South West Yarragadee Water Supply Development: Sustainability Evaluation/Environmental Review & Management Programme

Executive Summary

February 2006

Prepared for
Water Corporation
by Strategen

strategen

WATER CORPORATION

South West Yarragadee Water Supply Development: Sustainability Evaluation/Environmental Review & Management Programme

Executive Summary

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Client: Water Corporation

Report	Version	Prepared by	Reviewed by	Submitted to Client	
				Copies	Date
Preliminary Draft Report	V1	HV/LC	WC	1 Electronic	7 Dec 2005
Review Draft Report	V2	HV/LC	EPASU	1 Electronic	14 Dec 2005
Final Report to EPASU	V3	HV/LC	EPASU	2 bound, 1 CD	30 Jan 2006
Final Draft	V4	HV/LC	HV	1 Electronic	2 Feb 2006
Final	Final	HV/LC	HV	1 Electronic	20 Feb 2006

INVITATION

The Environmental Protection Authority (EPA) and Sustainability Panel[1] invite people to make a submission on this proposal.

The Water Corporation proposes to abstract 45 GL/yr of groundwater from the South West Yarragadee aquifer in the Southern Perth Basin in the south west of Western Australia to supply the Integrated Water Supply Scheme (including potential demand in the South West).

In accordance with the *Environmental Protection Act 1986,* the *Environmental Protection and Biodiversity Act 1999* and the *State Sustainability Strategy*, an Environmental Review and Management Programme (ERMP) and a Sustainability Evaluation have been prepared which describes this proposal and its likely environmental, social and economic impacts and how they are proposed to be managed. The document is also intended to provide information supporting the Water Corporation application to the Department of Water for a licence for groundwater abstraction under the *Rights in Water and Irrigation Act 1914* (RWI Act). The Sustainability Evaluation / ERMP is available for a public review period of twelve weeks from **Monday 27 February 2006, closing on Monday, 22 May 2006**.

Comments on all aspects of the proposal are invited for consideration by the EPA, Department of Water and Sustainability Panel. All comments will be responded to and a Response to Submissions document prepared and made publicly available on the Water Corporation and EPA websites. The Response to Submissions will be submitted to the EPA, Department of Water and Sustainability Panel.

Comments from Government agencies and from the public will assist the EPA and Sustainability Panel to prepare assessment reports in which recommendations will be made to Government. Electronic submissions are preferred, emailed to the project assessment officer or via the EPA Website (see address below).

Where to get copies of this document

Printed copies of this document may be obtained from Nick Churchill at the Water Corporation, 629 Newcastle St, LEEDERVILLE WA 6007, Ph (08) 9420 2420 at a cost of $10.00 per copy. CD versions and printed copies of the Executive Summary are also available free of charge from the same address.

Copies may also be obtained from the Water Corporation website at:
www.watercorporation.com.au/water/water_sources_sw_yarragadee.cfm

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[1] A Sustainability Panel has been established under the auspices of the Government's *State Water Strategy* as an independent body to provide advice to the Government and, as appropriate, to decision-making authorities at various stages of the sustainability assessment process. The Sustainability Panel will report to Government through the State Water Council and Cabinet. The Sustainability Panel provides transparent and independent advice on the proposal and provides a mechanism for integrated evaluation of social, economic and environmental factors. In preparing its advice, the Panel will assess the Sustainability Evaluation and will consider all the public submissions made during the 12-week public comment period, together with the Water Corporation response to those submissions, as well as the EPA report and recommendations. All Sustainability Panel advice is made publicly available. The Sustainability Panel may advise on all sustainability factors. Such advice is separate and additional to formal State or Commonwealth agency assessment procedures. The Sustainability Panel will maintain confidentiality on the authorship of all individual public submissions and on any organisation submissions that request such confidentiality.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence subject to the requirements of the Freedom of Information Act, and may be quoted in full or in part in each report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people), please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the Sustainability Evaluation / ERMP or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable. When making comments on specific proposals in the Sustainability Evaluation / ERMP:

- clearly state your point of view
- indicate the source of your information or argument if this is applicable
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful
- refer each point to the appropriate Volume, chapter or recommendation in the ERMP / Sustainability Evaluation
- if you discuss different sections of the Sustainability Evaluation / ERMP, keep them distinct and separate, so there is no confusion as to which section you are considering
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name
- address
- date
- whether you want your submission to be confidential.

The closing date for submissions is: **Monday 22 May 2006**.

Where to send your submission

You can either e-mail the submission to the project officer at the following address:

colin.murray@environment.wa.gov.au

OR use the submission form on the EPA website:

www.epa.gov.au/submissions.asp and click on the EIA Assessment Submission option

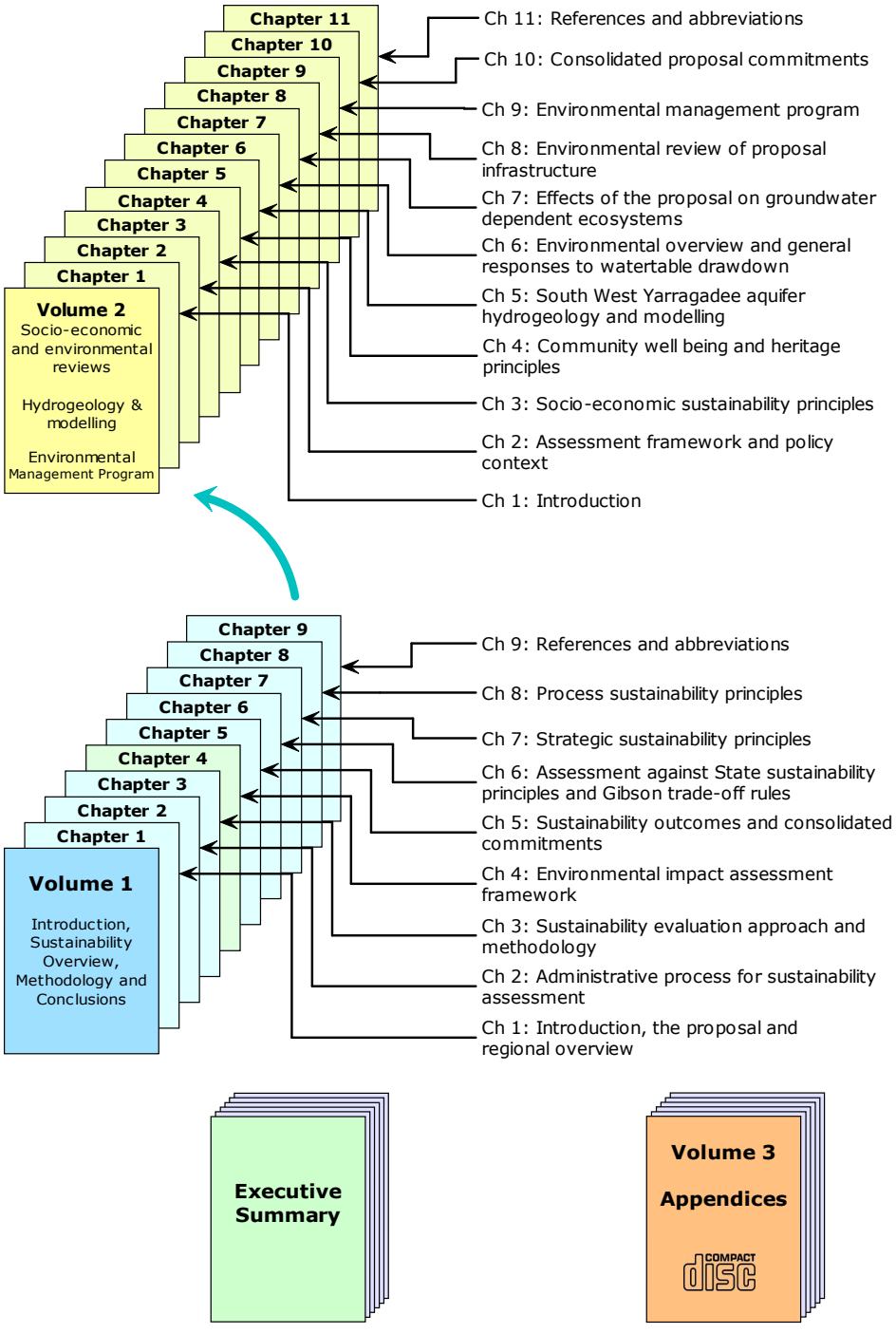
OR if you do not have access to e-mail then please post your submission to:

The Chairman
Environmental Protection Authority
PO Box K822
PERTH WA 6842
Attention: Colin Murray

SOUTH WEST YARRAGADEE WATER SUPPLY DEVELOPMENT
WATER CORPORATION PROPOSAL

Sustainability Evaluation/ERMP Document Structure

This Sustainability Evaluation and ERMP is presented in three volumes as shown diagrammatically below. The Executive Summary is presented in a separate stand-alone document.



EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

1. INTRODUCTION

The South West Yarragadee Water Supply Development proposal involves the abstraction, treatment and conveyance of 45 GL/yr of groundwater from a wellfield on the eastern Blackwood Plateau in the south-west of Western Australia. The proposal is intended to provide the next major water source for the Integrated Water Supply Scheme[2] (IWSS).

Assessment of the sustainability of the next major IWSS water source is a requirement of the *State Sustainability Strategy*.

A Sustainability Evaluation of the proposal has been prepared for assessment by Government in accordance with the requirements of the *State Sustainability Strategy*. The overall intention of the evaluation has been to develop a proposal that will result in net positive environmental, social and economic outcomes. The Sustainability Evaluation includes an Environmental Review and Management Programme (ERMP) prepared pursuant to Part IV of the *Environmental Protection Act 1986* (EP Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The document is also intended to provide information supporting the Water Corporation application to the Water and Rivers Commission for a licence under the *Rights in Water and Irrigation Act 1914* (RWI Act) to permit the abstraction of 45 GL/yr from the South West Yarragadee aquifer.

The proponent is the Water Corporation, a corporatised government trading enterprise that provides water services across Western Australia. The Corporation has the role of providing water supply services to operating areas within Western Australia for which it has a licence under the *Water Services Licensing Act 1995*.

2. THE PROPOSAL

The South West Yarragadee Water Supply Development proposal includes the construction and operation of a wellfield to abstract 45 GL/yr from the South West Yarragadee aquifer to meet growing demand in the IWSS (including potential public water supply demand in the South West). The water will be treated and pumped via a new pipeline to Harvey to connect with the existing Stirling Trunk Main (Figure 1). This proposal includes up to ten production wells at five sites in the Jarrahwood area. Additional sites for production wells that may be necessary to modify pumping regimes as an adaptive management response have also been selected. The proposal effectively involves extension of the IWSS into the South West. In time, this will allow the region to access the benefits of a major integrated water supply scheme in meeting a proportion of future regional public water supply needs.

The proposed wellfield configuration has been selected as the preferred layout after considering the drawdown effects of several alternative layouts in environmentally sensitive areas.

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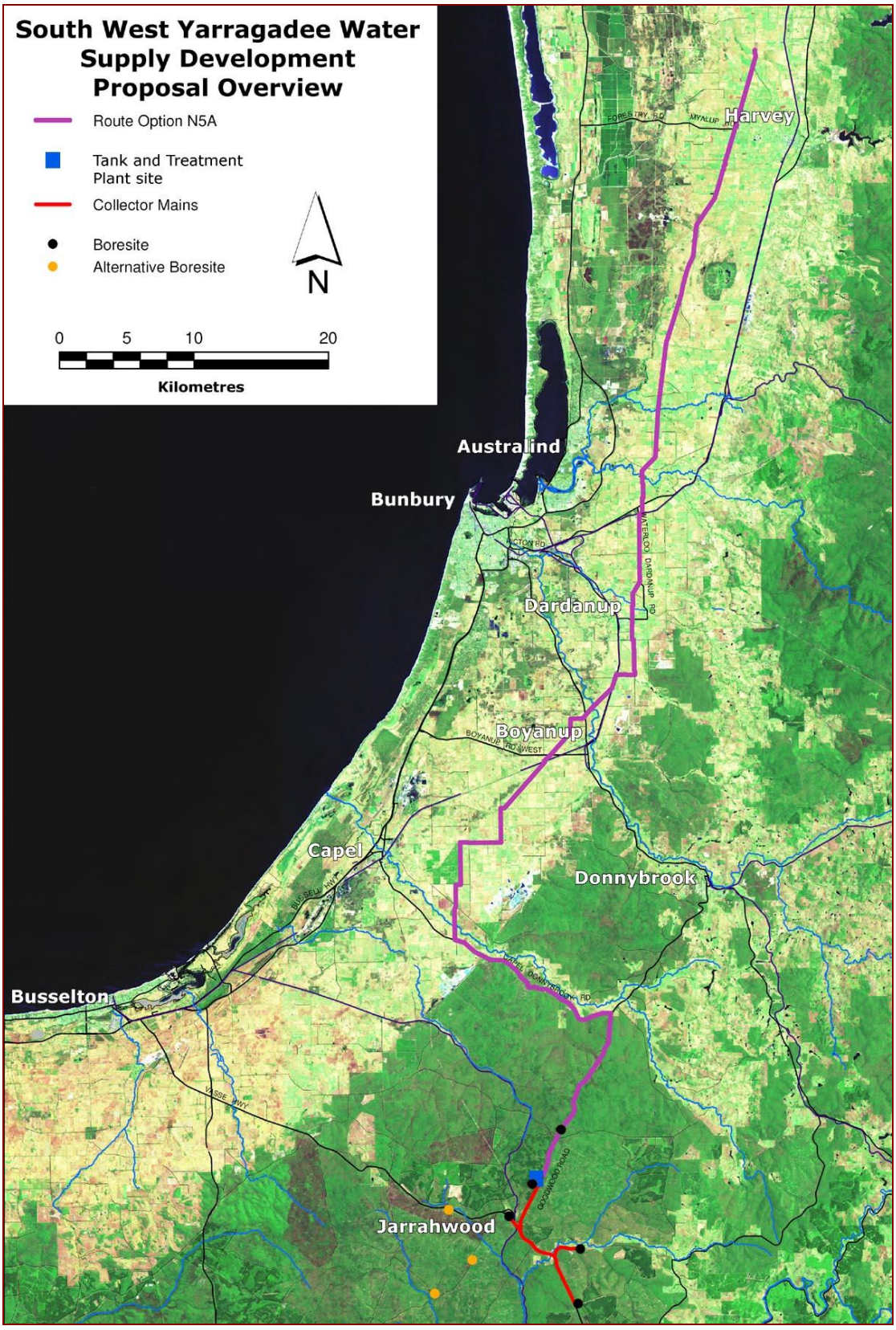
[2] The Integrated Water Supply System (IWSS) is the integrated combination of surface and groundwater sources and their distribution system that services Perth, Pinjarra, Mandurah, Harvey, Waroona and the Goldfields and Agricultural Water Supply. Sources supplying this system currently extend as far south as the Harris Dam, and through this, the system is connected to the Great Southern Towns Water Scheme.

Figure 1 Locality plan of the South West Yarragadee Water Supply Development



The proposal includes a water treatment plant to be located in a pine plantation to the north of the source works and transfer main to take water from the treatment plant to the existing IWSS Stirling Trunk Main at Harvey mostly along roadsides and through cleared land (Figure 1 and Table 1).

Table 1 Key characteristics table

Element	Description
Wellfield	
Source	South West Yarragadee aquifer
Rate of abstraction	45 GL/yr
Location of wells	Refer Figure 1 for indicative location
Well type	Conventional up to 20 ML/day capacity
No. of wells	Up to 10
Pipeline	
Water transfer mains	Shown as Route Option N5A in Figure 1 from Storage Tank to Harvey. Final alignment subject to detailed studies, engineering considerations and landowner consultation.
Length	105 km
Diameter	1400 mm
Wellfield collector main	Shown in Figure 1
Length	7.5 km
Diameter	1400 mm
Water treatment plant	
Location	Goodwood Road on the Whicher Scarp near Jarrahwood
Facilities	Filtration, chlorination, pH adjustment, sludge drying beds
Capacity	135 ML/day
Storage tank	25 ML
Energy use	
Wells	600 kW each (35 GWhr/yr)
Treatment plant	600 kW each (5 GWhr/yr)
Pump stations	None*

* A proposed pump station at Ravenswood is not specific to the South West Yarragadee Water Supply Development project.

Construction of the project infrastructure will take two years and is planned to commence in late 2007 with commissioning in late 2009. Construction of the pipeline will be carried out during two summer periods (2007/08 and 2008/09) to minimise impacts when the watertable is close to or at the ground surface.

3. PROPOSAL DEVELOPMENT AND ASSESSMENT PROCESS

3.1 STAKEHOLDER CONSULTATION

Extensive stakeholder consultation was undertaken during the development of this proposal, including the formation of a Community Reference Group, public forums, and public release of technical information summaries and distribution of newsletters.

3.2 SCOPING REPORT

An ERMP level of assessment was set following referral of the proposal to the Environmental Protection Authority (EPA) in 2005. In 2004, the Water and Rivers Commission advised of the information required to be submitted to support the application by the Water Corporation for a licence for groundwater abstraction under the RWI Act.

A Scoping Report was prepared and subsequently approved by the Sustainability Panel, EPA, Department of Environment and Heritage (Commonwealth) and the Water and Rivers Commission. The Scoping Report documents the sustainability principles and environmental, social and economic factors and proposed investigations relevant to the proposal and defines the scope of the matters to be addressed in the Sustainability Evaluation/ERMP (Table 2). The report was developed through extensive consultation with the community, including all key stakeholders.

