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City of Greater Geelong

Final Report for Sustainable Sports Fields Management

Revised to include Thomson Reserve

December 2006

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

GHD was originally engaged by the City of Greater Geelong (CoGG) to investigate general issues relating to sustainable water management of sports fields and to investigate four high use sites.

Following submission of the completed report a request was received to extend the work to include Thomson Reserve.

General

The following general issues relating to sustainability were identified.

- The majority of CoGG sites have cool season grasses. These grasses have a higher water requirement and are less saline tolerant than warm season grasses;
- Water budgets have been set for ovals that if successful will result in the irrigation being biased to conservation rather than encouraging vigorous growth;
- Extending the principle of water budgets to golf courses and setting targets based on the actual areas and grass types will result in further water savings;
- Improved data gathering will assist in achieving best practice irrigation for Geelong conditions;
- A program of upgrading irrigation systems is well advanced;
- A trial of a subsurface irrigation system is recommended;
- Using water from the Barwon River has problems of salinity and availability;
- Class C treated wastewater is only available close to Portarlington and Black Rock Water Reclamation Plants and Barwon Prison;
- No suitable sources of trade waste for reuse have been identified;
- Reclaimed water may be available from Barwon Prison;
- Use of Swimming pool backwash water has potential;
- Bore water as a source is more sustainable than potable water but would require extensive dilution with potable water for the existing grasses. With more salt tolerant grasses bore water would only be suitable for replacement of 25% of irrigation requirement;
- Artificial surfaces should be considered for future provision for soccer and as a replacement for golf tees;
- There is the potential to reduce the playing area of ovals and soccer pitches to reduce irrigation;
- Reducing irrigation of the initial section of golf fairways can offer significant water savings;
- Water efficient fixtures should be introduced into all clubrooms and toilet facilities;
- The COGG should work in conjunction with tenants of sporting facilities who manage the water use to work towards water saving; and
- The Thomson Reserve has potential to use reuse stormwater for irrigation from drains crossing the reserve.

Specific Sites

Savings will be achieved over the next year by the existing programs of setting irrigation targets for ovals and irrigation system upgrades. However there is considerable potential for additional savings.

A wide range of sustainability improvement options were considered for each of the sites. As some of the savings from particular initiatives affect savings from other initiatives a range of initiatives have been recommended for each site. The following options are recommended for further consideration.

Elcho Park

- Reducing irrigation of existing grasses;
- Conversion to 100% warm season grasses;
- Zone watering of fairways;
- Addressing evaporation in existing dam and improving efficiency of capture; and
- Potential use of bore assuming conversion to salt tolerant grasses has taken place.

With implementation of all recommendations 55ML of water per annum can be saved at a capital cost of $322 000.

Queens Park

- Reducing irrigation of existing grasses on golf course and further development of oval irrigation targets in future years;
- Conversion to 100% warm season grasses;
- Zone watering of fairways; and
- Potential use of bore assuming conversion to salt tolerant grasses has taken place.

With implementation of all recommendations 49ML of water per annum can be saved at a capital cost of $482 000.

Kardinia Park

- Conversion to 100% warm season grasses. $6 250/ML;
- Reducing parkland irrigation. Nominal Cost;
- Reuse of swimming pool backwash. $5 566/ML; and
- Potential use of bore assuming conversion to salt tolerant grasses has taken place. $5 000.

With implementation of all recommendations 32ML of water per annum can be saved at a capital cost of $131 000.

South Barwon Reserve

- Further development of oval irrigation targets in future years. Nominal cost; and
- Conversion to 100% warm season grasses. $6 125.

With implementation of all recommendations 17.5ML of water per annum can be saved at a capital cost of $99 000.

If all the recommended options are taken up for all sites there is the potential to save a total of 153.5ML at a capital cost of $1.3 million. The annual savings on water use and trade waste charges is estimated at $141 000.

Thomson Reserve

There are two ovals of which only the main oval is irrigated.

- Conversion of main oval to 100% warm season grasses. $6 207/ML;
- Conversion of the secondary oval cannot be recommended on sustainability grounds although conversion will improve the playability of the oval. Conversion would be recommended if irrigation system is to be re-established; and
- Reuse of stormwater drainage. $89 00/ML.

With implementation of all recommendations 2.9ML of water per annum can be saved at a capital cost of $18 000.

1. Introduction

In March 2006, GHD reported on Sustainable Water to the City of Greater Geelong, to assist in the city's Corporate Action Plan. As a result Sports Field Water Management was identified as a key issue. GHD was then engaged to provide this report on Sustainable Sports Field Water Management.

The report is in two parts as follows:

Part One

A general report on issues associated with reducing the use/reliance of potable water for sporting facilities.

Part Two

Specific reports in which the issues identified in Part 1 would be reviewed including concept plans and estimates with consideration of social, environmental and economic cost/ benefits for any potential water saving improvements for the following high priority sites:

1. Elcho Park Golf Course;
2. Queens Park Golf Course and Ovals;
3. Kardinia Park;
4. South Barwon Reserve; and
5. Thomson Reserve.

2. Usability

When investigating changes to water use for sports fields to improve sustainability the following aspects need to be considered:

- Safety and liability;
- Playability;
- All weather performance;
- Scheduling requirements;
- Maintainability; and
- Effect of the water on the soil.

These considerations are expanded on below:

2.1 Safety

Generally the surface needs to be even and clear of stones and trips such as tussocks. The top surface needs to consist of a covering that will minimise abrasion injuries and avoid locking feet when twisting. The structure needs to be soft enough to minimise injuries due to falls/tackles.

2.2 Playability

Then surface needs to offer adequate grip and perform consistently across the playing surface. For example a cricket pitch provides predictable bounce where as golf green needs to provide predictable putting performance.

Cracking crumbling, bare areas and the development of tussocks needs to be prevented.

2.3 All Weather Performance

Generally sports fields need to be available independent of weather conditions whether that involves hot dry weather or wet weather. For grassed surface this involves having a well-drained surface with a structure that retains moisture.

2.4 Scheduling Requirements

There is considerable demand for council sports fields and any reduction in the ability to schedule events due to the wear or other issues will have a considerable impact on how the council is perceived by the users.

A typical limitation on wear of turf football grounds would be three training sessions per week and three games over a weekend.

2.5 Maintainability

The costs in labour, plant and other consumables is an important factor in council budgets. Issues include:

- Mowing;
- Irrigation;
- Thatch Control;
- Fertiliser application; and
- Weed and Pest Control.

2.6 Effect of Water on the Soil

The performance of the playing surface of sports fields is a result of the combination of the turf and the top layer of soil. By careful grass species selection and management a sports field can be kept green. However one effect of a reduced watering regime will be that the surface layer becomes drier and as a result often become harder.

3. Turf Management

3.1 Selection of Species

Providing a species with low water use and superior drought resistance is a primary method of decreasing water needs.

3.1.1 Warm Season Grasses

Warm season grasses use 30-40% less water and are more drought tolerant than cool season grasses. Many are the creeping varieties and are self repairing during their growing season.

They become dormant in the winter, which limits their use in sports played through the winter where they are difficult to repair once worn. During this dormant phase they can also become brown, or yellow, depending on variety, which can detract from the publics expectation of the appearance of an oval.

In some cases warm season grasses can be considered environmental weeds and need to be carefully controlled.

3.1.2 Cool Season grasses

Cool season grasses will respond better to repair by resowing through winter playing seasons. Varieties are available that have lower water demands and considerable research is underway to identify better performing grasses.

3.1.3 Salinity

If bore, or reuse water, is to be considered for sports fields watering a key concern is salinity. The salinity may be at unacceptable levels for use as irrigation. Even with lower salinity levels over time irrigation this can lead to increasing soil salinity. Action can be taken to control salinity but selecting salt tolerant species may mean that no further action is required.

In general warm seasons grasses have better salt tolerance than cool season grasses.

3.1.4 General

City of Greater Geelong’s experience to date with the conversion of the Lara Main Oval has been that the difference between an oval with cool season grasses and one with warm season grasses has been a 43% reduction in water used.

Selection of grass species will relate to the intended use, period of main use and soil types.

Some grass species used in sports fields are classified as environmental weeds and need to be carefully controlled.

Table 1 indicates the general performance of a number of grass varieties in common usage for sports fields. Within each variety there are a number of different species that can have different performance characteristics.

Table 1 Typical Grass Characteristics

Grass Variety	Cool Season	Warm season	Drought resistance	Salinity mS
Buffalo		Yes	Good	1000-5000
Couch		Yes	Good	1000-5000
Kikuyu		Yes	Good	1000-5000
Tall fescue	Yes		Fair	300-800
Kentucky Bluegrass	Yes		Fair	< 300
Fine ryegrass	Yes		Fair	300-800
Fine fescue	Yes		Fair	300-800
Seashore paspalum		Yes	Good	10 000-30 000
Bermuda grass		Yes	Good	10000-15000

Note seawater has a salinity of 45 000-55 000mS(micro siemens).

3.2 Watering

Watering is more comprehensively dealt with in subsequent sections. However a maintenance consideration of a reduced watering regime is that the stresses on the grass increase. This can make the turf more susceptible to pests and or result in weeds out competing the grass.

3.3 Mowing Regimes

Consideration of the mowing regime will assist in maintaining a usable surface through hot dry periods. Principle mowing regime principles are:

- Increased mowing height. This will lead to grasses developing a deeper root system, thus improving their soil water extraction capability. It will also shade the crowns and the soil from solar radiation.
- Mow as infrequently as possible to reduce plant stress.

In the case of mowing regime changes a longer grass will affect playability for certain sports. Australian rules is not very sensitive to longer grass, however Cricket tends to be very sensitive to longer grass and soccer has some sensitivity to grass length.

Over the past few years the City’s parks maintenance group have experimented with increasing mowing height and believe they have found a good compromise of 33mm although this represents an ongoing concern to cricketers.

3.4 Thatch Regulation

A level of thatch improves player safety in the various football codes and hockey. The thatch can also insulate against temperature extremes and assist in moisture retention. Excessive thatch can restrict air and fertiliser entry into the soil. It can also restrict the development of root systems, decreases the effectiveness of rainfall and irrigation, reduce water absorption and increase drought stress.

In the case of grasses that develop dense thatches like Kikuyu de-thatching is typically required every 2-3 years. The City currently has dethatching equipment. The estimated cost of dethatching an oval is $1 400.

3.5 Fertiliser Regime

Providing an appropriate fertiliser balance is useful in minimising the stress on grasses.

Where saline waters are used for irrigation low salt fertilisers should be used. Also other sources of chloride should be avoided. For example potassium sulphate should be used in preference to muriate of potash.

3.6 Aeration

Effective aeration will improve the soils physical properties, particularly in relation to improving the infiltration rate, which will maximise the effectiveness of rainfall and irrigation.

Where saline waters with higher salinities are used deep aeration (up to 300mm) is often needed to promote leaching of sodium and other excess salts.

3.7 Wetting Agents

There are a number of wetting agents available on the market with the majority being available in liquid form for spray application. These break down the water repellent nature of dry soils and assist with water penetration maximising the effect of rainfall and irrigation. The effective life of agents varies from one month to several months. An ionic agent such as Newturf Stamina 90 would be effective for 3-4 months so it would need to be applied in spring.

