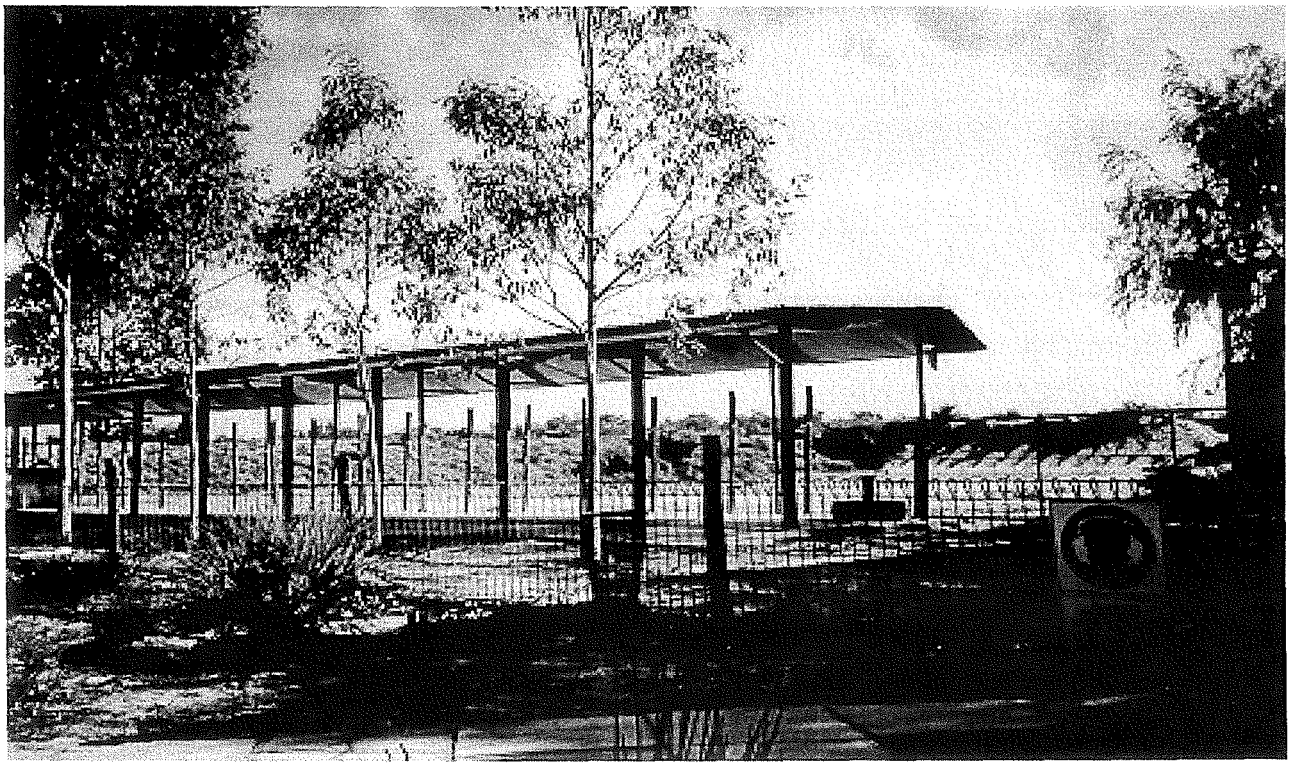
WRP 5

GOVERNMENT OF WESTERN AUSTRALIA

WANNEROO SHOOTING COMPLEX

Assessment and Recommendations for Management of Pollution Risks



WATER RESOURCE PROTECTION SERIES

WATER AND RIVERS COMMISSION REPORT WRP 5

1999

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Cover Photograph: Pistol range at Wanneroo Shooting Complex.