Table 2 Sustainability principles and factors relevant to the evaluation

Number and topic	Principle	Key factors
Environmental		
1. Biodiversity and ecological integrity	The proposal will result in a net increase in ecological function or biological diversity in the region	Flora and fauna Priority and Rare Flora Threatened Fauna Threatened ecological communities Blackwood River and tributaries Wetlands Other groundwater dependent ecosystems Development footprint (from infrastructure)
2. Energy efficiency	The proposal will be designed and operated at a level which is best practice in Australia	Greenhouse gas emissions
Socio-economic		
3. Long-term economic health	The proposal will assist current and future economic growth, generate government revenue, business development and investment opportunities within IWSS and South West Region	Economic growth Economic efficiency Economic diversity Business development
4. Public water supply for existing and future generations	The Water Corporation in conjunction with other water supply authorities, will supply water of appropriate quality to meet existing and future public demand in the IWSS and South West Region.	Water use efficiency Quality of supply Existing and future needs South West town supplies Drinking water source protection
5. Regional needs	The proposal will be developed such that reasonable regional needs for water, including social, recreational and projected future development needs are not compromised by the proposal.	Regional needs for private water supplies Current key water users
6. Community well being and heritage	The proposal will maintain or improve the quality of life for the Western Australian community.	Lifestyle, amenity and recreational use and access Direct and indirect job generation Sense of place Indigenous communities Development footprint

Number and topic	Principle	Key factors
Strategic		
7. Government policy	The proposal will facilitate the implementation of relevant government policies in a local, regional and State context.	Equitable access to water Government plans Regional development
8. Climate change	The current low rainfall period and possibility of future climate change should be taken into account in decision making about the development of the Yarragadee aquifer as a water source.	Climate change
9. International and national competitiveness of water users	The proposal will facilitate the competitiveness of local and regional industries in the national and international context.	Cost of water
10. Improved knowledge and skills	The proposal will enhance the knowledge of the resource to enable optimal use of the resource by self-suppliers.	Environmental risk Supply security
Process		
11. Precautionary principle	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by • a careful evaluation to avoid, where practicable, serious or irreversible damage to the environment • an assessment of the risk-weighted consequences of the options This definition from the EP Act 1986 (amended 2004).	Precautionary approach which includes – Risk management – Further knowledge – Environmental monitoring – Adaptive management – Precautionary project design – Contingency planning – Future legacy
12. Stakeholder engagement	The Water Corporation will seek the participation and views of stakeholders and take them into account in the development, construction and operation of the proposal.	Comprehensive and regular communication Relevant, balanced and inclusive consultation Openness and transparency Closed loop process (listen and respond)
13. Accountability	The Water Corporation will report publicly on its sustainability performance and provide public access to information on the proposal.	Define performance targets Report on achievement of performance targets

3.3 ASSESSMENT AND APPROVALS

Assessment of the sustainability of the South West Yarragadee Water Supply Development involves the following statutory and administrative processes.

1. Environmental impact assessment by the Western Australian EPA and decision making by the Minister for the Environment (or Cabinet) on the implementation of the proposal under the EP Act. The decision by the Minister would be made after consideration of the EPA assessment report, advice from the Water and Rivers Commission on licensing aspects, and advice from the Sustainability Panel (a combination of statutory and administrative processes).
2. Environmental impact assessment and decision making by the Commonwealth on whether the action may proceed under the *Environmental Protection and Biodiversity Conservation Act 1999.*
3. Groundwater licence application assessment by the Water and Rivers Commission under the RWI Act.
4. Assessment and advice to Government from the Sustainability Panel.

In addition, a "water removal permit" will be required from the Department of Conservation and Land Management (CALM) to allow the proposed activity to be undertaken within the CALM estate.

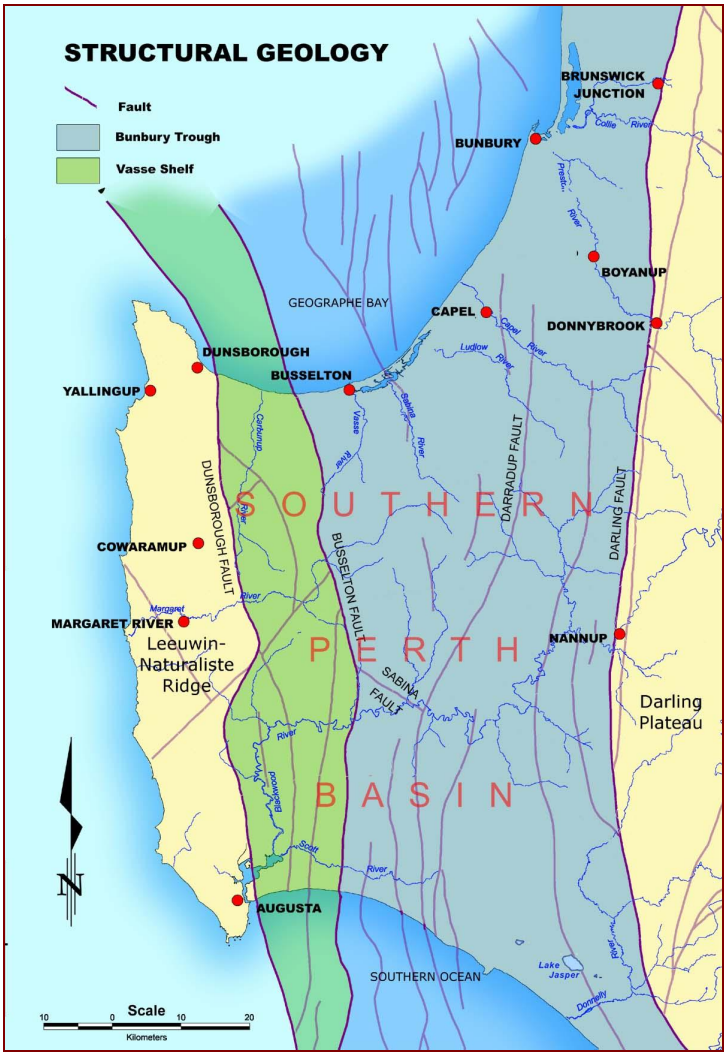
This Sustainability Evaluation/ERMP is intended to provide information to allow assessment by the relevant agencies, the Sustainability Panel, and by Government, and is based on consideration of the proposal against the social, economic and environmental factors identified in the Scoping Report.

4. HYDROGEOLOGY AND GROUNDWATER ABSTRACTION EFFECTS

4.1 HYDROGEOLOGICAL INVESTIGATIONS

An extensive hydrogeological investigation program was undertaken during 2002 – 2005 to quantify the extent of the South West Yarragadee aquifer. The investigation is one of the largest groundwater investigations carried out in Western Australia, consisting of a suite of geophysical surveys, exploratory drilling at 48 sites, test pumping, measurement and estimation of groundwater recharge and discharge, stream flow, groundwater flow and response to pumping.

Figure 2 Structural geology of the Southern Perth Basin



4.2 SOUTHERN PERTH BASIN

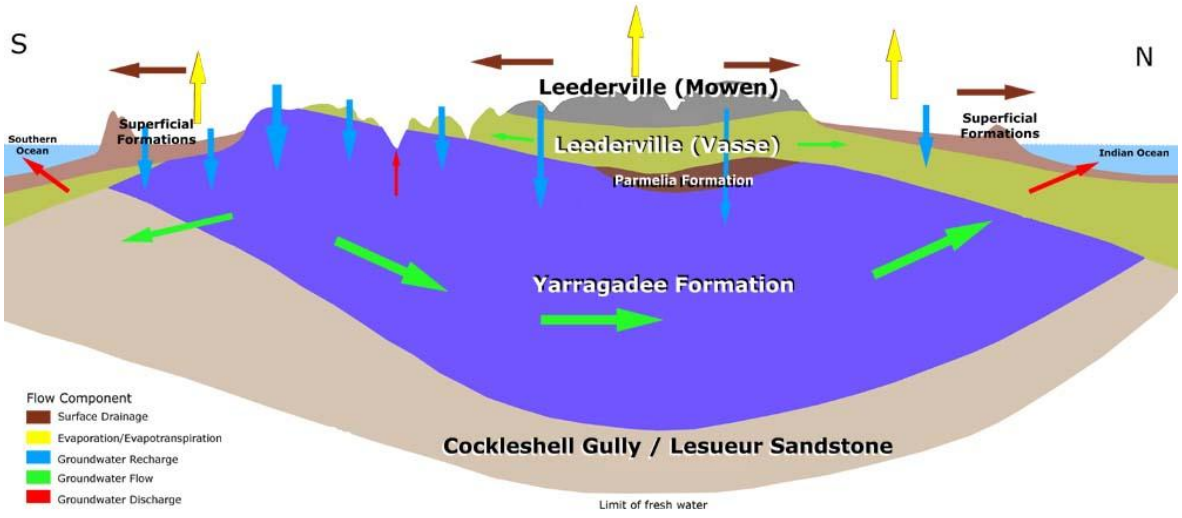
The Yarragadee aquifer is a major groundwater resource within the Bunbury Trough structure of the Southern Perth Basin in the South West of Western Australia (Figure 2). The basin extends to depths up to over 12 000 m, with the upper 1000 to 2000 m containing fresh water.

Resource and recharge

The basin contains about 1200 000 GL of water in storage. The basin is recharged at a rate of about 374 GL/yr through infiltration of rainfall over the region, of which about 151 GL/yr is recharged to the Yarragadee aquifer. The volume of freshwater held in storage equates to about 3200 times the annual recharge.

The Yarragadee aquifer varies between 1000 – 2000 m in thickness and is variably overlain by the Parmelia Formation, Bunbury Basalt, Leederville Formation and the superficial formations. It outcrops over an extensive area beneath and south of the Blackwood River. About 1000 000 GL of water is stored within the Yarragadee aquifer (Figure 3), most of which is fresh.

Figure 3 Diagrammatic North-South cross-section of Southern Perth Basin (Bunbury Trough)



Recharge from rainfall enters the groundwater system by downward infiltration over the region, and discharges into the local rivers and constructed drainage systems, into the ocean (Indian Ocean at Geographe Bay and the Southern Ocean off the south coast). A small proportion of the recharge to the Yarragadee and Leederville aquifers discharges directly into the Blackwood River.

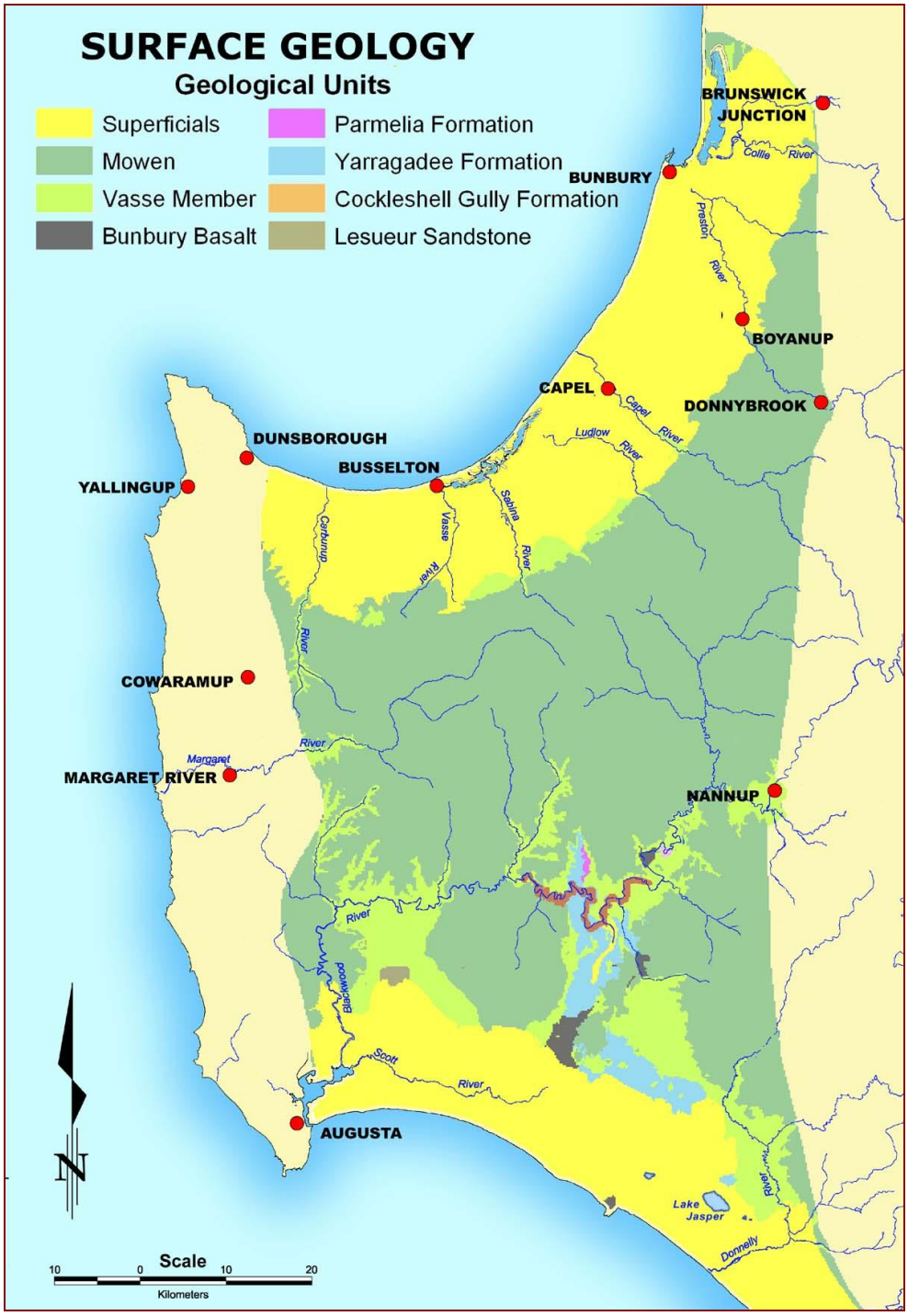
The Yarragadee aquifer is recharged by direct infiltration of rainfall in those areas where it directly outcrops at the surface, and by leakage from overlying formations in other areas. The Mowen Member is the predominant surface geology over the Blackwood Plateau, particularly in the higher parts of the landscape (Figure 4). In the southern parts of the plateau, the Mowen Member has been eroded away and the Vasse Member and upper Yarragadee Formation outcrop directly at the surface.

The Yarragadee outcrops at the surface near the Blackwood River (Figure 4). In the more elevated part of this outcrop area to the south of the river, rainfall directly infiltrates into the Yarragadee Formation at the surface at much higher rates than through the areas where it is overlain by other formations.

The Vasse member of the Leederville Formation is also recharged directly by rainfall where it outcrops at the surface. Although the rate of recharge is less than for the Yarragadee Formation, it outcrops over a larger area and contributes a significant quantity of water to the regional groundwater system.

The Mowen Member allows some downward leakage into the underlying aquifers whereas the Bunbury Basalt does not allow downward leakage. The Mowen Member and Bunbury Basalt not only inhibit downward leakage of water to the Yarragadee Formation, they also inhibit the transmittal of water level or pressure drawdown effects to the surface formations..

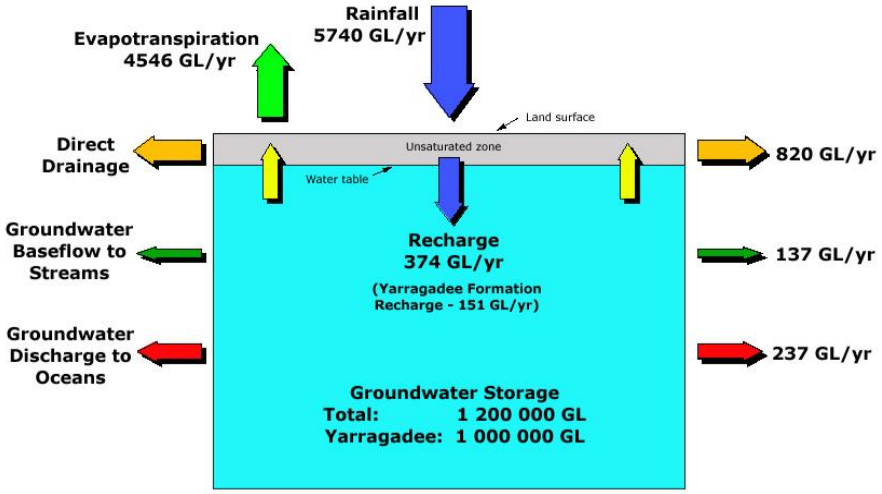
Figure 4 Surface geology



Water balance

The natural water balance of the Southern Perth Basin and the relative magnitude of the various water fluxes are influenced by a number of factors including rainfall, evapotranspiration, direct drainage and recharge to the groundwater system (Figure 5).

Figure 5 Natural water balance of the Southern Perth Basin



Current groundwater use from the Southern Perth Basin and water fluxes is about 72 GL/yr of which about half is taken from the Yarragadee aquifer. Estimates of future growth in groundwater use suggest that total use of this source in the region could increase to about 175 GL/yr by 2033 (220 GL/yr with the Water Corporation proposal for 45 GL/yr).

Groundwater quality

The quality of groundwater in the upper Southern Perth Basin is generally fresh, with brackish water occurring in some areas, particularly in the superficial formations and the Leederville Formation underlying the Swan Coastal Plain. The Yarragadee aquifer groundwater is fresh to very fresh water (being generally less than 500 mg/L TDS).

4.3 GROUNDWATER MODELLING

The South West Aquifer Modelling System (SWAMS) was developed for this project using the international industry-standard, groundwater modelling software package, MODFLOW. The regional scale model was used to identify areas where future groundwater pumping might affect groundwater dependent ecosystems (GDEs) under a range of possible future pumping scenarios. The scenarios included regional growth with and without the Water Corporation proposal. The base modelling scenarios used a sequence with rainfalls 9% lower than the long-term historical average. Progressive additional reductions in recharge of 5% and 10% over the next 30 years was also modelled to demonstrate the potential effects of a further drying climate in the region. This range of climate scenarios is consistent with the range of CSIRO climate predictions for the period to 2030. The CSIRO research suggests prognoses for the south-west ranging from 5% increases to 20% declines in annual rainfall by 2030. Therefore, the 9% decrease included in the base modelling is in the centre of the prediction range and a further 10% represents the worst-case scenario.

To minimise risk to sensitive groundwater dependent ecosystems, several different Water Corporation wellfield configurations were tested using the model to determine a preferred location.

Regional growth in groundwater use was based on 30-year growth projections by Economics Consulting Services, for which a straight-line rate of growth was assumed.

4.4 INTERPRETED MODEL RESULTS

The raw model drawdowns required further interpretation at the local scale as the regional model tends to over-predict drawdowns due to the highly conservative nature of the model, as confirmed by peer review, (Section 4.5), and because local scale hydrogeological information could not be fully taken into account in the regional model.

A key limitation of the regional model is the inability to account for increased recharge in response to drawdown (recovery of rejected recharge). On the coastal plains, the shallow watertables result in the thin soil profile becoming saturated during winter, with watertables rising to or above the surface. Additional recharge from rainfall is then effectively rejected. As there is no space for the water to be stored it flows away as surface drainage either to the river drainage systems, or, in the case of the eastern Scott Coastal Plain, towards the dune systems fringing the southern edge of the plain. Any lowering of the watertable in these areas would result in increased recharge during the winter, which has the effect of partially offsetting the drawdown effect. Within the limits of the amount of water being rejected as recharge, the system effectively resets to a "full" condition each year, and winter water levels are maintained. The summer drawdown effects are consequently significantly limited by this resetting effect. The inability of the model to simulate the recovery of rejected recharge is a major contributor to over-prediction of drawdowns on the coastal plains.

