His Worship the Mayor
Councillors

City of Marion

Notice of Asset and Sustainability Committee

Virtual Meeting Room - Zoom

Tuesday, 7 September 2021 at 6.30 pm

The CEO hereby gives Notice pursuant to the provisions under Section 83 of the *Local Government Act 1999* that an Asset and Sustainability Committee will be held.

A copy of the Agenda for this meeting is attached in accordance with Section 83 of the Act.

Meetings of the Council are open to the public. Due to COVID-19, interested members of the community are welcome to attend by electronic means. Access to the meeting is via the link published on the City of Marion website (https://www.marion.sa.gov.au/about-council/council-meetings/council-meeting-live-stream) on the day of the meeting.

Tony Harrison

Chief Executive Officer

1 Open Meeting

2 Kaurna Acknowledgement

We acknowledge the Kaurna people, the traditional custodians of this land and pay our respects to their elders past and present.

3 Elected Member Declaration of Interest (if any)

4 Confirmation of Minutes

4.1 Confirmation of Minutes of the Asset and Sustainability Committee Meeting held on 1 June 2021	
Report Reference	ASC210907R4.1
Originating Officer	Governance Officer – Angela Porter
Corporate Manager	Manager Office of the Chief Executive – Kate McKenzie
General Manager	Chief Executive Officer – Tony Harrison

RECOMMENDATION

That the minutes of the Asset and Sustainability Committee Meeting held on 1 June 2021 be taken as read and confirmed.

ATTACHMENTS

1. ASC210601 - Final Minutes [**4.1.1** - 7 pages]

MINUTES OF THE ASC210601 - ASSET AND SUSTAINABILITY COMMITTEE MEETING

Tuesday, 01 June 2021 at 06:30 PM

Council Administration Centre, 245 Sturt Road, Sturt

PRESENT
Councillors Matthew Shilling, Bruce Hull, Nathan Prior, Ian Crossland

IN ATTENDANCE
Tony Harrison – Chief Executive Officer
Tony Lines – General Manager City Services
Sorana Dinmore – General Manager Corporate Services
Mat Allen – Manager Engineering, Assets and Environment
Carl Lundborg – Unit Manager Engineering
Catrin Johnson – Asset Strategy Officer
Michael Bennet – Asset Management Officer
Angela Porter – Governance Administration Officer

OPEN MEETING
The Chair opened the meeting at 6.31pm.

KAURNA ACKNOWLEDGEMENT
We acknowledge the Kaurna people, the traditional custodians of this land and pay our respects to their elders past and present.

ELECTED MEMBER'S DECLARATION (if any)

The Chair asked if any Member wished to disclose an interest in relation to any item being considered at the meeting.

Councillor Prior declared a perceived conflict of interest in the item *Asset Management Update ASC210601R03*.

CONFIRMATION OF MINUTES

Confirmation of the minutes for the Asset and Sustainability Committee Meeting held on 6 April 2021
Report Reference: ASC210601R01

Moved Councillor - Nathan Prior **Seconded Councillor - Ian Crossland**

That the minutes of the Asset and Sustainability Committee Meeting held on 6 April 2021 be taken as read and confirmed.

Carried Unanimously

BUSINESS ARISING
Review of the Business Arising from previous meetings of the Asset and Sustainability Committee.

Business Arising Statement - Action Items
Report Reference: ASC210601R02

Mr Lines delivered a presentation regarding the year to date achievements of the committee. The following discussion points were noted:

Presentation from DIT

- Nil discussion.

Draft Transport Plan

- It was noted that there are potential issues with the proposed access/egress points for the South Road North South Corridor tunnel and that the progress will be monitored.

Tree management

- This item is scheduled to come back to Council on 8 June 2021. The guidelines and marketing strategy will be included and the Mayor has provided some comments which will be incorporated.
- Ready to go out for tender for the purchase of new tankers and a new role will be advertised when the budget has passed.
  The proposed new water tankers should be compatible to assist with emergency response in the case of fire. Administration to investigate this further.

Action: An update will be provided to Members regarding the Aleppo Pines within the next month.

SRWRA Progress update Mark Booth

- The committee noted that there has recently been another MRF fire and that funds have been spent to ensure the new SRWRA facility is well equipped to prevent this from occurring.

Residential Hard Waste and Dumped Rubbish Services

- Phase 2 of the Salesforce roll out is scheduled for December 2021 which will include the hard waste module but the go-live date has not been confirmed. An automated system can send SMS reminders to cover the 1% who forget to put hard waste out for collection.
- WHS statistics were not included in the Council report, however, this was addressed at the Council meeting of 25 May 2021. It was advised that year to date there have been 8 LTI reports with only 1 of those being in the hard waste team. The incident took place when exiting the truck and was not due to manual handling and the committee has been assured this is minimal risk.
- A question taken on notice at the General Council meeting on 25 May 2021 was addressed regarding waste over the allowed 1 cubic metre that is left behind at collection. Data collected between September and November shows that 3% of all collections were over 1 cubic metre resulting in some being left behind. Of those, just over half had 1 cubic metre available for booking. The hard waste team will be phoning the office to check if additional hard waste can be taken going forward.

Action: Staff to follow up why the cost and effectiveness of skip bins placed in Housing SA areas was missed from the Council report.

Waste and Recycling Update

- Nil discussion.

The Committee also discussed the potential to hold a 10-20 minute discussion at the end of the meeting to collectively discuss upcoming items for future meetings to prevent duplicated work of committee members. Members agreed they would prefer a separate meeting and discussed the potential to call a Special meeting in August. The Chair reminded Members that the schedule of meetings was already agreed to.

Moved Councillor – Ian Crossland **Seconded Councillor – Bruce Hull**

That the Asset and Sustainability Committee:

1. Notes the business arising statement, meeting schedule and upcoming items.

Carried Unanimously

CONFIDENTIAL ITEMS - Nil

REPORTS FOR DISCUSSION - Nil

REPORTS FOR NOTING - Nil

WORKSHOP / PRESENTATION ITEMS

Councillor Prior declared a perceived conflict of interest in the item *Asset Management Update ASC210601R03.*

Asset Management Update
Report Reference: ASC210601R03

Mr Allen and Ms Johnson delivered a presentation on Asset Management. The presentation included a video introducing the team and the following discussion points were noted:

- The City of Marion has over 90,000 assets with a total value over 1 billion.
- Benefits of asset management include accountability, good decision making, enhancing the customer experience and reducing the need for customers to contact us, effective risk management, improved financial efficiency and sustainability (over/under servicing)
- The four pillars of Asset Management are skilled people, improved processes, accurate data, intelligent systems

Asset Management Information System

- Process mapping has been completed with over 200 processes captured. This will help prevent a ‘single point of failure’.
- The preferred supplier has been selected for new asset information system. The cloud-based system, which staff can access and update in the field, will integrate with the other new systems including Salesforce and the GIS mapping system which also integrates with Forestree.
- Each asset will have a unique asset ID and accurately spatially mapped.
- Renewal projects will be identified through asset management plans with the new system providing some certainty around this. A review will be undertaken with the scope to be determined.
- Current manual spreadsheets will eventually be superseded by the new asset information system. Training will be provided to ensure all staff understand how to use the new systems and how this can add value to their jobs through automation, etc. The new system provides more accountability, a single point of truth, well maintained data sets and improved processes.

Asset Management life cycle

- Impact of climate change on assets and useful life
- Some gaps in the monitoring of the asset management lifecycle have been identified through a recent KPMG audit which will now become a focus for the team.
- Operation, maintenance and monitoring have been separated in the modelling allowing for more

accurate useful life data. It was noted that the current modelling includes projects that have not been endorsed by Council and grant funded projects such as the Coastal Walkway.

- Improved utilization assessment will help to determine disposal of assets. E.g. to prevent unused bus shelters from being replaced. The current threshold for provision/replacement of a bus shelter is 7 users per day which is lower than most other councils. It was noted that bus shelters are also used by pedestrians to shelter from inclement weather.
- Collection of more comprehensive data around open space management will enable a 'what if' analysis to identify potential reductions in operating expenditure.
- The lifecycle cost of an asset (maintenance, renewal, etc) should form part of the recommendations to Council with an additional option for 'disposal' of assets. A cost benefit analysis can be incorporated into future reports with consultation with Members to remove rather than maintain/replace assets.
- An Asset Management Maturity Assessment was completed in March this year with 96% of the core assessment areas achieved.
- 8 Asset Management Plans (AMPs) have been endorsed by Council. They will be internally reviewed annually with a comprehensive review and endorsement from Council every four years. The AMPs ensure clean data, a single point of truth, documented processes, informed decision making, improved knowledge and reduced risk (quality). The AMPs provide a holistic view across the asset base.
- Total funding forecast across the 8 AMPs over the next 10 years (fully funded) is $351.3million with the highest spend being on transport (traffic control, roads, etc), open space and stormwater.
- The AMPs are feeding into the Long Term Financial Plan (LTFP) which aids better financial modelling, asset lifecycle costs, etc. For the first time the AMPs have informed the LTFP, not vice versa.
- The AMPs are publicly available via the City of Marion website.
- We do not currently have systems in place to make asset information publicly available, however, there is potential to do this in future through the Digital Transformation Program implementation.
- It was noted that some major arterial roads throughout the City of Marion are in poor condition however these are the responsibility of DIT. The threshold for arterial road classification is 16,000 vehicles per day.
- The City of Marion is trialling different road treatment types to improve the life of assets. It was acknowledged that a higher upfront cost has potential to lower costs long term.
- New subdivisions (e.g. Tonsley) cause an increase in transport asset costs.
- A report will be brought to Council to identify and seek endorsement on how we manage transport infrastructure renewal programs.
- Next steps include implementation of the Asset Management Information System, service level monitoring, certified training, implementation and monitoring of internal audit recommendations and the Resilient Asset Management Pilot which includes improvement of climate resilience by retrofitting current assets and exploring new options rather than replacing like for like.

Moved Councillor - Ian Crossland **Seconded Councillor – Nathan Prior**

That the Asset and Sustainability Committee:

1. Notes the Report.

Carried Unanimously

Footpath and Kerb Ramp Condition Audit
Report Reference: ASC210601R04

Mr Lundborg delivered a presentation on the Footpath and Kerb Ramp Condition Audit. The following discussion points were noted:

Footpaths

- The City of Marion has 883km of footpath (over 10,000 segments) valued at $131m
- Levels of service identify safety, quality, capacity, functionality
- No cost has been allocated for operation. The City of Marion currently has two street sweepers working five days with the sixth day on pit clean up. The City of Charles Sturt have a similar road network with four large sweepers for roads and two small sweepers for footpaths. A footpath hierarchy will need to be developed before a report can be brought to Council for operation costs. Research and data collection through customer events are currently being undertaken to inform the report.
- Monitoring costs are allocated for footpath condition and defect auditing every 4 years. The current monitoring contractor is based in Victoria and the buggy has 2 cameras front and back taking photos every 2 metres via an onboard computer. Preliminary discussion for collaboration between Western councils has occurred to consider purchase of shared equipment and resources to undertake future audits in house.
- Footpath condition assessment – assessed at 20m intervals and provides a rating of 1(new) to 5 (in need of replacement) in line with IPWEA industry standards. 75% of our footpath network is sitting at level 3.
- Defects are measured at 10-20mm, 20-30mm, 30mm +, service pit trips and Temporary Asphalt Wedges. 7203 defects were identified on the network following the footpath blitz.
- Key service levels have been identified through the Transport Asset Management Plan:
    - Currently 5km of the network is condition greater than 4. Target - no condition greater than 4
    - Currently 1197 20mm defects, 264 30mm defects. Target - no defects above 20mm
- It was noted that there are some inefficiencies in operations as cutting/digging out and reinstating footpaths are completed by two separate crews, however, the City of Marion is currently working to close the gap between dig out and construction.
- Grinding provides a quick and cost-effective replacement of displaced footpaths. Grinding displacements greater than 10mm creates a weakness in the footpath (75-100mm thick) and should instead be replaced.
- The cost/benefit of concrete vs block paving and aggregate concrete was discussed by the Committee (per square metre: block paving $75-80, concrete $100-115, aggregate concrete $125) with concrete lifespan being 20-30 years longer than alternative options). Block paving is used for new and upgrade work and work to existing footpaths are matched unless a full segment is being replaced. Old block pavers, when replaced by the City of Marion, are taken to the Southern Depot where they are crushed and turned into road base.

Kerb ramps

- The City of Marion has 7362 kerb ramps
- To be DDA compliant requires correct alignment and a max grade of 1:8 for ramps – 57% not compliant, 43% compliant
- It was acknowledged that there are some areas where new ramps have been added and old non-compliant ramps are still in place. A program to replace kerb ramps is underway.

Action: Staff to follow up on locations where kerb ramps have been cut in preparation for replacement but have not progressed any further.

Mr Lundborg also shared a short video compiled of 1.7million photos of footpath network and gave a brief demonstration of machine learning software which can be used for regular condition monitoring through cameras on fleet, etc)

Moved Councillor – Ian Crossland **Seconded Councillor - Nathan Prior**

That the Asset and Sustainability Committee:

1. Provides feedback on the proposed future footpath strategies.
2. Supports a report to Council to endorse a Footpath Management Plan.

Carried Unanimously

OTHER BUSINESS – Nil

MEETING CLOSURE - meeting declared closed at 9.29pm

CONFIRMED THIS 7TH DAY OF SEPTEMBER 2021

.....
CHAIRPERSON

5 Business Arising

5.1 Business Arising Statement - Action Items	
Report Reference	ASC210907R5.1
Originating Officer	Executive Officer to the General Manager City Services – Colleen Madsen
Corporate Manager	N/A
General Manager	General Manager City Services– Tony Lines

REPORT OBJECTIVE

The purpose of this report is to review the business arising from previous meetings of the Asset and Sustainability Committee meetings, the meeting schedule and upcoming items.

RECOMMENDATION

That the Asset and Sustainability Committee:

1. **Notes the business arising statement, meeting schedule and upcoming items.**

ATTACHMENTS

1. ASC210907 forward agenda September 2021 [**5.1.1** - 4 pages]
2. ASC210907 Business arising statement - Action Items [**5.1.2** - 1 page]

Asset & Sustainability Committee

Meeting Schedule 2021

~~2 February 2021~~	~~6.30 – 9.30~~
6 April 2021	6.30 – 9.30
1 June 2021	6.30 – 9.30
7 September 2021	6.30 – 9.30
5 October 2021	6.30 – 9.30
2 November 2021	6.30 – 9.30

2021 Committee Membership

- Membership – 4 Elected Members plus the Mayor
- Quorum - 3 Committee Members

Presiding Member – Matthew Shilling

Members

- Bruce Hull
- Ian Crossland
- Nathan Prior

Asset & Sustainability Committee

Meeting Schedule 2021

Asset and Sustainability Committee		Date: Tuesday, 2 February	Time: 6.30pm – 9.30pm	Venue: Chamber
Topic	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
Draft Transport Plan				M Allen
Tree Management				F Harvey R Pitcher
Presentation from DIT				M Allen
Forward Agenda Items				I Houridis

Asset and Sustainability Committee		Date: Tuesday, 6 April	Time: 6.30pm – 9.30pm	Venue: Chamber
Topic	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
SRWRA progress update		Presentation	Mark Booth	S Dinmore
Residential Hard Waste and Dumped Rubbish Services	R			F Harvey R Belding
Waste and Recycling update	R			A Gibbons

Asset and Sustainability Committee		Date: Tuesday, 1 June	Time: 6.30pm – 9.30pm	Venue: Chamber
Topic	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
Asset Management Update				M Allen
Footpath Audit Results and Works Program				F Harvey

Asset & Sustainability Committee

Meeting Schedule 2021

Asset and Sustainability Committee	Date: Tuesday, 7 September	Time: 6.30pm – 9.30pm	Venue: Chamber	
Topic | Community	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
Preparing for a zero-carbon economy	Presentation		Mott MacDonald – Management consultants	Dana Bartlett
Rainwater Harvest Scheme		Rainwater Harvest Scheme within the Frederick Street catchment, a joint Holdfast Bay Council and Dept of Environment opportunity.		G Ricketts M Allen
Transport Plan		GC210622R15 – 1. Refer the Transport Plan to the Asset and Sustainability Committee for review		Carl Lundborg

Asset and Sustainability Committee	Date: Tuesday, 5 Octoberr	Time: 6.30pm – 9.30pm	Venue: Chamber	
Topic | Community	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
Demographics, aging				Liz Byrne
Levels of service, changing expectations				Liz Byrne
Aged care services, payments, update etc.				Liz Byrne
Engagement				Patrice Pearson
CRM, Salesforce				Megan Bradman

Asset and Sustainability Committee	Date: Tuesday, 2 November	Time: 6.30pm – 9.30pm	Venue: Chamber	
Topic | Environment	**Type of Report**	**Description**	**External Attendees**	**Staff Responsible**
Climate risk and its impact on assets				Ann Gibbons
Climate adaptation				Ann Gibbons

Asset & Sustainability Committee

Meeting Schedule 2021

Environmental Sustainability update (including from new Carbon Neutral Plan)				Rebecca Neumann
Carbon sequestration				Rebecca Neumann
Tree sequestration				Ian Seccafien
Pedestrian Pathway – David Avenue to Sampson Reserve, Mitchell Park				Mat Allen

CITY OF MARION
BUSINESS ARISING FROM THE ASSET & SUSTAINABILITY COMMITTEE MEETINGS

ATTACHMENT 1
AS AT 7 SEPTEMBER 2021

	Date of Meeting	Item	Responsible	Due Date	Status	Completed / Revised Due Date
1.	1 June 2021	**Business Arising Statement - Action Items** (Report Reference: ASC210601R02) • That an update will be provided to Members regarding the Aleppo Pines within the next month.	T Lines	**1 July 2021**	Email sent	2 July 2021
2.	1 June 2021	**Business Arising Statement - Action Items** (Report Reference: ASC210601R02) • Staff to follow up why the cost and effectiveness of skip bins placed in Housing SA areas was missed from the Council report.	T Lines	1 July 2021	Response emailed	6 June 2021
3.	1 June 2021	**Footpath and Kerb Ramp Condition Audit** (Report Reference:ASC210601R04) • Staff to follow up on locations where kerb ramps have been cut in preparation for replacement but have not progressed any further.	M Allen / C Lundborg	1 July 2021	Response emailed	7 June 2021

* Completed items to be removed are shaded

6 Workshop / Presentation Items

6.1 Preparing for a zero-carbon economy	
Report Reference	ASC210907R6.1
Originating Officer	General Manager City Development - Ilia Houridis General Manager City Services - Tony Lines
Corporate Manager	N/A
General Manager	Chief Executive Officer - Tony Harrison

REPORT OBJECTIVE

Presentation by Mott MacDonald Management Consultants to discuss a Carbon Portal tool.

EXECUTIVE SUMMARY

Mott MacDonald has developed a tool that tracks and reports on Carbon Footprints, including embedded carbon.

They are considering partnerships with local government with the benefit of measuring whole of life costs and whole of carbon costs of assets, along with the opportunity to commercialise the tool.

The Committee may wish to consider moving into confidence prior to the presentation by Mott MacDonald:

Pursuant to Section 90(2) and (3)(d)(i) and (ii) of the *Local Government Act 1999*, the Committee orders that all persons present, with the exception of the following persons: Chief Executive Officer, General Manager City Development, General Manager Corporate Services, General Manager City Services, Manager Office of the Chief Executive, Unit Manager Environmental Sustainability, and Executive Officer to General Manager City Development be excluded from the meeting as the Committee receives and considers information relating to Preparing for a zero carbon economy, upon the basis that the Committee is satisfied that the requirement for the meeting to be conducted in a place open to the public has been outweighed by the need to keep consideration of the matter confidential given the information relates to commercial in confidence information provided by a third party.

RECOMMENDATION

That the Asset & Sustainability Committee:

1. **Notes the presentation.**

SPEAKERS

David Johnson - Managing Director, Australia & New Zealand
Alex Osti – Territory Lead – Australia

ATTACHMENTS

Nil

7 Confidential Items - Nil

8 Reports for Discussion

8.1 Grant for Rainwater Tank Pilot Study	
Report Reference	ASC210907R8.1
Originating Officer	Water Resources Coordinator – Glynn Ricketts
Corporate Manager	Manager Engineering, Assets and Environment - Mathew Allen
General Manager	General Manager City Services - Tony Lines

REPORT OBJECTIVE

This report seeks support from the Asset & Sustainability Committee to provide the Rainwater Tank Funding Opportunity report to General Council, to accept a grant from the Department for Environment and Water to undertake a pilot study, in conjunction with the City of Holdfast Bay, on the benefits and costs of a proposed rebate scheme to encourage residents to install rainwater tanks.

EXECUTIVE SUMMARY

As part of the Government of South Australia's New Life for our Coastal Environment commitment, funding has been made available to invest in projects to limit damaging stormwater run-off containing sediment and pollutants from entering Gulf St Vincent.

The Cites of Holdfast Bay and Marion have previously investigated options to reduce stormwater runoff to the marine environment. Options investigated include permeable pavers, rain gardens and wetlands and incentives for residents to use rainwater tanks to increase stormwater reuse and reduce stormwater outflow. The use of plumbed rainwater tanks within private property was identified as a cost-effective solution to reduce stormwater discharge to the marine environment.

Consequently, the State Government (Department for Environment and Water, DEW) has proactively approached Council with an in principle offer of funding for the Frederick Street, Glengowrie, catchment rainwater tank incentive pilot scheme. This project was identified as aligning the objectives of the New Life for our Coastal Environment commitment.

The project would be a tripartite arrangement between the State Government, City of Marion and City of Holdfast Bay (CoHB). CoHB approved matched funding required from DEW at their General Council meeting on 10 August 2021.

RECOMMENDATION

That the Asset and Strategy Committee:

1. **Notes the in-principle funding offer of up to $130,000 for the Rainwater Tank Pilot Project.**

2. **Notes that the City of Marion will be the lead agency in this tripartite arrangement.**

3. **Notes that up to $65,000 in City of Marion funding is required, secured during quarterly budget review process during the 2-year anticipated timeframe for this project.**

4. **Notes that the project and $65,000 in funding is already supported with a City of Holdfast Bay funding commitment.**

5. **Supports the report to go to a General Council meeting for endorsement.**

GENERAL ANALYSIS

Council, in partnership with City of Holdfast Bay (CoHB) has been systematically implementing our joint Coastal Stormwater Management Plan. Consequently, we have jointly investigated water management options to reduce polluted stormwater flows to the Gulf St Vincent by up to 30%. To understand the optimum solutions to reduce stormwater flows to the Gulf, a consultant was engaged to identify and rank management solutions to recommend the best value solution (Attachment 1). The report concludes that Rainwater Tanks provide the most economical method of helping to meet this target accepting that other methods, such as permeable surfaces, rain gardens and wetlands are continued to be deployed as part of existing civil and open space project delivery.

The pilot project involves encouraging residents in Frederick Street Glengowrie catchment to plumb rainwater tanks into their houses to use the water and reduce stormwater runoff to the street and ultimately to the marine environment. To encourage residents, a financial incentive is proposed to either plumb existing rainwater tanks (preferred) or purchase and plumb a new rainwater tank (less preferred). The pilot project is budgeted at $260,000 with $130,000 from the State Government and the balance of funds from the City of Marion and City of Holdfast Bay.

A water balance assessment for a variety of rainwater tank configurations and a financial analysis to inform the optimum quantum and structure for a rebate scheme was undertaken. If effective and installed across the whole of the two Council areas, installed rainwater tanks are expected to reduce total annual runoff volume by 15%.

An incentive scheme that provides the equivalent of a 40% rebate (could be more depending upon level of interest) to residents for connecting an existing rainwater tank (minimum 2,000 litres per 100 square metres connected roof area) and for new rainwater tank installations (minimum 2,500 litres per 150 square metres connected roof area) has been recommended. The scheme is primarily targeted at households with existing rainwater tanks, as optimisation of the usage of existing tanks was a more economical option per kilolitre of water harvested compared with new tank installations. The rebate would not be applied to new dwellings, and it is expected that these would install a plumbed rainwater tank as part of the new building.

Table 1 shows a summary of the costs associated with the recommended rebate scheme.

Table 1: Summary of costings for Rainwater Tank Incentive rebate pilot

Cost item	Frederick St PILOT
Door knocking	$10,000
Administration	$40,000
Monitoring and evaluation	$106,600
Rebate - Tank + connection	$36,800
Rebate - Connection only	$66,600
Total	$260,000

If the trial proves successful, the estimated cost of implementing the incentive scheme over the entire Council areas to achieve a 15% stormwater reduction is estimated to be around $7.7M for Marion and $3.5M for Holdfast Bay over at least 12 years. There is no commitment to expanding the project and this would be critically reviewed based on the success of the pilot.

The 'Frederick Street Catchment' located within City of Marion has been identified as a potential demonstration site for the rainwater tank uptake strategy. The catchment is 45 ha with approximately 650 homes (with ongoing examples of infill development occurring which is seeing a gradual increase in homes within the catchment boundary). Based on the estimated number of existing rainwater tanks for Adelaide, 200 homes are expected to have an existing rainwater tank installed, and 65 are expected to have existing rainwater tanks plumbed for indoor use. The catchment runoff flow and water quality in this catchment has been monitored and has been previously used as a case study for modelling on-site retention and detention options by the University of South Australia. Monitoring equipment is still in place to enable ongoing work within the catchment. Given the pilot scheme is within Marion, Marion will be the lead delivery agent.

The University of South Australia has modelled the expected flow reduction benefit associated with 20% of the households in the Frederick Street Catchment using their rainwater tanks for indoor and external use. An annual volume reduction of around 10% of total annual runoff is expected based on average daily demand for a 3-person home.

The Department for Environment and Water has offered Councils 50% of this funding, up to $130,000 subject to both Councils providing the balance. The project including the monitoring phase is expected to take 2 years. 2021/22 costs will be covered through quarterly budget reviews, and 2022/23 costs will be included in the Annual Business Plan process.

CONCLUSION

It is recommended that to understand the benefits of proposing a rainwater tank rebate scheme across both Council areas that a pilot scheme is implemented and monitored in the Frederick Street catchment. The total cost of the pilot project is estimated at $260,000 with up to $130,000 provided by the Department for Environment and Water and the balance being equally provided by both the Cities of Marion and Holdfast Bay.

ATTACHMENTS

1. Attachment A - Reuse Scheme Proposal v 1 6 180420 [**8.1.1** - 70 pages]
2. Powerpoint - Rainwater tank pilot study grant [**8.1.2** - 9 pages]

City of Holdfast Bay

Holdfast Bay MAR Opportunities Assessment

STORMWATER REDUCTION AND REUSE OPPORTUNITIES ASSESSMENT

April 2018

Project Team

Michael Di Matteo

Craig Flavel

Geoff Fisher

Luke McPhail

Water Technology Pty Ltd t/a
Australian Water Environments
ABN: 60 093 377 283
ACN: 093 377 283
1/198 Greenhill Road
Eastwood SA 5063
Telephone: 08 8378 8000
Fax: 08 8357 8988
www.austwaterenv.com.au

Document History and Status

Issue	Version	Issued to	Qty	Date	Project Manager	Approved
DRAFT	1	RM	1	20-04-2018	GF	GF

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Client:	City of Holdfast Bay
Project:	Holdfast Bay MAR Opportunities Assessment
Name of Document:	Stormwater Reduction and Reuse Opportunities Assessment
Document Version:	v1_6
Job Number:	P18045

Disclaimer

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1 Introduction

The City of Holdfast Bay (Council) have an overarching objective of progressing towards a Water Sensitive City to minimise flooding and to harness the potential of stormwater to overcome water shortages, reduce urban temperatures, and improve waterway health and the landscape of the city.

As part of the transition towards becoming a Water Sensitive City, as recommended in the most recent Stormwater Management Plan (SMP), the Council have commissioned an investigation in to stormwater management options to reducing the volume of stormwater runoff flows into the Gulf St Vincent originating within Council boundaries by 30%.

The aims of this project are primarily to identify water management options to achieve this reduction target and are detailed as follows.

1.1 Project aims

The primary aim of the investigation is to identify options to reduce the volume of stormwater runoff flows into the Gulf St Vincent originating within Council boundaries by 30%.

Secondary aims of the investigation include identifying opportunities to reduce flooding; for alternative water supplies to irrigate parks and reserves within the Council area; and to manage impacts of runoff from the proposed Cement Hill development, upstream of Pine Gully at the southern end of the Council area

1.1.1 Reduce flows to Gulf St. Vincent

On average, annually 110 GL of stormwater runoff from urban areas within the Greater Adelaide region flows via natural and man-made channels into the Gulf St. Vincent (the Gulf), carrying pollutants including nutrients and sediment that have a range of impacts on the health of the near-shore marine ecosystems and amenity in areas of the coast used for recreation affected by stormwater pollution (ACWS, 2006). From the Adelaide Coastal Waters Study (Fox et al. 2007), the major discharges of nitrogen now occur from the Bolivar WWTP, the Penrice plant, and from the Glenelg WWTP, whereas stormwater flows are a small fraction of the overall loads.

City of Holdfast Bay, being a coastal Council, are particularly affected by the impacts on the Gulf. The western Council boundary is made up of nine kilometres of coastline, along the Gulf St Vincent, which are a major tourist attraction for South Australia. A large proportion of the runoff generated within the Council boundaries will run off into the Gulf via outfalls located along the coastline that discharge stormwater runoff collected from largely urban areas within Council and City of Marion areas.

Therefore, Council has set a target to reduce the average annual volume of inflows into the Gulf St. Vincent due to runoff originating within the Council boundaries by 30%. This a moderately difficult target, although lower than the target suggested by the NRM Board of 75% reuse of stormwater runoff and widescale uptake of water sensitive urban design (WSUD) practices (McDowell and Pfennig 2013). The Council requires an investigation into the options available to reduce the runoff flowing from stormwater drainage systems within it boundaries into the Gulf, and potential flow reduction offsets that can be implemented to reduce inflows originating from areas outside the Council boundaries.

The investigation will identify the total volume of runoff and pollutants generated within the Coastal Catchments, screen a range of options to reduce total runoff volumes, and provide recommendations for options.

1.1.2 Identify alternative water sources for irrigation of reserves

Harvesting stormwater runoff for reuse to irrigate some of the Council's 80 ha of reserve areas has been identified as an option to improve water security within the Council. Harvested water could provide an alternative source of water to potable mains supply, recycled wastewater, and groundwater, which are currently used to irrigate reserve areas and supply public amenities (e.g. public showers and toilets). There are also opportunities other than harvesting stormwater within the Council boundaries for example, extending the existing Holdfast Bay recycled Water Scheme further south, and connecting to the City of Marion operated stormwater harvesting schemes.

The investigation has identified a range of options to improve water security for the Council.

1.1.3 Identify opportunities for management of runoff from Cement Hill development

The City of Marion together with the City of Holdfast Bay is currently working with developers to facilitate residential and centre development in Seacliff Park. The site has historically been used for quarrying, concrete manufacturing, domestic land fill, roofing tile manufacturing and as a depot for a construction company. The land is located in both the City of Marion and the City of Holdfast Bay.

Of importance to this investigation in particular, the major future development at the Cement Hill" or the "Lorenzin/Monier" site (Figure 1) within the City of Marion could impact the Pine Gully Reserve within the Council boundary. Pine Gully adjoins the Kingston Park Cliff Face and forms part of a steeply-sloped gorge. Due to its terrain, only a small section of the reserve is accessible.

FIGURE 1 CEMENT HILL SITE (SOURCE: HTTPS://WWW.MARION.SA.GOV.AU/PAGE.ASPX?U=488, ACCESSED 4 APRIL 2018)

The investigation identifies opportunities to incorporate management of stormwater runoff from the Cement Hill site in the options screening and recommendations.

2 Background

The City of Holdfast Bay (the Council) have commissioned this investigation into stormwater management options for runoff volume outflow reduction and stormwater harvesting following recommendations in the *Stormwater Management Plan (SMP) for Coastal Catchments Between Glenelg and Marino* (2014) and *Water Sensitive Urban Design (WSUD) Masterplan* (2016). Previous studies have identified stormwater management, harvesting and recycled water schemes within City of Holdfast Bay, but have not quantified the total runoff volume reduction achievable.

2.1 Review of previous studies

2.1.1 MAR as a Stormwater Management Option Cities Of Holdfast Bay And Marion (AGT, 2011)

This study has captured hydrogeological learnings from recent drilling in the area. Importantly, the potential for a thick section of T2 aquifer to be hydraulically isolated from Zone 2 east of the Brighton Fault has been identified. The middle fault block in Figure 2 (cross section A-B) is misleading as the T2 is in fact ~120 m shallower than marked and there is no confining bed in the middle fault block. Secondly, the basement pick in the middle fault block is based on a bore (6627-1691) that is significantly to the south (and therefore structurally higher) than cross section A-B. Further work could prove an isolated storage compartment currently accessed by the City of Marion T2 wells along the train line. The T3 and T4 potential was not also not considered in AGT 2011. The AGT report also did not believe that large scale MAR might be possible in the Quaternary (or sand dunes) considering by considering environmental benefit for groundwater ecosystems and pressure support for local bore users.

The potential for semi-confined conditions near the onlap onto Adelaidean basement near Gilbertson's gully was not identified. Otherwise, the findings of the AGT 2011 report were in this study.

2.1.2 Stormwater Management Plan Coastal Catchments Between Glenelg and Marino (Tonkin, 2014)

The Stormwater Management Plan Coastal Catchments Between Glenelg and Marino was completed by Tonkin Consulting for the City of Holdfast Bay and City of Marion in 2014.

