CITY of MARION

LANDSCAPE IRRIGATION MANAGEMENT PLAN

Prepared for :

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Prepared by

June 2013

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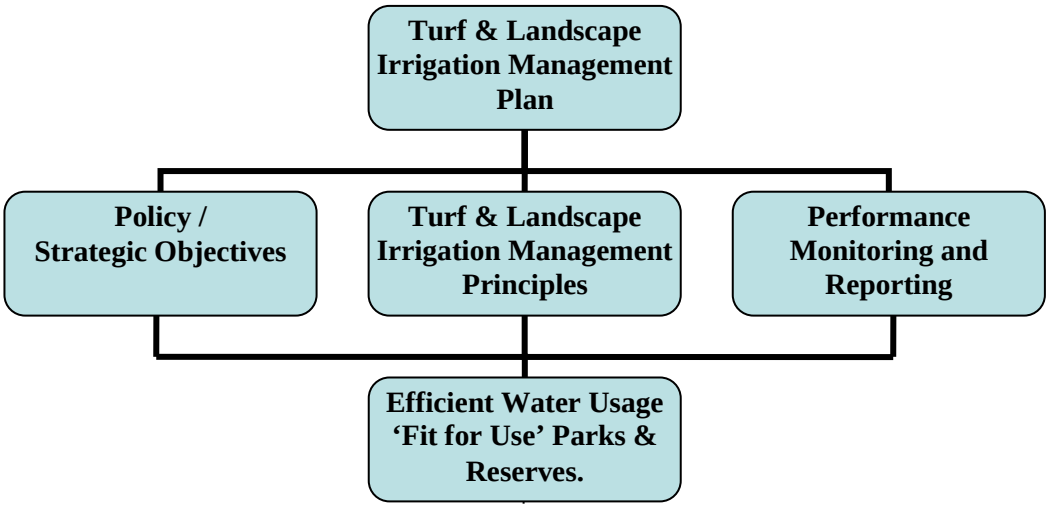
EXECUTIVE SUMMARY

This Landscape Irrigation Management Plan (LIMP) has been developed in response to the need for Council to strategically manage the use of water resources in an environment where water availability was restricted due to climate change, drought conditions experienced over the period 2004- 10 and the escalating cost of water which impacts significantly on Council's financial resources. Future water security will depend upon accountability for the use of this resource. Water consumption in the area of sports grounds, reserves and the landscape accounts for approximately 90% of total municipal water usage.

The Plan provides a framework whereby the issues of water usage are addressed strategically.



A robust, transparent and technically sound methodology has been developed to provide a framework and guidelines for decision making for the irrigation of public open space including the consideration of the sites to be irrigated and to what service level.

The methodology proposed is based on the Industry Code of Practice, legal requirements, Council policies and strategies regarding managing public open space and takes into account Council report GC1112212RO2 – Water Saving Target. Healthy Environmental Indicator.

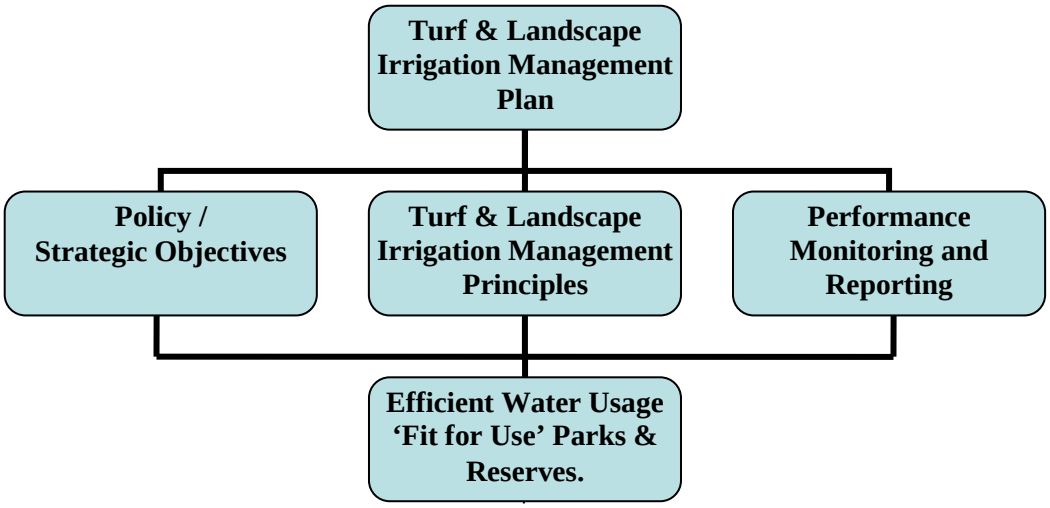
An operational tool has been developed to enable Council to assess the annual irrigation demand, water balance and budgets for the irrigation of public open space. The plan effectively removes the subjectivity in determining our irrigation schedules, drives the effective and efficient use of our water resources and provides the justification for the water budget.

1.0 INTRODUCTION

The City of Marion is committed to developing policies and strategies that demonstrate accountability and improve the water consumption practices within the City. This Landscape Irrigation Management Plan (LIMP) has been developed in response to the need for Council to strategically manage the use of water resources in an environment where water availability was restricted due to climate change, drought conditions experienced over the period 2004- 10 and the escalating cost of water which impacts significantly on Council's financial resources. Future water security will depend upon accountability for the use of this resource.

Water consumption in the area of sports grounds, reserves and the landscape accounts for approximately 90% of total municipal water usage. In circumstances where water restrictions are put in place, it is the area of irrigation of public open space which is in the first line of restriction. Also the escalating cost of mains water for irrigation is a significant issue for Council. It is necessary to develop strategies to ensure water is used efficiently in the irrigation of public open space.

This Plan provides a framework whereby the issues relating water usage are addressed strategically using the Code of Practice – Irrigated Public Open Space as a framework.



The plan addresses the following aspects of turf and landscape management;

- Irrigation policy and strategic objectives
- Council's drought response review
- Water supply options
- Turf and irrigation management principles
- Landscape design and management principles
- Turf and landscape monitoring and performance reporting

The plan culminates in a matrix of specific actions requiring Council endorsement and budget allocations to ensure sound turf and landscape management, demonstrated water use efficiency, 'fit for purpose' irrigated public open space and a proactive response to the provision of irrigated public open space.

2.0 LEGISLATIVE AND STRATEGIC FRAMEWORK

In managing the irrigated public open space within Council, there are Federal and State Government legislation and policies that need to be considered and adhere to. These include;

- National Water Initiative 2004
- Environment Protection Act 1993
- Environment Protection (Water Quality) Policy 2003
- Natural Resource Management Act 2004
- South Australian Strategic Plan 2005
- Permanent Water Conservation Measures 2010
- Water Proofing Adelaide Strategy : A Thirst for Change 2005 – 2025
- WPA Strategy No 33. – Code of Practice – Irrigated Public Open Space (2008)
- Water for Good (2009)
- Permanent Water Conservation Measures 2010
- Central Adelaide Groundwater Area Water Allocation Plan
- Public Health Act SA 2011

The City of Marion has developed policies and strategies that support efficient and environmentally responsible water management practices. These include

- City of Marion – Play Space Strategy 2008
- City of Marion – Open Space and Recreation Strategy 2006 - 2016
- City of Marion – Council Report Ref. GC111212RO2 – Water Saving Target. Healthy Environment Indicator (Dec 2012)

There are industry standards and codes of practice referenced in this document

- SA Water – 'Code of Practice : Irrigated Public Open Space' (2007)
- Irrigation Australia Ltd – 'Urban Irrigation : Best Management Practice' (2006)

3.0 LANDSCAPE IRRIGATION POLICY

In order to ensure sustainable water management is a priority for Council, a clear policy statement in relation to landscape irrigation has been developed. The policy outlines the commitment to sustainable water use in the management of irrigated public open space (IPOS). The policy is succinct and able to guide future decisions in relation to the provision and management of IPOS. The policy addresses the planning and development of new sites and provides guidelines to assess the appropriateness of current irrigated sites.

The objectives of this policy are to:

- Achieve a balance between the provision of an amenity landscape that is aesthetically pleasing, meets the needs of the community and is economically and environmentally sustainable.
- Implement the principles of 'Water Sensitive Urban Design' to achieve integration of water cycle management into urban planning and design.
- Achieve a consistent approach in the provision and development of the irrigated landscape.
- Provide a clear direction and framework for irrigation and water management strategies to enable water conservation and financial accountability.

The "Draft Marion Landscape Irrigation Policy" is attached as Appendix No 1.

Recommendation No 1 –

Council endorse the 'Marion - Landscape Irrigation Policy'

4.0 IPOS IVENTORY / BASE DATA

The base data for this "Landscape Irrigation Management Plan" has been compiled into an Irrigated Public Open Space (IPOS) Inventory which provides a range of information and data to provide modelling for the plan. The main data sets contained in the inventory are as follows;

- Base Data – reserve name, reserve type, UBD reference
- SA Water Data – property location, account No, meter No, water usage records 2005 – 2011.
- Reserve Inspection Data – meter location, GPS waypoints, reserve condition report.
- IPOS Decision Support Tool (IDST) Analysis – reserve classification, developments, IDST assessment, irrigated area, water supply, ASR priority, irrigation requirement, water cost.
- Irrigation Requirement / Water Cost Analysis – TQVS classification, water supply source, base irrigation requirement, water cost.
- Oaklands Park ASR Data – ASR priority, ASR potential irrigated area, irrigation requirement, water cost.
- Turf Maintenance Costs – current irrigated area, ASR potential irrigated area, IDST recommended irrigated area.
- Irrigation System Performance – irrigation audit results, remedial action, cost, action priority.
- 'Nearmap.com' is used to validate current irrigated area.

The IPOS Inventory is attached as Appendix No 2.

