Government of Western Australia
Department of Water

Years 11-12

Water Education Tools

time

Assessing Mr Fish's development application

WET 216

This is a case study of a proposal to develop a marron farm in a catchment that supplies drinking water. It will be your job to determine if the development is acceptable for protecting the quality of water in the catchment.

The exercises below are a sample of what a water source protection officer in the Department of Water would need to do in a real life situation.

Required Reference

- WET 218 Mr Fish's Application for Planning Approval (fictitious example)
- WET 224 Walpole Drinking Water Source Protection
- WET 217 Document Extract: Water Protection Guide for Aquaculture
- WET 222 Land use compatibility in Public Drinking Water Source Areas

Further Reference

- WET 219 Walpole Weir and Butler's Creek Dam catchment areas drinking water source protection plan
- WET 220 Water quality protection note 2: Aquaculture
- WET 221 Water quality protection note 25: Land use compatibility in public drinking water source areas

Government of Western Australia
Department of Water

Years 11-12

Water Education Tools

If you read the acknowledgement section of the Walpole Weir and Butler's Creek Dam Drinking Water Source Protection Plan you will find that Kathryn Buehrig was involved in its development.

Kathryn is a Senior Scientific Officer with the Department of Water. You can read about Kathryn and her job in WET 223.

Curriculum links

2BISC 3.27 - discuss the location of local water catchment areas

2BISC 3.28 - discuss biological or chemical contamination of water supply due to inappropriate catchment management e.g. salination, eutrophication and erosion

1AEES 1.8 - explain how changes in land use are linked to negative environmental changes such as salinity, eutrophication and soil degradation, and how these changes can be measured

2AEES 2.7 - explain how air and water quality are managed including pollution issues

Tips

- To locate a WET resource go to Water Education Tools site at www.water.wa.gov.au. Locate the spy glass search function and search using the WET number (only the numeric part).
- You can use the Questions template section to type your answers in. Just click under the question and enter your text.
- To delete cover pages click on the scissors (right), drag to top and press delete. ✂

Water Education Tools

Assessing Mr Fish's development application

WET 216

Name:
Student id:
Age:

This Q-time is based on Mr Fish's application to complete a development on his property. In this exercise it is your job to assess the impact on water quality of Mr Fish's proposed development after the Shire of Manjimup has requested advice from you (as if you were a Department of Water water source protection officer).

The main issue you need to consider is whether the proposed development is acceptable in the public drinking water source area and what impacts it might have on water quality.

Development

Read Mr Fish's Shire of Manjimup application for planning approval (WET 218)

1. **What is the address of the property where the development is going to happen?**

2. **What type of development is Mr Fish applying for?**

Public drinking water source areas

The Department of Water is responsible for managing and protecting the state's drinking water resources. In WA, specific catchments and groundwater areas supply water for drinking to cities, towns and communities (the tap water supply). Two of these areas that you might have heard of before are the Gnangara mound (groundwater resource) and the Mundaring Weir catchment area. Areas like this exist all over the state.

To complete Questions 3 and 4 refer to the section titled Summary and Figure 3 of *WET 224 Walpole Drinking Water Source Protection*. You can also use the online Geographic Data Atlas to search for Mr Fish's property. Go to www.water.wa.gov.au > tools and data > maps and atlases > geographic data atlas. You can click for an introduction on how to use the Atlas. Search by Lot number and enter Mr Fish's address. Then on the left hand side, turn on environment – public drinking water source areas theme.

3. **What is the name of the public drinking water source area that Mr Fish's property is in (*hint: see Figure 3 of WET 224)*, and what priority (priority 1, 2 or 3) is the section that covers his property (*hint: use Geographic data atlas)*?**

4. **Name the places that use drinking water from this source.**

5. **In Section 4 of the extract WET 224 Walpole Drinking Water Source Protection, pathogens and nitrates are identified as two water quality issues (contamination risks). If someone were to drink contaminated water, what would be the risks to their health associated with:**
    a. **Pathogens**

    b. **Nitrates**

Read the first section titled *Purpose* of WET 217 Document Extract: Water Protection Guide for Aquaculture and answer the question below.

6. **Does aquaculture pose a risk of pathogen and nitrate contamination?**

Water quality impacts of development

Read the remainder of WET 217 Document Extract: Water Protection Guide for Aquaculture.

7. **What type of impacts do you think Mr Fish's development might have on the quality of water surrounding his property?**

Read WET 222 Document Extract: Land use compatibility in Public Drinking Water Source Areas. (*Note – Department of Environment (DoE) doesn't exist anymore. It is now called Department of Water.*)

For the purpose of the next two questions, let's assume that Mr Fish's property is located in a Priority 2 (P2) area. (In reality, this land is owned by the Department of Water so it is Priority 1 (P1). All land owned by the government (crown) is generally P1).

8. **Is Mr Fish's development compatible with the priority 2 area of this drinking water source?** *Hint: Use the table in WET 217.*

9. **Considering the development and its location in a drinking water catchment, write five conditions that you (as a Department of Water officer) would like to put on Mr Fish's development approval so that he protects the water quality of the catchment**. *Hint: WET 217 Document Extract: Water Protection Guide for Aquaculture lists a number of points under Advice and recommendations that should help.*

Teacher's Comments

Mr Fish's Application for Planning Approval

WET 218

SHIRE OF MANJIMUP
TOWN PLANNING SCHEME NO. 2
APPLICATION FOR PLANNING APPROVAL
PO Box 1 Manjimup WA 6258
Phone 9771 7777 Fax 9771 7771

Note: This is a ficticious example for use with Water Education Tools Qtime # WET 216.
This template is used with permission from Shire of Manjimup.

BL: - **ALL SECTIONS MUST BE COMPLETED** -

OWNER DETAILS		
Name: Mr Michael Fish		
Address: 12586 North Walpole Road, Walpole Postcode: 6398		
Phone: (work): (08) 621 2345 (home): (mobile): 0419 123 456	Fax: -	E-mail: -
Contact Person: Mr Fish		
Signature: M Fish	Date: 20 April 2010	
Signature:	Date:	
THE SIGNATURE OF THE OWNER(S) IS REQUIRED ON ALL APPLICATIONS. THIS APPLICATION WILL NOT PROCEED WITHOUT THAT SIGNATURE		

APPLICANT DETAILS:		
Name: Mr Fish		
Address: as above Postcode:		
Phone: (work): (home); (mobile):	Fax:	E-mail:
Contact person for Correspondence:		
Signature:	Date:	

PROPERTY DETAILS		
Lot No: 12586	House/Street No. -	Location No. -
Street Name: North Walpole Road	Suburb: Walpole	
Nearest Street intersection: Plain Street		
Title encumbrances (e.g. easements, restrictive covenants): -		

EXISTING BUILDING(S)/LAND USE(S):

Nature of any existing buildings and/or land uses:
1 existing house
1 existing shed
3 existing dairy cattle paddocks
1 existing dam

PROPOSED BUILDING(S)/LAND USE(S):

Description of **ALL** proposed development(s) and/or land use(s):
6 new outdoor ponds for breeding marron (aquaculture)
1 new shed for pumps and equipment storage
1 new access track for vehicles
1 new wastewater treatment pond (for waste from marron ponds)

Materials / Colours to be used on External Surfaces: green colorbond shed; grey fibreglass ponds
Approximate cost of proposed development: $75,000
Estimated time of completion: December 2010

PLEASE NOTE REQUIREMENTS FOR PLANS TO ACCOMPANY THIS APPLICATION (SEE OVERLEAF)

*See maps attached.

Mr. Fish's property map ①

Note: This is a fictitious example for use with Water Education Tools Qtime # WET 216.