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Assessment and Recommendations for Management of Pollution Risks

Water and Rivers Commission
Policy and Planning Division
Water Quality Protection Branch

WATER AND RIVERS COMMISSION
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1. Background

The Wanneroo Shooting Complex (WSC) was established in the late 1960s. The complex is located on Perry Road, Pinjar and covers an area of 245 hectares (**Figure 1**). Ten different shooting clubs use the complex including:

- Northern Districts Pistol Club (NDPC)
- Perth Field Rifle Club (PFRC)
- Perth Handgun and Metallic Silhouette Club (PHMSC)
- Perth Lever Action Rifle Club (PLARC)
- Western Australian Field and Game Association (WAFGA)
- Perth Muzzle Loaders Club (PMLC)
- Perth Rifle and Metallic Silhouette (PRMS)
- Perth Western Action Club (PWAC)
- Wanneroo Full Bore Rifle Club (WARA)
- West Coast Pistol and Revolver Club (WCPRC)

The annual visitor and member usage of the complex is approximately 11 000 (WSC, 1996). The complex is located on land vested in the Department of Conservation and Land Management (CALM) who lease it to the City of Wanneroo. The City of Wanneroo sub-lease the site to the shooting clubs, with the current lease expiring in the year 2004.

The buffer requirements of shooting facilities means that there is no further land available for clubs to establish in the area.

2. Water resource issues

The complex is located within the Gnangara Underground Water Pollution Control Area (UWPCA) which is a Priority 1 source protection area (**Figure 2**). 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 are managed in accordance with the principle of risk avoidance. Further development in P1 areas is generally incompatible with this objective.

UWPCAs are declared under the Metropolitan Water Supply Sewerage and Drainage Act (1909). The by-laws under this act 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. Under the by-laws, permit approval is required from the Commission for any development that has the potential to pollute groundwater.

The Commission is concerned with the possibility of incremental growth within the Gnangara UWPCA with the establishment of additional infrastructure.

The Commission initiated this investigation to improve limited understanding of the impact of shooting ranges on water quality. The results of the water quality investigation have been used to develop a preliminary code for appropriate management practices at the site. This code of practice has been developed in close consultation with committee members of the Wanneroo Shooting Complex.

The complex is located immediately upgradient of Water Corporation production bores P50 and P60. The potential contamination risks associated with the complex include:

- Increased nutrient and microbiological loadings to septic tanks.
- Diesel fuel storage for generators.
- Increased chances of accidental spills from vehicles.
- Contamination resulting from the actions of vandals.
- Possible lead contamination of groundwater.
- General waste storage including tyres, batteries etc.

