The Southern River
Integrated Land and Water Management Plan

A Process Evaluation

Beckwith Environmental Planning Pty Ltd

Prepared for

Department of Water
Government of Western Australia

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Sincerely,

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Limitations

Beckwith Environmental Planning Pty Ltd has prepared this report for the use of the Department of Water in accordance with the usual care and thoroughness of the consulting profession. It is based on generally accepted practices and standards at the time it was prepared. The methodology adopted and sources of information used by Beckwith Environmental Planning Pty Ltd are outlined in this report.

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Acronyms

ADS	Arterial Drainage Scheme
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CALM	Department of Conservation and Land Management
DPI	Department for Planning and Infrastructure
DEC	Department of Environment and Conservation
DoE	Department of Environment
DPC	Department of Premier and Cabinet
DoW	Department of Water
DSP	District Structure Plan
DWMS	District Water Management Strategy
EPA	Environmental Protection Authority
EPP	Environmental Protection Policy
ILWMP	Integrated Land and Water Management Plan
MOU	Memorandum of Understanding
POS	Public open space
SCC	Swan Catchment Council
SCP	Swan Coastal Plain
SRT	Swan River Trust
TWG	Technical Working Group
UDI	Urban Drainage Initiative
UWMS Urban	Water Management Strategy
UWMP Urban	Water Management Plan
WRMS Water	Resources Management Strategy
WSUD	Water Sensitive Urban Design
WRC	Water and Rivers Commission
WAPC	Western Australian Planning Commission

Executive Summary

The Southern River Interim Integrated Land and Water Management Plan (ILWMP) is one of Western Australia's first attempts to integrate drainage water management planning and urban land development. Located in the South-East Land Corridor, the Southern River, Forrestdale, Wungong and Brookdale area is in transition from rural to urban, but is constrained by water resource issues including a high water table, wetlands, and a legacy of nutrient enrichment due to agricultural activities.

The Department of Water (DoW) retained Beckwith Environmental Planning Pty Ltd to evaluate the process used in preparing the ILWMP and identify lessons and recommendations for future urban developments in water sensitive areas on the Swan Coastal Plain.

Participants in the plan's preparation believe the ILWMP was a successful project and a step towards better integration of land use and drainage management. The process brought together most of the key land and water interests and allowed them to work in a more collaborative manner than they had in the past. Despite not having binding legal effect, the project's Memorandum of Understanding had strong symbolic value and facilitated cooperation amongst the various interests.

During preparation of the ILWMP, a guidance document was published to assist developers in the study area to understand the relationship between the land development and water resource management planning processes. The *Interim approach for integrating urban water management with land use planning in Southern River: Guidance for developers* outlined a land and water planning hierarchy defining the relationship between different scales of land development and water resource planning (Essential Environment Services 2006).

Unfortunately, preparation of the ILWMP was not consistent with the land and water planning framework. The water resource planning was unable to keep pace with the land development process. As a result, some subdivisions were built in the study area before the ILWMP was ready. This highlighted one of the key lessons from the evaluation of the Southern River Interim ILWMP - the need to provide adequate time in the water planning process for the collection of baseline water data and the development of water models.

Other lessons from the process evaluation of the ILWMP included:

- All of the key interests involved in preparing and implementing the plan should be part of the decision making process.
- There needs to be effective communication and reporting mechanisms between the Steering Committee and the Technical Working Group.
- The two-three years needed to collect baseline data and to build and calibrate local water models should be explicitly accounted for in the planning timeline.
- Preferred data collection and analysis protocols should be identified in guidance documents provided to all parties with monitoring responsibilities.
- A central data storage system should be established using consistent forms of data documentation.
- The costs and benefits of various water sensitive urban design mechanisms in WA contexts should be evaluated.
- Application of the ambitious drinking water consumption targets applied in the ILWMP should only be applied in cases where there is a real prospect of an alternative source of water supply to meet non-potable water demand.
- The integrated land and water plan for an area should demonstrate how its contaminant reduction targets contribute to meeting the water management objectives and targets of the larger water system (e.g. the catchment).

- Plans should include a strategy for securing land for stormwater management and guidance regarding long-term management responsibilities.
- Land developers would benefit from clearer guidance on the expectations of and acceptable approaches to developing Urban Water Management Plans.

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1 Introduction

1.1 Background

The Perth metropolitan area is one of Australia's fastest growing urban populations. Unfortunately, the majority of easily developed land on the Swan Coastal Plain has already been urbanised (e.g. residential, commercial uses). Many of the areas currently targeted for new urban development are constrained by water resource issues (e.g. high water tables, nutrient problems).

Land use planning and water resource management have traditionally functioned as separate disciplines. Especially in areas where water resource issues are significant constraints on urban development and/or where water resource values are threatened by new land development, insufficient cross-disciplinary efforts can result in poor outcomes from both a land development and a water resource management perspective.

This situation is changing. Over the past five years, key State land and water planning agencies have taken measures to better integrate land development and water resource management. This includes, State Planning Policy 2.9: Water Resources (WAPC 2006), the draft Liveable Neighbourhoods policy (WAPC 2004), the Stormwater Management Manual for Western Australia (DoW 2007) and the Better Urban Water Management[1] framework (Essential Environmental Services 2007).

Located in the South-East Land Corridor, the Southern River, Forrestdale, Wungong and Brookdale area is in transition from rural to urban, but is constrained by water resource issues such as a high water table, wetlands, and a legacy of nutrient enrichment due to agricultural activities. The Southern River Interim Integrated Land and Water Management Plan (ILWMP) is one of the first attempts to integrate drainage water management planning and urban land development (Water Corporation 2007). The plan includes the adoption of water sensitive urban design principles.

The Department of Water (DoW) retained Beckwith Environmental Planning Pty Ltd to document and evaluate the process used in preparing the ILWMP. The project provides a number of lessons for the integration of land and water management planning for future urban developments in water sensitive areas on the Swan Coastal Plain.