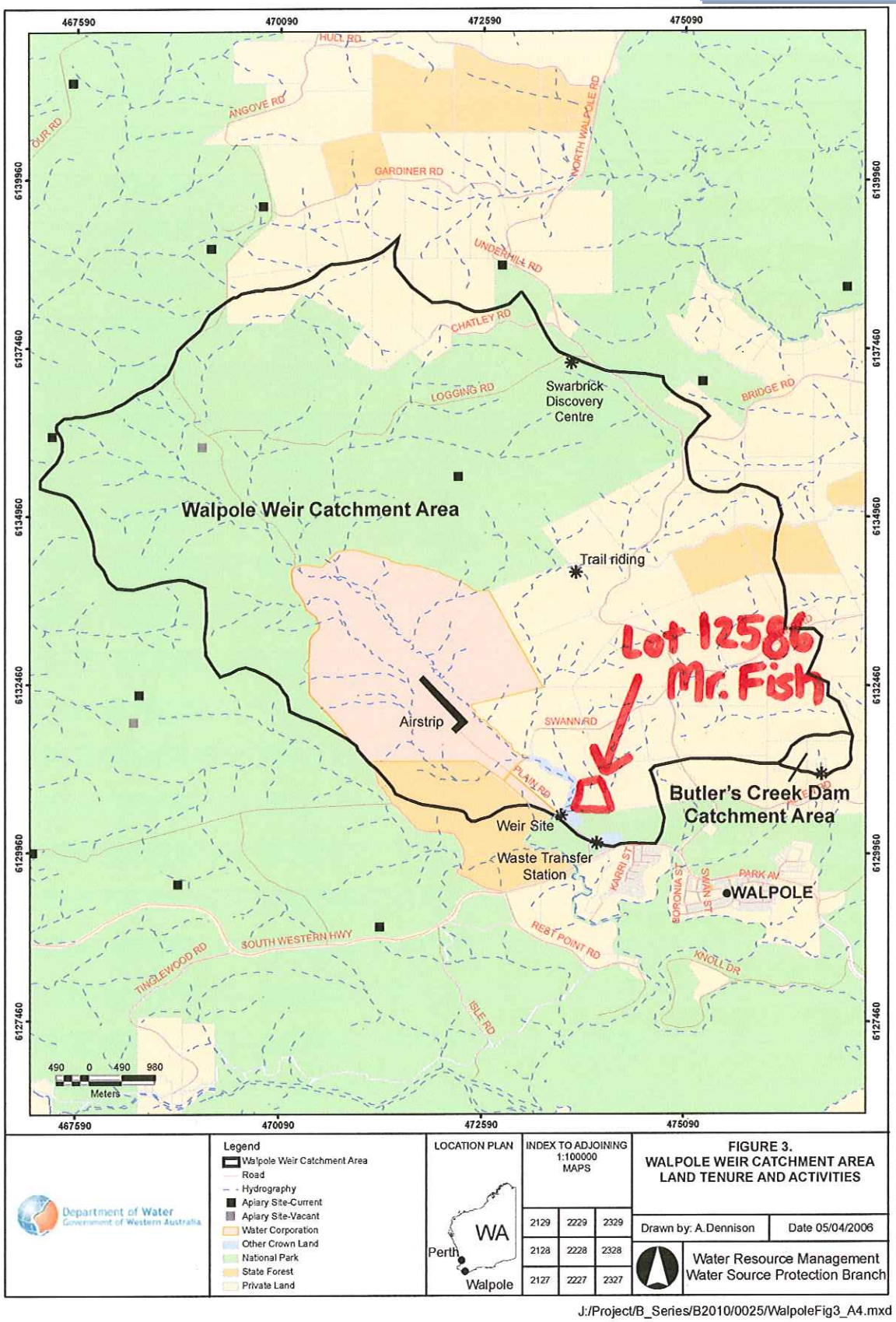
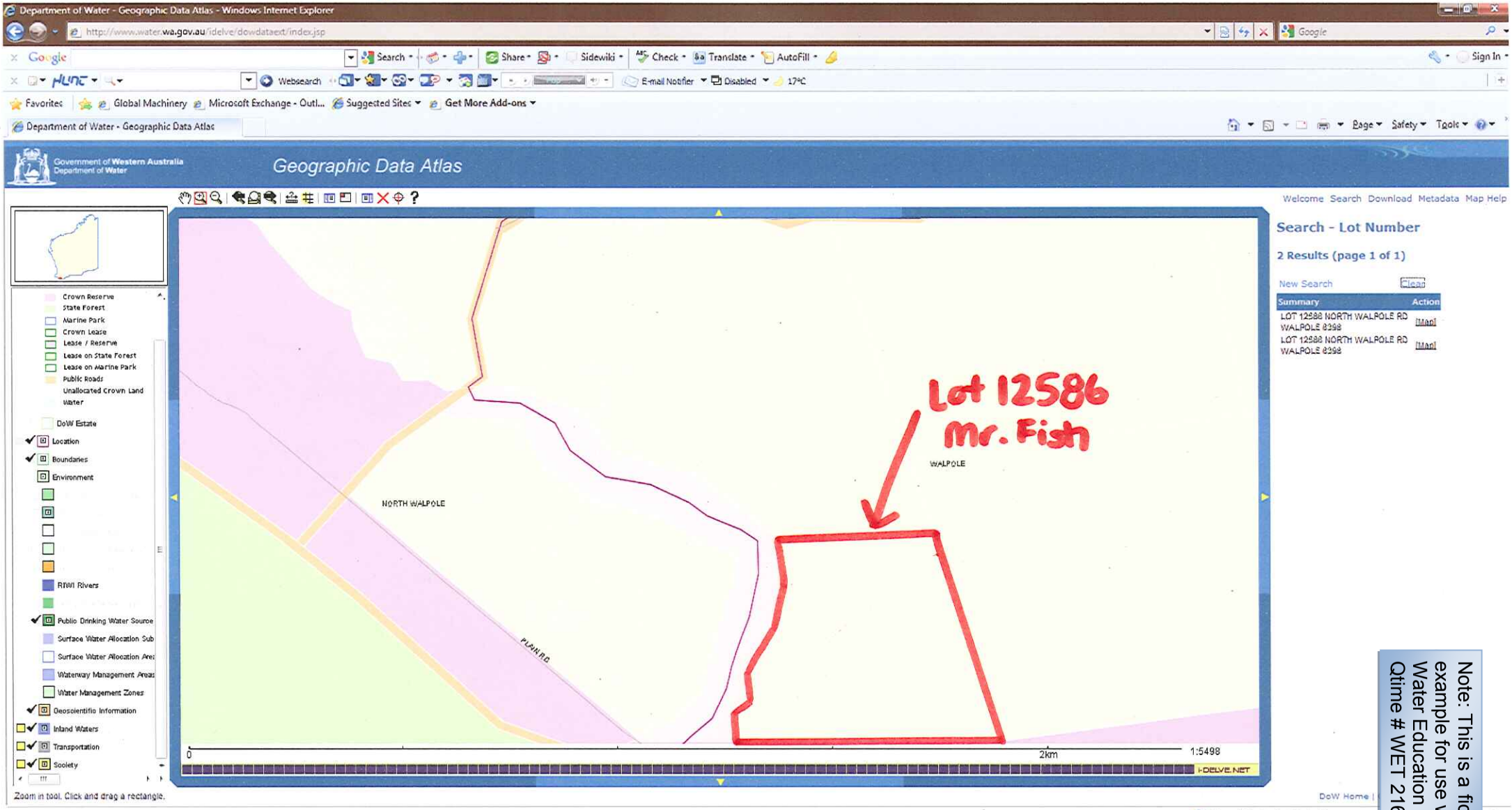