5,0 IMPACT of DROUGHT RESPONSE STRATEGIES

5.1 Drought Response 2004 – 2010.

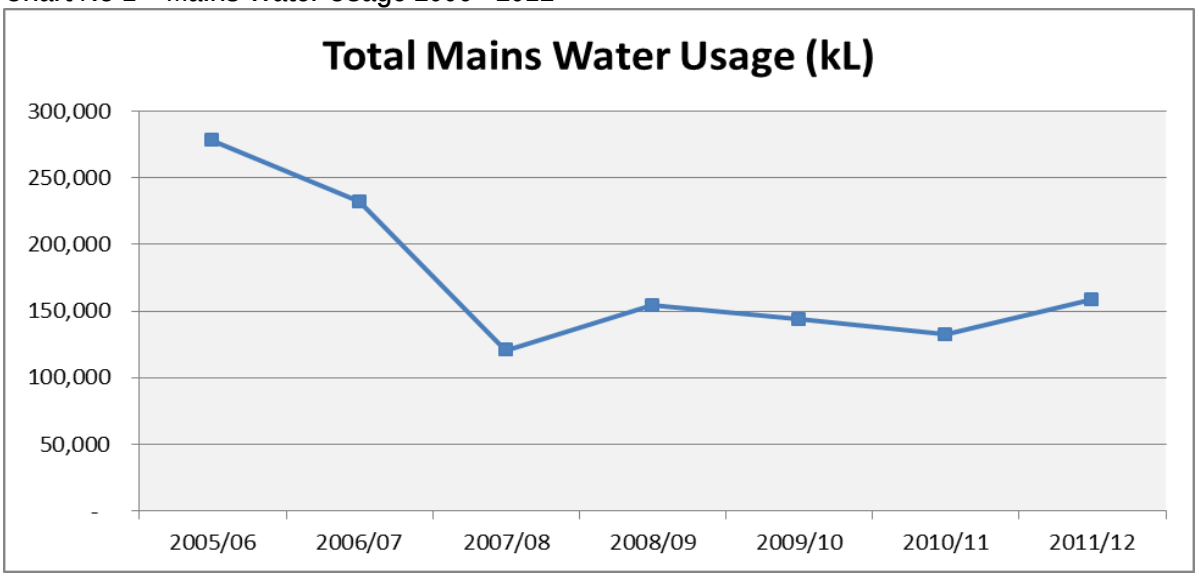
The use of mains water for the irrigation of public open space was restricted since the implementation of 'Permanent Water Conservation Measures' in 2004'. The introduction of Level 3 Restrictions in 2007 resulted in the requirement to gain an exemption permit from the restrictions in order to irrigate Council reserves. As part of the exemption principles Council was required to demonstrate a 20% reduction in water use through the 'browning off' of some reserves. Whilst restrictions were removed in 2011, 'Water Wise Measures' are now in place which continue to require Council to register irrigated sites with SA Water and report monthly on water usage against water use targets. These targets are based on the irrigation requirement of the site, calculated according to the principles outlined in the 'Code of Practice – Irrigated Public Open Space'. For further information on 'Water Wise measures' for Local Government can be found on the SA Water website. www.sawater.com.au. The use of alternative water sources to SA Water mains has remained unrestricted throughout this period.

In response to the drought and restricted access to mains water the City of Marion adopted a strategy whereby the irrigation of all reserves except for major sporting ovals and community parks was turned off in 2007. This resulted in significant reduction of water consumption as detailed in the table and chart below.

Table No 1 - Mains Water Usage 2006 - 2012

Year	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12
Total Mains Water Usage (kL)	278,114	232,002	120,573	154,309	143,814	132,402	158,544
Diff compared to 2005/06 (kL)		46,112	157,541	123,805	134,300	145,712	119,570
Diff compared to 2005/06 (%)		16.6%	56.6%	44.5%	48.3%	52.4%	43.0%

Chart No 1 – Mains Water Usage 2006 - 2012



Prior to 2007/08, the number and area of reserves was 144, 134 on mains water and 10 on bore water, with a total area of 75.3 ha. The number of reserves irrigated in 2008/09 had reduced to 26, 16 on mains water and 10 on bore water with a total area of 41.8 ha. This equates to a reduction of 82% in the number of irrigated reserves across the city and 44% in total irrigated area. (Actual reserves are listed in Appendix No 2 – IPOS Inventory)

Table No 2 - Irrigated Reserves Pre / Post 2007/08

Period	Pre - 2007/08		Post - 2007/08		Variance	
Description	No of Reserves	Area (ha)	No of Reserves	Area (ha)	Diff No (%)	Diff ha (%)
Irrigated Reserves	144	75.3	26	41.8	82%	44%
SA Water Mains	134	55.6	16	22.1	88%	60%
Ground Water Bores	10	19.7	10	19.7	0%	0%

5.2 Drought Response Post - 2011.

Water restrictions were lifted and replaced by 'water wise measures' in 2011 following significant rainfall in 2010 and the construction of the Adelaide Desalination Plant. This enabled Council to re-activate irrigation on reserves. As a result of the playground re-development program and customer requests the number of irrigated reserves was increased across the City to a total of 71, 61 on mains water and 10 on bore water, with a total area of 53.1 ha. This represents a reduction on pre-2007 levels of 51% in the number of irrigated reserves across the City and 29% in total irrigated area compared to pre-drought conditions.

Table No 3 - Irrigated Reserves Post – 2011

Period	Post - 2011		Variance Pre - 2007 Vs 2011	
Description	No of Reserves	Area (ha)	Diff No (%)	Diff ha (%)
Irrigated Reserves	71	53.1	51%	29%
SA Water Mains	61	33.4	54%	40%
Ground Water Bores	10	19.7	0%	0%

Chart No 2 & 3 shows the number and area (ha) of reserves irrigated pre-drought in 2007 with the reduction in irrigation as a result of water restrictions in 2007/08 and the subsequent increase following the lifting of restrictions in 2010/11.

Chart No 2 – Comparison of No of Irrigated Reserve Pre-2007 Vs Post-2011

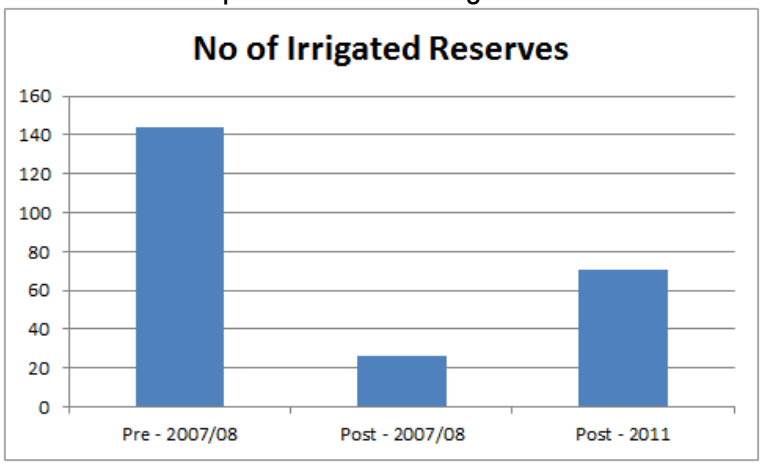
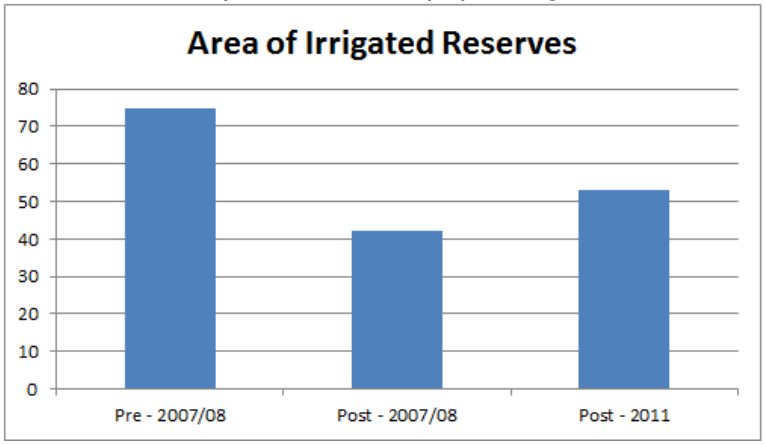


Chart No 3 – Comparison of Area (ha) of Irrigated Reserves Pre-2007 Vs Post-2011



5.3 Impact of Mains Water Cost Increase.

Whilst mains water is now accessible, the cost of water has had a significant impact on Council's ability to provide irrigated public open space. There has been a 217% increase in water cost per kL from 2006 to 2012 as detailed Table No 4.

Table No 4 - SA Mains Water Cost Increase 2006 - 2012

Year	2006	2007	2008	2009	2010	2011	2012/13
Cost $ / kL	1.09	1.16	1.38	1.88	2.48	2.75	3.45
Variance $		0.07	0.22	0.50	0.60	0.27	0.70
Variance %		6%	19%	36%	32%	11%	25%
				Varaiance 2006 - 2012 ($)			2.36
				Variance 2006 - 2012 (%)			217%

The increase in the cost of water has meant that even though there has been a reduction in total water use in the order of 43% since 2006, the actual expenditure on total water used in 2012 has in fact risen by 48% as detailed in Table No 5;

Table No 5 - Impact of Mains Water Cost Increases.

Year	2005/06	20011/12
Water Usage (kL)	278,114	158,544
Water Cost ($ / kL)	1.06	2.75
Total Cost	$ 294,801	$ 435,996
% reduction in water usage		43%
% increase in water cost		48%
2006 usage @ 2012 cost		$ 764,814

This cost increase has meant that whilst water restrictions have been lifted and mains water has become more accessible, Council's ability to return to pre-drought levels of irrigated public open space and water consumption is impacted by significant water cost increases.. Whilst public pressure to provide higher amenity and green space has increased, Council must manage the total area of irrigated public open space so that an appropriate amenity is provided for the community within budgetary constraints.

