GOVERNMENT OF WESTERN AUSTRALIA

DE GREY RIVER WATER RESERVE

WATER SOURCE PROTECTION PLAN

Port Hedland Regional Water Supply

WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 24

2000

WATER AND RIVERS COMMISSION

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(Cover Photograph: The De Grey River)

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Policy and Planning Division

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Foreword

Water Source Protection Plans

Water Source Protection Plans establish the level of protection required within Water Reserves. The plans identify sources of contamination that should be investigated and set out programs for management of the resource. Water Source Protection Plans are developed in consultation with affected landowners and industry groups and relevant Government agencies.

Proclaiming Water Reserves under *the Country Areas Water Supply Act (1947)* protects the quality of water sources in country Western Australia. The Act's by-laws enable the Water and Rivers Commission to control potentially polluting activities, to regulate land use, inspect premises and to take steps to prevent or clean up pollution.

The Water and Rivers Commission aims to work pro-actively with planning agencies to incorporate water protection in the land planning process. Decisions on land use zoning and subdivision applications have a significant impact on the protection of water sources. The Commission supports the amendment of Town Planning Schemes and Development Strategies that reflect land use compatible with Water Source Protection Plans.

This Water Source Protection Plan provides a basis for establishing compatible land uses within the Water Reserve at De Grey River and is a mechanism for practical implementation of the Commission's protection strategies. Local government decision-makers, State planning authorities and operational staff are encouraged to recognise this document as a basis for ensuring the long term protection of this groundwater resource for generations to come.

Water quality protection framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. The Commission has developed policies for the protection of public drinking water source areas (PDWSAs) that include three levels of priority classification.

Priority 1 (P1) source protection areas are defined to ensure that there is no degradation of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of risk avoidance and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is no increased risk of pollution to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in accordance with the principle of risk minimisation and so some development is allowed under specific guidelines.

Priority 3 (P3) source protection areas are defined to minimise the risk of pollution to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments. Protection of P3 areas is achieved through management guidelines rather than restrictions on land use. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, well-head protection zones are defined to protect the water source from contamination in the immediate vicinity of production wells. Well-head protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. These zones do not extend outside water reserves. Special conditions apply within these zones.

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Summary

The De Grey River wellfield is used in conjunction with the Yule River wellfield to supply water for Port Hedland. The De Grey River wellfield is operated by the Water Corporation and draws groundwater from the alluvial deposits of the De Grey River. The aquifer is vulnerable to contamination from inappropriate land uses.

The De Grey River aquifer has the potential to be contaminated from several sources including spillage of contaminants along the highway and railway that traverse the Water Reserve and fuel storage within the Water Reserve.

The existing Water Reserve should be modified to incorporate future extensions of the wellfield and to exclude areas that are unlikely to be used for public water supply. The proposed Reserve should be managed for Priority 1 source protection.

This plan has undergone extensive consultation during the development process. Prior to the preparation of the draft plan, discussions were held with key stakeholders. The draft plan was released for comment to key stakeholders including the Water Corporation, Ministry for Planning, Department of Environmental Protection, Department of Land Administration, Department of Conservation and Land Management, Pastoralists and Graziers Association, Shire of East Pilbara, Town of Port Hedland, Shire of East Pilbara, affected landowners and the Conservation Council. Comments received were considered and have been addressed in the preparation of this plan.

1. Introduction

The De Grey River wellfield is approximately 60 km east of the town of Port Hedland on the eastern bank of the De Grey River near the confluence with the Shaw River (**Figure 1**). Water is drawn from an aquifer of alluvial deposits of the De Grey River.

The Water Corporation operates the wellfield in conjunction with the Yule River wellfield to supply water to the Town of Port Hedland.

The existing De Grey River Water Reserve was gazetted under the *Country Areas Water Supply Act (1947)* on 12 August 1977 for the purpose of protecting the public water supply source. The Water Reserve lies within the administrative boundaries of the Town of Port Hedland and the Shire of East Pilbara.

The current annual average abstraction from the De Grey River wellfield is 3.3 GL whilst the installed capacity is 8.4 GL (WRC, 1996). The Water Corporation recently reviewed the safe yield of the aquifer and subsequently applied to reduce the licensed abstraction to 6.5 GL/annum with upgrades in the future to increase the installed capacity to 8.7 GL/annum.

The wellfield consists of 11 production bores (1/76, 2/76, 3/76, 5/76, 6/76, 7/76, 8/76, 10/76, 12/76, 13/76, 1/79 see **Figure 2**) and a network of monitoring bores. The production bores vary in screened depth between 40 and 70 m below ground level. The bores pump to the Strelley pump station tanks where water is disinfected with chlorine before being transferred to Port Hedland (WAWA, 1991).

2. Physiography

The climate of the region is semi-arid, hot and mostly dry, with an average annual rainfall of 347 mm at nearby Goldsworthy. Rainfall is irregular and most falls between December and April as a result of cyclonic and thunderstorm activity. Infrequent and unreliable winter rain also occurs. Annual evaporation in the De Grey River area is about 2.5 m.

The hills are steep and rise abruptly from the plain, with scree slopes at the base. A network of numerous small creeks and erosion channels has produced a rugged terrain.

The main drainage channels flowing intermittently to the northwest are the De Grey, Coongan, Shaw, and Strelley (East and West branches) Rivers. These are locally very wide and sandy and sometimes braided, with semi-permanent and permanent pools (**Figure 1**).

3. Hydrogeology

The De Grey River is near the northern edge of the Pilbara Craton, consisting of Archaean rocks, including granite, schist and quartzite. The wellfield draws water from an alluvial sequence of gravel, coarse sand and minor silty clay averaging 50 m thick (WAWA, 1991). The aquifer, described by Davidson (1973), consists of beds of highly permeable sand and gravel separated by low permeability silt and clay. It possibly occupies a palaeochannel of the Shaw River. The aquifer is essentially unconfined and hydraulic connection exists between the upper and lower sand beds. The alluvium has resulted from sediment deposition of the De Grey, Shaw, Oakover, Coongan and Nullagine Rivers (PWD, 1983). The watertable in the wellfield is approximately 6 to 8m below the ground surface.

Aquifer recharge occurs predominantly from infiltration during riverflows, with some recharge from percolation of rainfall through the riverbed sand and adjacent alluvium during high intensity rainfall events. Regional groundwater flow is generally north to northwest. Baseflow in the Shaw and De Grey Rivers converges upstream of the wellfield, moves north to northwest through the wellfield area and onwards to the western side of the De Grey River upstream of the De Grey Station homestead.

As the aquifer is unconfined and recharged directly by rainfall and river flow, it is vulnerable to contamination. Also, as groundwater flow is to the northwest, any contaminants entering the aquifer south of the wellfield could affect water quality.

Water quality within the aquifer is variable with total dissolved salts (TDS) ranging between 200 and 4000mg/L. The salinity in the production bores is generally between 400 mg/L and 800 mg/L and increases to the north and east of the wellfield (Martin,

1996). Bore 1/79 is an exception to this as it has a slight decrease in salinity trend.

Recent drilling has identified potential for expansion of the wellfield to the west side of the De Grey River. The area has shown to be high yielding because of direct hydraulic connection with the De Grey River (Martin, 1996).