Figure 3 Land use and activities in the Walpole Weir Catchment Area

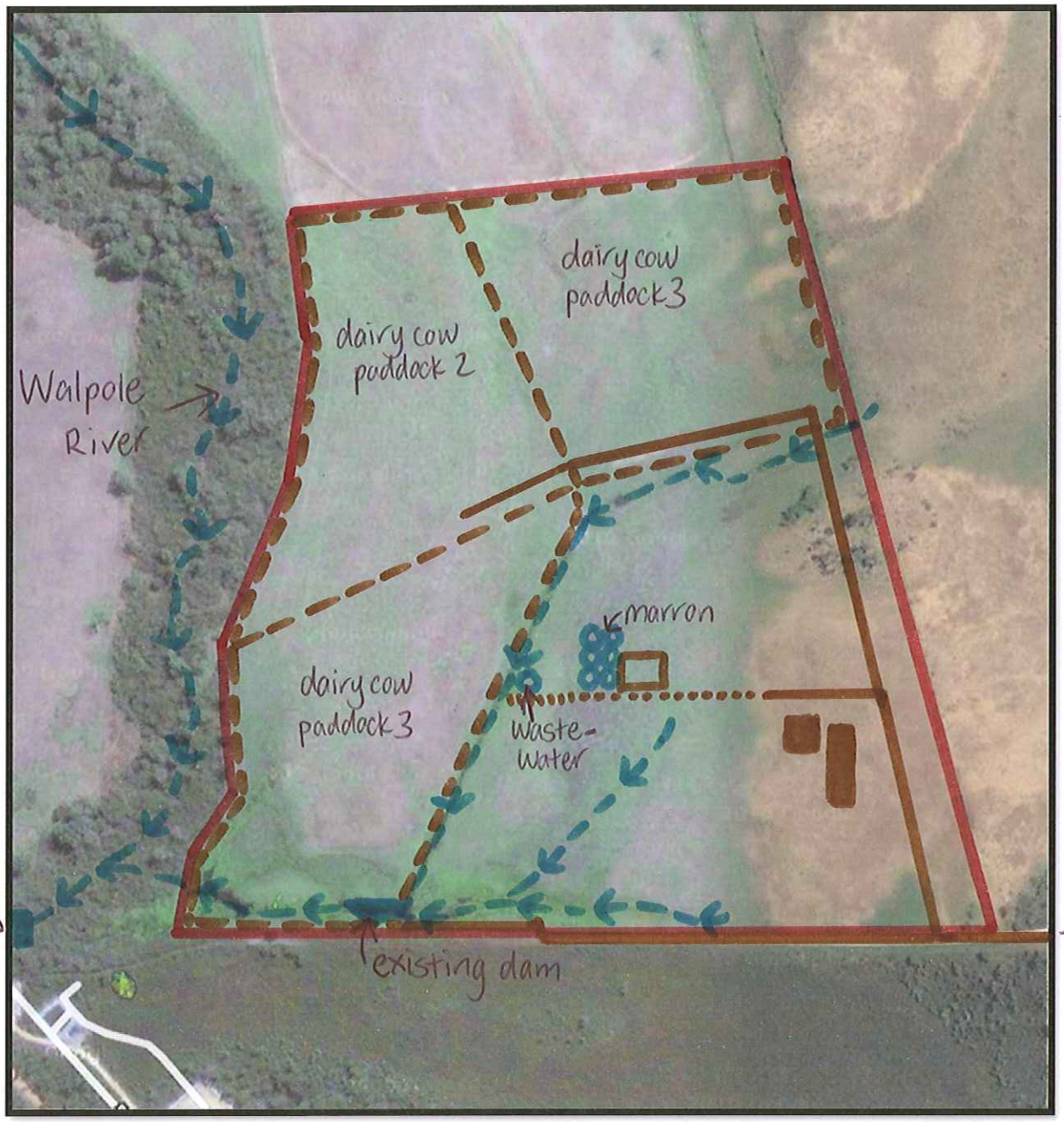
Mr. Fish's property Map ②



Note: This is a fictitious example for use with Water Education Tools Qtime # WET 216.

Mr. Fish's property Map 3

Note: This is a fictitious example for use with Water Education Tools Qtime # WET 216.



Key:

- Property boundary
- Existing access track
- Proposed access track
- Existing buildings
- Proposed buildings
- Proposed ponds
- Direction of waterway flow (creeks, rivers, open drains)
- Existing fences

↑ North

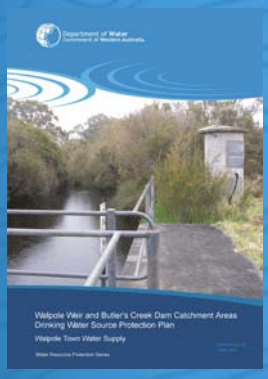
Government of **Western Australia**
Department of **Water**

Water Education Tools
Document Extract

Walpole Drinking Water Source Protection

WET 224

Original Document (Extract Source)



Walpole Weir and Butler's Creek Dam Catchment Areas Drinking Water Source Protection Plan

Water Resource Protection Series No. 58

June 2007

Department of Water
http://www.water.wa.gov.au
Phone: 08 6364 7600

Looking after all our water needs

Water Education Tools Document Extracts have been developed as a way for teachers and students to use everyday water management documentation.

The purpose is to bring the valuable information relating to a topic or line of enquiry out of a larger document to allow easier examination of an issue.

The original document can be obtained by contacting the original document owner or via their website. See the original document details on the front cover.

This extract contains the following information sets from the original document: Pages vi, 4, 6 7, 8, 13, 15, 16, 17, 35, 36, 39, 40, 41, 42.

For further information on the topic related to this extract or information on the original document contact the Original Document Owner (see front cover).

For information on Water Education Tools or Document Extracts email:
WaterEducationTools@water.wa.gov.au

Department of Water
168 St Georges Terrace, Perth, 6000
PO Box K822 Perth WA 6842
Phone: 08 6364 7600
www.water.wa.gov.au

Summary

Walpole is located 423 km south of Perth and 120 km west of Albany. Walpole acts as a service centre for the nearby industries of beef and sheep farming, dairying, fishing and forestry. Viticulture is becoming increasingly popular in the area and the town also supports a thriving tourist industry.

The Walpole Town Water Supply is sourced from a weir on the Walpole River to the north west of the town, and in summer months also from Butler's Creek Dam to the north east of the town. Water from these sources supplies the Walpole town site, the nearby Boronia Ridge development, the Coalmine Beach Caravan Park and some surrounding farms. Both catchments are within the Shire of Manjimup. The catchments for these sources have not been gazetted as Catchment Areas under the *Country Areas Water Supply (CAWS) Act, 1947*. This plan recommends that both catchment areas be gazetted to ensure appropriate protection of the water supply sources.

Potential risks posed to the water quality of this source have been carefully assessed in this plan.

The objective of water source protection in both these catchments is to preserve water quality at its current level, and where practical achieve an improvement. It is recommended that Crown land and an area of private land adjacent to the weir and dam be managed for Priority 1 source protection and all remaining privately owned land in both catchments be managed for Priority 2 source protection. The existing land uses of farming and other agricultural activities are generally considered 'compatible with conditions' under a Priority 2 classification, if management controls are implemented to ensure water quality is protected.

The northern and central sections of the Walpole Weir catchment are under Crown ownership, and managed by the Department of Environment and Conservation (DEC) as National Park and State Forest as part of the Walpole Wilderness Area (WWA). The central section of the catchment is currently vested in the Water and Rivers Commission (now Department of Water) and managed for public drinking water source protection.

The only recreational site within the catchments is the Swarbrick Discovery Centre for the WWA.

Land management and farming activities in the Walpole Weir catchment include forest management and animal grazing. Land use in the Butler's Creek Dam catchment is predominantly animal grazing.

These activities have the potential to pose a risk to the water quality of this source and this plan outlines strategies to manage those risks.

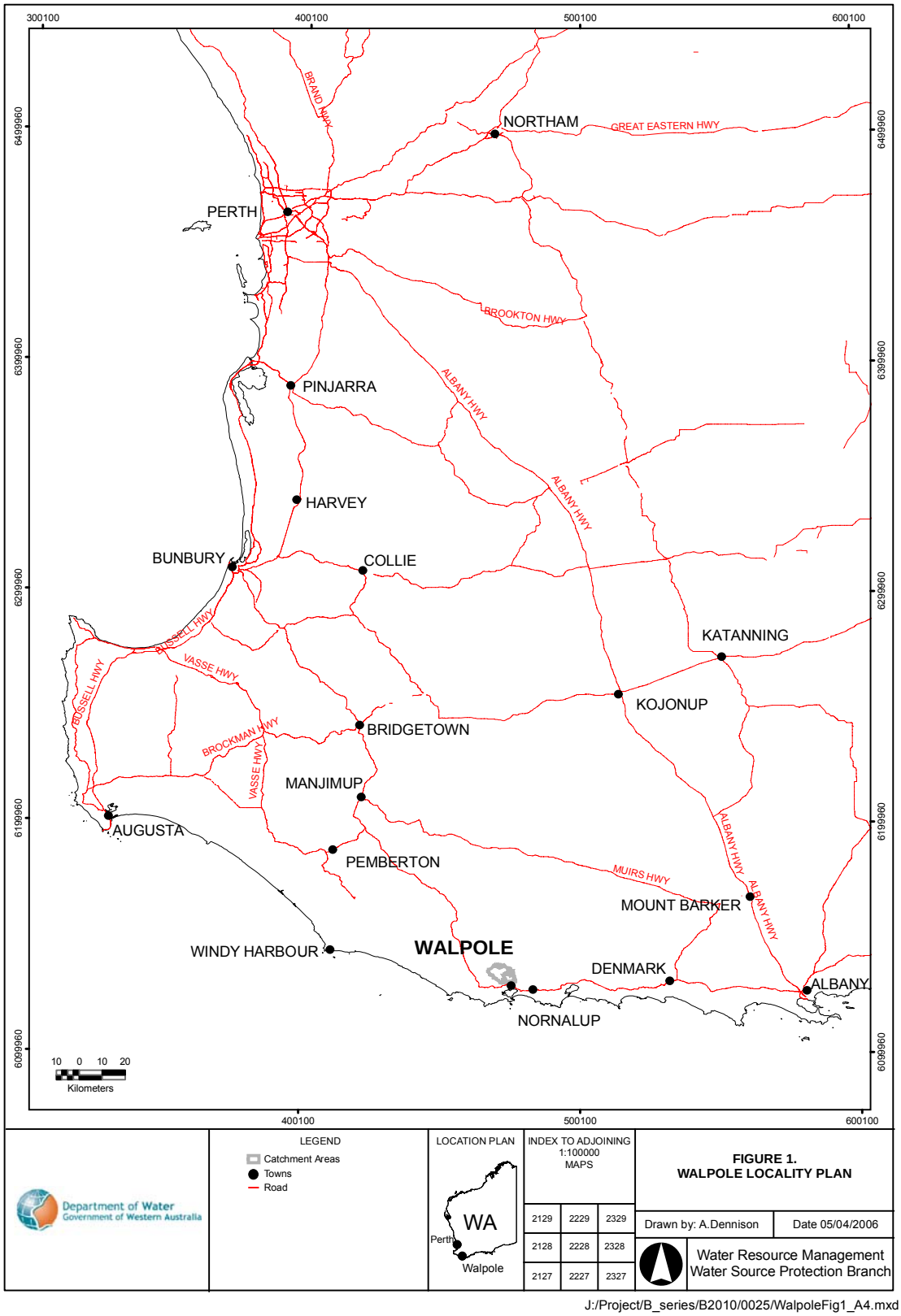


Figure 1 Walpole locality map

3 The catchment

3.1 Climate

Walpole has a temperate climate, characterised by warm, dry summers and cool, wet winters. The long term average rainfall for Walpole is 1321 mm which is associated with passing cold fronts. The average annual rainfall since 1974 to present is 1251 mm. This drop in rainfall has seen a statistically significant reduction in stream flow since 1975 (WRC, 1998).