6.0 TURF IRRIGATION WATER REQUIREMENT BENCHMARKS

Using the Irrigation Requirement Model developed for the IPOS - Code of Practice, water usage benchmarks have been calculated for the 4 categories of irrigated public open space according to the Turf Quality Visual Assessment (TQVS) classifications. The model calculates the annual base irrigation water requirement based on climatic, agronomic, turf quality and system performance factors. The outcome is water consumption targets, based on long term average climatic conditions, in kiloliters per hectare (kL/ha). As this data is calculated using average climatic data from 2005 – 2010, there is always some variance due to seasonal differences. When monitoring water use efficiency the actual irrigation water requirement for the period should be used, which is based on the actual climatic conditions for that period. Table No 6 below shows a comparison between the Base Irrigation Requirement (BIR) calculated using long term climatic data, data for the period 2005 - 2010 and the actual irrigation requirement (AIR) for the last irrigation season 2012/13

Table No 6 - Irrigation Water Requirement Benchmarks

TQVS cat.	Description	Base Irrigation Requirement Long Term Avge (kL/ha)	Base Irrigation Requirement Avge 2005 -2010 (kL/ha)	Actual Irrigation Requirement Actual 2012/13 (kL/ha)
TQVS 1	Elite Sports Turf	8,400	**10,500**	11,700
TQVS 2	Premier Sports Turf	4,600	**5,700**	6,700
TQVS 3	Local Sports Turf	3,600	**4,500**	5,500
TQVS 4	Passive Recreational Turf	2,700	**3,300**	4,200

The variance in irrigation requirement is significant, with the 2012/13 irrigation season being 53% higher than the long term average and 22% higher than the drought average.

The base irrigation requirement is used for forecasting and budgeting purposes whereas the actual irrigation requirement is used for scheduling and monitoring irrigation efficiency.

7.0 WATER SUPPLY OPTIONS.

There are several options other than SA Water mains water supply for the irrigation of public open space within the City. Alternatives include ground water bores, aquifer storage and recovery (ASR) - Oaklands Park Stormwater Reuse Project, treated effluent - SA Water Glenelg Adelaide Pipeline (GAP). The current profile of water supply for irrigated public open space across the city is detailed below.

Table No 7 - Current Water Supply and Cost 2012/13

Water Supply	Water Cost per kL ($)	Reserves (No)	Area (ha)	Area %
SA Water Mains	3.45	61	33.4	63%
Ground Water Bores	0.60	10	19.7	37%
Oaklands Park ARS	2.20	0	0	
SA Water GAP recycled	2.40	0	0	
Total		71	53.1	

The cost of water varies significantly from $0.60 for ground water bores to $3.45 for SA Water mains. The cost of ASR and recycled water is approximately 70% that of mains water at $2.20 and $2.40 respectively.

Whilst all irrigation is currently supplied by either SA Water mains or groundwater bores the Oaklands Park ARS Project is currently under construction and has potential to supply water to many reserves. The above water supply options are further discussed below.

7.1 SA Water Mains Water

Currently 63% of the irrigated area in the City is supplied by SA Water mains water. As discussed the use of SA Water mains water supply for the irrigation of public open space was significantly restricted during the drought years 2005 – 2010. This resulted in the browning off of many of the formerly irrigated reserves within the City. The construction of the 100 Gl desalination plant and increased rainfall has resulted in increased access to mains water for irrigation. However the significant increase in the cost of water (217% from $1.06 in 2006 to $3.45 in 2012) has impacted on the ability of Council to fund the use of mains water for irrigation. Whilst it is envisaged that increases in mains water cost will be kept in line with the Consumer Price Index (CPI) for 2013/14, in the long term it is expected that mains water cost will increase substantially. The use of SA Water mains water is expensive and continued use as the main supply for irrigated public open space is not financially viable, hence the development of alternative water sources.

7.2 Groundwater Bores

Approximately 37% of Councils irrigation requirements are supplied by ground water bores within the Central Adelaide Groundwater Area (CAGA). Whilst the capital cost of developing a ground water bore is high, the ongoing cost of water supplied from bores is significantly less than mains water. The costs consist of electricity costs for pumping and pump and bore maintenance. When compared to increasing costs of mains water the ground water option is desirable.

Table No 8 - Estimated Cost of Groundwater

Water Source	Cost per kL ($)	Comment
Existing Bore	$0.60	Includes power and bore maintenance

Ground water bores in the Central Adelaide Ground Water Area (CAGA) were prescribed in 2007. Prescription establishes a water allocation and licensing system. In order to continue drawing water from existing bores, Council was required to apply for a 'Water Licence'. The Water Allocation Plan for the CAGA is currently being developed. An interim water licence was approved for all current users which will allow Council to continue to use water from existing bores. The water allocation plan will set water allocation quotas for all licensed bores. A condition of the licence will be that all bores are metered. For Council to increase its use of ground water bores, it will be necessary to apply for new licenses, purchase existing licenses from current users or gain credits from aquifer recharge and storage.

Bore water usage records do not exist as bores are currently not metred so it is not possible to determine accurate water usage rates. Using benchmark irrigation requirements, it is possible to approximate usage rates. Reserves supplied by ground water bores and approximate water usage are listed in Table No 9.

Table No 9 - Reserves Supplied by Ground Water Bores.

Reserve Name	Area (ha)	Irrigation Requirement (kL/Annum)	Bore Water Cost @ $0.60 kL	Mains Water Cost @ $3.45 kL
Dwyer Rd Reserve	0.48	1,584	$ 950	$ 5,465
Edwardstown Memorial Oval	1.90	8,550	$ 5,130	$ 29,498
Glandore Oval 1	2.00	11,400	$ 6,840	$ 39,330
Hazelmere Reserve	1.54	6,930	$ 4,158	$ 23,909
Marion Oval	5.10	22,950	$ 13,770	$ 79,178
Marion Swim Centre Inside fence	1.20	3,960	$ 2,376	$ 13,662
Marion Swim Centre Reserve	1.60	5,280	$ 3,168	$ 18,216
Oakland Estate	2.70	8,910	$ 5,346	$ 30,740
Plympton Oval	1.80	8,100	$ 4,860	$ 27,945
Warraparinga	1.40	4,620	$ 2,772	$ 15,939
Total	**19.7**	82,284	**$ 49,370**	**$ 283,880**

A total of 19.72 hectares of reserves are currently supplied by ground water bores accounting for a total of 82,284 kL of water. This equates to an annual cost of approximately $49,400 at a rate of $0.60 per kL compared to $283,900 at the current mains water rate of $3.45 kL.

A condition of bore licencing is the installation of approved water meters. Currently bores are not metered and 10 sites will require meters at an approximate cost of $5,000 per site.

7.3 Storm Water Harvesting / Aquifer Storage & Recovery (ASR)

Council currently has no irrigation supplied by stormwater harvesting or ASR sites. However, with the construction of the Oaklands Park ASR Project, which is currently in progress, opportunities arise to covert many reserves from mains water to ASR supply. Oaklands ASR Project is located at the old Department of Transport Driver Training Centre on Oaklands Rd. The project consists of a series of wetlands to cleanse water redirected from the Sturt Creek which is then injected into ASR bores. Water is then recovered from the bores during the irrigation season and directed through a mainline to reserves. The mainline runs along the Sturt Creek linear park with spur lines running off where appropriate. This project has the potential to provide a total of up to 400 ML/Annum for irrigation purposes.

The 'Oaklands Park Wetlands Peak Demand Audit Report - 2012' investigated irrigation demand and suitable sites for supply by the Oaklands Park ASR project. Sites selected are listed in Table No 10;

Table No 10 - Oaklands ASR Project – Irrigation Potential

Reserve Name	ASR Priority 1 / 2 / 3 / 4 / 5	ASR Potential Irrigated Area (ha)	Current irrigated Area (ha)	Current Water Supply	Current Irrigation Requirement (kL/Annum)	ASR Irrigation Requirement (kL/Annum)	System Remedial Works required.	Remedial Works Cost ($)
Alison Avenue Reserve	1	0.32	0.22	Mains	726	1,056	Maintenance	$ 500
Bombay St Reserve	1	1.65	0.00	No Irrigation	-	5,445	New	$ 83,000
City of Marion Depot (Mario	1	0.50	0.00	No Irrigation	-	1,650	New	$ 25,000
Kenton Ave Reserve	1	0.74	0.00	No Irrigation	-	2,442	Maintenance	$ 2,000
Maldon Ave Reserve	1	0.75	0.40	Mains	1,320	2,475	Replaced	$ -
Marion Swim Centre Inside f	1	1.20	1.20	Bore	3,960	3,960	Maintenance	$ 500
Marion Swim Centre Outside	1	2.43	1.60	Bore	5,280	8,019	Maintenance	$ 3,000
Mitchell Park Oval / Reserve	1	5.00	4.57	Mains	20,565	22,500	Maintenance	$ 10,000
Oakland Estate	1	2.70	2.70	Bore	8,910	8,910	Maintenance	$ 5,000
Oakland Wetland	1	1.30	0.00	No Irrigation	-	4,290	New	$ 65,000
Oakleigh Rd reserve	1	0.48	0.00	No Irrigation	-	1,584	Maintenance	$ 200
Oliphant Ave Reserve	1	0.75	0.00	No Irrigation	-	2,475	New	$ 38,000
Quick Reserve inc Egan Cres	1	1.07	0.00	No Irrigation	-	3,531	New	$ 54,000
Rajah St Reserve	1	0.29	0.00	No Irrigation	-	957	Good	$ -
Ascot Park Bowling Club (Da	2	0.55	0.55	Mains	5,775	5,775	Good	$ -
Denham Reserve	2	0.40	0.00	No Irrigation	-	1,320	Maintenance	$ 500
Everest reserve	2	0.72	0.00	No Irrigation	-	2,376	Replace	$ 36,000
Kellet Oval	2	1.33	1.33	Mains	5,985	5,985	Maintenance	$ 3,000
Marion Bowling Club	2	0.75	0.75	Mains	7,875	7,875	Good	$ -
Marion Leisure Centre & Ros	2	0.91	0.00	No Irrigation	-	3,003	Replace	$ 46,000
Marion Oval 1 & 2 & croque	2	5.10	5.10	Bore	22,950	22,950	Maintenance	$ 20,000
Parsons Gr Reserve 1	2	0.20	0.00	No Irrigation	-	660	Maintenance	$ 500
Sandison Res (South Res Par	2	0.26	0.00	No Irrigation	-	858	Maintenance	$ 2,000
Chittleborough Reserve No 1	3	0.61	0.61	Mains	2,013	2,013	Maintenance	$ 500
Chittleborough Reserve No 2	3	0.13	0.13	Mains	429	429	Maintenance	$ 300
George St Reserve	3	0.87	0.95	Mains	3,135	2,871	Maintenance	$ 500
Hamilton Park	3	1.00	1.00	Mains	3,300	3,300	Maintenance	$ 5,000
Hazelmere Reserve	3	1.54	1.54	Bore	6,930	6,930	Maintenance	$ 5,000
Marion Community Centre (	3	0.47	0.00	No Irrigation	-	1,551	New	$ 23,000
Allawoona Reserve 1	4	0.90	0.00	No Irrigation	-	2,970	Replace	$ 45,000
Tonsley Hall Reserve	4	0.30	0.00	No Irrigation	-	990	New	$ 15,000
Trowbridge Ave	4	0.63	0.00	No Irrigation	-	2,079	Maintenance	$ 4,000
Appleby Reserve	5	0.98	0.00	No Irrigation	-	3,234	New	$ 49,000
Kendall Reserve (McKellar R	5	0.27	0.00	No Irrigation	-	891	New	$ 14,000
Na Botto Reserve	5	0.40	0.00	No Irrigation	-	1,320	Replace	$ 20,000
Penrith Crt Reserve	5	0.23	0.00	No Irrigation	-	759	New	$ 11,000
Willoughby Avenue Reserve	5	1.40	0.20	Mains	660	4,620	Replaced	$ -
Total		**39.13**	**22.85**		**99,813**	**154,053**		**$ 586,500**