1.2 Study area

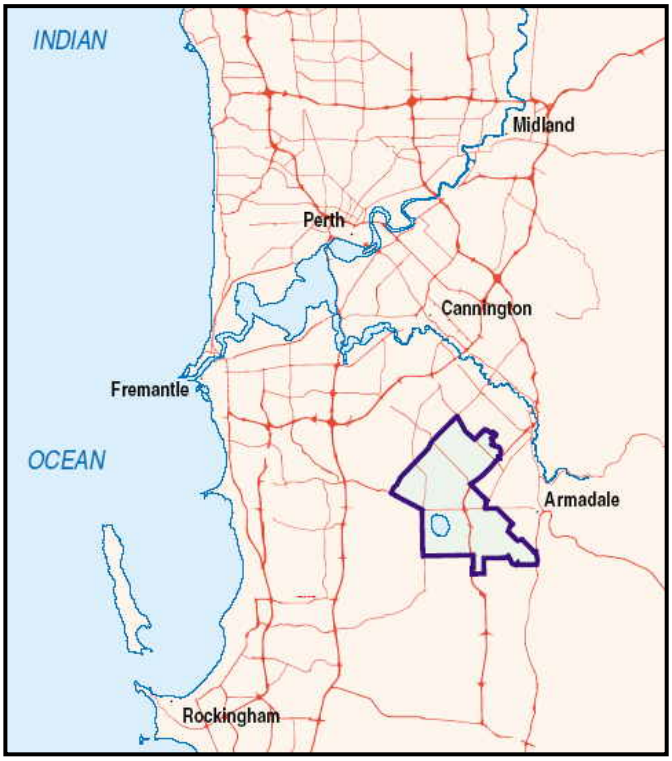
The ILWMP study area is 20 km southeast of Perth (Map 1) and is approximately 7,000 ha in size. It includes the Southern River in the City of Gosnells and Forrestdale, Wungong and Brookdale in the City of Armadale.

Over the past 15 years, the study area has experienced increasing development pressures (WAPC 2001). Already, several new residential subdivisions have been built in the northern portion. It is expected that development will continue to expand in the north. In the south east, residential development is planned but the western portion is expected to largely remain as rural land uses (e.g. grazing).

[1] The framework is a joint effort by the DPI, the DoW, the Western Australian Local Government Association and the Department of Environment, Water, Heritage and the Arts.

The major waterway is the Southern River that runs along the eastern boundary of the study area. It starts at the confluence of the Wungong Brook and Neerigen Brook and discharges into the Canning River.

The study area has a high water table, with large areas classified as seasonally waterlogged (WAPC 2001). This includes several significant wetlands such as Forrestdale Lake and Balannup Lake. Both water features are conservation category wetlands and are listed under the Environmental Protection (Swan Coastal Plain Lakes) Policy[2] (EPA 1992). In addition, Forrestdale Lake is listed on the Ramsar Convention on Wetlands of International Importance.



1.3 Planning timeline

While the interim ILWMP was released in mid-2007, the project has a long history (Table 1).

Table 1 Publication of key documents

Date	Document
1999	Draft Southern River/Forrestdale/Brookdale/Wungong District Structure Plan (WAPC 1999)
2001	Southern River/Forrestdale/Brookdale/Wungong District Structure Plan (WAPC 1999)
2002	Urban Water Management Strategy (JDA 2002)
2003	Southern River/Forrestdale/Brookdale/Wungong Memorandum of Understanding
2007	Southern River Interim Integrated Land and Water Management Plan (Water Corporation 2007)

1.3.1 District Structure Plan

In 1999, in response to growing development pressures, the Western Australian Planning Commission (WAPC) released the Draft Southern River/Forrestdale/Brookdale/Wungong District Structure Plan (DSP). The DSP provided guidance for future land development in the study area, including indicative development areas, road networks, community facilities, conservation areas and neighbourhood structures.

The Environmental Protection Authority (EPA) provided informal advice to the WAPC on the DSP. The EPA recommended that the WAPC not proceed with implementation until the agency had "… demonstrated that the key environmental issues relating to nutrients and hydrology can be adequately managed" (EPA 2000, pg 17). These issues included:

- Ensuring the objectives and targets for the Swan-Canning system could be met once the proposed land use changes occur,

[2] The EPP aims to protect the environmental values of lakes on the Swan Coastal Plain. It was gazetted in 1992, along with a plan identifying the lakes to be protected. The EPP makes it an offence to fill, drain, excavate, pollute or clear the protected lakes, unless authorised by the EPA.

- Avoiding adverse impacts on wetlands, watercourses and the Swan-Canning system due to changes in hydrology, as a result of the proposed land use changes,
- Completion of a drainage, nutrient and hydrological strategy and creation of an implementation mechanism, and
- Finalisation of Bushplan site boundaries.

1.3.2 Urban Water Management Strategy

In 2001, the DSP was finalised on the understanding that an Urban Water Management Strategy (UWMS) would be prepared to address the EPA's concerns prior to implementation of the DSP. The UWMS, released in 2002, focused on regional stormwater management issues, including flood management and the protection of water resources (JDA 2002). It also analysed the potential for application of water sensitive urban design mechanisms (e.g. swales).

1.3.3 Memorandum of Understanding

Following review of the UWMS, the EPA recommended a staged approach to land development in the DSP area to allow for adaptive management. The EPA also requested that a Memorandum of Understanding (MOU) be prepared to facilitate implementation of the UWMS. The MOU, prepared in 2003, was signed by the EPA, Water and Rivers Commission[3] (now the Department of Water), WAPC, City of Armadale, City of Gosnells, Water Corporation, and Armadale Redevelopment Authority.

Box 1. MOU Objectives:

- Facilitate the orderly implementation of the Urban Water Management Strategy (UWMS)
- Encourage environmentally responsible development which meets the intent and recommendations of the UWMS by specifically addressing issues of water quality management and wetland protection
- Provide clarity regarding the relationship between the key agencies involved with the implementation of the UWMS
- Encourage all parties to work in a cooperative manner towards achieving the intent and recommendations of the UWMS
- Facilitate water quality monitoring and review in the UWMS area and progressively implement adaptive management response to the monitored outcomes
- Facilitate the preparation of an Integrated Land and Water Management Plan (i.e. a water cycle plan).

1.3.4 Integrated Land and Water Management Plan

Under the MOU, the EPA requested that a water cycle plan[4] be prepared. The Water Corporation managed preparation of the water cycle plan. The draft Southern River Interim Integrated Land and Water Management Plan (ILWMP) was released in mid-2007 and submitted to the EPA in October 2007.

The ILWMP identifies water management requirements for the study area. This includes targets and design objectives for surface and ground water quality and quantity, targets for conservation of potable water, and strategies for managing potential impacts from land use changes. It also provides an implementation plan (e.g. monitoring) with a summary of roles and responsibilities for key agencies.

[3] At the time, the Water and Rivers Commission was supported by the Department of Environment.
[4] Total water cycle planning includes water conservation, water management during storm events, water quality, and monitoring.

1.3.5 Steering Committee

A Steering Committee was established following preparation of the MOU. Members included MOU signatories as well as representatives from the Swan River Trust, Swan Catchment Council and CSIRO. The Committee oversaw preparation of the ILWMP.