3.2 Physiography

The Walpole River basin consists of flat and swampy terrain on sedimentary rock with broad drainage floors in lower reaches of streams. The associated sands have a high tendency to leach phosphorous but are at low risk of eroding.

Surrounding the basin, the remainder of the catchment consists of hills rising above the general basin level, mainly mantled by laterite outcrop with some igneous rock outcrop. The soils are sandy or gravely duplex soils that have a higher phosphorous holding capacity than the basin soils, however they can be more susceptible to erosion.

3.3 Hydrology

The Walpole Weir catchment is approximately 50.5 km^2, and is located in the Shannon River Basin. The average annual stream flow of the Walpole River at the Weir is estimated to be 19 100 ML. There is negligible storage at the weir site. Supply to the weir is generated mostly from surface run-off, however groundwater seepage provides a significant amount of flow during summer months. There is perennial flow in the Walpole River, although the average monthly flow in the winter months is significantly greater than in the summer months, hence the need to supplement the supply in summer.

Butler's Creek Dam has a small surface catchment of approximately 0.41 km^2. Summer inflow is generated largely from local groundwater seepage.

4 Water quality and treatment

4.1 Water quality

The Water Corporation regularly monitors the Walpole Weir and Butler's Creek Dam water sources for a range of parameters in accordance with the Australian Drinking Water Guidelines (ADWG). A summary of the raw water quality data for Walpole Weir and Butler's Creek Dam is shown in Appendix A.

It should be noted that the raw water from these sources is treated and chlorinated prior to supply to Walpole as drinking water. The treated drinking water supply complies with ADWG health, microbiological and aesthetic requirements. The combination of catchment protection and treatment is undertaken to ensure the availability of safe, good quality drinking water.

Microbiological contaminants

Pathogens are types of micro-organisms that are capable of causing diseases. These include bacteria (such as *Escherichia coli*), protozoa (such as *Cryptosporidium* and *Giardia*) and viruses. In water supplies the pathogens of concern that can cause illness, such as stomach upset, diarrhoea and even death, are mostly found in the faeces of humans and domestic animals. *Escherichia coli* counts are a way of measuring these pathogens and are an indicator of faecal contamination.

Pathogen contamination of a drinking water source is influenced by the existence of pathogen carriers (ie humans and domestic animals, such as dogs or cattle); their subsequent transfer to and movement in the water source; and the ability of the pathogen to survive in the water source.

Pathogens may enter a water source through activities involving direct contact of people and domestic animals with the main water body or its tributaries (such as fishing, marroning and swimming), primarily through the transfer of faecal material, or indirectly through their presence (eg runoff moving faecal material into the water).

There are a number of pathogens that are commonly known to contaminate water supplies worldwide. These include bacteria (eg *Salmonella*, *Escherichia coli* and *Cholera*), parasites (eg *Cryptosporidium*, *Giardia*) and viruses. The percentage of humans in the world that carry various pathogens varies. For example, it is estimated that between 0.6 to 4.3 per cent of people are infected with *Cryptosporidium* worldwide, and 7.4 per cent with *Giardia* (Geldreich, 1996).

The ability of pathogens to survive in surface water differs between species. For example, *Salmonella* may be viable for two to three months, *Giardia* may still infect after one month in the natural environment (Geldreich, 1996) and *Cryptosporidium* oocysts (cells containing reproductive spores) may survive weeks to months in freshwater (NHMRC & NRMMC, 2004).

The effects of pathogen contamination in drinking water varies significantly, ranging from illness to death, as was the case in Walkerton, Canada in 2000 where seven people died due to contamination by *Escherichia coli* and *Campylobacter* in the town water source and supply. Preventing the introduction of pathogens into the water source is the most effective barrier in avoiding this public health risk.

The raw water microbiological quality data for Walpole Weir and Butler's Creek Dam shows both sources are significantly contaminated with faecal matter from the catchments. Agricultural land use in the catchments is a primary source of microbiological contamination and catchment management is required to reduce the impact of these activities.

Health related characteristics

Land use activities within the catchment can directly influence the effectiveness of water treatment. For example, driving on unauthorised tracks contributes to erosion and the uprooting of vegetation. Erosion results in the mobilisation of soil particles, which are released into the air and tributaries, increasing the turbidity of the main water body. The problem is, pathogens can adsorb onto these soil particles and may be shielded from the effects of disinfection. Increased turbidity also impacts upon other environmental constituents, ie smothering riparian vegetation and reducing light transfer within the water column which affects plant growth.

A number of chemicals (organic and inorganic) are of concern in drinking water from a health perspective because they are potentially toxic to humans. Chemicals usually occur in drinking water sources attached to suspended material such as soil particles and may result from natural leaching from mineral deposits or from different land uses.

Pesticides include agricultural chemicals such as insecticides, herbicides, nematicides, rodenticides and miticides. Contamination of a drinking water source by pesticides may occur as a result of accidental spills, incorrect or over use and leakage from storage areas. In such cases, prompt action is required to notify relevant authorities and clean up the spill.

Nutrients (such as nitrogen) can enter drinking water supplies from leaching of fertiliser, septic tanks, and from faeces of domestic animals (such as cattle grazing on the land). Nitrate and nitrite (ions of Nitrogen) can be toxic to humans at high levels, with infants less than 3 months old being most susceptible.

Hydrocarbons (fuels, oils, solvents) are potentially toxic to humans, and harmful by-products may be formed when they are combined with chlorine in water treatment processes. Hydrocarbons can occur in water supplies from pollution events from vehicle accidents, refuelling and leakage from storage areas.

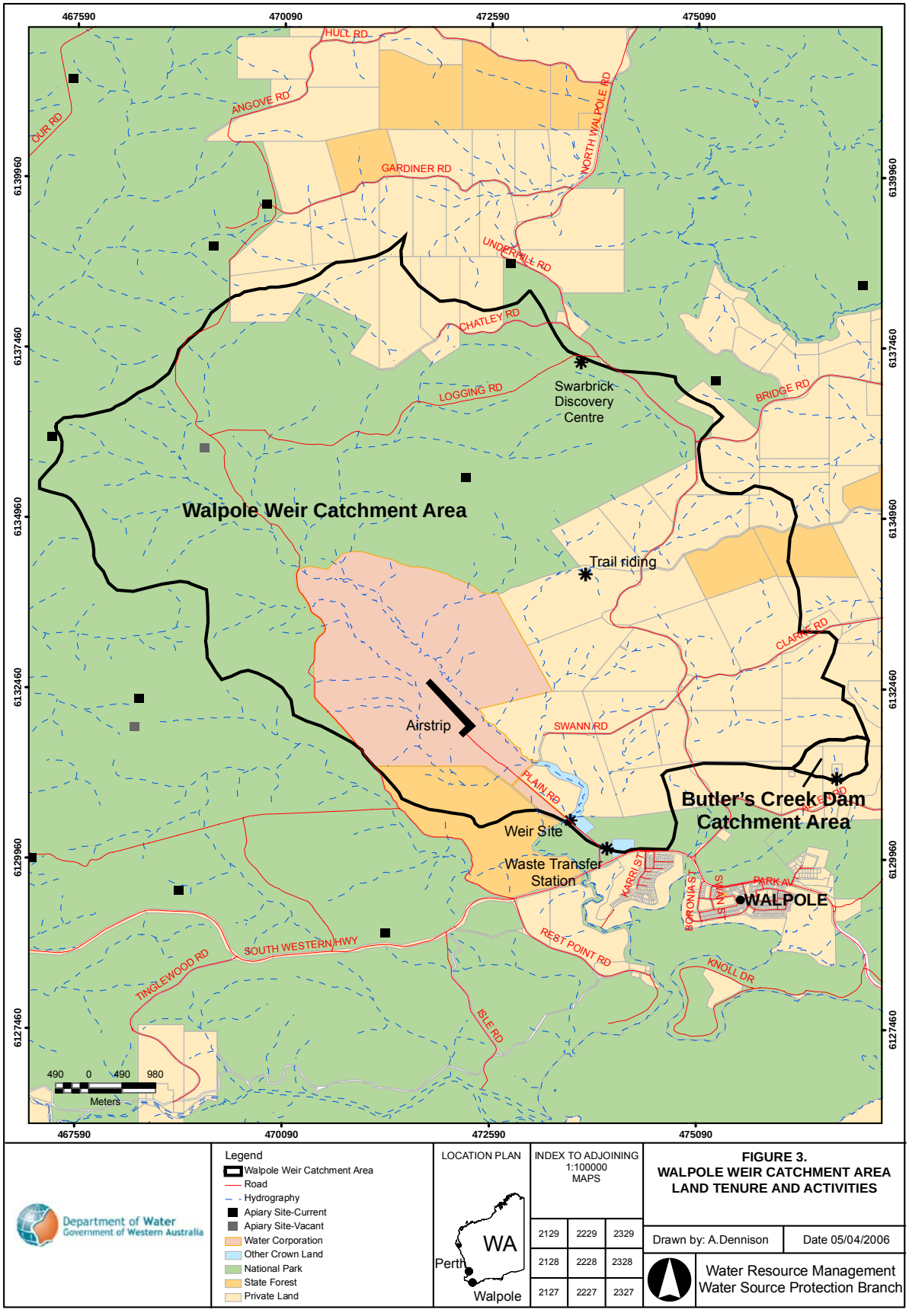


Figure 3 Land use and activities in the Walpole Weir Catchment Area

6 Catchment protection strategy

6.1 Protection objectives

The objective of water source protection in both these catchments is to preserve water quality at its current level and where practical, achieve an improvement so as to provide a safe drinking water supply.