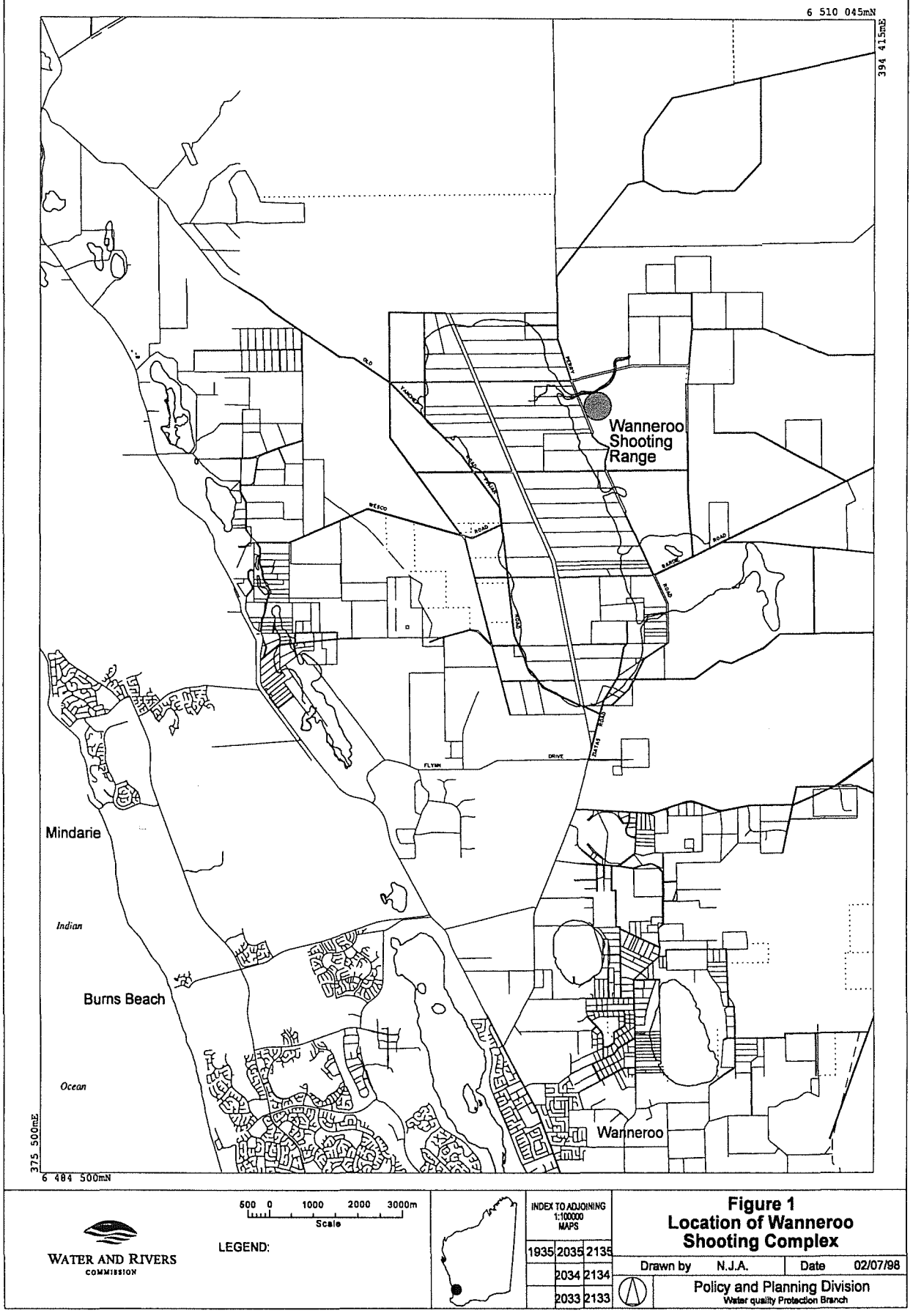
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Figure 1
Location of Wanneroo
Shooting Complex
Drawn by N.J.A.
Date 02/07/98
Policy and Planning Division
Water quality Protection Branch

