City of Whyalla

Stormwater Harvesting and Reuse Strategy

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1 INTRODUCTION

As part of the conditions of the Stormwater Management Plan (SMP) developed in 2019, it was specified that City of Whyalla (Council) was to develop a Stormwater Harvesting and Reuse Strategy (SHRS). This SHRS is required to satisfy the requirements of the Stormwater Management Authority (SMA) and Council's liveability goals. Council is also seeking to meet its own goals for improving liveability for the town's population.

Whyalla experiences a unique climate. Rainfall is distributed reasonably evenly across the months of the year, however further inspection of data reveals that rainfall events typically occur in the form of heavy downfalls on only a couple of days of the month, with minimal rainfall outside of these periods. This presents issues with flooding within the township, and adds a level of complexity to achieving a sustainable stormwater harvest yield.

The SHRS has therefore been developed with the purpose of providing financially viable stormwater harvesting options, which provide additional water resource security when combined with existing recycled water reuse within Whyalla. This is in line with Objective 3 of the SMP: 'Maximise the economic use of stormwater runoff for beneficial purposes' (Tonkin, 2019).

Key items discussed within this strategy include:

- Existing Demands and Water Usage, including the existing reuse of recycled wastewater supplied by SA Water. Although this report is focused on stormwater harvesting opportunities, the reuse of recycled wastewater is relevant as the cost for this water is very low; in the order of $0.61 per kL.
- Future Demands, including increases caused by:
  - Impacts of climate change (50 year time scale).
  - Additional Developments within Whyalla with increased greenspace or increased levels of user amenity.
- Harvesting Options and Costing including Net Present Value (NPV) with return period of 50 years.
- Trigger Points for Implementation, primarily opportunity and cost-based;
  - As the SMP has indicated that flood mitigation is required, there is an opportunity to subsequently incorporate some stormwater harvesting into these flood mitigation facilities for relatively small incremental costs.
  - Due to the reuse of recycled wastewater as part of the integrated water supply strategy for Whyalla, in order for recycled water projects to be deemed feasible they must be more attractive cost-wise when compared to potable water supplies from SA Water.

2 SITE DESCRIPTION

2.1 SITE CHARACTERISATION

Whyalla is a coastal environment, bordered by the ocean on the south-eastern side and small hills on the north-western side. The town grades southwest from the peak levels in the northwest, before flattening out and gently grading toward the ocean, as shown in Figure 1.

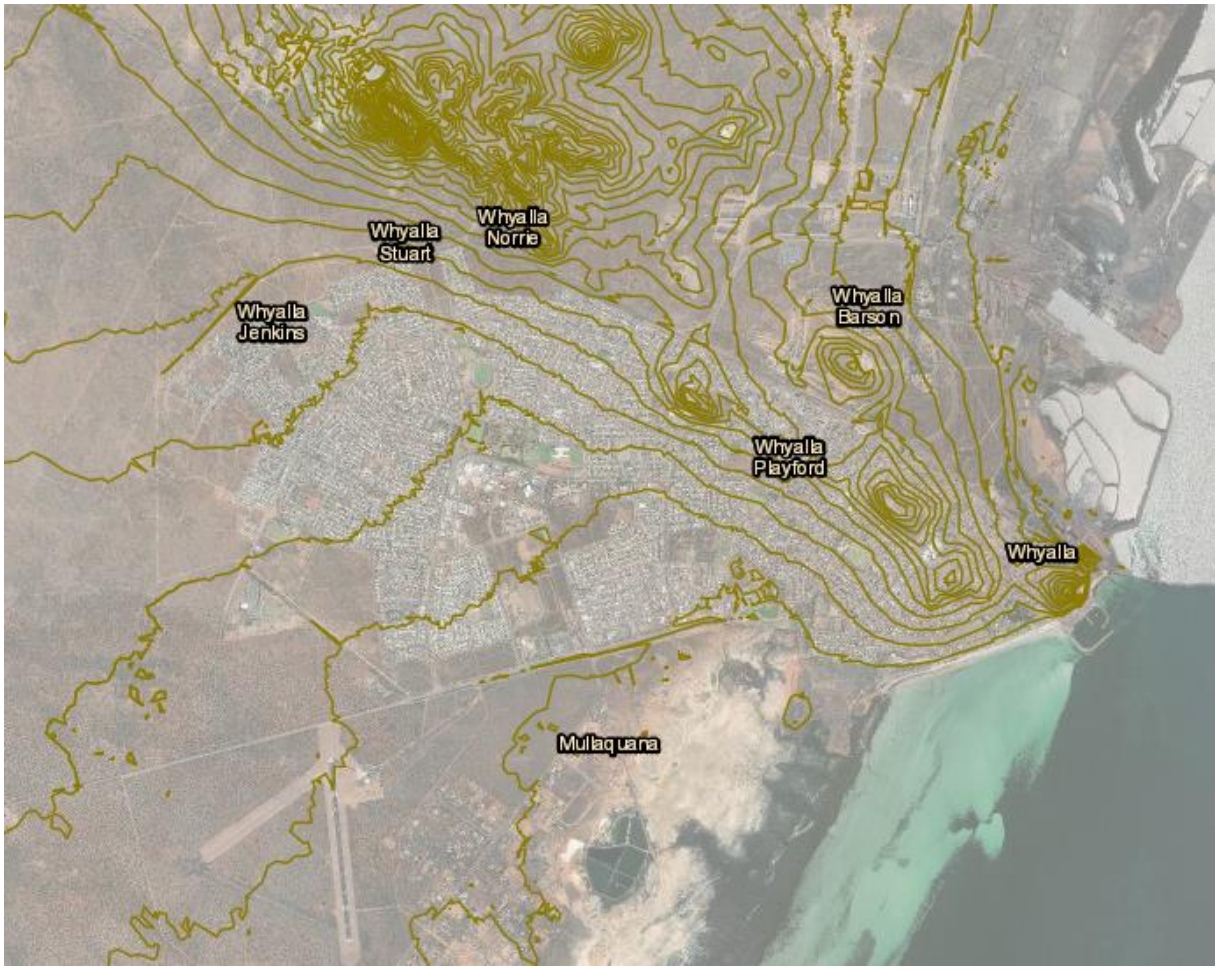


Figure 1: Greater Whyalla Topography

This topography creates a significant rural catchment which flows toward the urbanised areas. Stormwater diversion infrastructure is in place to the north of Whyalla, which was identified in the SMP as needing repairs.

2.1.1 Rainfall and Evaporation Data

Rainfall for Whyalla is on average, reasonably consistent across all months. The overall rainfall total is typically less than 300mm, which is considered to be very dry. In months experiencing 90th percentile high flow event, these months can see over 40mm of rain, most of which would occur in one rainfall event. In a 10th percentile dry month, total rainfall can be only a few millimetres. This relationship is shown in Figure 2. It is noted that often the monthly rainfall can occur in only one or two events during any one month, which can create nuisance flooding for the township.

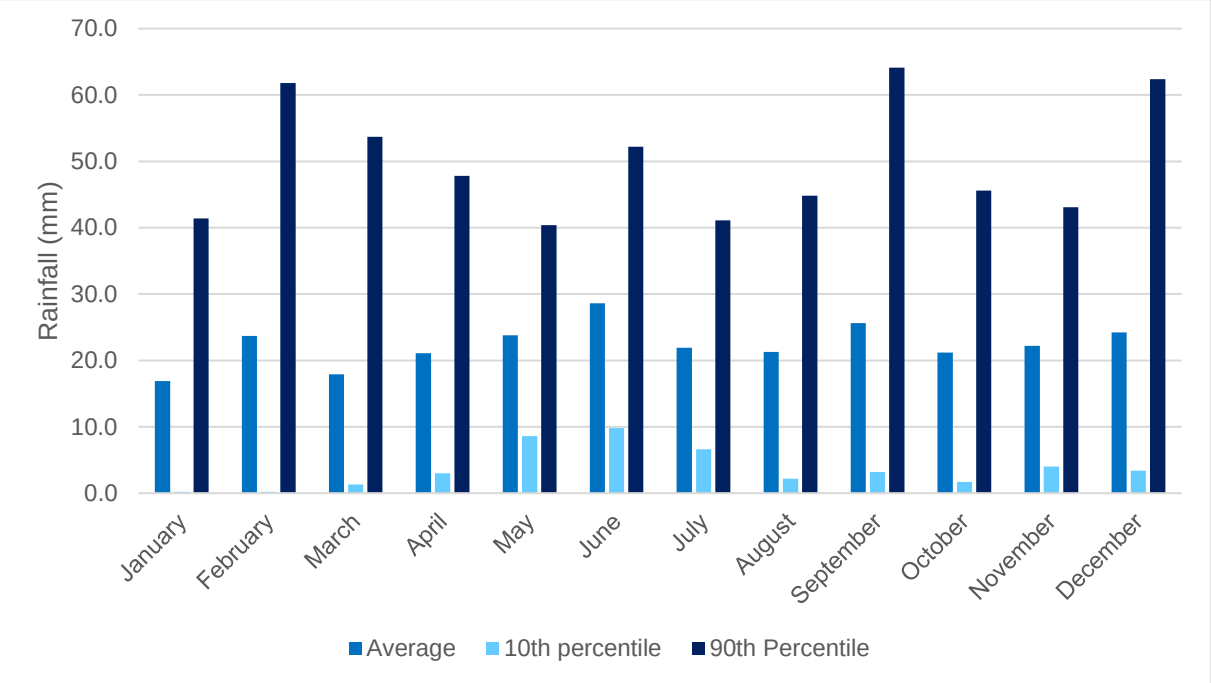


Figure 2: Rainfall Data for Whyalla (BoM) (Station 018120)

Additionally, evaporation for the Eyre Peninsula and Whyalla is extremely high, as shown by the daily evaporation values provided in Table 1.

Table 1: Daily Evaporation for Whyalla

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily Evaporation (mm)	11.1	9.9	8.2	5.8	4.0	3.0	3.2	4.3	6.3	7.9	9.5	10.8
Monthly Evaporation Total (mm)	344	277	254	174	124	90	99	133	189	244	285	334
Monthly Net mm of Evaporation	333	267	246	168	120	87	96	129	183	237	274	324

Due to the rainfall and evaporation conditions, there are often days where evaporation exceeds the available rainfall, as indicated by the average monthly rainfall provided in Table 2.

Table 2: Monthly Rainfall Data - Average

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Rainfall Average (mm)	16.9	23.7	17.9	21.1	23.8	28.6	21.9	21.3	25.6	21.2	22.2	24.2

This results in the town's greenspace areas being extremely reliant on irrigation in order to provide sufficient soil moisture to maintain the surfaces usability.

2.1.2 Site Specific Risks

Evaluation of the catchment has indicated there are several characteristics of the Whyalla catchment and existing system which should be treated as constraints for some types of stormwater harvesting options.

These characteristics include:

- Whilst rainfall is spread relatively evenly across the year, the events providing this rainfall are often very 'peaky' and may occur on only one or two days of the month. This constrains the ability to provide a sustainable harvest yield and turns the priority toward flood mitigation for the catchment.

- There is a high level of evaporation throughout the year, which means when harvested water is stored in basins before use there are likely to be significant evaporation losses, reducing the annual reuse yield.

- There is a shallow, saline groundwater table. Existing open drains and basins, if unlined, are likely to add salinity to the stormwater as it travels through the catchment. Overland flow may also uptake heavy metals which are present in the soil, as well as increase the levels of suspended solids, which presents a water quality risk.

- Each site is required to be included in an overarching Risk Management Plan and/or Irrigation Management Plan.

  - These documents are required for management of any environmental and public health risks associated with the usage of recycled water sources.
  - The Department for Health and Wellbeing (DHW) requires these documents in order to be informed of the public health protections in place, such as implementation of restricted irrigation practices (overnight irrigation, buffer distances etc.) for water sources where disinfection is not incorporated into the treatment process for the water.
  - Submission of an application to the DHW is required for any reuse of recycled wastewater, and any new sites incorporated into this plan would result in the requirement for a need to update the Risk Management Plan.

2.1.3 Climate Change impacts

Climate change has been considered during this study, as one of the key considerations regarding a stormwater harvesting scheme is the consistency of supply and the degree to which a scheme can be 'future-proofed'. Stormwater harvesting requires a reliable supply of rainfall in order to be incorporated in the water supply system as a primary water source. On the demand side however, if rainfall in the region significantly declines then it is expected that demand for additional water sources would greatly increase. This would therefore result in a higher benefit of a supplementary supply of water from a stormwater harvesting scheme, even if a consistent primary water supply cannot be guaranteed by this source.