The Plan recognises the right of existing approved land uses to continue to operate in the catchments. The prevention, minimisation and management (in that order) of risks to water quality is imperative for the protection of public health.

6.2 Proclaimed area

The catchments of the Walpole Weir and Butler's Creek Dam have been defined from the physical drainage area by combining the most recent contour information with ground truthing. It is recommended these catchments be proclaimed as Catchment Areas under the *CAWS Act 1947* to ensure appropriate protection of the water supply sources.

6.3 Priority classifications

The protection of the Walpole Weir and Butler's Creek Dam Public Drinking Water Source Areas (PDWSAs) relies on statutory measures available in water resource management and land use planning legislation. The Department's policy for the management of PDWSAs includes three risk management based protection classification areas, Priority 1 (P1), Priority 2 (P2) and Priority 3 (P3).

P1 areas have the fundamental objective of risk avoidance. P2 areas have the consider risk minimisation, and P3 areas consider risk management. The Department's *Water Quality Protection Note - Land Use Compatibility in Public Drinking Water Source Areas* (see References) outlines activities that are acceptable, compatible with conditions, or incompatible with the different Priority areas.

The priority classification areas for PDWSAs are determined through the Drinking Water Source Protection Plan (DWSPP) process in consultation with State Government agencies, landowners, local government and other key stakeholders. The Priority areas for Walpole Weir and Butler's Creek Dam Catchments are a combination of Priority 1 and 2 areas as follows.

6.3.1 Priority 1 areas

All Crown land in the Walpole Weir catchment and the Water Corporation owned land in the Butler's Creek Dam catchment is classified for Priority 1 source protection (see Figures 5, 6 and 7). This classification is appropriate as:

- water from these sources constitutes a strategic supply to the town of Walpole so it should be afforded the highest feasible level of protection;
- retention time in the weir is negligible so there is little time for water quality improvement during storage; and
- existing land uses on the Crown land are considered compatible with Priority 1 objectives.

A small area of privately owned land adjacent to the Walpole Weir has the potential to be classified as P1 due to its proximity to the weir and waterlogged nature. Liaison between the affected landowner and the Department of Water will be ongoing to determine how this area can best be protected.

One option being considered is the sale of this land to the Department of Water. If this occurs the land would be classified P1 (see Figure 7). If not, other approaches may be negotiated to maximise the quality of water from this area (such as planting native vegetation).

6.3.2 Priority 2 areas

All remaining private land in the Walpole Weir and Butler's Creek Dam catchments and the Shire Waste Transfer Station are classified for Priority 2 source protection (see Figures 5, 6 and 7). This classification is appropriate as:

- water from these sources constitutes a strategic supply to the town of Walpole so should be afforded the highest feasible level of protection;
- land is freehold and zoned rural so the development rights are recognised; and
- existing land uses on private land can be managed for Priority 2 objectives with implementation of best management practices.