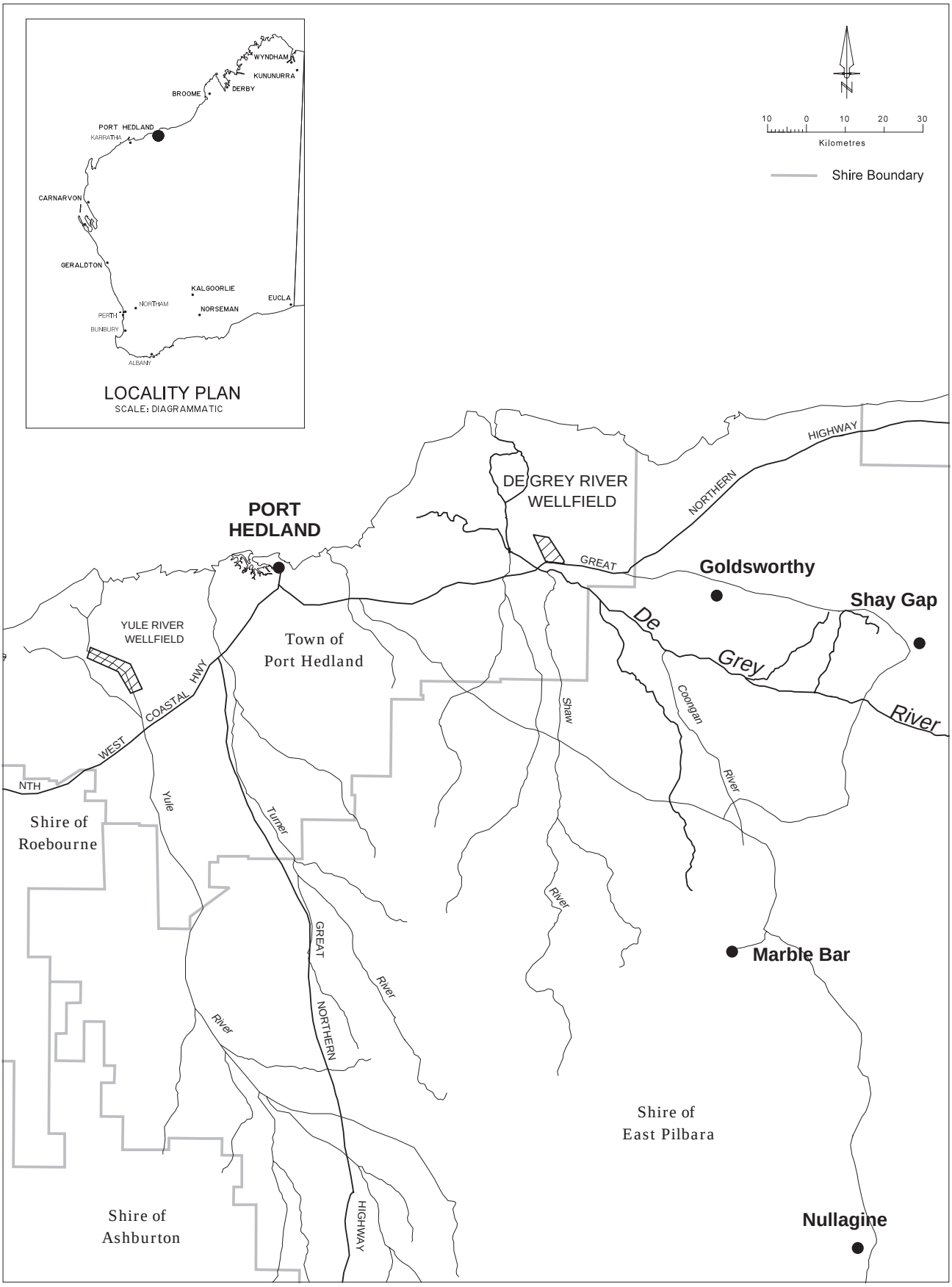

Figure 1: De Grey River locality plan

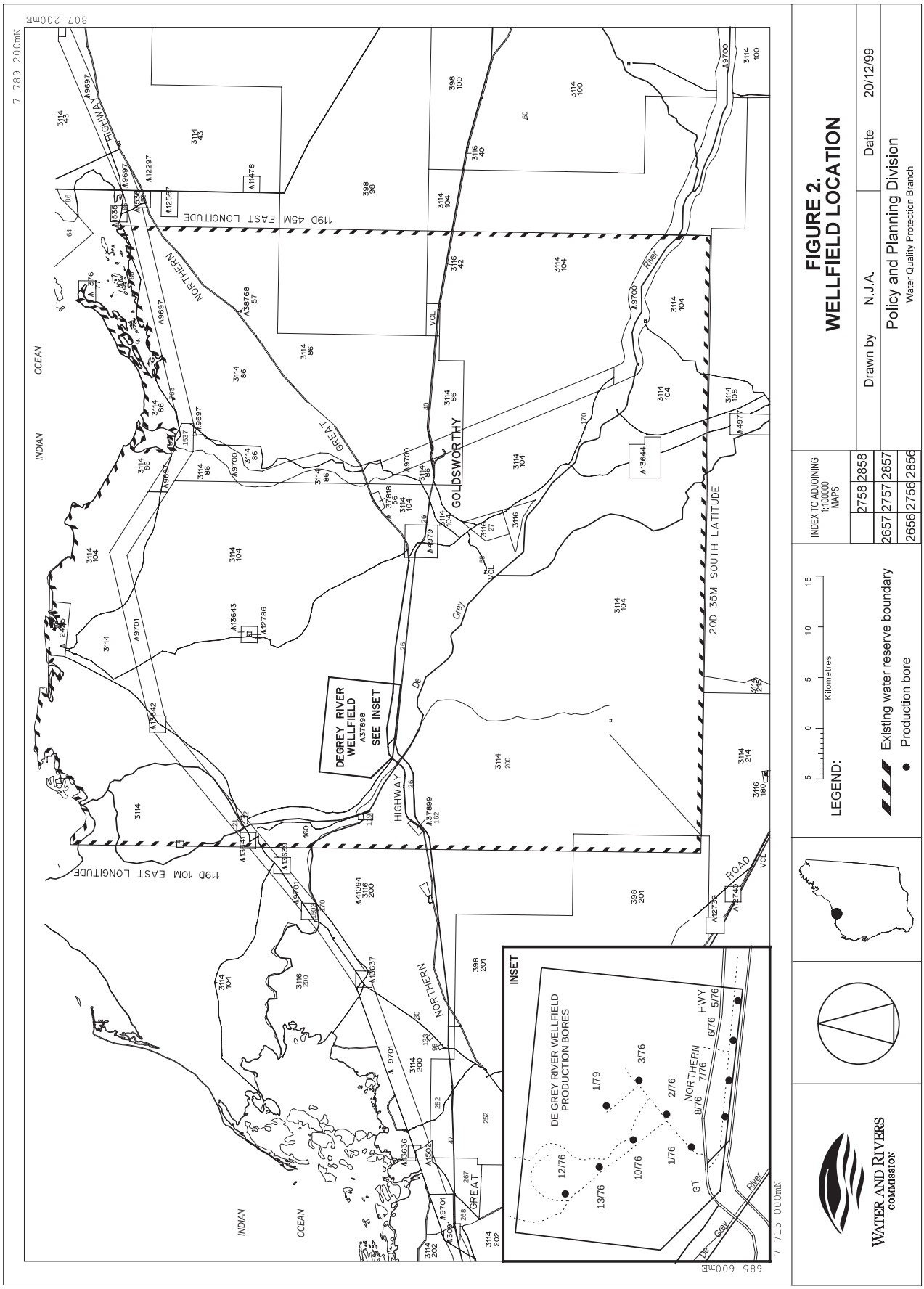

Figure 2. De Grey River Wellfield

4. Existing and proposed land use

The existing Water Reserve extends over two pastoral leases (De Grey and Pardoo). Both cattle and sheep graze over the leases that consist of savanna-woodland vegetation. The De Grey lease has incorporated the Mulyie pastoral lease.

Two disused stock routes De Grey to Peak Hill and De Grey to Mullewa, cross the existing Water Reserve.

Several special act mineral leases, exploration licences and a mining lease exist within the current Water Reserve. Mineral exploration activities are mainly for gold and iron ore. There is no active mine site on any of the existing tenements with most being used as borrow pits for railway maintenance.

The Port Hedland - Shay Gap Railway runs in an east-west direction across the Water Reserve and is used by BHP to transport iron ore from the mine at Yarrie to Port Hedland.

Great Northern Highway, the major transport route that links the major towns in the region, traverses the Water Reserve. Travellers and supply vehicles predominantly use the highway.

The leaseholder of De Grey station has indicated the intention to develop small areas of intensive fodder production to the north and east of the Homestead.

5. Proposed proclaimed area

As mentioned earlier, the existing Water Reserve, shown in **Figure 3,** was proclaimed in 1977. It is proposed to modify the boundary of the Water Reserve.

