River Action Plan

Mounts Bay Main Drain

A report of the inaugural workshop into water quality of the Mounts Bay Main Drain System

Report prepared for Claise Brook Catchment Group
Kathleen Broderick, June 2006

Report contents

Summary of Recommendations

Recommendation 1 Provide funding and in-kind support for a Water Quality Improvement Coordinator for the MBMD and wider system.

Recommendation 2 Provide support to the Town of Cambridge to develop a whole of catchment management plan for Lake Monger.

Recommendation 3 Establish a coordinated monitoring program for the drainage system to determine the nutrient and pollutant content of the various flows.

Recommendation 4 Continue improvements to land and water management practices in the MBMD catchment and better connect management to data.

Recommendation 5 Ensure any future development in the Mounts Bay area adequately addresses water quality and drainage issues concerning both localised run off and infiltration, and water quality output of the Narrows Interchange Lakes and Mounts Bay Main Drain.

Recommendation 6 Identify opportunities to retrofit measures to improve water quality within the Mounts Bay Drain and Narrows Interchange as part of development of the Mounts Bay Foreshore.

Recommendation 7 Investigate a number of options for improving stormwater and groundwater water quality inflowing to the drainage system. In particular:

- **The pollutant contribution of groundwater seepage through landfill into Lake Monger and how this could be treated.**
- **The nutrient contribution of groundwater infiltration at the Hamilton Interchange and how this could be treated.**

The nutrient and pollutant contribution of urban stormwater to the system at Lake Monger and the Hamilton Interchange Lakes and what strategies could be implemented to prevent these sources entering the system.

Recommendation 8 Investigate treatment options to remove pollutants from freeway drainage prior to discharge into river and maximise infiltration.

Recommendation 9 Investigate possibilities for the treatment of MBMD water quality within the system. Some possible locations for in system treatment include:

- **The south eastern corner of Lake Monger**
- **Hamilton Lake 1**
- **Western Lake in the Narrows Interchange**
- **Divert MBMD flows into Western Lake for treatment prior to discharge to the Swan River.**
- **Compensation basins at Stamford Street and City West**

Acknowledgements

This report was prepared by Kathleen Broderick with Sally Lake, Coordinator of the Claise Brook Catchment Group in June, 2006.

Much of the background information was prepared by Sally Lake. Attendees of the Stakeholder workshop (see Appendix 3 for a list of workshop participants) provided input and verified accuracy of the information used in the development of this report.

The Mounts Bay Main Drain is a 'Declared Main Drain' owned and operated by the Water Corporation. This report acknowledges that any proposal for change to the drainage system must be hydraulically satisfactory and be approved by the Water Corporation.