The current study seeks to identify options to achieve 'Strategy 2: Management of Runoff Quality and its Effect on Receiving Waters both Terrestrial and Marine Where Relevant', primarily by reducing the total volume of flows to coastal waters. The following description of Strategy 2 is reproduced from the SMP:

> *The receiving waters for stormwater runoff from the study area are the Adelaide Coast. The principal issues of concern for the Adelaide Coastal Waters have been identified by the EPA in its Adelaide Coastal Water Quality Improvement Plan (ACWQIP) as the nutrient nitrogen, suspended solids and CDOM. Targets for stormwater include a reduction in nitrogen of 67%, a reduction in suspended solids of 50%, and a decrease in CDOM.*
>
> *The ACWQIP proposes that this issue be dealt with through the reuse of stormwater noting the Natural Resource Management (NRM) Board's target of 75% reuse, and the widespread adoption of WSUD. During discussions, the EPA has also suggested that coastal waters would benefit from a reduction in the number of runoff events. This could be achieved by providing retention devices throughout the catchments to capture the smaller rainfall events.*

Secondary, but still important, issues associated with stormwater pollution include:

- *pathogens that impact on recreational water quality*
- *litter and debris that detracts from aesthetic qualities and contributes to CDOM*
- *toxicants including pesticides, that whilst not implicated in causing any environmental harm to the marine environment, ought not to find their way into stormwater.*

Existing plans and policies provide plenty of support for programs that lead to water quality improvements, particularly WSUD, street sweeping, enforcement of codes of practice and GPT construction and maintenance. The Development Plans of both Councils also include objectives and principles to require that development does not contribute to pollution, and these plans will be strengthened by conversion to the Better Development Plan policies.

The strategies proposed to address runoff quality issues in the catchment are described in the following section.

Strategy 2.1

To the extent that it is technically possible and financially viable, the road and drainage network should be progressively retrofitted with WSUD devices that strive to capture and treat road runoff to meet the water quality improvement requirements for stormwater required by the Adelaide Coastal Waters Study and other relevant state government policy.

Strategy 2.2

Redevelopment of open spaces and other community facilities should incorporate WSUD devices that strive to meet the water quality improvement requirements for stormwater required.

Strategy 2.3

Develop statutory planning policy to require that all new development incorporates WSUD techniques that assist in meeting pollutant reduction targets.

Strategy 2.4

Wherever technically feasible and without compromising flood protection objectives, all stormwater outlets discharging to the Adelaide beaches should be fitted with GPTs.

Limited stormwater reuse options were identified for within City of Holdfast Bay. An onsite detention strategy for new developments utilising rainwater detention tanks and on site infiltration were suggested.

The data from the SMP relevant to the current study includes:

- Catchment delineation for this study should match that in the SMP.
- Soils assessment
- Stormwater reuse options
- Stormwater runoff quantity and quality presented in the SMP for the total catchment was derived from a previous study undertaken for the for the Adelaide Coastal Waters Study

(ACWS) (Wilkinson J, July 2006). The current study will identify the average annual flow volumes and pollutant loads from individual sub-catchments.

2.1.3 City of Holdfast Bay Recycled Water Supply Pipe Network (W&G, 2014)

An investigation into extension of the Glenelg to Adelaide Parklands (GAP) recycled water scheme, options for stormwater harvesting within the City of Holdfast Bay, and connection to City of Marion Schemes was conducted by W&G in 2014. Important findings included:

- City of Holdfast Bay groundwater bores, which may be experiencing degradation similar to that identified within City of Charles Sturt, may be unusable for irrigation of parks and reserves in the future. Hence supplying these sites with recycled wastewater for irrigation was considered, as an alternative to potable water supply.
- An extension of the Glenelg to Adelaide Parklands (GAP) recycled water reticulation scheme from Broadway within the CofHB area to the south of CofHB at Brighton Caravan Park was recommended to meet the demands of the majority of CofHB parks and reserves 116 ML/year currently supplied and 125 ML/year projected to be supplied by the extension (241 ML/year total).
- A Minda site stormwater harvesting assessment was conducted, in which a 50ML wetland/detention ASR Scheme was prepared. The associated costs would be in the order of $1,080,000. This scheme has not progressed as of 2018.
- A Pine Gully stormwater harvesting scheme was reviewed. It was determined that there would be relatively low yield potential primarily due to a limitation in catchment area and the relatively steep terrain. Due to the large annual demands that would pertain to the Pine Gully stormwater harvesting scheme, it was identified that it would be more efficient to utilise the Minda redevelopment wetlands system to a supply these demands.
- Connection to the Marion stormwater reuse scheme was considered. The extent of the Marion scheme is approximately located on the corner of Oaklands Road and Hazelmere Road. It was suggested in the study that connecting back into the line supplying both Good Neighbour Reserve and Bowker Reserve would likely be the most effective point to connect both recycled water networks. This would require an extension from Bowker Reserve North following Muriel Street and then East along Oaklands Road approximately 1200m in length.

2.1.4 WSUD Masterplan (GHD, 2016)

The WSUD Masterplan identified and suggested prioritisation of options based on a multi-criteria assessment with CofHB and CofM. In particular, fourteen projects for integrating WSUD into streetscapes within CofHB through drainage and road upgrades (SMP Strategy 2.1) were identified. The total volume reduction performance of these projects were not quantified, which is carried out in this study,

2.1.5 Gully Masterplans (Aspect Studios, 2013-2014)

The potential for stormwater harvesting was assessed in the Gilbertson Gully (2013), Pine Gully (2014), and Barton Gully (2014) Masterplans. All three masterplans recommended that stormwater harvesting would not be suitable at the sites. The Holdfast Bay Recycled Water Scheme was suggested as an alternative source rather than harvesting at the sites.

The hydrogeological assessment for Gilbertson Gully were not assessed further, however, and there may be adequate storage in line of the gully for a harvesting scheme using mechanical treatment. In

addition, the Pine Gully harvesting scheme may contribute to water quality outcomes. These options are assessed further in this study.

2.2 Catchment characteristics

The catchment extent and delineation adopted in this study are the same as those identified in the Stormwater Management Plan (not shown). The catchment numbering is defined in this study, and does not refer to any numbering adopted in other studies.

The catchment is 35 km^2 of which 13 km^2 is in the City of Holdfast Bay and 22 km^2 is in the City of Marion. Approximately 30 km^2 is urban and the remaining 5 km2 is the rural open spaces of the escarpment at the southern end of the catchment. The topography is mostly flat, with foothills in the south and south east. The catchment is bounded:

- To the west by the coastline along Gulf St. Vincent
- To the north and north east by the Patowolunga lake and Sturt River
- To south and south east by the Southern Expressway and a ridgeline through O'Halloran Hill and to Marino

3 Runoff quantity and quality assessment

A water balance assessment and water quality modelling was conducted to determine the average annual load of runoff and pollutants for various sub-catchments in the study area. This is done to identify locations where there is sufficient runoff to harvest or infiltrate, and the quality of runoff available.

The modelling results are used to determine the required runoff volume needed to be retained (through harvesting, infiltration, etc.) to achieve City of Holdfast Bay's 30% reduction target and the expected water quality improvements.

The modelling approach, results and recommended water quality and volume targets and expected water quality improvements are as follows.

3.1 MUSIC modelling and analysis

A MUSIC model was developed using the catchment delineation in the Stormwater Management Plan Coastal Catchments Between Glenelg and Marino (2014). The model was used to determine 1) the average annual volumes and seasonality of runoff volumes available from each sub-catchment, 2) the average annual pollutant loads from each catchment. A layout of the MUSIC model is shown in Figure 2.

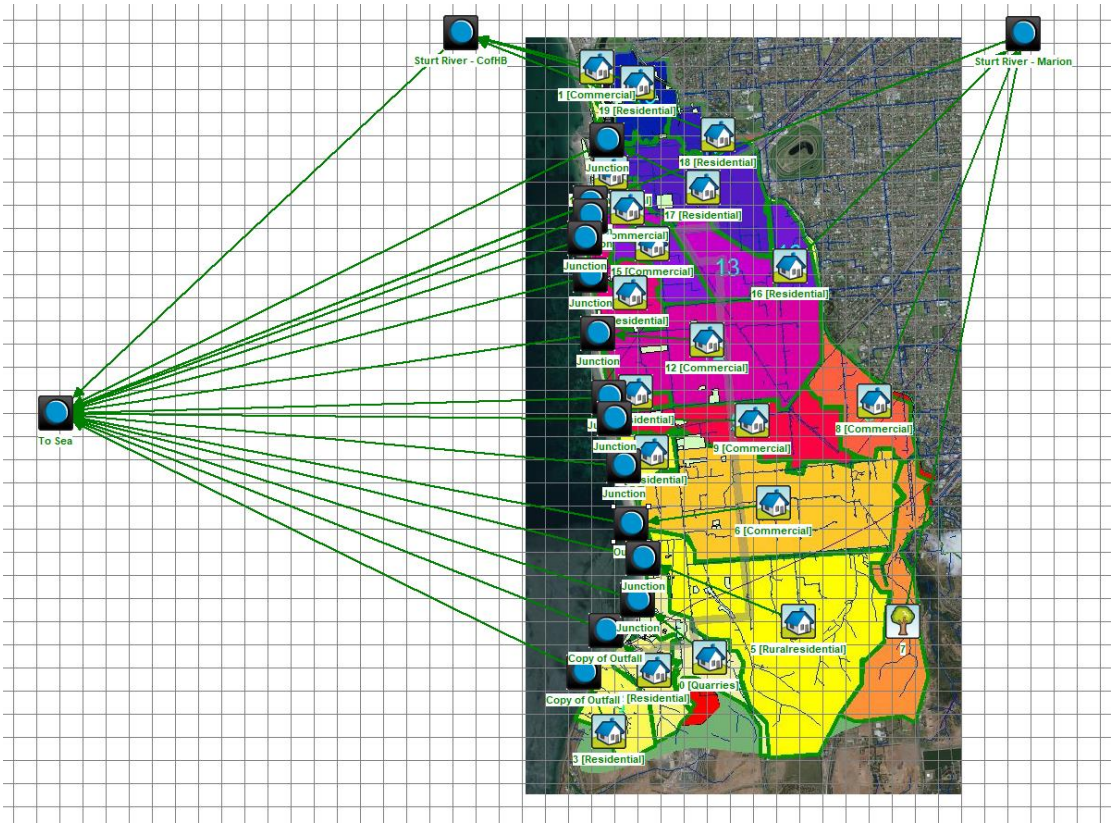

FIGURE 2 MUSIC MODEL LAYOUT

3.1.1 Climate data

The rainfall and evapotranspiration parameters for Adelaide Airport were used, which was the closest long-term rainfall gauge available for the study area. The period of rainfall (1967-2010) is regarded as a stationary period in the historical climate record for Adelaide, and includes periods of extreme wet and extreme dry (including the millennium drought), and thus suitable as a baseline estimate total annual average flows. The default Potential Evaportranspiration (PET) values for Adelaide were adopted. The climate data used is summarised in Table 2.

TABLE 1 CLIMATE DATA USED IN MUSIC MODEL

Catchment Name	P18110 MUSIC Model v1_2 MDM 1800307
Timestep	Day
Start Date	13/01/1967
End Date	31/07/2010
Rainfall Station	23034 ADELAIDE
ET Station	MUSIC default PET for Adelaide
Mean Annual Rainfall (mm)	421
Mean Annual ET (mm)	1128

3.1.2 MUSIC model calibration

3.1.2.1 Water balance modelling

The total flow volumes produced by a MUSIC model can be sensitive to the impervious fraction and soil storage parameters. Therefore, selection of impervious fraction should take into account the parameters adopted in studies where calibrated model parameters or recorded mean annual flow volumes are available for the catchment. The available impervious fraction and annual flow volume data used to inform model parameter selection are detailed as follows.

Impervious fraction

The MUSIC imperviousness parameter reflects real-world conditions best when it represents the catchment's directly connected impervious fraction (rather than combined directly connected impervious and indirectly connected impervious fraction).

The catchment data attachments of the SMP provide a high-resolution estimate of the current (2015) and future (2040) directly connected impervious areas (DCIA), indirectly connected impervious areas, and grassed areas for the catchment. This data was aggregated to provide an estimate of the DCIA fraction for the 20 sub-catchment catchments to be used as an input to MUSIC.

Kemp and Lipp (1999) estimated the appropriate impervious fraction for 1992 and 1993 storms for the Glenelg catchment ILSAX model to be 30% (with 17% supplementary paved, and 53% pervious), which was a fully developed catchment at the time of study. They determined an appropriate soil storage parameter was 5mm. The Coastal Catchments assessed here contain catchments that would have been less developed at the time, and therefore would have a lower fraction imperviousness than the Glenelg catchment in 1992.

The DCIA fraction values for Glenelg area in Kemp and Lipp (1999), and from the SMP are provided in Table 2.

TABLE 2 IMPERVIOUS AREA FRACTION VALUES AVAILABLE

Year	Source	Average Directly Connected Impervious Area (DCIA) fraction (%)
1992	Kemp and Lipp (1999)	30, Glenelg developed catchment
2015	Tonkin (201?)	35*
2040	Tonkin (201?)	47*

*weighted average by area of sub-catchment

Total annual flows

The historical annual flows provided in the SMP were those estimated in the Adelaide Coastal Waters Study (Wilkinson, 2007). This was based on the 21 km^2 catchment extent in the ACWS. Table 4 shows the annual flows provided in the SMP and flows been scaled to the 32km^2 catchment area used here, assuming the same total catchment yield as in the ACWS.

TABLE 3 HISTORICAL ANNUAL FLOWS FOR COASTAL CATCHMENTS (ADAPTED FROM ACWS)

Decade	Coastal Catchment Runoff (average annual GL/year; ACWS)[1]	Scaled Coastal Catchment Runoff (average annual GL/year)[2]
Total Catchment area (km^2)	21	32
1945–1954	1.02	1.55
1955–1964	1.13	1.72
1965–1974	1.22	1.90
1975–1984	1.41	2.15
1985–1994	1.87	2.85
1995–2005	1.68	2.56

1. *Adelaide Costal Water Study (ACWS) as presented in Tonkin (2014).*
2. *Scaled based on the catchment extent in the stormwater management plan Tonkin (2014), assuming same total catchment yield as in the ACWS.*

3.1.3 Analysis

The MUSIC model was run with the current (2015) and future (2040) direct impervious areas determined in the SMP, using the full rainfall record from Adelaide Airport from 1967-2010. This produced a long-term average annual runoff volume based on a stationary climate scenario including period of extreme wet and dry periods.

In addition, the model's sensitivity to selection of impervious fraction parameter, and to climate changes was conducted by

1. reducing the % impervious area by 5% for the current and future events
2. reducing the % impervious area to 20% and running the model during a period of drought (1995-2005) to evaluate the sensitivity of the model to a dry period.

3.1.4 Results

Figure 3 and Table 4 shows the average annual flows for the catchment area. This includes the scaled historical flows and MUSIC analysis estimates.

The MUSIC estimate utilising a 5% lower directly connected impervious area (DCIA) fraction than those in the SMP produces annual flows that better fit the long-term trend since enhanced development of the catchment in the 1980s. These scenarios are therefore adopted as the best estimates of mean annual flows to calculate the reduction targets and water quality performance.

The MUSIC model overestimated the annual flows for the dry period (1995-2005) compared with those estimated in the ACWS. This indicates further model calibration may be necessary for estimating flow during dry periods.

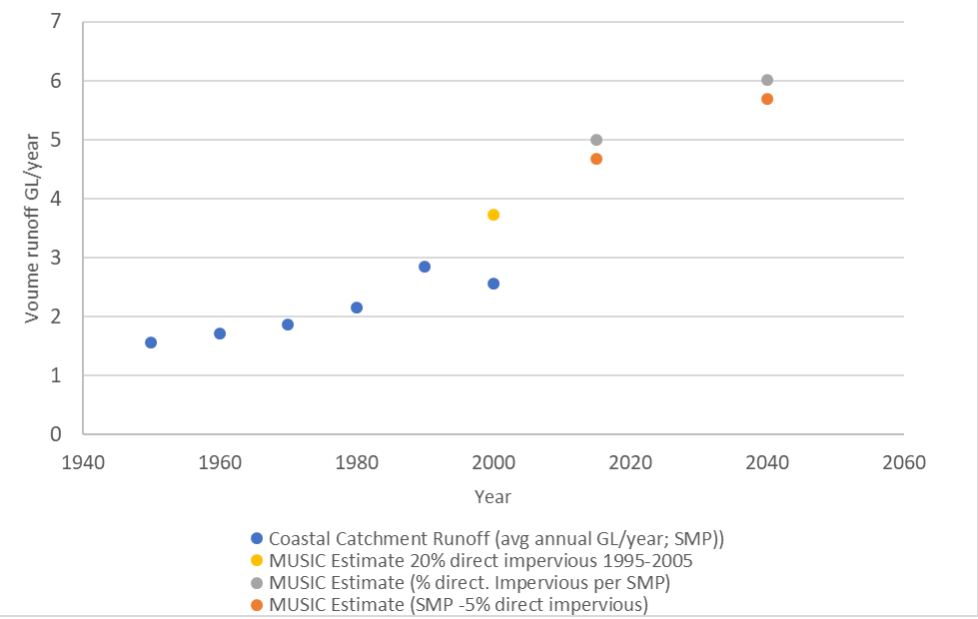

FIGURE 3 HISTORICAL AND MODELLED ANNUAL FLOWS TO SEA

TABLE 4 MUSIC MODELLING CALIBRATION PARAMETERS

Year	Directly Connected Impervious Area (DCIA; %)	Coastal Catchment Runoff (average annual GL/year)
Baseline		
2015	35	5.00
2040	47	6.02
Sensitivity Analysis		
2000[1]	21	3.73
2015	30	4.67
2045	35	5.69

1. *Rainfall period between 1995-2005 (dry period)*

A breakdown of annual flows by sub-catchment are shown in Figure 4. The large catchment including the hills face south of Seacombe Road and including Gilbertson Gully has a large annual flow volume collecting mostly within the stormwater trunk main along Seacombe Road and within the gully. There are several catchments (12, 6) that collect runoff from large areas including CofM and CofHB and discharge at outfalls at the coastline within CofHB.

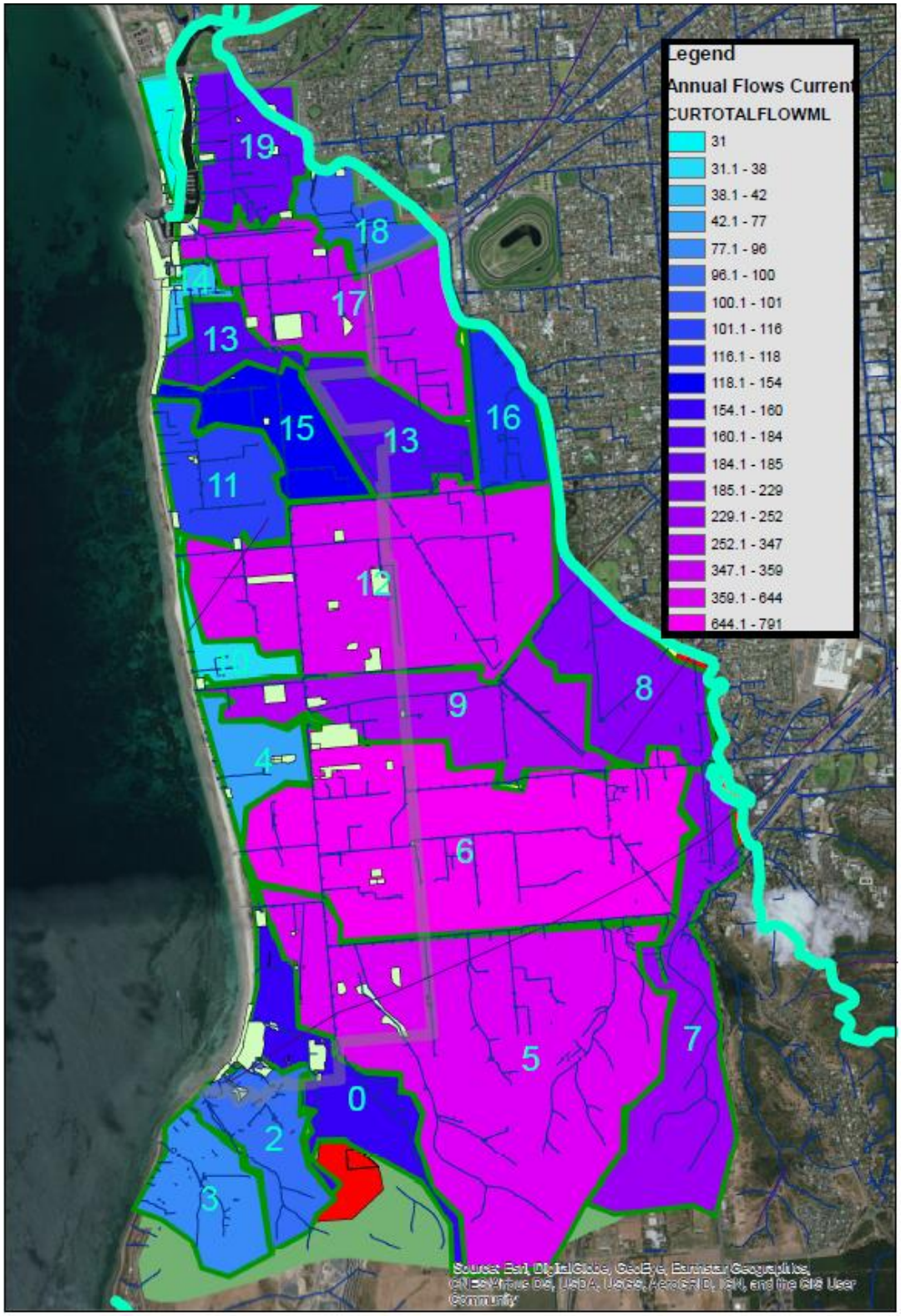

FIGURE 4 SUBCATCHMENT ANNUAL FLOWS MAP

3.2 Recommended Flow Reduction Target

The area of City of Holdfast Bay consists of 45%, and City of Marion 55% of the Coastal Catchments area modelled in MUSIC. It is assumed the total average catchment yields and pollutant characteristics are similar from the two council areas. Therefore, the total flow from City of Holdfast Bay is assumed to be 45% of the total estimated flows.

The estimate of mean annual flows from the catchments are as shown in Table 5. The total annual volume of runoff to sea from the City of Holdfast Bay that needs to be retained to achieve the 30% target is **632 ML/year**.

TABLE 5 CURRENT ANNUAL FLOWS

Council	Area (ha)	Catchment Area (%)	Assumed contribution to Flows (%)	Total Annual Runoff Volume (ML/year)	30% of Flows (ML/year)
City of Marion	1,758	55%	55%	2,559	768
City of Holdfast Bay	**1,448**	**45%**	**45%**	**2,108**	**632**
Total Coastal Catchments	3,206	100%	100%	4,667	1,400

4 Strategies and options

In this section broad strategies to achieve Council's flow volume reduction aims as well as the technology options available to implement the strategies are presented. The strategies include infiltration, harvesting (of ground surface or roof runoff), and connection with existing alternative water schemes. The technology options presented include a range potentially suitable for implementation within the City of Holdfast Bay for capture/transfer of runoff, retention storage, treatment, and harvesting and reuse options generally available or identified as part of previous studies. The strategies and technology options identified are detailed in the following sections.

4.1 Runoff reduction strategies

Four broad strategies implemented together are potentially able to achieve the primary project objective of reducing total annual runoff volumes to the Gulf. These strategies are described in the following sections.

4.1.1 Strategy 1 Surface runoff infiltration

Fourteen biofiltration and tree pits projects have been recommended to be integrated with streetscape as part of drainage and road upgrades within City of Holdfast Bay. The devices are designed to intercept surface runoff and infiltrate into the in-situ soils, which will contribute to the total runoff reduction target for the catchment.

In addition, four major outfall upgrades are proposed, which provide an opportunity to incorporate infiltration-based options.

4.1.2 Strategy 2 Surface runoff harvesting

Several surface runoff harvesting schemes have been identified as part of previous studies. These include:

- Minda scheme
- Pine Gully scheme
- Gilbertson Gully scheme

The Minda scheme has been extensively studied and is included as an option in the options assessment. A review of the sub-surface storage options for harvesting at Gilbertson Gully have been investigated in this study. In addition, options for volume reduction by managing runoff quality flowing into Pine Gully from the Lorenzin Site is considered in this study.

Additionally, Council may adopt a strategy to encourage local businesses that have large carpark/landscaped areas to harvest surface runoff through biofiltration and shallow aquifer injection to enable wider scale on-site irrigation of landscaped areas.

4.1.3 Strategy 3 Rainwater tank harvesting scheme

Roof water harvesting through allotment scale rainwater tanks has been demonstrated to significantly reduce total volumes of runoff from urban catchments. When adopted on a wide scale, can have several benefits including:

- Total runoff volume reduction
- Reduce frequency of minor flooding
- Reduce demand on potable water supplies

- Improve urban water security

The benefits on a catchment scale are realised only where rainwater tanks are connected to indoor water uses (e.g. toilet flushing) for an extensive number of allotments within the council area.

Current regulations mandate the installation of 1kL rainwater tanks for new allotments. There is currently no rainwater tank subsidy scheme available to City of Holdfast Bay residents in existing allotments.

4.1.4 Strategy 4 Expansion of existing water reuse schemes

Recycled wastewater is currently used by City of Holdfast Bay, and the adjacent City of Marion have extensive stormwater harvesting and reuse schemes. A scheme proposed in the City of Holdfast Bay Recycled Water Supply Pipe Network (W&G 2014) study could be implemented to supply recycled/reused water for irrigation of reserves within City of Holdfast Bay.

Connection to existing schemes may have the following advantages:

- Irrigating reserve areas or public amenities using recycled wastewater or stormwater reuse could reduce total flow volumes to Gulf St. Vincent from areas outside the local catchment
- Reduce reliance on potentially degrading groundwater bores, and potable water supplies
- Utilising existing water treatment infrastructure (e.g. wetlands, wastewater treatment plant) located outside the Council area
- Reduce administrative costs compared with a City of Holdfast Bay operated harvesting scheme
- Creates demand for existing recycled wastewater or stormwater reuse, thereby reducing the total cost of supply for all users

4.2 Runoff capture, transfer and retention options for Strategies 1 and 2

The following options may be suitable for achieving the flow reduction via surface runoff.

4.2.1 Capture and transfer options

The following options were identified to capture or transfer stormwater runoff within the Council boundaries as part of infiltration and harvesting (surface and roofwater runoff) strategies.

Diversion to passive irrigation of reserves

Surface runoff captured in roadside raingardens, bioretention basins, tree pits, kerbs or an overland flow path can be allowed to exfiltrate through into subsurface soils or discharge into roadside verge buffers or reserve areas as a form of passive irrigation and to reduce the total volume of flows reaching the subsurface drainage infrastructure. One advantage of this approach is that runoff can be intercepted at the surface where it has greater potential for conveyance via gravity to another surface discharge point (as opposed to once it is in an underground drainage system where it is costly to install a new discharge point).

Are part of the WSUD Masterplan a number of WSUD devices have been identified. Individual passive irrigation schemes are unlikely to yield large reductions in total runoff volumes, however as part of a long-term and catchment wide strategy total reduction volumes could be significant. The

opportunities for passive irrigation considered in the WSUD Masterplan coincide with drainage upgrades, to minimise the cost of modifications to existing kerbing and drainage infrastructure.

Permeable pavements and pipes

Permeable pavement and pipe solutions can be used to infiltration stormwater runoff (Figure 5). These solutions may be suitable where there are:

- High conductivity soils (e.g. sandy loam, sand)
- Reserve areas available for passive irrigation

Permeable pavements can be used in areas with low vehicle traffic, such as carparks to disconnect these areas from the formal stormwater drainage system, and can be used for harvesting of runoff or infiltration.

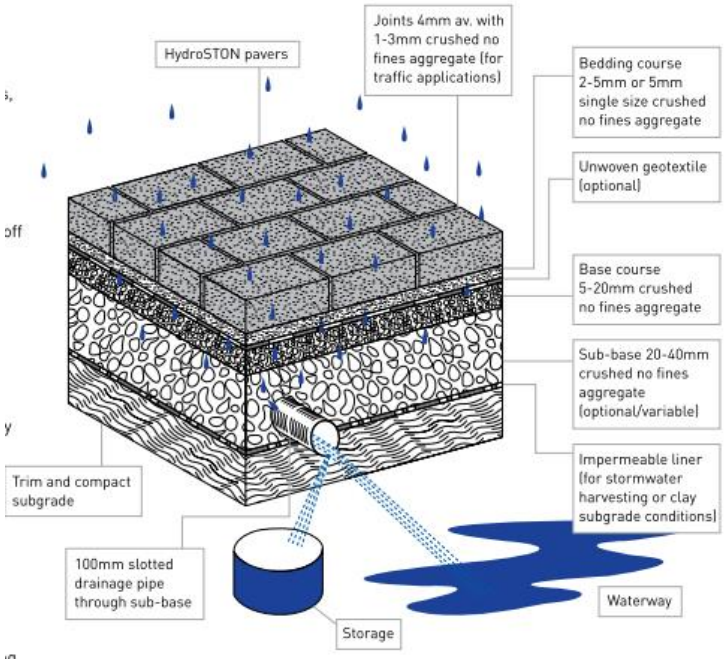

FIGURE 5 PERMEABLE PAVING SCHEMATIC (SOURCE: HYDROSTON BROCHURE)

Permeable concrete pipes, such as the HydroPipe manufactured by HydroCon (Figure 6), can be used to infiltrate stormwater runoff. The pipes can be installed along sections of existing drainage systems where there are opportunities to infiltrate runoff in sandy areas and/or near shore areas. Example applications include Bondi Beach stormwater harvesting scheme, and the Altona Beach Renourishment project.

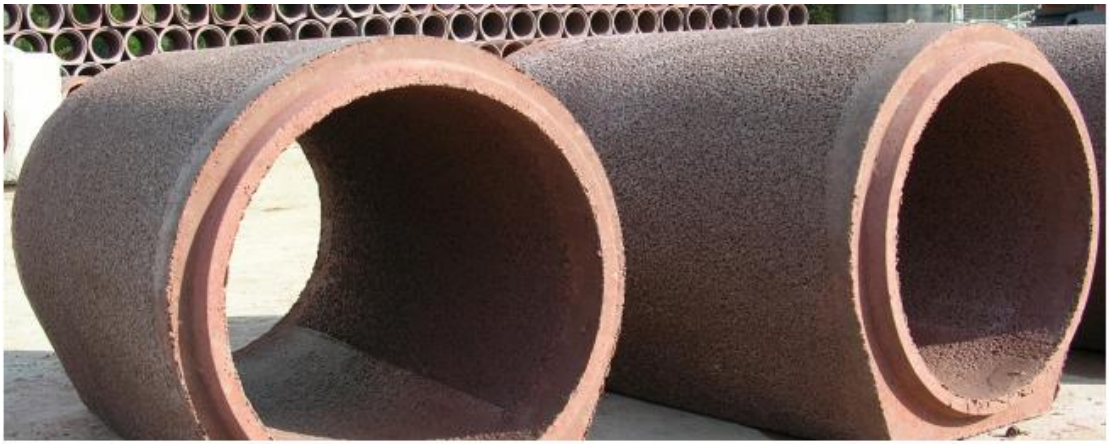

FIGURE 6 DN500 PERMEABLE CONCRETE PIPES BY HYDROCON

Stormwater mining

Stormwater mining involves the interception and diversion of runoff from underground stormwater mains to another location for infiltration, further treatment and/or reuse. The diversion usually branches from a sump inline of a stormwater pipe. Transfer from the diversion can be via gravity but usually a submerged pump is required to transfer runoff from underground to another location where it can be retained to allow infiltration/treatment over time.

Pumped transfer solutions have several limitations:

- pumped transfer may only occur whilst sufficient runoff flows pass through the stormwater mains, which will depend on the storm duration and responsiveness of the contributing catchment
- costs associated with pump operation and maintenance

As such, the flow rate at which stormwater can be mined (pumped) economically is typically the main limiter on the capacity of the system. Stormwater mining may be economical where it has flood mitigation benefits, for example where mining occurs upstream of a control point susceptible to regular flooding, which could justify the capital and ongoing costs.

Gravity-based transmission via existing drainage

Existing stormwater mains may be used for low-cost gravity transfer of runoff that has been retained or harvested for reuse upstream. Harvested runoff that has been treated may diminish in quality if it is transferred in this way, and may require additional polishing before further use.

4.2.2 Retention options

Stormwater runoff often needs to be retained in a storage basin to allow time for it to be treated further or infiltrated. The size and availability of retention storage can often limit the viability of stormwater harvesting schemes, which require sufficient storage to allow detention time for treatment. As construction of new storages is costly, retention storages can often situated inline of existing natural channels and within flood detention storages, below a freeboard level required to remain available for flood conveyance.

Existing inline storage

The opportunities for inline storage in the Council boundaries are limited to Gilbertson Gully where the estimated retention storage volume of the reach within Council boundaries is 2 ML, identified as part of the Gilbertson Gully Masterplan.

Pine Gully has a steep gradient, which would not be suitable for inline storage, and as such any harvesting scheme at Pine Gully would require retention storage off site.

New storages

Limited opportunities were are identified for new storages in the Stormwater Management Plan, due to the highly urbanised nature of the catchment. Any new retention storages would need to be claimed from reserve areas.

Investigations into expansion of the wetlands at the Minda Homes site would require further liaison with the private landholder.

4.3 MAR options for Strategy 1 and 2

Shallow Managed Aquifer Recharge (MAR) may be achieved via infiltration pits or galleries into semi-confined or unconfined aquifers. This type of MAR is a natural fit for combination with biofiltration beds which remove sediment and nutrient that can clog aquifer pores during recharge. In the CoHB, shallow MAR would be best achieved via many residential scale infiltration constructions in the Quaternary clays and/or many infiltration constructions in the sandy soils of the coastal dune system. In the latter example, naturally sand filtered stormwater would then discharge to the sea as shallow groundwater, following the natural hydrodynamic gradient.

Where there are favourable sub-surface conditions, Managed aquifer recharge (MAR) can be achieved either in confined or unconfined aquifers. Confined aquifers are sealed beneath an aquitard that prevents recharged water from returning to surface. Thus while drilling depths are greater, a higher injection pressure can be applied to pump water into storage. Deep MAR generally has fewer receptors which are usually neighbouring groundwater bore users.