Mid-way through preparation of the ILWMP, the Steering Committee established a Technical Working Group (TWG). The TWG was given two roles - development of the Forrestdale Main Drain Arterial Drainage Scheme (ADS) and review of urban water management plans (UWMPs).

1.4 Integration of land and water management

1.4.1 Scales of land and water resource planning

Table 2 displays the relationship between various scales of land planning and water resource planning. The ILWMP does not fit neatly into any one box but contains aspects of both a Regional Water Management Strategy and a District Water Management Strategy.

Table 2 Land use and water management planning

Scale	Land planning	Responsible party	Water resource planning	Responsible party
Region	Region Scheme Regional Structure Plan	WAPC/ DPI	Regional Water Management Strategy plus a chapter in the Region Scheme or Regional Plan	DoW
District	District Structure Plan Local Planning Strategy	WAPC/ DPI	District Water Management Strategy	DoW
Local	Town Planning Scheme	LGA	Not applicable (N/A)	N/A
	Local Structure Plan	LGA	Local Water Management Strategy	LGA
Subdivision	Subdivision application	Developer	Urban Water Management Plan	Developer

A guidance document was published in 2006 to assist developers in the study area to understand the relationship between the land development and water resource management planning processes. The *Interim approach for integrating urban water management with land use planning in Southern River: Guidance for developers* (*SR guidance for developers*) outlines an integrated land and water planning framework (Essential Environmental Services 2006).

1.4.2 Wungong District Water Management Strategy

The Wungong District Water Management Strategy (DWMS) is the first DWMS completed within the study area. It was prepared as part of the Wungong Urban Water Master Plan[5] and was guided by the strategic direction set in the ILWMP (e.g. targets). The document provides guidance for managing water in the Wungong area. The Armadale Redevelopment Authority, the agency responsible for development and planning in the Wungong area, established the Wungong Urban Water Steering Committee to prepare the Master Plan.

1.4.3 Urban water management plans

The WAPC is responsible for approving subdivision applications. As part of the approval process, the WAPC has the power to place conditions on a subdivision application, including preparation of an urban water management plan (UWMP). Once the WAPC is satisfied all conditions are met, subdivision development can proceed.

[5] The Wungong Urban Water Master Plan was prepared to guide development in the Wungong area.

If an UWMP is required, the developer is responsible for its preparation. The plans are to be consistent with the larger scale water plans and the *SR guidance for developers*. The plan should include surface and ground water conditions and water management strategies for the site. Once completed, the UWMP is reviewed by the appropriate approval agencies. For the ILWMP study area, the TWG serves as the review body.

2 Methodology

2.1 Evaluation framework

A framework (Table 3) was developed to guide the evaluation of the ILWMP process. The criteria were drawn from the MOU objectives (Box 1), the Stormwater Management Manual for Western Australia (DoW 2007)[6] and the decision and negotiation literature.

Table 3 Evaluation framework

Criteria	Principles	Source
Effectiveness	Clearly defined roles and responsibilities provide forms of accountability.	MOU
	Addressing water resource issues early in land development planning provides greater opportunity to meet water resource management objectives.	Stormwater Manual
	Effective leadership includes the ability to manage group dynamics and a diversity of interests.	Wondolleck and Yaffee (2000)
Efficient	Coordinated approaches to stormwater management reduce inefficiencies.	Stormwater Manual
	External factors beyond the control of participants can significantly influence (positively or negatively) planning outcomes.	Wondolleck and Yaffee (2000)
Trust	Where positive long term relationships are necessary to achieve outcomes, participants should improve or at least not damage relationships.	Fisher, Ury and Patton (1991)
	By seeking to meet each others' interests, barriers to negotiated solutions are reduced.	Fisher, Ury and Patton (1991)
Fairness	Participants who view a decision process as fair are typically more satisfied with the process outcomes.	Lind and Tyler (1988)
	Where there is disagreement on an issue, agreement on objective decision criteria can be beneficial.	Fisher, Ury and Patton (1991)
	Where there are different interests, each interest should be represented in the decision making process.	Wondolleck and Yaffee (2000)

2.2 Interviews

In-depth interviews were conducted with key participants involved in preparing the ILWMP. To the extent possible, interviews were conducted individually and face-to-face rather than in groups or by telephone.

With the assistance of the DoW, representatives from the following organisations were identified for interviews:

- Department of Water
- Water Corporation
- Department for Planning and Infrastructure

[6] The Stormwater Management Manual for Western Australia is published by the Department of Water, with the most recent updates in 2007. It aims to provide a consistent approach to stormwater management based on the principles of sustainability. The manual presents high level policy and planning principles and advice regarding best practice.

- Department of Environment and Conservation
- Swan River Trust
- City of Armadale
- City of Gosnells
- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Armadale Redevelopment Authority
- Swan Catchment Council
- Essential Environmental Services
- Jim Davies and Associates

Prospective interviewees were contacted by telephone and email to request their participation and arrange a convenient date and location for an interview. This was followed-up with a confirmation email and background document (Appendix A). In total, 17 individuals were interviewed in the period July-August 2007 (Appendix B).

A semi-structured interview format was applied to encourage consistency in data collection and analysis of the evaluation criteria (Appendix C). The interviews focused on:

- The evaluation criteria
- Key steps in the planning process
- Roles and responsibilities of the organisations and agencies involved
- Implementation of WSUD principles
- Strengths and weaknesses of the process
- Lessons from preparation of the ILWMP
- Recommendations for future projects involving total water cycle management

The interviewer took hand written notes during interviews; and, with the individual's permission, interviews were tape recorded to ensure accuracy. The interviews ranged in duration from 1 hour to 1.5 hours. The typed interview notes and tape recordings were reviewed multiple times and the data was organised into themes based on the evaluation framework.

All those interviewed will receive a copy of the study report following review by the DoW.

2.3 Limitations

By necessity, this study required a post-ILWMP evaluation. The fact that the planning process leading to the ILWMP had taken over five years meant that many interviewees had not participated in all stages of the process. The protracted project history meant that some interviewees had difficulty in remembering past events and the reasons behind some decisions. On the other hand, the post-plan evaluation did allow interviewees to reflect on the entirety of the process and to take a big picture approach in evaluating its strengths, weaknesses and the lessons learned.

3 Process Evaluation

Most interviewees were positive about the ILWMP preparation process and overall thought it had been successful. In drawing these conclusions, interviewees most often talked about two evaluation criteria – effectiveness and efficiency.