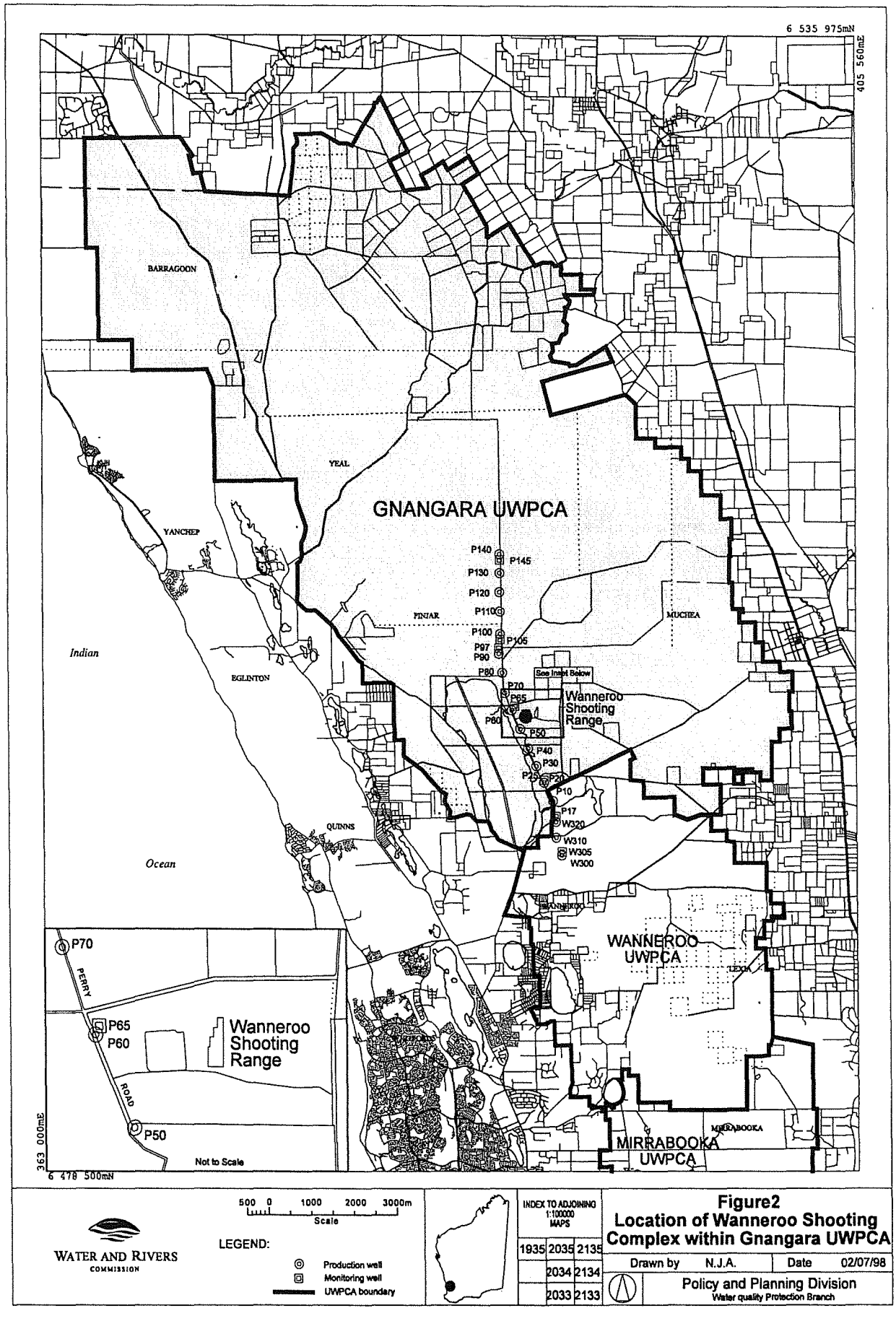
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Figure2
Location of Wanneroo Shooting Complex within Gnangara UWPCA
Drawn by N.J.A.
Date 02/07/98
Policy and Planning Division
Water quality Protection Branch

3. Existing facilities

Each shooting organisation using the complex has its own clubhouse and shooting range. Most clubs have their own ablution facilities although three clubs share facilities. There are five diesel generators used to provide power for clubhouses and to operate bores around the complex. The area is mainly cleared bushland with no substantial areas of lawn.

3.1 Ablution facilities

The existing ablution facilities include four private toilet blocks, one shared toilet block (used by three clubs) and three chemical toilet facilities. The Wanneroo Shooting Complex Committee at a meeting on 12 November 1996 provided information on the use of existing ablution facilities. This information is summarised in **Table 1**.

It was the opinion of the Wanneroo Shooting Complex Committee that a typical meeting would last for about half a day (4 hours) and that toilet facilities were not used frequently as most of the time was spent on the shooting range.

There is the possibility of dispersed effluent disposal by club members who did not have ready access to toilet facilities. Some people would not be willing to make a 500 to 1000 metre journey to use toilet facilities.

National and State championships take place every four to five years and last for two to four days. These events attract more competitors and spectators to the area thus increasing the usage of the ablution facilities during events. Some people may camp at the complex during the championships.

3.2 Diesel storage

The complex has five diesel generators on site. The use, volume of diesel stored and protection mechanisms in place for each of these generators are summarised in **Table 2.**

Diesel tanks are filled manually by members from diesel tankers and jerry cans. There has been no history of diesel spills during refilling from any of these facilities (WSC Committee Meeting, 12.11.96).