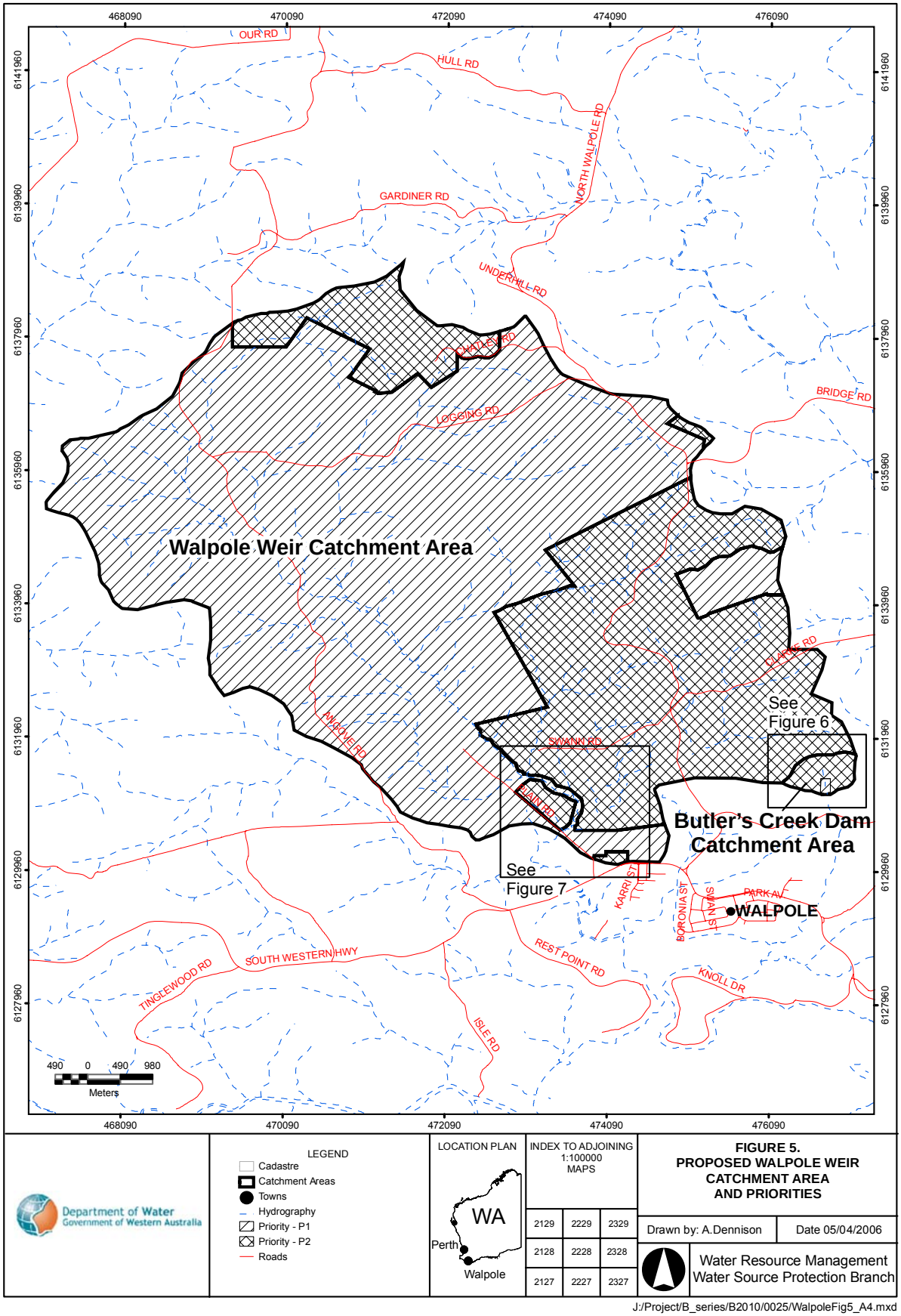


Figure 5 Priority classifications for Walpole Weir Catchment Area

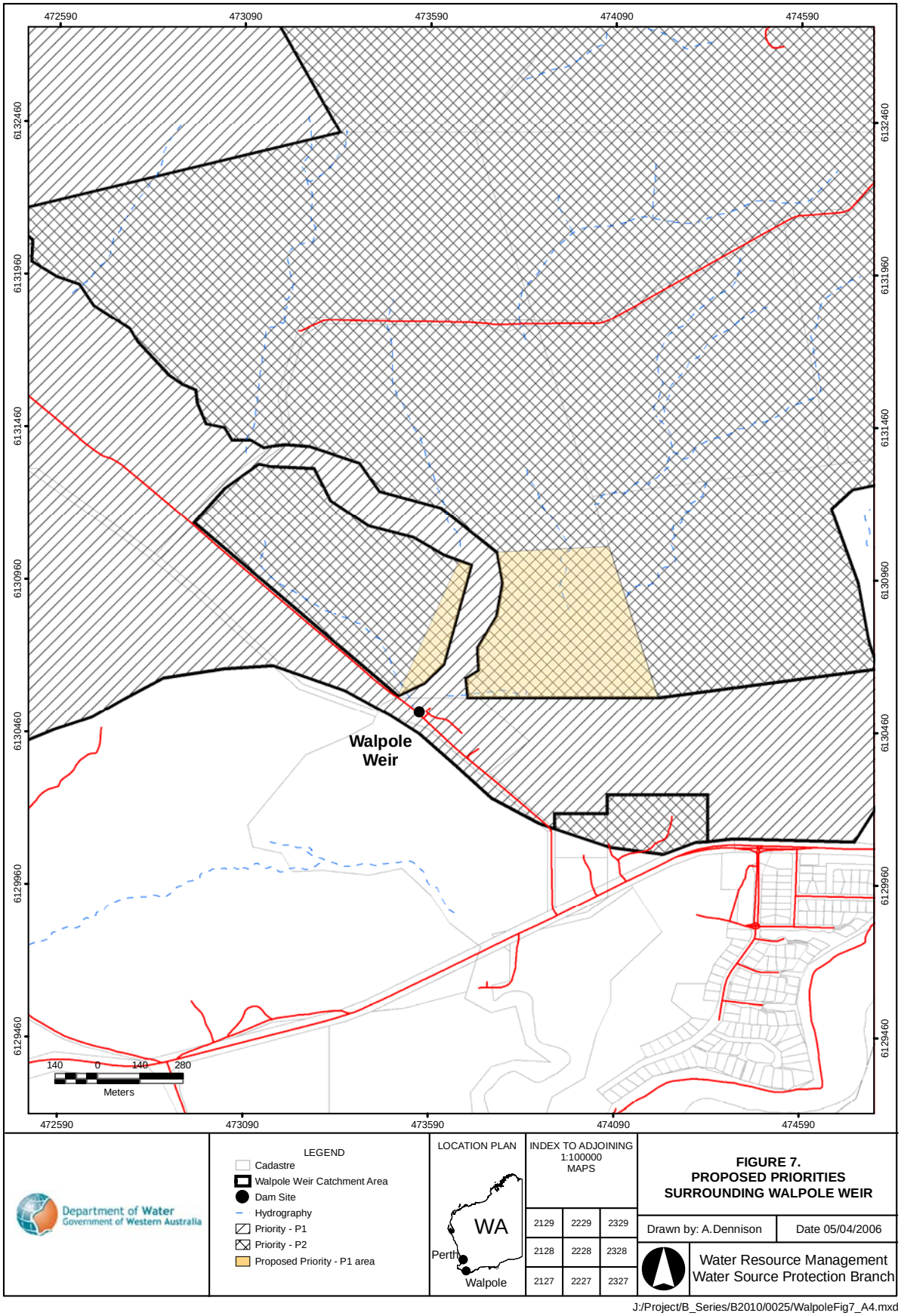


Figure 7 Enlargement of priority classifications adjacent to Walpole Weir

Appendix B Photographs

Photo 1 Walpole Weir

Photo 2 Water flowing over Walpole Weir showing highly coloured nature of water

Photo 3 Land use in the Walpole Weir Catchment Area – horse grazing

Photo 4 Land use in the Walpole Weir Catchment Area – cattle grazing

Glossary

ADWG	The Australian Drinking Water Guidelines, outlining guideline criteria for the quality of drinking water in Australia.
Aesthetic guideline	NHMRC guideline level ascribed to acceptable aesthetic qualities of drinking water such as taste, smell, colour and temperature.
AHD	Australian Height Datum is the height of land in metres above mean sea level. For example this is +0.026 m at Fremantle.
Allocation	The quantity of water permitted to be abstracted by a licence, usually specified in kilolitres per year (kL/a).
ANZECC	Australian and New Zealand Environment Conservation Council.
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand.
Augment	To increase the available water within a storage dam by pumping back water from a secondary storage/reservoir dam.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
CFU	Coliform forming units is a measure of pathogen contamination in water.
Diffuse source	Pollution originating from a widespread area eg urban stormwater runoff, agricultural infiltration.
EC	Electrical conductivity estimates the amount of total dissolved solids (TDS), or the total amount of dissolved ions in a solution (water) corrected to 25^{o} Celsius. Measurement units include milliSiemens per metre and microSiemens per centimetre.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
GL	Gigalitre (1 000 000 000 litres) or 1 million kilolitres
ha	Hectares (a measure of area)
HAZMAT	Hazardous Materials
Health	Australian Drinking Water Guideline value which is the concentration of

guideline	measure of a water quality characteristic that, based on present knowledge, does not result in any significant risk to the health of the consumer over a lifetime of consumption (NHMRC & NRMMC 2004).
HU	Hazen unit is a measure of water colour.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
kL	Kilolitres (1000 litres)
km	Kilometres (1000 metres)
km^2	Square kilometres (a measure of area)
Leaching / leachate	The process by which materials such as organic matter and mineral salts are washed out of a layer of soil or dumped material by being dissolved or suspended in percolating rainwater. The material washed out is known as leachate. Leachate can pollute groundwater and waterways.
LEMAC	Local Emergency Management Advisory Committee
m	Metres
mg/L	Milligrams per litre (0.001 grams per litre)
ML	Megalitres (1 000 000 litres)
mm	Millimetres
MPN	Most probable number (a measure of microbiological contamination).
mSv	Millisievert is a measure of annual radiological dose, with a natural dose equivalent to 2mSv/yr.
mS/m	MilliSiemens per metre is a measure of electrical conductivity of a solution or soil and water mix that provides a measurement of salinity.
NHMRC	National Health and Medical Research Council
NTU	Nephelometric turbidity units are a measure of turbidity in water.
Nutrient load	The amount of nutrient reaching the waterway over a given timeframe (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of

	nitrogen (nitrate and ammonia) and phosphorous (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.
Pathogen	A disease producing organism. Disease producing organisms that can cause disease through the consumption of water which include bacteria (such as Escherichia coli), protozoa (such as Cryptosporidium and Giardia) and viruses.
Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
Point source pollution	Pollution originating from a specific localised source, eg sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances, eg effluent, litter, refuse, sewage or contaminated runoff, change the physical, chemical biological or thermal properties of the water, adversely affecting water quality, living species and beneficial uses.
Public Drinking Water Source Area (PDWSA)	Includes all underground water pollution control areas, catchment areas and water reserves constituted under the *Metropolitan Water Supply Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947*.
Reservoir	A reservoir, dam, tank, pond or lake that forms part of any public water supply works
Run of the river scheme	A scheme that takes water from a flowing river. Water is taken directly from the source and there is no detention time (storage).
Run-off	Water that flows over the surface from a catchment area, including streams.
Scheme supply	Water diverted from a source or sources by a water authority of private company and supplied via a distribution network to customers for urban, industrial or irrigation use.
Storage reservoir	A major reservoir of water created in a river valley by building a dam.
Stormwater	Rainwater which has run off the ground surface, roads, paved areas etc and is usually carried away by drains.
TCU	True colour units (a measure of degree of colour in water)

TDS	Total dissolved salts, a measurement of ions in solution, such as salts in water.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Wastewater	Water that has been used for some purpose and would normally be treated and discarded. Wastewater usually contains significant quantities of pollutant.
Water quality	The physical, chemical and biological measures of water.
WESTPLAN HAZMAT	Western Australian Plan for Hazardous Materials.

Government of **Western Australia**
Department of **Water**

Water Education Tools
Document Extract

Water Protection Guide for Aquaculture

WET 217

Original Document (Extract Source)

Aquaculture

Water Quality Protection Note (WQPN) 02

February 2009

Author: Department of Water

Owner: Department of Water
www.water.wa.gov.au
Telephone +61 8 6364 7600

Looking after all our water needs

Water Education Tools Document Extracts have been developed as a way for teachers and students to use everyday water management documentation.

The purpose is to bring the valuable information relating to a topic or line of enquiry out of a larger document to allow easier examination of an issue.

The original document can be obtained by contacting the original document owner or via their website. See the original document details on the front cover.

This extract contains the following information sets from the original document: Section titled Purpose (part); Recommendations 1 (part), 4, 5, 7, 8, 16, 22, 25, 26, 31(part), 32 (part), 38, 39; text from various related headings.

Please note that this extract contains pages built from part pages and paragraphs from the original document. For a full understanding of the topic or issues outlined in the extract you should refer to the original document.

For further information on the topic related to this extract or information on the original document contact the Original Document Owner (see front cover).

For information on Water Education Tools or Document Extracts email:
WaterEducationTools@water.wa.gov.au

Department of Water
168 St Georges Terrace, Perth, 6000
PO Box K822 Perth WA 6842
Phone: 08 6364 7600
www.water.wa.gov.au

WQPN 02, FEBRUARY 2009

Aquaculture

Purpose

Aquaculture is gaining popularity in Western Australia as a result of the shortages, depletion or difficulty in harvesting wild stocks of aquatic plants, fish, crustaceans and shellfish. Aquaculture that is well-located and managed effectively can offer significant benefits to the community and environment by alleviating pressures on dwindling commercial stocks in the wild and preventing damage to aquatic ecology.