The interpretation process took account of the local hydrogeology, including the complex relationship between the watertable and surface physical processes, known local hydraulic properties and local water level observations, and the recovery of rejected recharge. The interpreted model results are still expected to be conservative, as recharge through irrigation return water and seepage from the Yarragadee clays have not been quantified for the interpretation and would act to minimise the drawdowns. The interpreted results were used in the assessment of risk to groundwater dependent ecosystems and other water users.

The regional scale model results were examined at the local scale and interpreted to consider:

1. Watertable drawdowns in areas containing potential or known GDEs to allow assessment of the potential environmental, and any associated social impacts.
2. Drawdowns in formations used by existing private and public groundwater users to determine the potential for drawdown interference and loss of well yield by those users.
3. Changes to groundwater discharge to the ocean and potential for seawater intrusion.

4.4.1 Watertable drawdowns

The interpretation of the model was used to create groundwater drawdown maps considered representative of the likely watertable responses to the abstraction in areas with potentially GDEs, under a scenario that accounts for a drier climate than has been experienced over the last century or so (Figure 6 and Figure 7).

The anticipated effect of the preferred wellfield configuration on summer minimum watertable levels after 30 years was determined after the effects of perched watertables, depths to watertables, aquitards and rejected recharge were taken into account (Figure 6). The 30-year drawdowns resulting from the proposal together with estimated future regional groundwater use are also shown (Figure 7). The drawdowns of cumulative use are substantially greater than the Water Corporation only impacts.

Figure 6 Interpreted watertable drawdowns from Water Corporation wellfield alone

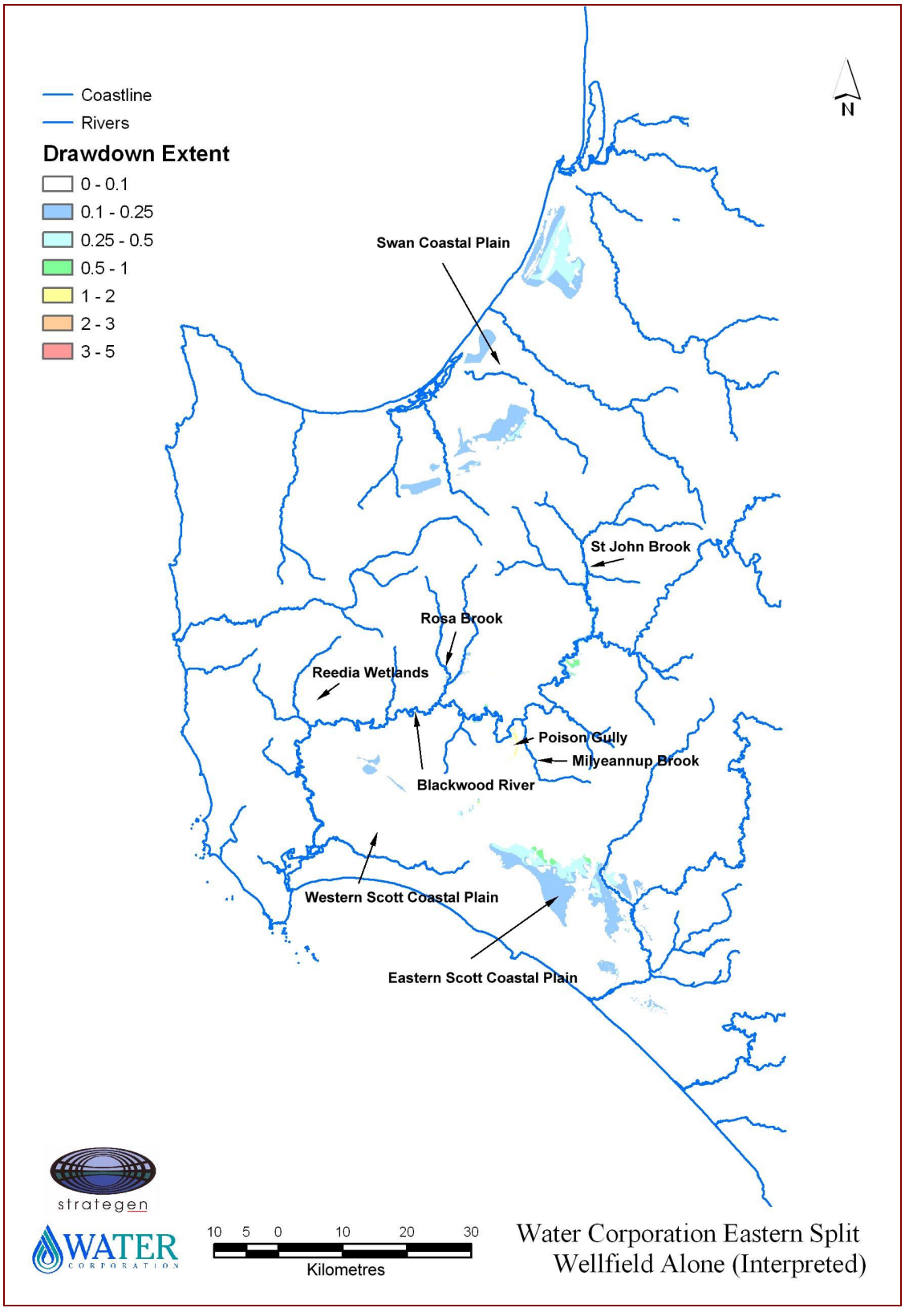
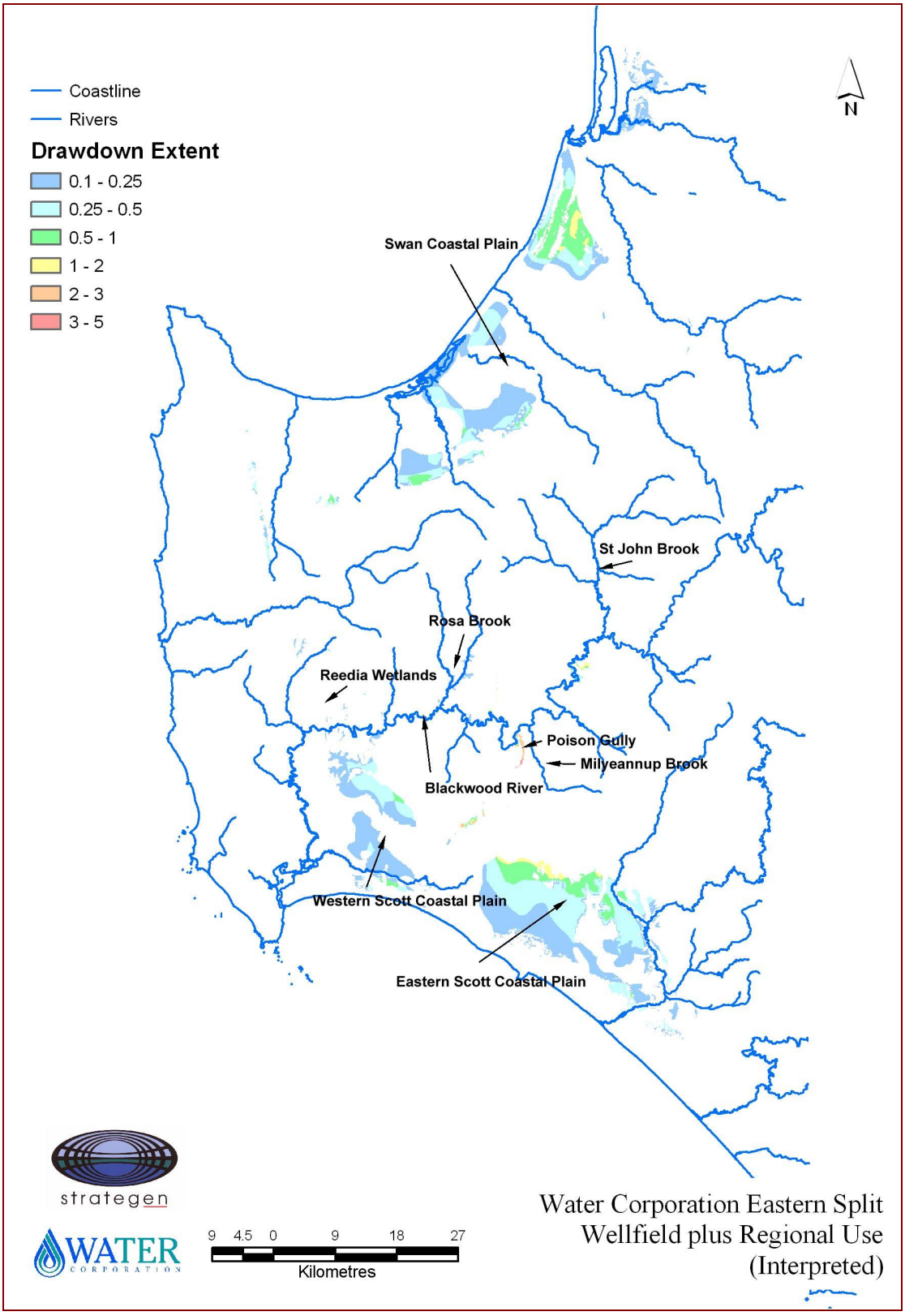


Figure 7 Interpreted watertable drawdowns from Water Corporation wellfield and regional groundwater use



The key areas of potential impact based on the hydrogeological understanding of the Basin and the modelling results are:

- Blackwood River
- Blackwood River tributaries (Poison Gully, Milyeannup Brook, St John Brook and Rosa Brook)
- Scott Coastal Plain
- Swan Coastal Plain.

The environmental consequences of drawdowns in these areas are discussed in Section 6.1. Discussion of impacts on the Scott Coastal Plain is limited to the eastern parts of the plain as the Water Corporation proposal does not affect the western portion. Regional groundwater use is expected to have some effect on the western portion, however, these effects are beyond the scope of this evaluation.

Actual drawdowns may be less than those considered in the evaluation because of the residual conservatism in the interpreted model outputs. The conservative approach was considered appropriate as a basis for decision-making on this project.

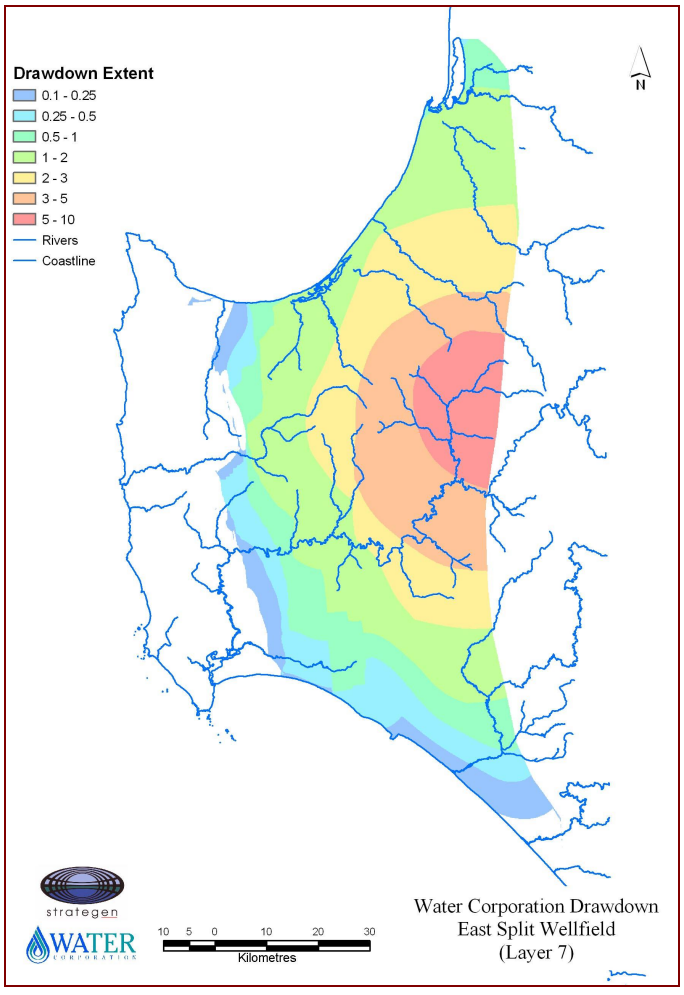
4.4.2 Drawdown interference

Modelled drawdowns in the deeper layer of the Yarragadee Formation (Unit 3), for the Water Corporation proposal alone, would propagate regionally (Figure 8) and may result in drawdown interference with some existing Yarragadee Formation wells. The interference on the Swan Coastal Plain would be 3 m at the most, occurring in the southern portion of the eastern Swan Coastal Plain and diminishing to the north and to the west.

Interference effects with Yarragadee Formation wells on the Scott Coastal Plain would be generally less than one metre, with the area of maximum interference being in the northern portion of the eastern Scott Coastal Plain.

Interference effects on shallow superficial aquifer wells would be less than 1 m anywhere within the region (Figure 6).

Figure 8 Drawdowns in Yarragadee Unit 3 layer from Water Corporation proposal alone

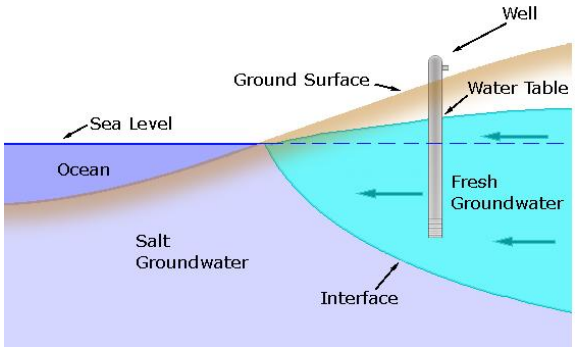


It is anticipated that this extent of drawdown will not cause detrimental impacts to any other groundwater users, provided those users have not constructed their wells to a marginal design that fails to recognise that other users may reasonably utilise the same groundwater resource.

4.4.3 Seawater intrusion

Groundwater discharging into the ocean does so through a freshwater/saltwater interface, the position of which is determined principally by the amount of water flowing towards the ocean. The interface tends to be wedge shaped, with the toe of the saline wedge extending inland (Figure 9). The face of the wedge moves inland in proportion to any reduction in flow.

Figure 9 Diagrammatic representation of freshwater/saltwater interface



From an interpretation of modelled changes in groundwater outflows, the seawater interface in the Yarragadee Formation is expected to move inland by up to 400 m in the Bunbury area in response to both regional and Water Corporation pumping. This movement is expected to be extremely slow and the full movement is likely to occur some considerable time beyond 2033. This will allow considerable time to plan any required modifications to existing wells with potential to be affected.

4.5 PEER REVIEW

The conceptual groundwater model, the numerical computer model and the modelling results were peer reviewed by a panel of independent expert hydrogeologists. The Panel reported that the model is a useful management tool for future allocation of licensed abstractions. The Panel considered the model to be conservative and that drawdowns would be less than projected by the model. The Panel also commented:

> *"Model v.2.0 is unsuitable for determining groundwater-level changes to the accuracy required for determining the impacts of abstraction on groundwater-dependent ecosystems (GDEs). The model can be used to show areas that could be at risk, so that further interpretation can be made and means of overcoming any impacts can be designed."*

This was clearly understood in interpreting the model results to consideration of potential groundwater drawdown impacts on GDEs (Section 4.4).

5. SOCIO-ECONOMIC AND STRATEGIC PRINCIPLES

The proposal was evaluated against the individual objectives of each of the sustainability factors under the suite of principles set out in Table 2. This process resulted in modification of the proposal to minimise adverse impacts, and the development of a range of commitments (Section 9). The modifications and commitments are intended to mitigate adverse effects and enhance positive aspects of the proposal to achieve the sustainability objectives of a net positive benefit for each of the environmental, social and economic accounts. The key aspects of the overall evaluation are set out in the following sections.

5.1 STRATEGIC PRINCIPLES

5.1.1 Government policy

The sustainability objective for the *Government policy* principle is:

The proposal will facilitate the implementation of relevant government policies in a local, regional and State context.

The proposal is demonstrated as being consistent with a range of Government plans and policies, in particular the *State Water Strategy* and *State Sustainability Strategy*. The project specific sustainability principles developed for this proposal are based on the *State Sustainability Strategy*. The proposal is consistent with both the foundation and process principles of the strategy and is an example of the application of these principles in a major public project.

The proposal is demonstrated as providing for regional development in consideration of the Strategic principle of *Improved knowledge and skills* and the Socio-economic principle of *Regional needs*.

Equitable access to public water supply schemes will be maintained through continued implementation of both the Government Policy on uniform tariff policy and the Water Corporation Customer Charter. Equitable access will be enhanced through the preparation and implementation of a South West Public Water Supply Future Plan (Section 5.2.3).

5.1.2 Climate change

The sustainability objective for the *Climate change* principle is:

The current low rainfall period and possibility of future climate change should be taken into account in decision making about the development of the Yarragadee aquifer as a water source.

The groundwater modelling used for the evaluation of impacts (Section 4.3) included consideration of a drying climate, and assumed rainfalls 9% lower than the historical average as the base case. The implications of a further drying climate (an additional 5% and 10% reduction in recharge) have been considered and the key issue is the uncertainty of the climate prognosis and the environmental benchmarks that might be used to assess acceptability of proposals that may cause further change. A framework for assessment of the proposal in the context of the uncertainty of climate change is put forward, that may have wider application as a policy approach.

It is proposed that the response to climate change should:

- be adaptive
- be based on monitoring and research
- recognise that there could be significant change to groundwater dependent ecosystems and associated values from climate change alone
- seek to manage the detected changes induced by the proposal within acceptable parameters.

5.1.3 International and national competitiveness

The sustainability objective for the *International and national competitiveness* principle is:

The proposal will facilitate the competitiveness of local and regional industries in the national and international context.

The proposal is a cost-competitive option to provide water to the IWSS. Extension of the IWSS into the South West will provide the region with access to this low cost and secure water supply, and assist in the development of high-value regional enterprises. It will consequently make a positive contribution to competitiveness of South West industries, and to the State and national economies.

5.1.4 Improved knowledge and skills

The sustainability objective for the *Improved knowledge and skills* principle is:

The proposal will enhance the knowledge of the resource to enable optimal use of the resources by self-suppliers.