A 50 year design life has been selected for this investigation and has been factored into the life cycle costings provided in later sections. Research by the Goyder Institute reflects the expected decrease in rainfall over the next 50 years. The Goyder Institute's climate modelling suggests that average annual rainfall is expected to decline significantly for both the RCP4.5 and RCP8.5 scenarios adopted, with the results provided in Figure 3.

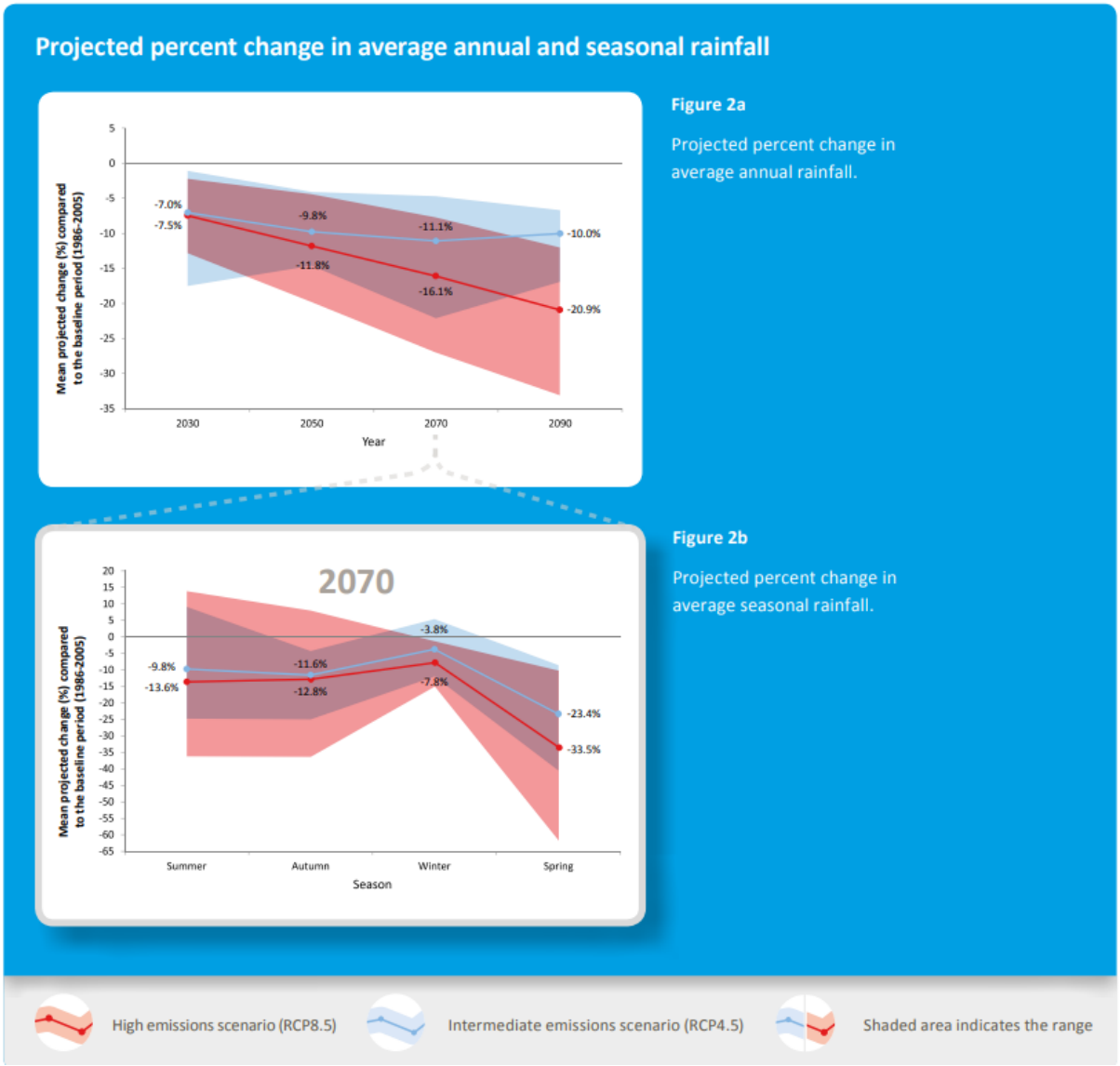


Figure 3: Climate Change Impacts on Rainfall in the Eyre Peninsula (Goyder Institute for Water Research, 2020)

2.2 EXISTING WATER SOURCES

Water within the Whyalla township is typically provided by the following sources:

2.2.1 Rainwater Tanks

Local rainfall capture and reuse is undertaken via household rainwater tanks. As this is included only on a household basis, the actual estimates of reuse quantities are difficult to develop, however typically a 2 kL tank and a connected roof area of 150 m^2 equates to approximately 19 kL of household rainwater reuse per year. Households in Whyalla have an average roof area of approximately 250 m^2, and based on aerial surveys and observations made when moving around the town, it would be estimated that in the order of 75% of households would currently have at least one rainwater tank providing a water source.

2.2.2 Council Stormwater Harvesting

Water is collected from the central stormwater capture basin on Racecourse Road, and reused for purposes such as irrigation and construction dust suppression. The water is collected for reuse by water tankers via a pump-out standpipe located at the basin. Operators have stated that the water quality of this supply is excellent in terms of salinity. Further testing for other water quality criteria such as heavy metals has not been conducted recently. Due to the simplistic access to this water (via standpipe and tankering only) this supply of water is relatively inexpensive to Council. Evidence suggests that this supply is in the order of 90 ML/year under the existing system arrangement.

2.2.3 SA Water Potable Water

This water is primarily provided for potable usage for Council and residents, however at times is also required to supplement Council's non-potable purposes such as irrigation. In previous years, the cost for water was $3.413, however recently SA Water have reduced their charge per kL. As per SA Water's 'Pricing Schedule for Water and Sewerage', the cost for potable water supplied to Council as of 2020/2021 is $2.775 per kL (plus typical annual supply fees). It is expected that this price will continue to fluctuate over time.

2.2.4 SA Water Recycled Water

Recycled water from the Whyalla Wastewater Treatment Plant (owned and operated by SA Water) is provided to Council for irrigation purposes for local parks and ovals. A significant distribution network for the distribution of recycled water has been constructed in Whyalla. The pipelines for most areas are now connected to irrigation distribution pumps. SA Water has allocated 350 ML of recycled wastewater per year to Council under their contract arrangements.

Though the network is in place, it is noted that there is insufficient supply of good quality recycled water to fully meet demands at all sites. Council has specified that at particular times of year, SA Water fails to meet desired water quality criteria and therefore cannot supply to their customer (Council) during those periods due to public health criteria.

It is also noted that at times the instantaneous demand at sites exceeds what can be supplied, due to supply requirements for restricted irrigation (again to meet public health safety criteria). Council must irrigate using the recycled water overnight, hence there are limitations to what may be distributed at any one time. The typical cost for Council to access this recycled water has been $0.6106/kL in recent years.

The location of the Racecourse Road stormwater supply and the WWTP/Recycled Water Supply is shown in Figure 4. The recycled water distribution network is shown in Figure 5.