The City has used wetting agents on golf courses but has not extended their use to sports fields due to budget constraints. The typical cost of one of the longer lasting ionic wetting agent applications is in the order of $1 200 per oval.

3.8 Endophyte Bacteria

Endophyte bacteria affect many grass species. A major factor influencing plant growth and health is the microbial population living in the rhizosphere and within the healthy plant tissue. This can be improved by infecting pastures with endophyte bacteria. Effects of endophyte infection on grass host plants can be:

- Enhanced resistance to some species of insect pests;
- Improved resistance to some grass diseases including root rot, nematodes and virus diseases;
- Improved seedling vigour and hence better seedling establishment;
- Better photosynthesis under stress: An increased number of tillers are grown s when moisture or nutrients are limiting; and
- Better drought tolerance.

As endophyte infection can be detrimental to growth of grazing animals however it has no health issues when used for sports fields.

The City currently use endophyte coated seeds but report little difference between newly seeded ovals and ovals previously seeded without endophyte. This may be due to the older ovals already being infected with naturally occurring endophytes in the soils.

3.9 City of Dandenong Experience

Michael Wilson, Grounds Manager for the City of Dandenong, believes the transition to warm season grasses has been very successful for the City. 16 ovals have been converted to date and further ovals will be converted as soon as funds are available. Typically the irrigation of converted ovals has reduced from 4-5 times a week to once a week.

Two grass varieties have been used, couch for ovals that have turf wickets and VFL standard football. For other applications Kikuyu has been used. There have been extremely few negative comments from users. One minor issue is the Kikuyu tends to go yellow in winter. The grasses have generally proved easy to maintain with lower fertiliser and reduced weed treatments being required. The increased thatch of Kikuyu has meant that although the soil may be harder at the start of the football season the overall turf performance is good. As the football season progresses the thatch is reduced through wear but the winter rains have softened the soil.

The cost of changing to a warm season grass has averaged $20 000 per oval.

4. Data Gathering and Setting Allocations

4.1 General

Turf behaviour is related to climate and maintenance levels. One method of achieving savings is to gather data on the various sites. This data can then be used to determine what is ‘Best Practice’ for particular areas and to determine better performing sites. This information can then be used to determine initial annual allocations of water for various sites. The allocations could then be refined.

In the case of Greater Geelong there are some climatic differences with the Bellarine Peninsula being different from the City. This may require at least two areas to be identified, with comparisons limited to sites in the same area.

4.2 Required Data

Site Data

The following data can be used to determine the base case for each ground:

- Grass types;
- Irrigated area;
- Type and frequency of use; and
- Soil type.

Local Climate Data

The following data can be used to build up information for a water budget:

- Rainfall; and
- Evaporation.

This is currently collected at two weather stations that are located at the Anakie Road and Belmont Depots. These automated weather stations measure and record; rainfall, evaporation, wind speed, wind directions, temperature, humidity and hours of sunlight. Minor climatic variations have been noted between the two sites.

In the long term it may be appropriate to either relocate a site to the Bellarine Peninsula or provide an additional station on the peninsula. This is due to the known variability of weather across the Peninsula.

The cost of an additional station would be $40 000.

Performance Data

The following data is used to determine the playability of AFL grounds:

- Harness;
- Shear strength; and
- Traction.

The equipment used for this performance data is specialised and one set of equipment could be used across the City with monthly readings being required.

4.3 Overall Water Budget

Currently a budget of 4.1ML/annum has been set per oval.

Various methods of calculating a water budget are used. A procedure that has been used in Victoria is described in detail in the EPA Guidelines for Wastewater Irrigation publication 168.

The method uses the local Rainfall data and a table to calculate the Effective Rainfall.

The basic formula is:

Irrigation requirement = Evaporation x Crop factor - Rainfall x Effectiveness

= Potential Evapotranspiration - Effective Rainfall

Currently the city uses a central irrigation controller that calculates the Potential Evapotranspiration from the weather station evaporation results and standard crop factors. It then calculates the application based on the soil type and sends the information to the site irrigation controller. This centralised control allows savings to be achieved in two ways:

- A more scientific method of determining the amount of irrigation; and
- Systems are switched off if rain is detected.

The City Operations Group report that this is working successfully but issues such as crop factors need further refinement. The following sections have been provided for reference when checking systems.

4.4 Rainfall Effectiveness

Rainfall effectiveness can be based on a standard table, included as Table 2 below; the table is a shortened form of the table found in EPA publication 168, 'G*uidelines for effective irrigation'*. A simpler estimation is 50% effectiveness is for falls of less than 12mm and 70% for rainfall greater than 12mm.

Table 2 Effectiveness of rainfall on pasture

Monthly median Evapotranspiration mm	**Monthly median rainfall mm**			
	25	**50**	**75**	**100**
50	17	34	48	62
100	19	37	54	70
150	21	42	61	78
200	24	47	68	96
250	25	>38		

4.5 Crop Factors

Typical Crop coefficients for grasses (Conellan 2002) are shown in Table 3 below:

Table 3 Crop Factor Values

Grass Type	Performance	Lower Range	Higher Range
Warm Season	Moderate growth	0.25	0.40
	Strong growth	0.45	0.55
	Vigorous Growth	0.55	0.70
Cool Season	Moderate growth	0.65	0.70
	Strong growth	0.70	0.75
	Vigorous Growth	0.80	0.85

4.6 Individual Irrigation Applications

To be fully effective each irrigation needs to be controlled to avoid run off. This control is in both the rate of irrigation and the total volume.

4.6.1 Rate

The following maximum rates are recommended:

Soil	Application Rate L/hour/m2
Coarse sandy Soils	50
Coarse sandy surface with compacted subsoil	44
Light sandy loams	44
Light sandy loams with compacted subsoil	31
Silty loams with compacted subsoil	15
Heavy textured Clay	5

4.6.2 Total Volume

Total volume is based on providing no more than 50% of the available water capacity of the soil over the root depth of the turf.

Assuming a typical root depth would be 200mm.

Soil	Application Rate L/m2
Coarse sandy Soils	5 – 10
Light sandy loams	10 - 15
Silty loams with compacted subsoil	15 – 20
Heavy textured Clay	12 – 15

On hot dry windy days the above quantities may have to be increased by 10% to compensate for evaporation.

4.7 Summary

The current estimated irrigation demand in the Geelong Area, based on historical records, for strong growth of cool season grasses is 6.0ML/ha/annum.

The current targets of 4.1ML/oval, with a typical area of 1.3ha, equates to 3.15ML/ha/annum and shows that the irrigation is being aimed at water conservation rather than strong growth. Further reductions in irrigation of cool season grasses, is likely to affect playability.

Conversion to cool season grasses has the potential to lower the water demand to 2.2ML/ha/annum or 2.8ML/oval/year for a typical oval.

In the long term, individual targets will need to be developed for each oval based on the areas of the oval and the grass varieties used.

Current irrigation practice is based on completing watering an oval overnight. This results in a more frequent and lighter irrigation than is desirable. Consideration should be given to heavier irrigations spread over two nights with a longer interval between irrigations.

5. Irrigation Systems

5.1 Main Types of Systems

Spray systems are the traditional method of spray application for sportsgrounds and are used by the City of Greater Geelong. Over the past ten years sub surface drip irrigation has become more accepted for sports fields.

5.2 Sprays

Sprays systems need to be carefully designed and maintained for maximum efficiency. Important factors are:

5.2.1 Uniformity

The sprays need to cover the whole surface uniformly to avoid under or over watering some areas.

This requires:

- Appropriate spray patterns;
- Optimum hydraulic design; and
- Regular checking of pressures and valve operation.

5.2.2 Correct outlet Selection

Relevant issues are large droplet size to minimise spray drift:

- Appropriate flow rate- See **Section 4;**
- Trajectory; and
- Blockage risk.

5.2.3 Location

Wetting of paths and roadways is a common cause of water wastage. Part circle sprays need to be correctly located and adjusted, and may need to be run for shorter periods.

5.3 Sub Surface Drip Irrigation

Sub surface drip irrigation uses a network of distributor pipes with integral drippers to deliver water directly to the root zone of the plants. The transmission of water from the drippers to the soil occurs by capillary action. The advantages of a sub soil system are:

- Water consumption savings of up to 40% over sprinkler systems due to preventing losses due to evaporation, spray drift, and run off,
- Encourages deep rooting;
- Removes the risks associated with pop up sprinklers;
- No vandalism or system damage as there are no obvious surface parts; and
- Where reuse water is available it removes risk of contact with effluent.

Sub surface systems are typically 30-40% more expensive than spray systems. The systems are however less sensitive to pressure than spray systems that mean that pumps and storages are not required which can reduce the cost difference.

Currently the City of Greater Geelong is considering a system of this type in Portarlington. This would be a worthwhile trial and if successful could lead to a change in strategy.

5.4 Determining frequency - Monitoring

Experience around the world has shown that people over water rather than underwater. The following methods are used when extending the period between irrigations:

- Examining with local knowledge of the site. Areas where the first indications of stress occur are determined and this area is regularly checked and irrigation scheduled;
- Calculation based on evaporation. There are many techniques for estimating plant use however the Crop factor method used in section 4 above is the most common and is currently being used by the City's central irrigation controller. This divides the depth of water loss in mm by the Potential Evapotranspiration;
- Soil Sensors. The most common sensors are soil moisture sensors. These can provide real time data at multiple depths. These sensors have been installed at City of Greater Geelong sites with limited success. The issues are believed to be due to fertilizer interference in the measurements. A trial of the latest Soil capacitance sensors is being considered. To be effective the placement of sensors need to be in a representative part of a uniformly watered area. Until all sites have had sensors installed a site with sensors would be able to act as a reference site for other sites in the same area; and
- Plant based stress monitoring is an emerging technology. This measures the light reflectance from the turf.

5.5 Controllers

There are a wide range of controllers available from simple switches that can be preset to start and stop irrigations to computerised systems that record moisture sensor and weather data to determine appropriate irrigation intervals. Systems can also be programmed to stop in the event of rainfall.

The City of Greater Geelong currently has in place sophisticated Maxicom Rainbird systems that are representative of best practice. Further local controllers are being installed as grounds are upgraded.

5.6 Time of Day

The following factors need to be considered when timing irrigations:

- For maximum effect irrigation needs to occur during cooler periods with low evaporation and with low wind to prevent spray drift;
- In the case of lower quality water supplies, minimisation of the opportunity for human contact is also important; and
- Where pumps are required for irrigation off peak power can produce savings. This is becoming more important as the automated irrigation systems need a constant pressure to be accurate. As a result many systems are being converted to pump systems to even out the pressure differences in the Barwon Water supply mains.

General irrigation during the hours of darkness is preferred if automated systems are available. If manual systems are used and irrigation has to be in normal work hours early in the morning would be the preferred time.

In general current City of Greater Geelong irrigations meet the above guidelines.

6. Alternative Water supplies

6.1 First use water

First use water is water from a separate source to potable water. It does take water from the environment. However the source may currently be under-utilised and have spare water. As the water is directly used without treatment (reducing power use, chemical use and treatment losses) it does have sustainability benefits.

There are three sources of first use water which are further described in the following sections.

6.1.1 Surface water diversion

In the case of City of Geelong the most obvious surface water diversion source is the Barwon River, which flows through the town next to two of the sites and close to the third site these sites are discussed in detail in later sections of the report.