Introduction

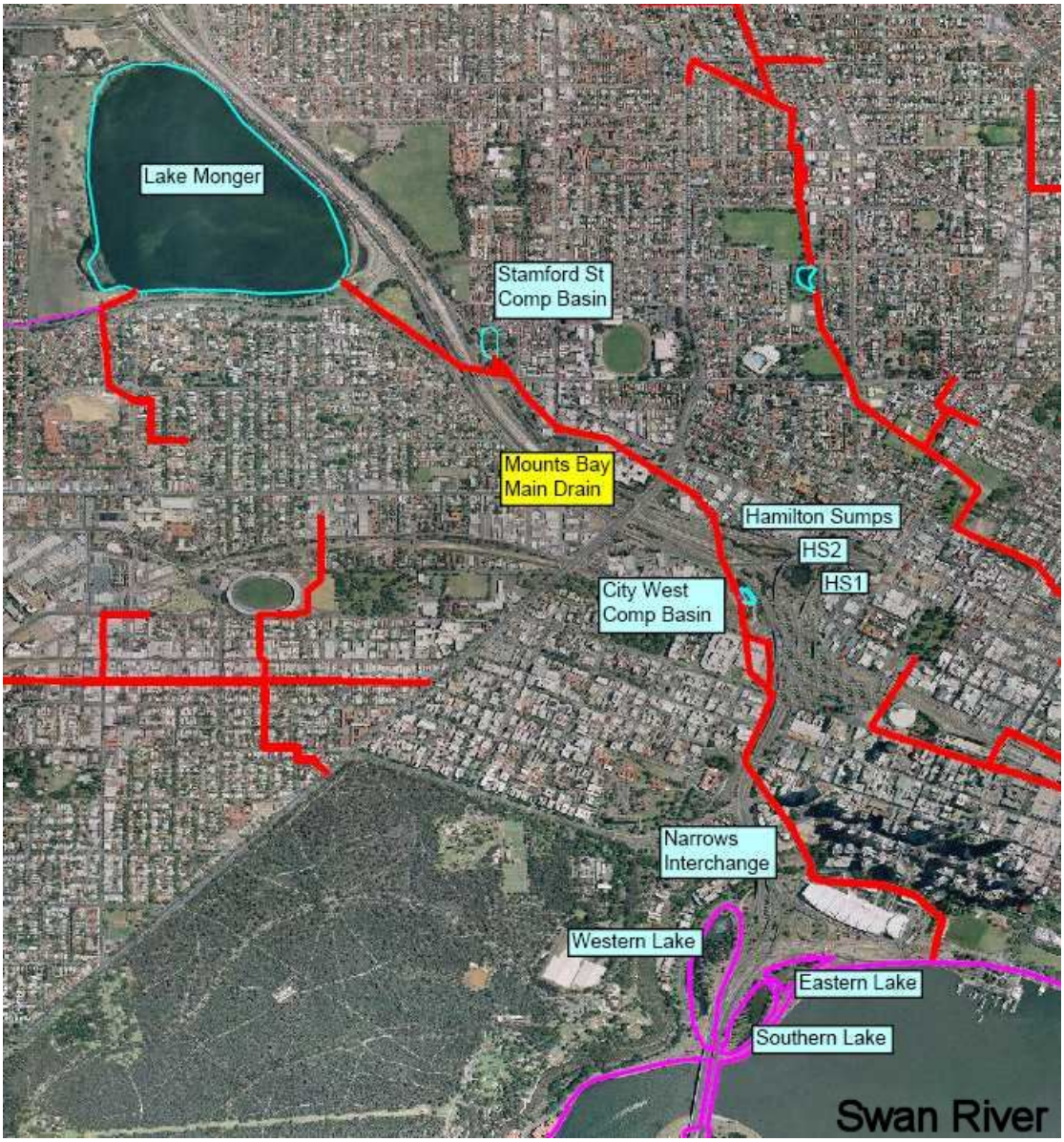
A river action plan identifies the environmental status of a river and issues associated with its use and management. It also identifies areas that require management along a river. In this case, the Mounts Bay Main Drain system (MBMD) provides all the functions of a river: nutrient and pollution transport; habitat; flood control; water source; and other social aesthetic and recreational benefits associated with waterways and water bodies. It is also a tributary of the Swan River. It is currently managed as a drain, although some sites such as Lake Monger and the Narrows Interchange Lakes are managed for passive recreation leading to potential public health problems. To complicate matters, several different Stakeholders and land and asset managers each have partial management responsibilities for the drain.

This report considers the MBMD as an integrated system and seeks to identify areas that could deliver multiple benefits through better coordination and management and by scoping future development opportunities. As part of the process of developing this action plan, the Claise Brook Catchment Group convened a half day Stakeholder workshop on the 4th May 2006 (supported by the City of Perth and the Swan River Trust). The background information prepared for the workshop and the notes generated from the workshop were verified by Stakeholders and this information forms the basis of this report.

Situation statement

The MBMD is part of a drainage system from Lake Monger to the Swan River at Mounts Bay. The water quality is poor and pollutants tend to get trapped in the poorly flushed Mounts Bay in the Swan River. The MBMD is a declared main drain and is owned and operated by the Water Corporation as part of its urban drainage network. Its catchment area includes the Lake Monger catchment, approximately 1300 hectares of urban development, and also includes an area of land west of the city centre.