4.4 Rainwater tank harvesting options for Strategies 3

A rainwater tank subsidy scheme may be suitable widescale rainwater harvesting for households within CofHB. Rainwater harvesting by connecting household roofs to a rainwater tank for indoor use has been demonstrated as an effective way to reduce total volume of runoff, reduce household demand for mains water, and can alleviate nuisance flooding where sufficient number of households have tanks installed. An additional benefit of rainwater tanks is that the operation and maintenance of the tanks are managed by individual householders.

4.5 Alternative scheme options for Strategy 4

Identifying sources of demand or supply of recycled wastewater or stormwater harvested outside the boundaries of CofHB could contribute to the total volume reduction target set by Council. The Council currently uses approximately 130 ML/year of recycled wastewater it purchases from SA Water through an extension of the Glenelg to Adelaide Parklands (GAP) recycled wastewater scheme.

In addition to this scheme, the following options have been identified:

- Extension of Glenelg to Adelaide Parklands (GAP) recycled wastewater scheme as detailed in W&G (2014)
- Connect Oaklands Park to recycled water scheme as detailed in W&G (2014)
- MAR injection of runoff harvested in Oaklands Park schemes
- Blending GAP recycled water with harvested water injected in CofHB aquifers
- Extend recycled/reuse water schemes to Adelaide Desalination Plant
- Connect to Morphettville Racecourse scheme

4.6 Options assessment criteria

The following criteria were selected for the assessment of potential options. The criteria are used to assess locations within the council area for favourable options for each strategy. The criteria include:

Volume of inflows

Surface runoff harvesting and infiltration options should be located where there are large volumes of inflows to minimise operational unit cost.

Proximity to demand

Situating the harvesting site in proximity to sustainable demand minimises the cost of transferring treated water.

Storage availability

Surface retention storage should allow sufficient volumes of runoff to be detained, treated and harvested, and sub-surface storage should be adequate for potential managed aquifer recharge schemes.

Water quality risks of inflows

Affects harvesting, as poor quality stormwater runoff will require higher costs for treatment, however may result in better efficiency of pollutant removal, and higher pollutant removal.

Soil type

Infiltration options should take advantage of favourable in situ soil conditions.

Coincide with major planned upgrades

Coinciding WSUD projects with planned drainage or road upgrades improves the likelihood that they can be funded, and reduces the construction costs.

Assessments carried out for these criteria are detailed in the following sections.

5 Water quality risk assessment

A catchment water quality risk assessment was conducted to identify locations within the City of Holdfast Bay contributing catchments where water quality may pose a risk of increased frequency of non-compliance of harvested water for potential schemes, and where runoff is likely to be of good quality that minimises the further treatment required.

Areas of higher risk coincide with areas of higher intensity land use or areas subject to future increases in development intensity. Industrial and major roadways are high risk land uses due to the high levels of pollutant generation that can be collected in runoff. Areas that will be subject to urban infill development (e.g. subdivision and development) are likely to produce high sediment loads that can diminish the treatment performance of WSUD treatment devices (such as biofilters, permeable pavement). Intense infill development will coincide with areas where the existing allotment sizes are large compared with the minimum allotment size allowed within the development zone.

Areas of lower risk include natural catchments, parkland and open space, and areas where there are established residential zones not likely be subject to infill development.

A surface runoff water quality risk map (Figure 7) was developed based on land use data within the catchment extent adopted in the SMP. The land use types associated with each risk level are shown in Table 6.

TABLE 6 WATER QUALITY RISK INDICATORS

Water Quality Risk Level	Colour	Land use type
High	Red	Industry, Mineral Extraction, Defence, Brighton Road, ANZAC Highway
Medium to High	Orange	Commercial, Shopping
Medium	Yellow	Residential (<= 300sqm lot zone), Community, District Centre
Medium to Low	Blue	Residential (300-600 sqm lot zone), Local Centre
Low	Green	Residential (> 600 sqm lot zone), Conservation, Hills Face, Caravan/Tourist Park, Open Space
Very Low	Light Green	Reserve Areas

Most runoff from residential areas within the City of Holdfast Bay boundaries, if taken at the surface, would be suitable for harvesting. In addition, drainage mains originating within Low or Medium to Low risk areas and terminating upstream of Brighton Road would be suitable for harvesting. However, most drainage trunk mains through City of Holdfast Bay carry runoff from higher density areas and infill development is likely to be of poorer quality.

The catchment for Gilbertson Gulley to the south, and also the drainage trunk main south of Seacombe Road would be a suitable quality for harvesting.

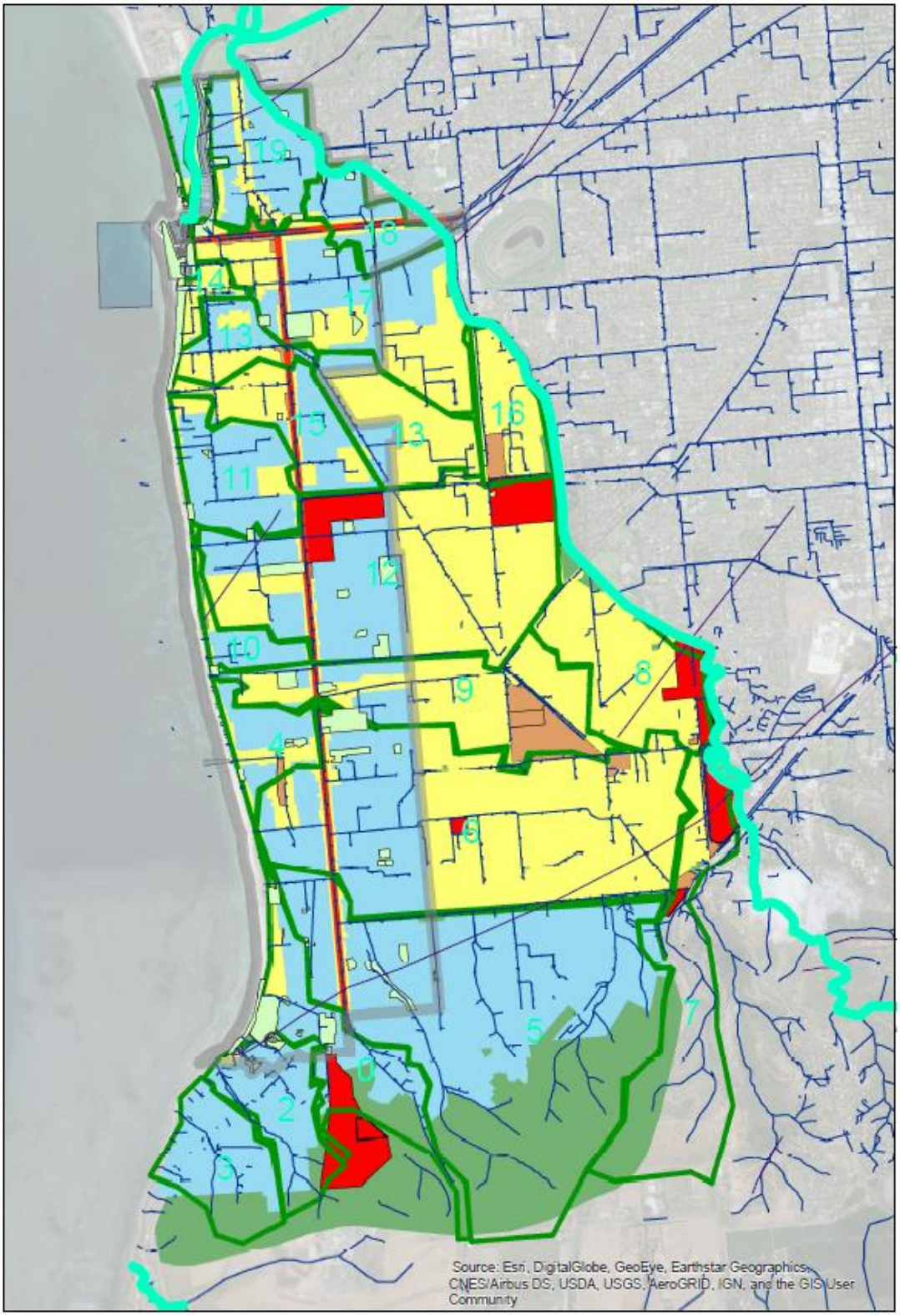

FIGURE 7 SURFACE RUNOFF WATER QUALITY RISK MAP

6 Demand assessment

Table 7 shows the mean annual Council irrigation demands from the *Holdfast Bay Recycled Water Scheme* (W&G 2014) report and those identified in this study by assessing the water usage data for 2016/17 financial year. The Council irrigation demands in 2016/17 were lower than those estimated in W&G (2014). This is likely because the mean annual rainfall in 2016/17 was much higher than mean rainfall over the period previously estimated, as shown in Figure 8, and much higher than the mean rainfall over the last decade, leading to lower irrigation volumes required. As such, the demands adopted in 2014 report will be adopted in this study, as they better reflect the long term average demands. A summary of the 2016/17 water usage data is in Appendix A.

TABLE 7 COUNCIL IRRIGATION DEMANDS

	Mean use (2011-2013)[1]	**Year ending 30/06/2017**	**Mean use adopted in this study**
Reticulated Water (ML)	130	102	130
Recycled Wastewater (ML)	130	58	130
Rainfall (mm)	391	553	391
Recycled Stormwater metered (ML)	N/A	0	0
Recycled Stormwater estimated (ML)	N/A	0	0
Bore Water Estimate (ML)	56.5	Not recorded	56.5
Total Water Usage (ML)	**316**	**N/A**	**316**

1. *From W&G (2014).*

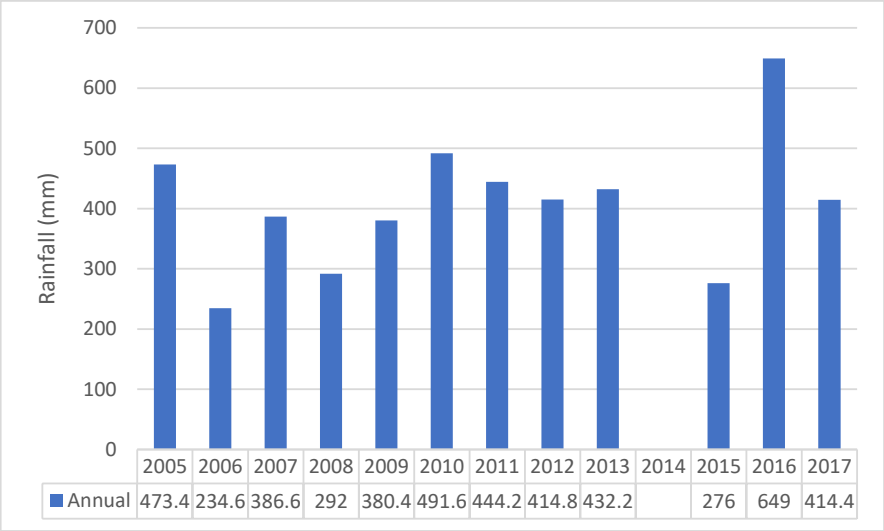

FIGURE 8 ANNUAL RAINFALL CITY OF HOLDFAST BAY (ADELAIDE AIRPORT)

It should be noted that bore water degradation is an issue regionally, which may result in the bores being unusable for irrigation purposes in the future. Furthermore, the potential introduction of groundwater allocation plans within the Adelaide plains may impact future groundwater availability.

There may be insufficient Council water demands to justify additional stormwater harvesting schemes, especially where the existing demand can be supplied at a lower cost by the proposed extension of Holdfast Bay Recycled Water Scheme. Additional regional demands for harvested stormwater (other than irrigation of Council reserves) could include:

- Blending recycled water with harvested stormwater to reduce salinity
- Transmission of stormwater (or a stormwater/recycled water blend) further south to the Adelaide Desalination Plant at Port Stanvac
- Substitute potable usage with reused stormwater, which has not been adopted in South Australia
- Irrigation of vegetation within and/or cooling of commercial or Council car parks to reduce urban heat island impacts

7 Soils and Geology

7.1 Soils

In the in Stormwater Management Plan (Tonkin, 2014) a soil map (listed as Figure 2.10), soil type description and soil permeability assessment were included. The sections are reproduced, as follows:

> *2.8 Soil Types*
>
> *The soil association map of the Adelaide region has been used to assess soil types in the study area (Figure 2.10). The map shows approximately 50% of the study area is a red brown clay soil with granular structure over clay with variable lime (medium clay). The other 50% of the soils over the site are varied, consisting of sands, alluvial soils and other types of clay.*
>
> *2.9 Soil Permeability*
>
> *Constant head permeability tests were carried out in reserves at 14 locations across the catchment. Detailed test results are contained in the Discussion Paper on Retention Storage Systems (Tonkin Consulting 2012) prepared as part of the investigations for this Plan. The test results indicate that within the red brown clay soils that occur across most of the catchment, permeabilities are generally in the range between 1.0 x 10-7 and 2.5 x 10-7 m/s. Some higher permeabilities (up to 1.5 x 10-5 m/s) were recorded in these soils at isolated locations, but the limited number of higher permeability results appears to be indicate that these higher permeabilities were not typical of these soils. A single test was carried out within the sandy soils of the coastal zone and as expected, this yielded a significantly higher permeability (greater than 3 x 10-4 m/s).*

7.2 Geology

The CoHB lies within the Golden Grove Embayment on the Adelaide Plains. The Precambrian Adelaidean basement forms the Adelaide hills and underlies shallower strata on the Adelaide Plains. There are three principal aquifer zones in the Quaternary, Tertiary and Proterozoic sediments (Gerges, 2006) which have distinct characteristics as discussed below.

Marine sediments and terrestrial sediments eroded from the Adelaide hills have been deposited across the Adelaide Plains since the Tertiary period. Two major fault zones, the Eden-Burnside Fault and the Para Fault, controlled the geometry of the strata and the surface topography of the area (Zulfic, Osei-Bonsu, & Barnett, 2008). Between these major faults, the Sturt and Brighton Faults near CoHB were interpreted in 1980 from gravity survey and stratigraphic analysis, however, the shape and location of the faults are poorly defined (Figure 10).

8 Hydrogeological assessment

8.1 Generalised Hydrostratigraphy

This section provides an overview of the aquifers of interest in City of Holdfast Bay (Council) areas. The general hydrogeology within the Golden Grove Embayment described in Figure 9. The general zones of interest are discussed in this section, with the tertiary aquifer requiring greater attention due to their storage capacity and hydrogeological complexity.

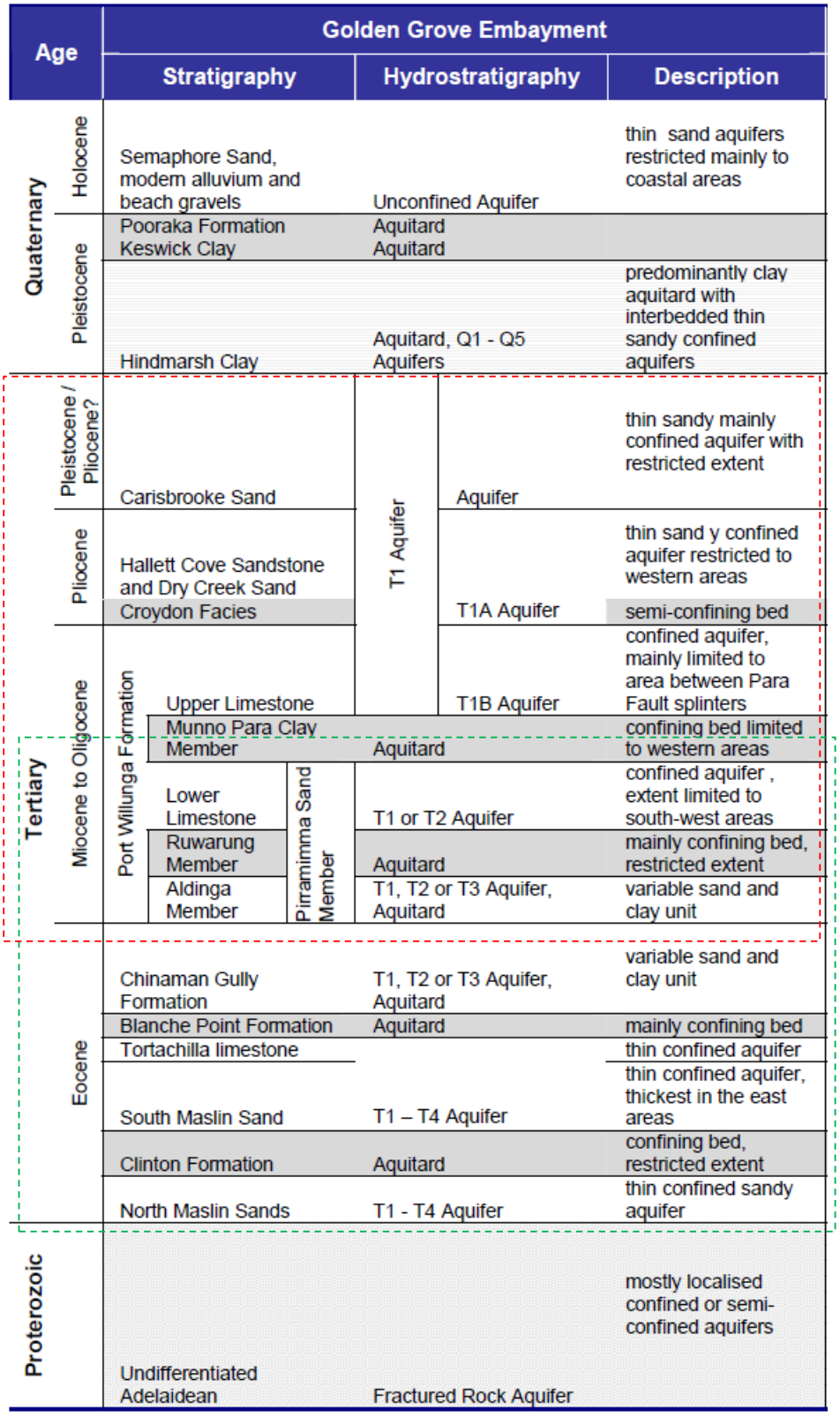

FIGURE 9: HYDROSTRATIGRAPHY (MARTIN & HODGKIN, 2005) SHOWING ZONES ACCESSED BY GROUNDWATER BORES IN RED AND AWE'S RECOMMENDED TARGET ZONE IN GREEN

8.1.1 Proterozoic Adelaidean Aquifer (NE)

The highly deformed fractured rock aquifer underlies the younger sediments and outcrops to the south of the Eden Burnside fault within the Council area. Although weathered sections of this strata may act as an aquitard, approximately 30% of managed aquifer recharge (MAR) schemes in Adelaide target this aquifer because fractures can enable high pumping rate and it is less often targeted by users of native groundwater. The presence of open fractures is key to a successful MAR scheme. Wells screened in the upper weathered strata through non-fractured intervals deliver little or no flow. The storage capacity is principally limited to the open fractures, thus smaller MAR schemes (<100 ML/a) typically target this zone.

The water quality varies from fresh at the recharge zone where the Adelaidean aquifer outcrops to saline where it underlies younger sediments. The connectivity of the fractures within this aquifer requires significant study to model storage and recovery.

8.1.2 Tertiary Aquifers

With reference to Figure 9, the Tertiary aquifers in this area directly overly the underlying Proterozoic aquifers. Deepest to shallowest, these aquifers are named T4 to T1. While the T4 and T3 aquifers exist in CoHB, they are seldom accessed by wells. Overlying these aquifers lie the T1 and T2 aquifers which are the most common MAR target in Greater Adelaide. The aquifer salinities are brackish and the homogeneity is favourable for modelling of MAR operations.

8.1.2.1 Tertiary Aquifer Compartmentalisation

The T1 to T4 aquifers may be hydraulically isolated laterally due to faults or 'pinch-outs' or vertically due to variable thicknesses of intervening clays which form aquitards across the Adelaide Plains.

The Munno Para Clay Member that separates the T1 from the T2 aquifer is a widespread vertical barrier to flow within the Golden Grove Embayment (Table 8). Other Tertiary members may separate the T2 from T3 and T3 from T4.

The Para Fault has been mapped (Hodgkin, 2004) across council areas in a southwest to northeast strike to the north of the Adelaide to Seaford train line. The T2 is thicker and downthrown to the northwest of this fault in the Oaklands Park area (**Error! Reference source not found.**) however, this variability has not been confirmed west of the Brighton Fault and bears further investigation.

The Brighton Fault may hydraulically isolate lower parts of the Tertiary aquifer south of either of the Para fault splinters along a strike approximately aligned with the eastern boundary of Council areas. This is important as it may provide a storage volume that is poorly connected with other MAR Schemes. Evidence to support this include

- Total dissolved solids: 1412 mg/L at 138 m vs. 1575 mg/L at 104 m.
- East of the fault, the T1 SWL is ~0.9 m AHD while the T2 SWL has been artesian since 2013 (6627-1873)

This faulting has led to altered aquifer geometry in three areas of Council areas which are described in the following sections. The northern half lies within Zone 2A of the Para Fault splinter, while the southern half comprises distinct geologies west and east of the Brighton Fault. These sub-sections of Zone 2 are described as Zone 2 West and Zone 2 East within this report.

8.1.2.2 Zone 2A

The hydrogeologically important Zone 2A in the northern half of Council areas comprises a thick zone of aquifers and aquitards. For example, well 6627-6491 (NOA026) encountered Tertiary limestone aquifer from 71 m to 473 m where it intersected the fractured rock of the Adelaidean basement.

TABLE 8: STRATIGRAPHY IN ZONE 2A

Depth From (m)	Depth To (m)	Strata Name
0	80	Hindmarsh Clay
80	170	Port Willunga Formation – T1 aquifer
170	185	Munno Para Clay Member
185	280	Port Willunga Formation – T2 aquifer

While the Glenelg Golf Course and Adelaide Airport MAR schemes target the T2 aquifer of Zone 2A, unsealed (open hole) bores such as 6628-7849, 6628-27008 and 6628-1501 allow communication between the T1 and T2 aquifers. This implies that the T1 and T2 are connected in Zone 2A.

TABLE 9: MUNNO PARA CLAY DEPTH AND THICKNESS

Well unit number	Zone/MAR scheme	Depth of Munno Para Clay
6628-25718	Zone 2A – airport MAR	170-185 m
6628-25719	Zone 2A – airport MAR	140-151 m
6628-22321	Zone 2A – Glenelg GC MAR	130-140 m
6628-7848	Zone 2A – Glenelg GC MAR	124-137 m
6628-11161	North of Zone 2A	227-233 m

8.1.2.3 Zone 2 West

The section of Zone 2 west of the Brighton fault contains thicker T2, T3 and T4 aquifers. For this to occur, the Adelaidean basement west of the Brighton fault was either downthrown at the time of deposition of marine sediment or a significant section of T1 was eroded before deposition of the Hindmarsh clay. This second explanation is unlikely as no evidence of a high energy paleoenvironment across the Brighton Fault has been published. The thick section of T2-T4 aquifers in within Zone 2 West that is poorly accessed by existing wells. An example of the stratigraphy in this area is shown in Table 10: Stratigraphy in well 6627-6492Table 10.

Bore 6627-6492 (NOA027) in Zone 2 West lies within the Minda site and encountered Adelaidean basement at 448 m. The stratigraphy of this well is provided in Table 10.

TABLE 10: STRATIGRAPHY IN WELL 6627-6492

From (m)	To (m)	Stratigraphy	Strata Name
0	62	Clay	Hindmarsh Clay
62	108	Limestone	Hallett Cove Sandstone and Port Willunga Formation – T1 aquifer
108	119	Clayey limestone	Munno Para Clay
119	214	Limestone	Hallett Cove Sandstone and Port Willunga Formation – T1 aquifer
214	244	Limestone	Ruwarung Member aquitard
244	274	Sand and clay	Aldinga Member aquitard
274	284	Sand and clay	Aldinga Member - T3 aquifer

284	313	Sand and clay	Chinaman Gully Formation – T3 aquifer
313	332	Mudstone	Chinaman Gully Formation – aquitard
332	414	Sand and clay	Blanche Point Formation - aquitard
414	440	Sand, marginal marine	South Maslin Sand - T4 aquifer
440	448	Carbonaceous clay	Clinton Formation
448	473	Undifferentiated Proterozoic rock	Adelaidean basement fractured rock

Deliverability is proven in the upper Tertiary aquifers. Three town water supply wells were drilled in this block along the rail corridor in 2017.

TABLE 11: STRATIGRAPHY IN ZONE 2 WEST, WELL 6627-15435

From (m)	To (m)	Stratigraphy	Strata Name
0	12	Clay	Hindmarsh Clay
12	14	Gravels	Hindmarsh Clay
14	70	Clay	Hindmarsh Clay
70	97	Limestone	Hallett Cove Sandstone and Port Willunga Formation – T1 aquifer
97	110	Clayey limestone	Munno Para Clay
110	150	Limestone	Port Willunga Formation - T2

Drilled in 2017, this well had a yield of 10 L/s from an open hole interval from 113-150 m (combined T1 and T2).

Deliverability in the lower aquifers is unknown and artesian pressures are likely.

8.1.2.4 Zone 2 East

There has been a lack of deep drilling to the east of the Brighton Fault to investigate the thickness of the T2 and the location of the Fault, however, at Oaklands Park MAR scheme further east, the top of the T2 aquifer is ~50 m below ground and no Munno Para Clay is evident. This implies that the T1 and T2 will be in good hydraulic communication in this Zone.

8.1.3 Quaternary Aquifers (Q1-Q4)

The shallower quaternary aquifers are typically low transmissivity and storativity. They also have high hydraulic gradients which reduces recovery efficiency from MAR but brackish salinity which improves the prospectivity for injecting fresher water.

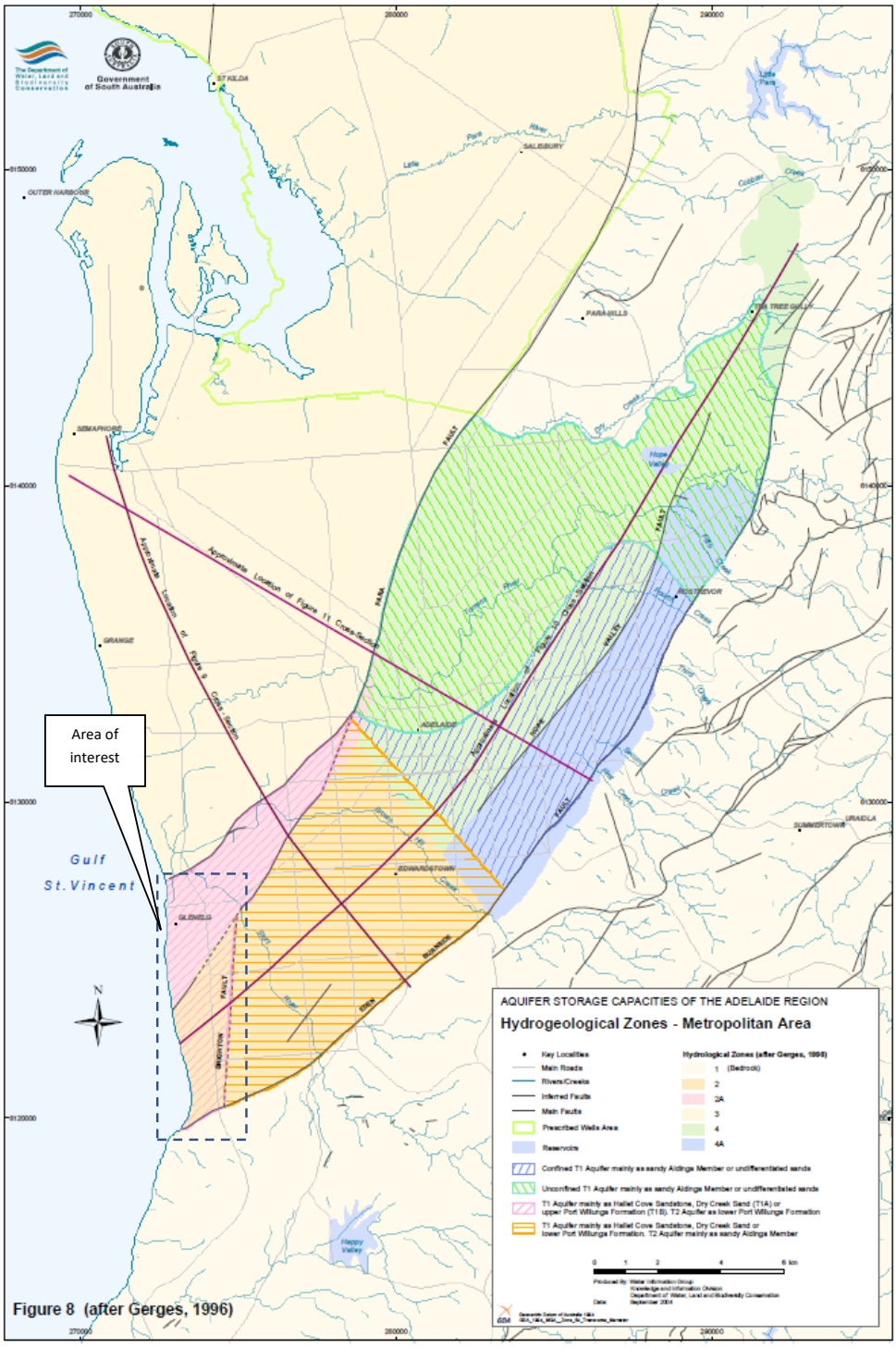

FIGURE 10: HYDROGEOLOGICAL ZONES OF THE ADELAIDE PLAINS (HODGKIN, 2004). THE PORTION OF ZONE 2 WEST OF THE BRIGHTON FAULT IS DECRIBED IN THIS REPORT AS ZONE 2 WEST.

8.1.4 Water level trends

With reference to **Error! Reference source not found.**, water levels in all aquifers reported in mAHD have been falling since 2002. The lower water levels in the upper Q3, T1 and T2 aquifers implies an upwards hydraulic gradient thus groundwater will tend to flow upwards from the lower strata.

The T1 aquifer has become artesian (SWL<0) several times, with 2016 water levels being particularly high due to lower groundwater extraction and increased recharge over a particularly wet winter.

8.1.5 Aquifer Parameters

The mean horizontal hydraulic conductivity is 2.5 m/d for the T1 aquifer and 2.8 m/d for the T2 aquifer (Zulfic, Osei-Bonsu, & Barnett, 2008).

From (Hodgkin, 2004), the storativity is $1.3x10^{-4}$ at Oaklands Park (T1 aquifer), $8.8x10^{-5}$ at Morphettville (T1 aquifer) and $2.8\ x10^{-4}$ for the T2. There is insufficient storativity information in each zone to estimate the available storage using the equations below.

Confined aquifer - ΔV = A . h . S
= A . h . b . Ss

where A = area
h = available head
S = storativity (storage coefficient)
b = aquifer thickness
Ss = specific storage

However, by applying the following equation:
Unconfined aquifer - ΔV = A . h . Sy
Where Sy = specific yield

to the Quaternary aquifer, between 76 - 6,600 GL could be stored if sufficient connectivity with the aquifers are established.

8.2 Potential for MAR

The upper sections of aquifer (T1, T2) are accessed by neighbouring MAR schemes at Oaklands Park, Morphettville Racecourse, Adelaide Airport and Glenelg Golf Club especially in Zone 2 East and part of Zone 2A. The artesian conditions in 2016 required sealing of several wells used by neighbours in the region. While MAR can be performed under artesian conditions and this zone has proven MAR viability, constructing a MAR scheme in the upper Tertiary aquifers in these Zones will require coordination with the existing schemes.

The connectivity between the T1 and T2 aquifers is not well understood in the area, however, untapped storage is likely to be present in the deeper Tertiary (T2-T4) aquifers of the Zone 2 West area (see **Error! Reference source not found.**).

Treatment of captured stormwater to an appropriate quality is required prior to injection. For reference, the Oaklands Park MAR Scheme EPA licence allows 500 ML/year to the T1 aquifer of source water that has

- Electrical conductivity < 3100 µS/cm and pH 6.5-8.5
- Suspended solids <20 mg/L and turbidity <20 NTU
- Total organic carbon <15 mg/L
- No pesticides
- *E.coli* <1000 col./100 mL

- Minimal metals and hydrocarbons

Decentralised storage in the Quaternary aquifers is possible throughout the CoHB, although recovery efficiencies will be nil to low due to poor connectivity with the aquifer as discussed above.

There may also be potential for approximately 50 ML/year MAR in the Adelaidean fractured rock aquifer in the south of Council area. MAR in this area will require significant delineation to locate transmissive fractures and determine connectivity with protected springs along the coast. MAR will have to consider both the requirement to draw down the water level before recharging the storage and the high hydraulic gradient expected in this area, however, land access and neighbouring users may be favourable.

8.3 Summary of MAR Options

In summary, further work is required to estimate the storage in all three aquifer zones however, the potential for MAR is proven in the Tertiary aquifers beneath the council area and significant (100-2000 ML/year) storage may be available in the T2-T4 aquifers in Zone 2 West and Zone 2A.

Coordination with surrounding MAR schemes is recommended if possible. CofHB has the potential to:

1. Work with coastal land care groups to build bank filtration infrastructure within the sandy dune soils
2. Construct multiple decentralised seepage pits/biobeds within areas of major run-off e.g. shopping centres
3. Offer access to T2-T4 aquifers for storage of water captured within CofHB
4. Offer access to T2-T4 aquifers for storage of water captured at Oaklands Park (within the same surface catchment) and transferred to Council for storage
5. Facilitate connection between the City of Marion alternative water infrastructure and the Glenelg Waste Water Treatment Plant recycled effluent alternative water pipeline outlet near Broadway within Council.
6. A combination of the above

9 Options assessment

9.1 Strategy 1: Surface runoff infiltration options

9.1.1 Opportunistic WSUD for passive irrigation in drainage upgrades

As part of the WSUD Masterplan, fourteen opportunities within CofHB include WSUD as part of planned major and minor drainage upgrades were identified. These included bioretention, rain gardens and tree pits which have the ability to infiltrate runoff into the insitu soils.