Table 1: Details of existing ablution facilities

CLUB	TYPICAL MEETING	ABLUTION FACILITIES
Northern Districts Pistol Club	10 members/fortnight	Shared toilet block
Perth Field Rifle Club	30 members/fortnight	New toilet block installed
Perth Handgun and Metallic Silhouette Club	20 members/fortnight	Private toilet block
Perth Lever Action Rifle Club	60 members/fortnight	Private toilet block
WA Field and Game Association	40 members/fortnight	Application for new toilet block to replace chemical toilets
Perth Muzzle Loaders Club	30-40 members/fortnight	New toilet block under construction
Perth Rifle and Metallic Silhouette	10-15 members/fortnight	Chemical toilets maintained regularly by member
Perth Western Action Club	10 members/fortnight	Shared toilet block
Wanneroo Full Bore Rifle Club	20 members/fortnight	Chemical toilets
West Coast Pistol and Revolver Club	30 members/weekend	Shared toilet block
COMPLEX:	**~300 members/fortnight**	

Table 2: Details of diesel storage at the complex

GENERATOR	VOLUME OF DIESEL STORAGE	DESCRIPTION
Generator located at PLARC (used by 3 clubs)	200 L	• Housed in secure brick shed • Base is blue metal over sand • Unbunded
Complex bore pump generator	60 L plus 5 L header tank	• Housed in unlocked metal shed • Sandy base • Unbunded
PMLC	20 L tank plus 20 L storage	• Housed in locked tin shed • Base is blue metal over sand • Likely to convert to electricity within next 12 months
WAFGA	100 L	• Housed in secure brick shed • Base is blue metal over sand • Unbunded
Perth Field Rifle Club	200 L	• Housed in secure brick shed • Base is concrete • Unbunded

3.3 Accidental contamination/vandalism

There have been minor spills of oils during the servicing of the generator located at PLARC (Interview with David Grew, 21.1.97). There have been no reported incidents of vandalism that have led to groundwater contamination. The complex has been broken into once where batteries and pumps have been stolen (Interview with Ken Matthews, 25.10.96).

Fuels and oils may leak from cars and enter the groundwater system. This practice is difficult to manage and could pose a problem if additional vehicles were to park at the site.

3.4 Lead contamination

Projectiles used in firearms contain lead and other metals. The leaching of lead from spent projectiles is usually limited due to the formation of lead carbonate, which has limited solubility. However, under certain conditions (such as in acidic groundwater with a low organic content) lead can be mobilised and migrate into groundwater. No lead has been detected in production bores P50 and P60 (detection limit 0.002 mg/L) since the bores were installed in 1989.

To determine the extent of lead contamination at the complex a groundwater quality investigation was undertaken by the Commission (see Section 4).

3.5 General waste issues

A site inspection (21.1.97) revealed that there are some general waste issues that need to be addressed as part of the management of the site. The most significant issue is the storage of tyres on the site. Tyres themselves are quite inert and do not significantly contribute to groundwater contamination. However, upon combustion, tyres produce highly toxic organic chemicals that may leach to groundwater. The risk of contamination from other general waste including used batteries and general refuse is relatively low but should be addressed as a matter of sound environmental management.

4. Groundwater quality investigation

4.1 Investigation program

The investigation was designed to determine any impact to groundwater from activities at the complex including:

- nutrients from ablution facilities.
- hydrocarbons from any diesel spills from power generating facilities.
- lead contamination from spent projectiles.

A total of 12 boreholes were drilled during the investigation with two being finished off as monitoring bores to enable ongoing groundwater sampling (**Figure 3**). Soil and groundwater samples were taken from the sample sites (**Figure 3**). Samples were obtained above and below the water table for comparison.

Samples were analysed for a range of nutrients (total nitrogen, nitrite, nitrate and phosphorus), metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, antimony and zinc), hydrocarbons, BTEX compounds, pH, electrical conductivity and redox potential.