The area between Lake Monger and the Swan River has been highly modified since 1829. Firstly the wetlands were used for market gardens, then the railway line was built (opened 1880) and Perth's first industries developed along the railway line before drainage and sewerage were extended through the area. More recently the Narrows Bridge was built, followed by the freeway and the Narrows and Hamilton Interchanges which required additional drainage. Most recently the Northbridge tunnel was constructed and the Perth Mandurah railway, which passes through the narrows interchange, is currently under construction. Future development of the river foreshore in the Narrows Interchange area is proposed creating further problems and opportunities for drain managers and developers alike.



The Mounts Bay Drain was constructed in 1909 to connect Lake Monger to the Swan River, allowing water levels in Lake Monger to be regulated. Overflow from Lake Monger, flows via the Mounts Bay Main Drain, discharging into the Swan River at Mounts Bay through an outlet west of Barrack Square. Between Lake Monger and the Swan River, water bodies at Stamford St and Citywest (west of the Hamilton Interchange) act as compensating sumps. These are controlled by the Water Corporation.

Between Lake Monger and the river, there is also a freeway drainage system with water bodies in the Hamilton Interchange and the Narrows Interchange. This system receives some of the water from Lake Monger and discharges into the Swan River via a number of outlets in Mounts Bay and through groundwater exchange. The water within this system is used as a resource to maintain water levels in the ornamental lakes and irrigate the park with the Narrows Interchange. This system includes two lakes within the Hamilton Interchange and three lakes within the Narrows Interchange as well as various drains, pumps and bores. While Main Roads is responsible for

this system, the City of Perth is also involved in some aspects of management of the system.

The lakes in the Narrows Interchange are readily accessible to the public and are surrounded by lawned parkland. Western lake is particularly important for recreation and enjoyment and features the 'Southern Cross Fountain', an ornamental fountain, highly visible from Kings Park lookout and landscaped gardens. The lakes in the Hamilton Interchange and the Stamford Street and City West compensation basins are comparatively inaccessible and yet Hamilton Lake 2 in particular, is surrounded by trees and provides good habitat for birds.

The issues for water management were identified as:

Poor water quality in Lake Monger, MBMD and Mounts Bay contributing to algal blooms and fish kills in the river

- Poor water quality throughout system from Lake Monger, MBMD into Swan River (Mounts Bay)
- nutrients and resulting algal blooms
- Discharge into MBMD is currently the only significant way that nutrients are removed from LM
- Mounts Bay poorly flushed so nutrients and other pollutants remain within bay
- Polluted sediment in Mounts Bay area (heavy metal: copper, lead, mercury and zinc).
- High proportion of nutrients flowing into Lake Monger comes from groundwater flowing through landfill areas.

Poor water quality in the Narrows Interchange, resulting in health concerns

- Western lakes in Narrows Interchange, important recreational and aesthetic area
- Western lake has very poor water quality, related to water sources, particularly the Hamilton Lakes
- resulting health concerns with algae in Western Lake
- water management (quantity and quality): specifically the Narrows Interchange Lakes and the discharge of freeway runoff directly into Mounts Bay.
- Narrows Lake and Hamilton lakes provide habitat but lack of vegetation around edges provides poor habitat and leaves banks subject to erosion.

Ongoing development pressure

- impacts of proposed development, dewatering, risk of developing acid sulphate conditions
- opportunities presented by development of the rail line and station and foreshore development plans for Mounts Bay.

It is anticipated that a combination of better coordination, improved knowledge of the system and improved management will result in many of these issues being addressed. Future developments have the potential to demonstrate best practice in urban water management and to contribute to

the transformation of the MBMD into a healthy extension of the Swan riverine habitat.

Current management

Stakeholders, roles and responsibilities

There are many Stakeholders in the MBMD system. The MBMD is a declared main drain and is owned and operated by the **Water Corporation**. The **Town of Cambridge** manages Lake Monger and controls the outlet weir which allows water to enter the MBMD from Lake Monger. The Hamilton Lakes and Narrows Interchange Lakes and associated pumps and pipes are managed by the **Main Roads Department** with the City of Perth (Main Roads provide water into Western Lake from the Hamilton Lakes and bores and contribute an agreed % of the cost.) **The City of Perth** manages the Narrows Interchange area as parkland for passive recreation and tourism purposes. Water from the Western Lake is used to irrigate the parkland.

