 3,500.00	488	$ 1,708,000.00
					$ 4,980,000.00
3	**PROPERTY PUMP STATIONS**				
	Supply and Install of Property Pump Unit including excavation and backfill	each	$ 10,000.00	39	$ 390,000.00
	Property pump power connection	each	$ 500.00	39	$ 19,500.00
	Property pump connection to boundary (including boundary kit)	each	$ 2,500.00	39	$ 97,500.00
					$ -
					$ 510,000.00
4	**PUMPING STATIONS AND RISING MAINS**				
	Pump Station 1A. 2.25m dia x 5.6m deep. 13kL emergency storage vessel. 7.2L/s @38m head	item	$ 450,000.00	1	$ 495,000.00
	Pump Station 1B. 2.25m dia x 5.6m deep. 1.5L/s @ 34m head.	item	$ 350,000.00	1	$ 385,000.00
	Pump Station 2. 2.25m diax 5.6m deep. 2.67L/s @68.5m head	item	$ 325,000.00	1	$ 357,500.00
	Pump Station 3. 2.25m dia x 4.1m deep. 1.5L/s @82.1m head	item	$ 300,000.00	1	$ 330,000.00
	Pump Station 4. 2.25m dia x 4.3m deep. 1.5 @ 66.6m	item	$ 300,000.00	1	$ 330,000.00
	Caravan Park Pump Station. 2.25m dia x 3.8m deep. 1.5L/s @ 42.6m	item	$ 275,000.00	1	$ 302,500.00
	Supply and lay DN50 PE PN12.5 minimum sewer rising main, fittings and valves including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 100.00	576	$ 57,600.00
	Supply and lay DN63 PE PN12.5 minimum sewer rising main, fittings and valves including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 130.00	322	$ 41,860.00
	Supply and lay DN90 PE PN12.5 minimum sewer rising main, fittings and valves including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 170.00	4338	$ 737,460.00
	Supply and lay DN125 PE PN12.5 minimum sewer rising main, fittings and valves including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 220.00	1504	$ 330,880.00
	Supply and lay DN180 PE PN12.5 minimum sewer rising main, fittings and valves including excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 280.00	1387	$ 388,360.00
	Electrical works including connection to SAPN service point	item	$ 11,000.00	1	$ 11,000.00
	Scour Valves	each			$ 31,123.20
	Air Valves	each			$ 31,123.20
	Isolation Valves	each			$ 15,561.60
					$ -
					$ 3,840,000.00
5	**MISCELLANEOUS**				
	Marker Posts	each	$ 500.00	41	$ 20,500.00
	Hydraulic Testing	item	$ 8,000.00	1	$ 8,000.00
	Air testing of all gravity collection drains and manholes up to the boundary flushing point.	item	$ 7,500.00	1	$ 7,500.00

Murray Bridge East CWMS

Construction Cost Opinion - Collection for Lagoon Option

Rural City of Murray Bridge

Consultant	Wallbridge Gilbert Aztec
Revision	B
Date	16/04/2024
Job No.	WGA231738
Eng	NJ
Chk	MOF

Ref Dwgs	WGA231738-SK-CV-0000_D WGA231738-SK-CV-0001_D WGA231738-SK-CV-0002_D WGA231738-SK-CV-0003_D WGA231738-SK-CV-0004_C

NO. CONNECTIONS	527

ITEM	DESCRIPTION	UNIT	RATE ($)	QUANTITY	AMOUNT ($)
	Hydrostatic testing of pressure sewer pipes	item	$ 20,000.00	1	$ 20,000.00
	As Constructed Survey	item	$ 15,000.00	1	$ 15,000.00
	Traffic Control	each	$ 50,000.00	1	$ 50,000.00
	Compaction Testing for trenched backfill for drains and pressure sewer pipes	each	$ 500.00	185	$ 92,500.00
	Service Investigation	each	$ 15,000.00	1	$ 15,000.00
					$ 230,000.00
	CONSTRUCTION SUB-TOTAL				**$ 10,520,000.00**
	CITB levy (0.25%)				$ 27,000.00
	Contingency (20%)				$ 2,104,000.00
	TOTAL CONSTRUCTION COST (Excl. GST)				**$ 12,660,000.00**
	Per Connection				**$ 24,022.77**

**Excludes land acquisition costs, easement costs, detailed design fees, service relocation fees, superintendency fees.*

Note: *This cost opinion is only based on the concept option. These are preliminary estimates of the construction costs only and are WGA's opinion of the probable rates for this project based on rates obtained from similar projects available at the time of preparing this cost opinion. As WGA is not a qualified Quantity Surveyor, nor does it employ quantity surveyors, WGA cannot and will not guarantee that any tenders or actual construction quantities/rates will not vary from this opinion of probable construction quantities/rates. As such, WGA does not accept any liability for actual costs varying from those estimated.*