Aquaculture poses the following contamination risks to the quality and values of water resources:

- increase in nutrients, organic material, pathogens, pharmaceuticals and suspended solid concentrations
- vegetation loss adjacent to waterways and wetlands
- loss of embankments and pond contents during storm events
- release of exotic species from different genetic populations into local waters threatening the local aquatic ecology
- turbid stormwater from earthworks during pond construction
- pond discharges with increased salinity resulting from solar evaporation effects.

Scope

This note applies to premises that propagate, grow or hold aquatic plants and/or animals (including fish, crustaceans, and shellfish) for commercial purposes and there is a risk of contamination from the premises or facilities to sensitive water resources.

This note is not intended to apply to marine or estuarine-based aquaculture, domestic or hobby-scale (not for profit) ponds or aquariums or aquaculture.

Advice and recommendations

Location

1 Where land-based aquaculture projects are situated on permeable soils, such as sand or gravel, or are located close to water resources, care should be taken at all stages of the project life to prevent water contamination. Wastes discharged into the local environment must not contain significant concentrations of either nuisance or harmful substances.

Within public drinking water source areas (PDWSA)

PDWSA is a collective term used for proclaimed 'water reserves', 'catchment areas' and 'underground water pollution control areas' that are used as a source for drinking water scheme supply. PDWSA are proclaimed under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

Various by-laws and regulations enable regulatory agencies to restrict high-risk land use and potentially polluting activities, inspect premises and take action if sites cause water contamination. PDWSA are managed using a system of protection areas designated in source protection plans. These areas are termed P1, P2, and P3. Additional constraints apply under catchment protection by-laws in the high risk areas close to the water source. These areas are called reservoir protection zones (RPZ) and wellhead protection zones (WHPZ).

4 Within P1 source protection areas, RPZ and WHPZ, the development of aquaculture activities is an incompatible activity and will normally be opposed by this department.

5 Within P2 and P3 areas, aquaculture is an activity that can be compatible with source protection objectives, subject to conditions. This department may provide advice on measures to protect water quality using appropriate pollutant containment and management practices. All aquaculture proposals within P2 and P3 source protection areas should be referred to this department for assessment and a written response in accordance with state planning policy 2.7 *Public drinking water source policy* and our water quality protection note 25 *Land use compatibility in PDWSA*.

On or near waterways

Aquaculture projects are often established near waterways that can provide a suitable water supply source. Freshwater species may be grown in ponds, farm dams or tanks adjacent to these water resources.

7 Aquaculture facilities should not be established on land that is seasonally flooded, needs to be artificially drained, where natural watercourses need to be diverted or construction will affect areas of fringing or riparian vegetation. These areas provide significant water quality benefits through their ability to sustain aquatic ecosystems and filter pollutants in stormwater runoff.

8 Ponds and facilities should be placed sufficiently high in the landscape to ensure negligible impact on waterways, wetlands and their dependant vegetation, and allow for the effective operation of runoff filter zones and sediment control measures.

Buffers to sensitive water resources

16 Perennial native vegetation buffers should be retained or be re-established between any land-based aquaculture facility and sensitive water resources (such as rivers). These natural buffers are crucial to the protection of the ecology of water resources, act as contaminant filters and should allow time for the effective remedial action in the event of contaminant spill incidents.

Design measures

22 Aquaculture projects should be operated so that fish or pond plant species, discoloured water, sludge, silt, toxic chemicals and/or unstable organic material are not discharged into waterways or wetlands as a result of pond overflow, cleaning or emptying. Provision should be made to contain these materials effectively on-site, pending treatment or offsite disposal.

Construction of land-based ponds

25 Ponds should be designed and constructed by qualified and experienced personnel using very low permeability materials (leakage less than 10^{-9} metres per second), such as clay or plastic-lined ponds, fibreglass, metal or concrete tanks. Native soils used for pond construction should be engineered to ensure their long-term secure operation. Our water quality protection note 27 *Liners for containing pollutants, using engineered soils* (Reference 6a) provides guidance on soil lining for ponds.

26 Ponds should not be established on steep slopes (greater than one in 10) or on unstable ground, as embankments may fail. The ponds should incorporate measures to divert storm event runoff e.g. cut-off drains without overtopping, eroding or breaching pond embankments or causing uncontrolled release/displacement of contents.

Site management and waste disposal

31 Feed regimes should be well balanced/recorded against stock growth needs.

Liquid waste

Wastewater discharges rich in organic matter, suspended solids and nutrients cause noxious odours, bacterial slime capable of fouling screens associated with water bores, and contribute to turbidity, silt deposits and algal blooms in waterways or wetlands.

32 For larger scale aquaculture projects, wastewater should be fully contained within the project site or treated to a standard set by regulatory agencies e.g. licences issued by the departments of Fisheries and/or Environment and Conservation compatible with the intended water use/protection of the values of the receiving environment.

Solid waste

38 Solid waste matter such as dead stock, dewatered pond sludge should be composted, then either applied to land as a soil conditioner, exported off site for a useful purpose, or if these options are not viable, disposed of at an approved putrescible waste landfill.

Contingency plans

39 Site operators should develop and implement measures that minimise potential environmental impacts from:

a equipment malfunctions

b natural events such as storms and bushfires

c inadequately trained staff

d disease outbreaks

e predators, pest species and poachers.

Government of **Western Australia**
Department of **Water**

Water Education Tools
Document Extract

Land use compatibility in Public Drinking Water Source Areas

WET 222

Original Document (Extract Source)


Water Quality Protection Note

Land use compatibility in Public Drinking Water Source Areas

Land use compatibility in Public Drinking Water Source Areas

Water Quality Protection Note (WQPN) 25

July 2004

Author: Department of Water

Owner: Department of Water
www.water.wa.gov.au
Telephone +61 8 6364 7600

Looking after all our water needs

Water Education Tools Document Extracts have been developed as a way for teachers and students to use everyday water management documentation.

The purpose is to bring the valuable information relating to a topic or line of enquiry out of a larger document to allow easier examination of an issue.

The original document can be obtained by contacting the original document owner or via their website. See the original document details on the front cover.

This extract contains the following information sets from the original document: Various selections as part pages.

Please note:

- ***This extract contains pages built from part pages and paragraphs from the original document. For a full understanding of the topic or issues outlined in the extract you should refer to the original document.***
- ***The Department of Water took over water quality protection responsibilities from the former Department of Environment, therefore the Department of Water is the document owner.***

For further information on the topic related to this extract or information on the original document contact the Original Document Owner (see front cover).

For information on Water Education Tools or Document Extracts email:
WaterEducationTools@water.wa.gov.au

Department of Water
168 St Georges Terrace, Perth, 6000
PO Box K822 Perth WA 6842
Phone: 08 6364 7600
www.water.wa.gov.au

Water Quality Protection Note

Department of Environment

July 2004

Land use compatibility in Public Drinking Water Source Areas

Scope

This note provides the DoE's position on a range of land uses assessed against the Department's water quality protection strategy and management objectives within PDWSAs. Where a specific land use has not been covered in the accompanying tables, it should be referred to the Department's Water Source Protection Branch for assessment and a written response concerning its acceptability or any necessary water resource protection measures.

Public Drinking Water Source Area in Western Australia is the collective description for:

- Underground Water Pollution Control Areas,
- Water Reserves, and
- Catchment Areas,

declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* or the *Country Areas Water Supply Act 1947*.

PDWSA protection framework

The protection of PDWSAs relies on statutory measures available in water resource management and land use planning legislation. The DoE policy for the protection of PDWSAs includes three risk management based priority classification areas and two types of protection zones. The priority classification areas and protection zones are determined via specific Drinking Water Source Protection Plans (DWSPP) that are prepared in consultation with State government agencies, landowners, local government, and key industry and community stakeholders. Where a fully consulted DWSPP does not exist for a PDWSA, the DoE initially prepares Drinking Water Source Protection Assessment (DWSPA) documents to reflect readily available information for use in land use planning assessments and decision making.

Priority classification areas

Priority 1 (P1) classification areas are managed to ensure that there is **no degradation** of the drinking water source by preventing the development of potentially harmful activities in these areas. The guiding principle is **risk avoidance**. This is the most stringent priority classification for drinking water sources. P1 areas normally encompass land owned or managed by State agencies, but may include private land that is strategically significant to the protection of the drinking water source (e.g. land immediately adjacent to a reservoir). Most land uses create some risk to water quality and are therefore defined as "**Incompatible**" in P1 areas.

Priority 2 (P2) classification areas are managed to ensure that there is **no increased risk** of water source contamination/ pollution. For P2 areas, the guiding principle is **risk minimisation.** These areas include established low-risk land development (e.g. low intensity rural activity). Some development is allowed within P2 areas for land uses that are defined as either "**Compatible with conditions**" or "**Acceptable**".