In summary the implications of irrigating all sites listed using the Oakland Park ASR project Include;

- A total of 37 reserves with a total area of 39.13 ha will be supplied by the ASR project.
- Of the 37 potential irrigated sites, 21 are currently not irrigated. This will result in an additional 16.28 ha of irrigation and an additional 54,240 kL per annum.
- 5 sites currently irrigated by ground water bores are to be transferred to ASR.

The report also identified remedial and replacement costs of $586,500 required to upgrade or install new irrigation systems to be supplied by the ASR project.

7.4 Treated Effluent – SA Water Glenelg Adelaide Pipeline

Completed in 2010, the SA Water Glenelg Adelaide Pipeline (GAP) transports 3.8 GL of Class A recycled water from the Glenelg Sewerage Treatment Works via a mainline down Anzac Highway to the Adelaide Parklands. This pipeline provides access to recycled water that can be used by Councils for the irrigation of public open space. The cost of GAP water is approximately 70% of mains water at 2.40 kL. There is potential for Marion to access the GAP water. To do this Council would have to provide funding to construct infrastructure to connect to the mainline to transport water to reserves. At this stage there are no plans for Council to access GAP water for irrigation.

7.5 Water Supply Options Summary

The rising cost of SA Water mains water and the uncertainty of future access to this water for irrigation results in a situation where, to ensure future security and cost effective supply of water to irrigate public open space, alternative water supplies are needed.

Council currently irrigates a total of 71 reserves covering an area of 53.1 ha. Of these 61 are supplied by SA Water mains water and 10 by ground water bores. The Oaklands Park ASR Project is under construction and has the potential to supply water to a total of 37 reserves with an area of 39.13 ha of which 16.3 ha is currently not irrigated. A summary of current and proposed distribution of water supply is detailed in Table No 11.

Table No 11 - Water Supply Current / Proposed – Area

		Current			Proposed		
Water Supply	Water Cost per kL ($)	Reserves (No)	Area (ha)	Area %	Reserves (No)	Area (ha)	Area %
SA Water Mains	3.45	61	33.4	63%	46	22.7	33%
Ground Water Bores	0.60	10	19.7	37%	5	7.6	11%
Oaklands Park ARS	2.20	0	0		37	39.1	56%
SA Water GAP recycled	2.40	0	0		0	0.0	
Total		71	53.1		88	69.4	

Whilst the health considerations of using ASR water are not significant, Council must meet Department of Health requirements in relation to hours of operation and signage to advise the public that non-potable water is being used. To this end it is recommended that Council develop a communication strategy including a logo and signage to ensure the community is aware of the benefits and health considerations of using ASR water.

Recommendation No 2 –
Council continue to develop alternative water supply sources to SA Water mains water for the irrigation of the landscape and open space within the City.

Recommendation No 3 –
Council install water meters at all bore sites prior to the 2013/14 irrigation season, at a cost of approximately $5,000 per site. (10 sites @ $5,000 = $50,000)

Recommendation No 4 –
Council develop a communication strategy including a logo and signage to ensure the community is aware of the benefits and health considerations of using ASR water.

8.0 WATER BUDGET

Using the IPOS – Irrigation Requirement Model a water budget has been developed which sets irrigation water consumption targets. The model calculates the irrigation requirement (Ir) of each site for a given period based on climatic, agronomic, turf quality and system performance factors. The outcome is water consumption targets, based on long term average climatic conditions, in kilolitres per hectare. From the water budget a financial budget for water cost can also be developed to enable the management of both water and financial resources. The base irrigation requirement data can be applied to Council's irrigated reserves to provide an aggregate irrigation water budget for the city. A water budget for each category of reserve is summarized in the Tables below. Note - Base Irrigation Requirements (BIR) for the period 2005 – 2010 have been used for budgeting purposes.

8.1 Current Irrigated Area Water Supply Cost

The costs for forecast water usage for the 2012/13 irrigation season are detailed in Tables 12 below.

Table No 12a – Current Mains Water Usage / Cost Forecast 2012/13

Reserve Type	TQVS Cat.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Elite Sport (Bowlimg Clubs)	1	1.72	10,500	18,060	3.45	$62,307
Premier Sport	2		5,700	0	3.45	$0
Local Sport	3	10.50	4,500	47,250	3.45	$163,013
Passive Rec.	4	21.19	3,300	69,927	3.45	$241,248
Total BIR		33.41	4,048	135,237	3.45	$466,568
2011/12 Irrig. Usage		33.41	4,289	143,294	3.45	$494,364
Target Irrigation Usage (Mains Water)		**33.41**	**4,000**	**133,640**	**3.45**	**$461,058**

Table No 12b – Current Bore Water Usage / Cost Forecast 2012/13

Reserve Type	TQVS Cat.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Elite Sport	1		10,500	0	0.60	$0
Premier Sport (Glandore Oval)	2	2.00	5,700	11,400	0.60	$6,840
Local Sport	3	10.34	4,500	46,530	0.60	$27,918
Passive Rec.	4	7.38	3,300	24,354	0.60	$14,612
Total BIR		19.72	4,173	82,284	0.60	$49,370
2011/12 Irrig. Usage (No records)					0.60	
Target Irrigation Usage (Bore Water)		**19.72**	**4,000**	**78,880**	**0.60**	**$47,328**

Table No 12c – Current Total Water Usage / Cost Forecast 2012/13

Reserve Type	No	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Total Mains Water Reserves	61	33.41	4,000	133,640	3.45	$461,058
Total Bore Water Reserves	10	19.72	4,000	78,880	0.60	$47,328
Total All Reserves	**71**	**53.13**	**4,000**	**212,520**	**2.39**	**$508,386**

Given the current number and area of irrigated reserves, it is forecast that a total of 212,500 kL of water at a cost of $508,400 will be used for irrigated turf.

8.2 ASR Potential Irrigated Area Water Supply Cost

With the completion of the Oaklands Park ASR Project and the proposed increase in the number and area of reserves and changes in water supply, the forecast water use and cost are detailed in Tables 13 below.

Table No 13a – Proposed ASR Water Usage / Cost Forecast

Reserve Type	TQVS Cat.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Elite Sport (Bowlimg Clubs)	1	1.3	10,500	13,650	2.20	$30,030
Premier Sport	2		5,700	0	2.20	$0
Local Sport	3	12.97	4,500	58,365	2.20	$128,403
Passive Rec.	4	24.86	3,300	82,038	2.20	$180,484
Total BIR		39.13	3,937	154,053	2.20	$338,917
Target Irrigation Usage (ASR Water)		**39.13**	**4,000**	**156,520**	**2.20**	**$344,344**

Table No 13b – Proposed Mains Water Usage / Cost Forecast

Reserve Type	TQVS Cat.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Elite Sport	1	0.42	10,500	4,410	3.45	$15,215
Premier Sport	2		5,700	0	3.45	$0
Local Sport	3	4.60	4,500	20,700	3.45	$71,415
Passive Rec.	4	17.68	3,300	58,344	3.45	$201,287
Total BIR		22.7	3,676	83,454	3.45	$287,917
Target Irrigation Usage (Mains Water)		**22.7**	**4,000**	**90,800**	**3.45**	**$313,260**

Table No 13c – Proposed Bore Water Usage / Cost Forecast

Reserve Type	TQVS Cat.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Elite Sport	1		10,500	0	0.60	$0
Premier Sport (Glandore Oval)	2	2.00	5,700	11,400	0.60	$6,840
Local Sport	3	3.7	4,500	16,650	0.60	$9,990
Passive Rec.	4	1.88	3,300	6,204	0.60	$3,722
Total BIR		7.58	4,519	34,254	0.60	$20,552
Target Irrigation Usage (Bore Water)		**7.58**	**4,000**	**30,320**	**0.60**	**$18,192**

Table No 13d – Proposed Total Water Usage / Cost Forecast

Reserve Type	No.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Water Cost ($/kL)	Total Cost ($)
Total ASR Water Reserves	37	39.13	4,000	156,520	2.20	$344,344
Total Mains Water Reserves	46	22.7	4,000	90,800	3.45	$313,260
Total Bore Water Reserves	5	7.58	4,000	30,320	0.60	$18,192
Total All Reserves	**88**	**69.41**	**4,000**	**277,640**	**2.43**	**$675,796**

Given the proposed increase in the number and area of irrigated reserves, and the addition of ASR water supply, it is forecast that a total of 277,600 kL of water at a cost of $675,800 will be used for irrigated turf.

8.3 Comparison of Current Vs Proposed Water Usage Cost

Table 14 below compares the current irrigated area and cost and that proposed with the ASR project.