3.1 Effectiveness

3.1.1 Governance

Issues of governance were identified as a long-term problem in the area of drainage planning and management. This was attributed to a lack of clear roles and responsibilities and the "evolving water governance structure in Western Australia"[7]. Interviewees noted that when old Departments are dissolved and new ones created, responsibilities "can fall through the cracks"; which they thought had happened with drainage.

Interviewees thought clearly defined roles and responsibilities for the players involved in drainage management and planning would help address this issue. Several interviewees noted that this should include the consideration of resourcing implementation of any new responsibilities. Several interviewees thought that the ILWMP process had taken positive steps towards providing clarity. A concrete example highlighted was the ILWMP implementation table[8] that identifies key tasks and agency responsibilities.

Several interviewees identified the *SR guidance for developers* as a framework for future drainage governance. The framework identifies the DoW as the lead agency in setting strategic water management direction. Other interviewees did not view the *SR guidance for developers* as providing a definitive governance structure. They thought additional work was required to define agency responsibilities; in particular, to ensure clear lines of accountability.

3.1.2 Address water resource issues early

Most interviewees discussed the need to address water resource management issues as early as possible in the land use planning process. However, they recognised that for the ILWMP, water resource management planning lagged behind on-ground land development. This did not appear to negatively impact interviewee perceptions of the process; instead they identified it as a lesson for future processes - timing.

Urban Water Management Plans

The larger scale water strategies (Table 2) are intended to provide surface and ground water modelling data and guidance on water quantity and quality outcomes. A number of interviewees noted that because some land development in the study area had progressed in advance of this larger scale water resource planning, land developers were already preparing UWMPs. This was despite some of the larger scale water management strategies not yet being in place. An exception is the Wungong District Water Management Strategy. In the absence of the larger scale water strategies, a greater burden is placed on developers with respect to tasks such as monitoring and modelling. Due to tight timeframes and budgets, the interviewees noted it was unrealistic to expect a developer to undertake this type of work.

[7] For example, the Public Works Department was responsible for drainage management until 1985 when the Water Authority of WA (WAWA) was formed. The WAWA was in operation until 1996 when the Water Corporation and the Water and Rivers Commission were formed.
[8] Table 1 in the ILWMP on page 28.

Several interviewees noted that development of the first UWMPs in the study area was effectively a case of trial and error. Trial and error was viewed as an inefficient and costly approach. However, it was acknowledged that the process has improved because of a greater understanding of UWMP requirements by all involved parties. One interviewee noted that if the UWMPs are to be implemented elsewhere, it is important that appropriate guidance is provided to developers at the start of the process.

In the study area, UMWPs are reviewed by the Technical Working Group. Several interviewees thought this was a positive step – a one stop shop – to expedite the process, rather than circulating the UWMP from one agency to another to get approval.

On-ground application

Although the ILWMP lagged behind the land development process, it was noted that land developers were applying WSUD mechanisms in the ILWMP area. They were encouraged by the willingness of developers to adopt these measures as part of the new direction in drainage management (Box 2). However, they thought earlier development of the ILWMP would have resulted in even greater application of WSUD.

Box 2. Change in drainage management

Traditionally, drainage systems were designed to prevent flooding by installing pipes or channels to transport stormwater away from an area (e.g. a subdivision) to a retention basin, waterway, wetland, beach or bushland. Over the past few decades, this has changed. There has been a move away from largely using pipes towards WSUD mechanisms, such as swales, bio-retention basins, buffer strips, etc. This reflects the growing view that drainage water is a resource and the importance of managing both water quality and quality.

Although excited about the prospect of on-ground applications, several interviewees expressed concern about using WSUD mechanisms. The key concerns included liability, risk and the maintenance costs of WSUD infrastructure. In particular, interviewees were unsure what type of on-going maintenance would be required and the potential cost and liability for local government.

Monitoring

The importance of having baseline data prior to preparation of a plan was highlighted by interviewees. Baseline data provides valuable information on existing water characteristics (quality and quantity) for an area and provides a starting point for developing water quality and quantity targets and models. This information also helps to determine the location of problems spots (e.g. high nutrient concentrations), which may require closer monitoring and additional management.

At the start of the ILWMP process, minimal baseline data existed. Since the start of the ILWMP process, both the CSIRO and the DoW have undertaken monitoring to support development of models for the study area. The fact that the data was collected at the same time as preparation of the plan, rather than in advance, made it difficult for the plan to take full advantage of this knowledge. It is expected that the models will make a further contribution to the smaller scale water strategies and plans.

As part of the monitoring process, the CSIRO established three permanent monitoring stations to collect real time data year round, including storm events. To provide a fuller understanding of the system, a few interviewees called for additional permanent stations. It was also noted that obtaining approval to establish the current monitoring stations was not straightforward. It had required nearly a year to obtain the required approvals to construct the three existing stations due to the need to address a range of issues including the potential mobilisation of acid sulphate soils and Aboriginal heritage values.

In addition to the monitoring conducted by the DoW and CSIRO, land developers are required to monitor for two years prior to developing an area. Several interviewees noted that it had been difficult for non-developers (e.g. government agencies) to access this monitoring data, for a variety of reasons (e.g. data was not in electronic form). Having the data made available for all parties involved with drainage planning and management was viewed as important.

A related issue pertained to the need to ensure that the various monitoring parties (i.e. government agencies and developers) employ consistent and complementary methods when collecting, documenting and analysing monitoring data. The use of standardized monitoring protocols was recommended to encourage maximum benefit from the various sources of monitoring data. A central storage unit for monitoring data, similar to the DoW WIN system, was also recommended. Any central storage system should be user friendly and accessible to all interested parties.

The ILWMP does require ongoing monitoring for the study area. However, some participants questioned whether this would occur. They noted that there is little political capital in an effective monitoring program and in tight fiscal times, monitoring is all too often among the first services cut by government.

Water quality management measures

The ILWMP notes that these "… interim targets will be adopted until such time as appropriate site-specific targets are developed" (Water Corporation 2007a, pg 24). Interviewees noted that had sufficient baseline data existed at the start of the planning process, it could have been used to develop numerical water quality targets and more sophisticated area/catchment models. This would have better guided preparation of the ILWMP as well as the smaller scale water plans (e.g. UWMPs).

The interim water quality targets in the ILWMP take the form of stormwater and groundwater design objectives (Table 4). The design objectives are relative to a development that does not actively manage water quality.