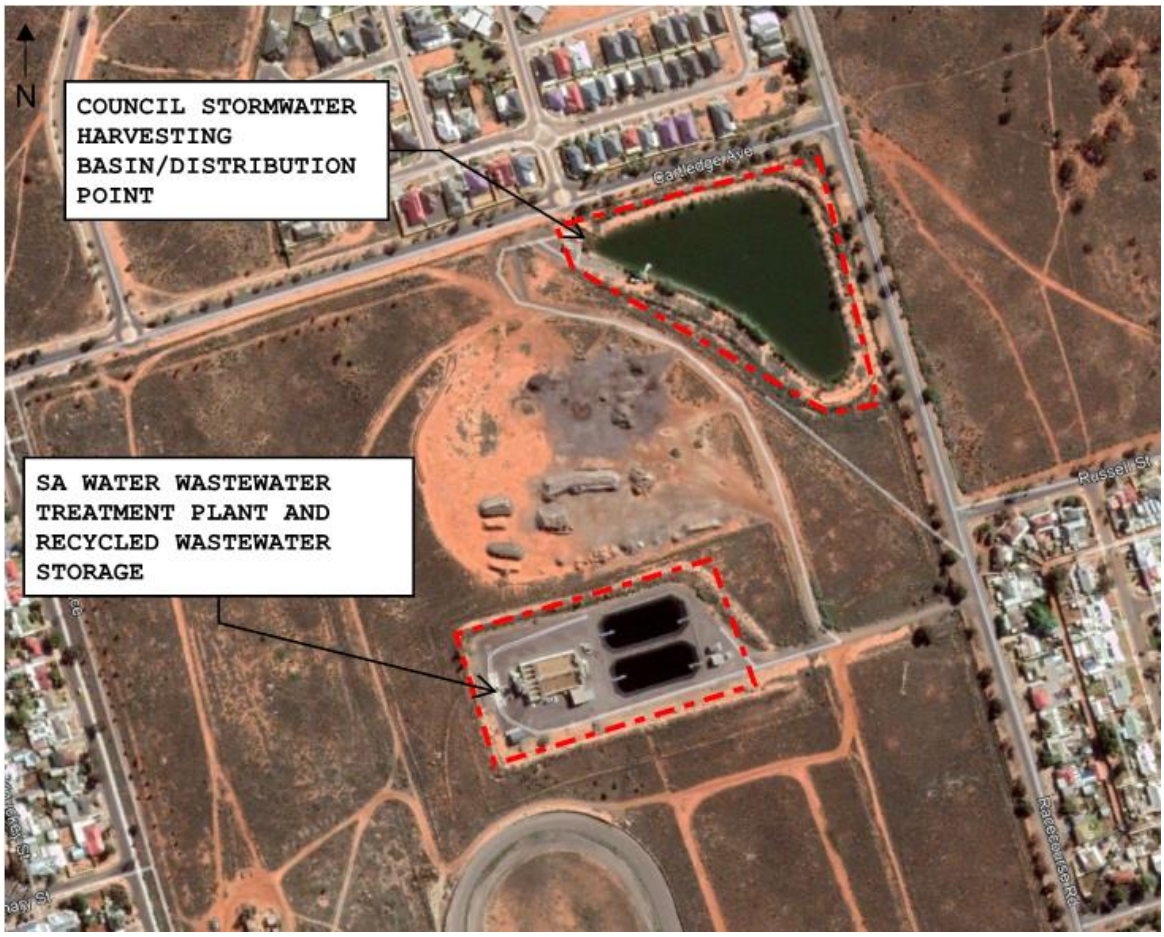


Figure 4: WWTP Recycled Water storage and Stormwater Harvesting Basin location

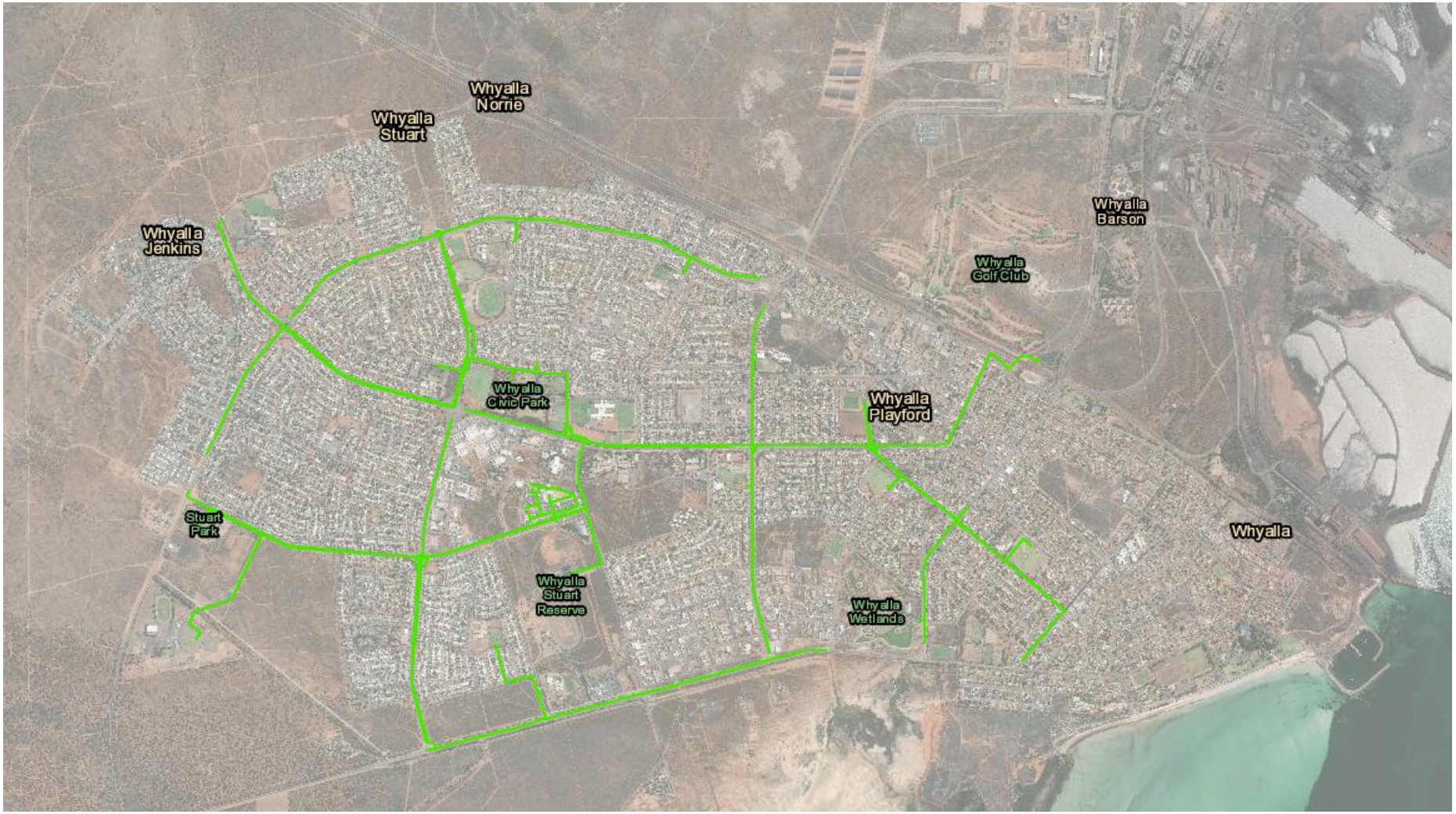


Figure 5: Recycled Water Network Extent

2.3 DEMANDS AND USAGE

2.3.1 Current Water usage

As described in Section 2.2, there are three primary water sources used by Council for irrigation within Whyalla. Quarterly usage data for the potable water and recycled wastewater has been provided by SA Water. Some potable water use shown in the annual statement is known not to be used for irrigation. The potable water values quoted in Figure 6 are therefore based on discussions with Council, which indicated that their potable water usage to supplement their other water sources is in the order of 100 ML/year, with high usage required in the spring/early summer period (Q4/Q1).

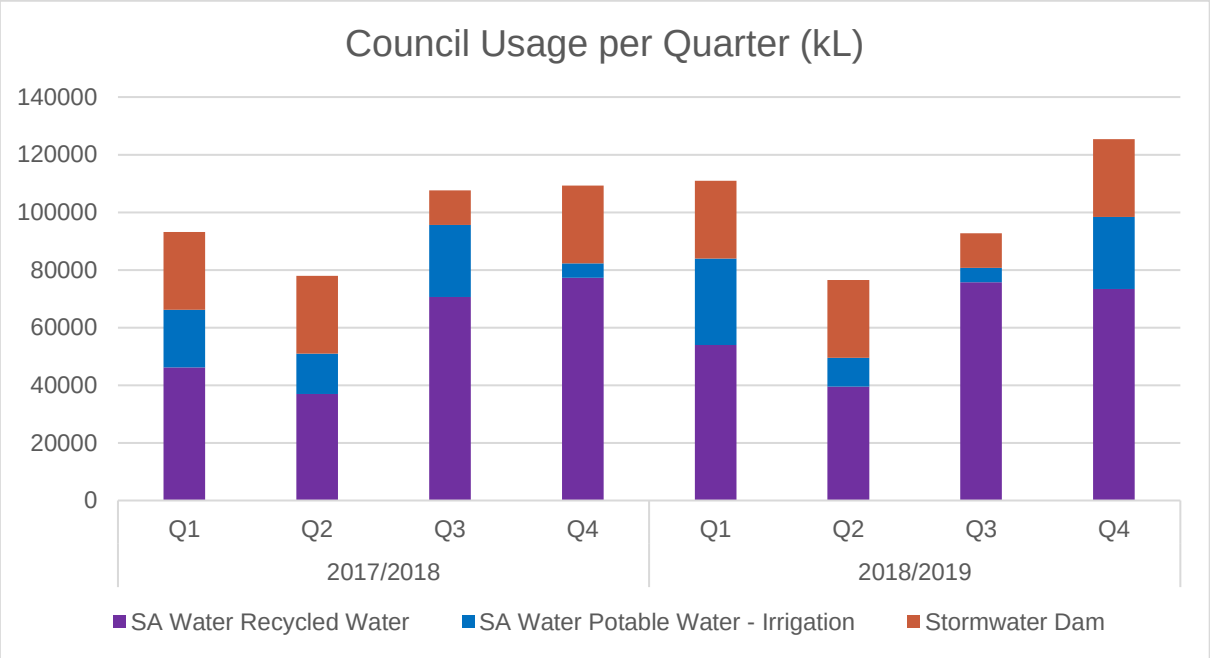


Figure 6: Council Irrigation Water Usage

This usage pattern has been cross checked against the IPOS Guidelines for the expected irrigation area across Whyalla, and typical turf irrigation requirements versus the functional purpose level adopted, based on observation of the turf surface quality.

Annual reuse of recycled wastewater has not met the allocated 350 ML/year in the past two years of recorded data; as indicated by the data shown in purple in the figure above, the annual usage is typically around the 230-250 ML/annum range. As mentioned in section 2.2.4 this shortfall is caused by both operational and supply issues.

2.3.2 Future Demand- Climate Change

Assuming climate change scenario RCP4.5, as described in section 2.1.3, the reduction percentages have been applied to the average monthly rainfall totals. This data was then used to assess irrigation demands for the township based on existing areas irrigated by Council only.

Based on this evaluation of data, and assuming no change to the net evaporation (as this data is not available) it was found that an additional 10ML of annual demand may be required for the existing irrigation areas to be maintained, under 2070 projected rainfall conditions.

2.4 FUTURE DEMANDS – ADDITIONAL DEVELOPMENT

There are several potential development locations within Whyalla, with various motivating factors which will determine which project is prioritised. A brief description of the 3 major potential projects and the corresponding additional water demand associated with the developments are provided in this section. The future demands indicated in each section have been based on irrigation areas proposed, using the IPOS guidelines.

Additionally, an example is provided of increased future recycled water demand, if a site which currently uses potable water was converted to use recycled water.

2.4.1 Civic Park Redevelopment

The Civic Park area is being considered as a high priority for redevelopment. Though the area is in reasonable condition, there is the potential for the area to be converted to become a centralised sports hub, providing a more equal opportunity for local residents to access the facilities. An aerial image of the existing site is provided in Figure 7.

Figure 7: Civic Park and Whyalla HS future development site

Figure 8 provides an example of the areas identified for future upgrades by Council in their preliminary stages of planning for the upgrades of Civic Park. It should be noted that from the identified areas, the future structures sports areas are likely to create additional outflows from the overall site, depending on the type of sporting surface implemented.

Figure 8: Civic Park Redevelopment High-Level Concept

The existing estimated demand for Schultz Oval, the mixed use area of Civic Park, and the Hockey association totals approximately 20 ML/year currently based on meter data. This is typically serviced by recycled wastewater sources, with some supplementation from potable water when required.

The irrigation demand is projected to be in the order of 80 ML/y once the site is developed. This will vary depending on whether the adjacent land from the high school is acquired and incorporated into what we consider as the full future development region. This represents an increase in usage by up to 60ML to achieve a high level of turf surface quality for use as a sports park.

2.4.2 Jubilee Park Development

This area is an existing sports field which is under consideration for expansion as outlined in the 'Jubilee Park Precinct Masterplan' report (2014) and displayed in Figure 9. This location is on the western side of town, toward the Southern end of Whyalla Jenkins and Whyalla Stuart.

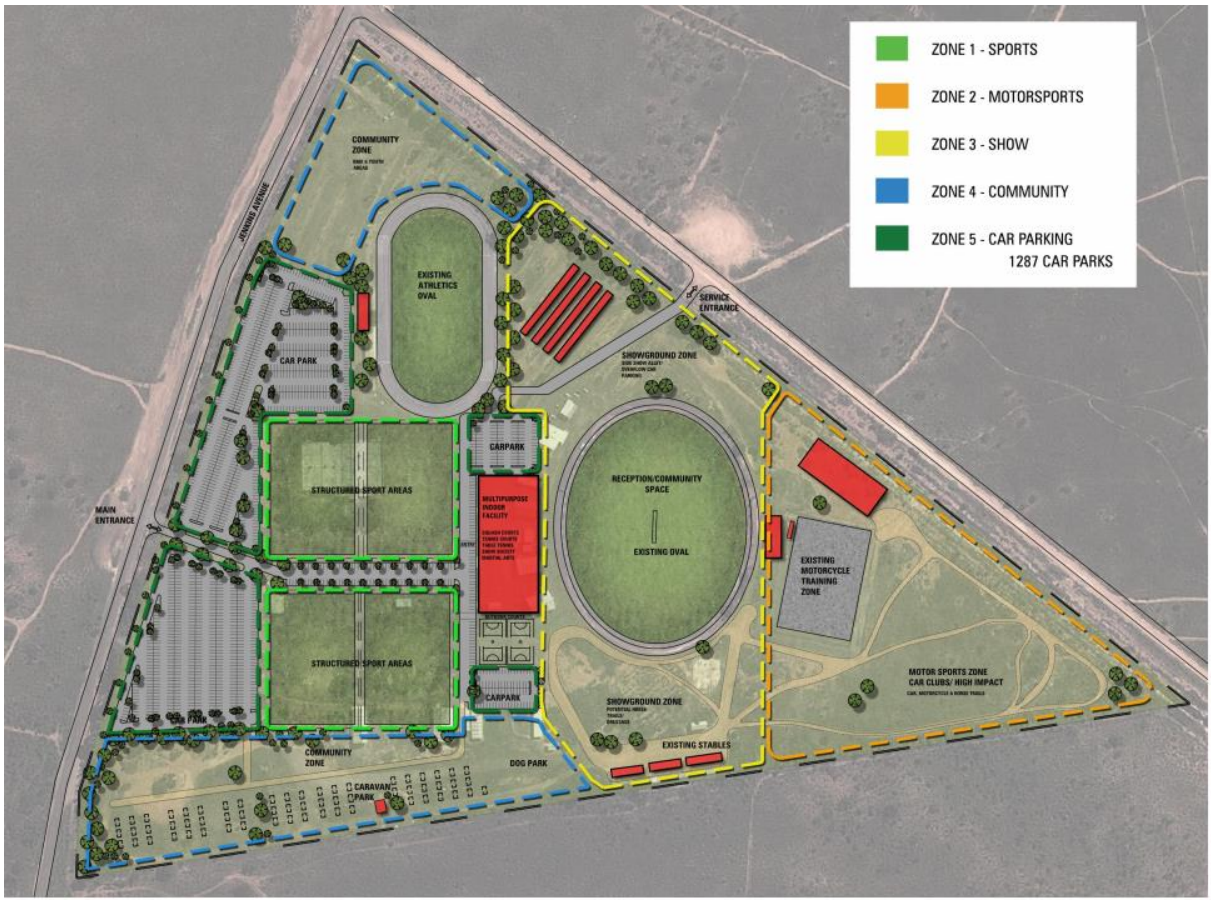


Figure 9: Jubilee Park Masterplan

Whilst meter data was not available for recycled wastewater consumption for this site, it is estimated that current usage could be up to 15 ML/year. The development for this area may be delayed if the Civic Park development occurs, however the overall future demand would be estimated to be around 40-60 ML/y depending on the final arrangements for this site.

Recently new infrastructure has been installed for irrigation of this site, including a significant number of solenoids, which indicates that this sportsground is likely to be maintained into the future even without further upgrades being implemented.

2.4.3 Bennett Oval Development

Located just north of the centre of Whyalla is Bennett Oval. This oval is typically used for Australian Rules football, with an adjacent smaller used for other casual sports such as touch football.

The masterplan provided in the 'KM Bennett Oval Master Plan Report' (2017) describes the intended change in land use proposed for Bennett oval.