Table No 14 – Current Vs Proposed Total Water Usage / Cost Forecast

Reserve Type	No.	Area (ha)	Base Irrig Req. (kL/ha)	Total Base Irrig Req. (kL)	Average Water Cost	Total Cost ($)
Total Current Water Supply. (Mains / Bore)	71	53.13	4,000	212,520	2.39	$508,386
Total Proposed Water Supply. (ASR / Mains . Bore)	88	69.41	4,000	277,640	2.43	$675,796
Difference Current Vs Proposed	**17**	**16.28**	**0**	**65,120**		**$167,410**

Whilst the Oaklands ASR Project has potential to supply water to a large number of reserves, the actual extent of irrigated reserves needs to consider the cost implications and the functional benefit of irrigation at each site. These considerations include;

- The ongoing water cost impact of the proposed transfer of water supply to ASR and the increase in irrigated area is an increase of $167,400 at current water prices.

- The cost of using ASR water is estimated at $2.20 per kL. Whilst this is considerably less than mains water ($3.45 kL) it is significantly more expensive than current ground water bores ($0.60 kL)

- There are currently 5 sites supplied by bores totalling 12.97 ha. at a water cost of $28,800 which would be increased to a water cost of $111,700 if converted to ASR.

- Of the 37 potential ASR sites, there are 21 sites that are currently not irrigated that would incur a water cost of $97,600 if the potential 13.5 ha was irrigated using ASR. Of these 10 sites do not have an irrigation system and 4 require a full replacement system at a cost of $524,000. For the remaining sites maintenance works to value of $62,500 are required. Refer Table No 10.

- There are 11 sites currently supplied by mains water totalling 10.71 ha at a water cost of $178,700 which would be reduced to $129,600 if converted to ASR.

- Overall the conversion of all potential sites to ASR would result in additional irrigated area of 16.3 ha from 53.1 ha to 69.4 ha at an increased water cost of $167,400 from $508,400 to $675,800 with an additional cost of $586,500 for maintenance, replacement and new irrigation systems.

Whilst the estimated ASR water cost of $2.20 p/kL cited is the market rate for ASR water, the actual costs to Council needs to be evaluated further.to ensure that internal charges reflect the actual cost of providing the ASR water. The actual cost of providing ASR water to internal customers, not including initial capital investment, is the operational cost associated with pumping and infrastructure maintenance. The internal cost transfer issue needs to be taken into consideration when evaluating the actual cost of using ASR water for irrigation.

Whilst the budget provides base line water consumption and financial targets, the budget must be reviewed monthly to account for seasonal weather variations. The plant water requirement during drought conditions can be up to 30% higher than the BIR and during a milder season where above average rainfall is experienced the plant water requirement can be less that the BIR.

Recommendation No 5 –
Council determine the actual cost of the provision of ASR water to form the basis of internal budgets and costings.

Recommendation No 6 – Water usage budgets be allocated as per forecasts in Table 14 depending on the actual extent of irrigated public open space. Current irrig area - $508,000 / ASR proposed irrig area - $675,000

9.0 IPOS DECISION SUPPORT TOOL (IDST)

Since the lifting of water restrictions in 2011 there has been significant community pressure to increase the extent of irrigated reserves to pre–drought levels. Whilst access to water is not an issue, the significant increase in the cost of mains water has created a situation where Council does not have the resources to fund pre-drought levels of irrigated public open space. Therefore it is necessary to evaluate current and potential irrigated sites to ensure that the provision of IPOS meets the needs of the community and is financially viable for Council.

A Decision Support Tool has been developed to guide and assist Council staff in making decisions in relation to what open space sites should be irrigated and the appropriate level of service provision for each site. This tool can be used for strategic planning to prioritise sites to be irrigated and as an operational tool to determine service levels and strategies to deal with water access or budgetary considerations in the rationalisation of irrigated public open space within the City.

The " Decision Support Tool" has been informed by the "Landscape Irrigation Policy 2013", "Landscape Irrigation Management Plan 2013", "Play Space Strategy 2008" and the "Open Space and Recreation Strategy 2006 - 2016".

The tool poses relevant questions that need to be considered when making a decision to irrigate sites in relation to the function of irrigated landscape, the area to be irrigated, water supply options, maintenance levels and the cost of irrigation. Whilst the cost of irrigation is a major consideration it should not be the initial factor considered. Factors such as functional benefit, natural and developed amenity, functional benefit and community usage should be considered in the first instance followed be an evaluation of water supply options and cost.

Appendix No 3 provides the "IPOS Decision Support Tool Methodology" and the "IPOS Decision Support Tool Flow Chart". The IDST is applied in the IPOS Inventory. The results of this evaluation are compared to the current and ASR proposed irrigated reserves in Table No 15 and 16.

Table No 15 - IDST Proposed Irrigated Reserves

Reserve Classification	No	Area (ha)	Requirement
Regional	12	22.8	115,155
Precinct	8	8.4	27,720
Neighbourhood	31	14.1	46,464
Local	63	10.7	35,393
Feature Landscape	2	0.3	990
IDST Proposed	**116**	**56.3**	**225,722**

Table No 16 - IDST Proposed Irrigated Reserves Compared to Current and ASR Proposed Reserves.

Irrigated Reserves	No	Area (ha)	Irrigation Requirement (kL/Annum)
Pre-2007	144	75.3	296,181
Post-2007	26	41.8	180,198
Current (2012/13)	71	53.1	217,521
Current + Proposed ASR	88	69.4	271,761
IDST Proposed	**116**	**56.3**	**225,722**

Whilst the total IDST proposed irrigated area is marginally higher than the current provision and lower than that of the ASR proposed, the number of irrigated reserves is significantly higher. This provides increased functional irrigated open spaces and higher amenity for the community distributed across the City and compliments other developments such as playgrounds and picnic facilities.

The IDST evaluation and recommendations provide a structured process by which decisions to provide IPOS can be made. The IDST recommendations provide a mix and quantity of IPOS that meets the needs of the community and is financially sustainable for Council.

Recommendation No 7 –
Council use the IPOS Decision Support Tool (IDST) and review the IDST recommendations in deciding the number and distribution of irrigated public open space within the City.

10.0 TURF AND IRRIGATION MANAGEMENT PRINCIPLES

In order to ensure Council provides appropriate, 'fit for purpose' sport and recreational facilities it is critical that sound turf and irrigation management principles are implemented. Council currently has a total of 71 irrigated reserves with a total area of approximately 53.1 hectares. The breakdown of active sports grounds and passive reserves is detailed in the Table below.

Table No 17 - Number / Area of Reserve Type (Mains & Bore)

Reserve Type	No	Area (ha)	Average ha/reserve
Active (Sports ground)	12	24.6	2.05
Passive Recreation	59	28.5	0.48
Total Irrigated Reserves.	71	53.1	0.75

It is important that irrigation systems perform to high standards applying the correct amount of water evenly across the irrigated area. It is also important that turf maintenance and renovation programs are appropriate to the level of usage and enable healthy turf growth and quick recovery following periods of intense usage.

10.1 Irrigation Maintenance.

Irrigation Australia Ltd has produced the 'Urban Irrigation – Best Management Practice Guidelines (BMP)'. These guidelines provide standards which will ensure irrigation systems operate to optimum performance efficiency. The areas covered in the guidelines are;

BMP 1 - Design the irrigation system to distribute water efficiently and evenly

The irrigation system should be designed to be efficient and to distribute water evenly. Specific criteria to consider include: soil type, slope, root depth, plant materials, microclimates, weather conditions and water source, e.g. quantity, quality and pressure. To conserve and protect water resources, the irrigation designer should choose appropriate equipment that meets relevant international, state and local standards and site requirements. The designer should be a Certified Irrigation Designer in compliance with the Irrigation Australia Ltd accreditation program.

BMP 2 - Install the irrigation system to meet the design criteria

The irrigation system should be installed according to the irrigation design specifications. To conserve and protect water resources, the installed components should meet the irrigation design specifications, manufacturer's specifications, and any state and local code requirements. The installation should result in water being distributed efficiently and evenly.

BMP 3 - Maintain the irrigation system for optimum performance

The irrigation system should be regularly serviced to maintain its performance, as designed. To conserve and protect water resources and the environment, the serviced components should meet the irrigation design specifications, manufacturer's specifications, and any state and local code requirements. Maintenance should result in water continuing to be distributed efficiently and evenly.

BMP 4 - Manage the irrigation system to respond to the changing water requirements of the landscape

To conserve and protect water resources and the environment, the irrigation schedule should be managed to provide supplementary water to maintain a functional and healthy turf and landscape with the minimum required amount of water to meet the plant water requirement and produce a 'fit for purpose' outcome.

Recommendation No 8 –
The Irrigation Australia, 'Urban Irrigation – Best Management Practices Guidelines' form the basis of irrigation design, installation, maintenance and management for all Council's irrigated public open space.

10.2 Current Irrigation System Performance

Council has had irrigation audits undertaken on a total of 47 sites. These audits cover all the major sports grounds and community parks and also cover all sites that are proposed to be supplied by the new Oaklands Park ASR project. The details of the audit results can be found in the appropriate reports (1. Hydroplan, Irrigation Audit Report 2008. 2. Hydroplan, Oakland Park Peak Demand Audit Report, 2012.). The audit results have been compiled in the IPOS Inventory. Table No 18 provides a summary of the audit findings.

Table No 18 - Irrigation Audit Summary

No. of Reserves	System Performance	Action	Maintenance Cost ($)	Replacement Cost ($)	Replacement 0 - 3 years	Replacement 4 - 10 years	Replacement 10+ years
3	Good	No Action		88,000			88,000
16	Average	Maintenance	62,500	1,145,000		750,000	395,000
11	Poor	Maintenance	46,000	917,000	172,000	497,000	248,000
5	Poor	Replace		227,000	227,000		
10	No System	New		377,000	377,000		
2	New System	Replaced 2012					
47			**108,500**	**2,754,000**	**776,000**	**1,247,000**	**731,000**
69	No Audit		**100,000**	**1,100,000**			
116			**208,500**	**3,854,000**	**208,500**		

The cost of remedial or replacement works required to bring the systems to an acceptable standard of performance is an immediate maintenance cost of $109,000 and a total replacement Of the 47 sites audited only 3 were found to be in good working order with 27 assessed as poor to medium requiring significant maintenance, 5 in poor condition requiring a system replacement and 10 sites proposed for supply by the ASR project with no irrigation system requiring a new installation. 2 sites have had a system replacement or upgrade since the audits were undertaken. cost of $2.8 million. The replacement program has been prioritised with sports grounds as the highest priority. The cost has been spread over a 10 year period with priority sites attended to early in the program.