Table 4 ILWMP Design objectives

Pollutant	Stormwater[9]	Groundwater[10]
Total suspended solids	At least 80% reduction	
Gross pollutants	At least 70% reduction	
Total phosphorous	At least 60% reduction	At least 60% reduction
Total nitrogen	At least 45% reduction	At least 45% reduction

There were different opinions on the merits of using design objectives based on percentage reductions relative to a standard development or having the design objectives be specific numeric values. Those supporting the percentage approach used in the ILWMP noted that there are few on-ground examples of WSUD in Western Australia. To encourage innovation among developers, the best way to do this would be through design objections expressed as percentages rather than numeric standards.

Others were less comfortable with the percentage reduction approach. They were unsure what was meant by an 'X' percentage reduction "as compared with a development that does not actively manage water quality" and questioned how this type of comparison would be measured.

[9] Refers to the pollutant load reduction sought for average annual load of stormwater run-off generated by a development.

[10] Refers to the nutrient load reduction sought for the average annual load of groundwater pollutants discharged from a development.

Some interviewees suggested that the relationship between the ILWMP design objectives and water quality targets of the Swan-Canning Clean-up Program[11] should be clear and complementary. The Clean-up Program provides short and long term targets for the Swan-Canning River system (Table 5); this includes tributaries such as the Southern River.

Table 5 Swan-Canning Clean-up Program Targets

	Target	
Contaminant	**Short-term**	**Long-term**
Total Nitrogen	2.0 mg/L	1.0 mg/L
Total Phosphorous	0.2 mg/L	0.1 mg./L

Some interviewees were unsure of the process used in setting the design objectives. They thought it important that all involved understand how the targets were prepared and that it was documented in the ILWMP.

One interviewee suggested that rather than setting design objectives based on conditions in other areas, catchment specific targets should be set to address water quality issues of particular relevance to the catchment.

Several interviewees noted that the design objectives and the potential gains from implementing WSUD (e.g. an 80% reduction) are based on the MUSIC (Model for Urban Stormwater Improvement Conceptualisation)[12] program. Several interviewees expressed concern that the MUSIC program was developed to replicate Eastern State conditions rather than Western Australian characteristics (e.g. sandy soils found on the Swan Coastal Plain). The DoW is currently working in conjunction with the model developers to calibrate the MUSIC model to reflect Western Australian conditions. As part of the Swan, Peel and Geographe Coastal Catchment Initiative, this work should address concerns regarding the model's usefulness for areas on the Swan Coastal Plain.

Water conservation, alternative sources and third pipe sources

Similar to the water quality targets, interviewees noted that it is important to set water conservation targets early in the process. The ILWMP provides design objectives for water conservation. The potable water consumption design objective is 40-60 kL/person/year for the residential sector. This is a much more ambitious target than the State Government's objective of 100 kL/person/year.

A number of interviewees were encouraged by the steps taken to conserve water, particularly in the face of climate change. However, several interviewees questioned the best way to implement the conservation target. They noted that in-house water conservation was typically outside the control of the developer. Instead, interviewees noted it was the responsibility of homebuilders (e.g. AAA rated shower heads) and households. Several interviewees recommended using education programs (e.g. Waterwise programs) to encourage the necessary household behavioural changes to implement conservation measures. To this end, the City of Armadale is currently undertaking a project on behavioural change to encourage conservation.

In addition to household conservation, a number of interviewees discussed alternative non-potable water sources (used through a third pipe system) to reduce potable water consumption. Suggested

[11] The Swan-Canning Cleanup Program started in 1994 in response to the deteriorating health of the Swan-Canning river system. The Program is run by the Swan River Trust and aims to improve the system's health.
[12] MUSIC was developed by the eWater Cooperative Research Centre and has been used throughout Australia to assess stormwater quality impacts and performance of stormwater quality treatment mechanisms.

sources included stormwater, rainwater tanks and community bores. Interviewees identified work being done at Brighton[13] (a development north of Perth) in implementing a third pipe system. However, they noted that site conditions in the study area would need to be considered to determine if there were viable alternative sources.

Many of those interviewed appeared not to realise the extent to which meeting the 40-60 kL/person/year target would be dependent upon a suitable non-potable supply to meet irrigation needs. Table 6 is taken from the *Wungong Urban Water Master Plan District Water Management Strategy* (Armadale Redevelopment Authority 2006) and indicates that reducing potable demand to around 150 kL/house/year (i.e. approximately 50 kL/person/year) would require that the bulk of potable water savings would come from the use of an alternate source to meet irrigation needs rather than in-house water efficiency savings.

Table 6 Single lot residential household water use estimates - Wungong Urban Water Master Plan

	Conventional use		**Waterwise Use**		
	Daily L/house/day	**Annual kL/house/yr**	**Daily L/house/day**	**Annual kL/house/yr**	**% of Conv Use**
In-house					
Bath & shower	171		161		94%
Washing machine	139		89		64%
Toilet	112		75		67%
Tap	83		69		83%
Other	18		14		80%
Total	523	191	409	149	78%
Ex-house					
Irrigation	687 (peak)	177	425 (peak)	155	88%
Total usage	**1,210 (peak)**	**368**	**833 (peak)**	**304**	**83%**

Legacy nutrients

A number of interviewees questioned how legacy nutrients (or legacy sites) will be managed. There is concern that some locations within the study area are storing nutrients from past land uses (e.g. agriculture) and if mobilised (e.g. during development) these nutrients will contaminate the surrounding groundwater. The end outcome may be an increase in nutrients in drains and local waterways (e.g. the Southern River).

Several interviewees mentioned the *Contaminated Sites Act 2003* and *Contaminated Sites Regulations 2006*, but were unsure how this set of legislation would apply. They thought it unfair to penalise land developers for purchasing land that potentially holds nutrients from past land uses. However, they were unsure of the best approach to managing such sites in cases where remediation is needed.

The ILWMP indicates that the *Contaminated Sites Act 2003* is unlikely to apply broadly to the study area (Water Corporation 2007a). It may however, apply to specific sites of groundwater nutrient contamination. The ILWMP notes that the Contaminated Sites Committee will be responsible for determining to which sites the Act (and Regulations) applies.

[13] Brighton is a residential development located north of Perth. Water conservation measures have been incorporated into the development.

A couple of interviewees identified soil amendments as one potential option for reducing the mobilisation of nutrients. However, more work was needed to determine the effectiveness of soil amendments.

Land reserved for drainage

A number of interviewees discussed the need to set aside land for stormwater management purposes early in the process. If land is not set aside early, it may be developed for other purposes. This limits the development of drainage strategies, possibly producing less than optimal outcomes.