A MUSIC model of a unit catchment contributing to a 10sq.m biofiltration basin (i.e. surface area assumed to be 0.1% catchment area) was used to provide a high level estimate of the expected infiltration yield per year from each device. The estimated yield model was 0.2 ML/ha catchment/year, and it is assumed that the devices will be able to achieve this yield. It is assumed the devices will be sized approximately 0.1% of the contributing catchment which is low due to the expected space constraints. A conservative exfiltration rate of 10 mm/hr was adopted, however the hydraulic conductivity in areas are likely to be higher than this.

Based on the above assumptions, the associated infiltration losses from planned WSUD as part of drainage upgrades are likely to be 28 ML/year (approximately 5% of the total reduction target). A breakdown of the infiltration losses are shown in Table 12. The total cost as listed in the WSUD Masterplan is $825,970 (2016 $).

TABLE 12 WSUD FOR DRAINAGE UPGRADES

WSUD Masterplan Ref	Location	BMP Type	Catchment (ha)	BMP Area (sq.m) (0.1% of catchment)	Flow reduction (ML/year)
A13	College Road, Somerton Park	Bioretention	14.3	143	2.9
A20	Yarmouth Street, South Brighton	Bioretention	7.3	73	1.5
A17	Alfreda Street, Brighton	Rain garden	7.6	76	1.5
A11	Walkers Road / Scarborough Street, Somerton Park	Tree pit	15.5	155	3.1
A16	Cecelia Street, North Brighton	Tree pit	12.7	127	2.5
A12	Moore Street, Somerton Park	Rain garden	9.7	97	1.9
A16	Caroona Street, Hove	Rain garden	7.8	78	1.6
A18	McCoy Street, Brighton	Rain garden	6.7	67	1.3
A22	Ophir Crescent, Seacliff Park	Rain garden	11.2	112	2.2
A23	Wheatland Street, Seacliff	Rain garden	16.6	166	3.3
A24	Walsh Street Drain	Tree pit	7	70	1.4
A19	Rudford Street, Brighton	Raingarden	5.9	59	1.2
A21	High Street, South Brighton	Raingarden	10.9	109	2.2
A14	Byre Avenue, Somerton Park	Raingarden	9.7	97	1.9
				Total	**28.6**

9.1.2 Permeable pipes in outfall upgrades

Outfall upgrades are planned for the Tarlton Street, Harrow Road, Jetty Road, and Edward Street identified for flood mitigation measures in the Stormwater Management Plan. Permeable pipes could form part of the outfall upgrade solutions and would be designed to maximise the infiltration of stormwater runoff. This would have several benefits including

- ensuring pipes are installed at locations where large amounts of runoff could be intercepted and infiltrated
- minimise costs of pipe installation
- take advantage of access to funding likely to be available for the outfall upgrades
- potential amenity benefits for visitors to the beaches due the reduced volumes of runoff and pollutants likely to discharge at the outfalls

All outfalls have sections running within a road reserve likely to be situated within dune sands, and all discharge to the beach. The Edward Street and Jetty road outfall upgrades have sections of pipelines proposed to run along the rail reserve.

The effectiveness of the infiltration options would be limited primarily by hydraulic conductivity of the insitu soils. The rail reserve is likely to be situated within sandy clay that is unlikely to be expansive and can have a hydraulic conductivity up to 30 mm/hr, however any infiltration option here would need to be at least 5m from footings of service buildings. The infiltration rates along the dune sands are likely to be high and amenable to an infiltration option. Infiltration within the road reserve could lead to wetting of the subgrade, which could be of issue in heavily trafficked roads and areas, and as such an impermeable liner may be required where the pipe adjoins subgrade. Soils tests conducted as part of the outfall upgrades would need to confirm the hydraulic conductivity.

Preliminary MUSIC modelling was conducted for including a permeable pipe as part of the outfall upgrades to determine the likely annual infiltration volumes. As there is no predefined node for a permeable pipe, a 1 m wide trapezoidal swale was used. The exfiltration rates adopted were as follows. The minimum exfiltration rate from the permeable pipes is 6 L/s per 100 m of pipe (Hydrocon) (or 200 mm/hr per metre of pipe), maximum exfiltration rate into in situ sandy clay of 0.8 L/s per 100 m pipe, and exfiltration rate into in situ dune sands of 8 L/s per 100 m pipe. In sandy clay the maximum exfiltration rate is 30 mm/hr (soil limiting exfiltration), and in dune sands 200 mm/hr (pipe limiting exfiltration).

Based on the above assumptions, the associated infiltration losses from proposed permeable pipes to be included as part of outfall upgrades could be between 7 and 34 ML/year (approximately 1% and 5% of the total reduction target). The MUSIC results for inflows and infiltration losses expected from each outfall project are in Table 14. The highest yielding project would be the Harrow Road outfall upgrade due to the large catchment size it services and length of pipe available within dune sands.

TABLE 13 POTENTIAL PERMEABLE PIPE OPTIONS

Planned outfall upgrade	Potential location	Catchment (ha)	Length of permeable pipe (m)	Inflows (ML/year)	Average annual infiltration into sandy clay (ML/year)	Average annual infiltration into dune sands (ML/year)
Edward Street	Rail reserve, along Edward Street or extend along beach	25	100	34	1.0	4.2
Jetty Road	Rail reserve, along Jetty Road	17	100	23	0.9	3.3
Harrow Road	Harrow Rd or extend along beach	300	200	411	4.5	24
Tarlton Rd	Tarlton Road or extend along beach	22	100	30	1.0	3.9
			Total		**7.4**	**35.4**

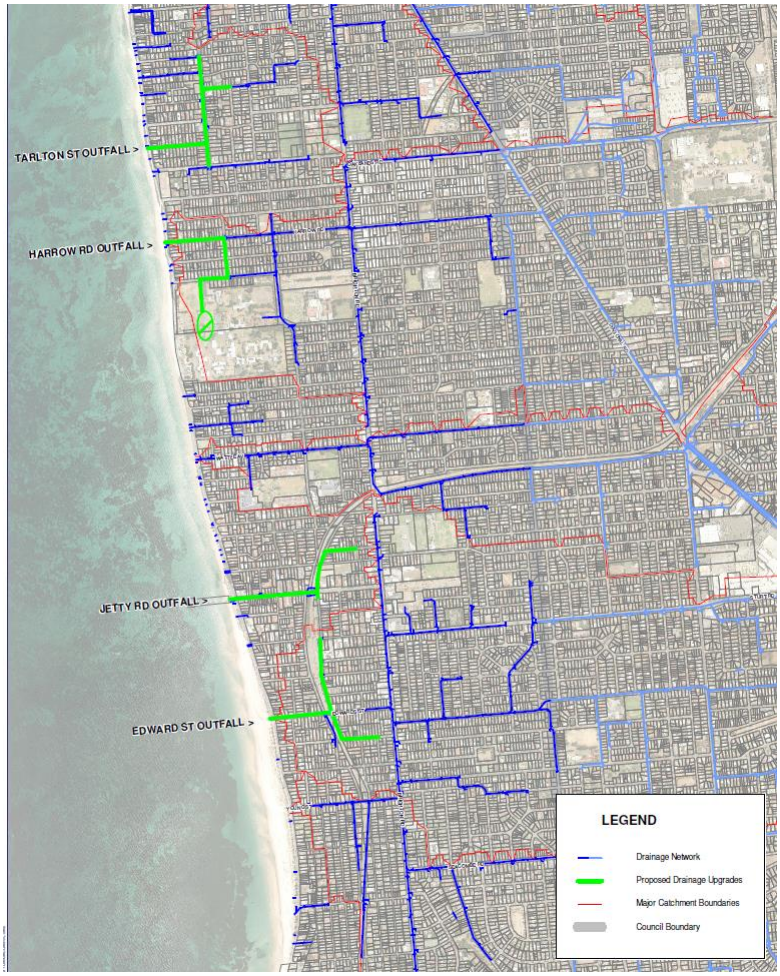

FIGURE 11 PROPOSED OUTFALL UPGRADES (SOURCE: TONKIN 2014)

9.2 Strategy 2: Surface runoff harvesting options

9.2.1 Pine Gully harvesting scheme

As found by W&G (2014), following a study by AWE (2010), a 1.6 ML/year harvesting scheme at Pine Gully would unlikely to be economically viable where a Holdfast Bay Recycled Water pipeline will be developed (See Strategy 4). Demand at the Brighton Caravan Park could be met by recycled water.

Council has indicated that a secondary objective of this study is to identify opportunities to manage runoff form the Cement Hill Development that lies within the catchment for Pine Gully. CofHB should prioritise the aesthetic, cultural and biodiversity value of Pine Gully during development at the Lorenzin site. There is limited space to detain/retain runoff from the Lorenzin site. In order to manage runoff from the site:

- a gross pollutant trap could be installed upstream of Pine Gully as recommended in AWE (2010). The cost of this would be $50,000.
- strict enforcement of runoff and sediment management practices on the site through weekly site visits.1

9.2.2 Stormwater mining at Seacombe Rd trunk main

The Seacombe Road trunk main near Cadell Reserve services a large catchment of approximately 300 ha, and is proposed for a drainage upgrade, and as such may be an opportunity for stormwater mining. Based on MUSIC modelling of a system with pumping from a sump within the trunk main at 20 L/s to a new 500 ML storage within Cadell Street Reserve this could yield 21ML/year for harvesting and/or passive irrigation of trees in the reserve.

The reserve is not intended to be part of the extension of the GAP scheme, however, the yield would exceed the demand at the reserve site, and therefore not all of the water could be used for reuse on site. Any new detention could possibly act as a holding basin for further treatment at a Gilbertson Gully scheme.

TABLE 14 INDICATIVE LOCATION OF STORMWATER MINING FROM SEACOMBE ROAD TO COINCIDE WITH DRIANAGE UPGRADE

9.2.3 Gilbertson Gully harvesting scheme

Gilbertson's Gully is located in the hills face zone where the Quaternary and Tertiary clays and sands onlap onto the Adelaidean fractured rock basement. Previous studies into the potential for MAR in this location focussed on the southeastern section of the gully and suggested that MAR would be infeasible. While it remains true that the fractured rock aquifer may be too well connected with springs to be used as a storage medium and possibly low productivity, the same cannot be said of the northwestern section of the gully. Here there is surface relief available for balancing storage and potentially semi-confining clays overlying Tertiary sediments with good hydraulic productivity. In other locations e.g. Scotch College, the fractured rock aquifer itself can be successfully used for small scale (5-100 ML/a) MAR projects. AWE recommends that further investigations into small-medium scale MAR are undertaken in this area.

It is estimated that revegetation efforts for 3 ha of gully reserve area would require 10 ML/year of irrigation to establish, maintain and potentially top-up ponds (based on equivalent areal usage for irrigated reserves in CofHB). In addition to amenity and ecological benefits, there may be real economic benefits through increases of house prices near the gully. Recent research by the CRC for Water sensitive Cities has demonstrated In Melbourne that 30% increases in house prices were attributed proximity to a revegetated living stream (see Appendix B). For 30% increase in prices of

approximately 560 houses within 200m of Gilbertson Gully could return an increase of approximately $80M in the area (i.e. 30% x $500,000 x 560 = $84M capital value added).

Based on MUSIC modelling, using a conservative 1ML of storage area to reduce amenity impacts within the Gully, the scheme could allow a harvest of flows of approximately 20ML/year using mechanical filtration (e.g. sand filtration) and MAR within the reserve area.

Alternatively, irrigation of the gully could be supplied by the proposed recycled water scheme – so environmental benefits associated with reduction of stormwater should be considered. Downstream of the gully is formal stormwater drainage, so there are likely to be limited improvement downstream other than reduced flows to sea.

9.2.4 Minda Homes site harvesting scheme and expansion

A wetlands system in conjunction with ASR is proposed within the Minda Development was proposed in W&G (2014). The Minda/Brighton site redevelopment has made provisions for the construction of a detention basin and wetlands system to enable stormwater detention and treatment. Further details are available in W&G (2014), and data are included in the options assessment in this study.

9.3 Strategy 3: Rainwater tank harvesting options

Rainwater harvesting by connecting household roofs to a rainwater tank for indoor use has been demonstrated as an effective way to reduce total volume of runoff, reduce household demand for mains water, and can alleviate nuisance flooding where sufficient number of households have tanks installed. An additional benefit of rainwater tanks is that the operation and maintenance of the tanks are managed by individual householders.

Rainwater tank flow reduction and harvesting performance

Water Sensitive SA recently conducted an analysis of the rainwater harvesting potential for different household rainwater tank systems within Adelaide. The yield depends largely on the size of tank, connected roof area, and use of the harvested water. The results are shown in Appendix C and summarised in Table 16.

TABLE 15 RAINWATER TANK SCHEME YIELD AND FLOW REDUCTION ESTIMATES

Performance	**Tank Size (kL)**		
	1	2	5
	100 sq.m roof connected to tank		
Average annual yield per lot (kL)	39.60	46.08	49.38
	200 sq.m roof connected to tank		
Average annual yield per lot (kL)	56.66	73.45	92.05

Note: Assuming full indoor use (toilet flushing, laundry) and outdoor use and occupancy rate of 3 persons per household.

Rainwater tanks can be fitted with a detention capacity to reduce peak flow rates arriving at council drainage systems. The detention storage fills during a rainfall event and slowly releases flows through an outlet orifice (usually situated above the retention storage volume).

Current rainwater tank policy

As from 1 July 2006, new houses built in South Australia are now required to install a rainwater tank of at least 1000 litres. The tank must be plumbed into the toilet, to a water heater or to all cold water outlets in the laundry. The CofHB approves the size and location of rainwater tanks for proposed developments. Although there is little data on the current level of uptake for rainwater tanks within the CofHb, the number of new developments within CofHB will be fraction of the total number of existing households without rainwater tanks installed for indoor use. As such, the CofHB may consider a rainwater tank rebate to encourage further uptake.

Examples of rebate schemes

The Victorian Government held a rainwater tank rebate schemes including the *Water Smart Gardens and Homes Rebate Scheme* and *Living Victoria Water Rebate Program* from 2007 to 2015 valued at up to $1000 for households. A summary of the rainwater tank rebates used in the schemes are shown in Table 17. An analysis of over 4,000 households who received rebates showed that water use of households reduced on average by 105 KL/year (42% of demand for all households) with the highest water savings achieved where the tank was plumbed to toilet or laundry with average savings of 119 KL/year (43.6% of demand of those households) (Gato-Trinidad and Gan, 2011). The cost of tank, plumbing, installation, and pump for a 5kL rainwater for indoor and outdoor use is approximately $2800 based data from Melbourne (Gato-Trinidad and Gan, 2011). The payback period for residents is approximately 14 years.

TABLE 16 VICTORIA GOVERNMNET RAINWATER TANK REBATE SCHEME

Tank capacity/plumbing	Rebate available
Rainwater tank connected to toilet OR laundry (tank size 2,000 to 3,999 litres).	$500
Rainwater tank connected to toilet OR laundry (tank size 4,000 litres or greater).	$900
Rainwater tank connected to toilet AND laundry (tank size 4,000 litres or greater).	$1000

The City of West Torrens currently has a *Residential Rainwater Rebate Scheme* to encourage reduction in mains water consumption by community members. The rebate ranges from $50 to $500 based on the size of tank installed, as shown in Table 18.

TABLE 17 CITY OF WEST TORRENS RAINWATER TANK REBATE

Tank capacity	Rebate available
Capacity 1,000 - 1,999 litres	$50
2,000 - 4,999 litres	$300
5,000 - 9,999 litres	$400
10,000 + litres	$500

Example City of Holdfast Bay Rainwater Tank Rebate Scheme

A key objective of a City of Holdfast Bay Rainwater Tank rebate scheme would be to minimise total runoff volumes and reduce local flooding, and improve urban water security for residents. Further economic analysis would be required in order to optimise the rebate value to achieve the desired

level of participation and resulting runoff volume and runoff targets. Here, we assume a 50% subsidy of the cost of a 5kL rainwater tank connected to indoor and outdoor use would be approximately $1,500, which is a generous rebate, and would result in 20% of household in City of Holdfast Bay connecting/installing tanks for indoor and outdoor use, as detailed in Table 19. The rebate scheme could be rolled out over a 10-year period and reviewed periodically.

TABLE 18 EXAMPLE RAINWATER TANK REBATE SCHEME

Conditions	Participation (% CofHB households)	Number of households Participating	Rebate value ($)	Total cost ($ thousands)	Expected flow reduction (ML/year)
5 kL 200 sq.m roof connected to full indoor and outdoor use	15	3,600	1,500	5,400	331

Note: Assumes participating household occupancy rate of 3 persons per household. CofHB average occupancy rate is 2.1 p.p.h. (40,000 population/ 18,700 lots).

Furthermore, an assessment of current rainwater tank usage and barriers to uptake should be further studied.

9.4 Strategy 4: Expansion of existing water reuse schemes options

Several options to expand existing recycles wastewater, stormwater harvesting and reuse, and groundwater usage schemes to supplement or replace existing groundwater or mainswater use within Council owned reserves.

9.4.1 Extension of Glenelg to Adelaide Parklands (GAP) recycled wastewater scheme

The proposed Holdfast Bay Recycled Water Scheme is detailed in W&G (2014) and could potentially meet 130 ML/year of existing demand for Council irrigation. The financial viability of the scheme project hinges on the amount of water used by Council, unless an additional demand can be identified. The use of recycled wastewater could have a greater per unit volume impact on reduced nutrient load into the Gulf, as the treated wastewater, which has a much higher nutrient content than stormwater, would otherwise be discharged. A map of the proposed scheme from W&G (2014) is reproduced here as Figure 12 and 13.

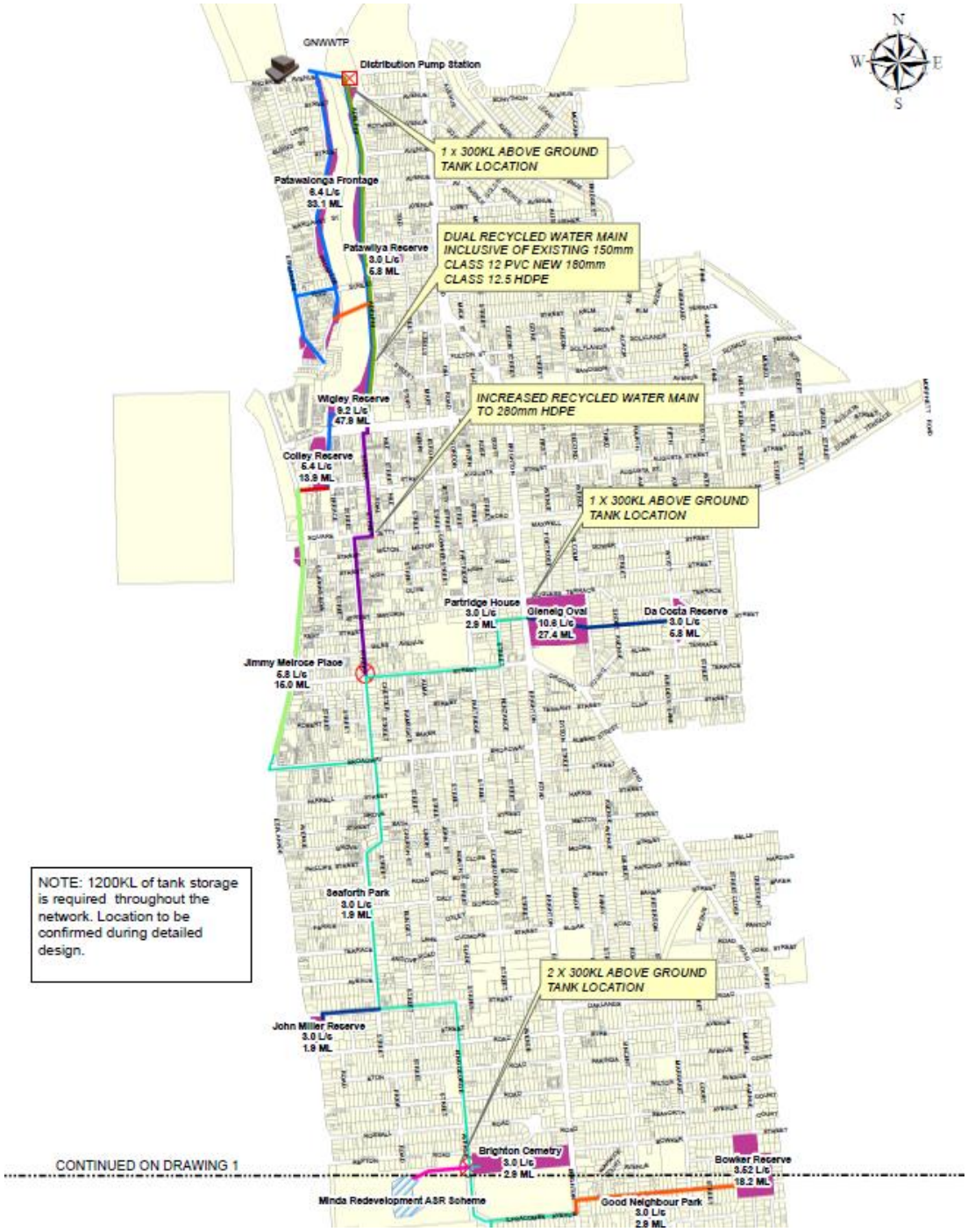

FIGURE 12 PROPOSED RECYCLED WATER LAYOUT (1/2) (SOURCE W&G 2014)

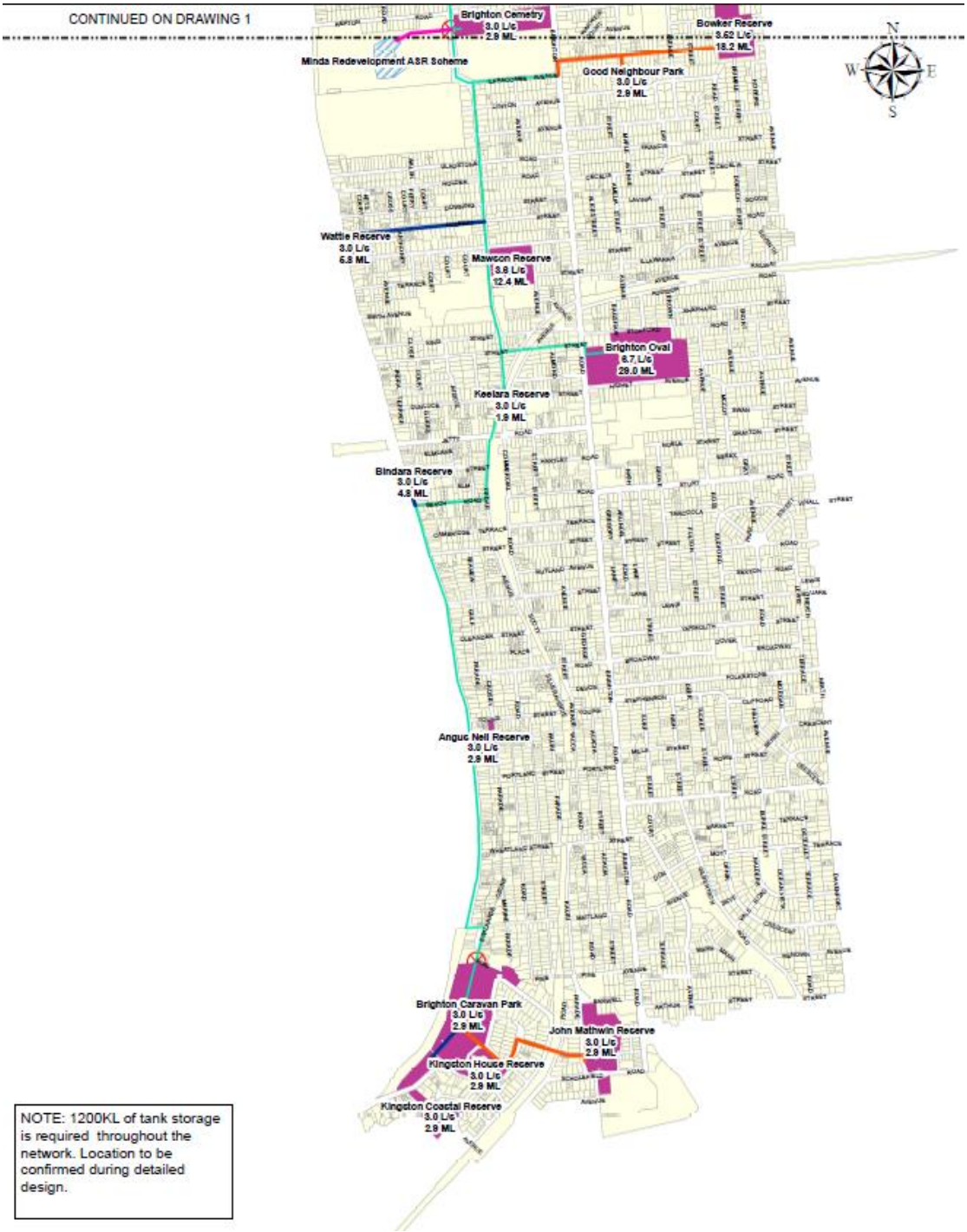

FIGURE 13 PROPOSED RECYCLED WATER LAYOUT (1/2) (SOURCE W&G 2014)

9.4.2 Extend recycled/reuse water scheme to Adelaide Desalination Plant

Where a Holdfast Bay Recycled water scheme extends to Brighton Caravan Park, it could be extended further to the Adelaide Desalination Plant (ADP) at Port Stanvac. This could be achieved via 7.6km of pipeline along the railway reserve from Singleton Road to near the Adelaide Desalination plant (Figure 14 and 15) or along the existing easement for the abandoned Port Stanvac gas pipeline.This

would provide a larger and more stable demand for harvested stormwater, and could provide a connection between GWWTP and ADP for indirect potable reuse of wastewater.

Currently, the ADP utilises seawater and treats to a potable standard, which produces a concentrated brine waste. Power costs for the plant were estimated to be $13.5 million in 2016-17 where approximately 10 GL of water was supplied, equivalent to $1.35 per kL energy costs. It is estimated that energy costs make up approximately 44% of seawater desalination (Younos 2005), as such the cost of desalinated water would be approximately $3.06 per kL. The total costs of brackish water desalination are approximately half that for seawater, equivalent to $1.53 /kL. The energy costs for brackish water desalination are approximately 11% of total costs, or the equivalent of $0.17 /kL for comparison with ADP seawater desalination costs.

Where harvested stormwater (which is less saline than brackish water) could be supplied to the ADP at less than $1.50 /kL, it may be a cost effective substitute to seawater. The possible benefits of utilising stormwater instead of seawater for desalination include:

- Stormwater could be blended with seawater in feedwater, which may lower the salinity of feedwater and reduce the total energy costs of treatment required
- Stormwater could be blended with brine waste to reduce local environmental impact

There may be disadvantages for treating stormwater at the ADP, including:

- Higher variation in feedwater quality, which would affect chemical dosing and operations
- Additional pollutants concentrated in the brine wastewater

Where the Oaklands Park harvesting scheme is connected to the Holdfast Bay Recycled Water scheme, up to 300ML/year could be provided to the ADP (200ML/year of 500ML/year capacity is currently utilised). The Morphetteville racecourse scheme could provide an additional 250ML./year (350ML/year of 600ML/year capacity is currently utilised). In addition, the GAP water could be supplied to the ADP. If 5GL/year stormwater/GAP water could be supplied to ADP at $0.50/kL taking advantage of economies of scale this would potentially save $5M/year plus additional benefits of 5GL less runoff to sea.

There is likely to be a low public acceptance for indirect potable reuse of wastewater (MARSUO 2014). Perth has an indirect potable recycled wastewater scheme using managed aquifer recharge of RO treated wastewater that has a residence time of 20 years in the aquifer before recovery for further treatment for potable supply. Following social acceptance studies this was determined to be more acceptable than using the RO treated wastewater for potable supply immediately. There is likely to be more public acceptance of stormwater that is further treated at ADP for reuse (MARSUO 2014), however the total volumes that could be supplied from Morphettville and Oaklands Park would be limited to approximately 0.5GL/year based on current capacity of those schemes, and the payback period for the scheme would be longer than a blended GAP/stormwater supply to ADP. Alternatively, untreated stormwater could be transferred to the ADP, however local it is likely transfer and settlement of water from the Field River would be more cost effective for this purpose.

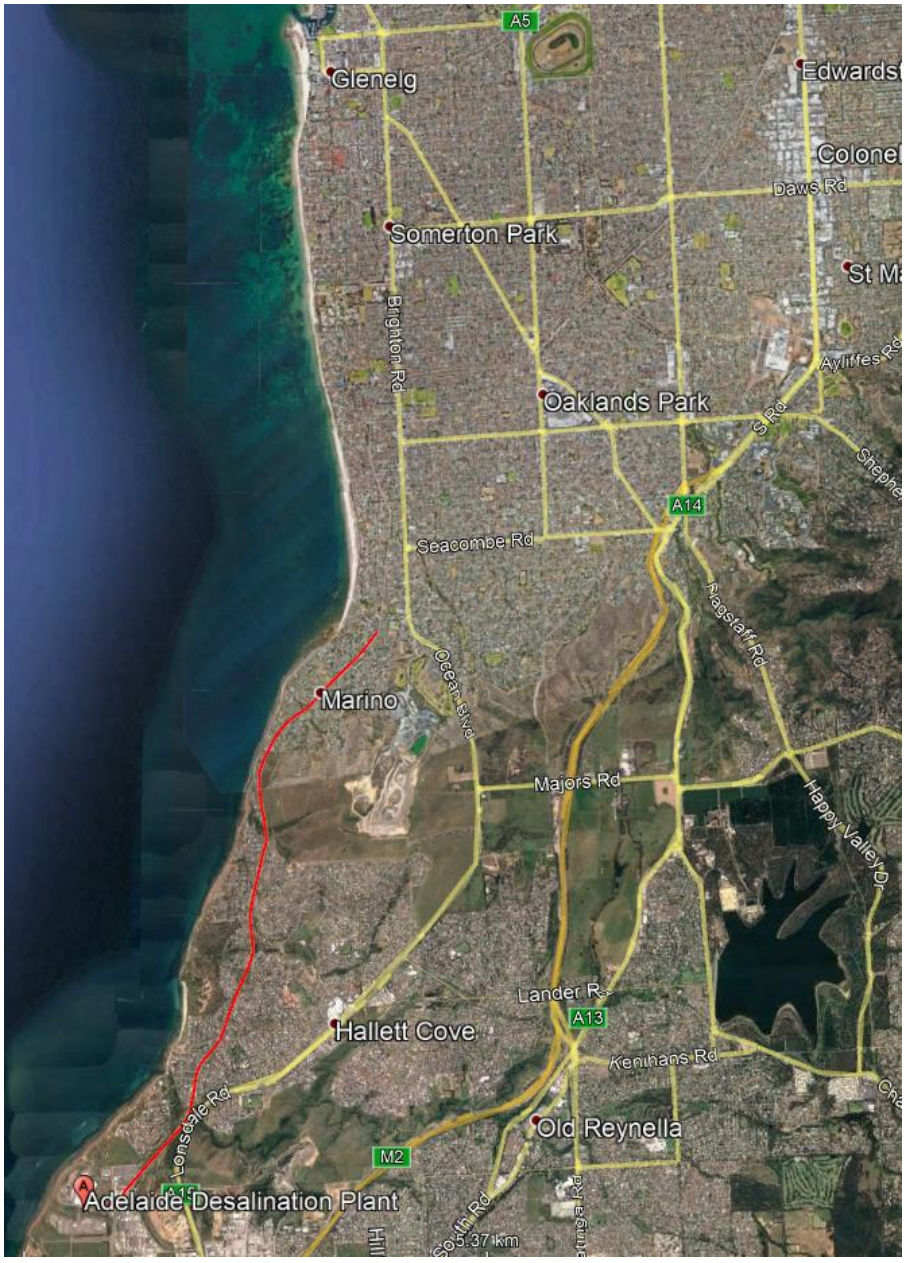

FIGURE 14 POTENTIAL EXTENSION OF HOLDFAST BAY RECYCLED WATER SCHEME TO ADELAIDE DESALINATION PLANT

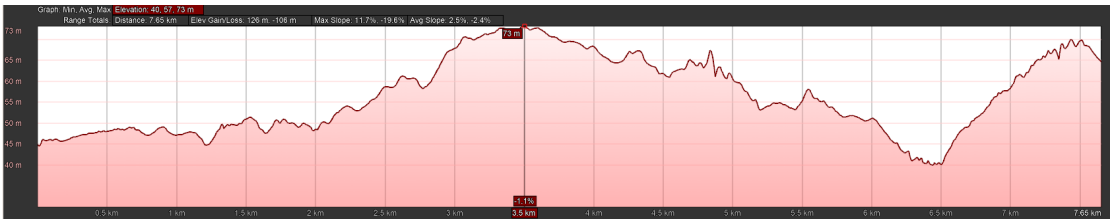

FIGURE 15 ELEVATION PROFILE OF HOLDFAST BAY RECYCLED WATER SCHEME EXTENSION TO ADELAIDE DESALINATION PLANT (ADP). PIPELINE DISTANCE 7.65KM, ELEVATION 43M AHD AT SINGLETON ROAD, MAX 73M AHD, 64M AHD AT ADP.

9.4.3 Other opportunities

Additional opportunities for stormwater or recycled wastewater reuse have been explored but were not considered further, and appear in Appendix D, including:

- Connect Oaklands Park to recycled water scheme as detailed in W&G (2014)
- MAR injection of runoff harvested in Oaklands Park schemes
- Blending GAP recycled water with harvested water injected in CofHB aquifers
- Connect to Morphettville Racecourse scheme

9.5 Options screening

The largest flow reduction would be available through a Holdfast Bay Rainwater Tank Subsidy scheme (315 ML/year) and the Holdfast Bay Recycled Water Scheme extension (116ML/year currently, and 125 ML/year proposed, totalling 241 ML/year). These schemes along with the expected surface runoff infiltration from streetscape WSUD (28 ML/year) and proposed permeable outfall pipes (55 ML/year), could achieve 639 ML/year reduction in flow to sea which would achieve the 30% annual flow reduction target of 632 ML/year. The recycled water and rainwater tank harvesting schemes can be sustained based on current Council and household demand.