It is expected that the performance of the remaining 69 irrigation systems, which have not been audited, will be variable. As these systems service passive recreation reserves it is recommended that maintenance programs are put in place to ensure sprinklers are operating at optimum levels.. It is not critical that there is high uniformity on these sites as they are not used for active competitive recreation and should reflect a reasonable amenity without being lush. Maintenance costs are estimated at $100,000 or $1,500 per site. Should a replacement program be required for these minor reserves an additional budget of approximately $ 1.1 million will be required.

Many of the audited sites will be supplied by the Oaklands Park ASR project and as such the water supply parameters will have changed significantly. It is important that the sites with a new water supply be audited to ensure the system performance is improved as forecast. It is also important to ensure all new or replacement systems are audited as part of the practical completion process to ensure installation and system performance is as per design.

An irrigation maintenance program is recommended whereby irrigation systems are routinely checked against the BMP's. This will provide early identification of faults and enable remedial action to be taken before the quality of the turf suffers. Where new or upgraded systems are planned it is important that design and installation is undertaken to best practice standards. The BMP's should form the basis of Council's design brief, installation specifications and maintenance programs.

Recommendation No 9 –
A budget of $109,000 be allocated for remedial maintenance works and $2,800,000 for a program for new and replacement system for all ASR sites over the next 10 years.

An additional budget of $100,000 be allocated for maintenance of non ASR sites. Should replacement of these systems on minor reserves be required an further allocation of $1,100,000 will be required.

10.3 Irrigation Scheduling

The IPOS – Irrigation Scheduling Model can be used to develop a base irrigation schedules based on average climatic conditions. This model can be used to set monthly irrigation programs. However, it is critical that irrigation programs are scheduled taking into consideration actual daily plant water requirement determined by daily climatic conditions. Therefore it is important that base irrigation schedules are adjusted regularly according to actual climatic conditions.

Council uses stand alone irrigation controllers to manage irrigation scheduling. Base irrigation schedules can be developed for each site as part of an irrigation audit and entered into the irrigation controllers. The schedules will need to be adjusted monthly to account for changing water demand and also periodically in consideration of local weather patterns, summer rainfall or extreme heat waves.

There are central control systems that enable irrigation schedules to be automatically adjusted according climatic data gathered from on site weather stations or from BoM data. Such systems are best practice irrigation management and actually match irrigation application with plant water requirement.

Soil moisture sensors are also available which are able to monitor soil moisture levels and can activated irrigation events when moisture levels deplete to pre-determined levels. The use of such technology (weather based irrigation controllers and/or soil moisture sensors) would further improve irrigation efficiency within the City.

Recommendation No 10 –
Base irrigation schedules be developed using climatic and agronomic data to ensure water application does not exceed plant water requirement.

Recommendation No 11 –
Technology such as climate based central control systems, soil moisture sensors and rain sensors be investigated to further improve irrigation efficiency on major water use sites ie sports grounds / community parks.

10.4 Turf Grass Species and Quality

Turf grass species can be classified as warm season (Couch / Kikuyu) or cool season (Rye / Fescue / Bluegrass). Cool season turf grasses use from 30 – 50% more water than warm season turf grasses. Drought tolerance of warm season grasses is also significantly higher than the cool season grasses. Turf species should be selected to meet the functional objective whilst minimising water use.

Warm season turf grasses (Kikuyu or Couch.) should be used as the predominant turf grass species for Irrigated Public Open Space in South Australian conditions. Council has Kikuyu as the predominant turf grass species on all sports grounds and passive reserves.

Turf should be maintained to meet quality and risk management standards appropriate for its intended use. Passive irrigated areas require a lower standard and have lower risk rating than active sports grounds. The standard to which turf is maintained has significant impact on water usage. Turf must be maintained at a level that ensures safety for users and meets the functional objective. A passive irrigated area can be maintained using up to 50% less water than an active sportsground.

Irrigated turf areas have been classified according to the intended function and the “fit for purpose’ principle. Reserves have been rated according to the TQVS classifications as detailed in the Code of Practice – Irrigated Public Open Space.. A list of specific reserve classifications is detailed in the “IPOS Inventory”.

10.5 Turf Maintenance Programs and Budget

Critical to the maintenance of quality, ‘fit for purpose’ irrigated public open space is sound turf and horticultural practices. An annual turf maintenance program should be developed aimed at

- improving soil texture and structure
- ensuring appropriate nutrient levels
- identifying and treating turf pests and diseases
- promoting deep root growth
- ensuring the turf surface is safe and ‘fit for purpose’.

Mowing heights, fertilizer application, compaction relief, rolling, top dressing, etc all have an impact on the quality and water requirement of the turf grass. Turf maintenance operations are required to improve soil structure through aeration, de-compaction and promotion of deep root growth ensuring water is utilised to its full potential and turf quality meets its functional objective.

The cost of maintaining reserves to a 'fit for purpose' standard can be broken down to unavoidable costs of irrigation and grass cutting, which are mandatory and provide basic quality, and turf renovation costs which are required where reserves or sportsgrounds are subject to high levels of usage and require significant maintenance to ensure they are 'fit for purpose' for use by the community.

Tables No 19 and 20 detail benchmark turf maintenance costs per hectare for current active sportsgrounds and passive reserves.

Table No 19 - Turf Maintenance Costs – Current Active Sports Grounds

Description	Comment	Unit	Rate ($)	Qty	Total ($)
Unavoidable Costs					
Mowing	Cylinder cut @ 40 x $100 / ha	Ha	4,000	24	96,000
Irrigation Maintenance	Basic Maintenance ie replace broken sprinklers	Ha	1,500	24	36,000
Total Unavoidable Costs		**Ha**	**5,500**	**24**	**132,000**
Renovation Costs					
Vertidrain / Coring / Earthquake	Bi-Annual Spring / Autumn	Ha	1,600	24	38,400
Top dressing soil supply and spread	80/20 sandy loam 100 tonne / ha @ $35/tonne. Annual Spring	ha	3,000	24	72,000
Turf Sodding	As Required	m2	14	500	7,000
Soil Analysis	Annual Spring	Site	200	9	1,800
Fertiliser supply and spread	Bi-Annual Spring / Autumn	Ha	2,200	24	52,800
Pest Control / weed / disease.	Annual	Ha	1,500	24	36,000
Total Turf Renovation Costs		**Ha**	**8,700**	**24**	**208,000**
Total Turf Maintenance Costs Active sports grounds		**Ha**	**14,200**	**24**	**340,000**

Table No 20 - Turf Maintenance Costs – Current Passive Reserves

Description	Comment	Unit	Rate	Qty	Total
Unavoidable Costs					
Mowing	Cylinder cut @ 26 x $100 / ha	Ha	2,600	28	72,800
Irrigation Maintenance	Basic Maintenance ie replace broken sprinklers	Ha	1,000	28	28,000
Total Unavoidable Costs		**Ha**	**3,600**	**28**	**100,800**
Renovation Costs				28	
Vertidrain / Coring / Earthquake	Annual Spring	Ha	1,100	28	30,800
Fertiliser supply	Annual Spring	Ha	500	28	14,000
Total Renovation Costs		**Ha**	**1,600**	28	**44,800**
Total Turf Maintenance Costs Passive Recreation		**Ha**	**5,200**	**28**	**145,600**

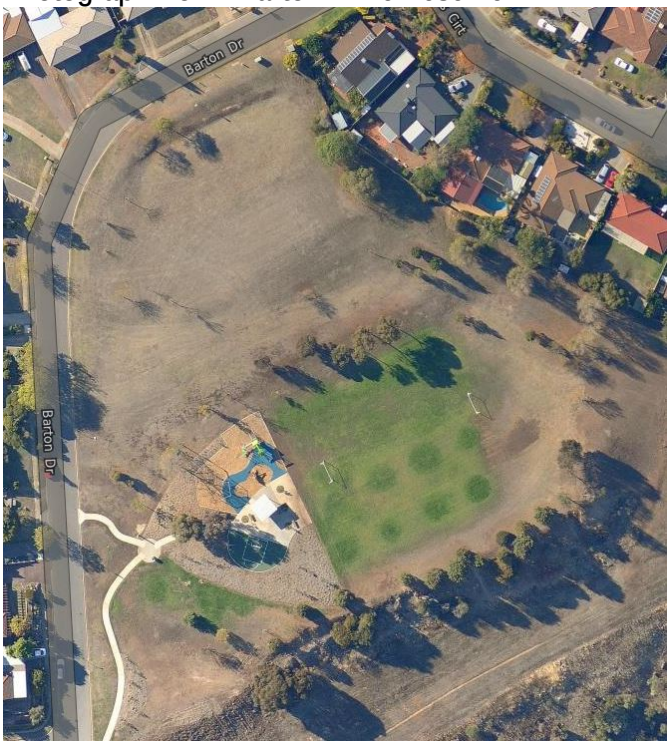
Benchmark turf maintenance costs for current irrigated reserves indicate that the total cost of turf maintenance for Council's 9 active sports grounds (24 ha) is approximately $340,000 and 57 irrigated passive reserves (28 ha) is $ 145,000 totalling $.485,000.

Recommendation No 12 -
A budget of $340,000 be allocated for sports ground maintenance and $145,600 for passive irrigated reserve maintenance.

11.0 LANDSCAPE DESIGN and MANAGEMENT PRINCIPLES.

Whilst the provision of Irrigated Public Open Space for large part is focused on irrigated turf and its function, other aspects of the landscape, particularly trees, are equally important in providing a sense of place and function. The high cost of water results in a situation where it is not viable to irrigate extensive areas of turf as once had been the case. Now we find that pockets of irrigated turf provide a functional amenity around other developments such as play spaces, picnic areas, etc. The remainder of the open space is often left undeveloped which undermines the total amenity. An example of a recently developed reserve which demonstrate this is Barton Drive Reserve where a new playground has recently been installed with irrigated turf provided as a ball play and recreation area. The surrounds of the turf area however are barren, detract from the amenity and are in need of landscape development to compliment the recent developments and improve the overall function of the open space. In contrast the new playground and irrigated turf at Maldon Avenue Reserve are enhanced by the open woodland setting created by the mature trees and the high natural amenity of the site.