A land developer is typically required to set aside ten percent of the development area for community services such as public open space and stormwater management. Several interviewees noted that in areas, such as the ILWMP, where urban development is constrained by water issues, more than the ten percent may need to be set aside for stormwater management purposes. They noted that in some cases public open space and stormwater management may be complementary land uses, however, in other cases each may require dedicated land.

A number of interviewees asked if land needs to be purchased, who will be responsible for purchasing the land. They expressed concern that local government will be "stuck with the bill". In the future, interviewees thought it important that this issue be resolved before an area is developed.

3.1.3 Leadership

The MOU identified the Water Corporation as the agency responsible for project managing preparation of the ILWMP. A number of interviewees noted that the Water Corporation contributed significant resources to the ILWMP process and was a key driving force in moving the process forward. After the DoW was formed, the Water Corporation took steps to slowly hand over the process to the DoW and the Steering Committee is now chaired by the DoW. Most interviewees thought the DoW should continue to lead the Steering Committee, because it is the most appropriate agency to lead drainage management planning.

Momentum

A number of interviewees commented that there had been a loss of momentum during the planning process. In part, this was attributed to the protracted timeline for the preparation of the ILWMP. Other factors that slowed momentum included frequent changes in committee members and chairs, requiring time for new members to get up to speed. However, one interviewee commented that new committee members added new ideas and new energy that was beneficial to the planning process.

During certain periods of the process, there were large gaps between Steering Committee meetings. Interviewees noted that when gaps were too long (e.g. six months plus), momentum was lost. They thought meeting more frequently would have helped better sustain momentum.

3.2 Efficiency

3.2.1 Coordinated approach

Nearly all interviewees thought the process was successful in bringing the relevant interests together. This was viewed as a significant achievement since, in the past, these interests had typically operated in isolation from one another. Interviewees thought coordination between interests was possible because of the MOU and the goodwill of those involved. The MOU was perceived as the impetus for getting players to the table. Although the MOU is not legally binding, the individuals involved in the process supported the MOU's intent and sought to work together. This made the MOU a successful symbol of cooperation.

Interests represented

Interviewees identified several key organisations that were missing from the Steering Committee (e.g. wetland management). When the ILWMP process started, the Department of Conservation and Land Management (CALM) was not represented on the Steering Committee. The EPA, in their review of the DSP, recommended fauna assessments be undertaken as part of a more detailed planning process. They also identified a "need to outline details of management measures to deal with issues such as habitat protection, fauna, relocation, prevention of road kills and non-native animal control" (EPA 2000, pg. 12). A number of these tasks fall within the core work of the CALM (now the Department of Environment and Conservation (DEC)).

When the Department of Environment split, forming the DoW and the DoE (now the DEC), the DoW continued to have a place on the Steering Committee. However, the DoE was no longer involved. This created a problem as the DoE still had a major regulatory role in managing wetlands and providing environmental protection. The DoE also houses the EPA Services Unit[14], which did not have a place on the Steering Committee.

When the DoE and CALM merged in 2006, representation on the Steering Committee did not change. The DEC however, became involved in development of the Forrestdale Main Drain Arterial Drainage Scheme (ADS).

Some interviewees indicated that involvement of a peak land development representative on the Steering Committee level would have been beneficial, particularly with respect to WSUD requirements. "A developer would have been able to say 'yes, practically that will work' or 'no, that will not work for these reasons'". In addition, interviewees thought it would have been helpful to share their perspective on WSUD with developers (e.g. reasons behind their decisions).

Interviewees noted that although key organisations were represented on the Steering Committee, there are often multiple interests within any one these organisations. It can be challenging for any one agency representative to represent the variety of mandates and positions of their agency. This can leave the resulting plan vulnerable to a lack of support during implementation.

Communication

Several interviewees noted that there was limited interaction between the Steering Committee and the TWG. In the absence of a strong two-way communication, the best use was not made of the combined expertise of the two committees.

Land use and water management integration

The ILWMP aimed to improve the integration of land and water management by coordinating planning efforts. This included publication of a land and water planning framework as part of the *SR guidance for developers* released during preparation of the ILWMP. A perceived benefit of the framework is that water management plans gain status through their linkages to their land use planning counterparts.

Many participants noted that the land and water planning framework was not followed in the appropriate sequence in the study area. Some detailed local level plans (e.g. subdivisions) had already been completed despite the higher level water planning not yet being in place. Those responsible for the lower level (e.g. local government and developers) plans expressed concern that they are left with an unrealistic burden when the strategic level land and water planning does not occur in a timely fashion.

[14] The EPA Services Unit provides staff support to the Environmental Protection Authority.

Several interviewees noted that the terminology in the land and water planning framework can be confused with that in the State Water Planning Framework (DPC 2007) and called for clear and consistent use of terminology. One interviewee noted that the State Water Planning Framework proposes the development of a number of water resource management plans. The interviewee questioned how these plans fit with those proposed in the land and water framework. For example, do the Regional Water Plans fulfil the requirements of the Regional Water Management Strategies?

Another term that was often confused was total water cycle. The ILWMP "… intended to cover all aspects of total water cycle management" (Water Corporation 2007, p 1). Interviewees provided a number of definitions for total water cycle. One interviewee noted that if the total water cycle is considered, this includes issues of source development and allocation. This definition would require additional interests to be involved in preparation of the ILWMP (e.g. the DoW allocation and source protection branches).

3.2.2 External factors

Change in approach

Interviewees identified two external factors that influenced the process. The most prominent was the change in the approach to drainage management (Box 2). A number of interviewees noted that Steering Committee members had readily accepted this change. However, the change in approach/philosophy was not necessarily being adopted more widely within the organisations involved with the ILWMP.

This created a tension between plan preparation and implementation. Interviewees identified examples in which plans called for the adoption of WSUD mechanisms but implementation reflected traditional drainage methods (e.g. curbs are installed instead of swales). The interviewees attributed this to concerns about risk, liability and management costs associated with WSUD. These concerns are heightened by the limited application of WSUD in Western Australia and "concerns about being the guinea pig".

Capacity building

To support the move towards WSUD, several interviewees thought more work needed to be done in capacity building and training. One interviewee recommended that WSUD be introduced in university courses as part of the training process. A number of interviewees cited the New WAter Ways program as a positive step in the capacity building process (Box 3).

Box 3. New WAter Ways

The program, established by the Western Australia Local Government Association in partnership with DPI, DoW and Water Corporation, aims to build awareness and skills amongst water management professionals; for example, building capacity within local governments to implement WSUD. To this end, the program has developed a 'WA water sensitive hub' website, to include WA WSUD case studies, a discussion board and links to data, research and cost of WSUD techniques. http://www.newwaterways.org.au/

Interviewees thought research and development were important contributors to building capacity. There are numerous on-ground examples of WSUD in the Eastern States; however, examples in Western Australia are limited. This means there is little information detailing the impacts (positive and negative) of using WSUD techniques in a local context. Interviews thought this would help ease concerns regarding risk and cost.