This objective is demonstrated as being met through the information provided by the extensive social, economic and environmental investigation program undertaken to support the proposal and its evaluation. The proponent has committed to implementing a South West Yarragadee Sustainability Initiative, intended to further enhance the information base. This initiative will provide information on key social and ecological aspects, and risk areas, to complement the information already made available through the proposal.

South West Yarragadee Sustainability Initiative

The South West Yarragadee Sustainability Initiative will be an element of the proposed adaptive management framework through the following activities:

1. A major biodiversity study of GDEs of the Scott and Swan Coastal Plains, and the Blackwood River area potentially affected by the development, to enhance the baseline against which changes can be assessed.
2. Supporting investigations into the potential for acidification from acid sulphate soils, and potential means of management in areas on the Scott and Swan Coastal plains.
3. Research into the magnitude and possible means of management of irrigation return water.
4. Investigations into the effects of changing land use on water demand, availability and quality.

The initiative will be funded through a capital investment of $2M with the capital and any earned interest made available to the initiative over a period of ten years.

5.2 PROCESS PRINCIPLES

5.2.1 Precautionary principle

The sustainability objective for the *Precautionary principle* is[3]:

Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

In the application of the precautionary principle, decisions should be guided by:

- *a careful evaluation to avoid, where practicable, serious or irreversible damage to the environment*
- *an assessment of the risk-weighted consequences of the options.*

This objective is demonstrated as being satisfied through:

- the gathering of information through the extensive investigation programs undertaken to support the proposal and identification of the potential risk areas
- design and proposed implementation of the proposal to minimise risks
- development of mitigation and enhancement actions, including identified contingency actions, to address identified risks
- commitment to an adaptive management approach based on research, monitoring and stakeholder engagement, to provide material responses to unexpected significant adverse outcomes.

5.2.2 Stakeholder engagement

The sustainability objective for the *Stakeholder engagement* principle is:

The Water Corporation will seek the participation and views of stakeholders and take them into account in the development, construction and operation of the proposal.

This principle is demonstrated as being met through the extensive stakeholder consultation process undertaken to develop the proposal as presented, and the commitments to ongoing engagement during implementation, including commitments under the *Accountability* principle.

5.2.3 Accountability

The sustainability objective for the *Accountability principle* is:

The Water Corporation will report publicly on its sustainability performance and provide public access to information on the proposal.

This principle is demonstrated as being met through the following range of commitments.

[3] The Precautionary principle as adopted is taken directly from the *Environmental Protection Act 1986.*

South West Yarragadee Monitoring Review Group

The proponent commits to forming and resourcing a stakeholder-based South West Yarragadee Monitoring Review Group to independently review the project and provide public advice and recommendations to the Water Corporation and other relevant Government agencies on:

- regular review and advice to the Water Corporation on monitoring programs, monitoring objectives and performance measures for the operation of the proposal
- review and provide public advice to the Water Corporation on monitoring results and provide comment on adaptive management measures
- review any changes to management of groundwater abstraction from the Yarragadee aquifer by the Water Corporation and provide advice on the acceptability of these changes.

The Water Corporation response to the Monitoring Review Group will form part of its annual Sustainability Report to Government.

The proponent also commits to establish a South West Yarragadee Interpretive Centre in the South West to provide information to the community and visitors about development of the aquifer. This centre could be utilised by the Monitoring Review Group as one of several avenues to make its advice public.

South West Public Water Supply Future Planning study

A South West Public Water Supply Future Planning study is proposed as the means of establishing a plan and development program to meet future public water supply needs in the South West. The plan would provide certainty to the South West, and would help to resolve some of the concerns relating to futures foregone, benefit and equity, and accommodating reasonable regional needs for water.

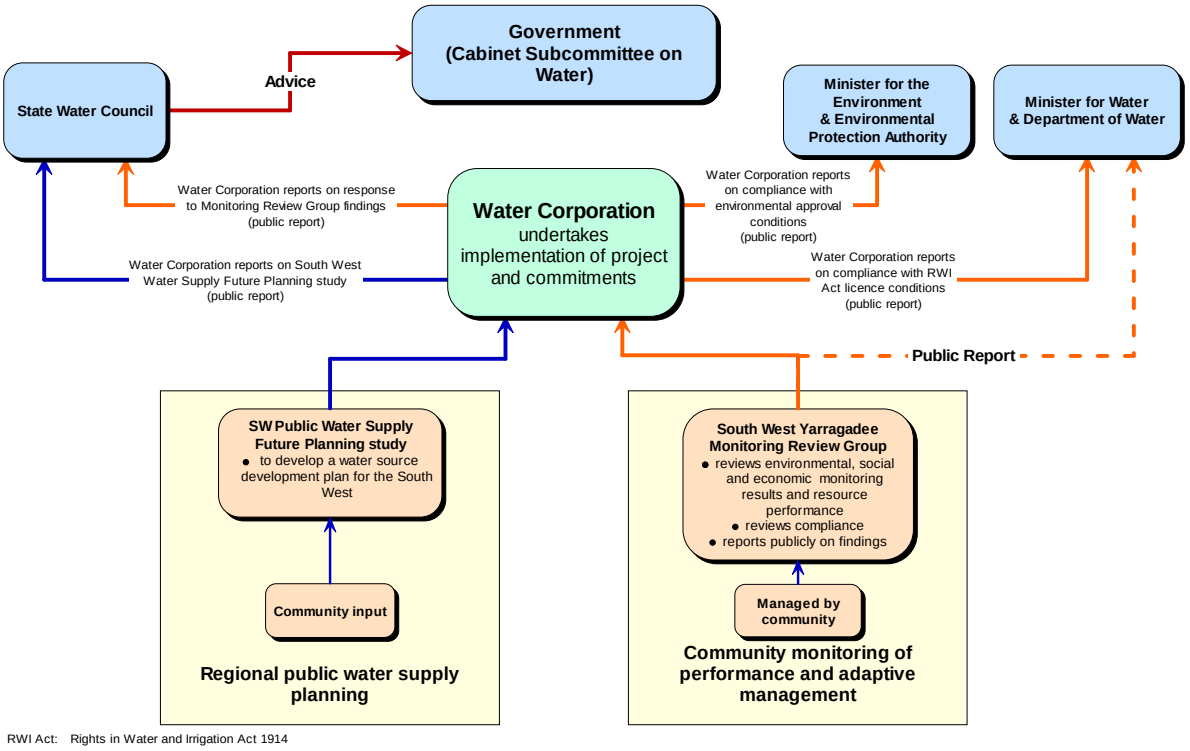
Sustainability Report

The Water Corporation will prepare and publish an annual Sustainability Report outlining:

- compliance with conditions of environmental approval and the water abstraction licence
- assessment of performance against key performance indicators
- implementation of commitments
- summary of environmental and socio-economic monitoring information.

The implementation of the proposal involves a number of organisations with differing roles, responsibilities and processes for reporting to the community and Government (Figure 10).

Figure 10 Proposed roles and responsibilities for the implementation of Water Corporation commitments



5.3 SOCIO-ECONOMIC PRINCIPLES

5.3.1 Long-term economic health

The sustainability objective for the *Long-term economic health* principle is:

The proposal will assist current and future economic growth, and generate government revenue, business development and investment opportunities within IWSS and South West Region.

The proposal meets this objective by providing a cost-competitive water supply source and an integrated extension of the IWSS into the South West. Water will be available from the scheme for high economic value uses within the IWSS and the region.

5.3.2 Public water supply for existing and future generations

The sustainability objective for the *Public water supply for existing and future generations* principle is:

The Water Corporation in conjunction with other water supply authorities will supply water of appropriate quality to meet existing and future public demand in the IWSS and South West Region.

Through extension of the IWSS into the South West Region, the proposal will directly contribute to achievement of this objective. Commitments to support catchment protection will ensure a high quality of supply.

5.3.3 Regional needs

The sustainability objective for the *Regional needs* principle is:

The proposal will be developed such that reasonable regional needs for water, including social, recreational and projected future development needs are not compromised by the proposal.

The proposal provides considerable opportunity for additional water to be made available to the region from the groundwater resources of the Southern Perth Basin through the extension of the IWSS into the area and the increased knowledge of the capacity of the aquifer for water supply. The water available from the Southern Perth Basin is expected to exceed current and medium-term future water demands by a significant margin and the Yarragadee aquifer system will be significantly under-utilised in the short to medium term. Based on current demand projections and expected water availability, any competition between the various demands is not expected to occur for several decades. This provides an opportunity to adaptively develop the resource and learn more about its behaviour under higher levels of abstraction than it is now experiencing. The information gained will be invaluable in making future management decisions about limits on use.

The preferred approach to addressing reasonable regional needs is based on the following sequence of events:

1. 45 GL/yr will be provided to the IWSS servicing the areas north of Harvey in the first instance.
2. As regional public water supply demands grow, regional use of water from the extended IWSS may also contribute to meeting those needs.
3. By 2033, it is expected that a proportion of the 45 GL/yr provided to the extended IWSS from the Yarragadee aquifer will be used locally to meet some of public water supply, or high value needs, of the South West, and only the remaining portion would be transferred out of the region.

Any future competition between the extended IWSS and other regional demands would be addressed on the specific merits and impacts of the competing uses, under the circumstances that apply at the time and in accordance with the reasonable regional needs principles developed as part of this evaluation. This approach will ensure that the opportunities for regional development will be maximised, particularly in terms of job creation, and in a manner that is beneficial to both the State and the South West Region.

5.3.4 Community well being and heritage

The sustainability objective for the *Community well being and heritage* principle is:

The proposal will maintain or improve the quality of life for the Western Australian community

This objective is demonstrated as having been satisfied in that no direct changes to amenity, lifestyle and recreational use in the area will occur as a result of the proposal. No changes to “sense of place” will result from the proposal. A benefit will come from increased community involvement in monitoring and reporting of results, leading to better safeguards of community amenity.

The proponent has undertaken the preliminary infrastructure design to minimise any disturbance to Aboriginal heritage sites, which includes avoiding all sites on the current Department of Indigenous Affairs register, except in the case of linear features such as listed rivers. Further consultation will establish the protocols for future field surveys to identify any sites not currently on the register.

Where possible, opportunities will be provided for Aboriginal people to be employed on aspects of the project.

The Water Corporation will engage in a program of direct dialogue with those affected by the proposal, including landholders on the proposed pipeline route. Compensation for the disturbance of any agricultural land will be negotiated. Construction impacts will be largely minimised through the Water Corporation standard procedures, which include discussion with landholders to plan construction activities to minimise disruption.

The potential benefits of employment and economic activity will be enhanced through the Water Corporation "buy local" policy. The potential impacts on smaller communities from the influx of construction workers will be managed through discussion with the potentially affected shires.

6. ENVIRONMENTAL PRINCIPLES

The sustainability objective for the *Biological and ecological integrity* principle is:

The proposal will result in a net increase in ecological function or biological diversity in the region

The aspects of the proposal that relate to this principle are:

- drawdown impacts from the abstraction on groundwater dependent ecosystems
- footprint of the infrastructure and construction impacts.

6.1 ABSTRACTION EFFECTS

The areas potentially affected by groundwater drawdown from the proposal are:

- the Blackwood River
- Blackwood River tributaries (Poison Gully, Milyeannup Brook, Rosa Brook and St John Brook)
- the Swan and Scott Coastal Plains.

The Reedia wetlands are not expected to be affected, as there is very little hydraulic connection between the Lesueur aquifer that underlies the Reedia wetlands and the Yarragadee aquifer.

Blackwood River

Approximately 10 GL/yr of Yarragadee aquifer groundwater discharges directly into the Blackwood River in the stretch from 25 km southwest of Nannup to Darradup. The drop in pressure in the Yarragadee aquifer caused by the Water Corporation proposal is expected to reduce this discharge.

Impacts on the vegetation along the Blackwood River are not anticipated, as the Blackwood River valley slopes are steep with artesian pressure maintaining the watertable at the valley floor. Most of the potential drawdown occurs in mid – upslope areas with deep watertables (greater than 10 m) where vegetation is unlikely to be groundwater dependent.

The predicted drawdown from the proposal is expected to result in a 6% reduction in the summer baseflow of the Blackwood River in the driest years (those years with no summer surface runoff). The cumulative impact from estimated future regional use and the proposal is expected to result in a 13%

reduction in the minimum summer flows. In most years, there is some summer rainfall in the catchment and the reduction in flow would be substantially less than 10%. The cumulative reduced baseflow will continue to meet all the ecological water requirements defined for the Blackwood River.

The proposal alone would cause a less than 10% increase in salinity during January and February. This change in salinity is not expected to have a significant impact on the ecological values of the already altered Blackwood River. A 13% reduction in groundwater discharge to the Blackwood River (cumulative impact) is expected to cause a 14% increase in the summer salinity of the river during January and February but salinity will still be much lower than during the rest of the year. The significance of the change to salinity in the Blackwood River should also be viewed in the context that the salinity of the Blackwood River is highly variable and expected to double over the next 50 years.

Proposed mitigation includes supplementation of summer flows in the Blackwood River if unexpected and unacceptable impacts occur.

The commitment to support the management of threatening processes within the area will enhance ecological values currently affected or under threat, and enhance biodiversity in the area. The knowledge and data obtained from the proposed biodiversity study and comprehensive monitoring program will improve the natural understanding of the area and provide for adaptive management to ensure the area is cautiously managed into the future, even in the context of climate change.

Blackwood River tributaries

The Yarragadee aquifer discharges directly to Milyeannup Brook and Poison Gully within State Forest. The potential watertable drawdowns after 30 years from the proposal are anticipated to be greatest in these two valleys, with up to 1 – 2 m in Poison Gully and up to 2 – 3 m in Milyeannup Brook. The total predicted watertable drawdown resulting from the proposal together with estimated future regional use in both Poison Gully and Milyeannup Brook after 30 years is up to 3 – 5 m.

In the proposed St John Brook Conservation Park, the total predicted watertable drawdown from the proposal and estimated future regional use upstream of Barrabup Pool after 30 years is 1 – 2 m with most of this drawdown attributable to the proposal. St John Brook is underlain by the Leederville aquifer so this may be an over-prediction of the drawdowns that will occur.

In Rosa Brook within the proposed Blackwood National Park, the drawdowns from the proposal after 30 years are mostly less than 0.25 m and mostly less than 0.50 m from the combined abstractions. These drawdowns are unlikely to result in measurable changes in the valley ecosystem.

The drawdowns from the combined abstractions are predicted to occur at a gradual and steady rate over the 30 years, with total drawdown rates in all areas expected to be less than 0.10 m/yr. The gradual change minimises the potential impact on vegetation as the system has time to adapt.

The area of vegetation in Poison Gully, Milyeannup Brook and St John Brook potentially affected by drawdown to varying degrees, is anticipated to be approximately 177 ha, 52 ha and 700 ha respectively, based on drawdowns and the area of each valley with a less than 10 m depth to watertable. The vegetation within these areas most likely to be affected occurs on the lower slopes of Poison Gully. Milyeannup Brook and St John Brook are more dissected and have heavier soils so both the extent and the amount of change is expected to be substantially less. In these valleys, the range of site vegetation types is expected to be maintained; however, the extent of their occurrence may shift down slope.

Poison Gully, Milyeannup Brook and St John Brook are all perennial streams with a small summer baseflow in their lower reaches that is maintained by groundwater discharge. Poison Gully and Milyeannup Brook are connected directly to the Yarragadee aquifer and there is expected to be a 30% reduction in groundwater discharge to these streams due to both the proposal and other estimated future abstraction in the area.

The length of permanent streamflow in these streams may reduce. The distance of the retreat is likely to be of the order of several hundred metres in Poison Gully from the current position 3500 m upstream from the confluence with the Blackwood River. The source of summer flow in the Milyeannup Brook is likely to retreat downstream by up to 1500 m from the current location, which is 2500 m from the Blackwood River. As the summer flows in St John Brook are already very low, there is potential that the groundwater discharge will cease in the upper section of the brook within the first order stream section.

The potential contraction of the perennial stream length in Milyeannup Brook and Poison Gully will result in a "compression" of the aquatic fauna into the lower reaches. However, these lower reaches are the most diverse and extensive areas of fauna habitat. Milyeannup Brook is a significant habitat for the Priority 4 Balston's pygmy perch.

A contingency of supplementing flows in Milyeannup Brook and/or St John Brook is proposed. The contingency of supplementing flows in Milyeannup Brook would be triggered if hydrological monitoring indicated that the permanent aquatic habitat extent (based on habitat area not stream length) of the Balston's pygmy perch is likely to reduce significantly. In St John Brook, the contingency would be triggered if hydrological monitoring indicates that the permanence of the brook at the start of the second order stream section is at risk.

If supplementation is required, the rates of flow will be designed to mimic natural flows and water quality conditions.

Offsetting the potential impacts on these areas will focus on supporting the management of threatening processes (feral animals, weeds, and dieback) in the area to improve the condition and restore diversity of the ecosystems. There will also be a major biodiversity study in the region including the Blackwood Plateau. This will improve the knowledge available on these ecosystems and enable more informed decision making on their management and adaptive management of the proposal.

Coastal Plains

The Yarragadee Formation underlies the superficial formations in areas of both the Swan and Scott Coastal Plains. Therefore, there are large areas that have the potential to be affected by the proposal. However, the coastal plains are a long way from the wellfield and the potential drawdowns are small at such distances.

Over the Scott Coastal Plain where GDEs may be at risk within the area of potential drawdown from the proposal, the watertable drawdown from the proposal alone after 30 years is expected to be less than 0.25 m. The potentially affected area of the Swan Coastal Plain will experience drawdowns less than 0.5 m after 30 years, with drawdowns being less than 0.25 m to the east of Busselton. The watertable on the coastal plains has high seasonal fluctuations and the water level is expected to recover fully each winter in areas where the watertable is near the surface.

In most areas, there is not expected to be measurable changes to the ecosystem. In the northern part of the eastern Scott Coastal Plain and the Swan Coastal Plain south of Bunbury, there may be some local changes in the composition of site vegetation types. However, these are not expected to affect the conservation status of any flora or fauna species or occurrence of vegetation complexes.

Given the small drawdowns, very low rate of drawdown and the expectation of full recovery of coastal plain watertable levels each year, the risks of exposure of any existing acid sulphate soils are expected to be minimal and temporary.