A high level cost estimate of the options is summarised in Table 20 and 21 and presented in full for an indicative works program for all sites in Appendix E. The harvesting/reuse options that can substitute existing mains water uses are likely to be the most economically sustainable options, given the typically higher cost of mains water. The Rainwater Tank Subsidy Scheme and Holdfast Bay Recycled Water Scheme would be the most cost efficient methods for reducing total volume of flow via harvesting/recycled water use. The permeable pipes are the more cost effective method for infiltration as they would be coincided with outfall upgrades, however the infiltration benefit would be one of several objectives for the WSUD streetscape upgrades.

The viability of the Minda Homes, Gilbertson Gully and Pine Gully surface runoff harvesting schemes on economic grounds will depend on identifying sources of demand for the harvested water. Should the Holdfast Bay Recycled Water Scheme be extended the Minda Homes and Pine Gully scheme would need to compete with the operating cost of recycled water at approximately $0.75 per kL. The Gilbertson Gully scheme could provide additional irrigation for revegetation within the Gully, the cost of which could be offset by rates increases due capital value of land within the area, however it may be possible to extend the recycled water scheme for this purpose.

Based on the potential flow reduction and other benefits available, the preferred scheme would include the following options:

- Passive irrigation (Strategy 1 Infiltration)
- Permeable outfall pipes (Strategy 1 Infiltration)
- Gilbertson Gully (Strategy 2 Surface Harvesting)
- Rainwater Tank Subsidy (Strategy 3 Rainwater Harvesting)
- Recycled Water Scheme Extension (Strategy 4 Extension of existing schemes)

TABLE 19 SUMMARY OF INFILTRATION OPTIONS (STRATEGY 1)

Infiltration scheme	Source of infiltration	Infiltration volume (ML/year)	Lifecycle Cost ($ million, 7% discount rate)	Cost to Council (average in first 10 years) ($ per kL)	Cost to Council (average over 30 years) ($ per kL)	Impact on flow to sea pollutant reduction
Opportunistic passive irrigation based on WSUD masterplan (unlined)	Infiltration associated with bioretention/rain garden planned devices identified in WSUD Masterplan.	28	1.3	10.5	5.4	Moderately Low
Permeable pipes in outfall upgrades	Include permeable sections of pipe in proposed outfall upgrades to infiltrate runoff into insitu soil.	55	0.43	0.99	0.67	Moderately Low

TABLE 20 SUMMARY OF RECYCLED WATER OR STORMWATER HARVESTING REUSE OPTIONS (STRATEGY 2, 3 AND 4)

Reuse scheme	Source of demand	Capacity (ML/year)	Existing Demand Replaced (ML/year)	Lifecycle Cost ($ million, 7% discount rate)	Cost to Council (average in first 10 years) ($ per kL)	Cost to Council (average over 30 years) ($ per kL)	Can be supplied by HB Recycled Water Scheme or other schemes?	Impact on flow to sea pollutant reduction
Rainwater Tank Subsidy Scheme	Household indoor and outdoor potable supply substitution (assuming 5kL tank fitted to 20% households within CofHB)	315	315	6.3	6.05	2.37	No	High
Holdfast Bay Recycled Water Scheme (HBRWS)	Irrigation of reserves otherwise supplied by mains or ground water including: Wigley (existing), Patawolonga Frontage (existing), Colley Reserve (existing), Patawilya Reserve (existing), Jimmy Melrose Reserve (existing), Mawson Oval, Wattle Reserve, North Brighton Cemetary, Seaforth Park, John Miller Reserve, Good Neighbour Reserve, Bowker Reserve, Keelara Reserve, Glenelg Oval, Partridge House, Da Costa Reserve, Brighton Oval, Bindara Reserve, Angus Neil Reserve, Brighton Caravan Park, Kingston Coastal Reserve, Kingston House Reserve, John Mathwin Reserve	300	116 (currently supplied) 125 (expansion)	3.8	4.15	3.11	N/A	High
Minda Homes	Irrigation of reserves otherwise supplied by mains or ground water including: Good Neighbour Reserve, Bowker Oval, Mawson Oval, Wattle Reserve, Keelara Reserve, Brighton Oval, Bindara Reserve, Angus Neil Reserve, Brighton Caravan Park, Kingston Park Coastal Reserve, Kingston House Grounds, John Mathwin Reserve	102	89	4.3	10.2	5.0	Yes	High
Pine Gully	Irrigation of Brighton Caravan Park	1.6	1.6	0.50	37.14	25.45	Yes, with proposed HBRWS	Low
Seacombe Road stormwater mining	Irrigation of Susan Grace Benny Reserve, Gilbertson Gully	21	13	0.38	10.79	3.97	Yes, extend proposed HBRWS or Gilbertson Gully	Moderate
Gilbertson Gully	Irrigation of Susan Grace Benny Reserve, Gilbertson Gully	26	13	0.61	5.57	4.25	Yes, extend proposed HBRWS or Seacombe Road	Moderately Low

10 Recommendations

The following options are recommended for detailed analysis in order to achieve the City of Holdfast Bay target of 30% flow reduction.

Primary options

- Progress to detailed design the Holdfast Bay Recycled Water Reuse Scheme extension proposed by W&G (2014)
- Investigate a Holdfast Bay Rainwater Tank Subsidy Scheme

Secondary options

- Implement permeable outfall pipe (or other infiltration options) as part of future outfall upgrades and GPT installations. Investigate other options for infiltration into dune sands.
- Implement unlined streetscape WSUD per WSUD Masterplan
- Investigate high water usage at Angus Neil Reserve

The Recycled Water Scheme is outlined in W&G (2014) and provided the best option for irrigation of Council reserves. To the authors' knowledge, the Scheme has not been further progressed, however this should be prioritised. In addition, a Rainwater tank Subsidy scheme could help to achieve the flow reduction target, without large operating costs for the Council but also without the benefit of substituting Council water demand.

In addition, as part of planned outfall upgrades, permeable pipes offer a low-cost option for increasing flow reduction, and proposed WSUD streetscape upgrades should be implemented. Potential water savings could be gained through an investigation of the Angus Neil Reserve Water use (per Appendix A).

A high level costing for the scheme based on a discount rate of 7% over 30 years and 30% contingency cost is provided in Table 22. The Rainwater Tank Subsidy scheme could be increased after the construction of the recycled Water Scheme extension to reduce the high costs for the first 5 years.

TABLE 21 RECOMMENDED SCHEME FLOW DREDUCTION AND COST BREAKDOWN OVER 30 YEARS

	Strategy 1: Total runoff infiltrated (ML/year)	Strategy 2: Runoff harvested (ML/year)	Strategy 3: Rainwater harvested (ML/year)	Strategy 4: Recycled water use (ML/year)	Council Water Demand Substituted (ML/year)	Council Substituted Water Costs ($/year)	Total Flow Reduction (ML)	Total Cost to Council ($/year)
Recommended Scheme options:	*Passive Irrigation*	*Gilbertson Gully*	*RWT Subsidy Scheme*	*Recycled Water Scheme*	*Recycled Water Scheme*	*Recycled Water Scheme*	*All options/ Reduction Target :*	*All options*
Year	*Permeable outfall pipes*				*Gilbertson Gully*	*Gilbertson Gully*	*632*	
1	41	0	32	141	141	$ 833,357	214	$1,755,130
2	50	7	63	166	173	$ 872,916	285	$1,749,124
3	58	13	95	191	204	$ 1,038,556	356	$1,922,200
4	66	13	126	216	229	$ 999,107	421	$1,890,186
5	69	13	158	241	254	$ 1,053,077	481	$1,901,123
6	72	13	189	241	254	$ 367,439	515	$1,219,952
7	75	13	221	241	254	$ 386,189	549	$1,243,169
8	77	13	252	241	254	$ 386,189	583	$1,247,635
9	80	13	284	241	254	$ 386,189	618	$1,252,102
10	83	13	315	241	254	$ 386,189	652	$1,256,569
11	83	13	315	241	254	$ 386,189	652	$442,732
12	83	13	315	241	254	$ 386,189	652	$442,732
13	83	13	315	241	254	$ 386,189	652	$442,732
14	83	13	315	241	254	$ 386,189	652	$442,732
15	83	13	315	241	254	$ 386,189	652	$442,732
16	83	13	315	241	254	$ 386,189	652	$442,732
17	83	13	315	241	254	$ 386,189	652	$442,732
18	83	13	315	241	254	$ 386,189	652	$442,732
19	83	13	315	241	254	$ 386,189	652	$442,732
20	83	13	315	241	254	$ 386,189	652	$442,732
21	83	13	315	241	254	$ 386,189	652	$442,732
22	83	13	315	241	254	$ 386,189	652	$442,732
23	83	13	315	241	254	$ 386,189	652	$442,732
24	83	13	315	241	254	$ 386,189	652	$442,732
25	83	13	315	241	254	$ 386,189	652	$442,732
26	83	13	315	241	254	$ 386,189	652	$442,732
27	83	13	315	241	254	$ 386,189	652	$442,732
28	83	13	315	241	254	$ 386,189	652	$442,732
29	83	13	315	241	254	$ 386,189	652	$442,732
30	83	13	315	241	254	$ 386,189	652	$442,732
TOTALS								
30yr Total	2,331	371	8,033	6,980	7,351	$ 14,432,983	17,714	$ 24,291,835
+ 30% Contingency cost						$ 18,762,878		$ 31,579,386
30yr Total (Disc.7%)	901	143	2,791	2,772	2,915	$ 7,098,380	6,607	$ 13,552,014
30yr Unit cost (Disc. 7%)					$/kL	$ 2.43	$/kL	$ 2.05
10yr Total	671	111	1,733	2,160	2,271	$ 6,709,207	4,674	$ 15,437,190
+ 30% Contingency cost						$ 8,721,969		$ 20,068,347
10yr Total (Disc. 7%)	454	73	1,094	1,474	1,547	$ 5,018,576	3,096	$ 11,167,697
10yr Unit cost (Disc. 7%)					$/kL	$ 3.24	$/kL	$ 3.61

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Appendices

Appendix A : City of Holdfast Bay Water Usage 2016/17

Appendix B : Living Stream Benefits

Appendix C : Rainwater Tank Harvesting Analysis

Appendix D : Additional Stormwater Reuse Options

Appendix E : Options Assessment

Appendix A : City of Holdfast Bay Water Usage 2016/17

Council major mains water users for 2016/17 financial year are summarised in Table 11.The spatial distribution of Council water usage is shown in Figure x which includes Council mains and recycled water usage for 2016/17.

It should be noted that the mains water usage for Angus Neil Reserve was high at 6.9 ML/year at a cost of $23,000 (2016/17 SA Water usage data). A typical demand for a 1 ha reserve in the area is 3.7ML/year at a cost of $13,000 per year (e.g. Susan Grace Reserve). The higher usage may be explained by a need for larger total irrigation volumes to maintain the high amenity of Angus Neil Reserve, a mains supply leak, or excessive use of amenities (e.g. toilet flushing). It is recommended the source of the additional demand should be investigated further.

TABLE 22 COUNCIL MAJOR MAINS WATER USERS 2016/17

Major User	Consumption (ML/year)	Cost ($/year)
Kingston Park Caravan Park	9.6	$ 38,982
Angus Neill Reserve	6.9	$ 23,032
Fordham Reserve	5.4	$ 17,586
Susan Grace Benny Reserve	3.6	$ 12,241
Seacliff Sports Club	3.4	$ 11,718
Partridge House	2.7	$ 10,234
Kingston House Lawns	2.8	$ 9,480
Moseley Square Reserve	2.6	$ 8,976
Total (Major users)	**36.9**	**$ 149,836**
Total (All users)	**68.6**	**$ 337,276**

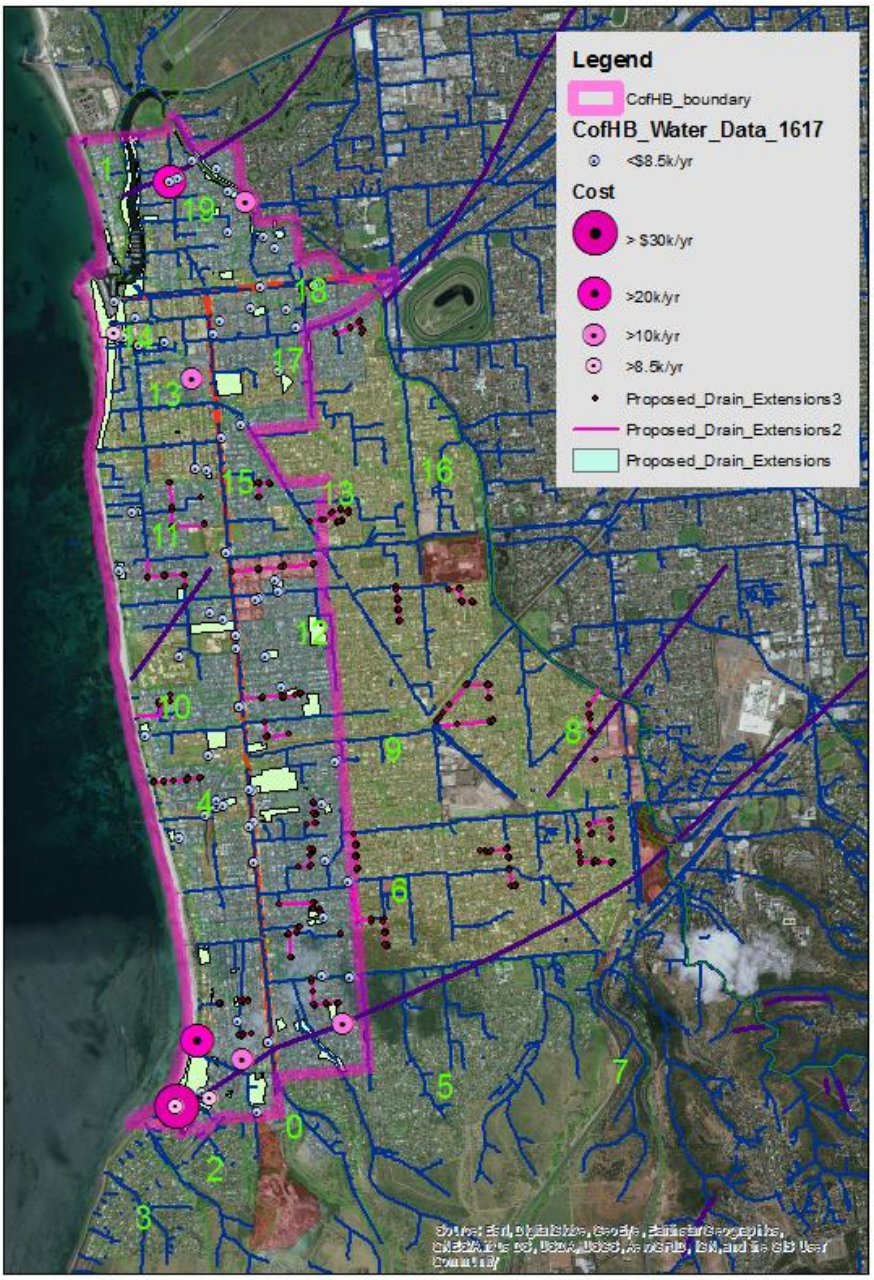


FIGURE 16 COUNCIL EXISING WATER USE MAP

Appendix B : Living Stream Benefits

The CRC for Water Sensitive Cities has reported on the value of restoring urban drains to living streams, which could be applicable to restoration efforts for Gilbertson Gully in the CofHB.

The study was of the amenity benefits of the Bannister Creek living steam project in the suburb of Lynwood in Perth, Western Australia provides evidence that there is a positive net effect on house prices in the neighbourhood of the living stream. Benefits include improving water quality in the catchment, slowing flow such that velocity in high flow events was acceptable for public safety, improving local amenity

The potential impact of the restoration was estimated within 200m of the project, which is approximately halfway between the restoration site and other local public open space. Modelling took into account the effect of general price inflation, the overall trend change in the price of homes in the area, and the unique attributes of the individual homes.

The restoration was completed over the period 2000-2002 and involved work on a 320m section of the main drain. Restoration work involved giving the creek a more natural shape with meanders, riffles (rocky, shallow areas), gentle sloping banks and planting fringing vegetation. Substantial earthworks were undertaken to reshape the existing steep banks and erosion control matting was used to stabilise the stream banks.

The median home within 200m of the restoration site **increased in value by $17,000 to $26,000** above the trend increase in house values in the area. This gain more than offsets the initial outlay of the restoration project and early project disturbances to surrounding residents.

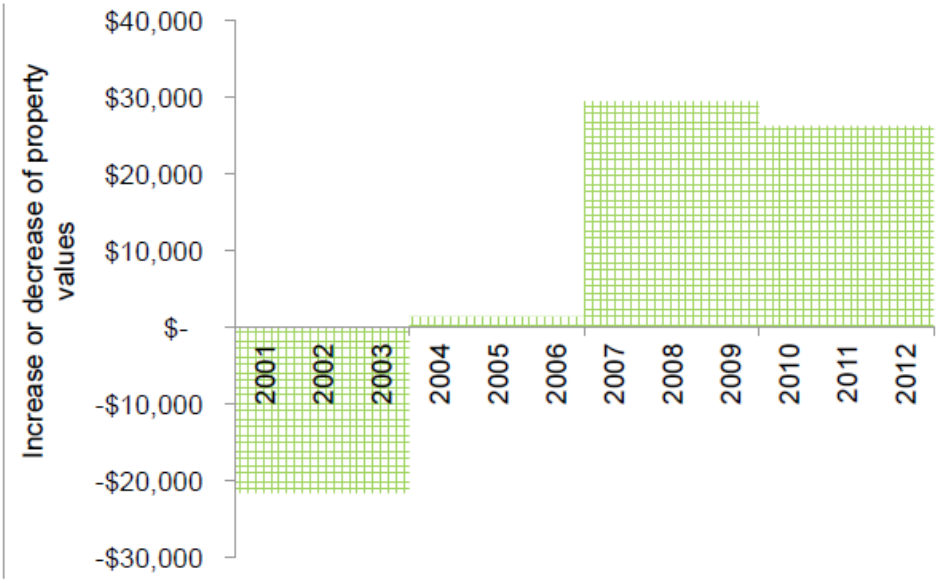


FIGURE 17 IMPACT OF BANNISTER CREEK LIVING STREAM ON THE VALUE OF A MEDIAN RESIDENTIAL PROPERTY WITHIN 200M OF THE PROJECT SITE (SOURCE: CRC WSC, 2015)

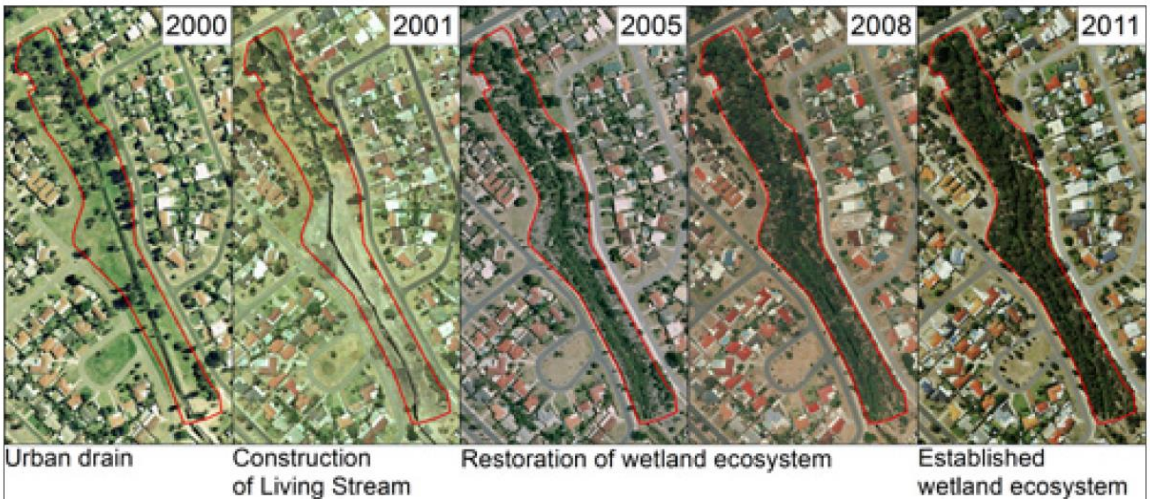


FIGURE 18 EVOLUTION OF BANNISTER CREEK LIVING STREAM PROJECT FROM 2001 TO 2011 (SOURCE: CRC WSC 2015)

Appendix C : Rainwater Tank Harvesting Analysis

TABLE 23 RAINWATER TANK HARVESTING PERFORMANCE FOR 100 SQM ROOF CONNECTED TO TANK

Location upon which rainfall based:	Adelaide					Adelaide					Adelaide					Adelaide					Adelaide				
Years of rainfall data modeled:	10					10					10					10					10				
Tank capacity:	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500
Roof area m2:	100					100					100					100					100				
%age of roof connected to rainwater tank:	100.00%					100.00%					100.00%					100.00%					100.00%				
Number of occupiers:	3					3					3					3					3				
	Option 1:					Option 2:					Option 3:					Option 4:					Option 5:				
Consumption per day:	**Max internal use (conventional use)**					**"retrofit1: HWS, WC & laundry"**					**"retrofit2:HWS, WC & laundry"**					**Low grade uses**					**Full use (in & out)**				
	[11L single flush toilet, 100% laundry needs - front load & HWS]					(6/3L) Dual flush toilet, AAA-rated shower head, 100% laundry & HWS					(6/3L) Dual flush toilet, AAA-rated shower head, front load WM & HWS					Toilet flushing and laundry use only (water conserving)					**Maximum potential for all uses**				
Internal water use L/day (RWT):	364.5					251.27					195.91					95.71					364.5				
Average external water use L/day:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	405.15	405.15	405.15	405.15	405.15
Average rainfall from data (mm):	583.00					583.00					583.00					583.00					583.00				
Average ANNUAL harvest into tank (KL):	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56	49.56
Ave overflow from tank (per occasion) L:	652.00	674.00	1011.00	0.00	0.00	590.00	601.00	627.00	0.00	0.00	581.00	573.00	570.00	500.00	264.00	531.00	518.00	505.00	489.00	492.00	668.00	739.00	877.00	0.00	0.00
Number of overflows / year:	20.10	8.50	0.60	0.00	0.00	26.20	13.40	3.20	0.00	0.00	30.20	18.70	7.80	3.40	0.80	48.30	42.90	36.20	30.30	27.90	14.90	4.70	0.20	0.00	0.00
Average annual yield (demand met by harvested roof run-off) (KL):	36.45	43.83	48.95	49.56	49.56	34.09	41.50	47.55	49.56	49.56	32.01	38.84	45.11	47.47	48.62	23.88	27.28	30.91	33.96	34.62	39.60	46.08	49.38	49.56	49.56
Average draw upon mains water / annum to meet deficit in tank connection (KL):	127.94	120.55	115.44	114.83	114.83	82.78	75.37	69.32	67.32	67.32	64.64	57.80	51.54	49.17	48.03	11.08	7.68	4.05	1.00	0.34	272.78	266.30	263.01	262.83	262.83
Daily demand on tank met as percentage of average daily demand on tank:	19.03 %	25.68 %	30.30 %	30.82 %	30.82 %	30.06 %	39.53 %	47.08 %	49.74 %	49.74 %	39.20 %	50.26 %	60.31 %	63.92 %	65.64 %	65.43 %	76.49 %	87.43 %	96.63 %	98.85 %	5.97%	8.24%	9.61%	9.66%	9.66%
Reduction in overflows to street (as % of runoff from the effective roof area connected to tank storage)	73.55 %	88.44 %	98.78 %	100.00 %	100.00 %	68.78 %	83.74 %	95.95 %	100.00 %	100.00 %	64.59 %	78.38 %	91.03 %	96.57 %	99.57 %	48.20 %	55.20 %	63.12 %	70.09 %	72.33 %	79.92 %	93.00 %	99.65 %	100.00 %	100.00%
Ave. no. days / year in which the tank met FULL daily demand	69.50	93.80	110.70	112.60	112.60	109.80	144.40	172.00	181.70	181.70	143.20	183.60	220.30	233.50	239.80	239.00	279.40	319.40	353.00	361.10	21.80	30.10	35.10	35.30	35.30

TABLE 24 RAINWATER TANK HARVESTING PERFORMANCE FOR 150 SQM ROOF CONNECTED TO TANK

Location upon which rainfall based:	Adelaide					Adelaide					Adelaide					Adelaide					Adelaide				
Years of rainfall data modeled:	10					10					10					10					10				
Tank capacity:	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500
Roof area m2:	150					150					150					150					150				
%age of roof connected to rainwater tank:	100.00%					100.00%					100.00%					100.00%					100.00%				
Number of occupiers:	3					3					3					3					3				
	Option 1:					Option 2:					Option 3:					Option 4:					Option 5:				
Consumption per day:	**Max internal use (conventional use)**					**"retrofit1: HWS, WC & laundry"**					**"retrofit2:HWS, WC & laundry"**					**Low grade uses**					**Full use (in & out)**				
	[11L single flush toilet, 100% laundry needs - front load & HWS]					(6/3L) Dual flush toilet, AAA-rated shower head, 100% laundry & HWS					(6/3L) Dual flush toilet, AAA-rated shower head, front load WM & HWS					Toilet flushing and laundry use only (water conserving)					**Maximum potential for all uses**				
Internal water use L/day (RWT):	364.5					251.27					195.91					95.71					364.5				
Average external water use L/day:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	405.15	405.15	405.15	405.15	405.15
Average rainfall from data (mm):	583.00					583.00					583.00					583.00					583.00				
Average ANNUAL harvest into tank (KL):	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33	74.33
Ave overflow from tank (per occasion) L:	895.00	910.00	939.00	774.00	0.00	867.00	877.00	877.00	849.00	832.00	856.00	827.00	792.00	773.00	723.00	769.00	748.00	734.00	742.00	739.00	963.00	1060.00	941.00	1246.00	0.00
Number of overflows / year:	34.10	20.80	6.80	2.70	0.00	39.70	28.00	16.30	11.30	7.20	44.00	35.60	27.20	22.10	17.70	63.30	59.80	55.30	52.00	51.60	25.60	11.60	2.20	0.10	0.00
Average annual yield (demand met by harvested roof run-off) (KL):	43.81	55.41	67.95	72.24	74.33	39.91	49.79	59.98	64.40	67.55	36.68	44.87	52.57	56.64	60.47	25.68	29.54	33.38	34.96	34.96	49.68	62.04	72.26	74.21	74.33
Average draw upon mains water / annum to meet deficit in tank connection (KL):	120.58	108.97	96.43	92.14	90.05	76.96	67.08	56.90	52.47	49.32	59.97	51.77	44.08	40.01	36.18	9.29	5.42	1.58	0.00	0.00	262.71	250.35	240.12	238.18	238.05
Daily demand on tank met as percentage of average daily demand on tank:	24.99%	35.45%	46.29%	50.07%	51.90%	36.96%	49.93%	62.91%	68.25%	71.89%	46.67%	59.57%	71.53%	77.69%	83.33%	71.06%	83.30%	95.10%	100.00%	100.00%	9.25%	13.66%	17.74%	18.64%	18.72%
Reduction in overflows to street (as % of runoff from the effective roof area connected to tank storage)	58.94%	74.55%	91.41%	97.19%	100.00%	53.69%	66.98%	80.77%	87.09%	91.94%	49.35%	60.37%	71.02%	77.03%	82.80%	34.54%	39.84%	45.41%	48.08%	48.68%	66.83%	83.46%	97.22%	99.83%	100.00%
Ave. no. days / year in which the tank met FULL daily demand	91.30	129.50	169.10	182.90	189.60	135.00	182.40	229.80	249.30	262.60	170.50	217.60	261.30	283.80	304.40	259.60	304.30	347.40	365.30	365.30	33.80	49.90	64.80	68.10	68.40

TABLE 25 RAINWATER TANK HARVESTING PERFORMANCE FOR 200 SQM ROOF CONNECTED TO TANK

Location upon which rainfall based:	Adelaide					Adelaide					Adelaide					Adelaide					Adelaide				
Years of rainfall data modeled:	10					10					10					10					10				
Tank capacity:	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500	1000	2000	5000	9000	13500
Roof area m2:	200					200					200					200					200				
%age of roof connected to rainwater tank:	100.00%					100.00%					100.00%					100.00%					100.00%				
Number of occupiers:	3					3					3					3					3				
	Option 1:					Option 2:					Option 3:					Option 4:					Option 5:				
Consumption per day:	**Max internal use (conventional use)**					**"retrofit1: HWS, WC & laundry"**					**"retrofit2:HWS, WC & laundry"**					**Low grade uses**					**Full use (in & out)**				
	[11L single flush toilet, 100% laundry needs - front load & HWS]					(6/3L) Dual flush toilet, AAA-rated shower head, 100% laundry & HWS					(6/3L) Dual flush toilet, AAA-rated shower head, front load WM & HWS					Toilet flushing and laundry use only (water conserving)					**Maximum potential for all uses**				
Internal water use L/day (RWT):	364.5					251.27					195.91					95.71					364.5				
Average external water use L/day:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	0.00	405.15	405.15	405.15	405.15	405.15
Average rainfall from data (mm):	583.00					583.00					583.00					583.00					583.00				
Average ANNUAL harvest into tank (KL):	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11	99.11
Ave overflow from tank (per occasion) L:	1167.00	1159.00	1112.00	1162.00	1069.00	1140.00	1100.00	1046.00	1014.00	981.00	1088.00	1069.00	1034.00	1019.00	993.00	978.00	970.00	951.00	954.00	958.00	1252.00	1322.00	1440.00	1806.00	622.00
Number of overflows / year:	43.20	31.40	17.90	10.70	7.70	48.80	40.50	31.40	26.90	23.20	54.90	47.50	40.30	36.00	32.50	74.10	70.30	67.70	66.40	65.70	33.90	19.40	4.90	0.90	0.20
Average annual yield (demand met by harvested roof run-off) (KL):	48.68	62.72	79.20	86.64	90.42	43.47	54.56	66.12	71.29	75.35	39.39	48.34	57.20	61.79	65.74	26.63	30.81	34.34	34.96	34.96	56.66	73.45	92.05	97.49	98.99
Average draw upon mains water / annum to meet deficit in tank connection (KL):	115.70	101.67	85.18	77.75	73.96	73.40	62.31	50.75	45.58	41.52	57.26	48.31	39.45	34.86	30.90	8.33	4.15	0.62	0.00	0.00	255.73	238.93	220.33	214.90	213.40
Daily demand on tank met as percentage of average daily demand on tank:	28.88%	41.88%	56.17%	62.61%	65.70%	41.03%	55.43%	69.89%	76.16%	80.78%	50.97%	64.82%	78.46%	85.33%	91.02%	73.86%	87.19%	98.08%	100.00%	100.00%	11.72%	17.85%	25.65%	28.03%	28.72%
Reduction in overflows to street (as % of runoff from the effective roof area connected to tank storage)	49.12%	63.28%	79.91%	87.45%	91.69%	43.86%	55.05%	66.87%	72.49%	77.05%	39.74%	48.77%	57.95%	62.99%	67.43%	26.87%	31.17%	35.03%	36.06%	36.51%	57.17%	74.11%	92.88%	98.36%	99.87%
Ave. no. days / year in which the tank met FULL daily demand	105.50	153.00	205.20	228.70	240.00	149.90	202.50	255.30	278.20	295.10	186.20	236.80	286.60	311.70	332.50	269.80	318.50	358.30	365.30	365.30	42.80	65.20	93.70	102.40	104.90

Note: Shaded values represent scenario used in Rainwater tank subsidy scheme in this study.

Appendix D : Additional Stormwater Reuse Options

D.1 Connect Oaklands Park to recycled water scheme

City of Marion operates a managed aquifer recharge and recovery scheme through the Oaklands Wetland, at Oakland Road, Oaklands. City of Marion have previously estimated the cost of extending the Oaklands scheme to supply the nearest Council reserve (Bowker Oval) at approximately $252,000 (1200m @ $210 per linear metre) for supply main, plus $15,000 for headworks (person. Comm. G Ricketts, City of Marion, 2018).

There is no SA Water mains water usage recorded for Bowker Oval, and it is assumed the reserve currently uses between 6-12 ML/year of groundwater for irrigation. Based on current usage, extension of the Oaklands Park scheme to supply Bowker Oval with harvested water is unlikely to be cost competitive with current groundwater use. However, future groundwater degradation will increase into the future, and the Oaklands scheme could provide an alternative to groundwater use.