4.2 Sampling results

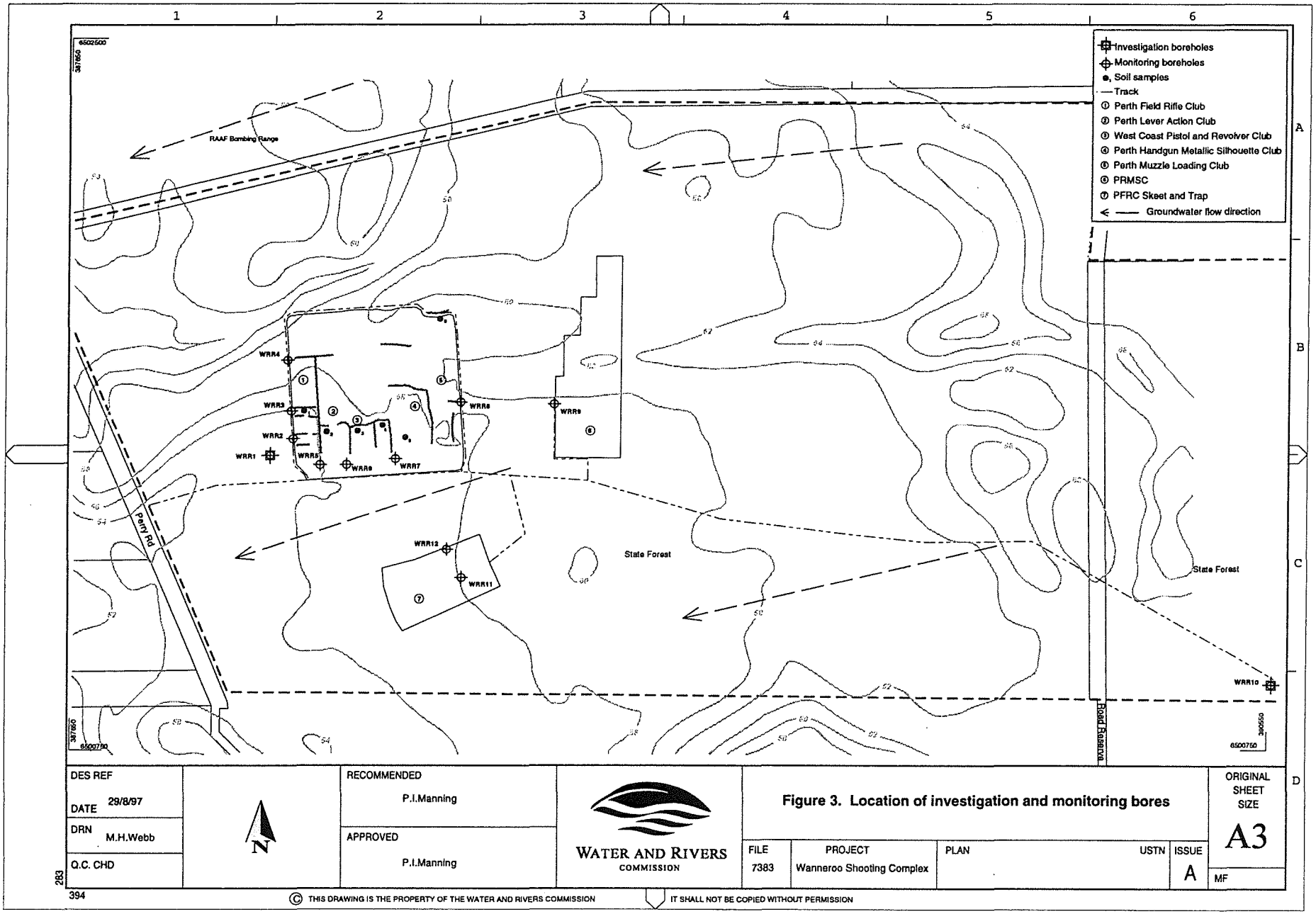
A groundwater quality investigation was undertaken at the site (Manning, 1997a). The results of this investigation are discussed below

Field measurements of the pH of groundwater indicate that it was acidic (in the range of 3.7 to 5.4) and fresh with total dissolved solids ranging from 100 to 250 mg/L. These were verified by laboratory measurements.

Samples taken downgradient of a generator shed revealed trace levels of short chain hydrocarbons.

Results of the groundwater analysis indicate heavy metals were below limits of detection in the samples, with the exception of zinc. Zinc levels ranged from 0.12 to 1.2 mg/L, well below the recommended maximum value of 3 mg/L based on aesthetic considerations in drinking water (ARMCANZ & NHMRC, 1996). The results are comparable with a lead contamination investigation (Manning, 1997b) undertaken by the Commission at a pistol range located in the Jandakot Underground Water Pollution Control Area (a Priority 2 source protection area).