The total predicted drawdowns on both coastal plains from estimated future regional use and the proposal after 30 years, are more widespread with total drawdowns mostly less than 1 m and small areas of drawdown in the 1 – 2 m range. Estimated future regional abstraction has the potential for significant impact over a substantial area, irrespective of the impact of the proposal, and will require management in its own right.

No drawdown is expected at either Lake Quitjup or Lake Jasper from the proposal; however the cumulative drawdown from the proposal and estimated future regional use is 0.1 – 0.25 m near both these lakes. The water levels in the Vasse Wonnerup Wetlands on the Swan Coastal Plain are connected through the superficial aquifer with the ocean so will not be affected by the proposal.

The ironstone Threatened Ecological Communities (TECs) and the significant Scott (Swi) vegetation complex on the western Scott Coastal Plain are not within the area affected by the proposal. There are three TECs on the Swan Coastal Plain within the area of potential drawdown from the proposal. The predicted drawdown at all sites is less than 0.25 m after 30 years and there is not expected to be a measurable or significant ecological impact at any of these sites.

Proposed offset commitments to reduce threatening processes within these areas will also help protect and restore ecological values currently affected or under threat and enhance biodiversity in the area. The knowledge and data obtained from the proposed Sustainability Initiative and comprehensive monitoring program will improve the natural understanding of the area. This will provide for adaptive management to ensure the area is cautiously managed into the future, particularly in the context of climate change.

6.2 INFRASTRUCTURE IMPACTS

The development footprint for this proposal includes the wellfield, treatment plant, storage tank and the pipeline to join with the Stirling Trunk Main at Harvey (Figure 1). The general location of the infrastructure was decided through a detailed planning process to avoid and minimise environmental impacts, disturbance to landholders and project costs.

The following environmental values were considered as constraints for proposed infrastructure and were considered as follows:

- clearing of native vegetation – the pipeline and treatment plant could not be constructed through a significant area of remnant vegetation unless no viable alternative existed
- wetlands – infrastructure could not be constructed within 50 m of Environmental Protection Policy Lakes or conservation / resource enhancement categorised wetlands unless no viable alternative existed
- TECs and Declared Rare Flora – there was a requirement to avoid areas where TECs or Declared Rare Flora occur

- Aboriginal heritage sites should be avoided wherever possible.

Further to the requirements to avoid the above areas, preference was given to pipeline routes based on the following environmental and social considerations:

- use cleared corridors with the widest current clearing where possible
- minimise the loss of remnant vegetation
- maintain a buffer distance of at least 50 m (absolute constraint), and preferably greater than 200 m between the pipeline and significant wetlands
- minimise impacts on wetlands and waterways
- minimise the disturbance or removal of any structures or plantings that are considered to have value to the local community
- avoid where possible or minimise the disturbance of any European heritage sites
- avoid where possible or minimise the disturbance of any archaeological and ethnographic Aboriginal heritage sites
- minimise long term disturbance to land uses
- minimise the nuisance to residents that may be associated with construction activities such as noise, dust and vibration from machinery
- minimise the chances of encountering areas of high risk of acid sulphate soils
- avoid spreading dieback through construction of the infrastructure.

Pipeline

The indicative pipeline route (subject to detailed studies and landowner consultation) is anticipated to result in:

- clearing of 50 ha of native vegetation (including the wellfield, treatment plant and storage tank) with associated impacts on local terrestrial flora and fauna
- five river crossings with associated impacts on riparian vegetation, flora and habitat
- risk of encountering acid sulphate soils at some locations along the route of the excavation trench.

Some clearing of mostly degraded remnant vegetation will be required on the Swan Coastal Plain along roadsides in vegetation complexes that have less than 10% of their pre-European extent remaining. This may reduce the remaining area of these vegetation complexes by a maximum of 0.06%.

All construction activities will be carried out in summer to minimise the requirements for dewatering. The occurrence of acid sulphate soils along the pipeline route will only be an issue if they occur within 2.5 m of the soil surface in an area where dewatering of the pipeline trench is required. In general, management will consist of lime dosing if and where acid generation occurs. No significant impact is expected as excavation and dewatering activities will be of relatively short duration.

The pipeline route crosses the Capel, Ferguson, Preston, Collie and Brunswick Rivers. These rivers are all registered as Aboriginal heritage sites. The pipeline may need to be installed under or over the rivers without disturbance depending on the outcome of the heritage surveys to be carried out before

construction. If disturbance is unavoidable, an application for permission to disturb sites will be submitted under Section 18 of the *Aboriginal Heritage Act 1972*.

All disturbances at the river crossings will be rehabilitated to ensure bank stabilisation and revegetation of the disturbed area. All crossings will be subject to the approval of the Department of Water.

The Water Corporation has committed (Table 4: Commitment 5a) to avoid the disturbance of TECs, declared rare flora (unless the disturbance is approved under the *Wildlife Conservation Act 1950*) and significant habitat for Threatened or Priority listed fauna.

A flora and fauna survey of the proposed pipeline route will be undertaken before construction. In most cases where Declared Rare or Priority flora is present in the vicinity, the pipeline route will be modified in consultation with CALM to avoid direct impacts, otherwise approval may be sought for disturbance under the *Wildlife Conservation Act 1950*). Habitat trees will also be avoided where possible along the pipeline route.

The nominal pipeline route does not pass through any known TECs. Should the flora survey identify any TECs along the pipeline route, the route will be modified to avoid disturbance. The alignment of the pipeline in agricultural areas will be determined in consultation with local landholders.

The impact of the pipeline has been minimised as far as possible through the selection of a route based on practicable use of existing infrastructure corridors.

Wellfield

The wellfield will be located in State forest around Jarrahwood and within the Nannup Shire and Busselton Shire. There will be ten wells installed at five sites. An additional three sites have been identified as contingency sites for possible use as part of the adaptive management process.

Construction of a well requires a clearing of 80 x 40 m but the maintenance area required is only 20 x 20 m, therefore the unused area will be rehabilitated following construction. The total clearing required for the five well sites will be about 2 ha. Access to the wells will be along existing roads or logging tracks so no clearing will be required for access routes.

Treatment plant and storage tank

The treatment plant will require the clearing of 20 ha of pine plantations in State forest. The storage tank site will require a clearing of approximately 5 ha and is near the treatment plant within native vegetation. A detailed flora survey of all areas to be cleared will be carried out prior to clearing.

The Water Corporation is committed to provide an offset for clearing native vegetation in State Forest through the contribution of land to the conservation estate using a loss/gain ratio of 1:1.5 and the principle of “like for like or better”.

6.3 ENVIRONMENTAL MANAGEMENT PROGRAM

The overall purpose of the Environmental Management Program (EMP) is to describe measures to protect significant environmental features that may be affected by the construction and operation of the proposal. This program covers the following component phases of the project:

- pipeline, wellfield, and treatment plant construction and operation
- groundwater abstraction of 45 GL/yr from the Yarragadee aquifer.

The main objective of the EMP is to ensure that incidents of significant and potentially significant environmental impacts are appropriately managed.

The EMP has been prepared for the purpose of the environmental assessment and approval process. The infrastructure construction related plans contained within the EMP will be further developed to provide detail suitable for use by construction personnel. These more detailed management plans will form a Construction Environmental Management System.

Each component management plan:

- defines EPA objectives and decision-making criteria for the factors it addresses
- describes the potential impacts of the proposal
- describes management measures required to give effect to the environmental commitments and to achieve environmental objectives related to the environmental factor
- provides a description of monitoring and review for meeting environmental commitments and objectives related to the environmental management plans as outlined below
- provides a description of the contingencies for unexpected adverse outcomes.

Most of the plans detail management during the construction phase. Two operational plans detail the management of the groundwater abstraction and treatment plant operation.

6.3.1 Uncertainty

There is some uncertainty inherent in a groundwater abstraction proposal as it is impossible to have a perfect understanding of a below ground dynamic three-dimensional flow system. The uncertainty has been minimised as far as practicable through extensive hydrogeological investigations, modelling and peer review. The residual uncertainty is addressed through an adaptive management approach that incorporates the key elements of extensive monitoring, reporting, stakeholder engagement, a process for determining the need to trigger contingency actions and a hierarchy of contingencies. Specific contingencies have been developed where a low risk of an unacceptable impact has been identified (e.g. change to the flow permanence of Blackwood River tributaries) and a decision making process has been developed to allow other appropriate contingencies to be developed in a timely manner if the need arises. The monitoring program will effectively monitor changes in the system at three levels:

- the pressure in the Yarragadee aquifer will provide information on whether the aquifer is responding to the abstraction as expected and effectively provide an early warning system of unexpected responses *before* they affect the surface
- watertable levels will be monitored (within and outside of potentially affected areas) to observe whether any Yarragadee pressure changes are affecting shallower aquifers

- biological monitoring to observe any unexpected or unusual trends in ecosystem health.

An unexpected change in any one of these levels of monitoring would trigger further investigation and an appropriate management response (Figure 11) as detailed in the Groundwater Abstraction Management Plan.

6.3.2 Groundwater Abstraction Management Plan

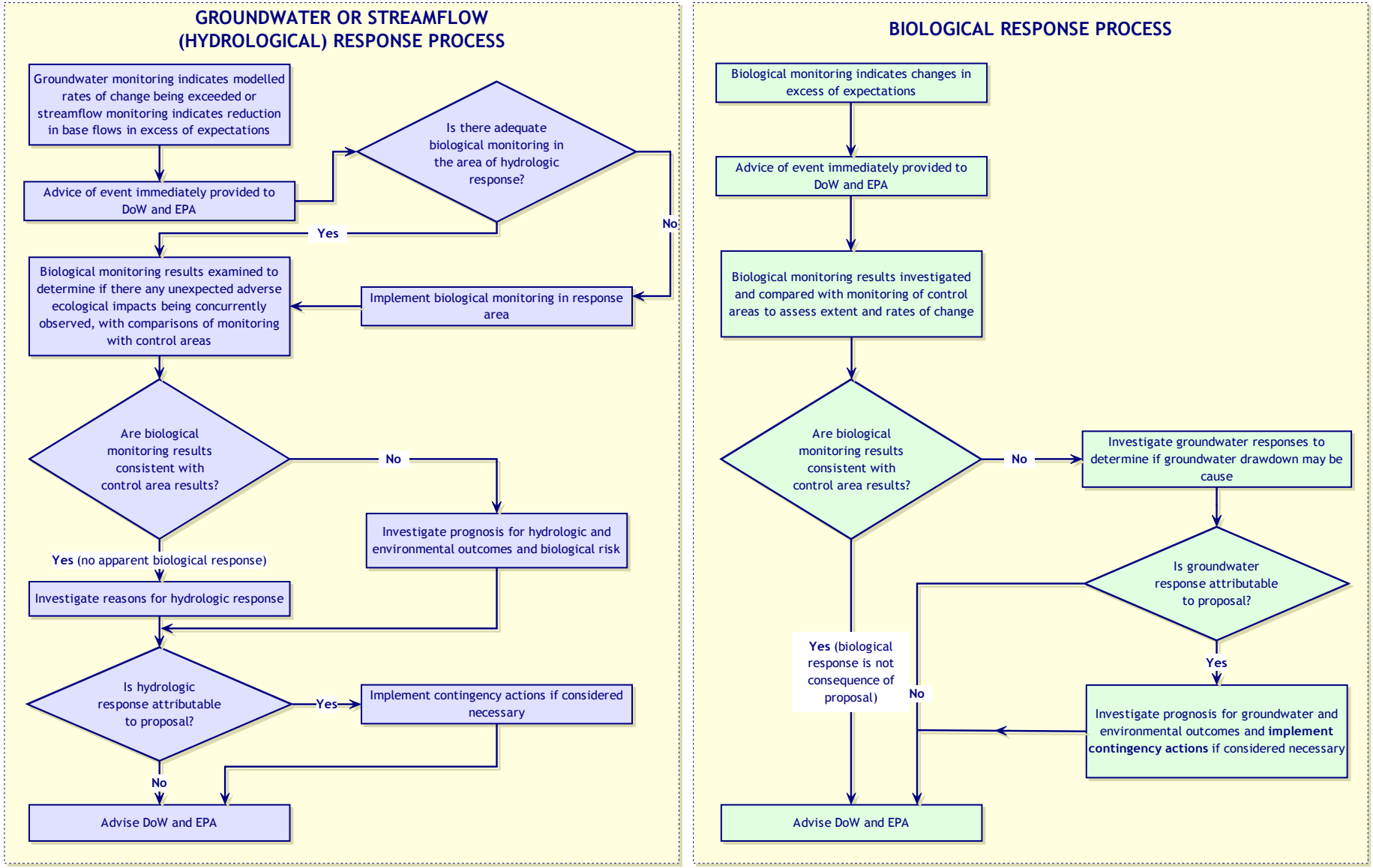
The Groundwater Abstraction Management Plan sets out how implementation of the proposal will be managed through the adaptive management process. Key elements of the adaptive management approach that will be applied in the operation of the South West Yarragadee Water Supply Development are:

1. Management objectives and performance measures will be regularly revisited and revised if necessary, in agreement with the regulatory agencies following consultation with the South West Yarragadee Monitoring Review Group.
2. The system model(s) will be used to explain responses to management actions and help identify gaps and the limits of scientific and other knowledge.
3. The range of possible response choices would be developed and evaluated in terms of the extent to which each choice would be likely to achieve the management objectives and the extent to which it will generate new information or foreclose future choices.
4. Monitoring will focus on significant and detectable indicators of progress toward management objectives. Monitoring will also help distinguish between natural perturbations and perturbations caused by management actions. The proposed South West Yarragadee Monitoring Review Group will be involved in the assessment of monitoring programs and their results.
5. A mechanism(s) for incorporating learning into future decisions.
6. A collaborative structure for stakeholder participation and learning. The Water Corporation intends to achieve meaningful stakeholder involvement that will enable active learning.

The proposed contingencies are hierarchical in order of responding to impacts of increasing severity as follows:

1. Site-specific contingencies. These contingencies include supplementation of flows in the Blackwood River, St John Brook and Milyeannup Brook if unacceptable flow reductions are recorded in any of these systems.
2. Adjustment of the abstraction regime by altering the proportion of water abstracted from the different units of the Yarragadee Formation. If major adjustment of abstraction is required, additional wells will be drilled at identified contingency well sites.
3. Contingencies developed in consultation with the Monitoring Review Group and the regulatory agencies in response to environmental monitoring suggesting unacceptable impacts may occur.
4. Temporary reduction in abstraction rates while further investigations into potentially unacceptable and unexpected occurrences are undertaken.
5. Permanent reduction in abstraction rates where determined appropriate by either the Water and Rivers Commission or the Water Corporation.
6. Cease abstraction and investigate alternative sources.

Figure 11 Flow charts showing action process for responding to hydrological or biological monitoring triggers



7. SUSTAINABILITY CONCLUSIONS

The process of evaluating and modifying the proposal against the environmental, strategic, process, socio-economic and social principles and objectives developed to achieve a sustainable outcome, has resulted in a proposal considered as meeting all objectives and satisfying all the principles.

As a result of groundwater abstraction by the proposal, there will be gradual drawdown that may effect the composition of vegetation complexes in several small areas (Poison Gully, Milyeannup Brook, St John Brook, parts of the eastern Scott Coastal Plain and on the ironstone communities on the eastern Swan Coastal Plain). Some clearing of native vegetation will be necessary, but the infrastructure will be located to ensure the areas cleared are minimised, rehabilitated to the extent possible after allowing for operational requirements, and located in areas avoiding Declared Rare or Priority Flora and fauna. The impact on vegetation is considered insignificant as there will not be any loss of rare vegetation types and the types affected are well represented elsewhere in the region. Impacts on faunal habitat will be limited to small areas. No Threatened or Priority fauna will be adversely affected. The drawdown-generated vegetation changes are expected to be gradual, with down-slope migration of drier environment vegetation types replacing more groundwater dependent vegetation types along some valley floors.

The fundamental approach of the Water Corporation to managing the cumulative drawdown impacts in the potentially affected areas is to take full responsibility for offsetting and management in those areas where the Water Corporation is the major contributor to the drawdown effect. In those areas where the Water Corporation is a minor contributor to drawdowns, involvement will be limited to monitoring and reporting, and only offsetting to the extent of the impacts of the Water Corporation proposal. This effectively means the Water Corporation will be responsible for offsetting all groundwater drawdown impacts on the eastern Blackwood Plateau. The Water Corporation does not propose to take responsibility for managing the drawdown impacts attributable to regional groundwater users on the coastal plains, or on the Blackwood Plateau west of the Busselton Fault.

Figure 12 presents a diagrammatic representation of the relationship between the proposal, the sustainability principles and key commitments and outcomes. Table 3 sets out a summarised view of the evaluation of the proposal with respect to all sustainability factors.

8. DOCUMENT STRUCTURE

The Sustainability Evaluation / Environmental Review and Management Programme (ERMP) is presented in three volumes. Volume 1 describes the proposal, the sustainability evaluation process, the assessment of the proposal outcomes against a range of sustainability principles and rules, consolidated commitments and overall sustainability conclusions. Volume 1 also includes the discussion of the strategic and process principles that are relevant as both context for the proposal, (e.g. Government policy and climate change) and in relation to the proposal itself (e.g. extension of the IWSS into the South West and inclusion of climate change in the modelling).

Volume 2 contains a description of the aquifer hydrogeology and groundwater `modelling, the evaluation against the full range of sustainability factors established through the project scoping process, together with the environmental management program. Volume 3 (Compact Disc) contains the Appendices.