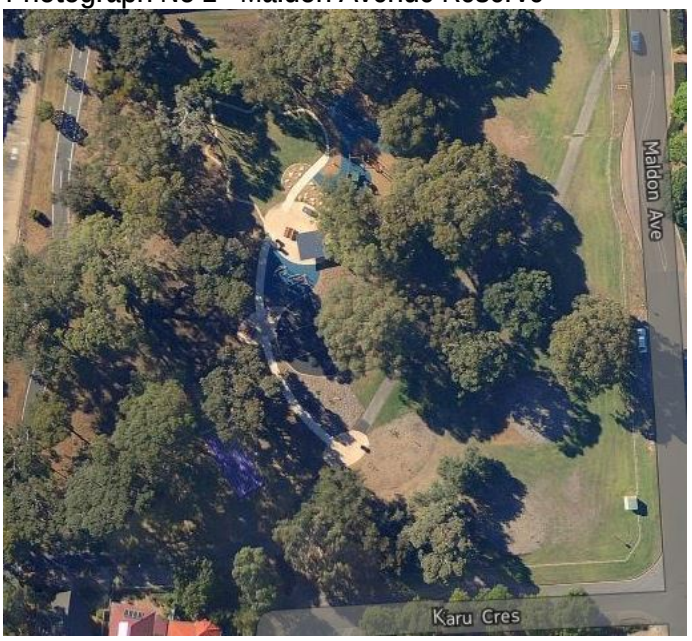
Photograph No 1 - Barton Drive Reserve



Barton Drive Reserve is an example of a large area of open space (15,000 m2) where a new playground has recently been installed with an area of irrigated turf developed as a ball play and a mini soccer pitch (5,000 m2) for unstructured recreation. Whilst these developments enhance the amenity and function of the reserve the undeveloped surrounds detract from the overall

amenity. In contrast, at Maldon Ave Reserve (10,000 m2) similar playground and irrigation developments (4,000 m2) are complimented with mature trees creating and open woodland setting. In this case the landscape enhances the amenity and function of the site providing shade, biodiversity and an attractive functional reserve.

Photograph No 2 - Maldon Avenue Reserve



Councils current landscape versus irrigated reserve area in relation to sites with playgrounds is summarized in Table No 22.

Table No 22 - Irrigated Vs Dry-landscape – Playground Sites.

Total No. Reserves with p/grounds	Total Landscape Area (ha)	No Reserves with Irrigated Turf	Total Area Irrigated Turf (ha)	Total Area dry-landscape (ha)	IDST Desirable Irrig Area (ha)
108	126.6	50	42.2	84.4	46.9

Council currently has 108 reserves with playgrounds with 50 sites also providing an irrigated ball play area. These reserves have combined landscape area of 126 ha with an irrigated turf area of 42 ha. Using the IDST all reserves with playgrounds would have an area of irrigated turf appropriate to the reserve classification which would marginally increase the irrigated area to 47ha.This leaves an area of 80 - 84 ha which requires appropriate landscape development to enhance the overall amenity and functionality of the open space.

It is important to ensure open space within the city is developed to enhance both the functional and natural amenity. Whilst the broader issues of landscape design and management are outside the scope of this report, a summary of current tree and landscape management provides a context for discussion on the irrigation requirement of trees

11.1 Landscape Design Principles

Currently Council does not have a landscape plan that addresses the wider issues of re-vegetation of open space within the city. Landscape development currently focusses on street tree plantings, the design of landscape elements to compliment new developments such as playgrounds in reserves, master planning of major regional and precinct reserves and feature landscapes around buildings. Plantings are a mixture of native and exotic species aimed at enhancing the natural form associated with the streetscape, new reserve developments or the built environment.

It is recommended that Council develop a landscape plan for the city to address the wider issues of re-vegetation of open space with a focus on enhanced bio-diversity, urban re-afforestation and water sensitive urban design principles.

Recommendation No 13 -
Council develop a 'Landscape Plan' for the City to address the wider issues of re-vegetation of open space with a focus on enhanced bio-diversity, urban re-afforestation and water sensitive urban design principles.

11.2 Trees and the Landscape

Trees play an important role in providing balance between the built and natural form within the City. Street trees enhance the streetscape and provide a diversity of form and colour in the built environment. Reserve plantings create a sense of place and add habitat and bio-diversity to large tracts of open space within the City.

The drought period of 2004 – 2010 had a significant impact on the trees within the City. Prolonged dry conditions and the reduction of irrigation on reserves resulted in the decline in the health of trees that were previously irrigated by turf irrigation systems and had come to rely on the supplementary watering. Overall the instances of tree decline and limb drop significantly increased over this period.

Council's tree management program focusses on the assessment and maintenance of existing trees and the planting of new trees in both the street scape and reserves.

11.3 Tree Maintenance, Planting and Watering Programs.

Tree maintenance programs are largely driven by customer service requests focusing on hazard reduction including canopy lifting / reduction, limb removal and tree removal where appropriate.

The tree planting program consists of the planting of approximately 1,000 street trees and 500 reserve plants per year. Street trees are semi-advanced stock, whilst reserve plantings are a mixture of semi–advanced and juvenile stock. Plantings include both drought tolerant native and exotic species.

New street tree plantings are watered using water trucks supplied by bore water, whilst reserve plantings are irrigated with drip irrigation systems where new systems have been installed using SA Water mains or by water truck using bore water where no system is installed. The watering program is for establishment only and continues for the 3 years after which time established trees are able to cope without supplementary watering.

The tree watering program consists of weekly watering of street trees with water trucks for the 3 year establishment period and fortnightly watering of reserve plantings. At each watering event 40 litres of bore water is applied per plant. The total water use for trees is detailed in the Tables No 23 & 24 below.

Table No 23 – Tree Water Usage

Tree Planings	Water applied per tree per watering event (Lts)	No Waterings per year	Total water used per tree / annum (Lts)	Total Trees Planted per annum	Total Trees watered per annum (3 year cycle)	Total water used per annum (Lts)	Total water used per annum (kL)
Streetscape	40	26	1,040	1,000	4,000	4,160,000	4,160
Reserve	40	13	520	500	2,000	1,040,000	1,040
Total	**40**	**39**	**1,560**	**1,500**	**6,000**	**5,200,000**	**5,200**

Table No 24 – Tree Water Cost

Water Supply	Bore	ASR	Mains
Water Cost / kL	0.6	2.2	3.45
Tree Water Requirement (kL)	5,200	5,200	5,200
Tree Water Cost ($)	3,120	11,440	17,940

Total tree water usage per annum is 5,200 kL. The current water cost using bore water is approximately $3,000. If ASR water is used the cost will increase to $11,500 and if SA Water mains water was used this cost would be $18,000.

Water consumption and cost in the area of tree management is minor when compared to the total water consumption for irrigated turf. The comparison of water requirement for trees versus turf is detailed in Table No 25. This is not to undermine the importance of tree watering but does highlight that water consumption for trees is negligible in comparison and that there is no need to be frugal in the water used for tree and landscape establishment.

Table No 25 – Comparison of Water Requirement for Trees Vs Turf

Description	Annual Water requirement (kL)
Irrigated Turf	226,000
Tree and landscape Watering	5,200

The use of bore water for tree watering can be problematic as the water quality can be variable due to high salt levels when water tables are decreased in times of drought. The high salinity levels are detrimental to tree establishment particularly for juvenile trees. Where high salinity levels are a problem it is suggested that either ASR of mains water be used for tree watering.

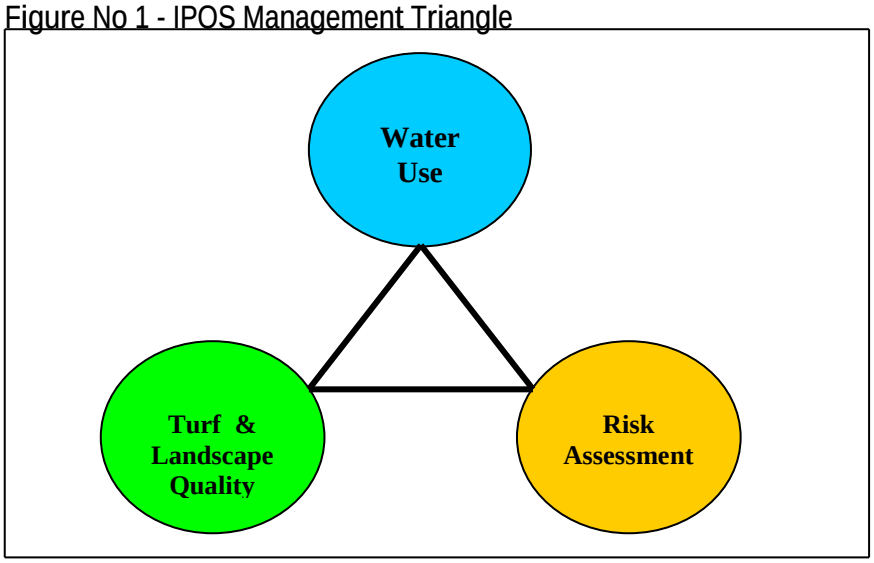
Recommendation No 14 -
Bore water continue to be used for tree watering where water quality is acceptable. Should salinity levels increase other water sources such as ASR or mains should be used for tree watering.

12.0 TURF and LANDSCAPE MONITORING AND PERFORMANCE REPORTING.

It is necessary to monitor both the water consumption and the quality or 'fit for purpose' standard of landscape, to ensure the objectives of efficient and effective turf, tree and irrigation management are being met. The objective of irrigation management is to produce a quality outcome that is able to meet its functional objective.

The three critical factors that make up the 'IPOS Management Triangle' are Water Use, Turf & Landscape Quality and Risk Assessment as illustrated in the Chart below.