The western boundary has been changed to include areas west of the De Grey River that have been identified by exploratory drilling as having potential for future production bores.

The boundary has been reduced in a northern and eastern direction to exclude areas that are not required for public water supply due to high salinities.

The De Grey River divides the northern boundary between the western and eastern sections of the Water Reserve. The proposed Water Reserve protects the existing wellfield and allows for appropriate expansion while not constraining land unnecessary for water source protection.

The main recharge areas for the wellfield, the riverbed and nearby floodplain of the De Grey River, are covered by the proposed Water Reserve. The boundary also includes the recharge area of the water supply wellfield that serviced the town of Goldsworthy. This source may be required in the future for the Port Hedland Regional Water Supply.

The De Grey station homestead and associated facilities are outside of the proposed Water Reserve.

The proposed Water Reserve should be managed for Priority 1 source protection. This classification is justified for the following reasons:

- The water source is of strategic importance to the town of Port Hedland.
- The land is largely under Crown reserve.
- Current and future land uses are generally compatible with the level of protection.
- The aquifer is unconfined and is susceptible to contamination if intensification of land use occurs.

In addition, wellhead protection zones consisting of a 500m radius centred around each production bore should be established. Specific restrictions on fuel storage will apply in these zones.

6. Potential for contamination

This plan aims to balance water quality protection and social needs and aspirations as much as possible.

Table 1 identifies and provides details on potential contaminant threats in the proposed Water Reserve. The 'Potential Impact' indicates the level of risk the issue is to the water source and 'Likelihood' indicates the chance of the issue contaminating the water source. **Figure 4** shows the location of potential contaminant threats.

6.1 Emergencies

Escape of chemicals during unforeseen incidents and use of chemicals during emergency response can cause groundwater contamination. The Shires of East Pilbara and Port Hedland Local Emergency Management Advisory Committee through the DEMAC Group Emergency Management District should be familiar with the location and purpose of the De Grey River Water Reserve. A locality plan should be provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team. The Regional Manager Water and Rivers Commission should have an advisory role to any HAZMAT incident in the De Grey River Water Reserve.

Personnel who deal with WESTPLAN - HAZMAT incidents within the area should be given ready access to a locality map of the Water Reserve. These personnel should receive training to ensure an understanding of the potential impacts of spills on the groundwater resource.

6.2. Wellhead protection zones

In addition, wellhead protection zones consisting of a 500 metre radius centred around each production bore should be established (see **Figure 4**).

7. Management of potential water quality risks

Priority 1 areas are managed in accordance with the principle of avoiding any risk of contamination.

7.1. Protection objectives

This plan recognises the right of existing approved land uses to continue to operate in the water reserve.

The De Grey River Water Reserve should be managed to ensure there is no further degradation of water quality. It is considered that an improvement in water quality is achievable through the proposed management strategies.

This plan is aiming is to balance water quality protection and social needs and aspirations as much as possible.

7.2. Best management practices

The adoption of best management practices (BMPs) for land use activities is encouraged to help protect water quality.

These are often in the form of an industry code of practice or environmental guidelines. They are developed in consultation with industry groups, producers and State government agencies.

7.3. Land use planning

Establishing appropriate protection mechanisms in statutory land use planning processes is necessary to secure the long-term protection of water sources.

It is therefore appropriate the Water Reserve and Priority classification be recognised as a in the future regional planning schemes and subsequently in the Town Planning Scheme.

7.4. Potential for contamination

Table 1 details the existing land uses in the catchment, the potential water quality risks and recommends a strategy to manage the risks.

The recommended strategy aims to secure the water quality of this strategic source for the community in the long term while minimising the constraints on development opportunities and recognising landholders' rights to continue using their land for lawful purposes.

Figure 4 shows a map of potential contaminant threats.

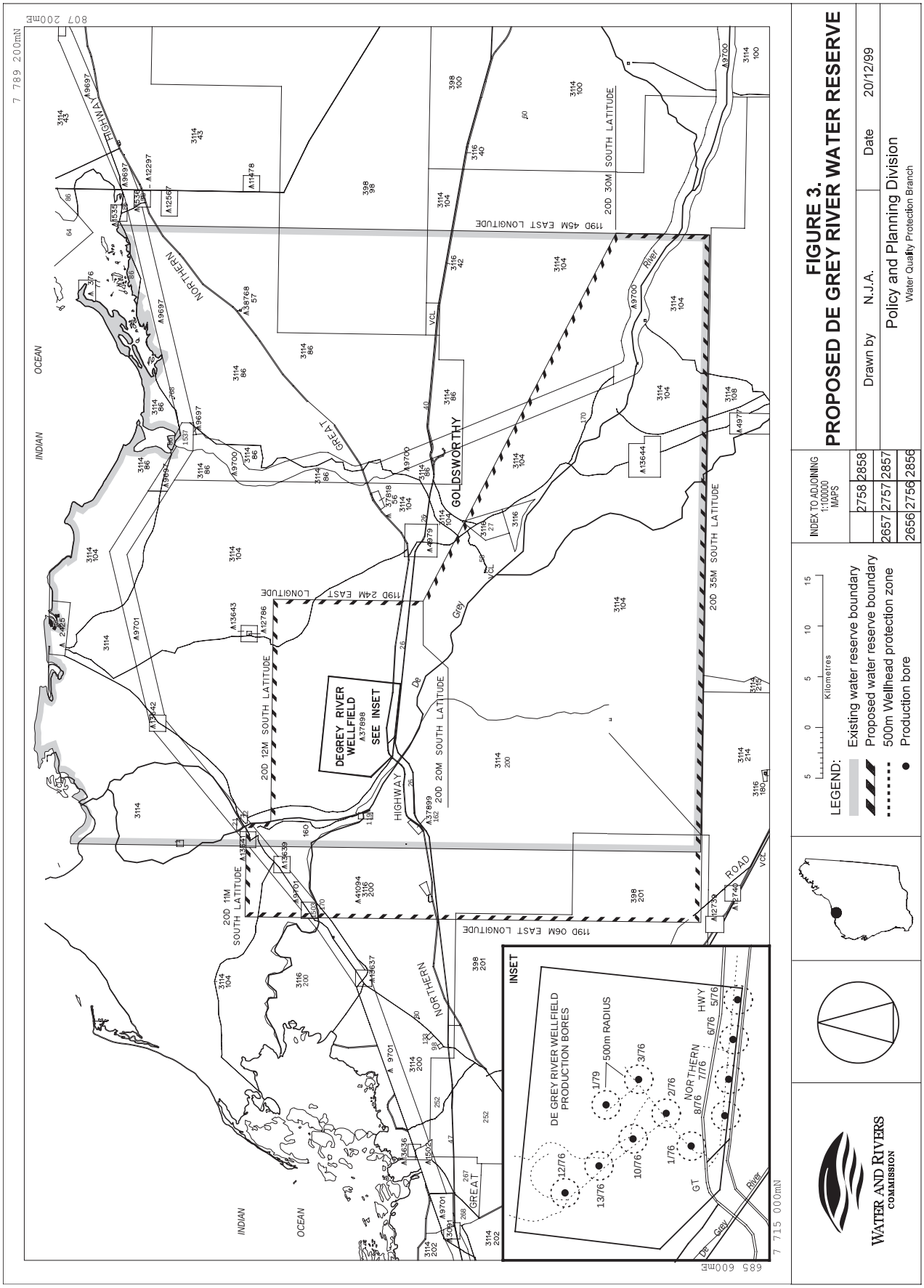

Figure 3. (Proposed) De Grey River Water Reserve

Table 1. Potential sources of contamination within the Proposed De Grey River Water Reserve

Map ref.	Issue	Threats	Risks	Potential Impact to Wellfield	Likelihood	Current Preventative Measures	Suggested Protection Measures
1.	Strelley Pump Station	• Three empty 50 000 L tanks, four 2400 L tanks used for diesel storage. • Small quantity of engine oil.	Contamination by hydrocarbons	Minimal.	Minimal	The pump station and wellfield have been electrified. All diesel engines pumps from bores and pumping station have been removed. A standby diesel generator is used when power is interrupted.	• Bund fuel and oil storage within compound to meet Commission's requirements (**Appendix 2**). • Remove disused tanks from the pump station.
2.	Camping near De Grey River Bridge.	• Riverbanks used for camping and a meeting place for Aboriginal people. • No toilet facilities at present.	Contamination from dispersed human waste.	Moderate, in wellfield recharge zone	Low	Main Roads Department has committed to installing toilets.	Signage to increase awareness of protection of water resources.
3.	Transport of diesel and chemicals along Great Northern Highway and Port Hedland - Shay Gap Railway.	• Three diesel tankers (one 100 000 L and two 40 000 L tankers) dispatched to mine weekly on separate runs. • Two locomotives hauling iron ore up to 10 trips daily carry up to 17 000 L of diesel. • Highway crosses De Grey River. • 22 kL diesel spill (18/1/89) on the East Strelley River road crossing with Marble Bar road.	Contamination by hydrocarbons and chemicals	High, as highway is located close to the De Grey River wellfield.	Low	• Detection system in place for locomotives. • Railway tracking system using sensors along tracks to detect derailment. • Emergency response plan for incident management associated with HAZMAT.	Ensure awareness of need to protect water resources is part of emergency response plan.