The **Claise Brook Catchment Group** is the local catchment group with an interest in this area. They are concerned with water quality and habitat and the better connection of people with their urban ecosystems. The **North Metropolitan Catchment Group** are the sub-regional natural resource management group and are interested in ensuring that the relevant community is involved in resource management issues. They are also the subregional natural resource management group (the Swan Catchment Council is the regional body) and are responsible for acquitting Federal and State funds through the Natural Heritage Trust Program and other programs, to benefit the local environment. Projects managed by NMCG include stormwater quality management and sustainable landscaping.

The **Swan River Trust** is working to reduce nutrient and pollutant inputs to the river and improve water quality as well as foreshore habitat through a number of programs. The **Department of Water** provides technical advice and policy direction for stormwater management.

The **Public Transport Authority** is currently building the infrastructure for the southern suburbs railway which includes the Esplanade train station and train access to the Narrows Bridge. There have been several proposals for development of the Mounts Bay area of the Swan River and the Narrows Interchange lakes. The **Department of Planning and Infrastructure** has responsibility for major development proposals through advice to the **Western Australian Planning Commission.**

Water flows and water quality

All Stakeholders recognised that water quality and quantity are intricately related. There appears to be delineation between those Stakeholders with a responsibility for managing water flows and those primarily concerned with water quality.

The **Water Corporation** is charged with maintaining the MBMD and preventing flooding and generally supportive of community efforts to improve water quality as long as works don't interfere with drainage capacity and appropriate arrangements have been made for ongoing maintenance. Similarly the **Main Roads Department** manages the water that runs off the freeway network and associated infrastructure. They manage the lakes and surrounding areas and are concerned with lake water quality and water levels.

The **Swan River Trust**, **Claise Brook Catchment Group**, **Department of Water** and the **North Metropolitan Catchment Group** are concerned with the environmental benefits of improving water quality. Local governments, the **Town of Cambridge** and the **City of Perth**, are also concerned with water quality and quantity, to prevent flooding and maintain environmental and recreational amenity and ensure public safety in the lakes in their jurisdiction.

The Vision

During the workshop, all Stakeholders were asked to articulate their vision for the MBMD and associated Hamilton and Narrows Interchange Lakes system. Though different Stakeholders have responsibility for different parts of the system there are many shared elements in their visions. All Stakeholders were concerned with water quality and recognise the need to make some improvements to the system to improve the water quality in the lakes and entering the Swan River.

Stakeholder	**Vision**
Claise Brook Catchment Group	Improved water quality and habitat for people's health and enjoyment and for wildlife.
Swan River Trust	Looking for opportunities to improve water quality and habitat along the Swan River.
Water Corporation	To deliver a main drainage service in accordance with its Operating Licence and Environmental Policy. Also to develop strategies and investigate best management practices in dealing with water quality in drains.
Main Roads	Improve water quality in the lakes and implement landscaping that requires less water while acknowledging original landscape design and heritage status.
City of Perth	Change edges of the lakes – landscape design, use natives, implement best practice in the managed areas (irrigation, soil management etc...), replace fountains ($350k) – investigate filtering systems, better aeration.
Town of Cambridge	Address water quality issues in Lake Monger
Department of Planning and Infrastructure	Look for opportunities in the redevelopment of Mounts Bay foreshore area, and Narrows Int. to improve system while creating a vibrant community with improved connections between the city and river.
Department of Water	Develop advice and in-kind support for implementation of best practice in the management of stormwater quality.
North Metropolitan Catchment Group	Catchments managed for water quality and habitat.

Planned improvements and development ideas

This section outlines some works either underway or proposed by various authorities and may benefit from coordination.