Political support

Interviewees noted that the ILWMP process received very little attention from the State Government at a political level. Several interviewees thought political support would have helped the process by expediting the ILWMP process through increased staff and resources. It could have also facilitated organisation-wide adoption of WSUD, which has been slow.

3.3 Trust and fairness

Most interviewees discussed trust and fairness criteria together, which is not surprising as the two criteria often overlap. Interviewees also linked trust and fairness with efficiency (e.g. effective leadership).

At the start of discussions, interviewees usually indicated that trust was high and the process was fair. Interviewees thought the Steering Committee provided an open forum for discussion among members. However, when trust and fairness were explored further, for most interviewees areas of dissatisfaction emerged. A number of interviewees expressed concern about the frequent discussions and conversations held outside the Steering Committee meetings. Although the informal conversations among agencies provided evidence that agencies were working collaboratively; there were concerns that important decisions were being made without vetting through the Steering Committee.

How an interviewee viewed the fairness of the decision making process was influenced by their sense of having the power to influence the process. Those who were driving the process viewed it as fair. However, a number of interviewees expressed concern about their ability to influence the process. Those without power did not see the process as fair and felt vulnerable to the outcomes. One example cited by interviewees was the unfair distribution of responsibility. This included giving additional responsibilities to some agencies without allocating them additional resources.

4 Lessons and Recommendations

Overall, interviewees viewed the ILWMP as a successful project and an important first step towards better integration of land use and water management planning. The lessons from the planning exercise are summarised below along with recommendations.

4.1 MOU

Despite not having binding legal effect, the MOU provided strong symbolic value. Almost all interviewees attributed the cooperative inter-agency working environment to the MOU. This was viewed as one of the most positive aspects of the project.

Recommendation: In future projects of this nature, the benefits of having an MOU should be considered. While it may not be needed in all cases, its strong symbolic value can facilitate cooperation amongst different organisations.

4.2 Steering Committee

Having the right combination of organisations represented on the Steering Committee is important.

There was a false premise that the Steering Committee members should be able to speak on behalf of the variety of mandates and positions of their agency. This proved to be unrealistic as many of the committee members were representing large and complex organisations. Often a committee member would be more familiar with the positions held within their own part of the agency but less so with the responsibilities and positions held by other parts of their agency. There were examples where a Steering Committee member went back to their organisation and were met with challenges from other parts of their agency on particular issues. The Steering Committee tried to address this by restructuring at the end of year one and by forming the Technical Working Group. The TWG was partially successful in addressing this issue. However, the transfer of information between the Steering Committee and TWG could have been improved.

Not all the key interests were represented on the Steering Committee. The most notable omission was wetland management with the DEC was not represented. The DEC was however a member of the TWG. Given its central role, representation on the Steering Committee would have been beneficial. Some interviewees suggested that the land development industry should have been represented.

Having a Steering Committee where all key interests were represented was useful in building trust among the parties. However, the decision by some committee members to meet and work through issues outside the Steering Committee was viewed poorly by some of the other members. Such actions eroded trust with fears that key decisions were being made outside the Committee and in a manner that was not transparent.

Recommendation: It is important that all of the key interests involved in preparing and implementing the plan be part of the decision making process.

One of the tests of whether or not all interests are represented is whether or not those interests most impacted by the outcome of the planning process are at the table. Just as local governments would be significantly impacted and are thus on the Steering Committee, land developers will have to play a significant role in the successful implementation of the ILWMP. Thus, a case can be made for the inclusion of a peak industry body representative from the land development sector.

It is unlikely that a single representative, other than a CEO, will be able to speak for an entire agency. In some cases, more than one individual may be required to participate in order to ensure that their agency is committed to the outcomes of the decision making process. Such a decision would have to be weighed against creating unwieldy numbers of representatives and issues of power.

There needs to be strong interaction and reporting mechanisms between the Steering Committee and the Technical Working Group.

4.3 Land and water framework

The terminology in the land and water planning framework in the *SR guidance for developers* created some confusion with the water planning framework in the State Water Plan.

When the hierarchy of water plans and strategies in the framework is not followed, the local government and land developers are left to fill these gaps in addition to their own responsibilities. This is an unfair burden and can lead to less than optimal outcomes.

Recommendation: The terminology used in the land and water planning framework should not conflict with the State Water Planning Framework. It would also be beneficial to use a consistent set of terms rather than having multiple labels for overlapping terms (e.g. integrated, total water cycle, water sensitive urban design).

It is essential that the higher level water management strategies are in place in a timely fashion, consistent with the land and water planning framework. Otherwise local government and land developers are left with an unfair burden and greater potential for less than optimal water resource outcomes. In addition, the local scale land (e.g. sub-division) and water planning should not proceed in the absence of the higher level water planning.

It is also important that land developers are provided with clearer guidance on the expectations of and acceptable approaches to developing UWMPs than is offered in the *SR guidance for developers*.

4.4 Land requirements

In areas highly constrained by drainage management issues, much more than ten percent of an area proposed for urban development may need to be dedicated to stormwater management. Early identification of these requirements allows the greatest flexibility to achieve stormwater management and public open space objectives.

Recommendation: Land requirements to meet stormwater management objectives should be addressed at each stage in the planning framework. In addition, a strategy for securing land for stormwater management and guidance regarding long term management responsibilities are needed.

4.5 Reduction targets

There was confusion among participants regarding how the contaminant reduction targets (or design objectives) adopted in the ILWMP were determined. There were also differences of opinion as to whether or not the percentage reduction approach was the most appropriate and whether the targets were consistent with the efforts of other organisations (e.g. Swan River Trust, Swan Catchment Council) seeking to improve water quality in the Swan-Canning system.

Recommendation: The timely development of baseline data is essential in order to set local water quality targets that reflect the systems' conditions.

Empirical contaminant reduction targets based on local data and modelling are preferable to targets described as percentage contaminant reductions based on a development that does not actively manage water quality.

The basis on which targets are developed should be clearly articulated in a plan.

The integrated land and water plan for an area should demonstrate how its contaminant reduction targets are compatible with and contribute to meeting those of the larger water system (e.g. the catchment, the Swan River Trust Clean-up Program).