(Table 1. Continued)

Map ref.	Issue	Threats	Risk	Potential Impact to Wellfield	Likelihood	Current Preventative Measures	Suggested Protection Measures
n/a	Pastoral grazing activity	Grazing of stock within the Water Reserve (low stocking rates).	Microbial and nutrient contamination	Minimal	Minimal	None	Production bores should be fenced off to prevent the intrusion of cattle
n/a	Herbicide use around bores	Roundup sprayed around bores every 3 weeks.	Herbicide contamination	Minimal	Moderate	None	Investigate use of non-chemical weed control methods.

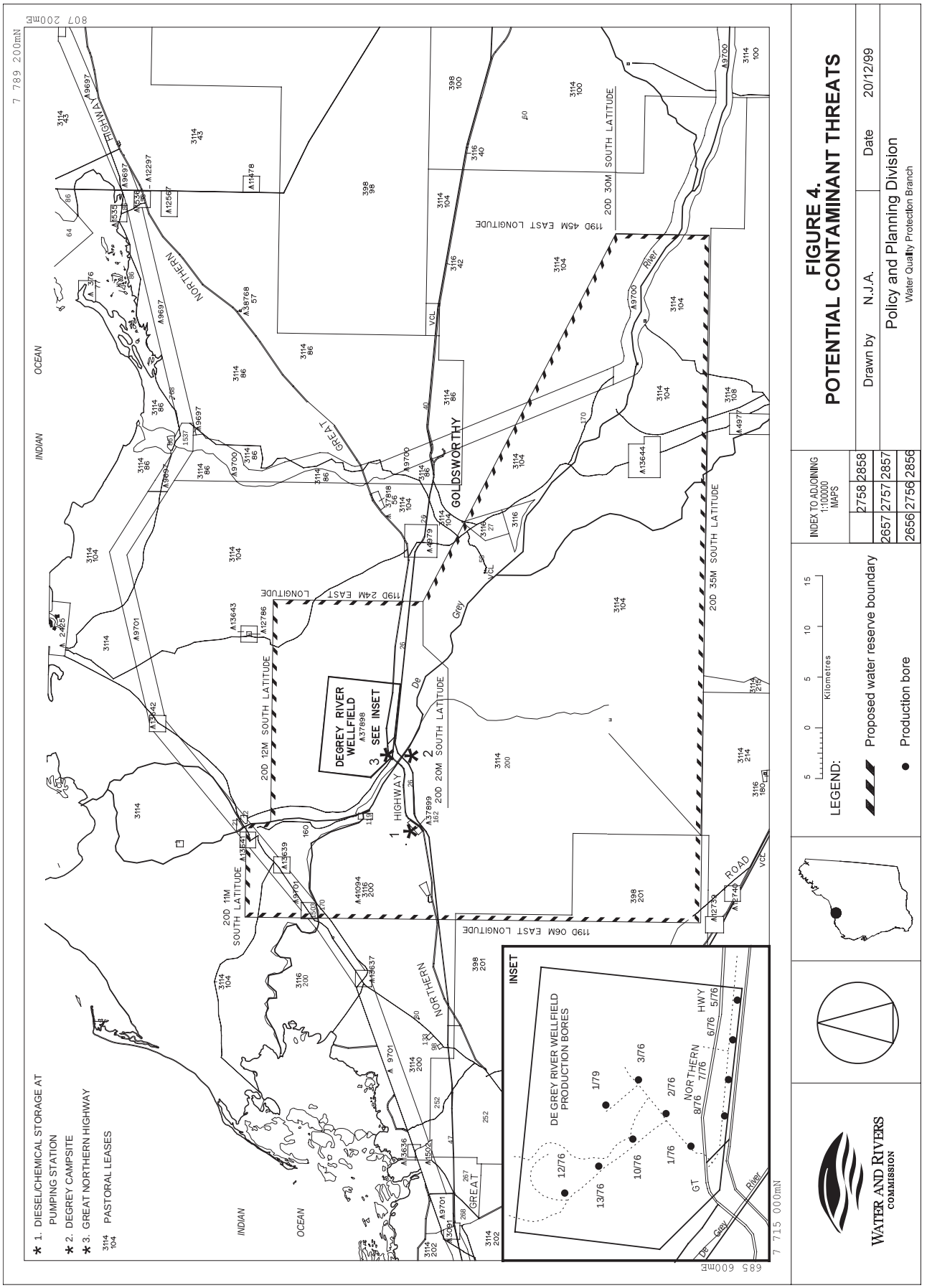

Figure 4. Potential contamination threats

Recommendations

1. The proposed De Grey River Water Reserve should be gazetted under the *Country Areas Water Supply Act* 1947.

2. Planning strategies should incorporate the management principles outlined in the Water and Rivers Commission's *Land Use Compatibility in Public Drinking Water Source Areas* (see **Appendix 1**) and reflect the Priority 1 classification given to the Water Reserve.

3. All development proposals in the Water Reserve that are likely to impact on water quality should be referred to the Water and Rivers Commission.

4. Signs should be erected along the boundaries of the Water Reserve and at the De Grey River bridge picnic area to define the reserve and promote public awareness of the need to protect water quality.

5. Incidents covered by WESTPLAN – HAZMAT in the De Grey River Water Reserve should be addressed through the following measures:

- The Shires of East Pilbara and Port Hedland Local Emergency Management Advisory Committee (through the Karratha Emergency Management District) being familiar with the location and purpose of the De Grey River Water Reserve.
- The locality plan for the De Grey River Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory Team.
- The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the De Grey River Water Reserve.
- Personnel dealing with WESTPLAN - HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.

6. A surveillance program should be established to identify potential contaminant threats within the Water Reserve.

7. Fuel and chemical storage should be bunded at the Strelley Pump Station to meet the Commission's requirements. Disused diesel storage tanks should be removed.

8. Production bores should be fenced off to prevent the intrusion of cattle.

9. The use of non-chemical weed control measures within the bore compounds should be investigated.

10. Implementation of these recommendations should be reviewed annually after this plan is endorsed. A full review of this protection plan should be undertaken after five years.