Total nitrogen concentrations in samples ranged from 6 mg/L to 12.5 mg/L, with one very high reading at site WRR6 of 43 mg/L. This high result is believed to be incorrect. In addition, analyses revealed concentrations of nitrogen as nitrate in two samples taken near ablution facilities located towards the front of the complex (4.3 mg/L and 5.4 mg/L).



DES REF		RECOMMENDED		**Figure 3. Location of investigation and monitoring bores**		ORIGINAL SHEET SIZE
DATE 29/8/97	N	P.I.Manning	WATER AND RIVERS COMMISSION			A3
DRN M.H.Webb		APPROVED		FILE 7383 / PROJECT Wanneroo Shooting Complex / PLAN / USTN / ISSUE A		MF
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5. Future development at the complex

Members of the Wanneroo Shooting Complex Committee have recently released a draft 5-year development plan for the complex. The study looked at the strengths, weaknesses, opportunities and threats to the complex and came up with 10 goals related to management, finance, facilities, marketing and promotions, safety and environmental management.

The goals identified in this five year plan which may impact on water resources are discussed in detail below. Comments addressing each goal based on the protection of the water resources of the Gnangara UWPCA are outlined:

Goal 2: To become autonomous

2.1 Within five years, have a full report on the investigation of the conversion of the head lease for the complex to freehold

Comment:
The Gnangara Land Use and Water Management Strategy will be recommending that the land tenure remain with the Crown. This classification is consistent with the management objectives of Priority 1 areas. The Commission would oppose any proposal to convert the land tenure to freehold.

Goal 4: To increase the injection of funds

4.1 To increase memberships by 3% over the next 12 months

Comment:
This growth rate needs to be assessed by the Commission to determine the impact from increased loadings to existing ablution facilities. This issue is addressed in section 6.1.

Goal 6: To improve and maintain the current facilities

6.2 To investigate the use of alternative power

Comment:
The use of alternative power supply facilities would negate the need for diesel powered equipment and would eliminate the risk of diesel spills. The Commission would encourage the club to look for alternative power sources that present lesser risk to water resources.

6.3 To maintain the integrity of boundary fence and signage each month

Comment:
The maintenance of the fence will reduce the chances of access by potential thieves and vandals which reduces the risk of accidental or deliberate acts of contamination within the complex. Therefore the Commission would support the regular maintenance of boundary fences.

Goal 7: To develop new facilities

7.1 To re-investigate the ramifications of the development of a caretaker's residence by the end of the fourth year

Comment:

- A caretaker's residence is restricted within Priority 1 source protection areas. The establishment of a caretaker's residence will increase nutrient loadings to groundwater from an additional septic tank. The Commission would oppose irrigated lawns or trees for such a residence as this would require the addition of fertilisers that could contaminate groundwater.
- A caretaker will reduce the likelihood of thieves or vandals entering the complex.

7.2 To accumulate the finances to build a second ablution block within five years

Comment:
A second ablution block requires evaluation by the Commission to estimate the increased nutrient and

microbiological loadings to groundwater. This is discussed further in section 7.0.

7.3 To develop a camping area within 5 years

Comment:
This encourages more permanent facilities to be developed on the site. The Commission will only tolerate intermittent use of facilities provided at the complex. Camping accommodation is an unacceptable land use within Priority 1 areas. Any short term camping accommodation will need to conform to the City of Wanneroo's 'Caravan Park and Camping Regulations (1974)' and the relevant council by-laws.

Goal 10: To create an environmentally safe venue

10.1 To develop and implement an environmental policy in conjunction with CALM within five years

10.2 To control waste management fortnightly

10.3 To educate clubs on environmental management policy over five years

Comment:

- The Commission supports implementation of an environmental policy and waste management program.
- The Commission will assist in the development of such a policy as the complex is located in a Priority 1 UWPCA.
- The Commission supports the education of members on an environmental policy.