Discussions with Southern Rural Water (SRW) about availability of Water in the Barwon River indicate that the river is fully committed to existing licence holders. It is possible to buy water allocation from existing licence holders. SRW are unsure of the market but have made the following comments:

- The process is that the purchaser has to find a willing seller. The purchaser and seller than apply for SRW to transfer the water. The transfer is advertised and following consideration of any objections a decision on the transfer is made;
- SRW can provide a register of locations of licence holders although names are withheld for privacy reasons. Or on a fee for service basis SRW can write to each customer asking if they are willing to transfer water;
- Recent rates for transfers, from other rivers than the Barwon, been; temporary transfers $50/ML/annum, permanent transfers $100 - $1 000ML. The higher figure has normally been for water from a regulated dam and a more likely maximum for the Barwon would be $400;
- In periods of low flow rosters limiting the volume and timing of access to the water may apply;
- The following usage charges would apply:
  - Annual Licence $ 200
  - Volume charge $6.80ML

Capital cost for installation of an irrigation pump would be in the order of $30 000 plus the cost of providing an electricity supply to the installation point.

There are elevated salinity levels in the Barwon River that would limit the use to salt tolerant grass species.

The microbiological quality of the water will be lower than bore sources and warning signs are recommended.

An electric pump, filter system and connecting pipe work to existing irrigation systems would be the equipment needed.

The physical works of an off take pipe and screen would depend on the nature of the site. In sites of high environmental value this can be a significant cost.

There will be no loss of environmental flow downstream of any potential offtake point as the option relies on purchasing an existing entitlement. As the transfer of entitlement is most likely to be from an upstream customer there will be additional flows between the original entitlement holder and the extraction point resulting in minor environmental benefits.

A major advantage of river water is that it can normally be taken as required and removes the need for storage.

In summary there will be minor environmental/sustainability benefits but the water will be more saline requiring blending with potable water and/or conversion to a more salt resistant grass. There are likely to be significant capital costs in acquiring water entitlement and constructing the offtake pumping station. However there will be considerable savings on consumption over potable water use.

6.1.2 Bores

Bore water, where available, can provide an acceptable source of water. Salinity can be higher than other sources.

Southern Rural Water is the licensing authority.

The principal capital cost is normally the construction of a bore. The bore pump is relatively small and can often be installed in the bore.

Providing the yield of the bore is adequate for typical irrigation demand bore water can be taken as required and removes the need for storage.

Bore supplies are administered by Southern Rural Water. In addition to initial licensing charges of $1 170 the following charges would apply:

- Annual charge $214
- over 10ML/annum $2.40

Typical cost for installation of an irrigation bore in the Geelong formations would be in the order of $30 000.

As there is currently limited demand for groundwater in the Geelong area the use of groundwater is more sustainable and has lower environmental consequences than continuing to use potable water originating from surface sources.

In summary there will be significant sustainability benefits but the water will be more saline requiring blending with potable water and/or conversion to a more salt resistant grass. There are likely to be lower capital costs than the river option. There will be considerable savings on consumption over potable water use.

6.1.3 Storm Water

Storm water includes both roof drainage and general run off from paved and unpaved areas both on site and from adjacent areas.

A significant disadvantage of stormwater is that it needs to be stored from the period when it is available until it is needed. When considering sports field irrigation the total volume of storage can be very significant.

For example to provide a single irrigation equivalent to 15mm of rain for one hectare of sports field requires a storage volume of 150m^3.

Building a storages based on a storage depth of 2m the surface dimensions of the water would be 10x7.5m. Also average net monthly evaporation (evaporation less rainfall) in City of Greater Geelong for the period November to March is in the order of 150mm. For a 2 m deep dam this would lose 7.5% of its volume per month.

To provide a real benefit a storage volume of a size able to provide several irrigations would be required. Such a storage as well as taking up a considerable area would present public safety risks unless appropriately fenced.

Capital costs are site dependant but would be in the order of $40-50 000 per ML of volume. Each ML of storage would provide 3-4ML of water per annum.

A dam to capture run off from land for irrigation use would come under the Farm Dam Legislation administered by Southern Rural Water. In addition to licensing charges the following usage charges would apply:

- 0 – 10ML/annum $600
- Over 10ML/annum $2 000

In summary there will be sustainability and environmental benefits. The water would be of a quality that can be used on existing grasses. There are likely to be extremely high capital costs in constructing storages and the area of the storages will be an issue. There will be savings on consumption over potable water use.

6.2 Reclaimed Water

6.2.1 Reclaimed Swimming Pool Backwash

Currently swimming pool water cleaning systems involve the water being passed through filters. Periodically these filters are backwashed with clean water to remove particles caught in the filter. This backwash is then discharged to waste. The disinfection levels in the swimming pool water mean that the water is microbiologically of high quality and initial settlement followed by simple filtration means that 80-90% of the backwash water is recoverable.

There may be some concern about build up of salt or disinfection by-products if the only source of irrigation water is swimming pool backwash.

Although the backwash from a swimming pool is unlikely to be able to be sufficient for a football oval it may be able to be utilised by supplementing it with water from another source. Alternatively it may be suitable for use on part of a golf course.

The relatively high quality of typical backwash makes this source suitable for irrigation with minimum treatment as long as an appropriate dilution with water from other sources occur.

6.2.2 Reclaimed Town Waste Water

Currently the only plants in the City of Greater Geelong that are able to supply recycled water are at Black Rock and Portarlington. Both are able to supply Class C water. More detailed results from the Portarlington Plant are in Table 4 below:

Table 4 Average Water Quality Portarlington plant

Parameter	Value
Biological Oxygen Demand	7mg/L
Suspended Solids	10mg/L
pH	8
Phosphorous	9mg/L
Nitrogen	5mg/L
Ec	2660
E coli	31org/100mL

Currently the majority of effluent from Portarlington is committed to customers close to the plant although a further allocation will shortly be advertised. A review of sewerage for the whole of the Bellarine Peninsula is underway. One of the options that is currently being investigated, is to pipe additional flows to the Portarlington Treatment Plant, which will increase the volume of water available for reuse.

Infrastructure to supply potential customers other than those close to Black Rock is not in place. No plans currently exist to provide recycled water back to the city from this plant.

Barwon Water is currently reviewing the possibility of providing a water reclamation plant, to the North of the city, in conjunction with Shell. No firm commitments have been made at the time of this report.

Cost impediments to the use of recycled water by the City of Greater Geelong are:

- Capital Cost. Barwon Water expects customers to meet the capital cost of constructing the pipeline between the treatment plant and the customer; and
- Tariffs. Barwon Waters policy for recycled water pricing setting is; Recycled water prices should be set to maximise revenue earned having regard to the price of any alternative substitutes and the customers willingness to pay.

In effect the above means that the likely total cost of using recycled water is going to be higher than using town water.

In summary use of recycled water from Barwon Water is only practical if the irrigation site is close to a Barwon Water, water reclamation plant.

6.2.3 Trade Waste

Reclamation of trade waste is another source of reclaimed water. Without detailed analysis of the waste stream it is hard to draw definite conclusions. Although this is a potential source there are a number of issues that need to be considered.

- Generally there is a regular supply meaning that storages can be relatively small only being required to store a maximum of one irrigation;
- As the industry has to pay a disposal charge of at least $1.00 per kL discharged to Barwon Water they may be prepared to pay for the City of Greater Geelong to dispose of their effluent by irrigation;
- Many large industrial dischargers are food processors. These companies often use caustic chemicals in the process of cleaning process vessels and lines. The consequence of this is the salinity of the discharge water can be unacceptably high unless mixed with a low salinity water stream;
- Nutrients. Many industrial discharges contain nitrogen and phosphorous nutrients that will promote growth and save on fertiliser application. However the nutrients need to be kept in balance with the plants take uptake of nutrients by the plants if issues such as soil acidification are to be prevented;
- Industrial dischargers tend to be focussed on their product rather than their waste stream which means that the quality can vary across the day; and
- The city may need to install a treatment plant, which will bring the effluent up to at least Class C Standard.

Steggles was approached as part of this report. Their view was that they previously investigated using water from their site to Supply Geelong Racecourse but had not proceeded as their investigations had indicated the project was not viable.

In summary use of trade waste is generally only practical if high quality, low salinity water is available. Currently the only source that has been identified is the Barwon Prison that has been further discussed in the section relating to Elcho Park.

7. Artificial Surfaces

7.1 General

Artificial grass surface are common now in many sports. In the case of hockey they are the standard surface for international games. They provide a highly consistent surface that can stand high levels of use without deterioration.

The advantages to the City of Greater Geelong are:

- One artificial grass pitch would be able to replace several grass pitches if acceptable scheduling of games and practice sessions could be organised; and
- Artificial grass tees on golf courses would improve resistance to wear while removing the need for watering. Although the saving initially seems fairly small 36 tees on a typical 18-hole course equates to 2 000m^2. Also the watering of tees usually involves a fair amount of over spray meaning the reduction in area watered would be in the order of 3 000m^2.

Manufactures claim that artificial grass can be used on golf greens. In Colorado the Echo Basin Golf Course is completely constructed with artificial grass. This can provide more substantial saving than the use on tees however extensive consultation with users would be required before a change could be recommended.

The cost of these surfaces is relatively high compared with grass. In the past they have caused abrasion burns, however their performance has improved considerably in this regard. As a consequence they are more suited to sports where tackling an opponent to the ground is not part of the sport, for instance soccer, hockey, and golf.

7.2 Experience with Artificial Grass Soccer Pitches in Victoria

Three artificial pitches have been installed at the Football Federation Victoria headquarters at the Darebin International Sports Centre (DISC).

Melbourne Victory has used the pitches for training and pre-season friendly matches The Victory Coach believes that synthetic pitches, like those at the DISC, are the way of the future. Some of the Victory players commented that the surface takes some getting used to.

VIS Head Football coach Ian Greener has been quoted as follows: “This is the surface they used at the recent FIFA U-17 World Championship in Peru. Some of the teams took time to adjust, but by the end of the tournament they absolutely swore by it”.

George Angelopooulos, Head of Business Affairs for Football Federation Victoria (FFV) made the following comments:

- FFV is happy with the three pitches that have been in place since last May;
- The pitches are fully booked from 5.00pm to 9.00pm most evenings;
- Floodlighting is required to maximise the benefit;
- Bookings are increasing for weekday use;
- Fencing is needed to keep bikes off the area and control use; and
- Monthly maintenance by the specialist contractor costs $3 000 per year.

A budget cost for installation of an artificial soccer pitch including floodlighting and fencing is $430 000. If the pitch was to be used for contact sports such as rugby an elastic layer is recommended at an additional cost of $240 000.

7.3 Artificial Golf Tees

A budget cost for installation of artificial grass golf tees by a specialist contractor is $150/m2.

The nearest location that can be inspected is the practice fairway of the Sanctuary Lakes Course at Point Cook.

7.4 Water Requirements

Modern soccer pitches and club standard hockey do not require any watering. International hockey is played on a watered pitch to speed up movement of the ball.

In hotter climates for soccer played in the middle of the day a light watering is sometimes applied to improve player comfort.

8. Size of Playing Surfaces

An area of high potential savings when looking to reduce the water consumption for sports fields is to minimise the playing area and hence the area requiring irrigation.

8.1 Team Sports

Table 5 below shows the size of Popular Australian sports that are played on turf sports fields.