Figure 12 Key sustainability commitments and outcomes

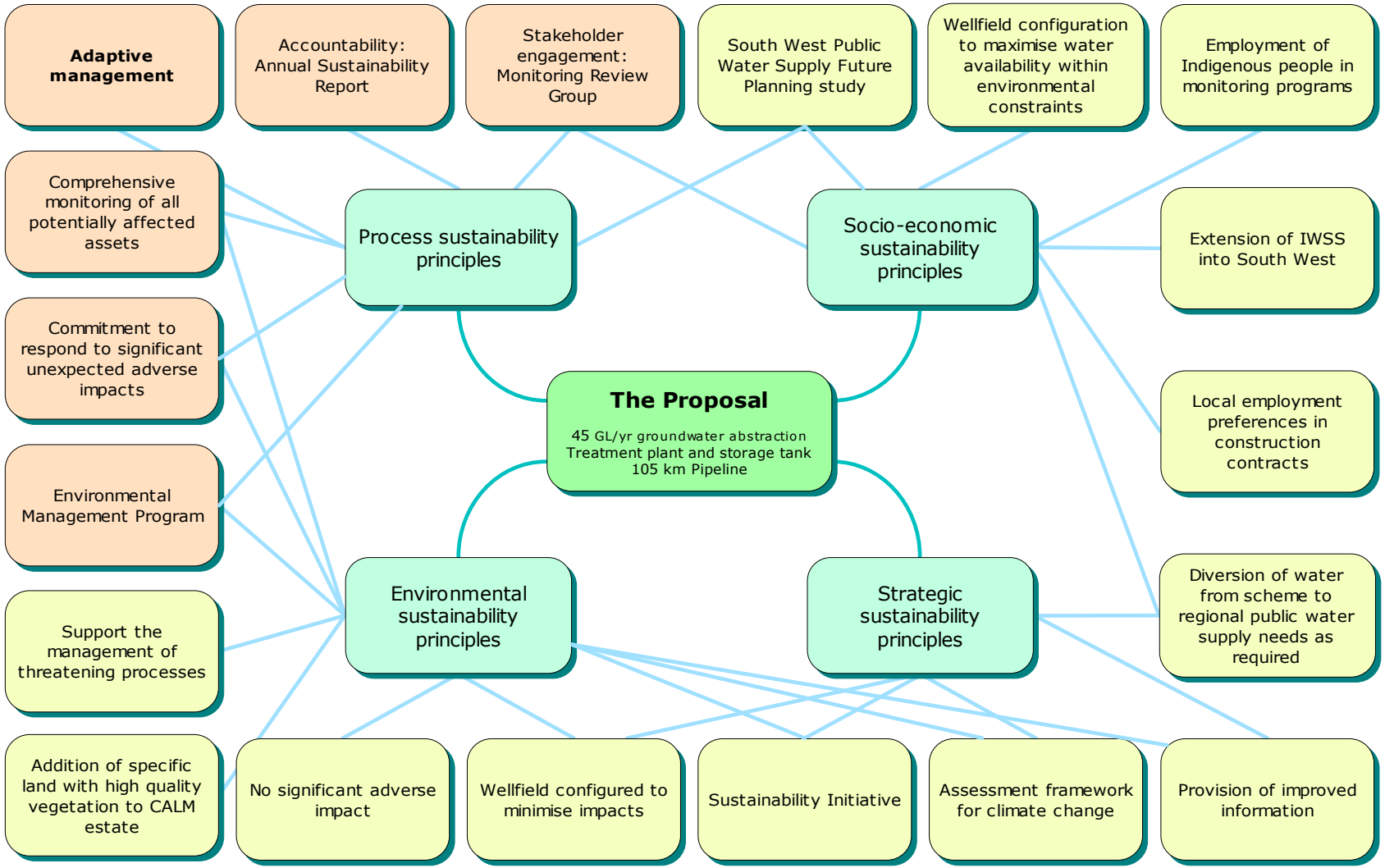


Table 3 Summary of relevant sustainability factors, proposed management and expected outcomes

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
ENVIRONMENTAL PRINCIPLE – Biodiversity and ecological integrity					
Flora and fauna The Water Corporation will seek to achieve a net increase in flora and fauna in the region As a minimum, the proposal will have no adverse impact on flora and fauna in the region **Rare and Priority Flora** (groundwater dependent) The Water Corporation will seek to achieve a net increase in priority and rare flora in the region. As a minimum, the proposal will have no adverse impact on rare and priority flora in the region	Blackwood River	The Blackwood River discharges 940 GL/yr of water to the Hardy Inlet and is extensively used for recreation. The river is affected by salinity with around 30-40 GL/yr of fresh groundwater baseflow that lowers the salinity of the river during summer. Other issues in the river are nutrient levels, erosion, turbidity, pool aggradation and pool anoxia. Five species of freshwater fish (salt tolerant) exist in the River. Riparian vegetation is dominated by Flooded Gums, Peppermints and Paperbarks. Human disturbance has led to high numbers of understorey weeds in some sections.	No significant impact is expected on the terrestrial or riparian environment along the Blackwood River. The predicted drawdown from the Water Corporation proposal only is expected to result in a 6% reduction in the summer baseflow of the Blackwood River in the driest years with an associated less than 10% increase in salinity during January-February These hydrological changes are not expected to have a significant impact on aquatic fauna.	Proposed mitigation includes a commitment to the supplementation of summer flows in the Blackwood River if unexpected and unacceptable impacts are likely to occur.	The predicted change in salinity is not expected to have a significant impact on the ecological values of the already altered Blackwood River. All ecological water requirements will be met even with the predicted change in flows from both the proposal and estimated future regional use. The commitment to support reduction in threatening processes within the area will enhance ecological values currently affected or under threat and improve biodiversity in the area.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Threatened Fauna The Water Corporation will seek to achieve a net increase in the viability of threatened fauna populations in the region As a minimum, the proposal will have no adverse impact on the distribution and viability of threatened fauna populations in the region **Threatened ecological communities (groundwater dependent)** The Water Corporation will seek to achieve a net increase in the viability of threatened ecological communities in the region As a minimum, the proposal will have no adverse impact on the distribution and viability of threatened ecological communities in the region	Poison Gully and Milyeannup Brook	Poison Gully and Milyeannup Brook are permanent tributaries of the Blackwood River that contribute approximately 0.1 GL/month of Yarragadee Formation discharge to the Blackwood River. Milyeannup Brook is a narrow tributary with Jarrah, She-Oak, Marri with Peppermints and dense undergrowth. Poison Gully is more diverse with a greater range of soil and moisture conditions. Five species of endemic freshwater fish were recorded in Milyeannup Brook and four in Poison Gully. Two of these, the mud minnow and Balston's pygmy perch are Priority 4 species. Both species were recorded in Milyeannup Brook and only the mud minnow was recorded in Poison Gully.	The predicted watertable drawdown resulting from the proposal is up to 1-2 m in Poison Gully and up to 2-3 m in Milyeannup Brook after 30 years of pumping. The total predicted watertable drawdown resulting from the proposal together with estimated future regional use in both valleys after 30 years is up to 3-5 m. There are approximately 177 ha of vegetation in Poison Gully and 52 ha of vegetation in Milyeannup Brook that has a depth to watertable of <10m and may be affected by groundwater drawdowns. Within this area, there may be a shift in some vegetation types in the lower slopes of the valleys; however the full range of vegetation types will still exist, only their extents may change. The current spring in Poison Gully may migrate several hundred metres downstream from its current position 3.5 km upstream from the Blackwood River and the permanent stream length of Milyeannup Brook flow may contract from 2.5 km to 1 km from the proposal and estimated future regional use. There is expected to be an approximate 30% reduction in summer baseflow.	An extensive monitoring program will be undertaken in Poison Gully and Milyeannup Brook. If unexpected and unacceptable impacts are likely to occur, contingencies will be implemented. A specific contingency is proposed to supplement flows in Milyeannup Brook if hydrological changes are likely to significantly reduce the habitat available for the Balston's pygmy perch in Milyeannup Brook. If supplementation is required, the rates of flow will be designed to mimic natural flows and water quality conditions.	Watertable drawdowns in Poison Gully are expected within a localised area. Some local changes in vegetation composition are expected. This change in vegetation composition will not significantly affect any significant flora or fauna species or local or regional occurrence of any vegetation complex or site-vegetation types. The composition of some site types may change in a small section of Milyeannup Brook and Poison Gully but there will be no significant loss of keystone species, ecosystem function (including fauna habitat) or resilience. The tributaries are important refugia for significant freshwater fish species but all defined ecological water requirements are predicted to be met and instream ecology is not expected to be significantly affected. Proposed mitigation includes a commitment to the supplementation of summer flows in Milyeannup Brook if the Balston's pygmy perch habitat is substantially affected. Commitments to reduce threatening processes within the area will enhance ecological values currently affected or under threat and improve biodiversity in the area.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Blackwood river and its tributaries The Water Corporation will seek to increase the ecological integrity of the Blackwood River and its tributaries. As a minimum, the proposal will have no significant adverse impact on the Blackwood River and its tributaries	Rosa Brook	Rosa Brook is not perennial and generally flows for six months from early winter to late spring. Localised pools persist in the brook throughout the year The valley is entirely within State Forest and has similar vegetation to Milyeannup Brook; forests and woodlands of Jarrah, Marri and Peppermints with dense undergrowth. No DRF species but three Priority 3 species were recorded in Rosa Brook. Four species of freshwater crayfish and five species of freshwater fish occur including the Priority 4 mud minnow.	The predicted drawdown likely to occur after 30 years as a result of the proposal is between 0.1 m and 0.25 m with small areas of drawdown in the 0.25 – 0.5 m range near Crouch Road. This drawdown over 30 years is not expected to have a measurable effect on vegetation or habitat values. The total predicted watertable drawdown resulting from the proposal together with estimated future regional use in Rosa Brook after 30 years is up to 0.5 m (with a few very small areas with a drawdown in the 0.5 – 1 m range). The Yarragadee Formation does not outcrop at the surface in Rosa Brook and the stream is not permanent so the proposal will have no discernible impact on the hydrology of the stream.	No measurable changes in Rosa Brook are expected. The groundwater levels will be monitored to ensure that the system responds as expected. If unexpected water level changes occur, contingency measures will be developed depending on the extent of impact.	The predicted groundwater drawdowns in Rosa Brook are small and the proposal is likely to result in a "low – no measurable change" impact through most of the potentially affected area within the valley. Any vegetation change that occurs will not affect the conservation status of any significant flora or fauna species or the local or regional occurrence of any vegetation complex. Small changes may occur in some site-vegetation types but regional occurrence will not be significantly affected. Rosa Brook flows will not be affected by the proposal.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Wetlands The Water Corporation will seek to increase the ecological integrity of wetlands in the region. As a minimum, the proposal will have no significant adverse impact on wetlands **Other Groundwater Dependent Ecosystems (GDEs)** The Water Corporation will seek to increase the ecological integrity of other groundwater dependent ecosystems in the region. As a minimum, the proposal will have no significant adverse impact on other groundwater dependent ecosystems	St John Brook	St John Brook is the largest tributary of the Blackwood River and has a number of large permanent pools including Barrabup Pool and Workmans Pool. The brook has a small summer baseflow from the Leederville Formation of approximately 0.3 GL/yr (10 L/s), which is approximately 0.6% of the mean annual flow in the brook. Most of the St John valley is included within proposed conservation reserves and 16% of the St John Brook catchment has been cleared. The vegetation of St John Brook is dominated by open forest with an overstorey of Marri and Jarrah in the valleys and jarrah on the lateritic slopes. Three species of freshwater crayfish and four species of freshwater fish occur in St John Brook including the Priority 4 mud minnow.	The total predicted watertable drawdown resulting from the proposal together with estimated future regional use upstream of Barrabup Pool after 30 years is 1-2 m with most of this drawdown attributable to the proposal. There are approximately 700 ha of vegetation in St John Brook within the general area that may be affected by groundwater drawdowns. Within this area, the lower slopes are most likely to show change, with a small down-slope shift in the vegetation types. The scale of the model and the accuracy of the depth to groundwater contours is not sufficient to refine the area of actual expected impact further, however St John Brook is highly dissected and the lower slopes that may show some change would make up only a small proportion of the 700 ha. Drawdown above (not including) Barrabup Pool is expected to cause a small reduction in summer water levels in permanent pools and reduce summer streamflow. As the summer flows are already very low, there is potential that the groundwater discharge will cease in the upper section of the brook.	An extensive monitoring program will be undertaken in St John Brook. If unexpected and unacceptable impacts are likely to occur, contingency measures will be developed depending on the type and extent of impact. One proposed specific contingency is to supplement flows in St John Brook if hydrological monitoring indicates that the permanence of the stream is at risk. If supplementation is required, the rates of flow will be designed to mimic natural flows and water quality conditions.	The proposal has the potential to cause some groundwater drawdown within a general 700 ha area along St John Brook. There may be an effect on some vegetation on the lower slopes of the valley within this broad area. This will not significantly affect the conservation status of any significant flora or fauna species or the occurrence of any vegetation complex, but may affect the local occurrence of some site-vegetation types in a small section of the brook. Reduction in artesian pressures in the Yarragadee Formation below some sections of the brook also has the potential to reduce summer baseflow from groundwater discharge and pool levels above Barrabup Pool. Barrabup Pool itself and other pools below it are not expected to be affected. A contingency to supplement flows is proposed to ensure that this does not result in an unacceptable impact on the brook.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
	Reedia Wetlands	The Reedia wetlands occur both north and south of the Blackwood River between Hut Pool and Adelaide Brook within the State forest. The wetlands consist of narrow channels of creek-line flow and small permanent pools that are maintained by groundwater flows from the Leederville Formation supported by artesian heads from the underlying Lesueur Sandstone. The Reedia wetlands are named after the Priority 4 Reedia spathacea species that is found within the wetlands. The significant components of the Reedia wetlands are the valley floors with small permanent pools that support a proposed threatened ecological community and a habitat for a critical frog species.	The investigations undertaken by the Water Corporation have shown that groundwater abstraction from the Yarragadee aquifer will not transfer across the Busselton Fault and affect water table levels in the Reedia wetlands. Therefore, the Water Corporation proposal is expected to have no impact on the Reedia Wetlands.	Monitoring will be undertaken to ensure that no unexpected impacts occur on the Reedia Wetlands.	No impact from the Water Corporation proposal is expected on the Reedia Wetlands. Groundwater monitoring will be carried out to ensure that no unexpected changes in water levels occur as a result of the project. This will provide an early warning system if the aquifers do not perform as predicted. The investigations to date and the proposed ongoing hydrological monitoring of the Reedia wetlands will provide increased knowledge of other threats to the wetlands that will help inform management decisions that reduce the risk to the environment and may contribute to a net improvement.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
	Scott Coastal Plain	The Scott Coastal Plain occurs south of the Blackwood Plateau and north of the coastal dunes system. The eastern Scott Coastal Plain is internally draining and characterised by swamps and lakes. The surface geology comprises largely sandy deposits. The D'Entrecasteaux National Park includes a large area of the south eastern Scott Coastal Plain and includes Lake Jasper, Lake Quitjup and the lower parts of Barlee Brook and the Donnelly River. The Scott Coastal Plain is partially cleared for agriculture with large areas of remnant native vegetation. The flora and vegetation on the plain are highly diverse and specialised, and many species have a restricted range. The "Scott River Ironstone Association" vegetation community is listed as Endangered by CALM but the community has not yet been formally listed by the State Minister for Environment and is not listed as a TEC under the EPBC Act.	The watertable drawdowns (based on a 9% reduction in long term rainfall) from the proposal on the eastern Scott Coastal Plain are expected to be mostly less than 0.25 m in the summer minimum after 30 years, with up to 1m drawdowns in small areas in the northern part of the coastal plain. Drawdowns from the proposal combined with future regional use abstractions are expected to be more widespread with drawdowns of up to 1 – 2 m. Drawdowns on the western Scott Coastal Plain are expected to be minor (less than 0.25 m) from the proposal and up to 1 m from the combined abstractions. Drawdowns will occur very gradually over the 30 year period providing the opportunity for groundwater dependent ecosystems to adapt. Lake Jasper and Lake Quitjup are not expected to be affected by drawdowns from the proposal. Most other wetlands on the Scott Coastal Plains are seasonal and will not be affected by a drop in summer minima of water levels. There are 7150 ha of vegetation within the eastern Scott Coastal Plain and 110 ha on the western Scott Coastal Plain where the watertable is likely to be within 10 m of the surface and may potentially be affected by drawdowns from the proposal. No drawdown is expected under the Scott Coastal Plain Ironstone Association. The estimated drawdown in the majority (about 90%) of this area is expected to be 0.25 m or less resulting in a "low – no measurable change" potential impact on groundwater dependent ecosystems. Some small areas (north eastern part of the plain) where drawdown may be as much as 1 m, there may possibly be a "moderate" to "high" potential impact on groundwater ecosystems. Any adverse impact on these systems is likely to be mitigated by soil conditions and the recovery of the watertable during winter where inundation of the landscape occurs. There is not expected to be a measurable change in vegetation (except in small areas where there is potential for changes in site vegetation types in the north eastern part of the plain) given the anticipated full recovery in the watertable each year, soil characteristics and that drawdowns are much smaller than the observed seasonal watertable variation. Similarly, the effect of drawdowns on acid sulphate soils (acid generation) is expected to be minor.	The Water Corporation will develop and implement an extensive biological, hydrological and physical monitoring program for the region including the Scott Coastal Plain to assist in the adaptive management of the proposal. If unexpected and unacceptable impacts are likely to occur, appropriate responses will be developed and submitted to the Monitoring Review Group and the Department of Water for assessment. The Water Corporation is also committed to undertaking a comprehensive biodiversity study (within the proposed Sustainability Initiative) which will include the Scott Coastal Plain and investigate the relationship between ecosystems and groundwater. This study is proposed as a research offset and to assist with the adaptive management of the proposal. The Water Corporation will contribute to a program for the management of threatening processes (weeds, feral animals, etc) in area of conservation significance and areas of potential impact.	Over the majority of the area of potential impact (areas where the watertable is within 10 m and a drawdown is expected) no detectable changes in groundwater dependent ecosystems are anticipated for the Water Corporation proposal. In the northern part of the eastern Scott Coastal Plain there may be gradual local changes to some site-vegetation types but this will not adversely affect fauna habitat or the conservation status of any significant flora or fauna species or occurrence of vegetation complexes. The Scott River Ironstone Association is not expected to be adversely affected. Given the expected small predicted drawdowns and recovery of watertables each year, the effects of acid sulphate soils are expected to be minimal on the Scott Coastal Plain. Similarly, no significant adverse impact on wetland functions is expected. Proposed mitigation commitments to reduce threatening processes within potential areas of impact will help protect and restore ecological values currently affected or under threat and enhance biodiversity in the area. The knowledge and data obtained from the proposed biodiversity study (within the proposed Sustainability Initiative) and comprehensive monitoring program will improve the natural understanding of the area and provide for adaptive management to ensure the area is cautiously managed into the future, particularly in the context of climate change. The proposal combined with estimated future regional abstraction is expected to result in a much greater area and amount of drawdown.