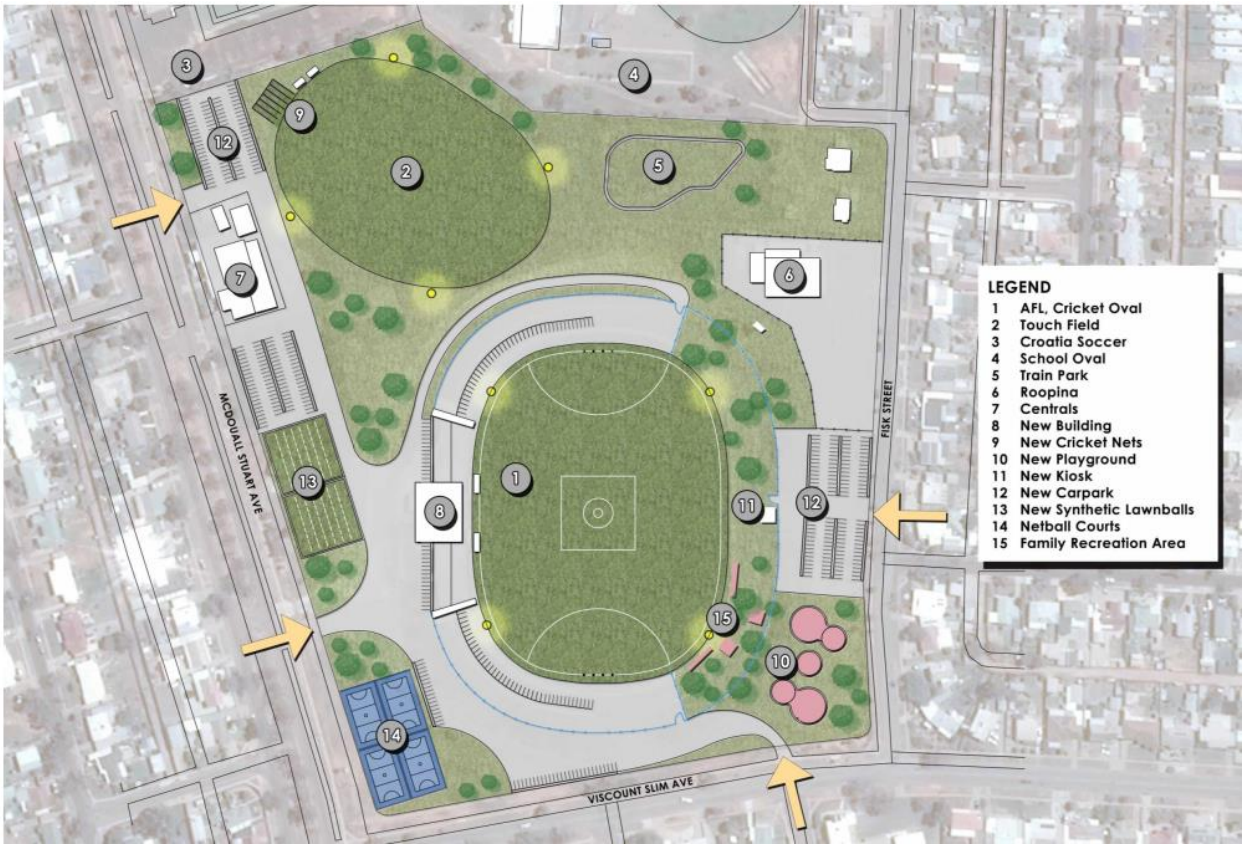


Figure 10: Bennett Oval Masterplan

The estimated water use for this development, if maintained in a high-level condition (TQVS 2) would be 80 ML/y. This represents a significant increase from the existing maintenance level of the site, which is in the order of 30 ML/y according to meter readings.

It should be noted that if the Civic Park redevelopment proceeds, it is unlikely that both the Bennett Oval development and Jubilee Park Development would be allocated funding.

2.4.4 Whyalla Foreshore

There is an existing public greenspace area along the Whyalla foreshore, adjacent to the newly built jetty. The areas of interest are shown in Figure 11. This area has high pedestrian traffic and attracts both local families and tourists visiting the region. Currently this system is not connected to the recycled water distribution network, therefore this project would require additional pipe infrastructure to connect into the existing system. Recent usage data from SA Water reveals that this site uses approximately 15 ML/year for irrigation of the lawn areas.

Figure 11: Whyalla Foreshore Irrigation Areas

This potable usage could be converted to a recycled water usage, requiring 15 ML per year of available recycled water.

2.4.5 Future Demand Summary

As described in the sections above, the future demands for future developments currently being considered are as shown in Table 3, with the locations for these across Whyalla shown in Figure 12.

Table 3: Future Expected Irrigation Demands

Future Scenario	Expected Additional Demand
Climate Change Scenario RCP 4.5 (maintain existing sites only)	10 ML
Civic Park Redevelopment	60 ML
Jubilee Park Redevelopment	25 - 45 ML
Bennett Oval	30 ML
Whyalla Foreshore	15 ML

The demands shown in Table 3 are not extensive and do not reflect all potential future demands, however they provide an indication of the likely increase in irrigation demand. This future demand profile should be considered when evaluating whether stormwater harvesting initiatives are desirable and feasible.

Figure 12: Future Irrigation Supply Options

3 STRATEGIES AND OPTIONS

3.1 OVERARCHING STRATEGY BASIS

Guidance has been sought from the SMP and via discussions with Council. Through the investigations conducted for the purposes of this stormwater harvesting and reuse strategy, the following key concepts have been identified as the basis for the strategy:

- Existing irrigation and water supply from existing recycled sources could be optimised
- More water could be used within Whyalla for irrigation if it was made available
- Nuisance flooding is common, and mitigation infrastructure is in the process of being designed

This information guides the recommended strategy to be implemented by Council for stormwater harvesting. The drivers for implementing a stormwater harvesting strategy are comprised of economic, environmental and social factors. In the case of Whyalla, due to the existing low-cost source of recycled water, to date there has been a low motivation to invest in a stormwater harvesting scheme. When combining the above key factors, stormwater harvesting can become more attractive from a financial perspective, and can also seek to contribute to positive environmental and social impacts.

The options proposed for Whyalla therefore consider the Stormwater Harvesting and Reuse opportunities from an integrated water approach perspective, as the cost efficiency of any option relates directly to whether alternative sources of water could be sourced for a lower cost.

3.2 OBJECTIVES AND TARGETS

The following objectives are recommended for adoption for Whyalla, in order to maximise their stormwater harvesting opportunities and enable greater security for the water supply:

- Implement projects which are likely to be eligible for sources of additional funding, such as:
  - Flood mitigation projects, such as the flood mitigation basin, which have a proven need are eligible for funding from the SMA.
  - The COVID-19 Economic and Business Growth fund, which considers projects eligible under a range of industries including tourism, which could be promoted further whilst local tourism is expanding within South Australia.
  - The Department for Environment and Water (DEW) Coastal protection grant, with $1 million per year available for eligible projects until 2022-23. Stormwater harvesting projects with suitable treatment systems can provide an additional benefit of improving the quality of water discharged to the coastal area and reducing the overall discharged volumes.
  - Projects with a focus on increased amenity for community purposes and sporting field upgrades are likely to be eligible for funding sources in future, if they demonstrate suitability for implementation.

- Integrate Water Sensitive Urban Design (WSUD) initiatives into sites under development within the township. This objective allows future sites to provide amenity, minimise stormwater runoff and corresponding nuisance flooding.

- Maximise the reliability of water resources utilized for irrigation by providing infrastructure for a diverse range of source waters including small scale stormwater harvesting and reuse, opportunistic stormwater harvesting from flood mitigation infrastructure, and utilizing recycled wastewater wherever possible.

- Optimise the quality of the water provided through the existing stormwater harvesting scheme, and any additional stormwater harvesting initiatives. Ensure existing risks such as the shallow saline groundwater table are mitigated during detailed design and construction of future schemes to avoid disturbing the water quality by allowing mixing with high salinity water.

- Where possible, maximise reuse of recycled water (reclaimed wastewater). SA Water have an existing agreement with Council, to whom they have allocated 350 ML/year. In order to receive this volume, storage at irrigation sites should be maximised to enable additional water take to occur during the day when irrigation is not permitted. Build on the relationship with SA Water and ensure that if opportunities arise in future to be allocated additional recycled wastewater, that Council can accept this water and will be able to utilize it appropriately to minimise reliance on potable water sources.

- Observe the requirements of the relevant regulatory bodies such as the DHW with regard to public health risks, and the EPA with regard to environmental hazards. Ensure approved documentation such as Recycled Wastewater Management Plans and Irrigation Management Plans are in place for sites which receive recycled wastewater.

- Minimize additional maintenance works wherever possible by centralizing systems or integrating the supply with the demand for localised capture and reuse sites.

- Continue to encourage the uptake and use of rainwater tanks for local residents, to allow for amenity to be created without the requirement for Council to undertake the maintenance of such reuse infrastructure.

3.3 EVALUATION OF OPTIONS

With the selected initiatives and criteria in mind, the following options have been selected for Council's consideration moving forward. Each option provides an expected yield and per kL cost, as per the high level Net Present Value (NPV) assessment conducted. All quoted costs broadly include infrastructure costs with a 7% discount rate, over a 50 year life cycle. These costs also consider any associated additional running costs for the schemes, for example based on additional personnel required for maintenance or additional electricity costs expected for new pump stations. Any costs for existing infrastructure have been excluded.

A locality plan showing the opportunity locations for stormwater harvesting is provided in Figure 13, whilst the infrastructure costings are provided in Appendix A.

Examples of potential treatment infrastructure is provided in Appendix C. The particular sizing and details regarding the best treatment for each option is to be further explored as each opportunity is developed.

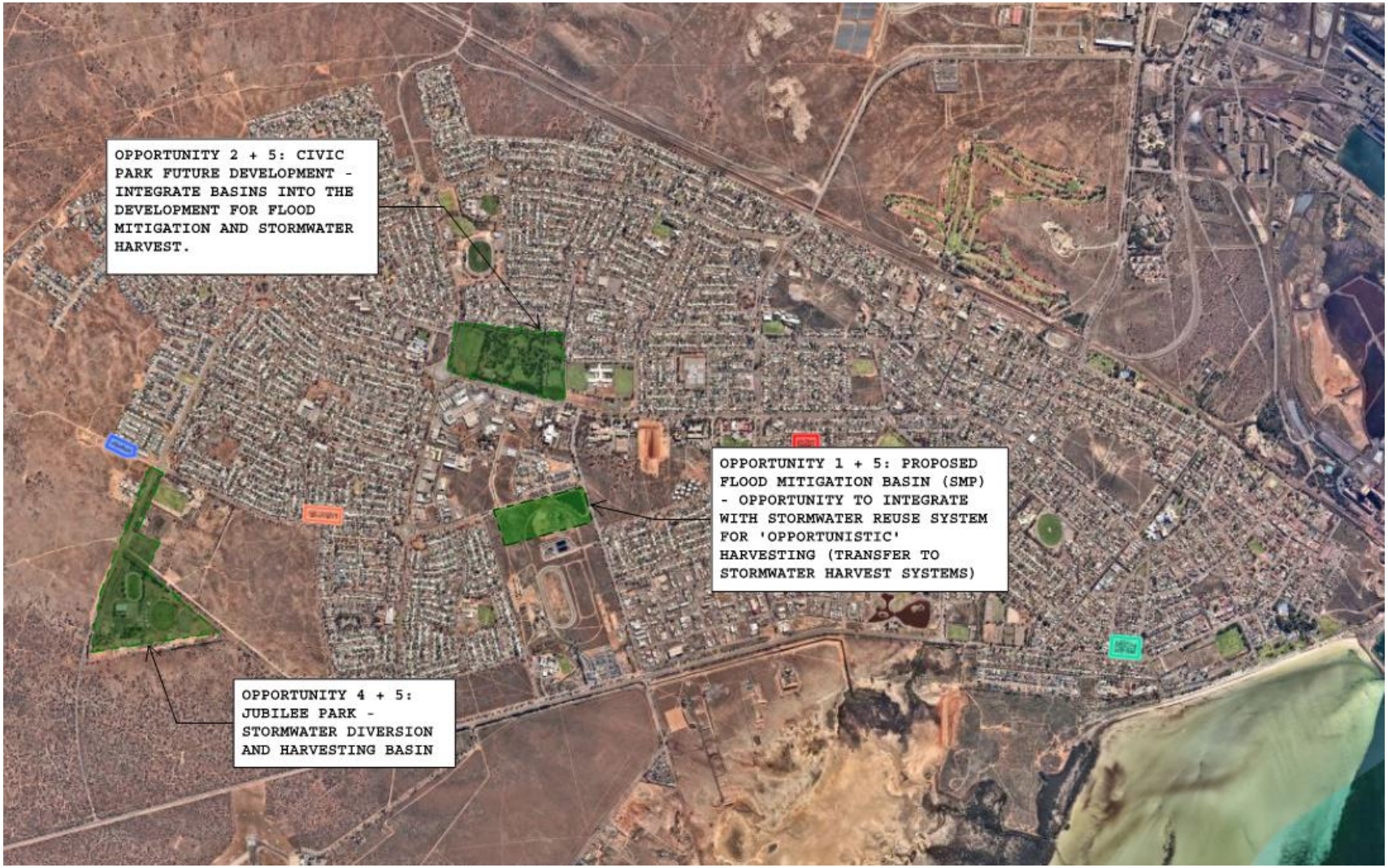


Figure 13: Stormwater Harvesting – Locations of Opportunities

3.3.1 Opportunity 1 – Flood Mitigation Basin

The Russell Street Options Study (Tonkin, 2020) has proposed that the primary flood mitigation basin should be located at the site of the existing stormwater harvesting basin, on Racecourse Road. It is noted that the most recent design concept for the proposed basin does not account for maintaining the existing harvesting operation of the Racecourse Road Dam.