Table 5 Sports fields Dimensions

Sport	Length	Length	Width	Area	Reduction in playing area
AFL	Max	185	155	2.25	NA
	Min acceptable	135	110	1.17	48%
Senior Cricket (1)	Min acceptable	142	120	1.13	NA
Junior cricket	Typical	122	100	0.94	17%than senior
	Min acceptable	102	80	0.62	45% than senior
Rugby Union	Max	144	70	1.01	NA
	Min acceptable	104	68	0.71	30%
Rugby League	Standard	116	68	0.79	NA
Soccer Overall	Max	120	90	1.080	NA
	Min acceptable	90	45	0.41	70%
Soccer International	Max	110	75	0.83	NA
	Min acceptable (2)	100	64	0.64	22%
Hockey	Standard	91.4	55	0.50	NA

(1) Sport and recreation Victoria (based on 60m radius from pitch)

(2) Current standards for new COGG pitches

It can be seen from the table that for several sports there may be the opportunity to minimise the playing area for several sports and thus reduce the area requiring irrigation. For example for every soccer field constructed to the minimum dimensions, rather than the current standard, the saving in maintained area would be 50%.

The current standard pitch dimensions are in excess of Football Federation Victoria's recommended dimensions, which are shown in Table 6 below:

Table 6 Football Federation Victoria Minimum Pitch Dimensions

Classification	Standard	Length	Width
Class A	Premier League	100	60
Class B -D	State League Division 1	96	60
Class C	State League Division 2,3, Provisional League Division 1, Women Premier League	96	60
Class D	Provisional League Division 3,3, Women State League	96	60
Other	Junior	75	55

In the case of Ovals used by cricket and AFL the reduction needs to accommodate the sport with the larger minimum dimension. For example a football oval can only be reduced to 110m width if cricket use is limited to juniors.

All future pitches should be constructed to minimum dimensions.

In the case of existing pitches there may some user objection to size reduction and there are cost implications in moving existing fences. A user consultation process would be required before any changes.

Arguments that can be used to support a sports field reduction strategy are:

- Reduction in size will mean a reduction in cost;
- Water savings would mean that the risk of remaining sports fields being subjected to restrictions is reduced;
- Larger sized sports fields are aimed at professional sportspersons who have a high level of fitness. A smaller sports fields allow users to play using their skills but with a lower dependence on fitness/stamina; and
- Smaller fields may be appropriate for junior grades.

8.2 Golf

It is likely that any reduction in the overall area of a golf course would meet considerable resistance from club members and other users.

There may however be an opportunity to modify the surface treatment of the areas of the golf course that have a low frequency of use. In the case of golf courses this would be the area within 100m of the tee that would only be used by golfers that miss hit the ball. This area would have a lower irrigation rate and a lower frequency of mowing to reduce stress.

For a typical golf course with 30m wide fairways the effect of zoning fairways would be to substantially reduce the irrigation requirement over an area of 5.4ha.

9. Rationalising Sports Grounds use

9.1 Current and Future Provision

Generally sportsgrounds have been provided over a long period of time based on the demand at the time of provision.

Demand may change over time resulting in the grounds being under utilised for the sport that they were initially provided for. The City's sports ground bookings suggest that there is no current oversupply of grounds. This should continue to be monitored.

9.2 Scheduling

Innovative scheduling may be required to maximise water conservation while providing rationalised facilities that meet the community's needs:

For example:

Cricket clubs could be encouraged to:

- Play two-day matches over a single weekend with two teams sharing a pitch, playing alternate weekends;
- Schedule Sunday games;
- Limit the overs so play can be completed in a day; and
- Have separate limited over, evening competitions during daylight savings.

Football clubs could be encouraged to schedule games on Sundays although wear and tear on grounds may become a factor.

9.3 Artificial Grass for Soccer

With the under provision of soccer pitches the issue is rational provision of pitches rather than rationalisation. Where additional capacity for soccer is by providing artificial pitches it will be possible to provide fewer pitches than if grass pitches are provided. In this way additional soccer facilities can be provided without any water use.

9.4 Use of Education and Privately controlled Grounds

The City currently takes advantage of the opportunity to share facilities on grounds that come under the ownership of other Authorities.

10. Club Rooms and Toilets

This report is aimed at sustainability of sports fields so the issue of water efficient fittings has not been considered in detail. The actual water use through plumbing fixtures in general will be quite small compared with irrigation usage. Any upgrade to plumbing fixtures will be best dealt with during a building upgrade or an area contract for fixture upgrades.

Plumbing fixtures that should be considered for upgrades are:

- Single flush toilets replaced with dual flush units;
- Conventional taps in washbasins replaced by automatic cut off taps;
- Shower heads with water efficient shower heads;
- Automatic flushing urinals converted to manual flush or adjusted to prevent flushing during periods of non-use; and
- Hoses without trigger outlets.

11. Sports Facilities Managed by Clubs

11.1 General

A number of recreational clubs operate on City of Greater Geelong land such as dog clubs, horse clubs, soccer clubs and shooting clubs. Some of these clubs do their own grounds maintenance including irrigation of grounds. Usually the arrangement is that the City pays for the water.

This approach does not encourage the clubs to be water conscious in their ground management.

11.2 Education

An initial approach to encourage better water use is to provide education in water saving. This could be aimed at all clubs or just targeted at the higher volume users.

11.3 Water budgets

Issuing water budgets based on the estimated irrigation requirement of the grounds plus toilets use could assist in the education process. With this approach the club would receive an allocation of water for the year. This would be based on supply to the budget volume at no cost. All usage would be charged at standard Barwon Water volume charges. This would act as an incentive to keep use at or below the water budget volume.

11.4 Sharing in Saving

A further development of the water budget would be to offer to share the savings of reduced water use with the club. Typically any consumption less than the budget would result in a rent reduction, or payment, equivalent to a percentage of the standard Barwon Water volume charges. This would act as an incentive for the clubs to be proactive in reducing consumption.

12. Specific Site Reviews

In the GHD report of March 2006 to the City of Greater Geelong on Sustainable Water a number of high use sites were identified.

As part of this review the following four sites were identified for a more specific review:

1. Elcho Park Golf Course;
2. Queens Park Golf Course and Ovals;
3. Kardinia Park; and
4. South Barwon Reserve.

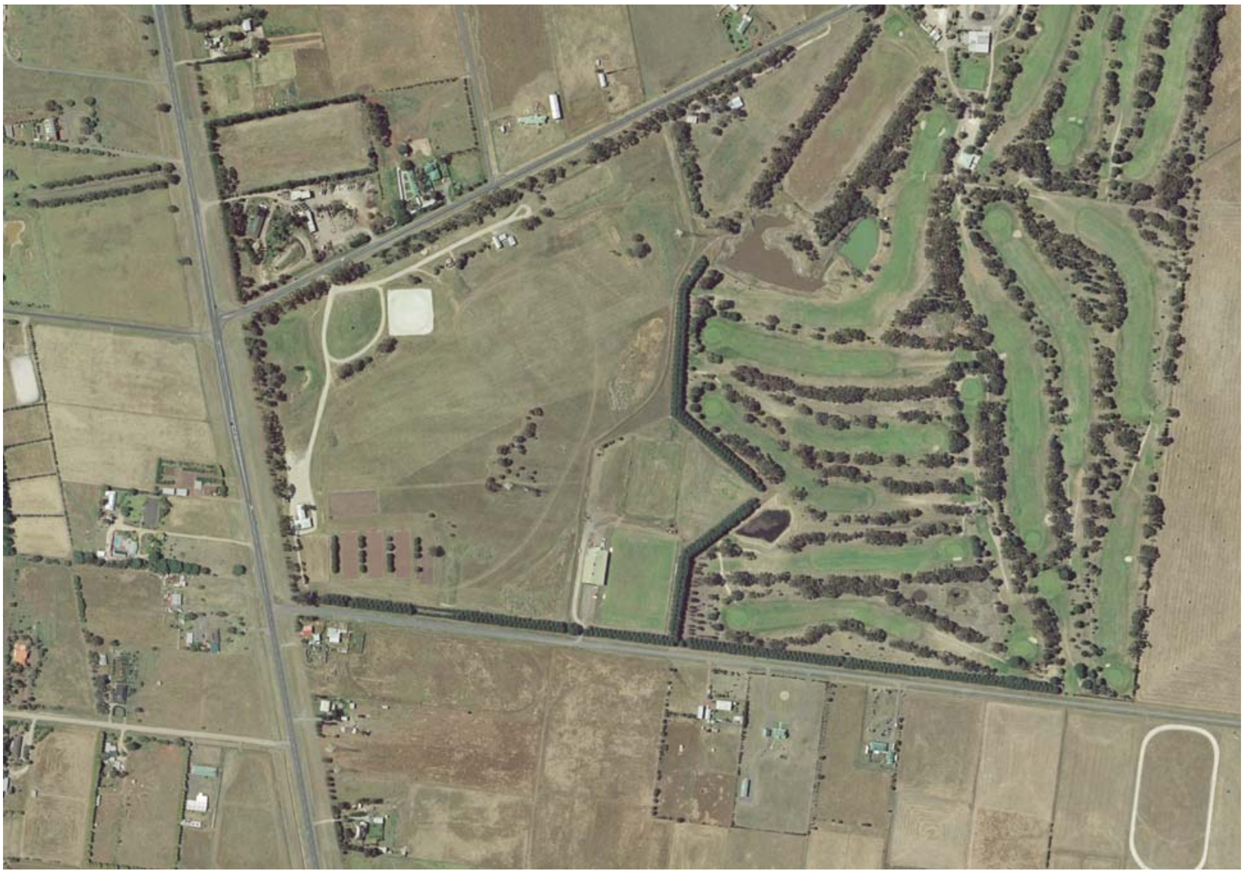
A further site of Thomson Reserve was added to the original study following the completion of the original work

Detailed reviews of each site are included in the following five sections.

Specific issues identified in Part 1 are reviewed including concepts and estimates with consideration of social, environmental and economic cost/ benefits for any potential water saving improvements.

Dimensions used in the report were measured from aerial photographs that have been checked against survey information. These dimensions were used in area calculations.

13. Elcho Park Golf Course



13.1 General

The facility was visited with Jon Halsall of the City of Greater Geelong and Toby Munday, the course curator.

The Elcho Park Complex consists of the following four facilities:

- The Golf Course;
- Dog Club- No Irrigation;
- Horse Club – No irrigation; and
- Soccer Club – Owned and managed by the soccer club (Excluded from the report).

13.2 Golf Course

This is an eighteen-hole golf course with a practice fairway and putting green. The total area is approximately 54ha. Approximately 24 000 rounds of golf are played a year.

Grass varieties are as follows:

- Greens are generally bent impala;
- Fairways are mixture of kikuyu and couch; and
- Tees half couch remainder rye.

The soil is reactive clay that has been subject to improvement. Deep cracks can develop when the soil dries out.

13.3 Water Usage

Water usage 2004-5, the last complete year for records, was 52 ML. The five-year average is 71ML.

Water usage at this site is in the following areas:

- Club House and Toilets. Typical domestic use toilets are fitted with dual flush systems and urinal has manual flushing. All sewerage is discharged to a small treatment plant which discharges treated effluent to the irrigation dam;
- Garden Irrigation. Limited area around club house has manual micro spray irrigation system;
- Machinery washing. Washing bay has high volume hose controlled from tap; and
- Irrigation. Approximately 50% of the 54 ha course is irrigated by a computerised system. (Estimated irrigated area 27ha) Manual sprinklers are used for the practice area.