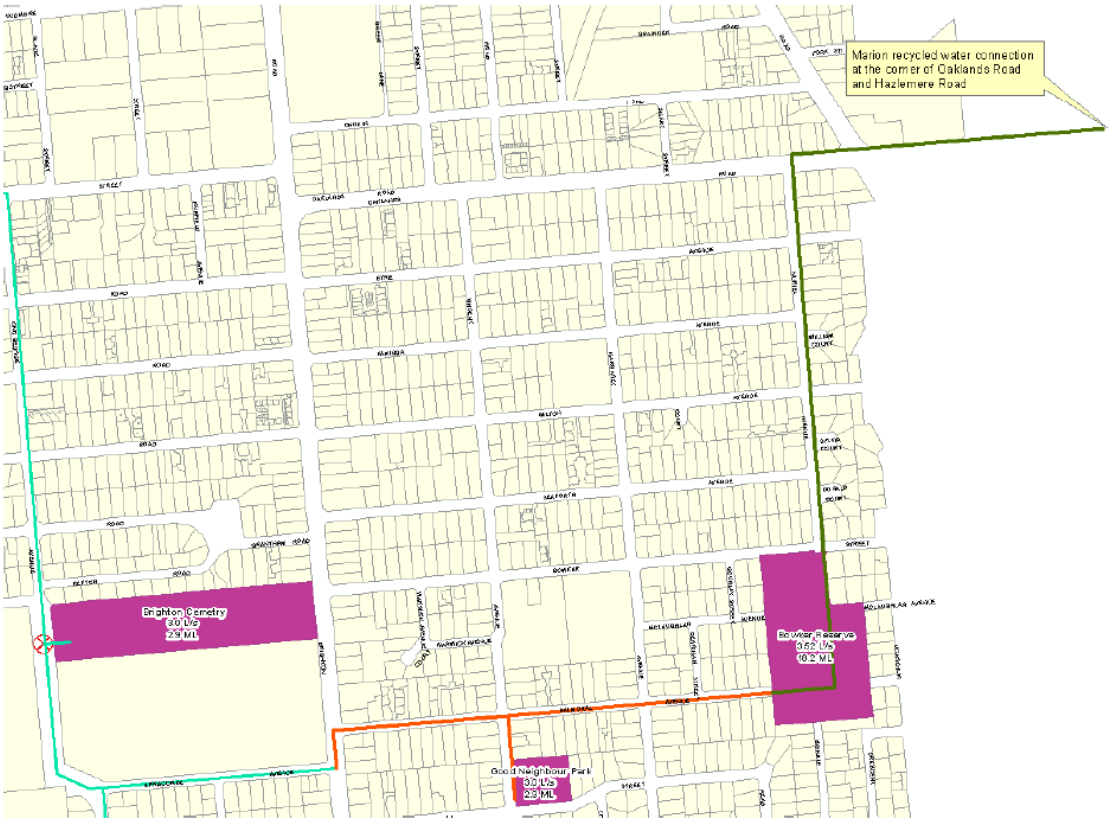


FIGURE 19 POTENTIAL CONNECTION TO MARION RECYCLED WATER SCHEME (SOURCE: W&G, 2014)D

D.2 MAR injection of runoff harvested in Oaklands Park schemes

Part of the cost of extending the Oaklands MAR scheme could be met by laying a transmission line into the City of Holdfast Bay area to take advantage of the unique sub-surface storage available. Storage within aquifers under City of Holdfast Bay could be an alternative to those within City of Marion. The CoM has already invested in several 150 m deep wells along the train line of up to 10 L/s for town water supply to the Marion Golf Club and these could be incorporated into the expanded scheme. Increasing the harvested stormwater volume would reduce the surface water flows and minimise operational limits due to artesian pressures experienced in the Oaklands Park

scheme to the east of the Brighton Fault. A further advantage to this concept is that such a pipeline would terminate proximally to the currently unused treated effluent pipeline from the Glenelg Waste Water Treatment Plant (WWTP). The WWTP supplies Class A treated effluent to the Adelaide Parklands and may increase the quality and security of alternative water supply from linking pipeline networks. While some contractual negotiations would be required, this would minimise the capital expenditure of CoHB while maximising stormwater capture and water security.

D.3 Blending GAP recycled water with harvested water injected in CofHB aquifers

Blending treated effluent with stormwater and groundwater recovered from a MAR scheme provides increased water security and flexibility in water quality and pricing.

D.4 Connect to Morphettville Racecourse scheme

The Morphettville Racecourse stormwater harvesting scheme, utilises a wetland in the centre of the racecourse track constructed to treat up to 600 ML/y of stormwater to reduce nutrient and sediment loads in the Sturt River. Treated stormwater from the wetland is directed to a two-well MAR scheme that was designed to harvest up to 350 ML/y. Excess treated water from the wetland is directed back into the catchment (DEWNR, 2017). The scheme could be connected by approximately 1500m of pipeline to Da Costa Reserve end of the proposed Holdfast Bay Recycled Water scheme at a cost of approximately $330,000 (1550m @ $210/m, plus $15,000 headworks).

The Council reserve areas near the Morphettville Racecourse, are currently serviced by GAP recycled water. As such extension of the Morphettville Racecourse scheme to service these reserves is unlikely to be sustainable for Council use based on the alternative water sources already used. However, if an additional source of stormwater demand becomes available (e.g. Adelaide Desalination Plant) this could become economical.

Appendix E : Options Assessment

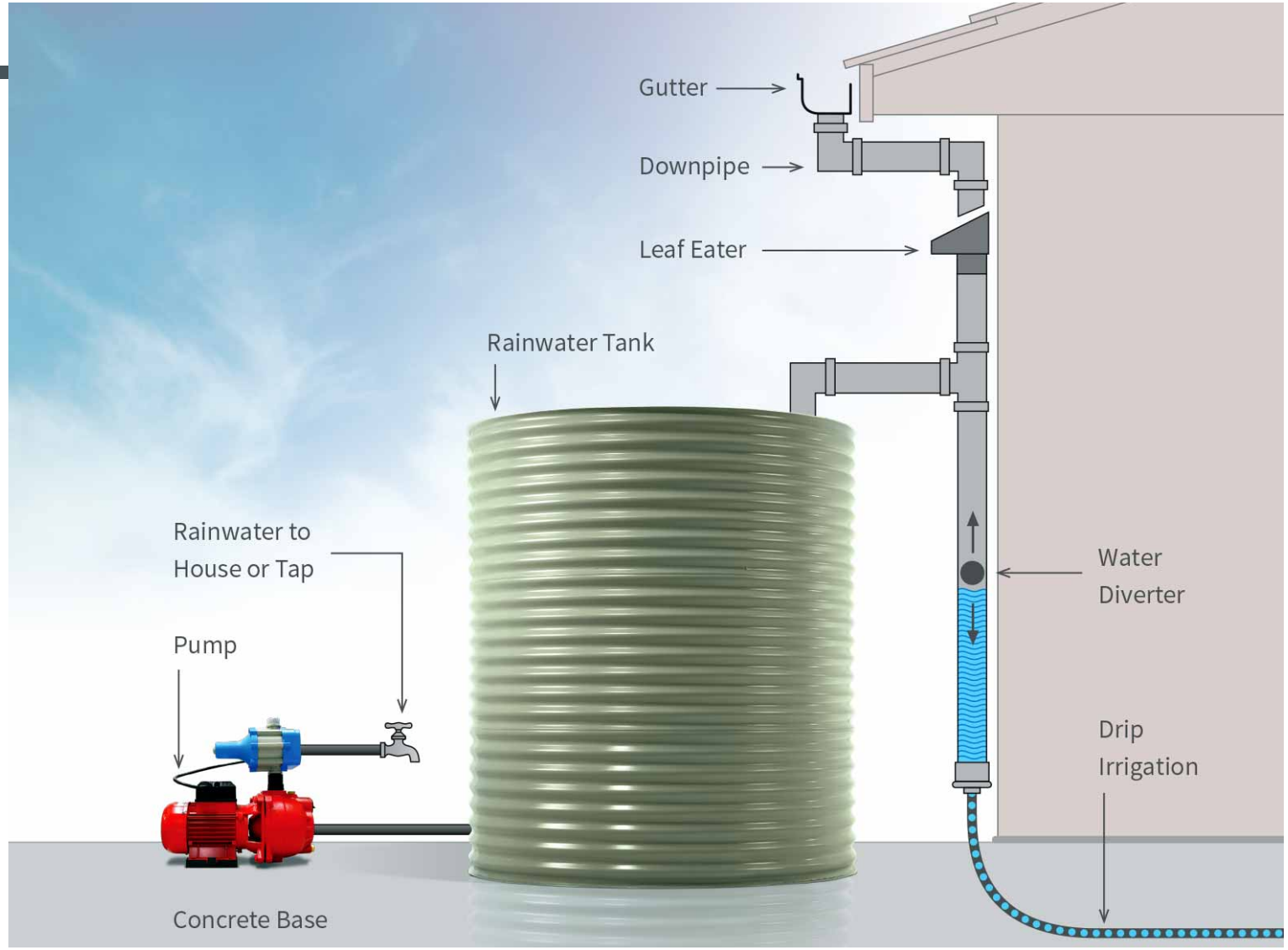
Data	Passive irrigation				Permeable outfall pipes				Pine Gully				Gilbertson Gully				Minda homes			
	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX
Cost data ($)			$825,970				$237,500				$189,750				$186,837				$1,080,000	
Cost data (year)			2016				2018				2011				2018				2014	
Revised cost (2018$)			$893,369	5%			$237,500	5%			$249,698	5%			$186,837	5%			$1,263,447	5%
Annual reduction (ML)		28.00				55.00				1.60				13.00		$20,000		50.00		
YEAR																				
1	10%	2.80	$89,337	$4,467	25%	38.50	$95,000	$2,969	100%	1.6	$249,698	$12,485	0%	0	$0	$0	0%	0	$0	$0
2	20%	5.60	$89,337	$8,934	50%	44.00	$47,500	$5,938	100%	1.6	$0	$12,485	50%	6.5	$93,419	$4,671	0%	0	$0	$0
3	30%	8.40	$89,337	$13,401	75%	49.50	$47,500	$8,906	100%	1.6	$0	$12,485	100%	13	$93,419	$29,341.85	50%	0	$631,723.62	$31,586.18
4	40%	11.20	$89,337	$17,867	100%	55.00	$47,500	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$631,723.62	$63,172.36
5	50%	14.00	$89,337	$22,334	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
6	60%	16.80	$89,337	$26,801	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
7	70%	19.60	$89,337	$31,268	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
8	80%	22.40	$89,337	$35,735	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
9	90%	25.20	$89,337	$40,202	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
10	100%	28.00	$89,337	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
11	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
12	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
13	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
14	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
15	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
16	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
17	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
18	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
19	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
20	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
21	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
22	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
23	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
24	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
25	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
26	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
27	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
28	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
29	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
30	100%	28.00	$0	$44,668	100%	55.00	$0	$11,875	100%	1.6	$0	$12,485	100%	13	$0	$29,341.85	100%	50.00	$0.00	$63,172.36
TOTALS																				
30yr Total		714	$ 893,369	$ 1,139,046		1,617	$ 237,500	$ 338,438		48	$ 249,698	$ 374,547		371	$ 186,837	$ 826,243		1,350	$ 1,263,447	$ 1,737,240
30yr Total (Disc.7%)		248	$ 627,465	$ 395,735		653	$ 205,285	$ 131,424		20	$ 233,363	$ 154,926		143	$ 157,853	$ 315,133		489	$ 997,614	$ 643,908
+ 30% Contingency cost			$ 815,705	$ 514,455			$ 266,871	$ 170,852			$ 303,371	$ 201,403			$ 205,208	$ 409,673			$ 1,296,898	$ 837,080
30yr Unit cost (Disc. 7%)			Total $/kL	$ 5.36			Total $/kL	$ 0.67			Total $/kL	$ 25.42			Total $/kL	$ 4.29			Total $/kL	$ 4.36
10yr Total		154	$ 893,369	$ 245,677		517	$ 237,500	$ 100,938		16	$ 249,698	$ 124,849		111	$ 186,837	$ 239,406		350	$ 1,263,447	$ 473,793
10yr Total (Disc. 7%)		97	$ 627,465	$ 155,174		357	$ 205,285	$ 67,472		11	$ 233,363	$ 87,689		73	$ 157,853	$ 157,114		220	$ 997,614	$ 303,696
+ 30% Contingency cost			$ 815,705	$ 201,727			$ 266,871	$ 87,714			$ 303,371	$ 113,995			$ 205,208	$ 204,248			$ 1,296,898	$ 394,804
10yr Unit cost (Disc. 7%)			Total $/kL	$ 10.46			Total $/kL	$ 0.99			Total $/kL	$ 37.14			Total $/kL	$ 5.57			Total $/kL	$ 7.69

FIGURE 20 OPTIONS ASSESSMENT (PART 1)

Data	Minda Homes (expansion)				Seacombe Road stormwater mining				Rainwater Tank Subsidy				Recycled Water Scheme Extension			
	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX	% completed	Annual flow reduction (ML)	CAPEX	OPEX
Cost data ($)			$1,400,000				$300,000				$6,900,000				$3,010,568	
Cost data (year)			2014				2018				2018				2014	
Revised cost (2018$)			$1,637,802	5%			$300,000	5%			$6,900,000	1%		116.00	$3,521,939	5%
Annual reduction (ML)		39.00				13.00				315.00				125.00	GAP Water Price	$ 0.75
YEAR																
1	0%	0	$0	$0	0%	0	$0	$0	10%	31.50	$690,000	$40,000	20%	141	$704,388	$128,969
2	0%	0	$0	$0	0%	0	$0	$0	20%	63.00	$690,000	$34,500	40%	166	$704,388	$70,439
3	0%	0	$0	$0	0%	0	$0	$0	30%	94.50	$690,000	$34,500	60%	191	$704,388	$211,408
4	0%	0	$0	$0	0%	0	$0	$0	40%	126.00	$690,000	$34,500	80%	216	$704,388	$265,378
5	0%	0	$0	$0	0%	0	$0	$0	50%	157.50	$690,000	$34,500	100%	241	$704,388	$319,347
6	50%	0	$818,901	$40,945	0%	0	$0	$0	60%	189.00	$690,000	$34,500	100%	241	$0	$338,097
7	100%	39.00	$818,901	$81,890	50%	6.5	$150,000	$7,500	70%	220.50	$690,000	$34,500	100%	241	$0	$356,847
8	100%	50.00	$0.00	$81,890.10	100%	13	$150,000	$15,000	80%	252.00	$690,000	$34,500	100%	241	$0	$356,847
9	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	90%	283.50	$690,000	$34,500	100%	241	$0	$356,847
10	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$690,000	$34,500	100%	241	$0	$356,847
11	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
12	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
13	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
14	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
15	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
16	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
17	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
18	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
19	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
20	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
21	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
22	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
23	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
24	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
25	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
26	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
27	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
28	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
29	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
30	100%	50.00	$0.00	$81,890.10	100%	13	$0	$15,000	100%	315.00	$0	$0	100%	241	$0	$356,847
TOTALS																
30yr Total		1,189	$ 1,637,802	$ 2,006,307		306	$ 300,000	$ 352,500		8,033	$ 6,900,000	$ 350,500		6,980	$ 3,521,939	$ 9,897,964
30yr Total (Disc.7%)		375	$ 1,055,639	$ 653,129		95	$ 180,714	$ 109,967		2,791	$ 4,846,271	$ 247,454		2,772	$ 2,888,129	$ 3,737,265
+ 30% Contingency cost			$ 1,372,330	$ 849,067			$ 234,928	$ 142,957			$ 6,300,153	$ 321,690			$ 3,754,567	$ 4,858,444
30yr Unit cost (Disc. 7%)			**Total $/kL**	$ 5.92			**Total $/kL**	$ 3.97			**Total $/kL**	$ 2.37			**Total $/kL**	$ 3.11
10yr Total		189	$ 1,637,802	$ 368,505		46	$ 300,000	$ 52,500		1,733	$ 6,900,000	$ 350,500		2,160	$ 3,521,939	$ 2,761,025
10yr Total (Disc. 7%)		106	$ 1,055,639	$ 212,113		25	$ 180,714	$ 29,185		1,094	$ 4,846,271	$ 247,454		1,474	$ 2,888,129	$ 1,815,480
+ 30% Contingency cost			$ 1,372,330	$ 275,747			$ 234,928	$ 37,941			$ 6,300,153	$ 321,690			$ 3,754,567	$ 2,360,124
10yr Unit cost (Disc. 7%)			**Total $/kL**	$ 15.55			**Total $/kL**	$ 10.79			**Total $/kL**	$ 6.05			**Total $/kL**	$ 4.15

FIGURE 21 OPTIONS ASSESSMENT (PART 2)

Rainwater Tanks Pilot Scheme



21EW0013466

Government
of South Australia

Office of the Minister for
Environment and Water
81-95 Waymouth Street
Adelaide SA 5000
GPO Box 1047
Adelaide SA 5001

Tel 08 8463 5680
minister.speirs@sa.gov.au

Mayor Kris Hanna
City of Marion
Email: council@marion.sa.gov.au

Dear Mayor Hanna

Re: *New life for our coastal environment* - WSUD project

As part of the Government of South Australia's *New life for our coastal environment* commitment, resources have been made available to invest in projects with local government to limit damaging stormwater run-off filled with sediment and pollutants from entering Gulf St Vincent.

I am delighted to announce that the City of Marion's joint project with the City of Holdfast Bay, *'Frederick Street catchment rainwater tanks'*, has been recommended for grant funding.

Grant funding of up to a total of $130,000 is available toward the infrastructure and on-ground delivery of this project. The Government expects that the Cities of Marion and Holdfast Bay will provide an equivalent contribution to ensure the successful delivery of this project.

Staff from the Department for Environment and Water will be in contact to negotiate co-contributions and grant agreements in the coming weeks.

I appreciate your support for these commitments and look forward to seeing the outcomes of these projects.

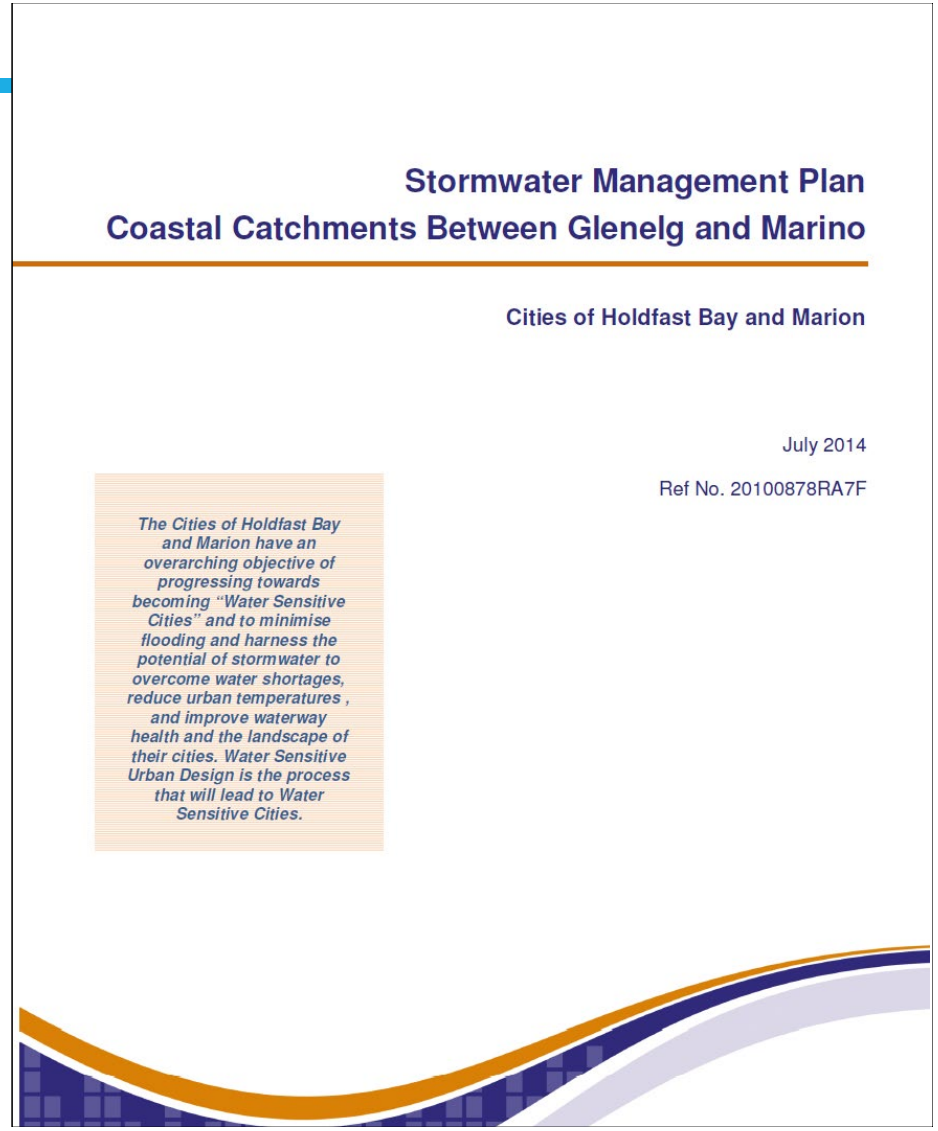
Yours sincerely

DAVID SPEIRS MP
Minister for Environment and Water

Date: 16/06/21

Joint SMP CoHB and CoM

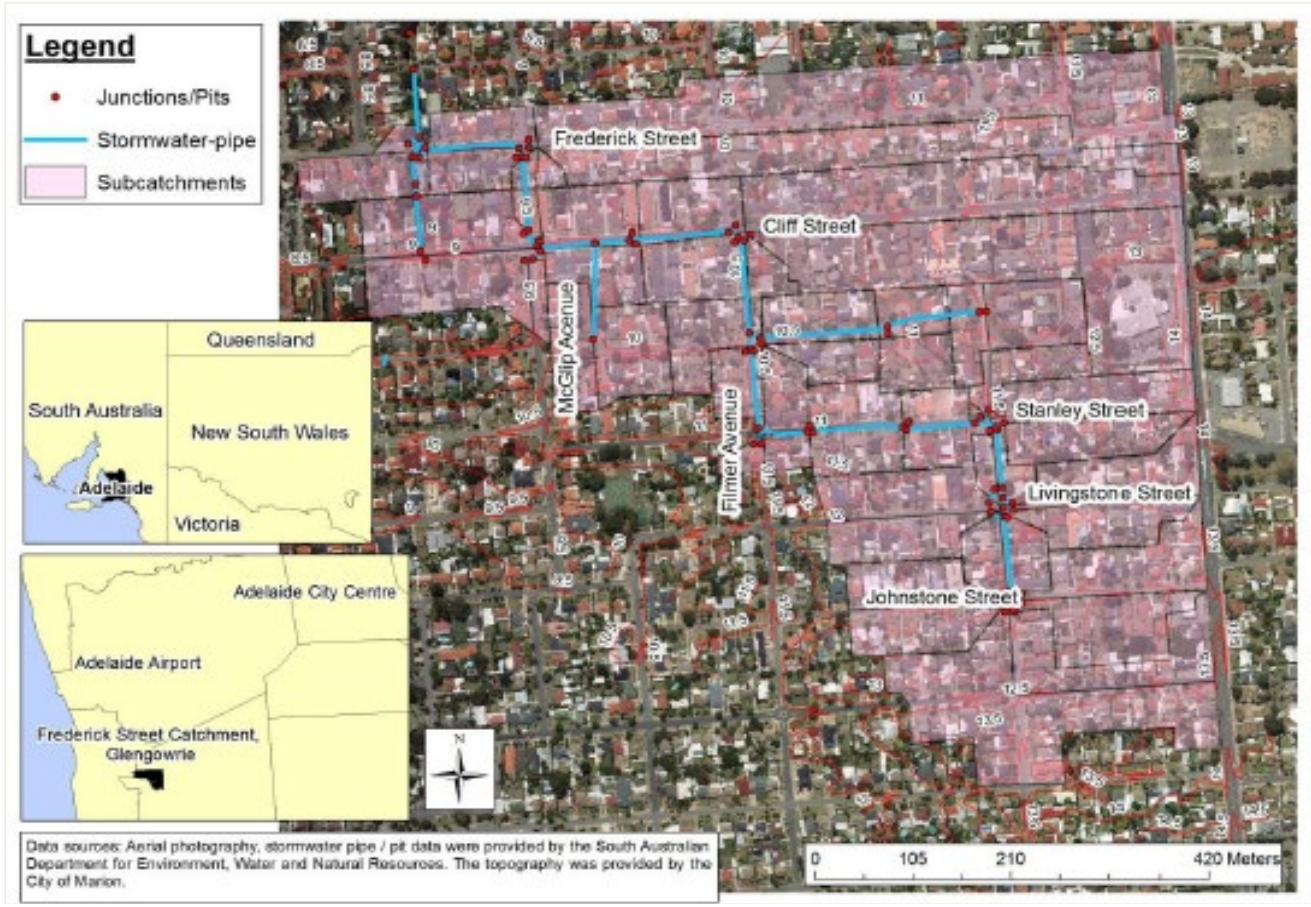
- ***Objective 3.2***
- Encourage on-site use of stormwater by rainwater tanks, detention and retention systems.

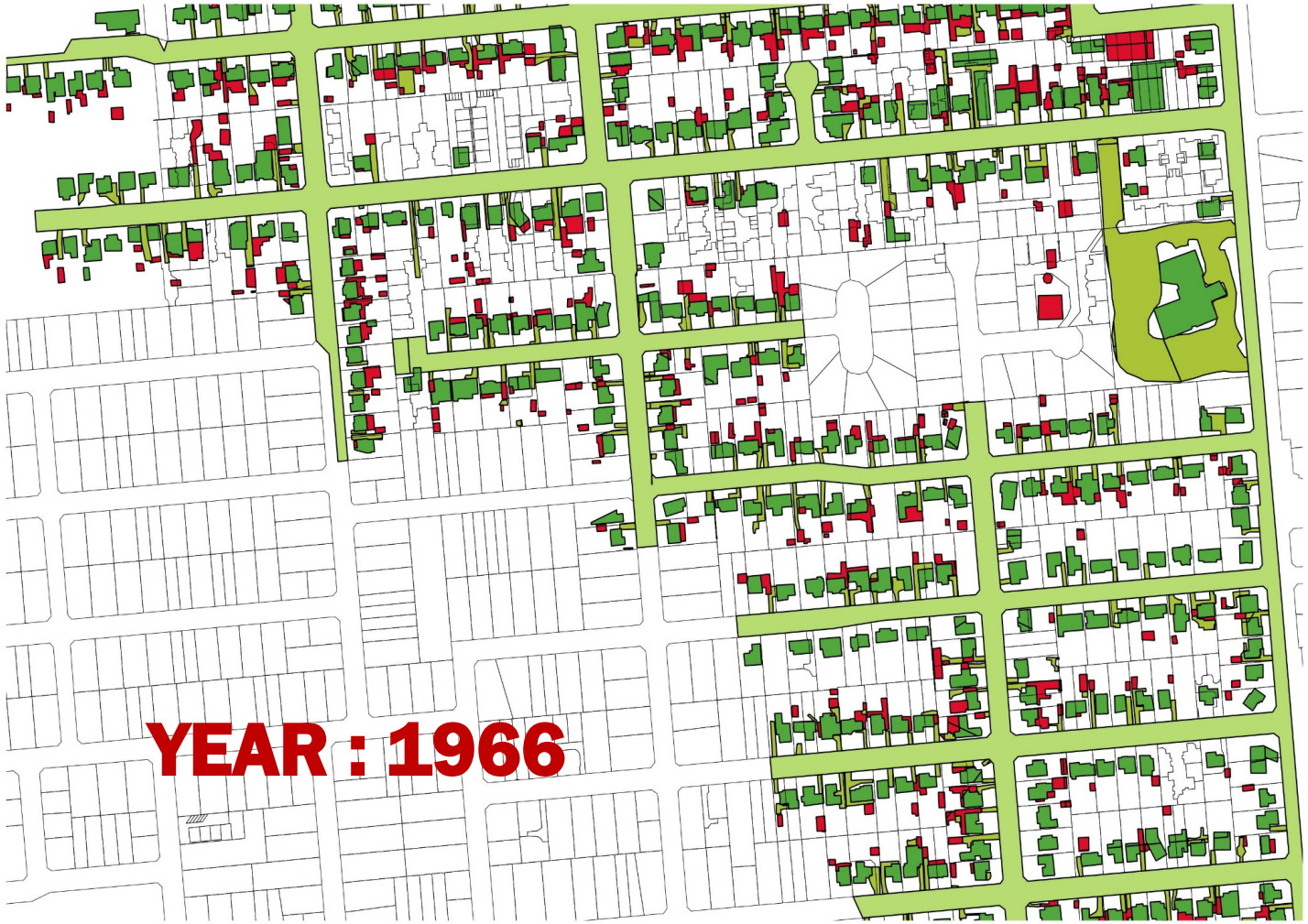


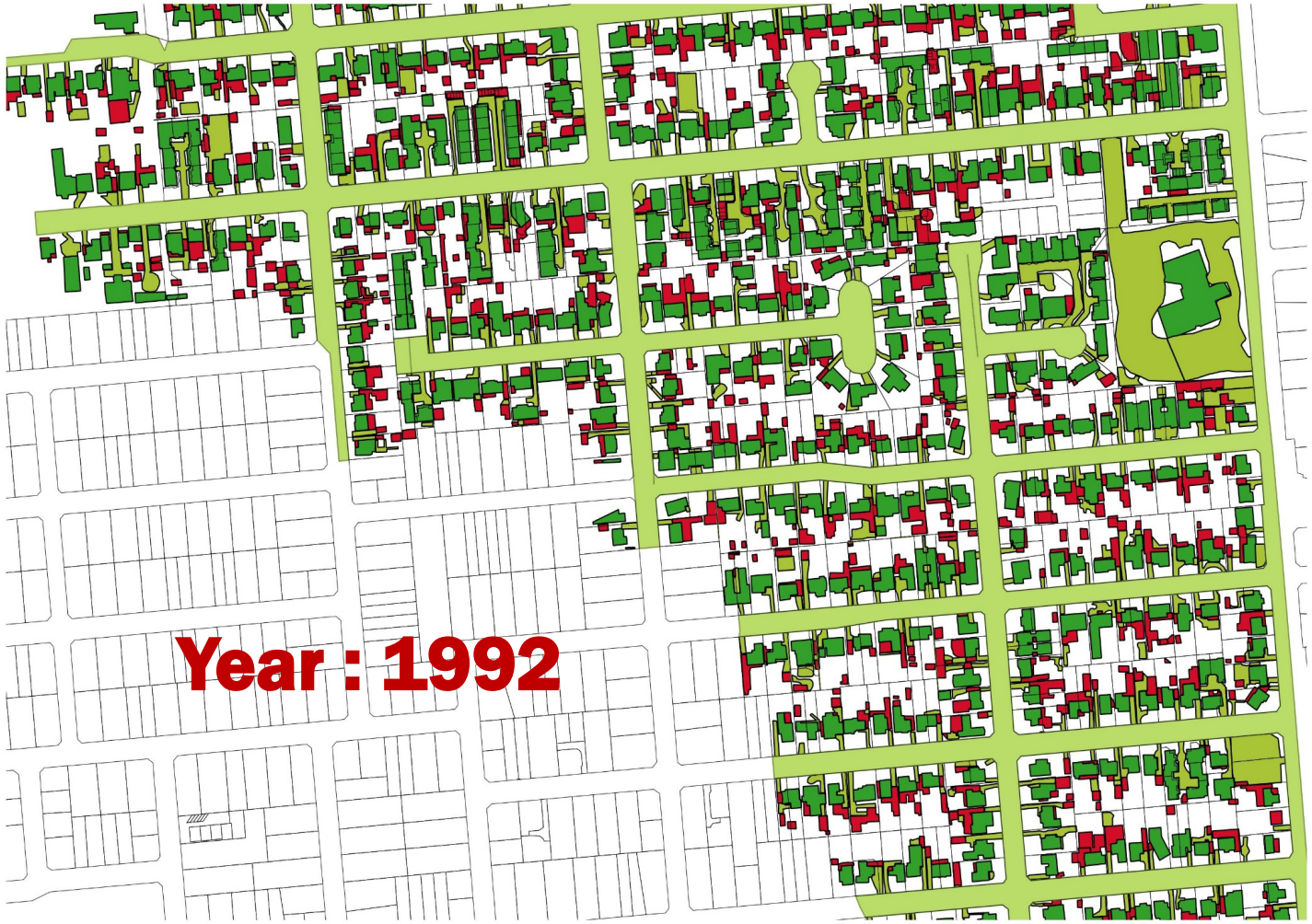
University of South Australia

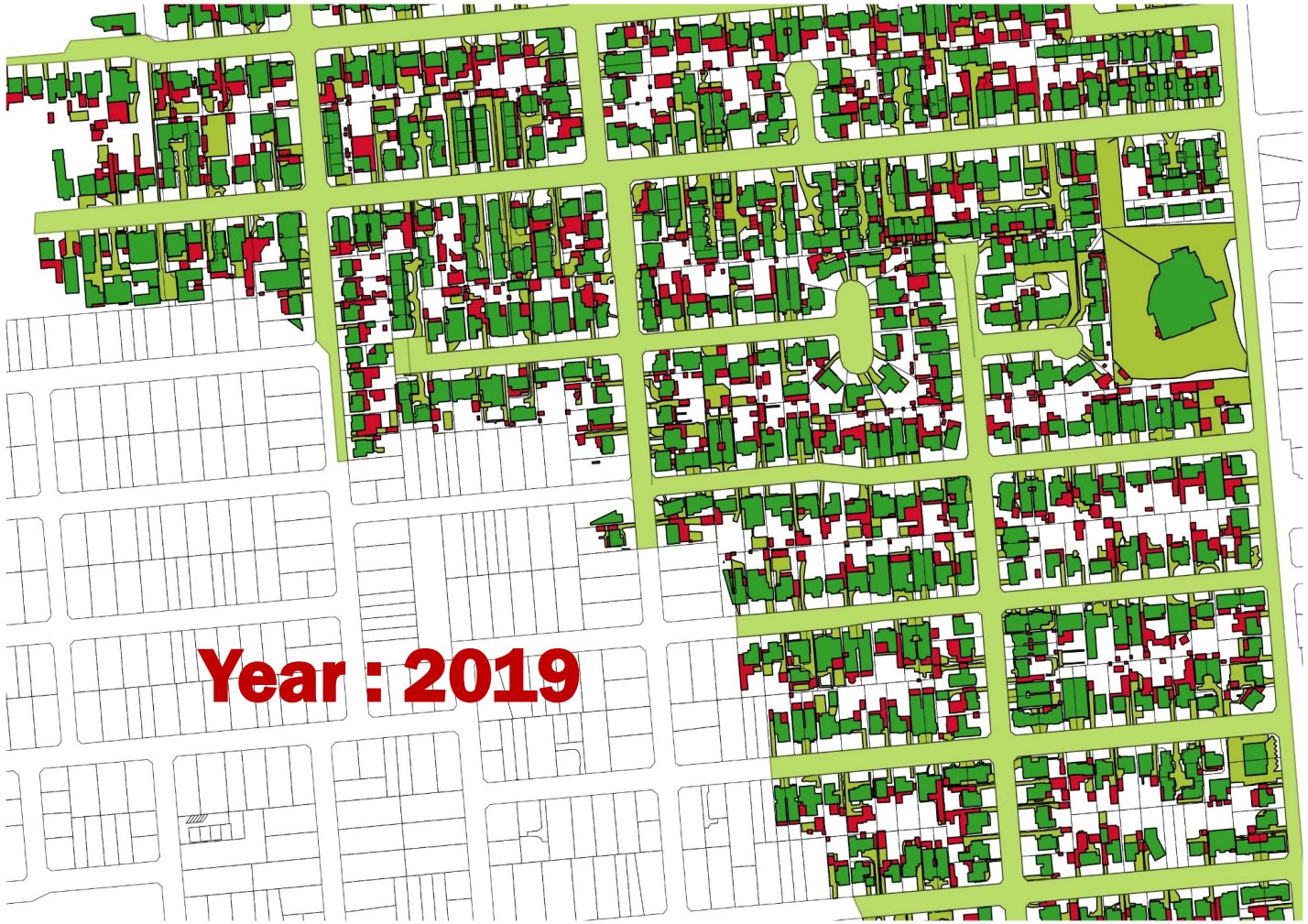
Frederick Street sub-catchment (Drain-18)

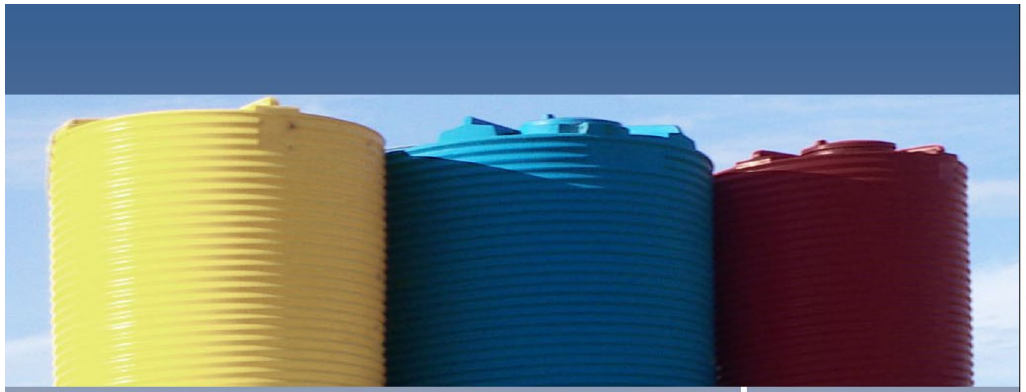
- 45 Ha Residential
- 0.5% grade
- **Rainfall data: July 1992 to present**
- **Flow data: August 2013 to present**




YEAR : 1966


Year : 1992


Year : 2019



The cost effectiveness of residential rainwater tanks in Perth

A report prepared for
Water Corporation and the Department of Water

April 2009

Marsden Jacob Associates

City of Holdfast Bay

Holdfast Bay MAR Opportunities Assessment

STORMWATER REDUCTION AND REUSE OPPORTUNITIES ASSESSMENT

April 2018

Project Team

Michael Di Matteo

Craig Flavel

Geoff Fisher

Luke McPhail

Water Technology Pty Ltd t/a
Australian Water Environments
ABN: 60 093 377 283
ACN: 093 377 283
1/198 Greenhill Road
Eastwood SA 5063
Telephone: 08 8378 8000
Fax: 08 8357 8988
www.austwaterenv.com.au

Australian WATER Environments

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Stage 2 - Final Report

Rainwater Tank Incentive Scheme Optimisation

City of Holdfast Bay and City of Marion

28 June 2019

Cost item	Frederick St	City of Marion	City of Holdfast Bay
Doorknocking	10,000	307,692	138,462
Administration	40,000	1,230,769	553,846
Monitoring and evaluation	106,600	0	0
Rebate - Tank + connection	36,800	2,173,040	995,440
Rebate - Connection only	66,600	4,014,000	1,839,600
Total	**260,000**	**7,725,501**	**3,527,348**

8.2 Transport Plan	
Report Reference	ASC210907R8.2
Originating Officer	Unit Manager Engineering – Carl Lundborg
Corporate Manager	Manager Engineering, Assets and Environment - Mathew Allen
General Manager	General Manager City Services - Tony Lines

REPORT OBJECTIVE

The purpose of this report is to provide a summary of the Draft Transport Plan community consultation feedback and to seek the Asset and Sustainability Committee's feedback before presenting the Draft Transport Plan to a General Council meeting for endorsement.