Planned change	Who?	When?
The Southern Cross Fountain in the Western Lake Narrows Interchange will be replaced.	City of Perth in consultation with Main Roads.	On hold pending development proposal for the area.
Work on lake (HI and NI) water quality. Current biological treatment of Western Lake by Environmental Products Australia to improve water quality and reduce conditions leading to algal blooms. Consider sub surface flow wetlands as proposed in the 2001 management and development plan.	Department of Main Roads as part of 2001 Management Plan.	Current.
Narrows duplication, rail project.	Public Transport Authority	2006
Updated management plan for Lake Monger to address water quality issues at the lake.	Town of Cambridge	Current.
Mounts Bay Foreshore Development Plans.	Department of Planning and Infrastructure	Under development
Iconic urban water management project involving Narrows Interchange Lakes, Mounts Bay Main Drain and Lake Monger.	Coordinated group of Stakeholders	Proposed at the MBMD Stakeholder Workshop

Next steps

Coordination

Achieving improved water quality in this system, which is a vision shared by all workshop participants, will require the coordinated efforts of all Stakeholders and possibly other parties. The MBMD and associated Freeway Lakes drainage system does not require coordination in the traditional

catchment management sense. It is already managed by Water Corporation and Department of Main Roads. However, theirs is only partial management responsibility. It is apparent that water quality is intricately related to water quantity or flows and the various parts of the system are interconnected, therefore all Stakeholders will have a role in achieving improvements in water quality. Communication and planning between the Stakeholder groups will benefit from dedicated resources in the form of a coordinator's time, communication and workshop resources and access to professional advice as necessary. The Claise Brook Catchment Group is able to take on this coordination if adequately resourced. Demonstrable improvements in water quality will most likely be achieved by improved coordination of Stakeholders.

Recommendation 1 Provide funding and in-kind support for a Water Quality Improvement Coordinator for the MBMD and wider system.

Recommendation 2 Provide support to the Town of Cambridge to develop a whole of catchment management plan for Lake Monger.

Maintenance

While it is recognised by all Stakeholders that the drainage system was not designed to manage water quality, it is possible to make improvement in management practices that will likely result in water quality improvements. Work is currently being done to improve community awareness of water quality in the catchments and to improve land management in the Narrows Interchange lake areas and water quality in Lake Monger. This work must be better connected to water quality and flow data to determine what impact changes are currently achieving and what results are likely to be achieved from further improvements. Some continued improvements in water quality are likely to be achieved by the City of Perth in the management of the Narrows Interchange Lakes and surrounding parklands, the timing and quantity of flows released from Lake Monger through the management of the weir system into the MBMD (and catchment management in Lake Monger see recommendation 2), and the timing and use of the Hamilton Interchange Lakes system as a top up for the Western Lake in the NI.

Recommendation 3 Establish a coordinated monitoring program for the drainage system to determine the nutrient and pollutant content of the various flows.

Recommendation 4 Continue improvements to land and water management practices in the MBMD catchment and better connect management to data.

Development

The Mounts Bay area is in a great location for future development as the plans presented by the DPI at the MBMD Stakeholder Workshop attest. There is a strong desire to improve connections between the city and the Swan River, and the Mounts Bay foreshore, located between the city, the Swan River and Kings Park is ideally located to achieve an improved

connection between the city and the river. However any development of the Mounts Bay foreshore will be adversely affected by the current poor water quality in the Narrows Interchange Lakes and in the Mounts Bay area of the Swan River.
There are many possibilities for improvements in the system further up the catchment around and above Lake Monger, in the Hamilton interchange Lakes or in the Narrows Interchange and Mounts Bay area (see issues that require further investigation below).

Recommendation 5 Ensure any future development in the Mounts Bay area adequately addresses water quality and drainage issues concerning both localised run off and infiltration, and water quality output of the Narrows Interchange Lakes and Mounts Bay Main Drain.

Recommendation 6 Identify opportunities to retrofit measures to improve water quality within the Mounts Bay Drain and Narrows Interchange as part of development of the Mounts Bay Foreshore.

Issues that require further investigation

There have been many recent improvements in the management of urban stormwater quality that may be applied to the Mounts Bay Main Drain system. Examples include treating stormwater in specially designed nutrient stripping systems and intercepting pollutants before they reach the main drainage system using specially designed traps. There are many opportunities for better management of stormwater in the MBMD system. Each of these require further investigation to ensure that a) they are likely to result in improved water quality in the system and b) they will not adversely affect the flood protection qualities of the drainage system. It is desirable to pursue options that are likely to have no adverse effects on flooding and that achieve maximum water quality improvement on the investment.