Priority 3 (P3) classification areas are defined to **manage the risk of pollution** to the water source from catchment activities. Protection of P3 areas is mainly achieved through guided or regulated environmental

(risk) management for land use activities. P3 areas are declared over land where water supply sources co-exist with other land uses such as residential, commercial and light industrial development. Land uses considered to have significant pollution potential are nonetheless opposed or constrained.

Definition of terms used in the following tables

'**Acceptable** ' (equivalent to 'compatible' in previous version of this note)- means the land use is accepted by DoE as not likely to harm the drinking water source, and is consistent with the management objectives of that priority classification. The adoption of best practice environmental management methods for new proposals to protect water quality is expected. Existing land users are also encouraged to adopt best practice environmental management methods to help protect water quality. These land uses generally do not need referral to the DoE.

'**Compatible with conditions**' (equivalent to 'conditional' in previous version of this note) **-** means the land use is likely to be accepted by DoE as not likely to harm the drinking water source, (and is consistent with the management objectives of the priority classification) provided best environmental management practices are used. This may result in the application of 'specific conditions' (via the planning or environmental approval processes) that must be complied with to ensure the water quality objective of the priority area is maintained.

Land uses described as 'Compatible with conditions' need ONLY to be referred to DoE for assessment and a written response if the activity does not follow recommendations endorsed by DoE such as those made in policy, environmental management guidelines, protection notes; Ministerial Conditions, Works Approvals, Licenses or agreements (e.g. a 'Memorandum of Understanding' developed between any Local Government and DoE).

'Incompatible'- means the land use is UNACCEPTABLE to DoE as it does not meet the management objectives of the priority classification area. DoE will normally oppose approval of these land uses through the planning decision making process and under legislation administered by DoE. If planning decisions are made to approve these land uses (e.g. as a consequence of a planning appeals process), then DoE should be advised of that decision and have been directly involved in providing advice to the planning decision makers on water quality protection issues. It should be noted that contentious proposals may be referred to the EPA for Environmental Impact Assessment under the *Environmental Protection Act 1986.*

'Extensive'- means limited additional inputs beyond those supplied by nature are required to support the land use, e.g. for agriculture- animal feed supplements only during seasonal dry periods, or during the final preparation of stock for the market.

'Intensive'- means regular additional inputs are required to support the desired land use, e.g. for agriculture-irrigation, fertilisers, pesticides, or non-forage animal feeding dominates.

Tables defining compatibility of various land uses within PDWSA

Model Scheme Text & interpreted type of land use	P1 areas	P2 areas	P3 areas
Agriculture– extensive			
- pastoral leases	Compatible with conditions	Acceptable	Acceptable
- floriculture (non irrigated), stock grazing (excluding pastoral leases) and broad hectare cropping,	Incompatible	Compatible with conditions (see notes 11, 12)	Acceptable
Agriculture- intensive			
- aquaculture (fish, plants and crustaceans)	Incompatible	Compatible with conditions	Compatible with conditions
- orchards; production nurseries– potted plants; viticulture– wine and table grapes	Incompatible	Compatible with conditions	Acceptable
- floriculture; market gardens (see note 24); turf farms	Incompatible	Incompatible	Compatible with conditions
- hydroponic plant growing	Incompatible	Compatible with conditions	Compatible with conditions
- plant nurseries / garden centres	Incompatible	Compatible with conditions (see note 2)	Acceptable
Agro-forestry	Incompatible	Compatible with conditions	Acceptable
Amusement parlour	Incompatible	Incompatible	Acceptable (see note 1)
Animal establishment			
- animal saleyards and stockyards (see note 13)	Incompatible	Compatible with conditions (see note 2)	Compatible with conditions (see note 2)
- apiaries	Compatible with conditions	Acceptable	Acceptable
- catteries	Incompatible	Acceptable	Acceptable
- dairy sheds	Incompatible	Compatible with conditions (see notes 2, 3, 12)	Compatible with conditions (see note 3)
- dog kennels	Incompatible	Compatible with conditions	Compatible with conditions
- equestrian centres (see note 17)	Incompatible	Incompatible	Acceptable
- feedlots, intensive outdoor livestock holding	Incompatible	Incompatible	Compatible with conditions
- stables (see note 18)	Incompatible	Compatible with conditions	Acceptable
Animal husbandry- intensive			
- piggeries	Incompatible	Incompatible	Incompatible
- poultry farming - housed	Incompatible	Compatible with conditions	Compatible with conditions
Bed and breakfast (accommodating a maximum of 6 guests)	Compatible with conditions (see notes 6, 16)	Acceptable (see note 23)	Acceptable
- farm stay accommodation, rural chalets)	Compatible with conditions (see notes 6, 16)	Compatible with conditions (see note 4)	Acceptable
Betting agency	Incompatible	Compatible with conditions (see note 2)	Acceptable (see note 1)
Caravan park	Incompatible	Incompatible	Compatible with conditions (see note 1)
Caretakers dwelling	Compatible with conditions (see note 2)	Compatible with conditions	Acceptable

Answer Guide

WET 216 - Assessing Mr Fish's development application

1. Answer should say:
   - Lot 12586 North Walpole Road, Walpole 6398

2. Answer should say:
   - Aquaculture operation/fish farm for breeding marron, or marron farm.

3. Answer should say:
Walpole Weir and Butler's Creek Dam Catchment Areas (Walpole Weir Catchment Area is sufficient) (*Refer to Figure 3 of WET 224 - Walpole Drinking Water Source Protection and Geographic Data Atlas.)*
   -
   - Priority 1 (P1) area *(Refer to Geographic Data Atlas online.)*

4. Answer should say all of the following:
   - Walpole
   - Boronia Ridge development
   - Coalmine Beach Caravan Park
   - some surrounding farms

Refer to Page 1 of WET 224 - Walpole Drinking Water Source Protection.

5a. Answer should include:
   - Illness such as stomach upset, diarrheoa, or even death.

Refer to Page 4 of WET 224 - Walpole Drinking Water Source Protection.

5b. Answer should include:
   - Nitrate can be toxic to humans at high levels, with infants being most susceptible.

Answers

Refer to Page 5 of WET 224 - Walpole Drinking Water Source Protection.

6. Yes

Refer to Page 1 of WET 217 Document Extract: Water Protection Requirements for Aquaculture.

7. Answer should include 2-3 of the following (depending on the level of the students):
   - increase in nutrients, organic material, pathogens, pharmaceuticals and suspended solid concentrations
   - vegetation loss adjacent to waterways and wetlands
   - loss of embankments and pond contents during storm events
   - release of exotic species from different genetic populations into local waters
   - threatening the local aquatic ecology
   - turbid stormwater from earthworks during pond construction
   - pond discharges with increased salinity resulting from solar evaporation effects
   - harmful or nuisance wastes discharged to the environment.

Refer to Page 1 of WET 217 Document Extract: Water Protection Requirements for Aquaculture.

8. Answer should say:
   - “compatible with conditions”. (In other words, yes, the development is acceptable provided some conditions are met that make sure water quality is protected.)

Refer to Page 3 of WET 222 Document Extract: Land use compatibility in Public Drinking Water Source Areas

9. Answer could include any 5 of the following:
   - Wastes discharged into the local environment must not contain significant concentrations of either nuisance or harmful substances.
   - Should not be established on land that is seasonally flooded, needs to be artificially drained, where natural watercourses need to be diverted or construction will affect riparian vegetation.
   - Ponds should be high enough in the landscape to ensure negligible impacts on waterways, wetlands and their dependant vegetation, and allow for the effective operation of filter zones and sediment control.
   - Establish or maintain a vegetation buffer between the development and the Walpole River.
   - Operated so that fish or pond plant species, discoloured water, sludge, silt, toxic chemicals and/or unstable organic material are not discharged into waterways or wetlands as a result of pond overflow, cleaning or emptying.

Answers

- Contain waste materials effectively on-site, pending treatment or offsite disposal.
- Ponds should be designed and constructed by qualified and experienced personnel using very low permeability materials such as clay or plastic-lined ponds, fibreglass, metal or concrete tanks.
- If native soils are used for pond construction, they should be engineered to ensure their long-term secure operation.
- Ponds should not be established on steep slopes (greater than one in 10) or on unstable ground, as embankments may fail. The ponds should incorporate measures to divert storm event runoff e.g. cut-off drains without overtopping, eroding or breaching pond embankments or causing uncontrolled release/displacement of contents.
- For larger scale aquaculture projects, waste water should be fully contained within the project site or treated to a standard set by regulatory agencies.
- Solid waste should be composted, then either applied to land as a soil conditioner, exported off site for a useful purpose, or if these options are not viable, disposed of at an approved landfill.
- Site operators should develop a contingency plan that addresses equipment malfunctions, natural events such as storms and bushfires, inadequately trained staff, disease outbreaks, predators, pest species and poachers.

Refer to Pages 1-3 of WET 217 Document Extract: Water Protection Requirements for Aquaculture.