Implementation strategy

No	Description	Implemented by	Timing
1.	Gazettal of Water Reserve.	Water and Rivers Commission	2000/2001
2.	Incorporation into land planning strategies.	Shire of East Pilbara and Town of Port Hedland	Ongoing
3.	Referral of development proposals: (i) WRC to provide the Shire of East Pilbara and the Town of Port Hedland with guidelines for referral of development proposals. (ii) Referral of development proposals.	(i) Water and Rivers Commission (ii) Shire of East Pilbara, Town of Port Hedland, Ministry for Planning, Department of Minerals and Energy and Department of Environmental Protection.	(i) To be arranged (ii) Ongoing
4.	Erection of signs: (i) Development of guidelines for signage. (ii) Determine number and location of signs required. (iii)Erect signs.	(i) Water and Rivers Commission (ii) Water and Rivers Commission (iii)Water and Rivers Commission	(i) 2000/2001 (ii) 2000/2001 (iii)To be arranged

(continued)

5.	Incidents covered by WESTPLAN – HAZMET in the De Grey River Water Reserve should be addressed through the following measures: (i) The Shires of East Pilbara and Port Hedland Local Emergency Management Advisory Committee (through the Karratha Emergency Management District) being familiar with the location and purpose of the De Grey River Water Reserve. (ii) The locality plan for the De Grey River Water Reserve being provided to the Fire and Rescue Services headquarters for the HAZMAT Emergency Advisory. (iii) The Water Corporation advising the HAZMAT Emergency Advisory Team during incidents in the De Grey River Water Reserve. (iv) Personnel dealing with WESTPLAN - HAZMAT incidents in the area given ready access to a locality map of the Water Reserve and training to understand the potential impacts of spills on the groundwater resource.	(i) Shires of East Pilbara and Port Hedland Local Emergency Management Advisory Committee through WRC (North-west region) (ii) Water and Rivers Commission (North-West region) (iii) Water Corporation (iv) Shires of East Pilbara and Port Hedland Local Emergency Management Advisory Committee	(i) 2000/2001 (ii) 2000/2001 (iii) Ongoing (iv) Ongoing
6.	Surveillance program: (i) Develop guidelines for the surveillance of Water Reserves. (ii) Implement the surveillance program.	(i) Water and Rivers Commission (ii) Water and Rivers Commission and Water Corporation	(i) 2000/2001 (ii) On completion of surveillance guidelines.
7.	Bunding of fuel and chemical storage at the Strelley Pump Station. Disused diesel tanks to be removed.	Water Corporation	To be arranged
8.	Fencing of bores to prevent animal access and congregation.	Water Corporation in consultation with pastoral lease owner	To be arranged
9.	Investigate the use of non-chemical weed control around bores.	Water Corporation	To be arranged
10.	Review of this plan and recommendations: (i) review implementation strategy annually. (ii) full review after 5 years.	Water Quality Protection Branch (WRC).	(i) initial review – 2001/02 (ii) full review – 2006/07

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Glossary

Abstraction	Pumping groundwater from an aquifer.
Allocation	The quantity of groundwater permitted to be abstracted by a well licence, usually specified in kilolitres/year (kL/a).
Alluvium (alluvial)	Detrital material which is transported by streams and rivers and deposited.
Aquifer	A geological formation or group of formations able to receive, store and transmit significant quantities of water.
Bore	A narrow, lined hole drilled to monitor or withdraw groundwater.
Catchment	The area of land which intercepts rainfall and contributes the collected water to surface water (streams, rivers, wetlands) or groundwater.
Confined Aquifer	An aquifer that is confined between shale and siltstone beds and therefore contains water under pressure.
Diffuse Source Pollution	Pollution originating from a widespread area e.g. urban stormwater runoff, agricultural runoff.
Effluent	The liquid, solid or gaseous wastes discharged by a process, treated or untreated.
Groundwater	Water which occupies the pores and crevices of rock or soil.
Hydrogeology	The study of groundwater, especially relating to the distribution of aquifers, groundwater flow and groundwater quality.
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.
m AHD	Australian Height Datum. Height in metres above Mean Sea Level +0.026 m at Fremantle.
Nutrient Load	The amount of nutrient reaching the waterway over a given time (usually per year) from its catchment area.
Nutrients	Minerals dissolved in water, particularly inorganic compounds of nitrogen (nitrate and ammonia) and phosphorus (phosphate) which provide nutrition (food) for plant growth. Total nutrient levels include the inorganic forms of an element plus any bound in organic molecules.

Pesticides	Collective name for a variety of insecticides, fungicides, herbicides, algicides, fumigants and rodenticides used to kill organisms.
Point Source Pollution	Specific localised source of pollution e.g. sewage or effluent discharge, industrial waste discharge.
Pollution	Water pollution occurs when waste products or other substances e.g. 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 Water Source Area	(PWSA) As for UWPCA, but allowing the taking of groundwater for public supplies.
Recharge	Water infiltrating to replenish an aquifer.
Recharge Area	An area through which water from a groundwater catchment percolates to replenish (recharge) an aquifer. An unconfined aquifer is recharged by rainfall throughout its distribution. Confined aquifers are recharged in specific areas where water leaks from overlying aquifers, or where the aquifer rises to meet the surface.
Runoff	Water that flows over the surface from a catchment area, including streams.
Saltwater Intrusion	The inland intrusion of saltwater into a layer of fresh groundwater.
Scheme Supply	Water diverted from a source (or sources) by a water authority or 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.
Treatment	Application of techniques such as settlement, filtration and chlorination to render water suitable for specific purposes including drinking and discharge to the environment.
Unconfined Aquifer	An aquifer containing water, the upper surface of which is lower than the top of the aquifer. The upper surface of the groundwater within the aquifer is called the watertable.
Underground Water Pollution Control Area	UWPCA) An area defined under the Metropolitan Water Supply Sewerage and Drainage Act, in which restrictions are put on activities that may pollute the groundwater.
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.
Watertable	The upper saturated level of the unconfined groundwater.
Wellfield	A group of bores to monitor or withdraw groundwater.

Appendices

Appendix 1: Land use compatibility in Public Drinking Water Source Areas

LAND USE COMPATIBILITY IN PUBLIC DRINKING WATER SOURCE AREAS

Purpose

To provide information on land use and activities that may impact on the quality of the State's water resources.

These notes provide a basis for developing formal guidelines in consultation with key stakeholders.

Scope

These notes apply to proposed and existing land use within Public Drinking Water Source Areas (PDWSAs).

PDWSAs include Underground Water Pollution Control Areas, Water Reserves and public water supply catchment areas declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, and the *Country Areas Water Supply Act 1947*.

Preamble

The following notes reflect the Commission's current position. They are recommendations only, and may be varied at the discretion of the Commission.

Overview of Protection Framework

The Water and Rivers Commission is responsible for managing and protecting Western Australia's water resources. The Commission has policies for the protection of public drinking water source areas that include three levels of priority classification of lands within PDWSAs.

Priority 1 (P1) source protection areas are defined to ensure that there is **no degradation** of the water source. P1 areas are declared over land where the provision of the highest quality public drinking water is the prime beneficial land use. P1 areas would typically include land under Crown ownership. P1 areas are managed in accordance with the principle of **risk avoidance** and so land development is generally not permitted.

Priority 2 (P2) source protection areas are defined to ensure that there is **no increased risk of pollution** to the water source. P2 areas are declared over land where low intensity development (such as rural) already exists. Protection of public water supply sources is a high priority in these areas. P2 areas are managed in

accordance with the principle of **risk minimisation** and so some development is allowed under specific conditions.

Priority 3 (P3) source protection areas are defined to **manage the risk of pollution** to the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments.
Protection of P3 areas is achieved through **management guidelines** for land use activities. If the water source does become contaminated, then water may need to be treated or an alternative water source found.

In addition to priority classifications, **well-head protection zones** and **reservoir protection zones** are defined to protect the water source from contamination in the immediate vicinity of production wells and reservoirs. Well-head protection zones are usually circular, with a radius of 500 metres in P1 areas and 300 metres in P2 and P3 areas. Reservoir protection zones usually consist of a 2 kilometre buffer area around the top water level of a reservoir and include the reservoir itself. These zones do not extend outside water reserves. Special restrictions apply within these zones.

Tables showing Land Use Compatibility with the Commission's PDWSA protection strategy

These tables should be used as a guideline only. More detailed information on the Commission's requirements in the form of activity guidelines or notes is available for some land uses. These can be found on the 'Protecting Water' web page on the Commission's Internet site (www.wrc.wa.gov.au). Alternately information relating to land use and development within PDWSAs including those not listed in the tables, can be obtained from the Commission's Water Quality Protection Branch.

The Commission recognises that many activities were established before the introduction of these tables. The Commission will negotiate with the operators of such activities to develop appropriate management practices to minimise the impact on water resources.

These tables do not replace the need for assessment by the Commission. Please consult the Commission for advice on any land use proposals in Public Drinking Water Source Areas that may impact on water resources.