Recommendation 7 Investigate a number of options for improving stormwater and groundwater water quality inflowing to the drainage system. In particular:

- **The pollutant contribution of groundwater seepage through landfill into Lake Monger and how this could be treated.**
- **The nutrient contribution of groundwater infiltration at the Hamilton Interchange and how this could be treated.**
- **The nutrient and pollutant contribution of urban stormwater to the system at Lake Monger and the Hamilton Interchange Lakes and what strategies could be implemented to prevent these sources entering the system.**

Freeway drainage

Runoff from the Narrows Interchange currently flows directly into Mounts Bay via four outlets. With the development of the area, opportunities to reduce the pollutant load on the river should be identified and implemented.

Recommendation 8 Investigate treatment options to remove pollutants from freeway drainage prior to discharge into river and maximise infiltration.

Recommendation 9 Investigate possibilities for the treatment of MBMD water quality within the system. Some possible locations for in system treatment include:

- **The south eastern corner of Lake Monger**
- **Hamilton Lake 1**
- **Western Lake in the Narrows Interchange**
- **Divert MBMD flows into Western Lake for treatment prior to discharge to the Swan River.**
- **Compensation basins at Stamford Street and City West**

Appendix 1 Background Information

This information was prepared by Sally Lake prior to the Stakeholder Workshop.

Description

The Mounts Bay Drain was constructed in 1909 to connect Lake Monger to the Swan River, allowing water levels in Lake Monger to be regulated. Overflow from Lake Monger, flows via the Mounts Bay Main Drain, discharging into the Swan River at Mounts Bay through an outlet west of Barrack Square. Between Lake Monger and the Swan River, water bodies at Stamford St and Citywest (west of the Hamilton Interchange) act as compensating sumps. These are controlled by the Water Corporation.

Between Lake Monger and the river, there is also a freeway drainage system with water bodies in the Hamilton Interchange and the Narrows Interchange. This system receives some of the water from Lake Monger and discharges into the Swan River via a number of outlets in Mounts Bay and through groundwater exchange. The water within this system is used as a resource to maintain water levels in the ornamental lakes and irrigate the park with the Narrows Interchange. This system includes two lakes within the Hamilton Interchange and three lakes within the Narrows Interchange as well as various drains, pumps and bores. While Main Roads is responsible for this system, the City of Perth is also involved in some aspects of management of the system.

Significant changes are occurring in this area including the construction of the Perth to Mandurah Railway, proposed development of the river foreshore between Barrack Square and the Narrows Bridge and the relocation of the Main Sewer and Stormwater Drain in Leederville. Construction of the tunnel for the Graham Farmer Freeway has already impacted on the lakes in the Hamilton Interchange which were used as settling ponds for dewatering during construction.

The major developments within the area may provide opportunities to improve water quality within this catchment. The intention of the workshop is to bring together all significant Stakeholders to identify opportunities for improvement, assess the relative benefits, identify any difficulties to implementation and prioritise possible works.

Summary of Sites

Name	Also known as	Responsible Authority	Description	Water Quality	Comments
Lake Monger		Town of Cambridge	71 Hectare lake with surface and groundwater inflows.	Water quality degraded by urban development, landfill etc.	Seasonal flushing of the lake into the Mounts Bay Main Drain important to flush nutrients out of the lake.
Mounts Bay Main Drain	Spring St Main Drain	Water Corporation	Connects Lake Monger to the Swan River.	Water quality poor. Does not meet *Riverplan* Targets	
Stamford St compensating sump	Egg Swamp; Leederville Comp Basin	Water Corporation	Compensating basin on Main Drain. Also receives groundwater inflow.	Probably better water quality than Hamilton Basins	Space available to reconfigure and establish sedge zones to improve nutrient stripping.
Diversion chamber, Hamilton Interchange		Water Corporation	Diverts stormwater from Lake Monger between Mounts Bay Main Drain and Hamilton Sump 2		
City West compensating basin	Hamilton Sump 3. Parry comp basin	Water Corporation	Push/Pull Sump on Mounts Bay Main Drain below Diversion Chamber. Not directly connected to Hamilton Sumps 1 & 2.		Smallish sump. Steep sided. Some space available but may be road reserve and therefore required for future purposes.
Mounts Bay Main Drain outlet	Spring St Main Drain outlet	Water Corporation	Outlet into Swan River, into Mounts Bay, west of Barrack Square.	Location means pollutants are released into poorly flushed bay.	Consider moving outlet closer to Narrows Bridge for better flushing.