Factor & objectives	Potentially affected area	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
	Swan Coastal Plain	The portion of the Swan Coastal Plain considered in this report is from Busselton to Bunbury. The plain is relatively flat with shallow, highly seasonal watertables and the plain is prone to seasonal flooding and waterlogging. Much of this area has been cleared and drained for agriculture. Remnant vegetation in this area is highly significant and contains several listed TECs. The Vasse–Wonnerup Wetland system (Ramsar wetland) occurs in a linear system along much of this coastline.	The predicted drawdowns in summer watertable minimums from the proposal alone after 30 years are all less than 0.5 m south of Bunbury and less than 0.25 m east of Busselton. Combined drawdowns are mostly less than 1 m with small areas of drawdown in the 1 – 2 m range. A total of 2270 ha of remnant vegetation on the Swan Coastal Plain is within areas of potential drawdown from the proposal where the watertable is within 10 m of the surface. Predicted proposal drawdowns of 0.25 m in this area may possibly result in "low" potential impact where there is likely to be "no measurable change" in ecological processes and species composition and abundance. Therefore, the proposal is not expected to have any significant impact on the vegetation of the Swan Coastal Plain in these areas. "Moderate – small change" in groundwater dependent ecosystems may possibly occur in small areas where drawdown may be up to 0.5 m after 30 years (south of Bunbury). Given the full recovery of the watertable each winter, the natural seasonal variation is greater than predicted drawdowns, no significant adverse impact on vegetation is anticipated. Three TECs occur in areas where the predicted drawdown from the proposal is less than 0.25 m after 30 years. There is not expected to be a measurable or significant adverse impact at any of these sites given the full recovery of the watertable in winter, presence of clay pans and ironstones and moisture holding capacity of soils in these areas. The potential for drawdown to adversely affect acid sulphate soil (acid generation) are expected to be minimal as the drawdowns are small and full recovery of water level is expected each year.	As for the Scott Coastal Plain.	The proposal alone is not expected to have any significant impact on the vegetation or TECs of the Swan Coastal Plain. The risk of effects of drawdown on acid sulphate soils (acid generation) is expected to be minimal. No impact is expected on the Vasse–Wonnerup Wetland system from groundwater abstraction as the water levels are connected to the ocean. The proposal will result in no significant impact on the seasonal wetlands of the Swan Coastal Plain, as surface water levels will recover fully each winter. Knowledge and data obtained from the proposed South West Yarragadee Sustainability Initiative biodiversity study and comprehensive monitoring program will improve the understanding of the area and provide for adaptive management to ensure cautious management into the future, particularly in the context of climate change.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
ENVIRONMENTAL PRINCIPLE – Biodiversity and ecological integrity					
Development footprint	The construction of the proposal will cause minimal permanent disturbance	The development footprint for this proposal includes the wellfield, treatment plant, storage tank and the pipeline to join with the Stirling Trunk Main at Harvey. The pipeline route crosses the Capel, Ferguson, Preston, Collie and Brunswick Rivers.	Clearing of 50 ha of native vegetation. Clearing of pine plantation for the treatment plant. Five river crossings that are Aboriginal heritage sites. Dewatering may be required in some areas for installation of the buried pipeline. This introduces the risk of temporary exposure of acid sulphate soils.	A flora and fauna survey will be undertaken of all areas to be cleared. The method of installing the pipeline across the rivers will be determined through the heritage survey. All crossings will be stabilised and rehabilitated to minimise erosion and water quality impacts. The Water Corporation proposes to provide an offset for clearing through the contribution of land to the conservation estate using a loss/gain ratio of 1:1.5 and the principle of “like for like or better”.	The impacts of the proposal infrastructure have been minimised through avoiding areas of environmental significance as far as possible. The 50 ha of vegetation clearing required will be offset through land contribution to the conservation estate.
ENVIRONMENTAL PRINCIPLE – Energy efficiency					
Greenhouse gas emissions	The proposal will be designed and operated according to Australia best practice regarding greenhouse gas emissions	Groundwater will be extracted from each well and pumped to a treatment plant and holding tank for treatment. The treated water will then be gravity fed from the holding tank to Harvey and on to Perth for use. Power will be required for each well and at the treatment plant, and will be sourced from the South West Interconnected System.	Energy consumption for pumping and operation of the treatment plant will amount to approximately 4.6 MW. The increase in emissions is estimated to be 41 000 t/yr CO_2e based on an assumed indicative carbon intensity of the Western Power South West Integrated System of 1032 kg CO_2/MWhr.	The Corporation has set an aspirational target of being carbon-neutral by 2030. As part of the GHG management portfolio approach, a Greenhouse Emissions Reduction Plan will be developed to manage GHG emissions consistent with the Water Corporation purpose of “sustainable management of water services to make Western Australia a great place to live”.	Implementation of the proposal will indirectly contribute to increased energy use in Western Australia. The Corporation will utilise best practice in the design and operation of the infrastructure to minimise energy use and will pursue its carbon neutral policy with the expected longer-term outcome of no increase in greenhouse gas emissions.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
SOCIO-ECONOMIC PRINCIPLE – Long-term economic health					
Economic growth	The proposal will facilitate economic growth in the IWSS and South West regions.	Communities with a diversity of economic enterprises tend to be more stable and less subject to economic cycles. They offer a wider range of employment opportunities leading to a more diverse business culture and richer society. This diversity maintains population levels and reduces outward migration. It may even attract inward migration. Approximately 36 GL/yr is currently drawn from this aquifer to service many of the town supplies as well as self-supplied enterprises, including agriculture.	Development of the proposed wellfield and allocation of 45 GL/yr to the Water Corporation does not preclude future use by the local water boards and other private users. The transfer pipeline brings a substantial source into the system and transports it across the region. This will facilitate local access rather than inhibit it for anyone seeking a public water supply of good quality water. Improved access to water will encourage business development, economic growth and economic diversity.	The Water Corporation has a responsibility to supply water to all customers on terms agreed by the Government. The Water Corporation commits to making water available from the new infrastructure to any consumer prepared to enter into the standard access arrangements that apply to water users in the State. New customers in the region will be eligible to apply for access to the proposed pipeline on the standard terms.	The proposal will contribute to the maximisation of economic output for the State. The proposal will enhance economic diversity and provide opportunities for economic growth through increased business activity in the South West region and areas served by the IWSS.
Economic diversity	The proposal will enhance economic diversity in the IWSS and South West	As above	As above	As above	As above
Business and industry development	The proposal will provide opportunities for increased business activity	As above	As above	As above	As above
Economic efficiency	The proposal will provide the most cost-effective water supply source for the State.	Economic (allocative) efficiency relates to maximising the economic output by selection of the most efficient water supply option.	The South West Yarragadee water development is the most cost effective approach to meet the forecast need of 45 GL/yr within a practically achievable timeframe. Public water supply is one of the highest value water uses, which maximises the economic output from the resource.	As above	The proposal will provide cost-effective water supplies to those communities serviced by the IWSS.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
SOCIO-ECONOMIC PRINCIPLE – Public water supply					
Water use efficiency	The Water Corporation will encourage the efficient usage of water.	The State Water Strategy requires efficiency targets as a condition of water allocation licences. The Water Corporation has implemented several measures to encourage the efficient use of water including: • Rebate Scheme for water efficient items and practices • Higher prices for high water consumers • Education program.	The proposal will meet increasing demand in the IWSS that is due to expansion of the system and population growth. The proposal will not affect the Water Corporation commitment to reducing per capita water use.	The Government has set a target of reducing per capita water use from the current unrestricted level of 180 kL/person/yr to 155 kL/person/yr by 2012. The Water Corporation has committed to the achievement of that strategic objective.	Increasing efficiency in water use in the IWSS through progressive implementation of a demand management program.
Existing and future needs	The proposal will contribute to meeting the existing and forecasted demand for public water supply in the IWSS and the South West under a range of possible future climate scenarios. Water will be available to meet reasonable regional public water supply needs.	The Water Corporation supplies water to most South West towns with the exception of Busselton and Bunbury, which are supplied by separate independent statutory water boards. Harvey, Waroona, Binningup, Myalup and Hamel are already connected to and supplied from the IWSS.	As a result of the internal sustainability evaluation process, the proposal to abstract water from the South West Yarragadee aquifer for the IWSS has developed into a plan to extend the IWSS into the South West region. The proposal will contribute directly to achievement of the public water supply sustainability objective of meeting existing and forecasted demand for public water supply in the IWSS through extension of the IWSS into the region.	The proposed South West Public Water Supply Future Planning study will develop a plan for future public water supply needs in the South West and how they will be met. The plan would provide certainty to the South West, and would help to resolve some of the concerns associated with futures foregone, benefit and equity, and accommodating reasonable regional needs.	The proposal will: • provide a major increase in the supply capability and reliability of the IWSS • provide major infrastructure to support the development of high value economic development in the region through the provision of an integrated public water supply system • result in a comprehensive plan to provide for the future development of regional public water supplies.
South West town supplies	This proposal will increase supply security for South West towns	As above	As above	As above	As above

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Quality of supply	To supply high quality water to consumers	Through its Customer Charter the Water Corporation has committed to provide the community with water that is safe to drink and that complies with directions on drinking water quality made by the Minister for Health.	The South West Yarragadee aquifer is of a quality highly suited for public drinking water supplies. The water is well within guideline values for all constituents, with the exception of iron, which will need to be treated for removal. The Yarragadee aquifer occurs at depth and is confined over most of its area by overlying formations. Land use over the majority of the recharge zone is State forest. This results in a water source with a high degree of protection against potentially contaminating activities that may be carried out on the land surface.	The proposal for development of the South West Yarragadee aquifer includes a filtration based treatment plant. The water will also be chlorinated to remove any pathogens that may enter the water after pumping from the aquifer, and fluoridated in accordance with Government policy. The Water Corporation commits to working with the relevant agencies to arrange declaration of a public water supply catchment area over the relevant portions of the Yarragadee aquifer recharge zones.	The outcome of use of the Yarragadee aquifer as proposed, is expected to be a high quality water supply suitable for use as a public water supply with minimal treatment. The administration of catchment protection under the *Country Areas Water Supply Act 1947* will assist in ensuring the quality of water is maintained for the future.
Drinking water source protection	The Water Corporation will work with the Water and Rivers Commission, Conservation Commission and CALM to protect recharge areas.	As above	As above	As above	As above

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
SOCIO-ECONOMIC PRINCIPLE – Regional needs					
Regional needs for private water supplies	The proposal will be developed such that reasonable regional needs for water, including social, recreational and projected future development needs are not compromised by the proposal.	The State Water Strategy requires that all reasonable regional needs for water, including social, recreational, projected future development and environmental water provisions will be satisfied before transfers can take place. The State Water Strategy also indicates that the South West Yarragadee source should be developed "for the benefit of communities in the South West and those serviced by the Integrated Water Supply Scheme".	While the source is being investigated at this time to meet strong growth in the existing IWSS, once connected these new assets would also be available to deliver water to high value uses in the South West. Based on current information, it is not anticipated that competition between the proposal and regional needs will occur in the near future and may be up to several decades away. However, it is apparent that expansion of usage in localised areas of the Scott and Swan Coastal Plains may be limited by environmental constraints, even in the absence of the IWSS abstraction.	The Water Corporation proposes to monitor the trends in water usage from the Yarragadee aquifer and potential future reasonable regional needs for water from this aquifer and report to Government.	The proposal is not anticipated to significantly constrain water availability from the Yarragadee aquifer to meet reasonable regional needs. The proposal has the potential to enhance overall water availability from the aquifer
Impact on current key water users	The Water Corporation will seek to understand and articulate the impact of the proposal on current key water users, to ensure that existing water users are recognised and protected from unreasonable impact.	The requirements of the RWI Act are that existing water users are recognised and protected from unreasonable impact.	The Water Corporation proposal has been deliberately located in the State forest area of the Blackwood Plateau to minimise impact on water availability to other users, and to maximise overall water availability from the resource. The proposal will not result in any reduction in water availability to existing users in the region, in terms of existing water allocations and levels of use. However, there is some potential for drawdown interference or seawater intrusion.	The freshwater/saltwater interface will be monitored to ensure that appropriate planning can be in place if saltwater intrusion is likely to occur. The Water Corporation has committed to directly make good any impacts of seawater intrusion on public water supply wells (unless such impacts can be clearly attributable to abstraction by a third party).	The proposal will not result in any reduction in water availability to existing users in the region, in terms of existing water allocations and levels of use. Any impact due to seawater intrusion will be mitigated.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
SOCIO-ECONOMIC PRINCIPLE – Community well being and heritage					
Lifestyle, amenity and recreational use and access	The Water Corporation will determine, through community consultation, whether community members anticipate changes to lifestyle, amenity, or recreational use and access as a result of the proposal, to ensure that negative impacts do not occur from this project and to explore potential positive outcomes.	The dominant social values of the Blackwood Plateau and its surrounds are: • Aboriginal sites of cultural significance (dealt with under Indigenous issues factor) • historic features and cultural sites of early settlement (dealt with under Sense of place factor) • tourism and recreation values • areas of high scenic quality. Collectively these contribute to a strong "sense of place", and the latter two particularly relate to lifestyle, amenity, and recreational use and access.	All communities included in the scoping phase of the social impact assessment study were concerned about potential changes to their enjoyment of the area as a result of the proposal. Concerns related to potential changes to the environment, especially the Blackwood River. No significant impact is expected on the environment of the Blackwood Plateau. There will be a small reduction in summer baseflow of the Blackwood River. This change is minor and is not expected to affect the social values of enjoyment or amenity in the river.	The Water Corporation proposes to establish a South West Yarragadee Monitoring Review Group composed of people from the South West to participate in the assessment of monitoring programs.	No changes to amenity, lifestyle and recreational use in the area will occur. The benefit will come from increased community involvement in monitoring and reporting of results, leading to better safeguards of community amenity.
Direct and indirect job creation	The proposal will create employment opportunities	The project would create employment directly in the building and maintenance of the infrastructure. Reliable water supply would also stimulate economic growth and industry with indirect benefits for employment.	Job creation both in the South West and the IWSS regions	Local employment preferences in construction contracts in accordance with Water Corporation contract and employment policy and practice. Employment of Indigenous people in monitoring programs in accordance with the Water Corporation Involvement and Indigenous Employment Opportunities Policy	Some employment opportunities through direct involvement in the project construction and operation. Increased regional job creation potential through provision of integrated water supply to support high value economic development with associated employment opportunities.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Sense of place	The Water Corporation will determine, through community consultation, whether community members with strong attachments to places and heritage values anticipate changes to those places and values as a result of the proposal, to ensure that negative impacts do not occur from this project and to explore potential positive outcomes.	Landscapes, people, and cultural or environmental 'icons' (such as the Blackwood River or a National Park) can contribute to 'sense of place'.	The South West communities expressed concerns related to potential changes to the environment. Sense of place in the South West is strongly linked to the Blackwood River. As the changes expected in the Blackwood River are minor, they are not expected to have a significant impact on sense of place.	The Water Corporation proposes to establish a South West Yarragadee Monitoring Review Group composed of people from the South West to participate in the assessment of monitoring programs. This will allow the community to be involved in decision making about the project and its impact on sense of place.	No change in the sense of place values of the South West is expected to occur.
Indigenous communities	The Water Corporation will undertake to protect and avoid disturbance of Aboriginal heritage sites. The Corporation will explore potential positive outcomes for and with the Indigenous communities.	The Blackwood River retains significant heritage and cultural value for the Aboriginal community. There are numerous sites near the Blackwood River on the Department of Indigenous Affairs (DIA) Register of Aboriginal Sites. This includes sites such as the Hardy Inlet (archaeological deposit, camp), Blackwood River Ochre Deposit, Sues Bridge (meeting place, camp, hunting place), Blackwood Riverbank (mythological), and Barrabup Pool (mythological)), as well as the Blackwood River itself.	Some heritage sites may be affected by the proposal. The implications of these effects need to be discussed with the Indigenous communities, and will be the subject of a separate extensive consultation process that will be reported separately. The Water Corporation will discuss opportunities for employment of Aboriginal people on aspects of the project with representative groups.	Monitoring, management and reporting of impacts on heritage sites will be undertaken within the requirements of the AH Act.	The Water Corporation has undertaken the preliminary infrastructure design to minimise any disturbance to Aboriginal heritage sites, which includes avoiding all sites on the current Department of Indigenous Affairs register, except in the case of linear features such as listed rivers. Further consultation will establish the protocols for further field surveys to identify any sites not currently on the register. Where possible, opportunities will be provided for Aboriginal people to be employed on aspects of the project.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Development footprint	The construction and maintenance of infrastructure will cause minimal permanent disturbance to the community	The final pipeline alignment through agricultural land is yet to be determined. A notional route has been identified but an intensive engagement process with potentially affected landholders will need to be undertaken.	The wellfield and treatment plant are not near residences and are unlikely to cause an impact. Impacts on individual landholders whose land is on the pipeline route. Impacts include disturbance to summer cropping, access, dust, noise, increased traffic on site, and the effects of a work team of up to 20 people on site.	Access to private land and appropriate compensation will be negotiated with each landholder before commencement of construction.	The outcome will be positive overall, but may be negative in the short term for farmers whose properties are along the pipeline route. The potential benefits of employment and economic activity will be enhanced through the Corporation "buy local" policy.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
STRATEGIC PRINCIPLE – Government policy					
Equitable access to water	The Water Corporation will ensure fair and equitable access to water for domestic use for all Water Corporation customers.	Water is a shared resource that should be available to all through equitable distribution. To ensure this, the cost of reasonable domestic water requirements should be affordable to all.	The Government uniform pricing policy will ensure that there is equity in the water supply costs. The Water Corporation commitment to prepare a South West Public Water Supply Future Plan would facilitate connection of centres to the IWSS or directly to the Yarragadee aquifer.	Through the South West Public Water Supply Future Planning Study, the Water Corporation will determine the future public water demand in those towns and centres in the South West that may be able to connect to the IWSS or be directly supplied from other sources.	Equitable access to public water supply schemes will be maintained through continued implementation of both Government Policy on uniform tariff policy and Water Corporation Customer Charter. Equitable access will be enhanced through the preparation and implementation of the South West Public Water Supply Future Plan.
Government plans	The proposal will be consistent with the following Government agency plans and policies where they are appropriate and congruent: • Environmental protection • Regional development • Forest management • Regional planning • Allocation planning and licensing	The State Water Strategy makes specific reference to development of the South West Yarragadee resource "for the benefit of communities in the South West and those served by the Integrated Water Supply Scheme". The State Sustainability Strategy (Government of Western Australia 2003b) indicated that the next new major source for meeting future water supply needs for Perth should be subject to a sustainability assessment. The South West Yarragadee project is being subjected to such an assessment, in compliance with the strategy.	The development of this proposal has identified a range of gaps in Government policies and proposed ways of addressing those gaps.	Two key policies that the proposal draws from are the State Water Strategy and the State Sustainability Strategy. The project specific sustainability principles developed for this proposal are based on the State Sustainability Strategy. The proposal is consistent with both the foundation and process principles of the strategy, and is an example of how these principles have been applied in a major public project	The proposal will comply with relevant Government plans and policies. Proposals to address policy gaps will enhance the development of Government policy to facilitate the consideration of this proposal and proposals for groundwater abstraction in other areas of the State.
Regional development	The proposal will provide opportunities for regional development	As for *Regional needs* factor and *Business development* factor.	-	-	-