Definitions used in the following tables

Compatible	The land use is compatible with the management objectives of the priority classification.
Incompatible	The land use is incompatible with the management objectives of the priority classification.
Conditional	The land use can be compatible with the management objectives of the priority classification, with appropriate site management practices. All conditional developments / activities should be referred to the Commission for assessment on a case specific basis.
Extensive	Where limited additional inputs are required to support the desired land use. eg supplementary animal feed only during seasonal dry periods.
Intensive	Where regular additional inputs are required to support the desired land use. eg irrigation, fertilisers and non forage animal feed dominates.

More information

We welcome your comment on these notes. They will be updated from time to time as comments are received or activity standards change. The Commission is progressively developing Water Quality Protection Notes and Guidelines covering land uses described in the attached tables. Advice on available guidance documents may be obtained by contacting the Commission.

If you wish to comment on the notes or require more information, please contact the Commission's Water Quality Protection Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours) or Fax:(08) 9278 0585.
E-mail: use the {feedback} section at our Internet address (http://www.wrc.wa.gov.au) citing the topic and version.

Tables showing Land use compatibility with PDWSA protection objectives

AGRICULTURE - ANIMALS

Land use	Priority 1	Priority 2	Priority 3
Animal saleyards and stockyards[14]	Incompatible	Incompatible[7]	Conditional[7]
Apiaries on Crown land	Conditional	Conditional	Conditional
Aquaculture eg. crustaceans, fish, algae farms	Incompatible	Conditional	Conditional
Dairy sheds	Incompatible	Incompatible[11,15]	Conditional[15]
Feedlots	Incompatible	Incompatible	Conditional
Livestock grazing - pastoral leases	Conditional	Compatible	Compatible
Livestock grazing - broad acre (extensive)	Incompatible	Conditional[11]	Compatible
Livestock grazing (intensive)	Incompatible	Incompatible	Conditional[11]
Piggeries	Incompatible	Incompatible	Incompatible
Poultry farming (housed)	Incompatible	Conditional	Conditional
Stables	Incompatible	Conditional	Compatible

AGRICULTURE - PLANTS

Land use	Priority 1	Priority 2	Priority 3
Broad acre cropping i.e. non-irrigated	Incompatible	Conditional[1]	Compatible
Floriculture (extensive)	Incompatible	Conditional	Compatible
Floriculture (intensive)	Incompatible	Incompatible	Conditional
Horticulture- hydroponics	Incompatible	Conditional	Conditional
Horticulture - market gardens	Incompatible	Incompatible	Conditional
Orchards	Incompatible	Conditional	Compatible
Nurseries (potted plants)	Incompatible	Conditional	Compatible
Silviculture (tree farming)	Conditional	Conditional	Compatible
Turf farms	Incompatible	Incompatible	Conditional
Viticulture (wine & table grapes)	Incompatible	Conditional	Compatible

DEVELOPMENT - COMMERCIAL

Land use	Priority 1	Priority 2	Priority 3
Aircraft servicing	Incompatible	Incompatible	Conditional[6]
Airports or landing grounds	Incompatible	Incompatible	Conditional[6]
Amusement centres	Incompatible	Incompatible	Compatible[6]
Automotive businesses	Incompatible	Incompatible	Conditional[6]
Boat servicing	Incompatible	Incompatible	Conditional[6]
Catteries	Incompatible	Compatible	Compatible
Caravan and trailer hire	Incompatible	Incompatible	Conditional[6]
Consulting rooms	Incompatible	Incompatible[7]	Compatible[6]
Concrete batching and cement products	Incompatible	Incompatible	Conditional
Cottage Industries	Conditional	Conditional	Compatible
Dog kennels	Incompatible	Conditional	Conditional
Drive in / take-away food shops	Incompatible	Incompatible	Compatible[6]
Drive -in theatres	Incompatible	Incompatible	Compatible[6]
Dry cleaning premises	Incompatible	Incompatible	Conditional[6]

Farm supply centres	Incompatible	Incompatible[7]	Conditional
Fuel depots	Incompatible	Incompatible	Conditional
Garden centres	Incompatible	Incompatible	Compatible
Laboratories (analytical , photographic)	Incompatible	Incompatible	Conditional[6]
Markets	Incompatible	Incompatible	Compatible[6]
Mechanical servicing	Incompatible	Incompatible	Conditional[6]
Metal production / finishing	Incompatible	Incompatible	Incompatible
Milk transfer depots	Incompatible	Incompatible	Conditional
Pesticide operator depots	Incompatible	Incompatible	Incompatible
Restaurants and taverns	Incompatible	Incompatible	Compatible[6]

Land use	**Priority 1**	**Priority 2**	**Priority 3**
Service stations	Incompatible	Incompatible	Conditional[6]
Shops and shopping centres	Incompatible	Incompatible[7]	Compatible[6]
Transport depots	Incompatible	Incompatible	Conditional
Vehicle parking (commercial)	Incompatible	Incompatible	Compatible
Vehicle wrecking and machinery	Incompatible	Incompatible	Conditional
Veterinary clinics / hospitals	Incompatible	Incompatible[7]	Conditional[6]

DEVELOPMENT - INDUSTRIAL

Land use	**Priority 1**	**Priority 2**	**Priority 3**
Heavy Industry	Incompatible	Incompatible	Incompatible
Light or general Industry	Incompatible	Incompatible	Conditional[6]
Power Stations	Incompatible	Incompatible	Incompatible

DEVELOPMENT - URBAN

Land use	**Priority 1**	**Priority 2**	**Priority 3**
Aged and dependent persons group dwellings	Incompatible	Incompatible	Compatible[6]
Cemeteries	Incompatible	Incompatible	Conditional
Civic buildings	Incompatible	Conditional[7]	Compatible[6]
Clubs -sporting or recreation	Incompatible	Conditional	Compatible[6]
Community halls	Incompatible	Conditional[7]	Compatible
Family day care centres	Incompatible	Incompatible[7]	Compatible[6]
Funeral parlours	Incompatible	Incompatible	Compatible[6]
Health centres	Incompatible	Incompatible	Compatible[6]
Hospitals	Incompatible	Incompatible	Conditional[6]
Medical centres	Incompatible	Incompatible	Compatible[6]
Toilet blocks and change rooms	Incompatible[7]	Conditional	Compatible

EDUCATION / RESEARCH

Land use	Priority 1	Priority 2	Priority 3
Community education centres	Conditional[7]	Conditional[7]	Compatible[6]
Primary / Secondary Schools	Incompatible	Incompatible	Compatible[6]
Scientific Research	Conditional	Conditional	Compatible
Tertiary Education Facilities	Incompatible	Incompatible	Conditional[6]

MINING AND MINERAL PROCESSING

Land use	Priority 1	Priority 2	Priority 3
Extractive industries (sand mining, quarries)	Conditional[2]	Conditional[2]	Conditional[2]
Mineral exploration	Conditional[4]	Conditional[4]	Conditional[4]
Mining	Conditional[4]	Conditional[4]	Conditional[4]
Mineral processing	Incompatible	Incompatible	Conditional[4]
Tailings dams	Incompatible	Incompatible	Conditional[4]

PROCESSING OF ANIMALS / ANIMAL PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Animal product rendering works	Incompatible	Incompatible	Incompatible
Abattoirs	Incompatible	Incompatible	Incompatible
Dairy product factories	Incompatible	Incompatible	Conditional[6]
Food Processing	Incompatible	Incompatible	Conditional[6]
Tanneries	Incompatible	Incompatible	Incompatible
Wool-scourers	Incompatible	Incompatible	Incompatible

PROCESSING OF PLANTS / PLANT PRODUCTS

Land use	Priority 1	Priority 2	Priority 3
Breweries	Incompatible	Incompatible	Conditional[6]
Composting / soil blending (commercial)	Incompatible	Incompatible	Conditional
Vegetable / food processing	Incompatible	Incompatible	Conditional[6]
Wineries	Incompatible	Incompatible	Conditional