13.3.1 Irrigation system

The water is sourced from a 1700m2 dam. The dam takes run off from the course, roofs, the equipment wash bay, discharge from the clubroom package treatment plant, and is topped up from potable water supply. The dam overflows to a secondary dam.

The system is a computer-controlled system less than 2 years old. The computer enables separate irrigation of Greens, fairways and tees, or selection of individual irrigation stations.

The current settings are based on providing the equivalent of 15mm of irrigation in 30 minutes of run time at each station. No checks on the accuracy of the sprinklers have been made. The system is based on manual input of the irrigation requirement.

Peak water usage is two irrigations a week that equates to 120mm in January.

13.4 Existing Water Saving measures

Water saving measures currently in place:

- Dual flush Toilets;
- Capture of run off from rainfall;
- Reuse of effluent from clubhouse treatment plant;

- Conversion of fairways to warm season grasses. This is being achieved by using a 50% strength application of Roundup in spring to kill cool season grasses. The warm season grasses although affected by the roundup recover quickly and in this way take over from the cool season grasses; and
- Wetting agents are used to assist in effectiveness of water take up of the soil.

13.5 Potential Water Saving Measures

Current water usage is estimated at 2- 2.6ML/ha/annum.

13.5.1 Improving Irrigation effectiveness/ Accepting Lower Growth Rates

Introducing a target based on the lower figure of 2.0ML/ha/annum will save in an average year 10ML of water.

There will be a nominal cost for this option.

13.5.2 Irrigation Based On Warm Season Grasses

If a crop factor of 0.25 is used (moderate growth of warm season grasses) the target for consumption would be 0.5ML/annum. This would require some work to ensure that warm season grasses are fully established across the course.

Estimated saving 37ML/annum.

A preliminary cost for conversion of the whole course to warm season grasses is $285 000 based on 50% of the playing area requiring conversion at $1.50/m2.

13.5.3 Zoning Fairways

Zoning fairways with irrigation of the initial section of the fairway reduced by 50% would result in an 8% saving in water usage. The fairways are likely to become brown in summer:

Zoning fairways at 2ML/ha target estimated saving 4ML.

Zoning fairways for cool season grasses estimated saving 1ML.

There will be a nominal cost for this option.

13.5.4 Lagoon Evaporation

Based on long-term weather records the net evaporation losses of the dam are in the order of 1.4ML per annum. Although there is some savings due to reuse water from the clubroom waste plant much of the evaporation takes place in the summer when there is little re-use or drainage water available. Approximately 240KL is estimated to be lost in January alone.

The System could be upgraded in the following ways:

- An irrigation supply tank to be provided. This would be fed by a submersible pump in the existing dam when water was available and by the potable water when the dam was empty. The dam would be empty or at very low levels for the majority of the time in the summer months. The additional volume available to take summer storms would improve the efficiency of recovery of stormwater.

A preliminary cost for the above works is $25 000 including a 25% allowance for design, supervision and contingencies.

- A second pump in the downstream dam pumping back to the first dam would further improve the recovery efficiency of stormwater.

  A preliminary cost for the above works is $20 000 including a 25% allowance for design, supervision and contingencies.

  Estimated total savings 3ML.

13.5.5 House Keeping

At the time of the visit equipment was being washed using a high volume hose controlled from a tap. More water efficient cleaning is to use trigger-operated hoses and have a pressure washer set up for easy use (now required under latest water restrictions). This issue when pointed out to staff was accepted as an urgent implementation issue.

13.5.6 Bore

Elcho Park rests upon basalts of the Newer Volcanics which are up to 30-40m in thickness. The volcanics overlie thin sand and clay of the Moorabool Viaduct Formation and then thick sequences, up to 200m, of the marine Fyansford Formation. The Fyansford Formation rests upon the basement rocks of the area, possibly consisting of granite at this site. Numerous bores have been drilled in the vicinity of the park. The groundwater is typically saline in this area with the EC ranging from 8 000 – 12 000. This equates to some 5 000 – 7 000 mg/L TDS. There is no indication that lower salinity groundwater will be found at depth in the stratigraphic profile.

Potential: the potential to find a standalone irrigation source in this area is extremely poor if not none. A very high shandy ratio would be required if groundwater was still considered an option, probably greater than 5:1. If a salt tolerant warm season grass is used. It would then be possible to replace 25% of the potable water used for irrigation.

A preliminary cost of installing a pump in the existing bore is $15 000.

13.5.7 Reuse

The nearest source of reuse is the treatment site for Barwon Prison. Copa Water currently operates this site. Initial discussions have taken place with Ray Anderson of Copa Water who made the following points:

- There is likely to be adequate water available for irrigation of the golf course;
- The site currently produces Class A and Class C water and would be able to provide water at Class C level or better;
- An initial usage price indication was in the region of 50% of Barwon Water Potable charges plus pumping; and
- Department of correction approval would need to be obtained before an agreement could be made.

A preliminary cost for the 5.5km transfer pipeline is $400 000 including a 25% allowance for design, supervision and contingencies.

13.6 Summary

A review of the cost indicate that the following improvements would generate 55ML of potable water savings per annum at a cost of $325 000:

- Improve irrigation efficiency;
- Convert golf course to all warm season grasses;
- Zone fairways;
- Stormwater improvements; and
- Bore water.

The savings on the costs of water would be in the order of $49 000 per annum.

Alternatively a saving of 70ML per annum could be achieved at a cost of $400 000. Due to the operational costs and charges for consumption the savings would be in the order of $25 000 per annum.

14. Queens Park Golf Course and Ovals

14.1 General

The facility was visited with Jon Halsall of the City of Greater Geelong and Glen Dixon, the course curator in regards to the Golf Course. A further visit was carried in association with Grant Baverstock with regards to the Ovals:

- The Queens Park Complex consists of the following four facilities;
- The Golf Course; and
- Two Ovals.

14.2 Golf Course

This is an eighteen hole golf course with a practice fairway and putting green. The total area is approximately 34ha. Approximately 48 000 rounds of golf are played a year.

Grass varieties are as follows:

- Greens are generally bent;
- Fairways are mixture of rye (est 60%) and Kikuyu (est 40%); and

- Tees rye. A trial tee using paspalum has been installed.

The soil is generally sandy loam. With deep valley sides and extensive tree cover Queens Park has its own microclimate, which will make conditions different to more exposed sites in Geelong. The trees are generally European exotics, which rapidly dry the area above their roots.

The lower areas of the course are flooded when the river breaks its banks at approximately five-year intervals. This does bring weeds onto the course.

There are no natural drainage lines across the course suitable for collection of natural run off. Run off from the clubhouse area drains along an open drain along the south side of the practice fairway to the river

14.3 Ovals

There are two Ovals:

Oval 1(Stinton Oval) **164m long x 130m wide** This oval has a turf wicket and is used for 1st grade cricket in summer and senior football in Winter and has heavy use. The soils is different to the other areas of the park being approximately 2m of silt over sand this creates a perched water table over the ground. Cool season grasses are predominant. Irrigation is automated, at a rate of 9.2mm/hour, 3-4 times per week in peak periods and centrally controlled. Estimated irrigation for January 40mm.

Oval 2 (Shaw Oval) **162m long x 110m wide** Usage is 2nd grade cricket in summer played on a matt wicket and junior football in winter. The oval is also used for car parking once a year for a Highland Gathering. The soil is a sandy loam the grass was originally cool season grass but Kikuyu is becoming established across the oval. Irrigation occurs 3-4 times per week in peak periods. The system is automated, but not centrally controlled. An irrigation rate was not available so a rate of 10mm/hour has been assumed. Estimated irrigation for January 40mm.

14.4 Water Usage

Water usage 2004-5, the last complete year for records, was 52.16ML. The five year average is 63.27ML.

Water usage at this site is in the following areas:

- Golf Club House Toilets. Typical domestic use, toilets are fitted with dual flush systems and urinal has manual flushing. Showers in changing room are fitted with low efficiency shower heads. All sewage is discharged to the public sewers;
- Stinton Oval Club Rooms. – Access to the clubrooms was not available. We have assumed that the fittings will be similar to the golf club rooms. Currently an upgrade of the rooms is proposed;
- Toilets in Park One of the toilet blocks has single flush toilets wash basins have standard taps;
- Machinery washing is by high volume hose controlled from tap;
- Golf Course Irrigation. Approximately 80% of the 34 ha course is irrigated by a computerised system irrigation system. (Estimated irrigated area 27ha); and
- Oval Irrigation Both ovals are irrigated.

The water is sourced from the Barwon Water potable supply.

The golf course system is a computer-controlled system approximately 10 years old. The computer enables separate irrigation of Greens, fairways and tees, or selection of individual irrigation stations.

No information about the application rates was available For the purpose of estimating consumptions 30mm of rain per hour has been assumed. No checks on the accuracy of the sprinklers have been made. The system is based on manual input of the irrigation requirement.

Peak water usage is three irrigations a week. Amounts per irrigation are:

- Greens and tees receive 30mins per station at each irrigation which equates to 190mm in January; and
- Fairways receive 20mins per station at each irrigation which equates to 140mm in January.

14.5 Existing Water Saving measures

Water saving measures currently in place.

- Dual flush toilets in majority of toilets. One external block is still single flush;
- Some conversion of fairways to warm season grasses. Couch was trialled but was unsuccessful as prone to disease. Kikuyu has been more successful;
- Mats are used for the practice fairway tee area;
- One tee has been renovated with paspalum prior to last summer. This performed very well over the summer on two irrigations a week. The curator considers that the frequency of irrigation could be dropped to one per week. The hole is a par three and heavy wear takes place due to golfers placing balls off the ground. The grass self repaired well in the summer. However at the time of inspection in July, the grass was dormant and the appearance of the tee had suffered; and
- Targets for oval irrigation

14.6 Potential Water Saving Measures

Current water usage is estimated at 2- 2.4ML/ha/annum.

14.6.1 Improving Irrigation effectiveness/ Accepting Lower Growth Rates

Introducing a target based on the lower figure of 2.0ML/ha/annum will save in an average year 9ML of water.

There will be a nominal cost for this option.

Ovals

The targets that are discussed in section 4.7 if successfully applied to these ovals will result in 2.41ML/ha/annum for the Stinton Oval and 2.81ML/ha/annum for the Shaw Oval. Reductions below these levels may be possible but could affect playability.

14.6.2 Change to All Warm Season Grasses

If a crop factor of 0.25 is used (moderate growth of warm season grasses) the amount of irrigation would be reduced to 0.5ML/ha/annum.

Estimated saving 35ML/Annum.

A preliminary cost for conversion of the whole course to warm season grasses is $450 000.

Preliminary cost for conversion of the ovals to warm season grasses are:

- Stinton $26 000; and
- Shaw $22 000.

The above estimates are based on the majority of the playing area requiring conversion at $1.50/m2.

14.6.3 Playing Area Size Reduction

Zoning Fairways

Zoning fairways with irrigation of the initial section of the fairway reduced by 50% would result in an 8% saving in water usage. The fairways are likely to become brown in summer.

Zoning fairways at 2ML/ha target estimated saving 4ML.

Zoning fairways for cool season grasses estimated saving 1ML.

There will be a nominal cost for this option.