4.6 Monitoring

The interviews revealed some weaknesses in the data collection and monitoring efforts associated with the ILWMP. These were:

- Insufficient time to collect baseline data
- Different parties applying different protocols for sampling and data analysis
- Problems in sharing data and access to data.

Recommendations: The two-three years needed to collect baseline data and to build and calibrate local water models should be explicitly accounted for in the planning timeline.

Preferred data collection and analysis protocols should be identified (e.g. AS/NZS 5667.1:1998 water quality sampling) and identified in guidance documents provided to all involved parties (e.g. *SR guidance for developers*).

A central data storage system accessible to interested parties should be established using consistent forms of data documentation that are user-friendly.

4.7 Evaluation and capacity building

Many of the key assumptions used in the ILWMP were based on Eastern States experience. Some questioned the validity of these assumptions in the context of the Swan Coastal Plain, including the use of the MUSIC program.

There was confusion about what type of on-going maintenance would be required and the potential cost and liability of implementing WSUD mechanisms, particularly for local government. The limited number of WSUD applications in WA and the shortage of evaluation of these cases heightened this concern.

Recommendation: It is essential that the costs and benefits of various WSUD mechanisms in WA contexts are evaluated and documented as part of any capacity building effort.

The DoW is in the process of developing WSUD demonstration sites and this is a step in this direction. The New WAter Ways online clearinghouse for information on stormwater management is another positive addition to capacity building efforts.

4.8 Potable water conservation and third pipe sources

The ILWMP provides design objectives for household water conservation. The potable water consumption design objective is 40-60 kL/person/year for the residential sector. This is a much more ambitious target than the State Government's objective of 100 kL/person/year.

Achieving that target is largely dependent on having a suitable alternative non-potable source to meet irrigation needs rather than in-house water efficiency savings (Armadale Redevelopment

Authority 2006). Possible alternative non-potable sources include stormwater, community bores, and rainwater tanks.

Recommendation: The application of the ambitious drinking water consumption targets applied in the ILWMP (i.e. 40-60 kL/person/year) should only be applied in other cases if there is a real prospect of an alternative source to meet non-potable water demand.

Developers require clear guidance regarding the regulatory processes and practical steps they should take in determining the viability of non-potable water supply in their area. The Water Corporation's developer guide to *Developing Alternative Water Supplies in the Metro Area* is a step in this direction. As is the Interim Position Statement on Community Bores being prepared by the DoW.

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Appendix A Background document

Southern River Integrated Land and Water Management Plan

Evaluation of the Planning Process

In 2004, a memorandum of understanding (MOU) was signed to facilitate the preparation and implementation of an Integrated Land and Water Management Plan (ILWMP) for the Southern River/Forrestdale/Brookdale/Wungong District Structure Plan area. Parties involved in developing the ILWMP included State Government agencies, local governments, and representatives from the private sector.

The ILWMP is a key demonstration project for achieving water sensitive urban design (WSUD) outcomes and integrating urban land and water management in Perth. The lessons learned from the planning process will benefit similar future projects in other areas.

Beckwith Environmental Planning Pty Ltd has been retained by the Department of Water (DoW) to document and evaluate the decision making process undertaken during the preparation of the ILWMP. The first step in the evaluation will be in-depth interviews with key individuals involved in the ILWMP process.

Thank you for agreeing to participate in the evaluation. In advance of your interview, we encourage you to reflect upon the decision making process and in particular:

- Key decisions and how they were made
- Effectiveness of the MOU in encouraging collaboration
- Roles and responsibilities of the organisations and agencies involved in the process
- Advice for future projects integrating urban land and water management and WSUD.

Either Jo Ann Beckwith or Sabrina Genter will conduct the interviews. On average, interviews take 1-2 hours of an individual's time.

Once all the interviews are completed, we will prepare a summary report evaluating the planning process. Each person interviewed will receive an electronic copy of our final report.

Thank you for your willingness to participate in this study. We look forward to meeting with you.

Sincerely

Jo Ann Beckwith PhD
Director
Beckwith Environmental Planning Pty Ltd

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Appendix B List of interviewees

Name	Affiliation
State Government	
Bill Till	Department of Water
Mark Tonti	Water Corporation
Mike Mouritz	Department for Planning and Infrastructure
Mark Jefferies	Department of Environment and Conservation
Lyndon Mutter	Department of Environment and Conservation
Darryl Miller	Swan River Trust
Local Government	
Andrew Bruce	City of Armadale
Ron Van Delft	City of Armadale
Simon O'Sullivan	City of Gosnells
Wayne van Lieven	City of Gosnells
Jeff Glass	City of Gosnells
Interest Group	
Don McFarlane	CSIRO
Olga Barron	CSIRO
Matt Taylor	Armadale Redevelopment Authority/SoPlan
Bruce Hamilton	Swan Catchment Council
Consultants	
Shelley Shepherd	Essential Environmental Services
Scott Wills	Jim Davies and Associates

Appendix C Interview guide

Interview: _____
Date: _____

Subject	Question
	When did you become involved in the project? In what capacity?
	Can you describe the chronology of the project leading to the draft ILWMP?
	Is there a planning framework or hierarchy? Where does the ILWMP sit in the larger planning framework?
MOU Roles/ Responsibilities	What was the need behind having a MOU? What was the MOU to achieve?
	Did the MOU include the correct mix of organisations?
	Was the MOU effective? Cooperation/collaboration, clarify roles
	Would you recommend using a MOU in the future?
	Would you change the MOU in any way?
Steering Committee	What was the role of the Steering Committee?
	What were the strengths and weaknesses of the Committee?
	What were its limitations? (leadership, composition, funding)
	How was the work of the committee supported? (funding, staff)
	Any recommendations regarding future Steering Committees?
ILWMP	What were the objectives in having an ILWMP?
	In you opinion, what were the crucial decision points?
	Were you happy with the manner in which decisions were made? Process/style?
	Were there any particularly poor decisions along the way?
	Were some parties/individuals dominant in the decision making process?
	Were developers allowed to continue developing in the study area during the preparation of the ILWMP? Conditions?
External factors	Were there any external factors that influenced the development of the ILWMP?
	There has been a recent shift in the perception of drainage water. It is now viewed as a resource rather than a waste product. How did this shift affect the process?
	Are all parties accepting of the new philosophy towards drainage water?
	What does the new philosophy mean for future processes?
Relationships	Has your own/agency's relationships with other participants changed? How?
	What could have been done to improve your relationships with other people?
	Did all parties have a good understanding of the needs/interests of the other parties?
	Was information freely shared among participants?
	Were the inputs of all participants respected by the other participants? Issue of power.
	What lessons should be learned form this project?