Murray Bridge East CWMS

Construction Cost Opinion - Lagoons

Rural City of Murray Bridge

Consultant	Wallbridge Gilbert Aztec
Revision	B
Date	16/04/2024
Job No.	WGA231738
Eng	NJ
Chk	MOF

Ref Dwgs	WGA231738-SK-CV-0001_D
NO. CONNECTIONS	527

ITEM	DESCRIPTION	UNIT	RATE ($)	QUANTITY	AMOUNT ($)
1	**PRELIMINARIES**				
	Establishment	item			
	Service locations	item			
	Insurance	item			
	Quality control/site admin/safety	item			
	Survey	item			
	Site compound	item			
	Site supervisor	item			
	Site engineer	item			
					$ 330,000.00
2	**Treatment Lagoons**				
	Site preparation and strip of topsoil	sqm	$ 5.00	36000	$ 180,000.00
	Screen	item	$ 90,000.00	1	$ 90,000.00
	Cut and fill to excavate for lagoons	cum	$ 50.00	18000	$ 900,000.00
	Surface preparation for liner	sqm	$ 6.00	16000	$ 96,000.00
	Import and place 200 thick subgrade to each lagoon	sqm	$ 10.00	16000	$ 160,000.00
	HDPE liner to all lagoons	sqm	$ 20.00	16000	$ 320,000.00
	Internal pipework	item	$ 30,000.00	1	$ 30,000.00
	Leak detection	m	$ 70.00	775	$ 54,250.00
	Leak detection monitoring points	item	$ 5,000.00	4	$ 20,000.00
	Access, signage, spillage, connection pipes etc	item	$ 30,000.00	1	$ 30,000.00
	Fence	m	$ 80.00	1134	$ 90,720.00
	Hardstand and rubble access road	sqm	$ 30.00	1650	$ 49,500.00
	Trafficable surface on anaerobic lagoon for desludging purposes (additional concrete ramps and access)	item	$ 200,000.00	1	$ 200,000.00
					$ 2,220,000.00
3	**Winter Storage Lagoon 27 ML**				
	Site preparation and strip of topsoil	sqm	$ 5.00	11000	$ 55,000.00
	Cut and fill to excavate for lagoons	cum	$ 50.00	12000	$ 600,000.00
	Surface preparation for liner	sqm	$ 6.00	9000	$ 54,000.00
	Import and place 200 thick subgrade to each lagoon	sqm	$ 10.00	9000	$ 90,000.00
	HDPE liner	sqm	$ 20.00	9000	$ 180,000.00
	Internal pipework and pump	item	$ 30,000.00	1	$ 30,000.00
	Leak detection	m	$ 120.00	416	$ 49,920.00
	Leak detection monitoring points	item	$ 5,000.00	2	$ 10,000.00
	Access, signage, spillage, connection pipes etc	item	$ 15,000.00	1	$ 15,000.00
	Fence excluded	m			$ -
	Hardstand and rubble access road	sqm	$ 30.00	1000	$ 30,000.00
					$ 1,110,000.00
	CONSTRUCTION SUB-TOTAL				**$ 3,660,000.00**
	CITB levy (0.25%)				$ 10,000.00
	Contingency (20%)				$ 732,000.00
	TOTAL CONSTRUCTION COST (Excl. GST)				**$ 4,410,000.00**
	Per Connection				**$ 8,368.12**

**Excludes land acquisition costs, easement costs, design fees, superintendency fees.*

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Murray Bridge East CWMS

Construction Cost Opinion - Mechanical RBC

Rural City of Murray Bridge

Consultant	Wallbridge Gilbert Aztec
Revision	A
Date	16/04/2024
Job No.	WGA231738
Eng	NJ
Chk	MOF