EXECUTIVE SUMMARY

The purpose of the City of Marion Transport Plan is to develop an overarching and consolidated approach towards the management of transport and its impact on the local community, businesses and the environment. The Plan outlines desired transport and movement outcomes for the city, and the strategies and actions to achieve these over the next five years 2021-26.

The Transport Plan is an action from the City of Marion Business Plan 2019-2023 (Action 19) and will contribute to the delivery of the outcomes of the City of Marion's community vision, in particular the themes of a livable, connected and a prosperous city.

Community consultation on the Draft Transport Plan commenced on 8 April until 30 April 2021. Making Marion engagement page was used to host information relating to the Draft Transport Plan and included a survey. The purpose of the survey was to determine the level of support for the plan, seek feedback and identify any issues/concerns.

Through the Community Consultation survey twenty three responses were submitted. Overall, people provided supportive feedback and comments on the Draft Transport Plan.

RECOMMENDATION

That the Asset and Sustainability Committee:

1. **Notes the Community Engagement Feedback Report (Attachment 1).**
2. **Provides feedback and supports the Draft Transport Plan being presented to a General Council meeting for endorsement (Attachment 3).**

DISCUSSION

A report was presented at an Elected Member Forum on 19 May 2020 to seek Elected Member feedback on draft principles, goals and proposed initial actions for the City Transport Plan (EMF200519R04).

The draft principles for a changing transport system were:

- Destination Centred
- Integrate and Effective
- Sustainable and Safe

- Smart and Future Focused
- Amenity and Character
- Partners and Collaboration

At the Asset and Sustainability Committee held on 2 February 2021 (ASC210202R02), the Draft Transport Plan report was presented to seek feedback from the committee in relation to the proposed action plan. Forty two actions were presented and nineteen of those actions that were identified as not included in other endorsed plans or strategies (or current ongoing projects) were discussed.

On 9 March 2021, Council endorsed the Draft Transport Plan to proceed to public consultation (GC210309R04). Council resolved that following the community consultation, a report of the feedback and a final Transport Plan to be considered for endorsement by Council in June 2021.

Community consultation on the Draft Transport Plan commenced on 8 April until 30 April 2021. Making Marion engagement page was used to host information relating to the Draft Transport Plan and included a survey. The purpose of the survey was to determine the level of support for the plan, seek feedback and identify any issues/concerns.

Throughout the Community Consultation survey twenty three responses were submitted. Overall, people provided supportive feedback and comments on the Draft Transport Plan. No feedback necessitated changes to the Draft Transport Plan.

A report into the summary of the consultation can be found in attachment 1. Full responses to the survey can be found in attachment 2.

ATTACHMENTS

1. Transport Plan Community Engagement Feedback Report [**8.2.1** - 4 pages]
2. Transport Plan Survey Responses Report [**8.2.2** - 16 pages]
3. Draft City of Marion Transport Plan 2021-2026 [**8.2.3** - 17 pages]

Draft Transport Plan
Community Engagement Feedback Report
June 2021

Background

Council's Business Plan 2019-2023 includes a project to: *Develop a City Transport Plan to enable ease of movement for people of all ages and abilities within and through the city*. This is a key project for Council to achieve its 10-year goal for a 'Connected' city - *by 2029 it will be easier and safer to move around our city which will have accessible services and plenty of walking and cycling paths. New technology and community facilities will better connect our community*.

The purpose of the City of Marion Transport Plan is to develop an overarching and consolidated approach towards the management of transport and its impact on the local community, businesses and the environment. The Plan outlines desired transport and movement outcomes for the city, and the strategies and actions to achieve these over the next five years 2021-26.

Between 8th April and 30th April 2021 the City of Marion sought community feedback on the draft Transport Plan.

The Making Marion engagement page hosted the following:

- Draft Transport Plan 2021 -2026
- Survey

This feedback will be utilised to finalise the Transport Plan – a summary of community feedback is provide as an attached to this report.

The purpose of the engagement was to

- To consult with the community about their level of support for the plan, seek feedback and identify any issues/concerns.

Community Engagement techniques

- Making Marion was used to display the Draft Transport Plan with an online survey to identify level of support for the plan
- Electronic Direct Mail
- Social media updates/posts

Community feedback statistics

- **60** people visited the Making Marion page
- **444** people were 'informed' by clicking through further to content on the page
- **23** people provided a submission to the survey on Making Marion
- **569** people were notified as subscriber's Making Marion email distribution link

Social media posts

During the month of April 2021 City of Marion posted about the project on the City of Marion's Facebook page on 3 occurrences and on LinkedIn.

Draft Transport Plan
Community Engagement Feedback Report
June 2021

CITY OF MARION

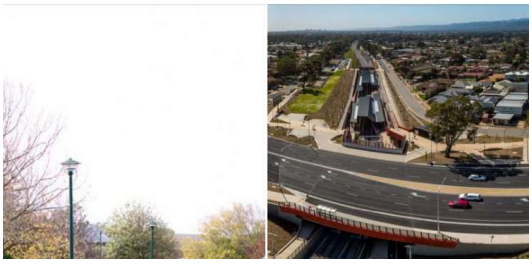
Example of posts or website information here

City of Marion
15 April ·

The City of Marion has developed a Transport Plan to enable ease of movement for people of all ages and abilities within and through the city. 🚗🚲🚶

As a resident, business owner or visitor, we are seeking your valuable feedback on the Draft Plan.

Check out the plan now and provide your feedback before the 30 April 2021. https://fal.cn/3eIP5



City of Marion
3,499 followers
1mo •

Draft Transport Plan closing for consultation soon.

Marion Council's Draft Plan outlines how we can help people reach key destinations such as libraries and neighbourhood centres, railway stations, tram stops and business precincts.

It takes account of infrastructure for pedestrians, cyclists and scooter users.
As a resident, business owner or visitor, we are seeking your valuable feedback on the Draft Plan.

View the plan now and provide your feedback before the 30 April 2021.
https://fal.cn/3f0mT

Update engagement | Time range: Apr 26, 2021 - Apr 28, 2021

Update title	Posted by	Created	Impressions	Views	Clicks	CTR	Reactions
City of Marion Draft Transport Plan All followers	Melanie Stewart	4/28/2021	885	-	25	2.82%	10

City of Marion
28 April ·

The Draft Transport Plan is closing for consultation soon.

The City of Marion has developed the Draft Plan to enable ease of movement for people of all ages and abilities within and through the city. 🚗🚲🚶

As a resident, business owner or visitor, we are seeking your valuable feedback before the 30 April 2021.

Visit https://fal.cn/3f0lT

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City of Marion
11 March ·

Council Meeting Update

After each fortnightly Council meeting, the Mayor shares an update on the 'hot topics' coming out of the Chamber.

This fortnight Mayor Hanna talks about the Draft Transport Plan, the renewal of the Edwardstown Employment Precinct, the new BMX Track being built in O'Halloran Hill and more.

If you would like to read the meeting minutes (published on the Friday afternoon following the meeting) or see the next Council meeting agenda, please visit https://fal.cn/3dVCw

#CityofMarion #CouncilMeeting #BMX
See less

8 2 comments 362 views

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Draft Transport Plan
Community Engagement Feedback Report
June 2021

Community Sentiment

Overall people provided supportive feedback and comments to the Draft Transport Plan.

A summary of key feedback and responses is provided here.

1. Feedback relating to how we can improve transport networks in the City of Marion

- Planting more trees to create cooler streets
- Encourage use of Public Transport
- Better access and connectivity on the road network
- Reduce Traffic congestion and improve safety
- Widen footpaths to accommodate to vulnerable users, scooters and wheelchairs
- More indented buses bays at bus stops to improve traffic movements
- Pay as you go bikes and E-Scooters
- Underground Power lines
- More electric vehicle charging stations
- Less single user cars on the road
- Liaise with council's and other relevant Government Departments

"Pay as you go bikes and E scooters like in the city"

"Promoting shaded cycling lanes that are also safe. This encourages people of the Marion community to adopt greener modes of transportation. Maybe barricading the cycling lane to promote safety for cyclists. The use of planting trees along cycling paths can be an opportunity to retain stormwater runoff. Installing more electric vehicle charging stations to encourage an uptake of hybrid vehicles to reduce emissions."

"Widen walking/bike pathways e.g. with a pram and a dog I take up more than the small side of a walkway and am always beeped by cyclists'

2. Feedback relating to overall thoughts on the Draft Transport Plan

- People had positive feedback about the draft Transport Plan
- People raised concerns on the high number of actions
- People pointed out that some actions were broad and needed specifics
- Some further comments were related around:
    - Using volunteers for greening
    - How to encourage more people to use public transport
    - Parking near schools
    - No commitment to 40 kph residential streets
    - Not particularly proactive in influencing other agencies

"The draft plan looks good, speaking as a cyclist, electric (vehicle) owner and public transport user."

"I think overall it is great. The greener & more community & family orientated the better for everyone."

"I think it's fairly innovative but pedestrians need to be given a bit more thought"

3. Feedback relating to the priorities listed in the Draft Transport Plan and what is most important

- 22 responders ranked their top priorities within the Draft Transport Plan

Ranking	Outcomes
1	We have an efficient and safe road network
2	We have alternative transport options
3	We have public transport areas that welcome people
4	We have schools and community facilities that encourage active travel
5	We have business districts that are attractive and accessible
6	We have cooler urban environments
7	We support zero-emissions transport initiatives
8	We have attractive streetscaping
9	We have fewer non essential vehicles within the council area
10	We use technology in our transport network

4. Any other Questions or Feedback provided

- Acknowledgment of kerb ramp upgrades occurring throughout the city
- Requesting more trees to be planted
- Highlighting the need for more investment towards DDA infrastructure
- Indicating that sub-divisions and the shift towards higher density living is negatively impacting transport movement and access

"We applaud Council on beginning this process. Associations such as ours have much to offer. We represent over 800 members, have regular contact with almost 2,500 households, and though our Committee and sub-group structure, access (to) much expertise. We are very keen to be involved in on-going consultation" **– 5049 Coastal Community Association**

Although some questions were unrelated to the Transport Plan and referred to operational or service requests, these requests have been logged for action in our Customer Event system.

We want your thoughts | Draft Transport Plan

SURVEY RESPONSE REPORT
08 April 2021 - 30 April 2021

PROJECT NAME:
City of Marion Draft Transport Plan

BANG THE TABLE engagementHQ

SURVEY QUESTIONS

Q1 How can we improve transport networks in the City of Marion?

Screen Name Redacted 4/12/2021 12:16 PM	Streetscapes having more trees, less powerlines and being more pedestrian friendly would be a big win. More connected greenways, especially the Tonsley Greenway. Trees that lose their leaves so that we still get some sunlight in winter!!
Screen Name Redacted 4/13/2021 10:49 PM	I would like to see more trees planted on streets to increase habit for birds and other animals and also reduce the heat island effect.
Screen Name Redacted 4/14/2021 10:31 AM	Encourage use of public transport
Screen Name Redacted 4/14/2021 10:31 AM	currently in hallett cove you need a vehicle to access Reynella. It is disappointing that in peak times there is standing room only from Hallett cove to the city & discriminates against persons with a disability or marion residents so networks needs to be matched with demand. 3 years ago I communicated with DPTI as to speed along Lonsdale & moving the 100kps allowance further south to make Gretal access/egress safer. At that time they stated there is sufficient usage to place traffic lights at Cove rd & Oval Rd intersections with Lonsdale rd but nothing eventuated.
Screen Name Redacted 4/14/2021 11:15 AM	For residents in the northern parts of Edwardstown, the biggest issues are the increased traffic in our streets. With blocks being sub-divided the increase population has created streets where only one car can pass at any time. I wouldn't ride a bike around this area for safety reasons. And if you can get out of this quadrant (try getting onto Towers

	Tce during peak hour!!!) you then head straight into the gridlock that has become South road/Daws Rd/Marion/Cross. Until something is done with those roads it will remain a nightmare in this sector no matter how many bike lockers and amenities you put in.
Screen Name Redacted 4/14/2021 01:41 PM	Update the Tram crossing on Morphett Rd near the Mophettville Race Track. This is an issue in the mornings with cyclists needing to cross at the traffic lights. Oaklands is a great example of how the traffic flow has improved significantly since it's introduction.
Screen Name Redacted 4/14/2021 03:34 PM	Improve crossing safety for pedestrians and bicycles across Cliff st, especially towards the eastern end to facilitate safe crossing for school students (e.g. traveling to/from Our Lady of Grace).
Screen Name Redacted 4/14/2021 04:30 PM	Encouraging people to use public transport is vital & COVID-19 has brought with it many challenges so I'm pleased to see trains being cleaned internally at the Adelaide Railway Station. But safety for passengers when leaving the train is also a high priority. Positioning of car parks by tram/train/bus stations needs to be thought of as not just numbers of spaces but are they safe for commuters especially when it's dark. The car park on the southern side of the new Oaklands Train Station is a prime example. The old carpark was close to the station & felt safe but it was moved a long walking distance from the new station. The pathway to the carpark & the carpark it self is not well lit & is across the road from a large, not very well maintained housing complex. Very scary at night. It's a long way for the disabled parks too. I

	often drive across to the northern side of the station or park in the street for a closer, safer park if there are any available.
Screen Name Redacted 4/14/2021 07:07 PM	Need to address Cross Road/Marion Road/tram intersection. your own data points to the issue!
Screen Name Redacted 4/14/2021 08:42 PM	Pedestrians. Access issues for walkers and people using walking sticks, walkers, scooters and wheelchairs. Widen more footpaths to 1.5m. Many footpaths have overgrown plants spilling onto them eg Gillepsie Str and Butler Cres Glengowrie. Uneven pavers around Cliff Str and other paths. So uneven...my friend tripped and fell. Tidy and trim more street trees and plant new ones especially where town houses are being built. There are not enough disability parking spaces and some are impractical with minimal understanding of a disabled person's needs. Some of the crossing ramps from footpath to roads are too steep and not wide enough for a wheelchair. The plan talks about DDA compliant but there is a question if the builders actually consult with people in Marion with disability. 2030 is too long as an end date for DDA compliance ...suggest bring forward by a few years.
Screen Name Redacted 4/14/2021 10:11 PM	The No.1 problem is allowing smaller blocks by subdivision and dense housing. More houses = more people = more cars and parking = traffic problems. Stop planting so many inappropriate trees that should not be higher than roof gutters (don't impact power lines or cause damage when they fall), have less aggressive root systems that cause road, footpath and kerb damage, or need constant maintenance with trimming and fallen leaves. Continue to improve

	footpaths to stop people walking or riding gophers on roads. Stop the dense housing where homes with 2,3 or more cars need to park on the streets. Attempt to have more kerb cut-outs at bus stops to allow better flow of traffic. Have less bus stops (not less buses). This makes the time travel shorter and stopping less frequent. Have kerbs with gradual slopes from the path to the road as in some states and O/seas and allow parked cars to have two wheels on the verge (not footpath). This widens the road space to allow cars to pass easier in opposite directions. Obviously not suitable for ALL streets, but can be considered where appropriate.
Screen Name Redacted 4/15/2021 07:21 PM	Pay as you go bikes and E scooters like in the city
Screen Name Redacted 4/15/2021 10:37 PM	Agree with the plan. Could you also consider undergrounding power lines to allow more and higher tree planting for shade? This is costly but has decreased ongoing costs from pruning and lower risk of blackouts from collapsed tress/powerlines. Also create more rainwater/stormwater detention to reduce localised flooding. This is very evident in the northern area (Glandore, Edwardstown, Plympton, to name a few) and discourages walking and cycling during rainy days.
Screen Name Redacted 4/19/2021 06:50 AM	-require residential new builds to include adequate room for realistic expected resident car parking. Streets are becoming choked with parked cars. Garages often appear not large enough to house modern cars. - Improve cycle ways with improved signage; marked 'bike lanes'; dedicated cycle ways (eg. Railway Terrace); - support

	increased 'green spaces' within council area. Encourage 'green verges' via supporting residents with information (suitable plant lists / benefits / 'technical info / etc), materials (mulch), promoting benefits. Consider 'rain gardens' to improve streetscapes / reduce heat islands / reduce storm-water runoff / traffic calming device. -improved infrastructure for electric vehicles (car & e-bike) - dedicated parking / charging stations. -consideration of needs of cyclists / pedestrians to be taken into account for new developments. eg:Westfield Marion is often not safe/easy to access for pedestrians or cyclists. -additional public green spaces / greening of existing public spaces. -consider small 'local' feeder buses to provide transport from residences to public transport hubs. -encourage walking / cycling to schools - promotion & improved infrastructure / safer streets.
Screen Name Redacted 4/23/2021 02:36 PM	Promoting shaded cycling lanes that are also safe. This encourages people of the Marion community to adopt greener modes of transportation. Maybe barricading the cycling lane to promote safety for cyclists. The use of planting trees along cycling paths can also be an opportunity to retain stormwater runoff. Installing more electric vehicle charging stations to encourage an uptake of hybrid vehicles to reduce emissions.
Screen Name Redacted 4/28/2021 09:51 AM	Widen walking/bike pathways eg with a pram and a dog I take up more than the small side of a walkway and am always beeped by cyclists
Screen Name Redacted 4/28/2021 11:32 AM	It should be safe and convenient for kids to cycle to schools, reducing obesity and traffic. Current cycling

	amenities are pathetic. Even pedestrian crossing lights take far longer than other countries to operate. Effective cycle paths that improve access for cyclists, parking for cyclists and safety for cyclists as part of a holistic transport scheme integrating public transport and last mile services which is environmentally sustainable must be vastly improved. More pedestrianised areas for improved quality of community life for residents and fast bypass arrangements for heavy through traffic
Screen Name Redacted 4/28/2021 09:32 PM	You talk about more people using public transport and Park n Ride yet you make all the streets around the train stations No Parking - which one do you want? Something must be done about traffic bottlenecks at tram crossings (Morphett Rd/Anzac Hwy, Marion Rd) - tram must go over these intersections
Screen Name Redacted 4/28/2021 11:06 PM	more public transport but not just the models we have now. use technology to hook commuters up. remember when we had ride sharing intiatives during the oil crisis. post Covid we should have less single user cars on the road. get the trucks off Brighton road, fix Majors and start of Lonsdale bumps
Screen Name Redacted 4/29/2021 09:58 AM	The Marino Greenway is terrific. It would be good to have an off road cycle link between Hallett Cove and O'Sullivans Beach
Screen Name Redacted 4/29/2021 12:14 PM	Here's a wild thought. What if citizens were encouraged to use free council transport whenever possible instead of their own cars & in return receive a reduction in their rates?
Screen Name Redacted 4/29/2021 02:16 PM	I believe that a pedestrian crosswalk near The Drake shopping centre is way overdue and 100% necessary.

	The perfect position to help the local elderly, mums with prams and children would be between Clifford and Wood Street. The amount of traffic on Marion road will soon see a fatal for a pedestrian trying to cross if something isn't done soon.
Screen Name Redacted 4/29/2021 05:56 PM	Map and understand existing networks; develop and/or access models of current and projected flow; liaise with adjoining Councils and relevant Government Departments; conduct analysis of possible future scenarios. That is, this requires a rigorous, thorough process that will require expert input, research and consultation

Optional question (23 response(s), 0 skipped)
Question type: Essay Question

Q2 What thoughts do you have on our Draft Transport Plan?

Screen Name Redacted 4/12/2021 12:16 PM	Looks like helpful priorities.
Screen Name Redacted 4/13/2021 10:49 PM	I like to see that marion is putting thought into the heat island effect and the forward thinking for electric vehicles.
Screen Name Redacted 4/14/2021 10:31 AM	It is exactly as you call it is a DRAFT PLAN I would like to see more detalis - especiallly of roads that people will be enouraged to use to access publuc transport
Screen Name Redacted 4/14/2021 10:31 AM	There is little mention of using volunteers to assist in brightening the area up. Currently areas exist which visitors would find unattractive - eg pedestrian. underpass from sports ground that is under Marion control. Acronyms are used without defining. You allude to other councils using Marion infrastructure. with increased

	residential areas in Onkaparing region Londsale Rd will become busier & this impacts on access & egress.
Screen Name Redacted 4/14/2021 11:15 AM	Unless there are major changes to the roads, the rest all seems pointless.... eg it will be easier to fix the roads then get people to ride-share in Adelaide.
Screen Name Redacted 4/14/2021 01:41 PM	good content and hopefully it will all come to fuition.
Screen Name Redacted 4/14/2021 03:34 PM	Nothing to include
Screen Name Redacted 4/14/2021 04:30 PM	There is a lot to do on this plan. It will be interesting to see how much is actually completed.
Screen Name Redacted 4/14/2021 07:07 PM	Nice overarching principles... Make it happen and not just in the southern suburbs or Marion Shopping Centre precinct.
Screen Name Redacted 4/14/2021 08:42 PM	Good to see increase in EV charging stations. I like the timeline on the action plan...supports accountability. I like the focus on upgrading old playgrounds.
Screen Name Redacted 4/14/2021 10:11 PM	A lot of it is good but blanket statements on certain issues need to be developed further. ie Parking near schools and school buses. Schools should have their own one way drive through path where cars can pull in to pick up their children and not allowed to stop for any other reason, then drive through to the street. Same thing for buses. Seaview school is a prime example. They have the area to have an inlet going into the school from a side street into the school ground (probably along the fence line for a short distance), pick up their children and drive through to Seacombe Road. This

	would reduce congestion near the school crossing and make it safer to cross the road. Trees to keep the temperature down is ok, but please plant the right trees.
Screen Name Redacted 4/15/2021 10:37 PM	It's good.
Screen Name Redacted 4/19/2021 06:50 AM	Plan appears to be more a statement of 'general intended outcomes' but lacking in specifics.
Screen Name Redacted 4/28/2021 11:32 AM	Australia is car obsessed and it is killing us. Both through lack of exercise when commuting and as kids and through absence of safe continous routes excepting for cars resulting in injury and death. The plan should address how far behing world standards we are.
Screen Name Redacted 4/28/2021 11:06 PM	the plan is very broad, no commitment to electric vehicles (charging stations) parking congestion on smaller residential streets, 40 kph in residential areas.
Screen Name Redacted 4/29/2021 09:58 AM	The draft plan looks good, speaking as a cyclist, electric owner and public transport user.
Screen Name Redacted 4/29/2021 12:14 PM	I think overall it is great. The greener & more community & family orientated the better for everyone.
Screen Name Redacted 4/29/2021 02:16 PM	I think it's fairly innovative but pedestrians need to be given a bit more thought.
Screen Name Redacted 4/29/2021 05:56 PM	Congratulations on the work so far! However the plan doesn't seem to suggest that it will integrate with initiatives undertaken by other levels of Government, nor does it suggest that Marion will be particularly proactive in influencing those other agencies. Of greater concern is a sparsity of specifics, particularly as they relate to outcomes expected

	and changes desired. Of particular relevance to us is : 1/ Outcome 1, which should surely be to the effect "Encourage and support increased use of Public Transport" .... with "public transport areas as welcoming people places" being one of several actions 2/ Outcome 14 seems a sparse and narrow response to "Partners and Collaboration", where are actions re consulting directly with the community, working with other Councils and the State? 3/ Outcome 5 should surely have as its first action something to the effect "identify issues and possible solutions" 4/ Outcome 8 we assume refers mainly to private cars. Why not make that explicit? 5/ Outcomes 9,10,11,12, 13 are really generic "motherhood" statements that should apply to all of Council's plans, and are not particularly relevant to transport only 6/ Specific concerns within the 5049 community are not mentioned eg congestion on Brighton Road, access to public transport (including stations) in Marino and Seacliff Park; parking at transport hubs; on-street residential parking; road traffic from suburbs to the south funneling down Brighton and Marion Roads (where is there reference to additional entrances to the Southern Expressway eg at Majors Road?). We expect other communities could identify their local issues which deserve a reference in this plan

Optional question (19 response(s), 4 skipped)
Question type: Essay Question

Q3 We have priorities listed in the Draft Transport Plan and want to know what is most important to you (1 being most important, 10 being least important)

OPTIONS	AVG. RANK
We have an efficient and safe road network	3.90
We have alternative transport options	4.29
We have public transport areas that welcome people	4.81
We have schools and community facilities that encourage active travel	5.18
We have business districts that are attractive and accessible	5.33
We have cooler urban environments	5.45
We support zero-emissions transport initiatives	5.48
We have attractive streetscaping	5.52
We have fewer non essential vehicles within the council area	6.76
We use technology in our transport network	7.10

Optional question (22 response(s), 1 skipped)
Question type: Ranking Question

Q4 Do you have any other questions or feedback?

Screen Name Redacted
4/12/2021 12:16 PM

Screen Name Redacted
4/13/2021 10:49 PM

I would love to see trees planted in streets that don't currently have them. In my street of baker avenue, there are only 5 trees which leaves most of the street without a tree in front of their house. I would like to see the council planting trees or encouraging residence in the street

	to plant trees and receive a rebates for such actions.
Screen Name Redacted 4/14/2021 10:31 AM	Not now
Screen Name Redacted 4/14/2021 10:31 AM	as society ages there will be an increased percentage of those living with people with a disability & all policy changes need to be mindful of decisions deemed to be appropriate but negatively impact older persons of those with a disability. In 2013 i wrote a submission which the LGA applauded as to suggestions & was also sent to all council mayors but little has changed from the recommendations. We also need counselors who actually get out & meet consumers to discuss issues & concerns & have a mindset as to disability needs (1/4 is said to live with such). I undertook a review of all infrastructure & pedestrian pathways (Hallett Cove) as a vision impaired person under the supervision of Carl Lundborg but only some has been attended to. Happy to be contacted Dr David Squirrell Pres Blind Citz Aust & Vice Pres National DeafBlind Aust.
Screen Name Redacted 4/14/2021 11:15 AM	I've made streetscaping a priority as I truly don't believe things will be improved transport wise in the area until major work is done on the larger, congested roads. At least while I'm sitting for long periods in traffic I'll have something nice to look at. Can you please let your residents know what is happening with the vacant blocks by Castle Plaza...why not use these areas as transport hubs, pay and ride locations? Please note too that the bike path along Railway Terrace may have been fine in theory but for day-to-day car users it actually means we are now waiting

	behind parked cars for traffic to flow through. It has turned Railway Terrace into a one-way street and the gap between passing cars is so narrow I'm just waiting for my side mirror to be hit. You can't even turn onto Railway Terrace without spooking an oncoming car with how close you are.
Screen Name Redacted 4/14/2021 03:34 PM	Nothing further
Screen Name Redacted 4/14/2021 04:30 PM	It is pleasing to see some work has progressed on the curb ramps around the southern area of Oaklands Park which will make it safer for people pushing prams, using wheelchairs or mobility scooters.
Screen Name Redacted 4/14/2021 07:07 PM	No consideration of the ruined street scapes caused be urban infill with insufficient parking leading to streets becoming car parks.
Screen Name Redacted 4/14/2021 08:42 PM	1.Remove fake grass down centre island of Brighton Road. It's falling apart, unattractive and traps heat. 2. Improve signage for play and park areas eg name of park, Indigenous name, list of birds, animals and plants you might see as native to the area. Holdfast Bay has done this very well along the new boardwalk at Somerton.
Screen Name Redacted 4/14/2021 10:11 PM	We need to be pro-active and not reactive. The other way around causes double the cost. We should consider what we are doing or about to do may affect the future. It's great to do this planning but not to something that causes another problem. The biggest mistake made in the last 20 years was to allow subdivision and medium to high density living. This must stop now before it's too late. I hope this Plan

	has much more open discussion with public opinion and regular updates. It's no good the Council making a decision, acting on it, then get public outcry and more issues and costs.
Screen Name Redacted 4/28/2021 11:06 PM	Seriously consider the blocking of Cove Road to traffic from Marino. Scholefild, Newlands, Jervois and the Cove roads have traffic going along to Hallett Cove which should be using LONSDALE ROAD. Block Cove at the Hallett Cove station or at the Westcliff court area. let this quiet area enjoy its amentiy rather than have a constant flow of traffic. at the least allow only flow in one direction north to south.
Screen Name Redacted 4/29/2021 12:14 PM	Well done.
Screen Name Redacted 4/29/2021 05:56 PM	We applaud Council on beginning this process. Associations such as ours have much to offer. We represent over 800 members, have regular contact with almost 2,500 household, and through our Committee and sub-group structure, access much expertise. We are very keen to be involved in on-going consultation

Optional question (12 response(s), 11 skipped)
Question type: Essay Question

DRAFT TRANSPORT PLAN

2021 - 2026

CITY OF MARION

Acknowledgement of Traditional Owners

The City of Marion respectfully acknowledges the Traditional Owners of the land, Kaurna people and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

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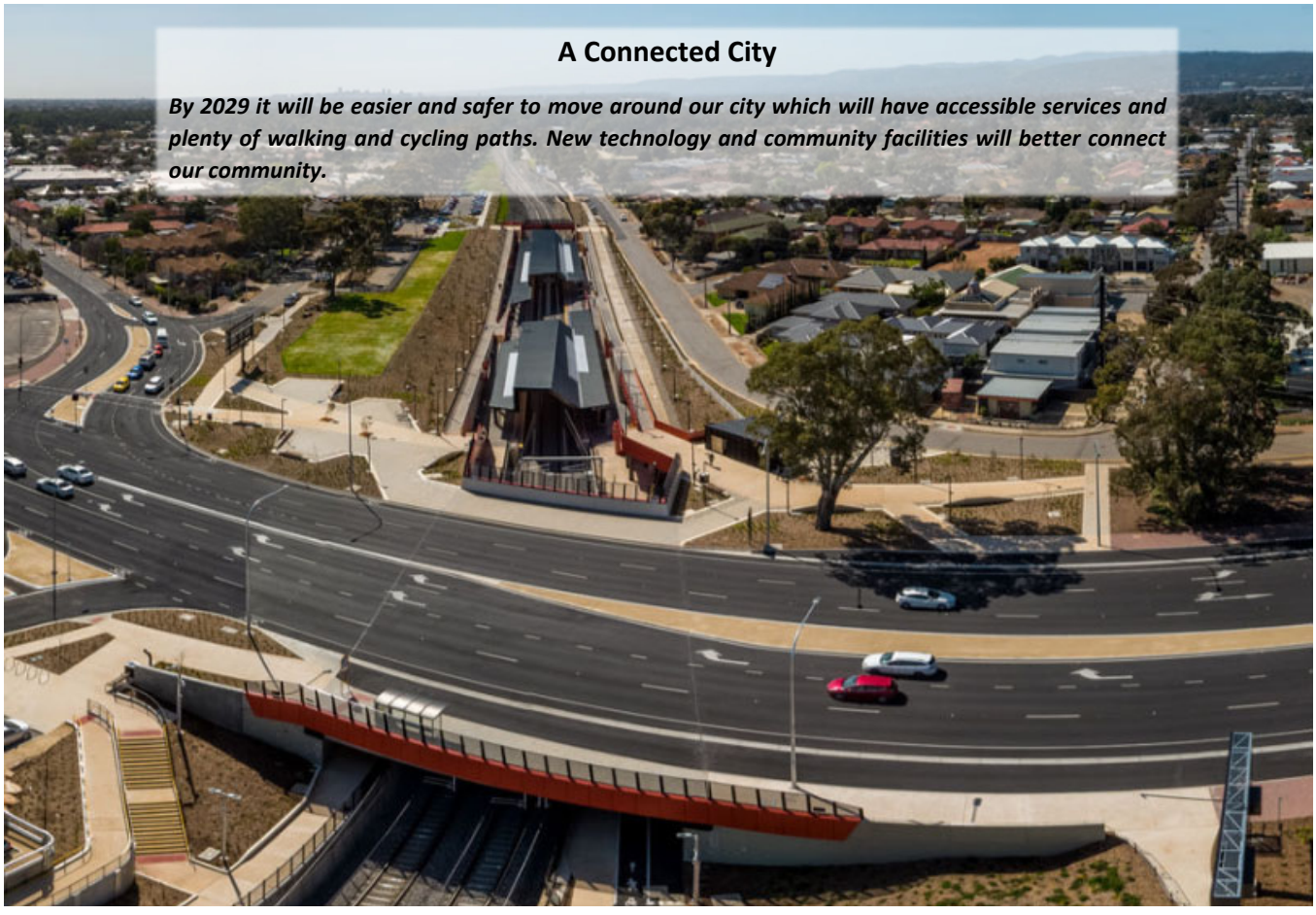


Message from the Mayor

It is expected the City of Marion's population will reach 100,000 before 2030.