In order to avoid disrupting the existing successful operation of the stormwater harvesting basin, it is suggested that this flood mitigation basin be built as two separate but interconnected basins. This will also enable flexibility of operation for the dams.

As additional flood mitigation storage is recommended for this site as a part of the existing Stormwater Management Authority recommendations, it is therefore eligible for SMA funding. It is not expected that this site could produce a sustainable yield, as with being designed to capture flood flows the basin must be empty for a considerable portion of the year in order to achieve that function. It is however expected that this site could supplement the existing racecourse basin, hence why it has been recommended to divide the basin into two storages to enable a flexibility in the operation of the dams for maximising harvest of stormwater.

As well as increasing the supply of water, this option would benefit from increasing the distribution capacity from the existing harvested stormwater storage. It is recommended that to ensure the flood mitigation of the basins are maintained, water from the storages should be able to be distributed to users with as much ease as possible. This allows flexibility in operation of the basins for stormwater harvesting purposes as well as flooding, as it could interrupt flood mitigation capacity of the basin if the water was left to evaporate and be reused by the typical standpipe/tankering reuse operation.

An additional pump station for the Basin site is therefore recommended to integrate this water source into the distribution network. Suitable documentation would need to be prepared, and backflow prevention devices included to minimise risk to the water quality of the existing harvested stormwater storage.

An indicative Concept is shown in Figure 14, with the precise location of the flood mitigation basin to be determined and approved by the Stormwater Management Authority. This indicative location is based on ‘Basin Option 2’ from the ‘Russell Street Options Study’ by Tonkin (2020). This study was completed as the originally proposed location for the flood mitigation basin in the SMP is not acceptable, due to the TAFE and High School developments occurring in that site to the East of Racecourse Road.

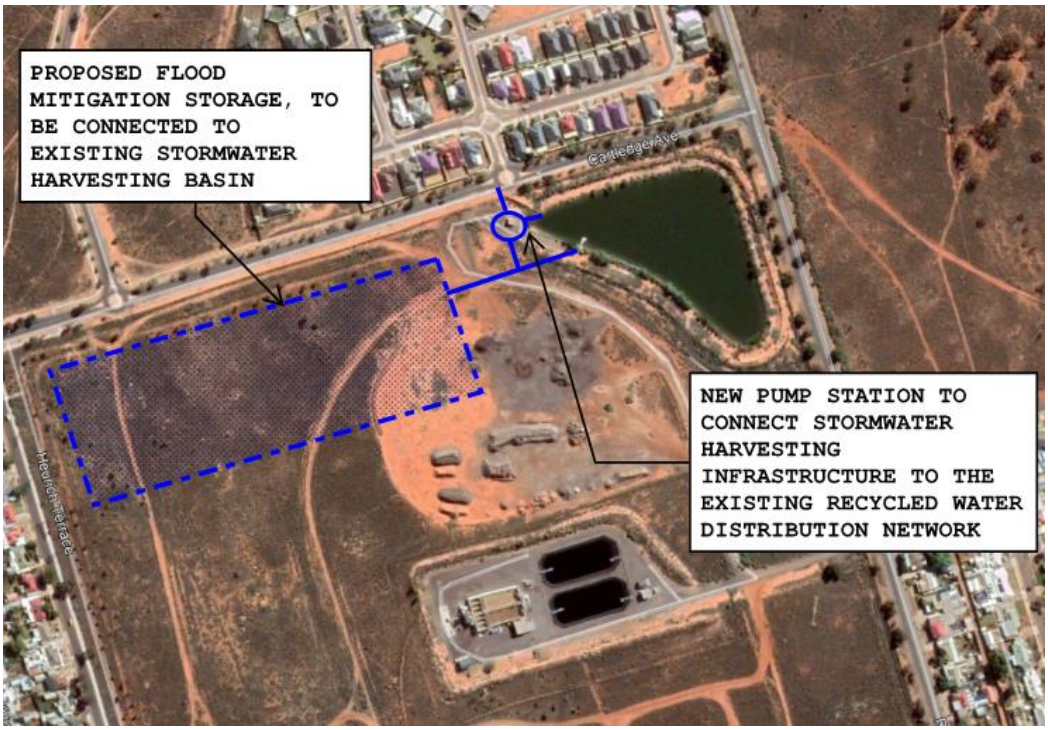


Figure 14: Indicative Concept for Additional Harvesting and Connection to the Network

It is expected that with the funding to be provided by the flood mitigation project, this integration of the existing storages into the Whyalla recycled water distribution network for more extensive reuse purposes could be completed with an overall running cost of around $0.96/kL. This is based on an assumed 70ML/year being distributed using this scheme, and assumes the basin upgrade costs are funded within the required flood mitigation works budget.

This is an attractive price for Whyalla Council, as it is cheaper than the mains water which is currently used to supplement the recycled wastewater usage. This cost is higher than for the recycled wastewater supplied by SA Water ($0.61/kL), as the stormwater harvesting cost reflects the depreciation and renewal costs of the distribution infrastructure, such as the water storages and pump stations.

3.3.2 Opportunity 2 – Civic Park Redevelopment

An opportunistic supply-side option for the civic park site is to incorporate some flood mitigation capacity by utilizing the ‘recreation’ areas of the site which have at this stage not been identified for repurposing as structured sports surfaces. Additionally, the flood mitigation basin could be integrated into the site in a suitable way to improve amenity. Due to the proximity to the existing stormwater harvesting basin on Racecourse Road, stormwater storage on this site becomes balancing flooding storage for runoff from the high rainfall events typical of the region, and therefore extends the overall harvesting capacity of the existing basin. The overall impact of this initiative is not expected to be significant in terms of harvest yields, therefore it should be considered as part of the flood mitigation infrastructure project, or if it is determined that there is sufficient amenity criteria justified by its implementation.

This option should be considered after or in conjunction with Opportunity 1, as it is an opportunistic supply and can feasibly offer a small quantity of water, in the order of 5 ML/year. As a standalone yield, the price for this water would be $3.85/kL, however it is proposed to integrate this solution with Opportunity 1 as a part of the flood mitigation infrastructure. This site is not suitable to provide a consistent harvested water supply as a standalone project. If the flood mitigation infrastructure is in

place from the Racecourse Road basin, then any additional runoff and storage able to be offered from this site will simply be directed to the racecourse basin to supplement that storage. This option would utilize the swales as recommended in the flood mitigation design (Basin option 2 from the Russell Street Study by Tonkin, 2020).

If implemented following on from Opportunity 1, this project would not require any further infrastructure to direct flows for distribution. The capital costs for this option are likely to be included in the flood mitigation infrastructure budget. If it is desirable to include Water Sensitive Urban Design initiatives or to maximise amenity as an additional aspect of the project, the costs for this could be partially borne by the budget for the Civic Park redevelopment budget, and incorporated as a development strategy by Council.

3.3.3 Opportunity 3 – Optimising Irrigation Storage

Whilst a significant portion of the township is able to be catered to by the existing recycled water distribution network, there are several reasons outlined by Council as to why their existing usage of recycled water is not able to meet their demand or allocated 350 ML of recycled water:

- Insufficient instantaneous flow through the line to provide the amount of water required for ovals
- Insufficient water availability at certain times of year (typically spring) due to recycled water provided by SA Water not meeting the required water quality targets

By providing additional storage for the recycled wastewater, either at the high priority greenspace and sporting surface locations or at a central location within Whyalla, the issue of instantaneous flow could be eased. This would enable water take to occur during the day for some sites to fill tanks, and irrigation could take place at night as per restricted irrigation requirements by the DHW, to avoid exposure for sensitive users to recycled water.

The use of recycled water ($0.61/kL) instead of potable water ($2.78/kL) at existing dual-source sites represents a potential cost saving for water supply. If for an example, the installation of a 200kL tank ($60,000 per tank plus pumping costs) at an existing dual-source irrigation site enabled 5ML of recycled water to be used per year instead of potable water, this could save Council $12,000 in water usage charges for the site per year. The cost of enabling this supply of water would vary considerably depending on the initial investigation results as to the shortfall of recycled water supply currently being supplied using the potable water source, and the infrastructure required to balance the supply.

The decision regarding a centralised storage or locally at irrigation sites would depend on specific operational requirements for each irrigation system, to determine the most cost-effective option. This would need to be explored in greater detail for each potential irrigation site, as it depends whether the issue for supplying is to do with pressure, or overall availability of water for one irrigation cycle.

3.3.4 Opportunity 4 – Jubilee Park Harvesting Diversion Infrastructure and Basin

As the open drain is noted to have a high proportion of flows entering it adjacent the Jubilee Oval site, this is an ideal location to divert stormwater for reuse prior to the flows entering the existing channel. This is desirable as the existing channel intersects the shallow groundwater table and results in high salinity water, inappropriate for harvesting, further down the channel.

This option would involve the capture of water in a standard pump sump at the location where the stormwater network enters the open drain. Some open drain upgrades would be required in order to facilitate appropriate initial storage and allow for sufficient pump-out of the stormwater resource. A high pumping rate could be adopted to compensate for minimising the footprint of the initial storage. The system would pump to an above ground basin in order to capture as much of each storm event as possible. From the above ground basin, it would be possible to allow harvested water to gravity feed through a treatment facility such as a small scale wetland (footprint would be in the order of 2% of the equivalent impervious area of the contributing catchment), or a biofiltration system with a smaller footprint. Treated water would then be pumped to the irrigation tank at the Jubilee Oval site. It's estimated this system could supply 40ML demand to the site, which could meet the site's overall irrigation requirements. This option assumes that the existing connection point for irrigation supply is used, therefore minimal additional pipe infrastructure is needed.

This option is of a reasonably high comparative cost, estimated to be in the order of $5.15/kL due to the low volume of water able to be supplied, and the higher operating costs associated with operating a non-central scheme. As this option is higher cost than the existing potable water supply, it is suggested that it would not be considered unless there is additional funding available such as sporting grounds grants for the Jubilee Park redevelopment to bring the infrastructure costs down.

3.3.5 Opportunity 5 – Centralised Harvesting System

If in future demand increases for water to be redistributed to non-central locations within the township, it may become viable to use a centralised scheme. This option could incorporate Opportunity 1, 2 and 3 described above, in order to make the best use of the available water. Additionally, this option would require a similar harvesting point as described in Opportunity 4, but rather than allocating this water locally for the Jubilee Park Oval, additional infrastructure would be included in order to feed this water back through the existing distribution pipeline, back to the centralised storage for distribution. This option also includes an above ground storage and treatment system as described for Opportunity 4.

This option would involve some pump station balancing storage at Jubilee Oval, and additional pump station infrastructure. Finer details of operation of the network to provide two way use of the pipe would be included in future network assessments and design, however preliminary investigations indicate this would be feasible due to the pipe sizes and relatively flat grades. The distribution network is existing, and this option assumes the centralised basin located on Racecourse Road would already be connected to the distribution network. Based on the additional potential harvest for this option of 40 ML combined with the expected 70ML total which is expected to be able to be distributed by the Racecourse basin, this would result in an overall cost of water of $1.95/kL.