Name	Also known as	Responsible Authority	Description	Water Quality	Comments
Mounts Bay		Swan River Trust	Bay between Barrack Square and Narrows Bridge. Sheltered from wind and tides so poorly flushed	Elevated heavy metals in sediment; risk of eutrophication; contact recreation not recommended.	Any works should avoid reducing water circulation such as through the construction of embayments. Avoid disturbing sediment such as through dredging.
Hamilton Sump 2 (HS2)	Bunning Lake	Main Roads	Receives water from Lake Monger via MBD and local drains. Water flows to Hamilton Sump 1. Long, narrow, deep, well-shaded.	Poor. Large litter (plastic bottles)	Well planted around though much weedy vegetation. Many waterbirds including young.
Hamilton Sump 1 (HS1)	Bunning Lake	Main Roads	Receives water from local drains and HS2. Water pumped from here to Western Lake in the Narrows Interchange. Circular, deep, trees around perimeter.	Poor. Large litter (plastic bottles)	Is an important contributing factor in the poor water quality in the Narrows Interchange western lake in summer.

Name	Also known as	Responsible Authority	Description	Water Quality	Comments
Western Lake – Narrows Interchange		Main Roads (City of Perth also involved in management) Swan River Trust?	Shallow, long, narrow lake. Receives water from Lake Monger (via HS2&1), groundwater inflow and bores. Well planted around edges, variety of vegetation (native and exotic).	Very poor, especially in summer. Algal blooms, health concerns from toxic aerosols spread by fountain.	Ornamental lake containing Southern Cross Fountain. Water levels maintained for aesthetic and irrigation purposes.
Southern Lake – Narrows Interchange		Main Roads (City of Perth also involved in management) Swan River Trust?	Receives excess water from Western Lake and topped up from Western Lake to maintain level. Discharges into Swan River via weir.	Poor water quality and high salinity.	Possible that weir lets river water into lake (hence salinity)
Eastern Lake		Main Roads (City of Perth also involved in management) Swan River Trust?	Groundwater inflow. Very little planted around edges. Currently (April 2006) receiving water from nearby construction site.	According to reports saline.	Not used for irrigation or connected to Western and Southern. Possible river inflow through ground, hence salinity.

Appendix 2 References

Annotated references prepared by Sally Lake from a list provided by DPI.

Narrows Interchange and River foreshore

1. Perth Foreshore Redevelopment: Preliminary Environmental Study - Barrack Street to Kwinana Freeway
   City of Perth (by Maunsell Australia), February 2004
   - Study the environmental issues facing the area and the potential opportunities for providing a net environmental gain from the development.
   - Amongst other environmental issues, the study sets out the issues related to water quality in Mounts Bay and the contribution of the main drain to these problems.

2. Narrows interchange Irrigation System & Southern Cross Fountain - Management and Development Plan
   Main Roads WA (by GHD), Dec 2001
   - General information on water quality management of the area and background information of the existing installation (such as pumps etc).

3. Landscape Improvements at the Narrows Interchange - Master Plan Review
   Main Roads WA, April 2004 (?)
   - Review of the late 1960s John Oldham Master Plan on landscaping the Narrows Interchange.
   - Articulation of issues related to the landscape and lakes of the interchange.
   - Proposals for a landscape masterplan for the interchange.

4. Bringing Back the Swans:
   The potential to encourage more black swans onto the Swan River
   Water and Rivers Commission (by ATA Environmental & others), September 2000
   - Investigates the feasibility of encouraging greater numbers of Black Swans on the Swan River system, by establishing permanent nesting and feeding sites, or creating a series of roosting precincts for Black Swans along the River.
   - Sets parameters that would be required of Mounts Bay and the adjacent lakes were to be made attractive to and supportive of swans and other large aquatic birds.