SUBDIVISION

Land use	Priority 1	Priority 2	Priority 3
Rural subdivision to a minimum lot size of 4 ha	Incompatible	Compatible	Compatible
Rural subdivision to a lot size less than 4 ha	Incompatible	Incompatible	Incompatible
Special rural subdivision to a minimum lot size of 2 ha	Incompatible	Conditional[8,9]	Conditional[8]
Special rural subdivision to a lot size between 1 and 2 ha	Incompatible	Incompatible	Conditional[8,9]
Special rural subdivision to a lot size less than 1 ha	Incompatible	Incompatible	Incompatible
Urban subdivision	Incompatible	Incompatible	Compatible[6]
Industrial subdivision	Incompatible	Incompatible	Conditional[6]

Note: Subdivision of lots to any size within Priority 1 areas is incompatible

SPORT AND RECREATION

Land use	Priority 1	Priority 2	Priority 3
Equestrian centres	Incompatible	Incompatible	Compatible
Golf courses	Incompatible	Incompatible	Conditional[1]
Motor sports ie permanent racing facilities	Incompatible	Incompatible	Conditional
Public swimming pools	Incompatible	Incompatible	Conditional
Recreational parks -irrigated	Incompatible	Incompatible	Conditional[1]
Rifle ranges	Incompatible	Conditional	Compatible

STORAGE/ PROCESSING OF TOXIC AND HAZARDOUS SUBSTANCES (THS)

Land use	Priority 1	Priority 2	Priority 3
Above ground storage of THS	Conditional	Conditional	Conditional
Underground storage tanks for THS	Incompatible	Incompatible	Conditional

TOURISM ACCOMMODATION.

Land use	Priority 1	Priority 2	Priority 3
Bed and breakfast accommodation	Incompatible	Conditional[16]	Compatible
Caravan parks	Incompatible	Incompatible	Conditional[6]
Farm stay accommodation	Incompatible	Conditional[16]	Compatible
Motels, hotels, lodging houses, hostels	Incompatible	Incompatible	Compatible[6]

WASTE TREATMENT AND MANAGEMENT

Land use	Priority 1	Priority 2	Priority 3
Injection of liquid wastes into ground water	Incompatible	Incompatible	Incompatible
Landfills -Class I, II or III	Incompatible	Incompatible	Conditional
Landfills -Class IV and V	Incompatible	Incompatible	Incompatible
Recycling depots	Incompatible	Incompatible	Conditional
Refuse transfer stations	Incompatible	Incompatible	Conditional
Sewers (gravity)	Incompatible	Incompatible	Compatible
Sewers (pressure mains)	Incompatible	Conditional	Compatible
Sewage pump stations	Incompatible	Conditional	Conditional
Used tyre storage / disposal facilities	Incompatible	Incompatible	Incompatible
Wastewater treatment plants	Incompatible	Incompatible	Conditional
Wastewater application to land	Incompatible	Incompatible[17]	Conditional

OTHER DEVELOPMENTS

Land use	Priority 1	Priority 2	Priority 3
Caretaker's housing	Incompatible[7]	Conditional	Compatible
Drinking water treatment plants	Conditional	Conditional	Conditional
Communications receivers / transmitters	Conditional	Conditional	Conditional
Construction projects (not shown elsewhere)	Conditional	Conditional	Conditional
Forestry	Conditional[1]	Compatible	Compatible

Major transport routes	Incompatible	Conditional[10]	Compatible
National and Regional Parks[13]	Compatible	Compatible	Compatible
Nature reserves	Compatible	Compatible	Compatible

Table reference notes:

1. Conditions may limit fertiliser and pesticide application.
2. Conditions cover the storage of fuels and chemicals, the depth of mining in relation to the water table with strict guidelines for rehabilitation.
3. Conditions cover the storage and use of fuel and other chemicals.
4. Conditions placed via the mining lease and / or environmental approval.
5. Special rural development must have appropriate provisions under the Town Planning Scheme, to prevent introduction of land uses and practices that pose an unacceptable risk to water resources.
6. Must be connected to deep sewerage, except where exemptions apply under the current Government Sewerage Policy.
7. Only permitted if this use is incidental to the overall land use in the area and consistent with planning strategies.
8. Lots should only be created where land capability allows effective on-site soakage disposal of treated wastewater. Conditions apply to siting of wastewater disposal systems in areas with poor land capability and / or a shallow depth to groundwater, animals are held or fertiliser is applied. Alternative wastewater treatment systems, where approved by the Health Department, may be accepted with maintenance requirements.
9. An average rather than minimum lot size may be acceptable if the proponent can demonstrate that the water quality objectives of the source protection area are met, and caveats are placed on titles of larger blocks stating that further subdivision cannot occur.
10. Conditions cover road design, construction and the types of goods that may be carried.
11. May be permitted if animal stocking levels (number of animals per hectare) are consistent with source protection objectives.
12. May be permitted if the type, volume and storage mechanisms for chemicals are compatible with water quality protection objectives.
13. Visitor and management infrastructure and facilities must be appropriately sited and maintained.
14. This does not include on-farm / pastoral lease stock-yards used for animal husbandry
15. Waste management practices must be compatible with source protection objectives.
16. Conditions apply on density of accommodation in Priority 2 areas
17. May be permitted if the quantity and quality are compatible with water quality protection objectives.

Appendix 2: Above ground chemical storage tanks in Public Drinking Water Source Areas

ABOVE GROUND CHEMICAL STORAGE TANKS IN PUBLIC DRINKING WATER SOURCE AREAS

Purpose

To provide information for facilities that may impact on the quality of the State's water resources.

These notes provide a basis for developing formal best management practice guidelines in consultation with key stakeholders.

Scope

These notes apply in Public Drinking Water Source Areas where chemicals that are potentially polluting, toxic or hazardous (including fuel) are stored in above ground tanks.
Chemicals covered by these notes include:

- Substances listed in Section 4 of the *Australian Water Quality Guidelines for Fresh and Marine Waters* published by the Australian and New Zealand Environment and Conservation Council (ANZECC),1992.
- Substances described in the current Schedules of the *Poisons Act 1964.*
- Concentrates and substances listed in Schedule Classes 3 to 9 of the *Explosive and Dangerous Goods Act, Classification Order of 1988.*

Chemicals used for hygiene or similar non-commercial purposes in quantities less than 25 litres are excluded**.**

These notes apply to facilities that will be used for 12 months or more. For temporary installations (used for less than 12 months) refer to Water Quality Protection Note – *Temporary Above Ground Fuel Storage in Public Drinking Water Source Areas.*

Public Drinking Water Source Areas (PDWSAs) describe areas declared under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909* and the *Country Areas Water Supply Act 1947* for the management and protection of sources of water used for public drinking water supply. They include declared Underground Water Pollution Control Areas (UWPCAs), Water Reserves and Catchment Areas.

Three priority classification areas have been defined in PDWSAs. They are **P1, P2 and P3.** Priority is determined by land tenure, land use and water flow paths. Different management strategies apply in each priority area. For further details refer to Water Quality Protection Note – *Land Use Compatibility in Public Drinking Water Source Areas.*

Above ground chemical storage tanks also require approval from the Department of Minerals and Energy (DME).

General recommendations

The following notes reflect the Commission's current position. They are recommendations only and may be varied at the discretion of the Commission.

Proposals for above ground chemical storage systems in PDWSAs need to be assessed by the Water and Rivers Commission prior to DME approval. The proposal should include:

- A site plan showing the location of the facility.
- Construction details of tanks and their associated containment compounds.
- An inspection and maintenance schedule for the facility to ensure effective containment of chemicals.

If the proposal is located in a UWPCA, a permit with approval conditions from the Commission is also required.

Chemicals including petroleum products should not be stored within 2 kilometres of the top water level of public water supply reservoirs.

In P1 and P2 public drinking water source areas, elevated tanks are not permitted inside wellhead protection zones.

In P1 and P2 public drinking water source areas, the total tank storage volume shall not exceed 5000 litres unless written approval is granted based on an environmental risk assessment.

Containment Compound Design

Storage tanks and associated containment compounds should comply with the current Australian Standard 1940,and the *Explosive and Dangerous Goods Act 1961* and its regulations.

Storage tanks should be located within containment compounds that effectively capture and contain chemical spills. These compounds should capture any leak or jet of liquid from any perforation of the tank or associated equipment. The Commission's minimum design criteria are appended to these notes as **Plan No. 1.**

Compounds should be constructed of waterproof reinforced concrete or approved equivalent, which is not adversely affected by contact with chemicals captured within them.