Ovals

A reduction to the minimum dimensions for both Ovals would reduce the area of irrigation by 0.45ha, a reduction of 15%.

Saving for Oval reduction

- Existing irrigation target 1.2ML; and
- Warm season grasses 0.25ML.

Preliminary cost for size reductions of the ovals are:

- Stinton $30 000; and
- Shaw $10 000.

14.6.4 Toilets and Showers

The specification for the upgrade to the Stinton Oval clubrooms should be checked to ensure that high efficiency shower heads and other plumbing fittings are specified.

Automatic cut off taps to be fitted to all toilets washbasins.

14.6.5 House Keeping

At the time of the visit equipment was being washed using a high volume hose controlled from a tap. More water efficient cleaning is to use trigger-operated hoses and have a pressure washer set up for easy use (now required under latest water restrictions). This issue when pointed out to staff was accepted as an urgent implementation issue.

14.6.6 Bore

Queens Park lies on the southern side of Barwon River at Highton. The elevated sector of the park lies upon high-level alluvial deposits consisting of outwash sand, gravel and clay. The northern, or lower sector of the park is underlain by younger river alluvium deposited along the floodplain of the Barwon River. From the Geelong 1:63 360 scale geological map sheet the high-level terrace deposits and the younger alluvium are interpreted to rest upon calcareous sand, clay, silt and marl of the Fyansford Formation. Towards the southern boundary of the park, along the Newtown Fault, the Lower Cretaceous age Barrabool Sandstones appear at surface. These rocks form the basement rocks in this region and are kilometres in thickness. The Barrabool Sandstones underlie the Fyansford Formation on the northern sector of the park.

There has been one bore drilled at the park. Limited records are available for bore 48033 as to depth of drilling and lithology intersected however a salinity measurement of 11 000 EC was recorded from the bore. This is equivalent to some 6 600 mg/L TDS adopting the relationship TDS = EC * 0.6. This salinity level is well in excess of the salinity level necessary to maintain growth of lawns and plants even under conditions of excellent drainage.

Potential: There is a considerable amount of uncertainty about the volumes that could be obtained at this site. It is considered there is limited potential to find a groundwater supply for irrigation at this park without significant shandying with a lower salinity water source. If for example the lowest salinity at this site is 6 600 mg/L a shandy ratio of at least 4:1 would be required to bring the mix to around 1,500 mg/L TDS. This could be used for salt tolerant grasses only. There is no indication also of potential bore yield from this location. Best potential target would be the Fyansford Formation targeting any limestone rich beds in the profile. A search of borehole information from Southern Rural Water's records indicated that a bore has been constructed at this site. The measured salinity was 11 100uS/cm EC.

It may be possible to replace 25% of the potable water used for irrigation following conversion to salt tolerant grasses.

A preliminary cost of installing a bore and pump is $30 000.

14.6.7 Reuse

Buckley Falls Stormwater

Hyder consulting carried out an investigation into options to collect and treat stormwater from the Highett Road/Buckley Falls Road area, for the City of Greater Geelong in 2001. The option considered to provide the best opportunity to maximise reuse was to construct a 6 000m2 wetlands near the 5th Hole. The cost estimates for the wetlands construction, and pipe work to connect to the wetlands, at that time was $400 000. The wetlands would only be capable of providing 3-4 days of irrigation demand before becoming dry.

Clubhouse and Parking Area Drainage

Currently this area drains along a channel to the south of the practice fairway a wetlands type of storage to capture a 40mm rainfall event would be in the order of 150m2. The cost is estimated at $60 000 including a pump and return pipeline and would save in the order of 1ML/annum. The storage would be dry for most of the year.

Fyansford Quarries Stormwater

Water from the quarries is currently pumped from the quarries to the bay. The water is pumped to the bay, as it is too saline to be discharged to the Moorabool River. It is therefore unlikely to be suitable for irrigation.

Club Rooms

It is not considered cost effective to install a treatment system to reclaim sewage from the club rooms.

14.7 Summary

A review of the cost indicate that the following improvements would generate 49ML of potable water savings per annum at a cost of $481 000:

- Improve irrigation efficiency;
- Convert to all warm season grasses;
- Zone fairways; and
- Bore water.

The savings on the costs of water would be in the order of $43 000 per annum.

15. Kardinia Park

15.1 General

The facility was visited with Jon Halsall of the City of Greater Geelong and the curator Simon Thornton for the park. Skilled stadium was inspected with curator Matt Ryan.

The Kardinia Park Complex consists of the following facilities:

- Two Public Ovals;
- Skilled Stadium;
- The swimming pool complex;
- Netball courts; and
- General parkland.

15.2 Public Ovals and Parkland

The Cricket Oval 160m x 145m with turf wicket this is the principal cricket oval for Geelong With approximately 120 days use over summer. In winter it is used by the Geelong umpires association for training.

The Oval has a high content of sand in the profile with the grass being rye and poa. A conversion to Santa Anna, a warm season grass, is currently scheduled for 2006/7.

Irrigation is automated, at a rate of 10.2mm hour with watering 3 times per week in peak periods for 20 minutes, and centrally controlled. Estimated irrigation for January 44mm.

St Marys Oval

The Oval is 165m x 108m in summer this is used by VAC thirds and fourths teams. The Geelong Football team also use the oval for pre-season training. In winter Geelong Football League level football is played with two nights of training per week.

The oval soil profile is a sandy loam that holds moisture better than the cricket oval, with the grass being rye and poi. A conversion to Santa Anna, a warm season grass, is currently scheduled for 2006/7.

Irrigation is automated, at a rate of 12mm hour with watering 3 times per week in peak periods for 20 minutes, and centrally controlled. Estimated irrigation for January 44mm.

Parkland

Approximately 3ha of parkland is irrigated.

15.3 Site

The site is very exposed on the west and partially exposed on the north resulting in strong winds that can dry the ovals and make spray drift a significant issue.

There are no natural drainage lines across the park. There are considerable areas of impermeable area including netball courts and parking that drain to an underground system.

15.4 Skilled Stadium

The oval is 180x 122m and solely used by Geelong Football Club for daily training and games on alternate weekends through the winter.

The Oval soil profile is a sandy loam that holds moisture better than the cricket oval, with the grass being principally rye.

Irrigation is automated, at a rate of 8mm hour per irrigation with watering 3 times per week in peak periods for 20 minutes. Soil sensors have been fitted but are considered indicative only and Matt Ryan takes final watering decisions. Estimated irrigation for January 36mm.

15.5 Swimming Pool

There are currently five pools in operation in the pool area, the main pool kept full and the filters run throughout the year. The smaller pools are drained in winter.

The system is described in Section 15.8.8.

15.6 Water Usage

Water usage for the swimming pool in 2004-5, the last complete year for records, was 19.495ML. The five-year average is 11.964ML.

Water usage for the open space for 2004-5, the last complete year for records, was 44.047ML. The five-year average is 54.654ML.

Water usage at this site is in the following areas:

- Club rooms, swimming pool changing rooms and toilets. Limited access only was available to the clubrooms. Typical domestic use toilets are fitted with dual flush systems and urinals have manual flushing. Showers are low efficiency type. All sewage is discharged to the public sewers;
- The whole of the park is irrigated with three separate controllers for both ovals and the parkland irrigation the system is computerised and on central control; and
- Water is used in the pool by discharge of filter backwash and by evaporation.

15.7 Existing Water Saving measures

Water saving measures currently in place.

- Dual flush Toilets;
- Centrally controlled irrigation systems;
- The main pool is covered during winter preventing evaporation loss;
- Proposed change to Santa Anna grass; and
- Targets for oval irrigation.

15.8 Potential Water Saving Measures

15.8.1 Improving Irrigation effectiveness

The targets which are discussed in section 4.7 if successfully applied to these ovals will result in the following:

- Cricket Oval 2.24ML/ha/annum;
- St Marys Oval 2.80ML/ha/annum; and
- Skilled stadium 2.29 ML/ha/annum.

Reductions below these levels may be possible but could affect playability. Experience on working to the targets and refining the targets based on area of ovals will allow development of best practice.

15.8.2 Change to All Warm Season Grasses

Changing to all warm season grasses will allow the targets to be reduced to 0.8ML/ha.

Estimated savings 8ML.

Preliminary cost for conversion of the St Marys Ovals and Skilled Stadium to warm season grasses is $50 000 based on the majority of the playing area requiring conversion at $1.50/m2.

The AFL do not offer firm guidance on the selection of varieties regarding playability, safety and appearance as the key issues rather than grass varieties. Discussions with the AFL’s Turf Consultant John Nayland have revealed that many of the existing AFL grounds use a couch, a warm season grass, in combination with a rye grass. Kikiyu would not be considered acceptable for AFL level competition.

Estimated savings 8ML.

15.8.3 Playing Area Size Reduction

A reduction to the AFL minimum dimensions for the Cricket and St Marys Ovals would reduce the area of irrigation by 0.77ha, a reduction of 24%.

Reduction in size of Skilled Stadium has not been considered.

Saving for Oval reduction:

- Existing irrigation target 1.7ML; and
- Warm season grasses 0.55ML.

Preliminary costs are $30 000 per oval.

15.8.4 Reducing or Stopping Parkland Irrigation

Parkland is irrigated on a similar basis to the ovals so a total use of 3ML/ha/annum has been assumed, total usage 9ML/annum. The savings on this system are dependant on the acceptability of the appearance of the park to the council.

15.8.5 Toilets and showers

The club rooms plumbing fittings should be changed to high efficiency shower heads dual flush toilets and automatic cut off taps to be fitted to all toilets wash basins.

The public toilets should be changed to dual flush toilets and automatic cut off taps to be fitted to all toilets washbasins.

15.8.6 House Keeping

At the time of the visit equipment was being washed using a high volume hose controlled from a tap. More water efficient cleaning is to use trigger-operated hoses and have a pressure washer set up for easy use (now required under latest water restrictions). This issue when pointed out to staff was accepted as an urgent implementation issue.

15.8.7 Bore

Kardinia Park, located in South Geelong, essentially rests upon basalt of the Newer Volcanics. The volcanics, possibly 20-30m in thickness overlie thin sand and clay of the Moorabool Viaduct Formation which in turn rests upon the Fyansford Formation and in turn the Barrabool Sandstones. A shallow bore has been drilled into the volcanics slightly east of the park (bore 57130) however no quality or yield information is available from this bore. Drilling in a similar geological setting at the Geelong Racecourse produced disappointing results with respect to salinity with the bore recording a salinity level greater than 6 000 mg/L TDS. No information is available with respect to Fyansford Formation in this area however it is anticipated, at best, the salinity level may only be marginally lower than that in the volcanics.

Potential: The aquifer systems underlying the park probably have the potential to deliver sufficient quantity for irrigation however without a minimum of a 4:1 shandy ratio of low salinity surface water to groundwater the groundwater is considered unsuitable for irrigation supply.

Bore water is only likely to be suitable if salt tolerant warm season grasses are used. It would then be possible to replace 25% of the potable water used for irrigation.

15.8.8 Reuse -Recycled Water

The Kardinia Sporting Complex includes a swimming centre consisting of five open air pools. These pools operate between October and March with the main use being November to March.