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
STRATEGIC PRINCIPLE – Climate change					
Climate change	Determine the impact of likely climate change scenarios on the sustainability of the proposal.	Winter rainfall in the South-West of Western Australia has decreased substantially since the mid-20th century, with a series of years of lower than average rainfall since the mid-1970s. The decrease in rainfall appears to be partly the result of changes in large-scale global atmospheric circulation associated with an enhanced greenhouse effect.	Climate change will have an impact on recharge to the Yarragadee aquifer, which may result in changes to the watertable in areas where there are groundwater dependent ecosystems. The change in the watertable may, in time, induce changes within that system. Under the scenario where climate in the south-west of Western Australia will become drier, the proposal may cause a further lowering of the watertable in areas where the drawdowns in the Yarragadee aquifer are transmitted to the watertable.	The issue of climate change has been recognised throughout the proposal development and a 9% reduction in the long-term rainfall average has been included in the base modelling scenario. The Water Corporation will conduct a major biodiversity study of the groundwater dependent ecosystems of the Scott and Swan Coastal plains and the Blackwood River area that will potentially be affected by the proposal, and other selected areas not affected, to establish a baseline against which climate-and proposal-induced changes may be assessed. The acceptability of the development impacts in the context of climate change will be judged against a set of defined principles.	The proposed key principles for determining the acceptability of change induced by the proposal in the context of climate change, and the proposed adaptive management framework, will ensure that the effects of climate will be comprehensively considered in the environmental management of the proposal.
STRATEGIC PRINCIPLE – International and national competitiveness of water users					
Cost of water	The proposal will facilitate the competitiveness of local and regional industries in the national and international context.	The cost of the various source options is an important consideration in progressively developing the water sources that form the basis of the IWSS as it expands to meet growing demand, and to provide higher levels of security. Overall, the IWSS has been built up within a program primarily based on developing the viable and environmentally acceptable sources in order of cost.	The South West Yarragadee aquifer is the most economical large scale source of water available to the IWSS in the required timeframe. Preferentially developing lower cost water sources for the IWSS maintains the lowest possible water pricing to customers. This in turn supports the national and international competitiveness of water users taking water from the system.	The Water Corporation will continue to execute all components of its Security Through Diversity strategy and update its source development plan based on the latest information available. The Water Corporation will undertake a review of public water supply planning in the South West that examines expected growth in the need for public water supplies and the potential options for meeting those demands.	A rational planning base for the future development of public water supplies that will support the development of high-value regional enterprises and, consequently, the competitive contribution of the region to the State and national economies.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
STRATEGIC PRINCIPLE – Improved knowledge and skills					
Environmental risk	Reduce environmental risk by Improving the scientific certainty of the South West Yarragadee characteristics and the ecosystems that it interacts with.	As for the *Precautionary principle.*	–	–	–
Supply security	Increase supply security by improving the scientific basis for decision making and planning regarding the use of the South West Yarragadee as a water source.	The groundwater investigation program undertaken to support this proposal is one of the largest such programs undertaken in Western Australia. Approximately $12 million has been expended since 2002 in improving our knowledge of the groundwater resources of the region and their relationships with environmental and social values.	The increased knowledge from the proposal will assist in maximising water availability from the Southern Perth Basin. The model developed has been made available to the Department of Water for use in the management of water resources in the region. This should reduce the amount of information required to be supplied by applicants for water licences.	The Water Corporation is proposing to implement a South West Yarragadee Sustainability Initiative, intended to enhance the information base to provide for maximisation of water availability in the region. This initiative will provide information on key social and ecological aspects, and risk areas, to complement the information already made available through the proposal and monitoring programs.	Information on the groundwater resource, its hydrogeology, environmental dependencies and social values will assist in maximising water availability from the Southern Perth Basin. This information will be enhanced through the proposed Sustainability Initiative.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
PROCESS PRINCIPLE – Precautionary principle					
Precautionary approach	Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the Precautionary principle, decisions should be guided by: • a careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • an assessment of the risk-weighted consequences of the options. This definition is taken directly from the EP Act.	The nature of groundwater is such that there is always an element of uncertainty when making decisions about water availability, and predicting the drawdown impacts of particular developments. Under these circumstances the options are: to make conservative decisions that limit the stress and allow a knowledge base to be developed as the stress is progressively allowed to increase under monitored conditions or, where the potential benefits of the proposal might be high, to adopt an approach that addresses risk and uncertainty through adaptive management and contingencies.	The Precautionary principle has been applied in this proposal through improving the knowledge of the resource, risk assessment, design and implementation of the proposal to minimise risk, mitigation, adaptive management and contingencies.	The project will be managed through an adaptive management process that consists of: • management objectives and performance measures • management response choices • monitoring and evaluation of outcomes • feedback of new information into the decision making process • stakeholder engagement, specifically through the Monitoring Review Group. The South West Yarragadee Sustainability Initiative is a key element of the proposed adaptive management framework for improving the knowledge of water availability in the region for all users.	The application of an approach of adaptive management and ongoing risk assessment will ensure a precautionary approach will be applied in implementation of the proposal. This approach will substantially reduce the risk of serious or irreversible impacts on social and environmental values dependent on the Yarragadee aquifer.

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
PROCESS PRINCIPLE – Stakeholder Engagement					
Comprehensive and regular communication	Water Corporation will maintain a comprehensive and regular information flow to the community about the project and the process throughout the sustainability assessment process.	Stakeholder engagement provided the foundation for community input to the design and implementation framework for the proposal. Stakeholder engagement was strongly focused on local communities in the South West Region including Nannup, Augusta, Margaret River, Busselton, Capel, Bunbury, and farmers on the Scott Coastal Plain. Water consumers in the Perth region also formed a key stakeholder group that was consulted in the evaluation process.	Stakeholder engagement through the development of the proposal has consisted of: • Community Reference Group from the SW that met regularly to provide input into the proposal • two sets of public information sessions and "walk-ins" • market research • focus group in the Perth region • technical information progressively made publicly available • public review of the draft Scoping report • interviews with stakeholders for the social impact assessment.	The stakeholder engagement phases yet to be completed are: – the public review of the Sustainability Evaluation /ERMP – the continued involvement of stakeholders in the adaptive management of the resource through the South West Yarragadee Monitoring Review Group.	The stakeholder engagement process has resulted in changes to the design and intent of the South West Yarragadee Water Supply Development. This process has also: • identified issues of concern • influenced the mitigation measures and enhancements of the proposal • influenced the extent and content of formal sustainability commitments • enhanced community awareness of the proposal and its potential consequences. • provided a social baseline for the implementation of the development.
Relevant, balanced and inclusive consultation	The Water Corporation will engage with key stakeholders and the broader community to discuss issues, and potential impacts and benefits of the project.	As above	As above	As above	As above
Openness and transparency	The Water Corporation will conduct investigations and proposal development processes in an open and transparent manner	As above	As above	As above	As above

Factor	Objective	Existing environment	Potential impact (+ve/-ve)	Proposed management	Expected outcomes
Closed loop process	The Water Corporation will respond to issues and queries raised by the community and will provide feedback about how those issues have been dealt with and how they have influenced the process.	As above	As above	As above	As above
PROCESS PRINCIPLE – Accountability					
Define performance targets	The Water Corporation will define economic, social and environmental performance targets that reflect achievement of the objectives set out herein	The Water Corporation has implemented a comprehensive stakeholder engagement program and social impact assessment during the preparation of this Sustainability Evaluation. This engagement has led to changes to the proposal and the development of the accountability framework.	Key stakeholders, including the community will be involved in the setting of management objectives, performance measures and targets for the development. The Water Corporation will be held accountable for achievement of these objectives and performance measures through an open and transparent process.	A South West Yarragadee Monitoring Review Group will be formed to assist implementation of the adaptive management framework	The proposed accountability framework and Water Corporation commitments for an open, transparent and accountable process during the implementation of the proposal will continue to promote and enhance stakeholder engagement. This engagement will enhance the empowerment of stakeholders in the implementation and management of the proposal.
Reporting performance on achievement of targets	The Water Corporation will report regularly and publicly on performance of sustainability measures	As above	Public reporting of results will provide an informed and independent review of the monitoring results and performance.	An annual Sustainability Report will be published to describe monitoring results, any environmental incidents and changes in management. The advice of the Monitoring Review Group and the Water Corporation response will also be made publicly available.	As above

9. COMMITMENTS

The following sections set out the full range of commitments made by the proponent to be implemented in proceeding with the proposal if approved. The subset of these commitments expected to form part of the conditions of formal environmental approval of the proposal is presented in Table 4 Section 9.3.

9.1 LEGAL REQUIREMENTS TO BE FULFILLED UNDER OTHER LEGISLATION

This section outlines actions and procedures that the Water Corporation is committed to undertaking under legislation or regulations other than Part IV of the EP Act.

Rights in Water and Irrigation Act 1914

1. Seek approval for the water pipeline crossings of all streams from the Department of Water pursuant to the RWI Act.
2. Prepare, and report on the implementation of, abstraction management plans and associated monitoring programs for the groundwater abstraction in accordance with any licence issued pursuant to the RWI Act and the Groundwater Abstraction Management Plan described in Volume 2 Chapter 9 Section 8.

Aboriginal Heritage Act 1972

3. Conduct a detailed Aboriginal heritage survey of the proposed infrastructure footprint before construction of proposal infrastructure in consultation with the local Indigenous community and in accordance with the requirements of the DIA.
4. Seek approval for any disturbance of identified heritage sites under s18 of the AH Act.

Environmental Protection Act 1986 Part V

5. Operate the treatment plant in accordance with conditions of any licence or works approval issued pursuant to Part V the EP Act.

Environmental Protection (Noise) Regulations 1987

6. All construction and operational activities will comply with the Noise regulations.

9.2 GENERAL COMMITMENTS

This section outlines commitments made by the Water Corporation that are not likely to be conditions of approval issued under Part IV of the EP Act and are not necessarily requirements under other legislation. These commitments will be publicly reported on and independently audited by an accredited Environmental Auditor every five years.

1. Work with the DoW and CALM to arrange declaration of a public water supply catchment area over the relevant portions of the Yarragadee aquifer recharge zones.

2. The Water Corporation will establish and support a South West Yarragadee Monitoring Review Group with the following functions:
   2.1. regular review and advice to the Water Corporation on monitoring programs, monitoring objectives and performance measures for the operation of the proposal
   2.2. review and provide public advice to the Water Corporation on monitoring results and provide comment on adaptive management measures
   2.3. review any changes to management of groundwater abstraction from the Yarragadee aquifer by the Water Corporation and provide advice on the acceptability of these changes.
3. Establish a South West Yarragadee Interpretive Centre in the South West to provide information to the community and visitors about development of the aquifer.
4. If existing Aqwest (formerly Bunbury Water Board) or Busselton Water Board public water supply wells are affected by saltwater intrusion (to the extent that they no longer meet the water quality criteria for potable use) caused by the Water Corporation groundwater abstraction from the Yarragadee aquifer, the Water Corporation will provide alternative means for accessing an equivalent amount of potable water at an equivalent cost, through either:
   4.1. provision of funding to install new wells into the Yarragadee aquifer further inland
   4.2. direct supply of water to the relevant company by the Water Corporation.
5. Develop and implement a landowner engagement program to finalise the pipeline alignment, management of pipeline construction and ongoing maintenance procedures.
6. Act within the provisions of the *Land Administration Act 1997* for the pipeline easement interest, but wherever possible, agree on compensation for the interest in land, for loss or for compensation through negotiation.
7. The water from the proposal will be available to any consumer prepared to enter the standard access arrangements (user pays cost of connection or as otherwise supported by the Government) and the uniform tariff pricing policy that applies to other IWSS water users in the State.
8. If the groundwater abstraction is reduced by the Water Corporation in accordance with the adaptive management program, or the Water and Rivers Commission reduces the licence allocation in the future, the Water Corporation commits to develop alternative strategies to address any shortfall in IWSS supply to IWSS consumers including those in the south west[4].
9. Undertake a South West Public Water Supply Future Planning Study to provide a plan for meeting the future public water supply needs in the South West. This plan would be undertaken in conjunction with Aqwest and Busselton Water Board and involve extensive consultation and market surveys of community satisfaction with the water planning and management. The plan would investigate and address the following:
   9.1. future public water supply demand
   9.2. potential sources for public water supply
   9.3. source development program for public supply
   9.4. assessment of quality and security of existing public water supplies

[4] It is understood that the development of alternative sources to meet supply shortfalls would be subject to the usual approvals, and no approval of contingencies would be implied by approval of this proposal.

9.5. program for upgrading existing quality and security of public water supplies where required

9.6. program for new connections to the extended IWSS or other sources.

10. Undertake a South West Yarragadee Sustainability Initiative that includes:

10.1. the biodiversity and acid sulphate soils studies in Environmental Commitment 2

10.2. sponsor a research program up to the value of $0.5M on:

10.2.1. the magnitude and potential means of management of irrigation return water

10.2.2. the effects of changing land use on water demand, availability and quality.

11. Provide opportunities for indigenous people to be employed in undertaking monitoring programs.

9.3 ENVIRONMENTAL COMMITMENTS

Table 4 Consolidated environmental commitments

No	Commitment	Factor	Timing	Seek advice from

1.	Implementation of the following environmental offsets:
	• The Water Corporation will contribute to a 5 year program to assist the management of threatening processes in areas that may be affected by the proposal. The funding will be up to $1M with the capital and any earned interest made available to the management program over a period of five years. The program will address weeds, disease, feral animals, erosion and uncontrolled public access issues insofar as they exist within these areas:
	  • along the Blackwood River
	  • Poison Gully and Milyeannup Brook valleys
	  • the proposed Blackwood National Park
	  • the proposed St John Brook Conservation Park
	  • the Scott Coastal Plain
	  • Swan Coastal Plain.
	• Protect the conservation value of selected land establishing conservation covenants or incorporate land into the conservation estate by the freehold transfer of land to the Executive Director of CALM to offset clearing of native vegetation in areas of State Forest for the project infrastructure using a clearing loss/gain ratio of 1:1.5 and of comparable or higher conservation value.
		TECs, Rare and Priority flora, Other GDEs, Flora and fauna, Threatened fauna, Wetlands, Development footprint.	To commence prior to operation	DoE, CALM

No	Commitment	Factor	Timing	Seek advice from
2.	a) Undertake a biodiversity and acid sulphate soils study in areas potentially affected by groundwater drawdown resulting from the proposal. The studies will be funded up to the value of $1.5M, with the capital and any earned interest made available to the studies over a period of ten years. The biodiversity component of the study may include but not be limited to the following (subject to the detailed scoping of the study in Commitment 3): • the occurrence, condition, spatial extent and groundwater dependence of floristic and vegetation communities at local and regional scale • the occurrence, condition, spatial extent and groundwater dependence of TECs • the occurrence and spatial extent of significant aquatic fauna • investigate the genetic diversity of significant aquatic fauna that use the tributaries as refugia • the identification and spatial extent of terrestrial fauna habitat • the occurrence and abundance of vertebrate fauna, including specifically, threatened fauna as defined in the Wildlife Conservation Act 1950 and the EPBC Act, Priority fauna as defined and listed by CALM b) The acid sulphate soils component of the study will be restricted to vulnerable areas on the Scott and southern Swan Coastal Plain to determine the occurrence, spatial extent and depth of acid sulphate soils. The studies will be scoped in consultation with CALM, any biodiversity and acid sulphate soils study technical steering committee, DoE and DoW and will be documented and made publicly available.	Blackwood River and tributaries, TECs, Rare and Priority flora, Other GDEs, Flora and fauna, Threatened fauna, wetlands	This commitment will be completed within 10 years of the commencement of construction	Send finalised reports to CALM, DoE & DoW
3.	Prepare and publish in a Water Corporation Sustainability Report on the following relating to the South West Yarragadee Water Supply Development: • compliance with environmental conditions and commitments • assessment of environmental performance and environmental management response • implementation of environmental management plans • summary of environmental monitoring information • summary of progressive results from the proposed biodiversity and acid sulphate soils studies • stakeholder engagement • Water Corporation response to the advice and recommendations on environmental issues from the Monitoring Review Group.	Blackwood River and tributaries, TECs, Rare and Priority flora, Other GDEs, Flora and fauna, Threatened fauna, wetlands	Annually during construction and for the first five years of operation. The frequency of reporting will then be reviewed.	DoE, DoW

No	Commitment	Factor	Timing	Seek advice from
4.	a) The Water Corporation will not, unless otherwise approved by the Minister for the Environment on advice of the Environmental Protection Authority, construct the proposed infrastructure so as to cause or contribute to the direct or indirect disturbance of the following: • TECs (including candidate TECs) • Declared Rare Flora unless the disturbance is approved under the Wildlife Conservation Act 1950 • significant habitat for Threatened or Priority listed fauna b) The Water Corporation will ensure that the proposal construction activities do not cause or contribute to the following: • acidification of land or surface water through the exposure of acid sulphate soils to the extent that it adversely affects native vegetation or streams • an increase in severity status of weeds or pests in State Forest • the spread of dieback disease to previously unaffected areas • placing any species or ecological community into a higher category of threat • visible dust at sensitive premises. • breach of noise regulations	As above	Prior to and during construction	CALM, DoE
5.	Undertake the following surveys along the pipeline route: • a soil sampling program to further define the risk of exposure of acid sulphate soils • a detailed flora and fauna habitat survey to identify species and communities of conservation significance.	As above	Prior to construction	CALM, DoE
6	Ensure independent third party audit of compliance of with commitment 5b above at quarterly intervals. Auditor reports will be made publicly available and submitted to DoE.	As above	During construction	DoE
7.	Finalise the suite of environmental management plans required for the proposal, as outlined in Volume 2 Chapter 9, and implement those plans.	As above	Plans to be finalised prior to construction. Implementation to be undertaken during construction and operation, as appropriate.	DoE, DoW