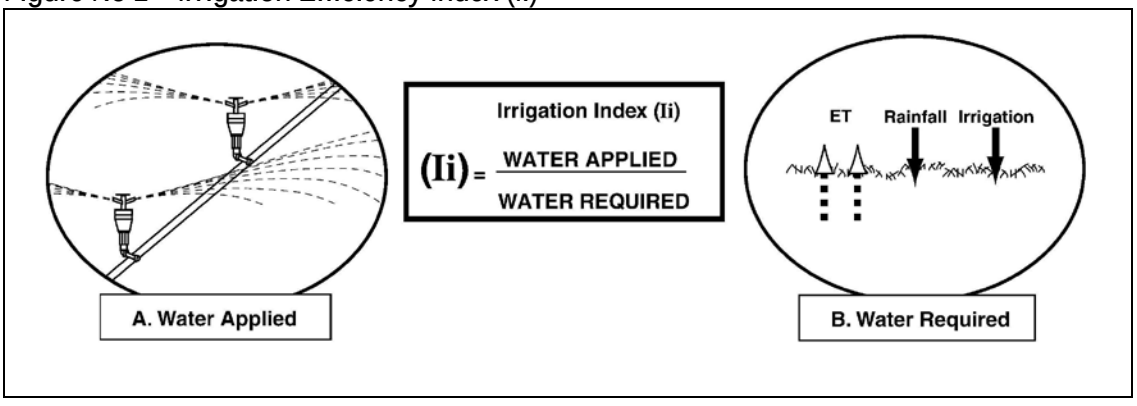
Figure No 1 - IPOS Management Triangle



12.1 Irrigation Efficiency Reporting

As a condition of exemption from SA Water Level 3 water restrictions Council must register irrigated sites and submit monthly irrigation efficiency reports to SA Water. The irrigation efficiency reporting compares irrigation water consumption with irrigation requirement targets to calculate the irrigation efficiency index. This is graphically represented in Figure No 1

Figure No 2 – Irrigation Efficiency Index (Ii)



The IPOS - Irrigation Efficiency Reporting Model compares the irrigation water applied with the irrigation requirement for the current period to calculate an irrigation efficiency index for each site.

An Irrigation Efficiency Index (Ii) result of 1.0 indicates that the Irrigation Application (I) is equal to Irrigation Requirement (Ir) which is the aim of good irrigation management. Where the result is >1.0 this indicates more water has been used than required. Conversely where the result is <1.0 the indication is that less water has been used than required. Good irrigation management should achieve an irrigation efficiency of between 0.90 and 1.10 within 10% of the irrigation requirement. The irrigation water applied is obtained by reading the water meter or from SA Water consumption records. Meters should be fitted to all water supplies. The irrigation requirement for the current period can be calculated using the IPOS - Irrigation Requirement Model using data accessible from the Bureau of Meteorology web site which is updated daily.

Council is currently reading meters on 24 of the major mains water supplied reserves monthly and an irrigation efficiency report is being prepared. Whilst individual sites vary, the overall irrigation efficiency index for all sites for 2011/12 is 1.04 which indicates efficient water usage.

Table No 26 – Irrigation Efficiency Index 2011/12

Location	Area (ha)	Irrigation Usage (kL)	Actual Irrigation Requirement (kL)	Variance (kL)	Irrigation Efficiency Index (IEI)
24 sites	23	88,693	85,394	3,299	1.04

Whilst the overall irrigation efficiency may be acceptable it is necessary to monitor the quality of individual sites to ensure the turf quality also meets the required standards. This is particularly important for active sports grounds.

It is also necessary for council to report on all irrigated sites and submit monthly irrigation efficiency reports to SA Water as part of the requirements of the current 'IPOS Water Wise Measures'. To this end it is necessary for water meters on all irrigated sites to be read monthly.

Recommendation No 15 –
All water meters on irrigated sites be read monthly and an irrigation efficiency report be prepared according to the 'IPOS – Irrigation Efficiency Model' to monitor water consumption at each site.

12.2 Turf Quality and Risk Assessment Reporting.

Turf should be maintained to meet quality and risk management standards appropriate for the intended use. Sporting clubs, associations and ground managers have a 'duty of care' to all persons using facilities. This means that sports facilities, including the turf surface, must not present an unacceptable risk of injury to those using the facilities. In order to meet the 'duty of care' responsibility and ensure active sports grounds are in a 'fit for purpose' condition, Council must ensure a risk management system is in place whereby grounds are inspected, assessed and documented.

Council currently uses the 'IPOS - Turf Quality and Risk Assessment System' to inspect, assess and monitor both the quality of the turf and risks to players and the community in relation to sports grounds. The risk management process involves monthly assessment of grounds identifying both issues of turf and surface quality which could impact on risk of injury to players. Assessment are both qualitative and quantitative using the professional skill and judgment of the assessor and quantifiable measures using instruments such as the Clegg Impact Hammer to determine ground hardness. High and Medium level risks are identified with remedial work required prior to play.

The sports ground condition and risk assessment reporting process has been developed in accordance with the Australian / New Zealand Standard – Risk Management (AS/NZS 4360 : 2004) and the Guidelines for Managing Risk in Sport and Recreation (HB 246 : 2004).

Turf Quality

Turf Quality is assessed according to documented standards and given an overall rating out of 100. The rating standards are as follows;

Table No 27 - Turf Quality Standards

Rating	Turf Quality Condition	TQVS Cat.	Sporting Level Acceptability.
> 80%	High - Desirable	1 / 2	Elite / Premier Sports
75% - 79%	Good - Acceptable	2 / 3	Premier / Local Sports
70% - 74%	Medium – Acceptable works req.	3	Local Sports
60% - 69%	Medium – Acceptable / Marginal works req.	3	Local Sports
50% - 59%	Poor – extensive works req.	3	Undesirable for Sport
> 50%	Very Poor – consider closure		Not Acceptable for Sport

The Table below details the results of turf quality assessments for Marion sports grounds for the past 12 months.

Table No 28 - Marion Turf Quality Assessment Results

Location Name	May / 2012	Jun / 2012	Jul / 2012	Aug / 2012	Sep / 2012	Oct / 2012	Nov / 2012	Dec / 2012	Jan / 2013	Feb / 2013	Mar / 2013	Apr / 2013
Capella Reserve	76.0	76.0	76.0	76.0	76.0	77.0	75.0	75.0	75.0	76.0	75.0	78.0
Edwardstown Oval	78.0	78.0	77.0	77.0	75.0	77.0	77.0	77.0	77.0	76.0	77.0	77.0
Glandore Oval	80.0	80.0	879.0	79.0	77.0	77.0	79.0	79.0	79.0	80.0	80.0	82.0
Hallet Cove Oval	76.0	76.0	76.0	76.0	77.0	76.0	77.0	76.0	76.0	78.0	78.0	77.0
Hallet Cove Soccer	77.0	77.0	75.0	74.0	75.0	76.0	76.0	76.0	76.0	78.0	78.0	78.0
Hazelmere Reserve	75.0	74.0	74.0	69.0	69.0	69.0	75.0	75.0	74.0	75.0	75.0	70.0
Kellett Oval	77.0	77.0	77.0	76.0	75.0	75.0	75.0	75.0	75.0	75.0	74.0	75.0
Mitchell Park Oval	77.0	77.0	77.0	75.0	75.0	75.0	75.0	75.0	76.0	77.0	77.0	79.0
Plympton Oval	78.0	78.0	77.0	76.0	75.0	75.0	75.0	75.0	76.0	76.0	76.0	76.0

Sports grounds in Marion have generally been to acceptable quality for local level sporting activities. Quality ratings have been between 70% - 80%. September / October saw a decline in turf quality which is related to high rainfall and heavy usage in the preceding month of August. Sound turf renovation and good rainfall in the warmer growing season has resulted in the turf recovering well and is currently in good condition.

Risk Assessment

Risks are evaluated against a set of documented criteria that addresses both the surface quality and associated fixtures that related to the turf playing area. These criteria are assessed bearing in mind that there are inherent risks associated with sporting activities and it is not possible to eliminate all risk. The objective is to identify and control risks where ever possible thereby minimizing risk to players. The risk process rates identified hazards into 3 categories of risk as detailed below.

Table No 29 - Risk Assessment Ratings

Risk Rating	Control Action
High	Does not meet Standard – Serious non-compliance – Urgent action prior to use
Medium	Does not meet standard – Marginal non-compliance – action to be programmed
Low	Meets standard – Maintenance programs to be continued.

- A risk rating of High indicates a serious non compliance with the standard which subjects players to a high risk of injury. Immediate action is required to remove or control the risk. Use of the ground should not commence until remedial action has been taken to control the risk or reduce it to an acceptable level.
- A risk rating of Medium indicates a marginal non compliance with the standard which subjects players to a moderate risk of injury. Action to remove or control the risk is to be programmed as soon as practicable. Play may commence.
- A risk rating of Low indicates compliance with the standard which subjects players to a low and acceptable level of risk of injury. Programmed works to continue to ensure the ground is maintained to appropriate standard.

Council has a sound turf quality and risk assessment process in place which ensures sports grounds are 'fit for purpose' and any unacceptable risks that occur are identified and controlled.

Recommendation No 16
Council continue to implement a risk management program reporting on turf quality and risk assessment to ensure sports turf and passive recreation areas are in a 'fit for purpose' condition.

12.3 Tree Assessment

Currently all street trees and large reserve plantings are being assessed to identify any hazards or health issues with results being entered into a tree data base. The results of this assessment will provide an ongoing pro-active tree maintenance program focusing on tree health and safety. At the same time Council responds to customer requests for tree maintenance and removal within the City to ensure trees do not present an unacceptable hazard within the community.

Recommendation No 17
Council continue to compile a tree data base recording tree assessment results from which a proactive tree maintenance program will be developed. Ongoing response to customer requests in relation to tree maintenance and removal will continue to ensure trees do not present an unacceptable risk to the community.

13.0 CONCLUSION

This Landscape Management Plan provides a framework by which Council can manage water use and turf quality into the future. The recommendations and action plan provide specific outcomes by which Council can reach 'best practice' in the management of irrigated public open space, accountability in relation to reporting on water consumption and risk management in the provision of sports ground and trees in the landscape