5. Place Database of Heritage Council of WA: Narrows Interchange Park
   Heritage Council of WA, March 2003

- Lists a brief assessment of the historical significance and aesthetic, social and scientific values of the Narrows Interchange parklands.

6. Landscape Strategy (DRAFT)
Commissioned by the City of Perth, Dec 1995
   - Tree planting and landscape strategy for Perth
   - References to Mounts Bay Road and the Narrows Interchange area (p29).

7. Register of Heritage Places - Permanent Entry: Esplanade Reserve
Heritage Council of WA, October 2003
   - Lists the historical significance and aesthetic, social and scientific values of the Esplanade Reserve
   - This is the open space over the last section of the drain. This document sets out some heritage constraints for this park area.

Hamilton Interchange Lakes and Leederville Basin

8. Fauna Use and Water Quality Measures in Six Compensation Basins
Prepared for Main Roads by Eddy Cannella September 1997
   - Comparison of six comp basins including the Leederville Basin (Egg Swamp)

Lake Monger

9. Water and Nutrient Balance Model of Lake
Commissioned by the Town of Cambridge, June 2002
   - Weir lowered annually to flush nutrients out of the lake into the Mounts Bay Drain
   - Groundwater discharge from landfill areas greatest source of P and N.
   - Reports recommends further investigation of interception of groundwater (say by a trench) and dispose directly to Mounts Bay Drain

10. Lake Monger Groundwater Study Parts 1 & 2
Commissioned by the Town of Cambridge, 1998
   - Summarise

11. Lake Monger Rehabilitation Plan – East and Southeast Areas
Commissioned by the Town of Cambridge, March 1995
   - Plan for restoring faunal and flora habitats and improving water quality entering the eastern and south-eastern sides of the lake

12. Lake Monger Management Plan. Part II - Plan for Management 1993-1998 *Commissioned by the City of Perth, November 1992*
   - Management recommendations

13. Lake Monger Management Plan. Part I - Background
Commissioned by the City of Perth, November 1992
- Background including History, Natural History (Hydrology, Fauna, Vegetation, Algae), Current Situation (Tenure, Use, Management, Value, Major Impacts), Implications.

14. Lake Monger – A social History Marlene Anderson [sic]
Wembley Primary School website
members.iinet.net.au/~wem/history.html
- Refers to the former tip "Reclaiming" the swampy edges of Lake Monger.
- Mentions types of materials deposited at tip.
- Lake Monger Community Group (formed 1991) led to the Lake Monger Management Plan 1993-1998.

Other reports not held by the CBCG

15. Waterways Report: Swan River Flooding - Perth Area
Main Roads WA, January 2004
- Recommends design flood levels for the 100 year and 500 year ARI events (1% and 0.2% probability of exceedence) of the Swan River at Barrack Square and Kwinana Freeway.
- Data of flood levels and hydrology in the area

Appendix 3 List of Workshop Participants

City of Perth (COP)
Lisa Cooke: Environment Officer
Brian Wall: Manager, Parks and Landscape Services
Vic Roberts: Parks and Landscape Services (Reticulation)
Eric Franco: Parks and Landscape Services
Chris Round: Parks and Landscape Services
Ivan Vasev: Engineering

Claise Brook Catchment Group (CBCG)
Warren McGrath: Char
Sally Lake: Coordinator (SL)
Chris Hair: Member (also at DPI)

Department for Planning and Infrastructure (DPI)
Glen Finn
Catherine McDonald
Chris Hair (also CBCG member)

Department of Environment (DoE)
Emma Molloy: Environmental Officer

Department of Water (DoW)
Peter Kata: Snr Engineer

Main Roads (MR)
Mark Hamblin: Asset Manager South - outgoing
Forbes Watson: Asset Manager South - incoming
Peter Swanson: Environmental Officer

North Metro Catchment Group (NMCG)
Marion Cahill: Coordinator
Debbie Besch: Stormwater Coordinator
Nicole Roach: Water Projects Coordinator

Swan River Trust (SRT)
Rachel Spencer

Town of Cambridge (ToC)
Ross Bowman

Water Corporation (WC)
Scott Davie

Facilitator
Kathleen Broderick