There are two filter systems in the pool complex:

1. An older system which filters the four original pools through two gravity sand filter. This system only runs during times of pool operation. Both filters are backwashed at the same time. This backwash frequency varies between two and ten days. Backwash water is discharged to a 90 000L underground tank. Two pumps then transfer the backwash water to the sewer at a maximum rate of 9L/sec (currently set at 5L/sec); and
2. A newer system that filters the new pool water through five pressure sand filters. This system runs throughout the year. As the filters only backwash on demand the winter backwashes on the system are very infrequently. The filters backwash sequentially and discharge to two 25 000L backwash tanks which then discharge by gravity to the sewer.

In common with all swimming pools the backwashing frequency is driven by the number of people using the pool. As the pools are open air the highest levels of patronage are on days of hot weather and school holidays, which mean the maximum volumes of water available for reuse, are available at periods of maximum irrigation demand.

Volume available for reuse

From figures provided by the city 20ML are used by the pool.

Of this total some of the water will be used in toilets, and showers, other water will be lost through evaporation.

Estimated backwash water 12ML.

As the backwash water contains a range of contaminants it will not be possible to use the total volume. The contaminants together with enough water to carry the contaminants through the sewers will still need to be discharged to the sewer. The maximum volume available for reuse is estimated at 75% of total backwash volume 9ML.

Concept Description of A Backwash Water Recovery System For Kardinia Park

A pipeline has already been laid from one of the parkland irrigation areas to the area of the swimming pool where the backwash tanks are situated. In order to minimise costs utilisation of as much of the existing infrastructure as possible is proposed. This can be achieved by utilising the existing backwash tanks as storage.

The proposed changes are:

- Divert backwash water from pressure filters to underground backwash tank;
- Install a pumped surface skimming system in the underground backwash tank pumping to a pressure irrigation filter;
- Connect the outlet to the pressure filter to the above ground backwash tanks; and
- Provide an irrigation pump pumping from the tanks.

A preliminary cost for the above works is $50 000 including a 25% allowance for design, supervision and contingencies.

Estimated saving 9ML.

15.8.9 Stormwater Reuse

On the whole of the Kardinia Park site including Skilled Stadium there is approximately 40 000m^2 of impermeable area. To capture all the flows from this area for a wet period delivering 50mm of rain would require a 2 000m^3 storage.

Concept Description of a Stormwater Reuse Scheme

The lowest cost option to provide such a storage while maintaining the amenity of the area would be by a wetlands with an average depth of 1.00m. Such a wetlands would be approximately 50m x 40m.

Details of the drainage layout were not available however the following has been assumed to be required.

An interception pump station, 400m long 200mm dia pipeline to storage, irrigation pump station, 500m of 100mm return lines.

A preliminary cost for the above works is $400 000 including a 25% allowance for design, supervision and contingencies.

Estimated saving 12ML.

15.9 Summary

A review of the cost indicate that the following improvements would generate 23ML of potable water savings per annum at a cost of $130 000:

- Improve irrigation efficiency;
- Convert to all warm season grasses; and
- Swimming Pool Backwash.

The savings on the costs of water would be in the order of $18 000 per annum. A further saving in trade waste volume charges is estimated at $9 000.

16. South Barwon Reserve

16.1 General

The facility was visited with Grant Baverstock.

The South Barwon Reserve Complex consists of the following facilities:

- Five irrigated Ovals;
- Shooting club;
- Dog-training club;
- BMX track; and
- Open space / Auskick football ovals.

16.2 Ovals

The main Ovals are numbered 1-5 .

The soil is generally silty clay although Number 3 Oval (Closest to the Barwon heads Rd Breakwater Rd junction) has a sandier profile than the other four.

Summer use is church grade cricket. Winter use is junior/school football.

Oval 1 Turf Wicket 146m long x 122m wide. Irrigation is automated, at a rate of 11mm hour, and will be upgraded to central control as part of a system upgrade in 2006/7.

Oval 2 Turf Wicket 123m long x 123m wide. Irrigation is automated, at a rate of 15mm hour, and centrally controlled.

Oval 3 Artificial wicket 162m long x 116m wide. Irrigation is automated, at a rate of 17mm hour, and centrally controlled.

Oval 4 Artificial wicket 140m long x 107m wide. Irrigation is automated, at a rate of 15mm hour, and centrally controlled.

Oval 5 Artificial wicket 137m long x 110m wide Irrigation is automated, at a rate of 17mm hour, and centrally controlled.

16.3 Water Usage

Water usage 2004-5, the last complete year for records, was 25 884kL. The five-year average is 23 824kL.

Water usage at this site is in the following areas:

- Club Room Toilets. Typical domestic use, toilets are fitted with dual flush systems and urinal has manual flushing. Showers in changing room are fitted with low efficiency shower heads. All sewage is discharged to the public sewers;
- Toilets in Park One of the toilet blocks has single flush toilets wash basins have standard taps;
- Oval Irrigation, Ovals are irrigated 3-4 times per week at 20 minutes per station. Rainfall equivalents for January months are in the order of:
  - Oval 1 -50mm
  - Oval 2 and 4 - 65mm
  - Ovals 3 and 5– 70mm

The water is sourced from the Barwon Water potable supply.

16.4 Existing Water Saving measures

Water saving measures currently in place.

- Four of the ovals have had upgraded irrigation systems installed with the fifth oval scheduled for 2006/7;
- As the ovals have been upgraded the supply main which has been subject to regular breaks and leakage has been replaced. The replacement will be complete with the final oval upgrade; and
- Targets for oval irrigation.

16.5 Potential Water Saving Measures

16.5.1 Improving Irrigation effectiveness

The targets which are discussed in section 4.7 if successfully applied to these ovals will result in the following:

- No 1 Oval 2.91ML/ha/annum;
- No 2 Oval 3.45ML/ha/annum;
- No 3 oval 2.70 ML/ha/annum; and
- No 4 & 5 Ovals 3.42 ML/ha/annum.

This will result in a reduction from 23.8ML/annum to 21.5ML/annum allowing 1ML for toilets and showers.

It would appear that the targets for ovals 2,4, and 5 could be reduced resulting in a saving in the order of 1.5ML. Reductions below these levels may be possible but could affect playability. Experience on working to the targets and refining the targets based on area of ovals will allow development of best practice.

16.5.2 Change to All Warm Season Grasses

Changing to all warm season grasses will allow the targets to be reduced to 0.8ML/annum.

Estimated savings are 16ML.

Preliminary cost are $98 000 based on $1.50/m2.

16.5.3 Playing Area Size Reduction

As senior cricket is currently played on these ovals the only oval that could be reduced in size is Oval No3. A reduction to the minimum dimensions for this oval would reduce the area of irrigation by 0.15ha,

The saving is estimated at 0.7ML at current irrigation rates and 0.25ML with warm season grasses.

Preliminary cost for size reductions Ovals No 3 is $15 000:

16.5.4 House Keeping

Any on site equipment washing facilities should be checked and if necessary replaced by water efficient fittings such as trigger operated hoses and pressure washers set up for easy use (now required under latest water restrictions).

16.5.5 Toilets and showers

The specification for the upgrade to the changing rooms should be checked to ensure that high efficiency showerheads and other plumbing fittings are specified.

Automatic cut off taps to be fitted to all toilets washbasins including public toilets.

16.5.6 Bore

South Barwon Reserve lies along the floodplain of Barwon River and Waurn Ponds Creek. It rests upon recent age river alluvium consisting of sand, clay and gravel. The alluvium rests upon basalt, thin Fyansford Formation and ultimately the Barrabool Sandstones. Although drilling has been conducted either side of this park there is limited information available as to the thickness of each formation or the potential yield and quality from the aquifer systems.

Potential: Without undertaking site specific investigations it is difficult to estimate the potential at this site. However based upon the general salinity levels recorded in bores in the Greater Geelong area it is anticipated that a shandy of, a minimum, 3: 1 would be required.

Due to the saline nature of water from bores in the Geelong Region bore water is only likely to be suitable if a salt tolerant warm season grass is used. It would then be possible to replace 30% of the potable water used for irrigation.

16.5.7 Reuse

Initial enquiries were made of Steggles Chickens, which are a high user of water and are reasonably close to the South Barwon Reserve. The manager responsible for water quality, Mr Brian Egan, is currently on long term sick leave so I was unable to gain definitive information however their response at this time was: “Steggles looked at the option of recycling water some time ago as part of a project to provide recycled water to the Geelong Race Course. Our investigations indicated that we would need to build a treatment plant to meet the quality requirements. The payback on the capital investment of the plant was in excess of 20 years. As a result of this long payback period no further action was taken in pursuing the proposal.”

16.6 Summary

A review of the cost indicate that the following improvements would generate 17.5ML of potable water savings per annum at a cost of $100 000:

- Improve irrigation efficiency; and
- Convert to all warm season grasses.

The savings on the costs of water would be in the order of $15 000 per annum.

17. Thomson Reserve

17.1 General

The facility was visited with Grant Baverstock of the City of Greater Geelong.

The Thomson recreation Reserve consists of the following facilities:

- Two Public Ovals;
- Two netball courts
- Tennis Courts
- General parkland.

17.2 Public Ovals and Parkland

The Main Oval 170m x 112m with turf wicket.

The oval surface consists of cool season grasses. It is used for senior cricket in summer cricket and football in the winter.

Irrigation is automated based on central control, with watering 3 –4 times per week in peak periods a typical irrigation is 76,000L.

Secondary oval 150m x 120m with artificial wicket

The oval surface consists of cool season grasses.

It is used for 3rd and 4th's cricket in summer cricket and junior/school football in the winter.

The irrigation system has not been used for some time due to vandalism. A significant green patch on the oval indicates that some leakage from irrigation pipes is occurring. City staff indicated that steps would be taken to isolate the oval irrigation system to prevent further water losses

Parkland

There is no irrigation to the parkland.

17.3 Site

The site is relatively sheltered by surrounding residential properties.

There are no natural drainage lines across the park. There are considerable areas of impermeable area including netball courts and parking that drain to an underground system.

17.4 Water Usage

Water usage for the open space for 2005-6, the last complete year for records, was 6.7ML. The six-year average is 8.1ML.

Water usage at this site is in the following areas:

- Oval irrigation to the main oval
- Club rooms, changing rooms and toilets. Access was unavailable to the clubrooms. Public toilets were fitted with Dual flush cisterns.. All sewage is discharged to the public sewers;

17.5 Existing Water Saving measures

Water saving measures currently in place are:

- Dual flush Toilets;
- Centrally controlled irrigation systems;
- Targets for oval irrigation. Over the past six years the average consumption has been in the order of 8.1ML, although the past two years it has been lower. As the majority of water use is likely to be oval irrigation for the single oval this indicates the recently set targets of 4.1ML/oval will result in savings

17.6 Potential Water Saving Measures

17.6.1 Improving Irrigation effectiveness

It has been assumed that future irrigation of the main oval will be based on the new target levels of 4.1ML/Oval Reduction below this level may be possible but could affect playability. This will give an estimated use for the reserve of 4.9ML/year based on 0.8ML being used in changing rooms and toilets. This will result in a saving of 3.2ML/annum over the average.

17.6.2 Change to All Warm Season Grasses

Changing to all warm season grasses will allow the targets for oval irrigation to be reduced to 0.8ML/ha. Revised targets; Main oval 1.2ML/annum, Secondary Oval 1.1ML/annum

Preliminary cost for conversion of the Ovals to warm season grasses is $44 000 based on a conversion cost of $1.50/m2.