This price is once again in excess of the current price of recycled water, however is lower in cost than supply of potable water and therefore the primary trigger is additional water demand exceeding what can be provided via the lower cost opportunities such as Opportunity 1 and 2 described above.

Figure 15: Opportunity 4 and Opportunity 5 – Jubilee Park Infrastructure Overview

3.3.6 Opportunity 6 – Household Rainwater Tanks

As noted in earlier sections of this report, it would appear that rainwater tanks are used extensively throughout the newly developed suburbs of Whyalla, as per the most recent development plan requirements. It is also noted that based on site visits and aerial data, rainwater tanks are common amongst all properties across Whyalla. Whilst in some Councils previously, a rainwater tank funding scheme has been adopted, it does not appear that this would be warranted in Whyalla due to the significant existing uptake of tanks.

It is therefore recommended to maintain the requirement that rainwater tanks be adopted by all new developments, and that Council should not allocate funding to this initiative to encourage uptake.

Note that future developments and potential runoff have therefore not been included in this assessment, as it is expected that any future subdivisions would require rainwater tanks, therefore limiting any harvesting potential.

3.3.7 Opportunity 7 – Irrigation of Whyalla Foreshore

This opportunity is for expanding the reuse of recycled water in Whyalla. As noted in section 2.4.4, if the foreshore was connected to the network, Council could reduce their usage of mains water by 15 ML/year. This option has a reasonable capital cost investment, which results in the cost of water supply being approximately $3.00/kL for the 15 ML/year. This does not include any harvesting infrastructure costs (water production costs), as this option would only be considered if there is a surplus of water supply in the network.

Figure 16: Option to Connect Foreshore into Recycled Water Distribution System

This is one example of the cost to supply an additional area with recycled water which is not already connected to the network. If in future, other private users within Whyalla requested connection to the recycled water network, this could also be considered at the time of the discussion, pending water availability.

4 SUMMARY

Whyalla City Council has sought advice to complete a Stormwater Harvesting and Reuse Strategy, as a part of the requirements set out in the SMP completed by Tonkin in 2019 and by the SMA for their acceptance of the SMP.

The outcomes sought to be achieved by this report included:

- Evaluation of the site-specific constraints for implementation of stormwater harvesting in Whyalla;
- Specification of the overarching strategy guidelines to be followed by Council for stormwater harvesting (refer section 3.1 and section 3.2);
- Identification and evaluation of specific opportunities to satisfy the SMP condition 3, to maximise economic, beneficial reuse of harvested stormwater (refer section 3.3 and Appendix B).

Due to Whyalla's current extensive reuse of recycled wastewater, this report also considers the irrigation demand in terms of an integrated water reuse strategy utilizing all available water resources. Whyalla has a unique climate, with a low overall quantity of rainfall distributed relatively evenly across all months, but with few rainfall events across the year. This results in frequent nuisance flooding events, and also presents complications in determining irrigation demands, and potential stormwater harvesting opportunities.

The Stormwater Harvesting and Reuse Strategy for Whyalla relies on balancing the irrigation water supply with the irrigation demands for the greenspace areas within the township. Through a water balance assessment, the existing supply was found to be insufficient to meet the demands for existing sites, resulting in an average of 100 ML/year of potable water being supplied by SA Water for irrigation use.

The main reasons for the imbalance of supply and demand were explored, and solutions incorporated into the suggested strategy for stormwater harvesting where possible. The stormwater harvest and supply options for Council have been evaluated in detail in Section 3.3, with costings summarised in Appendix B and examples of treatment infrastructure provided in Appendix C.

In terms of prioritization, it is recommended that Council completes Opportunity 1 (connect Racecourse Road basins into the recycled water distribution network) concurrently with the flood mitigation basin construction, in order to maximise the opportunity provided by the flood mitigation infrastructure being constructed. This is the lowest cost option, as the basin earthworks costs are excluded – this option is recommended regardless of whether the new flood mitigation basin is constructed to enable flexibility in operation and greater ease of distribution of the water already captured in the Racecourse Road basin.

Opportunity 3, increased irrigation tank storage at existing irrigation sites, should also be considered to be a high priority. A review of the irrigation operation and storages is recommended to be completed

as soon as possible. This review will generate the information required to determine if adopting this option for some key sites would result in Council increasing their usage of the existing recycled wastewater source instead of the higher cost potable water, and consequently saving in costs by optimising recycled wastewater reuse.

Opportunity 6 (rainwater tanks for households) is to remain as part of the development plan for Council, without additional funding being allocated to it as a stormwater harvesting strategy initiative.

The next option that is recommended for implementation would be Opportunity 5; however, this option requires a more significant footprint and capital investment from Council. It is expected that Council will greatly reduce their usage of potable water for irrigation by implementing Opportunity 1 and Opportunity 3. It is therefore recommended that Opportunity 5 and the remaining options be reviewed for implementation once these have been operational for at least a year to determine if they have been successful in balancing the water usage.

This strategy provides some guidance on opportunities which should be adopted under current conditions for Whyalla and provides further steps to be considered as demands increase in future and additional water sources are required.

APPENDIX A

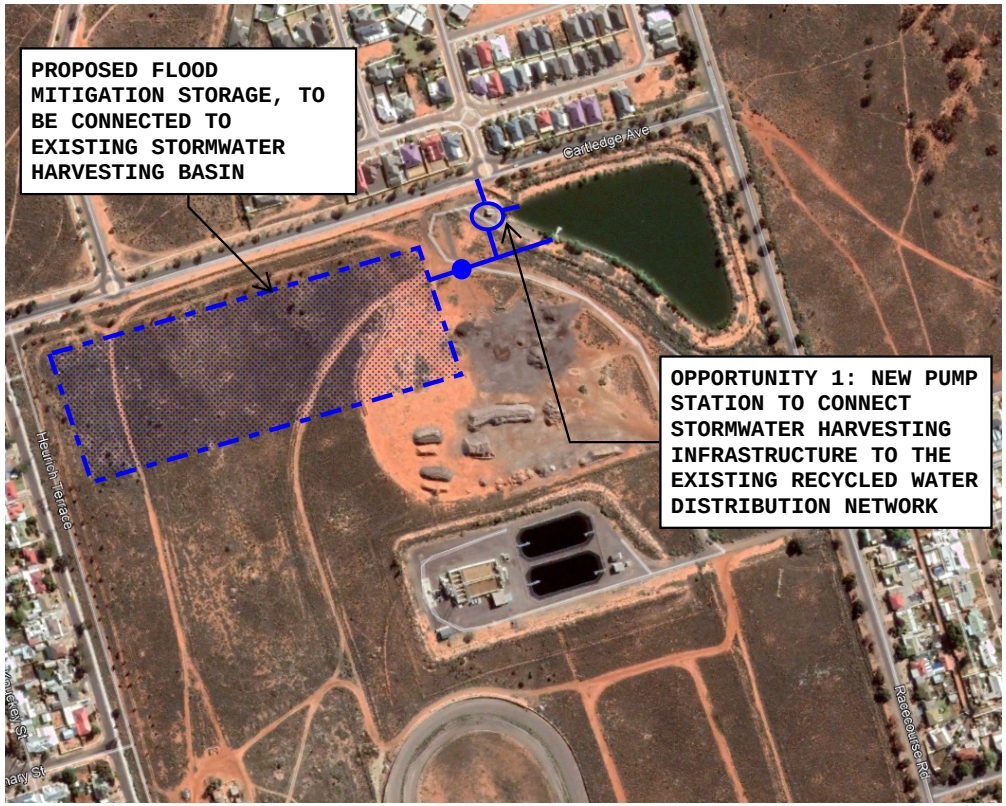
HIGH LEVEL COSTS FOR OPPORTUNITIES

Opportunity 1 - Flood Mitigation Basin

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Harvesting Infrastructure	Pump Station (30 L/s)	$/item	$ 80,000.00	1	$ 80,000.00	Transfer pump from new flood mitigation basin to existing stormwater capture
	Pump Station (15L/s)	$/item	$ 80,000.00	1	$ 80,000.00	Distribution pump to connect to existing network (Flow rate TBC)
	Basin Upgrade Works	$/item	$ 50,000.00	1	$ 50,000.00	Modifications to allow harvesting from new basin
	Pipe Infrastructure	$/m	$ 100.00	250	$ 25,000.00	Based on 100 mm pipe diameterincluding valve and fittings
	Connection to SA Water recycled network	$/item			$ 18,500.00	10% of pump station cost
	Instruments, Water Quality Monitoring and Control Panel		$ 7,500.00	1	$ 7,500.00	
				Total	**$ 261,000.00**	
				Contingency (40%)	$ 104,400.00	
				Construction Total	**$ 365,400.00**	

Additional Cost Allowances

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 25,578.00	
Regulatory Approvals and Documentation, Additional Augmentation expenses	Power augmentation		$ 200,000.00	1	$ 200,000.00	Allowance in case existing power source is insufficient for operation of adjusted pumping system
	Approvals	$/item	$ 50,000.00	1	$ 50,000.00	Functional Design, Risk Assessment, Water Quality Monitoring and Management Plans.
				Additional Allowance	**$ 275,578.00**	
				TOTAL	**$ 640,978.00**	

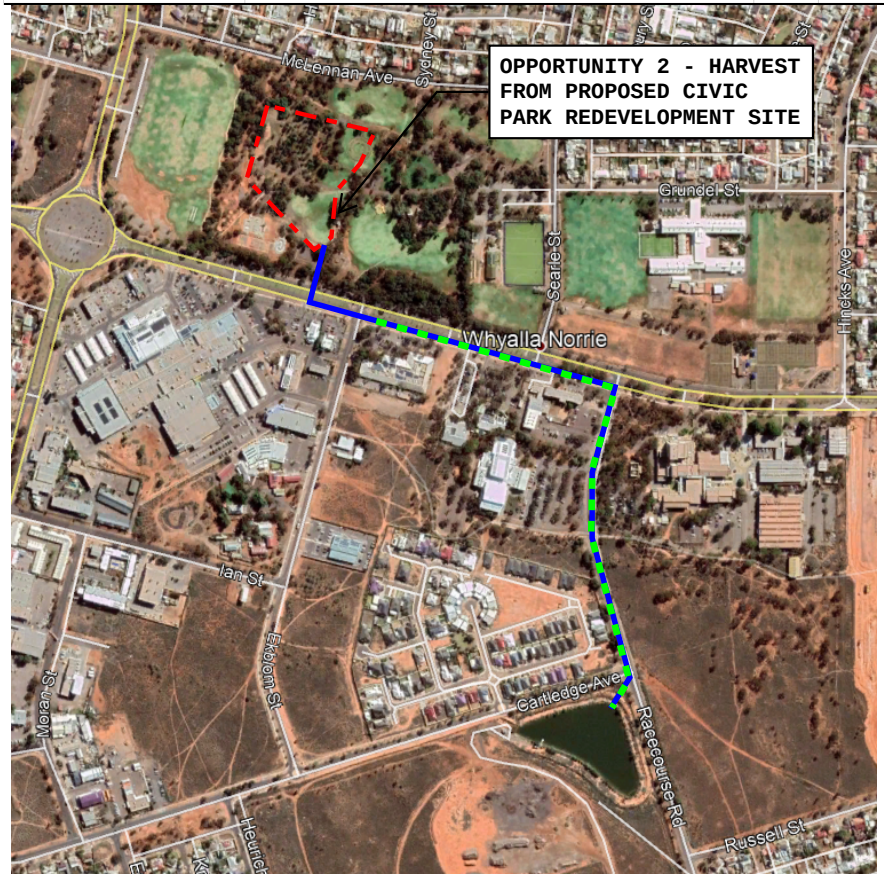


Opportunity 2 - Civic Park Redevelopment

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Harvesting Infrastructure	Pump Station (7 L/s)		$ 50,000.00	1	$ 50,000.00	Harvest Location in a sump built at exit of drainage pipe, or at entrance of trench.
	Basin Upgrade Works		$ 50,000.00	1	$ 50,000.00	Modifications to the proposed basin to ensure harvesting is enabled
	Pipe Infrastructure	$/m	$ 100.00	250	$ 25,000.00	Based on 100 mm pipe diameterincluding valve and fittings
	Connection to SA Water				$ 7,500.00	10% Of pump station cost
	Instruments, Water Quality Monitoring and Control Panel		$ 7,500.00	1	$ 7,500.00	
				Total	**$ 140,000.00**	
				Contingency (40%)	$ 56,000.00	
				Construction Total	**$ 196,000.00**	