Ref Dwgs	WGA231738-SK-CV-0001_D
NO. CONNECTIONS	527

ITEM	DESCRIPTION	UNIT	RATE ($)	QUANTITY	AMOUNT ($)
1	**PRELIMINARIES**				
	Establishment	item			
	Service locations	item			
	Insurance	item			
	Quality control/site admin/safety	item			
	Survey	item			
	Site compound	item			
	Site supervisor	item			
	Site engineer	item			
					$ 300,000.00
2	**WWTP (Mechanical)**				
	Site preparation and strip of topsoil	sqm	$ 5.00	900	$ 4,500.00
	Screen	item	$ 90,000.00	1	$ 90,000.00
	Modular RBC Mechanical WWTP Plant including 3 x 50kL balance tanks, RBC units, plattforms, pumps, connecting pipework, 3 x 50kL irrigation tanks	item	$1,705,000.00	1	$ 1,705,000.00
	Access, signage, spillage, connection pipes etc	item	$ 30,000.00	1	$ 30,000.00
	Fence	m	$ 80.00	120	$ 9,600.00
	Gates	item	$ 5,000.00	1	$ 5,000.00
	Hardstand and rubble access road	sqm	$ 30.00	900	$ 27,000.00
					$ 1,870,000.00
3	**Winter Storage Lagoon 27 ML**				
	Site preparation and strip of topsoil	sqm	$ 5.00	11000	$ 55,000.00
	Cut and fill to excavate for lagoons	cum	$ 50.00	12000	$ 600,000.00
	Surface preparation for liner	sqm	$ 6.00	9000	$ 54,000.00
	Import and place 200 thick subgrade to each lagoon	sqm	$ 10.00	9000	$ 90,000.00
	HDPE liner	sqm	$ 20.00	9000	$ 180,000.00
	Internal pipework and pump	item	$ 30,000.00	1	$ 30,000.00
	Leak detection	m	$ 120.00	416	$ 49,920.00
	Access, signage, spillage, connection pipes etc	item	$ 15,000.00	1	$ 15,000.00
	Fence excluded	m			$ -
	Hardstand and rubble access road	sqm	$ 30.00	1000	$ 30,000.00
					$ 1,100,000.00
	CONSTRUCTION SUB-TOTAL				**$ 3,270,000.00**
	CITB levy (0.25%)				$ 9,000.00
	Contingency (20%)				$ 654,000.00
	TOTAL CONSTRUCTION COST (Excl. GST)				**$ 3,940,000.00**
	Per Connection				**$ 7,476.28**

**Excludes land acquisition costs, easement costs, design fees, superintendency fees.*

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Murray Bridge East CWMS

Construction Cost Opinion - Irrigation

Rural City of Murray Bridge

WGA

Consultant	Wallbridge Gilbert Aztec
Revision	B
Date	16/04/2024
Job No.	WGA231738
Eng	NJ
Chk	MOF

Ref Dwgs	WGA231738-SK-CV-0002_D
NO. CONNECTIONS	527

ITEM	DESCRIPTION	UNIT	RATE ($)	QUANTITY	AMOUNT ($)
1	**PRELIMINARIES**				
	Establishment	item			
	Service locations	item			
	Insurance	item			
	Quality control/site admin/safety	item			
	Survey	item			
	Site compound	item			
	Site supervisor	item			
	Site engineer	item			
					$ 90,000.00
2	**WWTP Disposal**				
	Site preparation, leveling, rock removal	sqm	$ 3.00	50000	$ 150,000.00
	Spray irrigation	sqm	$ 8.00	50000	$ 400,000.00
	Rural type fence	m	$ 25.00	655	$ 16,375.00
					$ 570,000.00
3	**Return Main**				
	Supply and install DN125 PE PN12.5 minimum recycled water rising main from WWTP to irrigation area, including fittings, valves, excavation, disposal of excavated material, supply of materials, sand bedding, backfilling, compaction and surface reinstatement.	m	$ 180.00	0	$ -
					$ -
4	**Irrigation Pump Station**				
	Power connection	each	$ 160,000.00	1	$ 160,000.00
	Irrigation / control shed	each	$ 30,000.00	1	$ 30,000.00
	Irrigation pumps duty/standby included in disposal				$ -
	Intake pump	each	$ 20,000.00	1	$ 20,000.00
	Intake and discharge pipe	m	$ 150.00	100	$ 15,000.00
	Disc filter	item	$ 10,000.00	1	$ 10,000.00
	Sodium hypochlorite system	item	$ 12,000.00	1	$ 12,000.00
	Chlorine analyser	item	$ 2,500.00	1	$ 2,500.00
	Static mixer	each	$ 2,000.00	1	$ 2,000.00
	Flowmeter included in disposal				$ -
	Electrical and controls	item	$ 20,000.00	1	$ 20,000.00
	Irrigation pumps duty/standby	each	$ 5,000.00	2	$ 10,000.00
	Flowmeter	each	$ 5,000.00	1	$ 5,000.00
	Electricals and controls	item	$ 15,000.00	1	$ 15,000.00
					$ -
					$ -
					$ 300,000.00
5	**MISCELLANEOUS**				
	Signage	item	$ 2,000.00	1	$ 2,000.00
					$ -
					$ 2,000.00
	CONSTRUCTION SUB-TOTAL				**$ 960,000.00**
	CITB levy (0.25%)				$ 3,000.00
	Contingency (20%)				$ 192,000.00
	TOTAL CONSTRUCTION COST (Excl. GST)				**$ 1,160,000.00**
	Per Connection				**$ 2,201.14**

**Excludes land acquisition costs, easement costs, design fees, superintendency fees.*

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APPENDIX C
GEOTECHNICAL REPORT

WGA

FOR FURTHER INFORMATION CONTACT:

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