Estimated savings:

- Assuming main oval only irrigated saving will be 2.9ML; and
- If secondary oval irrigated savings will be 1.8ML. If this oval is not irrigated the conversions will improve the playability.

17.6.3 Playing Area Size Reduction

A reduction to the AFL minimum dimension length of 142m for both ovals would reduce the area of irrigation by 0.33ha, a reduction of 11%.

Saving for Oval reduction:

- Existing irrigation targets 0.5ML; and
- Warm season grasses 0.2ML. both ovals

Preliminary costs are $10 000 for main oval and $1 000 for the secondary Oval

17.6.4 Toilets and showers

It is understood that a master plan for redevelopment of the changing facilities is underway. This includes collection of stormwater from the roof for reuse. The volume generated by the roof is unlikely to make a significant impact on the irrigation but could result in savings on toilet fittings

It is recommended that the club rooms plumbing fittings should be include high efficiency shower heads dual flush toilets and automatic cut off taps to be fitted to all toilets wash basins.

17.6.5 Bore

This area of Geelong essentially rests upon basalt of the Newer Volcanics. The volcanics, possibly 20-30m in thickness overlie thin sand and clay of the Moorabool Viaduct Formation that in turn rests upon the Fyansford Formation and in turn the Barrabool Sandstones. Drilling in a similar geological setting at the Geelong Racecourse produced disappointing results with respect to salinity with the bore recording a salinity level greater than 6 000 mg/L TDS. No information is available with respect to Fyansford Formation in this area however it is anticipated, at best, the salinity level may only be marginally lower than that in the volcanics.

Potential: The aquifer systems underlying the park probably have the potential to deliver sufficient quantity for irrigation however without a minimum of a 4:1 shandy ratio of low salinity surface water to groundwater the groundwater is considered unsuitable for irrigation supply.

Bore water is only likely to be suitable if salt tolerant warm season grasses are used. It would then be possible to replace 25% of the potable water used for irrigation.

17.7 Stormwater Reuse

17.7.1 Potential for Stormwater Collection

A major stormwater drainage line passes through the reserve that consists of two 900mm diameter pipes.

The pipes drain an area in excess of 500ha. Assuming an impermeable factor of 0.5 gives an equivalent impermeable area of 250ha a 10mm rain event will result in run off from this area to the drainage system of 25ML. This means that relatively small events will provide run off which is considerably in excess of the total irrigation demand for the whole reserve.

Due to the excellent potential for reuse the development of a reuse scheme has been based on providing irrigation water to both ovals. This means that in dry years that the secondary ovals can be available for use by other sporting clubs whose own ovals may be unplayable

The options for stormwater reuse will be dependant on what other sustainability options are adopted for this site. The reason for this is that storage is a key cost component of any reuse scheme. Typically a storage will need to store at least 50% of the total irrigation demand. This assumes the storage will be full at he commencement of the irrigation period and rainfall events during the irrigation period that will replenish the storage. If a stormwater reuse scheme was based on retaining the existing grasses an enclosed storage would need to be in the order of 4ML capacity. If warm season grasses are adopted the storage volume could be reduced to 1.2ML.

17.7.2 Concept Description

A stormwater reuse system would consist of the following four components:

- A gross pollutant trap to provide removal of solids/rags from the stormwater. A Rocla 370 gross pollutant trap has been selected as these units are used elsewhere by the City of Greater Geelong.
- A collection pumpstation to fill the storage. The pump would typically be a single submersible pump in a wet well with a maximum capacity of 20L/sec. This would be capable of filling the storage from empty in less than 24 hours.
- Storage 1.2ML for an enclosed storage or 2ML for an open storage Options for storage have been separately considered below.
- Irrigation supply pump with filter. This pump would operate independently of the potable water which would be disconnected from the irrigation system

17.7.3 Options for Storage

The probable location for a storage would be the Southern corner of the reserve which is currently underutilised. This is close to the stormwater drainage line minimising the line between the pump and the storage. The wetlands storage volume is larger to allow for evaporation losses. The options and base construction costs (excluding engineering and contingencies) are as follows:

- 2.0ML Open Wetlands wetland average depth 1.0m area of 40m x 50m. Base cost $58 000;
- 1.2ML Earthen basin lined with a floating cover. Basin 4m deep with a roof 25m x 30m. Base Cost $107 000;

- 1.2ML Earthen basin lined with a steel roof. Basin 4m deep with a roof 25m x 30m. Base cost $156 000;
- 1.2ML Steel colourbond tank with membrane liner and domed roof 18.00m dia x 5.31m high. Base Cost $196 000 and
- 1.2ML Underground Storage based on Versitank plastic units in excavation 2.5m deep x 25m x 22m enclosed in waterproof membrane. Base cost $250 000.

Cost of Reuse

No additional landscaping or planting has been included in the following estimate. The basin has been assumed to be lined with clay recovered from the site:

Gross pollutant trap	20 000
Collection Pump Station	25 000
Storage	60 000
Irrigation Pump	15 000
Pipes	10 000
Sub Total	$130 000
Engineering	37 500
Contingencies	37 500
Total	**$205 000**

17.7.4 Summary

The lowest cost alternative for significantly reducing the potable water demand for the Thomson Reserve will be to convert from cool season grasses to warm season grasses. This will also increase the feasibility of using stormwater to supply the remaining irrigation demand on the site.

A review of the cost indicate that the following improvements would generate potable water savings of 1.8-2.9ML per annum, depending on whether irrigation was reinstated to the secondary oval at a cost of $44 000:

Reducing the secondary oval in size would reduces the cost of the grass conversion

The savings on the costs of water would be in the order of $15,000 per ML per annum.

A further 2.3ML of water could be saved by reuse of stormwater at an estimated cost of $205 000. The option of stormwater reuse is not cost effective in terms of cost per ML saved. Stormwater reuse however means that the oval can be irrigated, and thus remains useable, in drought conditions when irrigation from the potable supply is banned.

18. Conclusions

This report has identified issues relevant to improving sportsfields sustainability for all sportsfields.

It has also identified options for improving the sustainability of water use for specific sites in the City of Greater Geelong.

In determining the order in which the options are going to be considered a key factor is the cost per ML (1 000 000L) of water saved. Appendix A provides details of the savings for the various options.

Options that have a cost of less than $20 000/ML saved are described below:

- The most cost effective sustainability strategies are to improve irrigation efficiency are by providing better water budgets, and reducing watering of the initial sections of golf fairways and parkland. These improvements have nominal costs and all the cost savings from reduced potable water use can be achieved. There is likely to be a noticeable colour change in the grass during summer, particularly golf fairways;
- Changing the grasses to warm season varieties is able to provide considerable savings in use. Some of the grasses will have a noticeable colour change during winter when the grasses become dormant;
- Bores can offer some water savings but are dependent on changing the grass varieties to provide better salt tolerance. The bores will have additional power and usage charges that will offset some of the savings from reduced potable water use;
- Recycling swimming pool backwash water for irrigation will provide savings at Kardinia Park. This will also save trade waste charges;
- In the case of Elcho Park there are considerable water savings from taking recycled water from Barwon Prison if the existing cool season grasses are retained. The cost of the recycled water however means the cost saving from reduced potable water use will be only 40% of the value of water saved. If a change to warm season grasses takes place to reduce the overall water consumption this scheme becomes much less cost effective in terms of capital investment; and
- The existing reuse system at Elcho Park can be improved with no impact on the ongoing costs but savings on potable water use.

In the case of Thomson Reserve the option of stormwater reuse is not cost effective in terms of cost per ML saved. Stormwater reuse however means that the oval can be irrigated, and thus remains useable, in drought conditions when irrigation from the potable supply is banned.

Appendix A

Cost of Water Saving Measures

Table A1- Cost Saving

Proposed Method of Saving	Saving ML	Cost x$1000	Cost /ML saved	Comments
Elcho Park				
◗ Irrigation efficiency	10	1	$100	Recommended
◗ Warm Season Grasses	37	285	$7 703	Recommended
◗ Zoning Fairways				
– Existing grass	4	1	$125	
– Warm season Grass	1	1	$500	Recommended
◗ Stormwater improvement	3	20	$6 667	Recommended - Further investigation needed
◗ Bore after other improvements	4	15	$3 750	Recommended - Assumes replacement of 25% of potable
◗ Reuse - Barwon prison				
◗ Existing grass	70	400	$5 714	Further investigation needed
◗ Warm season Grass	13	400	$30 769	Further investigation needed
Total of Recommendations	***55***	***322***	***$5 845***	
Queens Park				
◗ Irrigation efficiency	9	1	$111	Recommended
◗ Warm Season Grasses	35	450	$12 857	Recommended
◗ Zoning Fairways				
– Existing grass	4	1	$125	
– Warm season Grass	1	1	$500	Recommended
◗ Oval reduction				
– Existing grass	1.2	40	$33 333	
– Warm season Grass	0.25	40	$160 000	
◗ Stormwater Club house	1	60	$60 000	Further investigation needed
◗ Bore After other improvements	4	30	$7 500	Recommended - Assumes replacement of 25% of potable
Total of Recommendations	***49***	***482***	***$9 827***	
Kardinia Park				
◗ Warm Season Grasses	8	50	$6 250	Recommended
◗ Oval reduction				
– Existing grass	1.7	60	$35 294	
– Warm season Grass	0.55	60	$109 091	
◗ Bore after other improvements	6	30	$5 000	Recommended - Further investigation needed - Assumes replacement of 25% of potable
◗ Reduce parkland irrigation	9	1	$111	
◗ Stormwater	12	400	$33 333	
◗ Swimming pool Backwash	9	50	$5 556	Recommended further investigation needed
Total of Recommendations	***32***	***131***	***$4 094***	
South Barwon Reserve				
◗ Irrigation efficiency	1.5	1	$667	Recommended Reducing targets on smaller ovals
◗ Warm Season Grasses	16	98	$6 125	Recommended
◗ Oval reduction				
– Existing grass	0.7	45	$64 286	
– Warm season Grass	0.25	45	$180 000	
◗ Bore after other improvements	1	30	$30 000	
Total of Recommendations	***17.5***	***99***	***$5 657***	
Thomson Reserve				
◗ Warm Season Grasses Main Oval	2.9	18	$6 270	Recommended for saving and to improve viability of Stormwater reuse
◗ Warm season grass secondary oval	NA	16.5	NA	Will improve playability if oval remains unirrigated. Will reduces required storage if stormwater reuse implemented
◗ Oval Reduction main oval	0.2	10	$20 000	
◗ Oval Reduction secondary oval	NA	0	NA	If grass conversion this will result in saving
◗ Stormwater reuse	2.3	205	$89 130	Required if ovals required to be irrigated independently of Potable water system
Total of Recommendations	***2.9***	***18***	***$6 207***	
Total of Recommended Options for all Sites	**156.4**	**1 051**	**$6 720**	

GHD Pty Ltd ABN 39 008 488 373

Level 3, 49-51 Malop Street
Geelong, Victoria 3220
T: (03) 5273 1800 F: (03) 5273 1801 E: gexmail@ghd.com.au

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0[1]	B Ashworth	C Lloyd	C.Lloyd*	C Lloyd	C.Lloyd*	12/9/06
1	B Ashworth	C Lloyd		C Lloyd		30/11/06

*Denotes signature on original

[1] Original document 31/19296/1604