Additional Cost Allowances

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 13,720.00	
Regulatory Approvals and Documentation, Additional Augmentation expenses	Power augmentation		$ 200,000.00	1	$ 50,000.00	
	Approvals	$/item	$ 50,000.00	1	$ 50,000.00	Function Design, Risk Assessment, Water Quality Monitoring and Management Plans.
				Additional Allowance	**$ 113,720.00**	
				TOTAL	**$ 309,720.00**	



Opportunity 3 - Optimising Recycled Water Reuse Using Tank Storage

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Optimise recycled water usage per irrigation site	Steel Tank (200kL)	$/kL	$ 300.00	200	$ 60,000.00	200 kL Balancing Storage Tank has been allowed.
	Underground Tank	$/kL	$ 600.00			*option to be considered
	~~Pipeline (100mm purple pipe)~~	~~$/km~~	~~$ 100,000.00~~		~~$~~	~~100m pipeline~~
	~~Pump Station - tank to oval (12 L/s)~~		~~$ 30,000.00~~		~~$~~	~~Cost based on previous project costs, allowing shed, pump station (dual pump redundancy) and valves.~~
	Instruments, Water Quality Monitoring and Control Panel					*existing sites should have this already
				Total	**$ 60,000.00**	
				Contingency (40%)	$ 24,000.00	
				Construction Total	**$ 84,000.00**	

Additional Cost Allowances

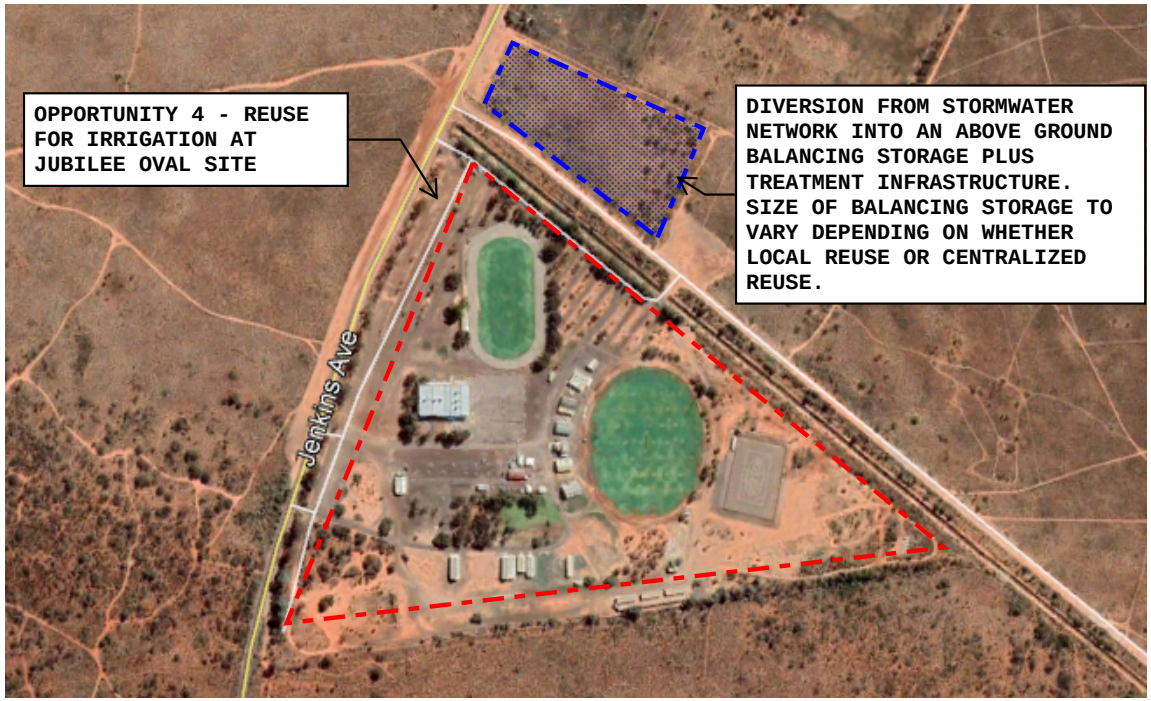
Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 5,880.00	
Regulatory Approvals and Documentation, Additional	Approvals	$/item	$ 10,000.00	1	$ 10,000.00	Updated Irrigation management Plan
				Additional Allowance	**$ 15,880.00**	
				TOTAL	**$ 99,880.00**	

Opportunity 4 - Jubilee Park Harvesting Diversion Infrastructure and Basin

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Transfer to drainage basins from trench, treatment	Pump Station from Trench (30 L/s)		$ 80,000.00	2	$ 160,000.00	Harvest Location in a sump built at exit of drainage pipe, or at entrance of trench.
	Channel Upgrade Works		$ 10,000.00	1	$ 10,000.00	Modifications to the open drain will be required
	Basin 1 - 1ML		$ 100,000.00	1	$ 100,000.00	1 x 1ML
	Drainage Basin and Wetland		$ 1,000,000.00	1	$ 1,000,000.00	30 ML
	Pipe Infrastructure	$/m	$ 100.00	250	$ 25,000.00	Based on 100 mm pipe diameterincluding valve and fittings
	Instruments, Water Quality Monitoring and Control Panel		$ 7,500.00	1	$ 7,500.00	
Storage/supply	Steel Tank (200kL)	$/kL	$ 300.00	200	$ 60,000.00	200 kL Balancing Storage Tank has been allowed.
	Underground Tank	$/kL	$ 600.00			*option to be considered
	Pipeline (100mm purple pipe)	$/km	$ 100,000.00	1	$ 100,000.00	1km pipeline
	Pump Station - wetland to irrigation tank (10 L/s)		$ 80,000.00	1	$ 80,000.00	Cost based on previous project costs, allowing shed, pump station (dual pump redundancy) and valves.
				Total	**$ 1,542,500.00**	
				Contingency (40%)	$ 617,000.00	
				Construction Total	**$ 2,159,500.00**	

Additional Cost Allowances

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 151,165.00	
Regulatory Approvals and Documentation, Additional Augmentation expenses	Power augmentation		$ 200,000.00	1	$ 200,000.00	
	Approvals	$/item	$ 50,000.00	1	$ 50,000.00	Function Design, Risk Assessment, Water Quality Monitoring and Management Plans.
				Additional Allowance	**$ 401,165.00**	
				TOTAL	**$ 2,560,665.00**	



Opportunity 5 – Centralised Harvesting System

Capture water at the Opportunity 1 (Flood Mitigation Basin) and Opportunity 4 (Jubilee Park Basin) locations. Pump to centralised location. Allow water to gravity feed through the central treatment facility - wetland or biofiltration. Assumes that you utilize existing connection point for irrigation supply, so minimal additional pipe needed

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Transfer to drainage basins from trench, treatment	Pump Station from Trench (30 L/s)		$ 80,000.00	2	$ 160,000.00	Harvest Location in a sump built at exit of drainage pipe, or at entrance of trench.
	Channel Upgrade Works		$ 10,000.00	1	$ 10,000.00	Modifications to the open drain will be required
	Basin - 1ML		$ 100,000.00	3	$ 300,000.00	3 x 1ML
	Drainage Basin and Wetland		$ 1,000,000.00	1	$ 1,000,000.00	30 ML
	Pipe Infrastructure - site 1	$/m	$ 100.00	4000	$ 400,000.00	Based on 100 mm pipe diameterincluding valve and fittings
	Instruments, Water Quality Monitoring and Control Panel		$ 7,500.00	2	$ 15,000.00	
Storage/supply	Steel Tank (200kL)	$/kL	$ 300.00	400	$ 120,000.00	2 x 200 kL Balancing Storage Tank has been allowed.
	Underground Tank	$/kL	$ 600.00			
	Pump Station - wetland to irrigation tank (10 L/s)		$ 60,000.00	1	$ 60,000.00	Cost based on previous project costs, allowing shed, pump station (dual pump redundancy) and valves.
				Total	**$ 2,065,000.00**	
				Contingency (40%)	$ 826,000.00	
				Construction Total	**$ 2,891,000.00**	

Additional Cost Allowances

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 202,370.00	$ 151,777.50
Regulatory Approvals and Documentation, Additional Augmentation expenses	Power augmentation		$ 200,000.00	1	$ 200,000.00	
	Approvals	$/item	$ 50,000.00	1	$ 50,000.00	Function Design, Risk Assessment, Water Quality Monitoring and Management Plans.
				Additional Allowance	**$ 452,370.00**	$ 411,245.45
				TOTAL	**$ 3,343,370.00**	

Opportunity 7 – Irrigation of Whyalla Foreshore

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Transfer	Booster Pump Station 7 L/s		$ 80,000.00	1	$ 80,000.00	Assuming pressures in existing network are insufficient to reach the foreshore
	Pipe Infrastructure - site 1	$/m	$ 100.00	2000	$ 200,000.00	Based on 100 mm pipe diameterincluding valve and fittings. Assumes that you utilize existing connection point for irrigation supply, so minimal additional pipe needed
	Instruments, Water Quality Monitoring and Control Panel		$ 7,500.00	2	$ 15,000.00	
Storage/supply	Steel Tank (200kL)	$/kL	$ 300.00	400	$ 120,000.00	2 x 200 kL Balancing Storage Tank has been allowed.
	Pump Station - to irrigation (10 L/s)		$ 60,000.00	1	$ 60,000.00	Cost based on previous project costs, allowing shed, pump station (dual pump redundancy) and valves.
				Total	**$ 475,000.00**	
				Contingency (40%)	$ 190,000.00	
				Construction Total	**$ 665,000.00**	

Additional Cost Allowances

Item	Element	Unit	Rate	Number of Units	Estimate	Assumption
Detailed Design		7%	7% of CAPEX		$ 46,550.00	
Regulatory Approvals and Documentation, Additional Augmentation expenses						
	Approvals	$/item	$ 50,000.00	1	$ 50,000.00	Function Design, Risk Assessment, Water Quality Monitoring and Management Plans.
				Additional Allowance	**$ 96,550.00**	
				TOTAL	**$ 761,550.00**	

Cost per kL for Supply of Harvested Stormwater

For each option where high-level infrastructure costings can be provided, we have further interrogated the costs to provide a cost per kilolitre for the supply of such water.

In this assessment, we consider the Net Present Value (NPV) of the infrastructure (with a 7% discount rate, and a 50 year operation of the scheme)

We have also factored in the cost to operate the scheme (an average of 30 cents per kL for schemes where only minor additional operational requirements are expected, or 50 cents where a significant extension is being created)

These costs are primarily based on the expected harvestable yields based on the high level assessment completed. These values may be adjusted during the concept design for each opportunity, however give some idea as to the expected running costs and consequently the trigger points (described further in Appendix B)

Opportunity 1 - Flood Mitigation Basin			
Assumptions			
Discount rate	7.0%		
Volume of water sold/Ml pa	70		
Operational Costs			
Operating $/Kl	$0.30		
Capital Works	**LIFE (YRS)**	**COST $'000**	**EAV $'000**
Total Capital	**50**	**365**	26.5
Additional Potential Upgrade Costs	**50**	**276**	20.0
Annual Operating			**21.0**
Total Annualised Costs			**67.4**
Net cost/KL			**$0.9635**

Opportunity 2 - Civic Park Redevelopment			
Assumptions			
Discount rate	7.0%		
Volume of water sold/Ml pa	5		
Operational Costs			
Operating $/Kl	$0.30		
Capital Works	**LIFE (YRS)**	**COST $'000**	**EAV $'000**
Total Capital	**50**	**196**	14.2
Additional Potential Upgrade Costs	**50**	**50**	3.6
Annual Operating			**1.5**
Total Annualised Costs			**19.3**
Net cost/KL			**$3.8650**

Opportunity 4 - Jubilee Park Harvesting Diversion			
Assumptions			
Discount rate	7.0%		
Volume of water sold/Ml pa	40		
Operational Costs			
Operating $/Kl	$0.50		
Capital Works	**LIFE (YRS)**	**COST $'000**	**EAV $'000**
Total Capital	**50**	**2,160**	156.5
Additional Potential Upgrade Costs	**50**	**401**	29.1
Annual Operating			**20.0**
Total Annualised Costs			**205.5**
Net cost/KL			**$5.1386**