The minimum compound volume should be 110% of the capacity of the largest tank system, plus 25% of the **total capacity of all** other separate tanks and containers within the compound.

In P1 and P2 areas, underground pipe-work carrying product from the tank to facilities outside the containment compound is **not** acceptable. In P1 and P2 areas, above ground pipe-work should be double contained. In P3 areas, underground pipe-work should have double containment. Pipe-work within the bund does not require double containment.

Containment compounds should have sufficient capacity to retain spilt chemicals and not be overtopped during extreme rainfall events. Additional capacity for rainfall captured within the compound should be calculated using a 1 in 100 year return frequency storm event over 24 hours. Stormwater assessment methods should be used as described in the current edition of *Australian Rainfall and Runoff* produced by the Institution of Engineers, Australia.

Tank equipment such as dispensing hoses, valves, meters, pumps, and gauges should be located within the containment compound.

Security should be provided to guard against vandalism when the site is unattended. This should include:

- Fencing of the tank compound or adequate security controls at the site.
- Locks on unattended dispensing hoses.

The base of the containment compound should grade towards a liquid retention sump to facilitate recovery of spilt liquids. The compound if exposed to storm-water intrusion, should be emptied by pumping, **not** through a valved gravity outlet, which could inadvertently be left open. Enclosed containment compounds should have adequate inspection and venting ports.

Incompatible or reactive chemicals should be stored in separate bunded compounds.

All chemicals stored within the bunded compounds should be clearly labelled detailing the nature and quantity of chemicals within individual containers. Sight gauges indicating the current volume are recommended for tanks larger than 250 litre capacity.

Chemical transfer areas

All chemical transfer activities (in and out of tanks) should occur on an impervious sealed area; kerbed, graded or bunded to prevent liquid runoff to the environment.

Chemical transfer areas should drain away from the perimeter bund to a containment pit. The pit should be capable of holding stormwater from at least a 48 hour, 2 year return frequency storm event, in addition to containing potential chemical spills. Designs should provide for the safe and efficient movement of vehicles.

Operation of containment compounds

Chemical spills should be cleaned up on discovery. The spilt liquid and clean-up material should be removed, treated and disposed of outside any PDWSA in accordance with requirements of the Department of Environmental Protection's (DEP) Waste Management Division.

The compound should be maintained to prevent accumulation of stormwater and litter. Only stormwater assessed as uncontaminated by a qualified and experienced person may be released to the environment.

In **P1 and P2** areas, one of the following measures should be used to prevent accumulation of stormwater:

- An enclosure, or roofed structure that extends at least 1 metre past the edge of the compound. Side walls or vertical roof turn- downs should be used (if appropriate) to prevent intrusion of wind -driven rainfall.

- A reliable assessment and management procedure for disposal of stormwater. The procedure should be documented and submitted to the Commission for approval.

In **P3** areas, adoption of one of the following measures is recommended:

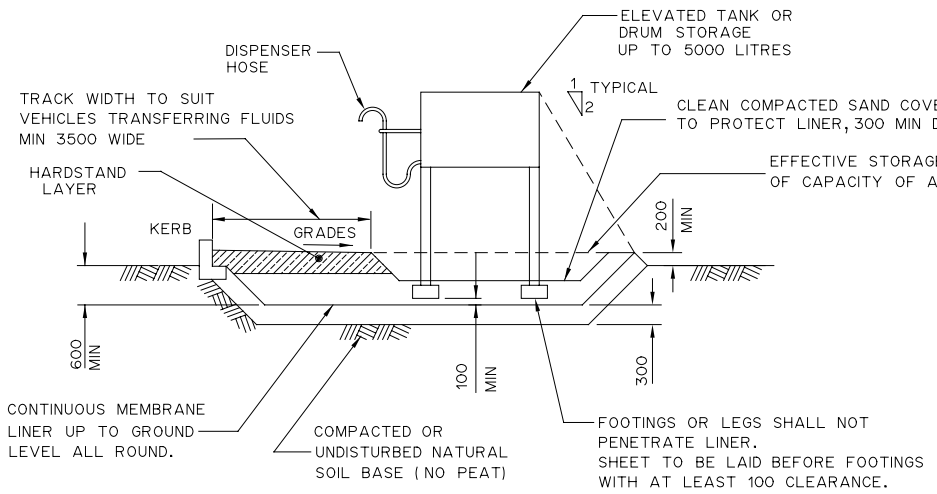
- Collect and dispose of stormwater to outside any PDWSA in accordance with the requirements of the DEP -Waste Management Division.

- Treat stormwater on-site in a separation unit to effectively remove contaminating substances. The method of treatment will depend on whether effluent is discharged to sewer or disposed of on-site in soaks. Any liquid released to the environment should conform to the criteria for Raw Water for Drinking Water Supply given in *Australian Water Quality Guidelines for Fresh and Marine Waters* – ANZECC (1992).

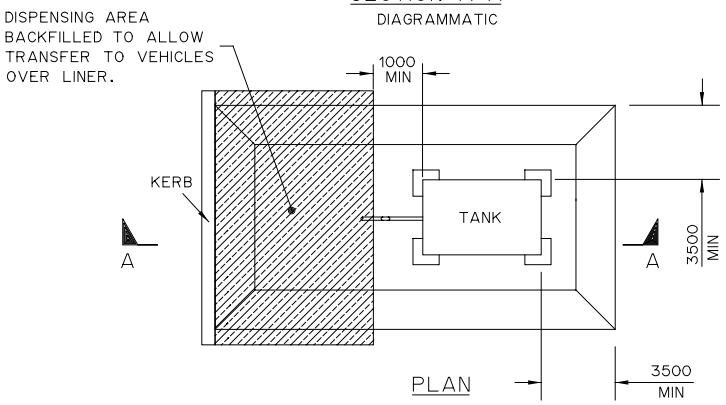
More information

We welcome your comment on these notes. They will be updated from time to time as comments are received or industry standards change.

If you wish to comment on the notes or require more information, please contact the Commission's Water Quality Protection Branch at the Hyatt Centre in East Perth.
Phone: (08) 9278 0300 (business hours) or Fax: (08) 9278 0585



SECTION A-A
DIAGRAMMATIC



PLAN
DIAGRAMMATIC

APPLICATION

This specification applies to chemical storage tanks (including fuels) of 250 litres capacity and greater, located within Public Drinking Water Source Areas (ie. Underground Water Pollution Control Areas, Water Reserves and Catchment Areas)

MINIMUM DESIGN CRITERIA:

1. Construction of flammable liquid storage tanks shall be in accordance with AS1940
2. The below ground liner shall be leakproof, resistant to chemical attack, and capable of retaining any spillage. The sheets must be continuously seam welded at edges, to form an impervious sheet over the specified area.
3. The membrane liner thickness required is 0.5mm minimum.
4. The membrane liner (or other impervious lining) must be approved by the Commission and installed in the presence of an authorised Commission Representative Phone Commission's local regional office to arrange for inspections.
5. Footings of the tank, and other structures over the liner shall not puncture the sheet. A minimum clearance of 100mm is required.
6. On removal of the tank, all contaminated soil must be disposed of outside any Public Drinking Water Source area, at a waste disposal site approved by the D.EP. - Waste Management division.
7. The tank dispenser and connections must be located over the liner. The minimum distance between the external edge of the liner and the end of the extended dispenser hose shall be 1.5 metres.
8. For clarification or discussion of this plan contact the Water Quality Protection Branch at the Commission.

LOCATION OF PUBLIC DRINKING WATER SOURCE AREAS

Maps showing the boundaries of the Public Drinking Water Source areas are available from the Water and Rivers Commission.
Please phone (08) 9278 0300 for more information.

NOTE : ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE.

ISSUE DATE	REVISION	DRN	REC	APPD

DES REF		RECOMMENDED	WATER AND RIVERS COMMISSION	PUBLIC DRINKING WATER SOURCE PROTECTION AREAS - SPECIFICATION FOR ELEVATED CHEMICAL AND FUEL STORAGE TANKS
DATE				
DRN		APPROVED		
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