Thinking about our growing population and their changing needs, Marion Council has reviewed our transport network.

This plan outlines how we can help people reach key destinations such as libraries and neighbourhood centres, railway stations, tram stops and business precincts.

It takes account of infrastructure for pedestrians, cyclists and scooter users. We will plant trees to enhance the appearance of streets and provide shade. We can also install bike lockers, drinking fountains and phone charging stations.

Council is always ready to work with the State Government on transport issues, especially on major projects such as the proposed South Road tunnel. We can also advocate for better public transport.

Yours faithfully

KRIS HANNA

Kris Hanna
Mayor, City of Marion

Introduction

The purpose of the City of Marion Transport Plan is to develop an overarching and consolidated approach towards the management of transport and its impact on the local community, businesses and the environment. The Plan outlines the Council's desired transport and movement outcomes for the city, and the strategies and actions to achieve these over the next five years.

The Plan's key priority is to create a safe and efficient transport network by improving conditions for all road users (particularly pedestrians, cyclists and those using public transport) while also exploring future transportation modes. It strives to achieve the right balance for accommodating these priority users, while also addressing the need for parking, car accessibility and movability.

The Transport Plan will contribute to the outcomes of the City of Marion's community vision, in particular the themes of a liveable, connected and a prosperous city.

Background of the City of Marion

The City of Marion is a metropolitan council area located south-west of Adelaide CBD. The Council is diverse across it's geography with an older area in the northern portion of the Council being generally developed as residential areas in the 1940s, the 50s & 60s, and the newer areas in the south being established from the 1970s onwards (and still occurring today).

Large sections of the older areas are experiencing significant growth in traffic through the combination of increasing urban consolidation through in-fill developments, large scale developments such as the Tonsley Innovation Precinct, and other major transport destinations such as the Marion Regional Centre and Edwardstown Industrial Precinct.

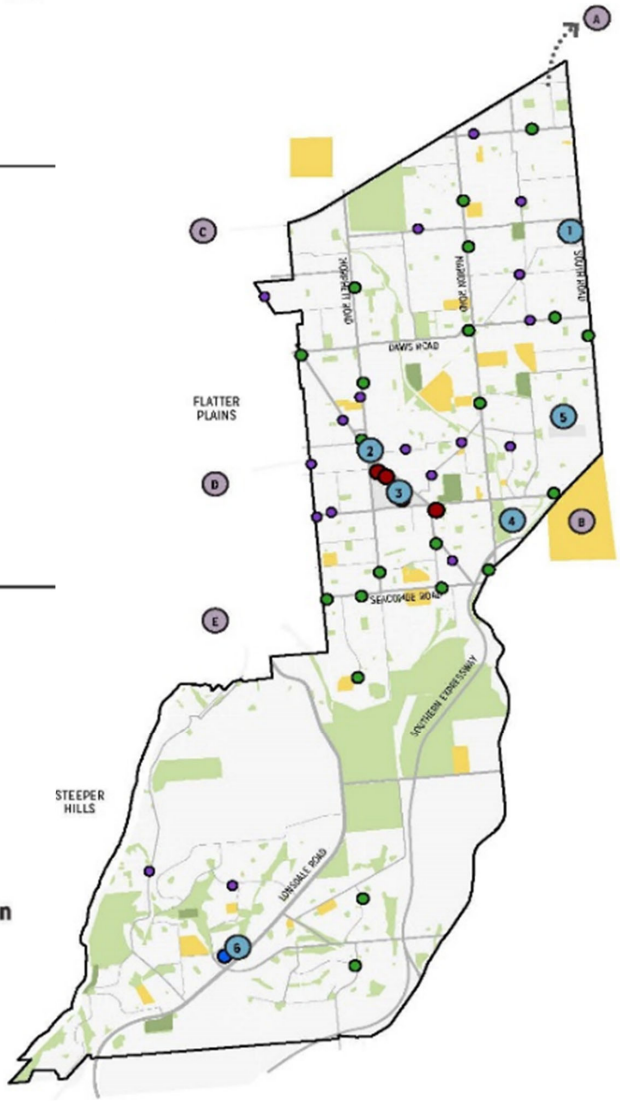
Also, the road network is witnessing an increase of competing demands such as the movement of people and goods, alternative modes and access to property, and on-street parking. With the high demand for vehicular traffic, and increased density emerging new transport options and increasing pressure to develop active travel options, these are presenting complex challenges to design and build.

North

- Older suburbs
- Grid-pattern
- Flatter topography
- Set-back from coast
- Some mixed use development
- Less open space and reserves
- Few large street trees, some in reserves
- Integration of industry (South Road)

South

- Newer suburbs
- Curved layout with cul-de-sacs
- Hillier topography
- Adjacent to coast
- Views to coast
- Nearly all residential land use
- More open space reserves
- Few large street trees, some large copses in reserves
- Views



Destinations

Key destinations within the City of Marion include:

1. Castle Plaza Shopping Centre
2. Marion Aquatic Centre and Marion Culture Centre (MCC);
3. Westfield Marion and Civic Centre;
4. Warriparinga Living Kaurna Cultural Centre and Wetland, Marion Holiday Park;
5. Tonsley Park Redevelopment;
6. Hallett Cove Shopping Centre and Civic Centre;
- Neighbourhood destinations;
- Local centres;

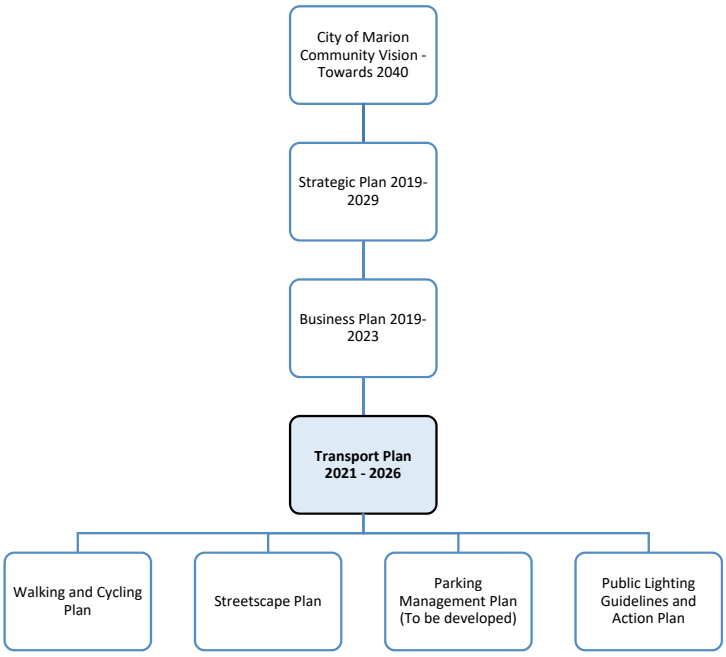
A. Adelaide CBD
B. Flinders University and Flinders Medical Centre;
C. Glenelg Beach + Jetty Road Shopping Precinct;
D. Brighton Beach and Jetty;
E. Seacliff Beach and Brighton Caravan Park.

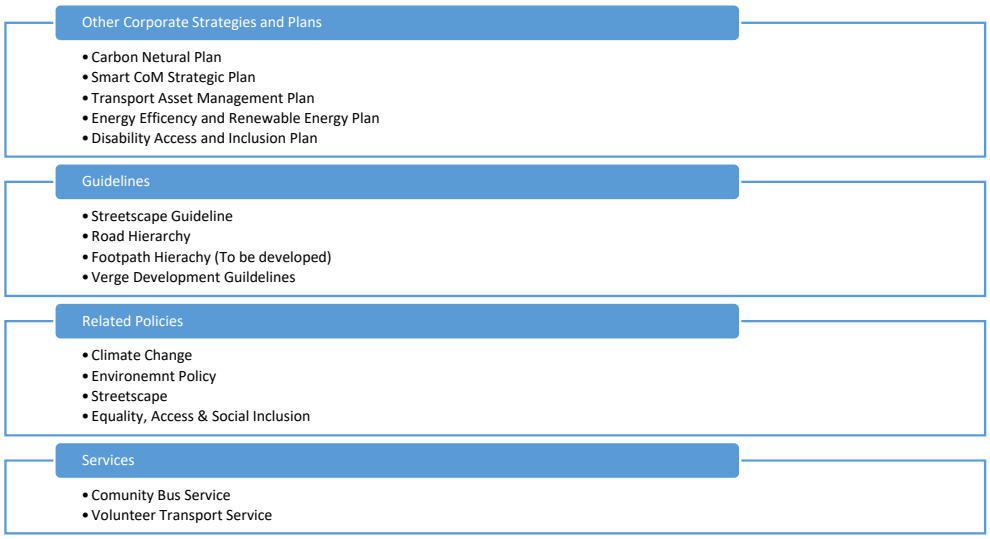
- Major centres;
- Schools and child care facilities;
- Key reserves / open spaces;
- Key sport and recreation; and

Figure 1: The City of Marion's Destinations and Contrast

Strategic Framework

To ensure the delivery of the Community Vision – Towards 2040 the City of Marion has a Strategic Management Framework in place. This is a suite of plans to provide a strategic direction and operational focus to achieve the goals and outcomes.



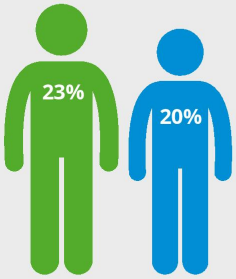


The City of Marion Transport Plan sets the outcomes and actions for the next 5 years. It outlines a set of initiatives, aimed to be safe and efficient and achieve our Connected Community Vision.

CITY OF MARION

Population

Projected growth
(2016 to 2036)



City of Marion (from 86,618 to 106,338)

Greater Adelaide (from 1,295,714 to 1,554,857)

Median age
39 City of Marion
40 Greater Adelaide

Older residents
(aged 65 and over)
17.3% City of Marion
17.2% Greater Adelaide

Key Stats

Council Area
55 km²

Road Length
480 km

Footpath Length
832 km

Shared Path Length
32 km

Schools
23

Open Spaces
291

32 Comunity Facilities
(Including Libraries, Neighbourhood Centres & Halls)

Train Stations
13

Tram Stations
8

Bus Stops
500

Households & Development

49%
of City of Marion households own 2 or more vehicles

15.6%
of households earn an income of $2,500 or more per week

Construction growth
(on dwellings constructed between FY2016/17 and FY2018/19)

City of Marion
(from 757 to 850)

12% increase

Employment

Local Businesses in the City of Marion
5,204

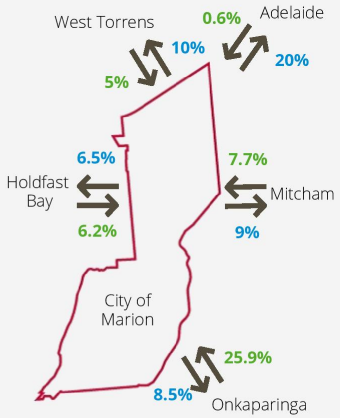
Local Jobs in the City of Marion
25,183

$3.6 Billion
The City of Marion's Gross Regional Product

Journey to work
(mode)

	(Public Transport)	(Car)	(Cycling)	(Walking)
City of Marion	10.9%	64.7%	0.9%	1.3%
Greater Adelaide	8.5%	64.7%	1.1%	2.1%

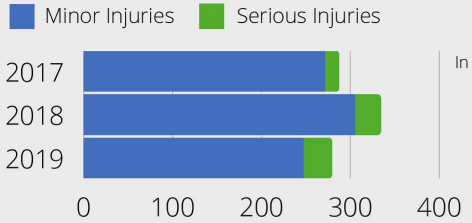
Journey to work
(Residents place of work / Workers place of residence)



Trends

Safety

40% Increase
In crashes involving pedestrians within the City of Marion from 2017 to 2019



6 Fatalities within the road network in City of Marion in the last 3 years

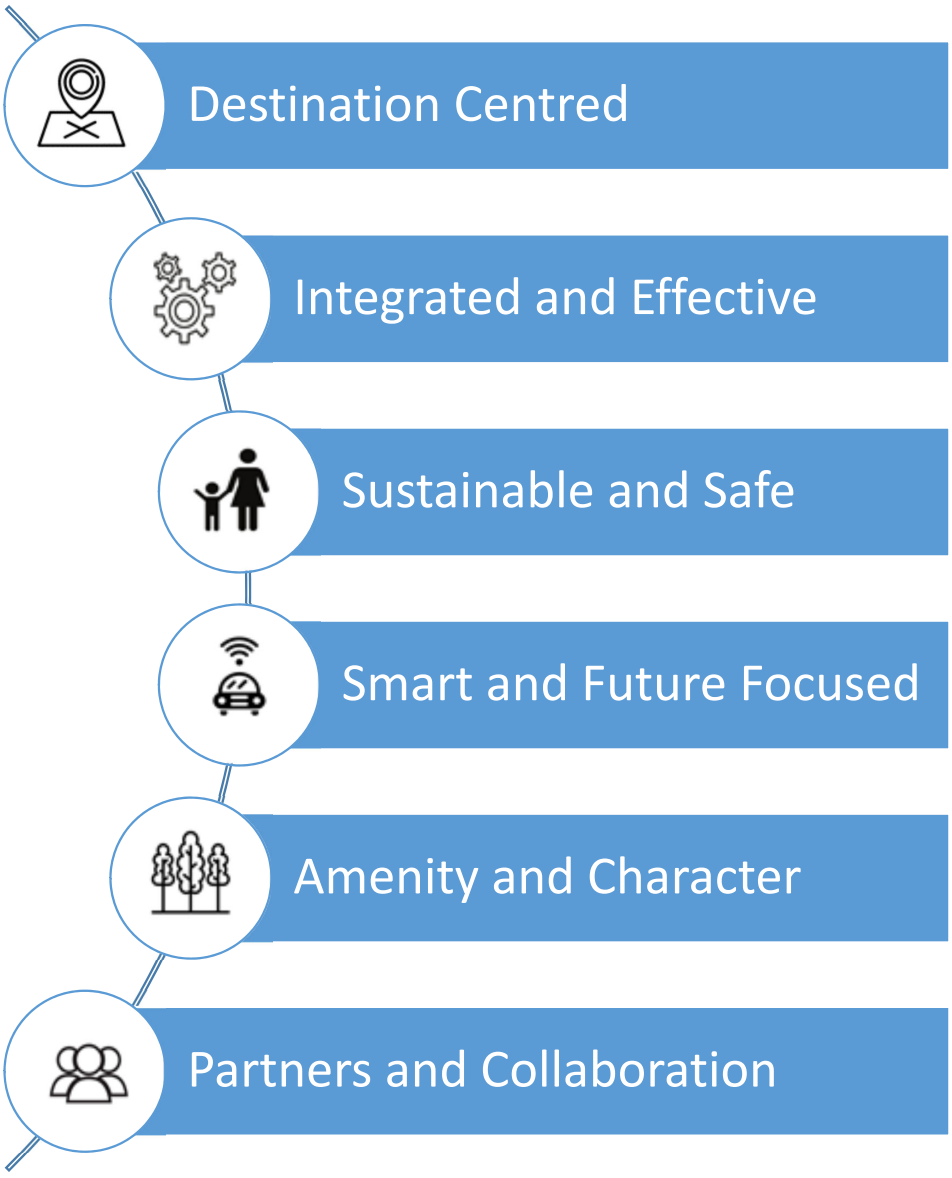
Future of Transport

45% Increase
In electric vehicle car sales in Adelaide between July 2019 to July 2020

3 EV Charging Stations in the City of Marion

Data sources: ABS Census 2016, Office of the Valuer-General and City of Marion Development Services Team

Principles for a Changing Transport System



Destination Centred

A transport system that supports the activation of destinations including community facilities, shops, schools, business precincts, transport hubs.

The development of transport infrastructure to facilitate the movement of people and goods to destinations is a key factor in the success of a place to do business, visit and live. Key destinations need to be welcoming, efficient and safe to ensure the use of infrastructure and services provided.

Collaborating with the State Government (Public Transport, Education and Infrastructure departments), businesses and local community within Marion are crucial to ensure key destinations are designed 'fit for purpose' and utilised effectively. With a key focus for designing for pedestrians, cyclists and those using public transport while also considering emerging transportation modes and the need for parking and movability.

The key outcomes and actions that would deliver a destination centred transport system are:

Outcome 1	**Public Transport areas as welcoming people places**
Action 1.1	Plan and upgrade key movement links to 13 railway stations and 8 tram stops. Including reviewing parking demand and identifying 'Park and Ride' solutions
Action 1.2	Facilitate complementary land use and deliver high-quality design of public spaces (including greening) around railway stations to encourage connectivity with, and use of public transport
Action 1.3	Advocate for upgrades of stations/platform areas
Action 1.4	Identify and upgrade infrastructure around highly utilised bus stops (e.g. Seaview High School bus zone on Seacombe Road)
Action 1.5	Advocate for improved public transport and/or park and ride facilities throughout the City of Marion at underserviced locations (e.g. Laffers Triangle from the south to Flinders/Tonsley/Westfield Precinct and onwards to CBD by public transport)
Outcome 2	**Attractive & Accessible Business Districts**
Action 2.1	Review and upgrade the Transport Network within the Edwardstown Industrial precinct
Outcome 3	**Schools and other Community Facilities that encourage active travel**
Action 3.1	Work with Schools & DIT to identify opportunities for improvements in local streets near schools (e.g. car parking, drop off/pick up, wide footpaths)
Action 3.2	Install amenities that support the destination zones (e.g. bike lockers, drinking fountains, device charging locations, etc.)

OAKLANDS CROSSING

Oaklands Train Station is an example of how the transport network supports a highly utilised destination. The accessible walking and cycling connections separated from the road network have provided a safer environment. This includes enhancing the area through trees and vegetation planting to make a cooler and more attractive place.

Integrated and Effective

A transport system that integrates and improves the attraction of different modes of transport to support seamless travel linking people with destinations.

The efficient movement of people and goods is critical to the function of our city. Economic growth and productivity are powered by efficient transport.

Promoting and encouraging 'First/Last mile' transport options such as walking, bikes, e-scooters, public transport and pooled ride-sharing services are key to an effective transport system. Fifty percent of commuters in capital cities live within 10 km of their workplace (25-30% within 5 km), yet driving a car is still the primary option. Prioritising alternatives to private cars will allow more room for amenities such as street furniture, wide paths and trees.

The key outcomes and actions that would create an integrated and effective transport system are:

Outcome 4	**Encourage Alternative Transport Modes**
Action 4.1	Implement the walking and cycling guidelines (including a cycle link as a continuation of Morphett Road to southern Marion)
Action 4.2	Support businesses to encourage ride-sharing or vehicle sharing partnership opportunities
Action 4.3	Encourage E-Bike and/or E-Scooters services (e.g. Tonsley Precinct)
Action 4.4	Encourage public transport options (e.g. social media, website, etc.)
Outcome 5	**Efficient Road Network**
Action 5.1	Develop the Parking Management Plan
Action 5.2	Work with developers (where appropriate) to achieve the best possible outcomes to parking and accessibility
Action 5.3	Undertake an annual monitoring program of Traffic Data of the road network to ensure network is operating as designed
Outcome 6	**Well Planned Transport Network**
Action 6.1	Implement the Tonsley-Flinders Integrated Traffic and Parking Strategy
Action 6.2	Explore opportunities through State Government for major projects to implement facilities that can improve the transport network (e.g. East-West connections for the proposed North-South Corridor project)

RAILWAY TERRACE, EDWARDSTOWN

Railway Terrace streetscape is an example of how a road can be redesigned to cater for multiple transport modes while also creating a safe and green environment. This includes bi-directional separated bike path, indented parking bays and footpaths.

Sustainable and Safe

A transport system that supports a shift to sustainable modes of travel, water sensitive urban design, and prioritises safety through traffic management and safe crossings for all users regardless of ability.

Cities which support convenient, comfortable and safe transport have healthier populations and a more equitable society. Streets designed for people ultimately attract investment and promote economic growth.

The National Road Safety Strategy Action Plan has identified a priority action to reduce speed limits to 40km/h or lower in pedestrian and cyclist places. Road users who are not protected by a vehicle are extremely vulnerable in collisions. The risk of death or serious injury increases significantly over impact speeds of 30 km/h. The City of Marion area has seen an increase in car crashes involving pedestrians by 40% in 2017 to 2019 (2017 – 17, 2019 – 24).

The key outcomes that would create a sustainable and safe transport system are:

Outcome 7	**Safe Transport Networks**
Action 7.1	Deliver footpath widening in high priority locations across the footpath network to a minimum of 1.5m (including ensuring no footpath assets in the network are less than 1.2m)
Action 7.2	Identify problem areas and create program for all crossings and kerb ramps to be DDA Compliant by 2030
Action 7.3	Minimise footpath obstructions and encroachments to free up more space for walking (e.g. reduce sign pollution and other obstructions)
Action 7.4	Apply for Black Spot grant funding where available
Action 7.5	Deliver and complete the DDA Bus stops and shelter compliance program by December 2022
Outcome 8	**Fewer non-essential vehicles within the Council Area**
Action 8.1	Identify gaps in public transport service levels and advocate for solutions to enable mobility in Marion

STURT RIVER LINEAR PARK

The Sturt River Linear Park is a shared use trail that meanders along the Sturt River, past historic buildings, significant fauna and environmental sites, as well as important local features within the City of Marion. It provides a safe walking and cycling connection through the city which connects to local parks and wetlands.

Smart and Future Focused

A transport system that is adaptive and flexible, responding to technological change, evidence-based data, and emerging trends.

As our population increases, and transport, parking and movement challenges become more complex there are real opportunities for technology and data to provide innovative solutions for our communities changing needs. Our streets, public places and road network must be adapted to meet the travel demands of the future while ensuring we continue to put people first in an innovative, liveable, prosperous and connected Marion.

Smart Places are the neighbourhoods we live, work and learn in, parks and facilities we gather in and places we recreate in. They harness information, technology and infrastructure to support our community to flourish.

The key outcomes that would create a smart and future-focused transport system are:

Outcome 9	**Utilising Technology to provide transport network benefit**
Action 9.1	Explore Smart City technology to gather data to support decision-making relating to infrastructure and services, for apps to access real-time GPS multimodal travel choice/travel time/route and pickup decision making by users for wayfinding and real-time signage
Action 9.2	Install Smart Parking Sensors in key destination and problem areas where demand is appropriate
Action 9.3	Identify and install wayfinding and digital interactive screens at key locations within the city
Outcome 10	**Support Zero-Emission Transport Initiatives**
Action 10.1	Work with private suppliers to install electric vehicle charging stations throughout the city to support the growing use of electric modes of transport
Action 10.2	Transition Council's Fleet to a renewable energy fuel source in accordance with the Carbon Neutral Plan
Outcome 11	**Sustainable Infrastructure**
Action 11.1	Encourage the use of recycled materials for transport infrastructure to support a circular economy

TONSLEY AUTOMOUS VEHICLE

South Australia is recognised as a national leader in future transportation systems and technologies with the State Government leading the nation in creating a legislative framework to support autonomous vehicle technology. Tonsley has been the testing grounds for the driverless vehicle that aims to assist in the development of a market- ready autonomous delivery vehicle.

Amenity and Character

A transport system where streetscapes provide amenity through contributing to the character of neighbourhoods and business precincts

Attractive streets foster vibrant communities, contribute to robust economies and healthy environments, and reinforce walking and cycling and social activity. Well designed and used streets are important in defining 'Sense of Place' and local character.

The City of Marion's approach to streetscape design focuses on a balanced view embracing people, environment and place. Vehicle movements are no longer considered the only function of streets and understanding the multitude of functions, providing civic and community destinations, facilitating activity, enhancing local walking and cycling movement and contributing to the local environment.

The key outcomes that would create amenity and character within the transport system are:

Outcome 12	**Attractive Streetscaping**
Action 12.1	Delivery of the 15 year Streetscape program
Action 12.2	Install amenities that support the use of active transport modes where appropriate (e.g. bike lockers, drinking fountains, park benches, etc.)
Action 12.3	Identify and provide interactive infrastructure (e.g. education paths & games within paving) that promotes active travel
Outcome 13	**Cooler Urban Environment**
Action 13.1	Delivery of the 10 year Treescaping program
Action 13.2	Lower the urban heat within transport corridors through tree planting and green infrastructure
Action 13.3	Implement WSUD treatments along streets where appropriate

COVE CIVIC CENTRE

The Cove Civic Centre is located on Ragamuffin Drive, Hallett Cove which is a shared urban space for pedestrians, cyclists and drivers. The site represents an example of how infrastructure and the environment can blend together to promote visibility and connectedness.

Partners and Collaboration

A transport system that is developed based on collaborative partnerships with regional, state and national governments and the private and education sector.

We are wise with more minds, through experience, sharing of resources, and funding. We value partnerships with government, businesses, community and researchers to collaboratively solve problems and identify opportunities.

Working in partnership with other road authorities, transport providers, businesses and other stakeholders is important to the operations of an efficient transport network. To achieve the actions and initiatives sought out in this plan for a future transport network requires the collaboration of multiple stakeholders.

The key to change and transition to a future transport network is to involve the community at every stage to promote the social, environmental and financial benefits for the community.

The key outcomes that would encourage partners and collaborations within the transport system and transport initiatives are:

Outcome 14	**Great Relationships**
Action 14.1	Work with Local Schools to provide information to improve awareness of road safety and traffic laws

Way2Go PROGRAM

The new shared pathway connections to Woodend Primary School, Sheidow Park was managed by Marion and funded by the State Government and was completed in 2019 through the Way2Go Program.

The joint initiative promotes and encourages students to actively travel to and from school all year round.

Grouped Action Plan

Principle		Outcome / Action	Comments / Funding	2021/22	2022/23	2023/24	2024/25	2025/26
Destination Centred	1	**Public Transport areas as welcoming people places**						
	1.1	Plan and upgrade key movement links to 13 railway stations and 8 tram stops. Including reviewing parking demand and identifying 'Park and Ride' solutions	Sites to be individually selected, scoped and cost estimations reviewed					
	1.2	Facilitate complementary land use and deliver high-quality design of public spaces (including greening) around railway stations to encourage connectivity with, and use of public transport	Sites to be individually selected, scoped and cost estimations reviewed					
	1.3	Advocate for upgrades of stations/platform areas	Within existing resources					
	1.4	Identify and upgrade infrastructure around highly utilised bus stops (e.g. Seaview High School bus zone on Seacombe Road)	Sites to be individually selected, scoped and cost estimations reviewed					
	1.5	Advocate for improved public transport and/or park and ride facilities throughout the City of Marion at underserviced locations (e.g. Laffers Triangle from the south to Flinders/Tonsley/Westfield Precinct and onwards to CBD by public transport)	Within existing resources					
	2	**Attractive & Accessible Business Districts**						
	2.1	Review and upgrade the Transport Network within the Edwardstown Industrial precinct	Within Existing Resources to review. Project to be scoped and cost estimations reviewed					
	3	**Schools and other Community Facilities that encourage active travel**						
	3.1	Work with Schools & DIT to identify opportunities for improvements in local streets near schools (e.g. car parking, drop off/pick up, wide footpaths)	Sites to be individually selected, scoped and cost estimations reviewed					
	3.2	Install amenities that support the destination zones (e.g. bike lockers, drinking fountains, device charging locations, etc.)	Future destination sites to be reviewed when upgrading for the opportunity to install amenities	Ongoing				
Integrated and Effective	4	**Encourage Alternative Transport Modes**						
	4.1	Implement the walking and cycling guidelines (including a cycle link as a continuation of Morphett Road to southern Marion)	Subject to project scope					
	4.2	Support businesses to encourage ride-sharing or vehicle sharing partnership opportunities	Within Existing Resources					
	4.3	Encourage E-Bike and/or E-Scooters services (e.g. Tonsley Precinct)	Within Existing Resources					
	4.4	Encourage public transport options (e.g. social media, website, etc.)	Within Existing Resources					
	5	**Efficient Road Network**						
	5.1	Develop the Parking Management Plan	Within Existing Resources					
	5.2	Work with developers (where appropriate) to achieve the best possible outcomes to parking and accessibility	Within Existing Resources - Ongoing	Ongoing				
	5.3	Undertake an annual monitoring program of traffic data of the road network to ensure network is operating as designed	Within Existing Budget ($20,000 /year)					
	6	**Well Planned Transport Network**						
	6.1	Implement the Tonsley-Flinders Integrated Traffic and Parking Strategy	Subject to project scope					
	6.2	Explore opportunities through State Government for major projects to implement facilities that can improve the transport network (e.g. East-West connections for the proposed North-South Corridor project)	Within Existing Resources					

Principle		Outcome / Action	Comments / Funding	2021/22	2022/23	2023/24	2024/25	2025/26
Sustainable and Safe	**7**	**Safe Transport Networks**						
	7.1	Deliver footpath widening in high priority locations across the footpath network to a minimum of 1.5m (including ensuring no footpath assets in the network are less than 1.2m)	Within Existing Budget					
	7.2	Identify problem areas and create program for all crossings and kerb ramps to be DDA Compliant by 2030	Within Existing Budget					
	7.3	Minimise footpath obstructions and encroachments to free up more space for walking (e.g. reduce sign pollution and other obstructions)	Within Existing Budget					
	7.4	Apply for Black Spot grant funding where available	Sites to be individually selected, scoped and cost estimations reviewed					
	7.5	Deliver and complete the DDA Bus stops and shelter compliance program by December 2022	Within Existing Budget					
	8	**Fewer non-essential vehicles within the Council Area**						
	8.1	Identify gaps in public transport service levels and advocate for solutions to enable mobility in Marion	Within Existing Resources					
Smart and Future Focused	**9**	**Utilising Technology to provide transport network benefit**						
	9.1	Explore Smart City technology to gather data to support decision-making relating to infrastructure and services, for apps to access real-time GPS multimodal travel choice/travel time/route and pickup decision making by users for wayfinding and real-time signage	Within Existing Resources - Individual technologies will be identified and cost estimated at future upgrade projects					
	9.2	Install Smart Parking Sensors in key destination and problem areas where demand is appropriate	Sites to be individually selected, scoped and cost estimations reviewed					
	9.3	Identify and install wayfinding and digital interactive screens at key locations within the city	Sites to be individually selected, scoped and cost estimations reviewed					
	10	**Support Zero-Emission Transport Initiatives**						
	10.1	Work with private suppliers to install electric vehicle charging stations throughout the city to support the growing use of electric modes of transport	Within Existing Resources					
	10.2	Transition Council's Fleet to a renewable energy fuel source in accordance with the Carbon Neutral Plan	Within Existing Resources					
	11	**Sustainable Infrastructure**						
	11.1	Encourage the use of recycled materials for transport infrastructure to support a circular economy	Within Existing Budgets					

Principle		Outcome / Action	Comments / Funding	2021/22	2022/23	2023/24	2024/25	2025/26
Amenity and Character	**12**	**Attractive Streetscaping**						
	12.1	Delivery of the 15 year Streetscape program	Within Existing Budget ($2.2 million /year)					
	12.2	Install amenities that support the use of active transport modes where appropriate (e.g. bike lockers, drinking fountains, park benches, etc.)	Sites to be individually selected and reviewed for cost estimations	Ongoing				
	12.3	Identify and provide interactive infrastructure (e.g. education paths & games within paving) that promotes active travel	Sites to be individually selected and reviewed for cost estimations					
	13	**Cooler Urban Environment**						
	13.1	Deliver the 10 year Treescaping program	Within Existing Budget ($400,000 /year)					
	13.2	Lower the urban heat within transport corridors through tree planting and green infrastructure	Within Existing Resources					
	13.3	Implement WSUD treatments along streets where appropriate	Sites to be individually selected, scoped and cost estimations reviewed					
Partners and Collaboration	**14**	**Great Relationships**						
	14.1	Work with Local Schools to provide information to improve awareness of road safety and traffic laws	Within Existing Resources					

9 Reports for Noting - Nil

10 Other Business

11 Meeting Closure

The meeting shall conclude on or before 9.30pm unless there is a specific motion adopted at the meeting to continue beyond that time.