Opportunity 5 – Centralised Harvesting System			
Assumptions			
Discount rate	7.0%		
Volume of water sold/Ml pa	110		
Operational Costs			
Operating $/Kl	$0.30		
Capital Works	**LIFE (YRS)**	**COST $'000**	**EAV $'000**
Total Capital	**50**	**2,065**	149.6
Additional Potential Upgrade Costs	**50**	**452**	32.8
Annual Operating			**33.0**
Total Annualised Costs			**215.4**
Net cost/KL			**$1.9583**

Opportunity 7 – Irrigation of Whyalla Foreshore			
Assumptions			
Discount rate	7.0%		
Volume of water sold/Ml pa	15		
Operational Costs			
Operating $/Kl	$0.30		
Capital Works	**LIFE (YRS)**	**COST $'000**	**EAV $'000**
Total Capital	**50**	**475**	34.4
Additional Potential Upgrade Costs	**50**	**97**	7.0
Annual Operating			**4.5**
Total Annualised Costs			**45.9**
Net cost/KL			**$3.0610**

APPENDIX B

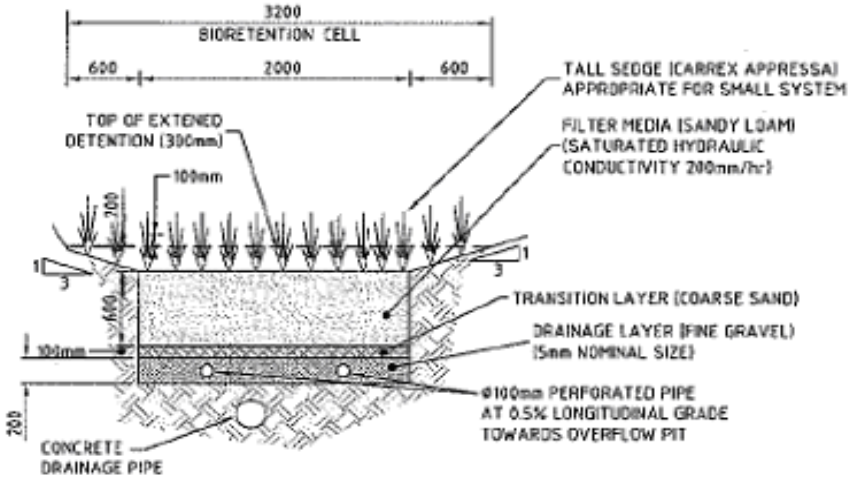
OPPORTUNITIES SUMMARY WITH TRIGGERS FOR IMPLEMENTATION

Criteria	Opportunity 1 – Flood Mitigation Basin	Opportunity 2 – Civic Park Redevelopment	Opportunity 3 – Optimising Irrigation Storage	Opportunity 4 – Jubilee Park Harvesting Diversion Infrastructure and Basin	Opportunity 5 – Centralised Harvesting System	Opportunity 6 – Household Rainwater Tanks	Opportunity 7 – Irrigation of Whyalla Foreshore
Additional Infrastructure required	Transfer pump/pipeline between basins, Pump for distribution via existing network	Transfer pump/pipeline to Main Racecourse Road basins to ensure flood performance is maximised	Storage tanks/basins	Storage Basin, Diversion structure for stormwater, treatment infrastructure, pump station	Storage Basin, Diversion structure for stormwater, treatment infrastructure, pump station, pipeline	Rainwater Tanks	Booster pump station and pipeline for distribution network
Capital Cost	$365,000* Excludes basin costs	$196,000* Excludes basin costs	$60,000 for a 200kL tank. Exact cost depends on demand and analysis of each site RE instantaneous flows	$2,160,000	$2,900,000	N/A (cost borne by household)	$665,000
Cost of Water Production	$0.95/kL	$3.85/kL	Varies - (Estimate $1.80-$2.10 incl. recycled water cost)	$5.15/kL	$1.95/kL	N/A (cost borne by household)	15 ML/y supplied, additional supply cost equates to $3.00/kL
Yield	Estimated up to 70 ML/year (Opportunistic)	5 ML/year (Opportunistic)	Nil (Demand Side)	40 ML/year	110 ML/year (combine 1, 2 and 4)	19 kL/annum per household	Nil (Demand Side Opportunity
Regulatory Requirements	SMA Approval	SMA Approval	Department for Health and Wellbeing Recycled Water Management Plan	Council Development Plan	Department for Health and Wellbeing Recycled Water Management Plan	Council Development Plan	Department for Health and Wellbeing Recycled Water Management Plan
Trigger for implementation	Funding via flood mitigation works	Funding via flood mitigation works	Review existing irrigation sites now to determine requirements and opportunities (funding currently available for this kind of study under COVID-19 stimulus)	Additional Water Required, Jubilee Park development commences, additional funding eg. For sports fields improvements is available	Additional Water Required, Jubilee Park development commences	Already in the Development Plan	Surplus of available recycled water to supply, tourism grant for funding

APPENDIX C

EXAMPLES OF TREATMENT INFRASTRUCTURE

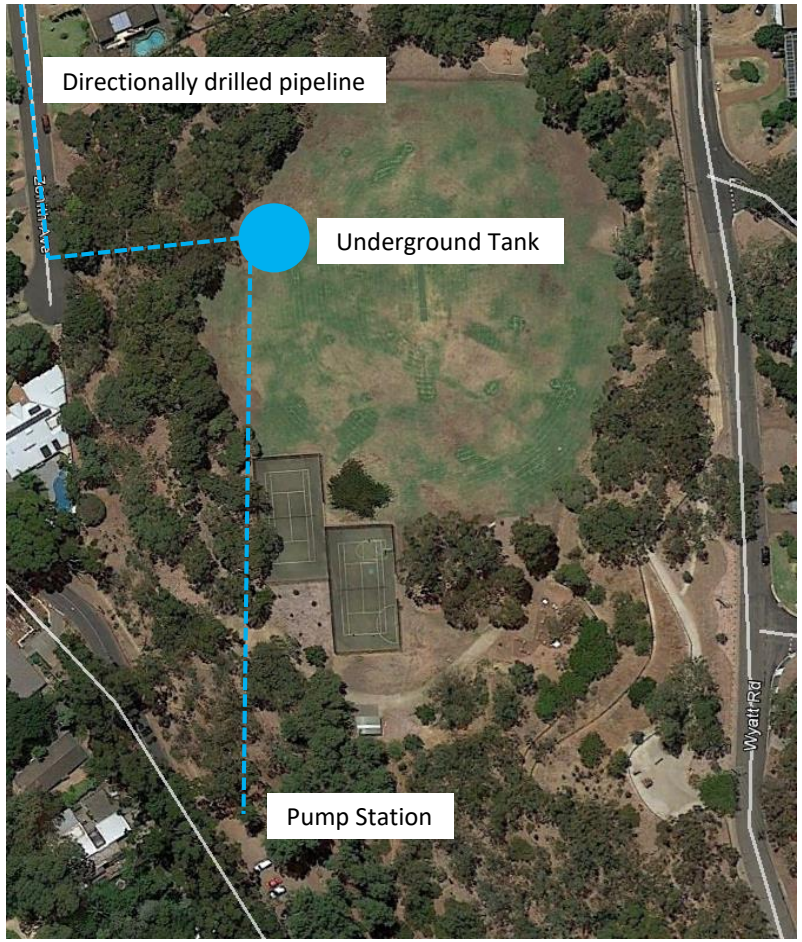
Treatment by Biofiltration



Example of a Media Filtration system for Stormwater Harvesting

Example: Pump Station & 500 kL Storage Tank for Stormwater Harvesting

WGA
WALLBRIDGE GILBERT AZTEC



Example Irrigation Tank Footprint

Treatment by Wetlands

WGA
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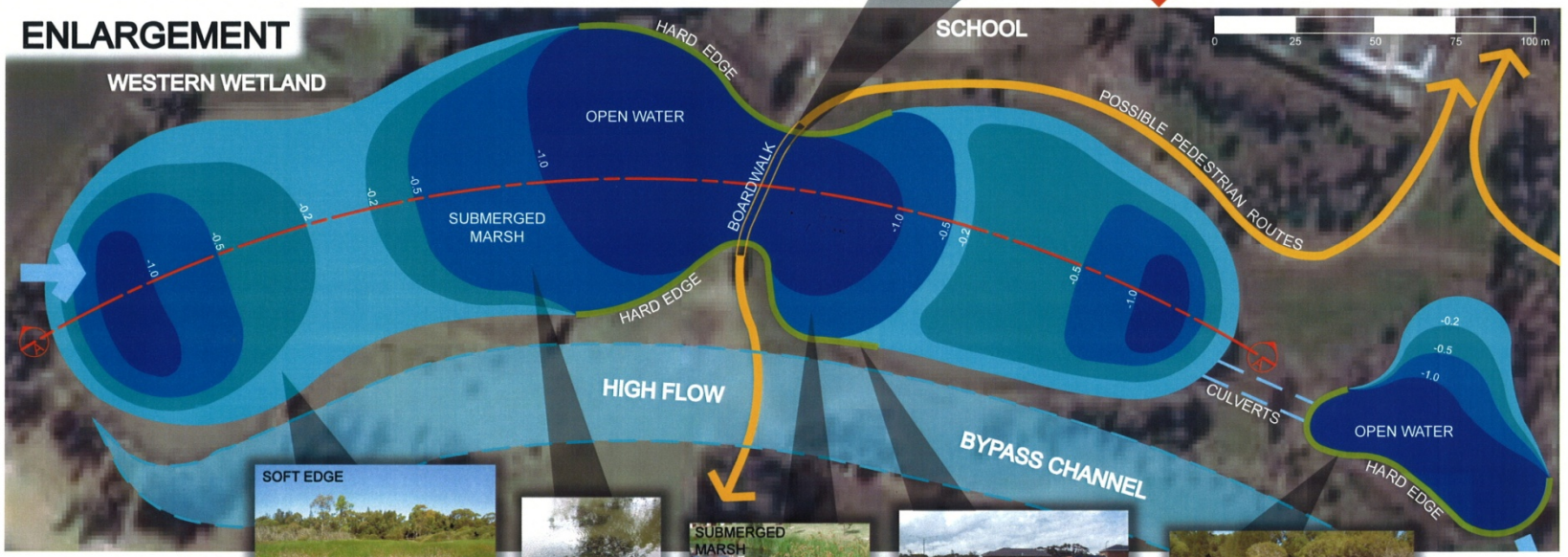
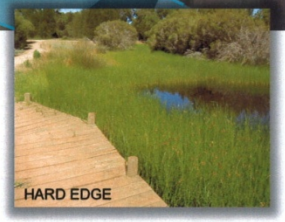
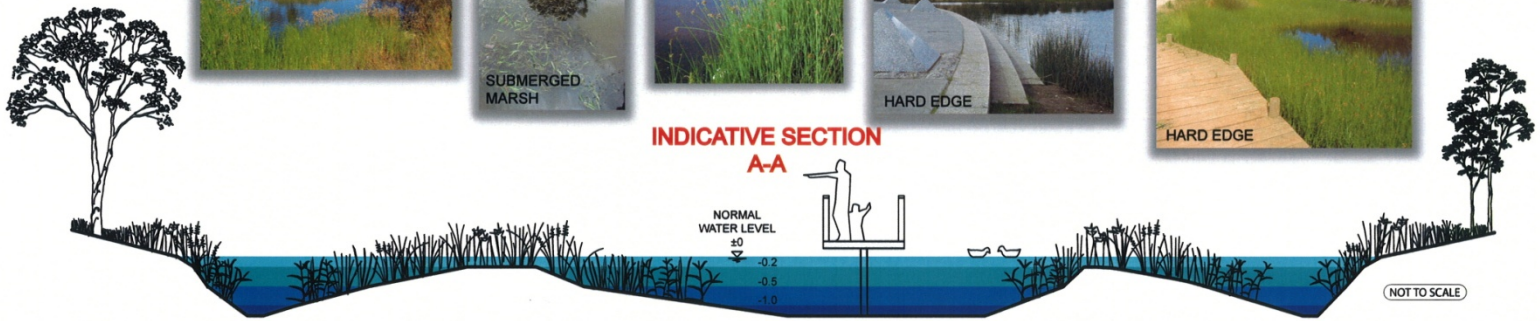
ANDREWS FARM WETLANDS

PROPOSED WETLAND AREAS		
ZONE	DEPTH BELOW NORMAL WATER LEVEL (mm)	AREA (m^2)
Emergent Vegetation	0-500	14,200.00
Submerged Marsh/Open Water	500-1500	15,700.00

EXISTING WATER AREAS	
ZONE	AREA (m^2)
Fringing Vegetation	7,100.00
Open Water	21,200.00







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