6. Assessment of the pollution risk from the facilities

6.1 Estimate of nutrient loadings

The following nutrient loading calculations represent a *worst case scenario* as three of the clubs are using chemical toilets which should result in zero discharge to groundwater and the use of toilets may be less frequent than that of a typical household.

The average number of people attending the site is 300 members for one day/fortnight. This can be translated to an equivalent daily loading by dividing by 14 i.e. 21.4 people/day. Assuming a typical household accommodates four people, this is equivalent to 5.4 household septic tanks. The estimated nitrogen discharge per house is 18 kgN/house/annum (Gerritse et al. 1992 reported in Kinhill, 1995). Meetings at the complex will typically last for one morning (a quarter of a day) whereas normal households would be occupied in excess of half a day. To account for this, the estimated loadings were reduced by 50% (i.e. 9 kg N/septic tank/annum). The estimated nitrogen loading from the complex is therefore of 48 kg N/annum.

The area over which the loading is spread was estimated from aerial photographs to be approximately 400 metres by 1800 metres, which equates to 72 ha.

The equivalent septic tank density for the complex is therefore calculated at 1 septic tank per 26.7 ha with annual nitrogen loading of 0.67 kgN per hectare.

The estimated nitrogen loadings from the complex for the anticipated growth rate of 3% a year are shown in **Table 3**. For these calculations it was assumed that the number of members using facilities at the site is proportional to the total number of memberships of the clubs. This will not necessarily be the case, as often meeting numbers will remain relatively constant despite membership growth due to other factors (such as limited shooting space, members with other commitments etc.).

The practice of using chemical toilets is compatible with the objectives of Priority 1 source protection. This is because there should be zero discharge to the environment due to the offsite disposal of waste. Currently three of the sites use chemical toilets. There is concern that waste is not being transferred from these toilets offsite. This has been taken into account in the nutrient loading calculations made in **Table 3**.

Table 3: Estimated future nitrogen loadings

Year	Estimated membership	Estimated equivalent septic tank density	Estimated nitrogen loading (kgN/ha/annum)
2000	328	1 septic tank/24.6 ha	0.75
2005	380	1 septic tank/21.2 ha	0.85

It is not realistic to use the 3% annual growth rate beyond this time because of the uncertainty associated with the growth of the sport. These rates represent a 25% growth in the membership of the clubs over eight years which again represents a conservative approach.

6.2 Diesel spills

The current preventative mechanisms to contain any diesel spills are inadequate and will need to be upgraded. The likelihood of a diesel spill is reduced as the tanks are filled manually. This eliminates errors associated with pumping, such as overfilling which may result from leaving the tank unattended. The traces of short-chain hydrocarbons detected as part of the water quality investigation indicate that additional management of this risk is required.

6.3 Lead contamination

Although lead contamination is not a significant issue it is one that can be easily managed. Mechanisms to collect spent bullets or existing detrital lead or the use of bullet traps should be considered by the clubs, particularly with new facilities. Collection of lead may have some economic benefit to the clubs.

Although the risks of lead contamination are low, they can be readily managed or eliminated using these simple management tools. Therefore, the Commission strongly supports the implementation of bullet collection (if practical) as it is consistent with the management principle of risk avoidance in P1 areas.

6.4 Tyre storage

The possibility of fire in the area is significant given the natural bushland setting of the complex. The by-products of the combustion of tyres are highly toxic organic chemicals, which may leach to groundwater. The Commission is concerned about the risk of groundwater contamination in the event of a fire.

7. Proposed management of pollution risks

7.1 Nutrient management

The elevated nutrient concentrations in groundwater samples taken near ablution facilities highlight the importance of managing the nutrient loading from ablution facilities.

The Commission's policy for Priority 1 areas includes no further subdivision and a septic tank density of no more than one tank per 20 hectares.

The establishment of additional clubs is equivalent to subdivision of the area and is therefore considered to be unacceptable by the Commission. The calculated increased nutrient loading to the year 2005 falls within the Commission's policy for septic tank density. However, it should be noted that the density of septic tanks is higher towards the front of the complex (Perry Road) which is close to the production bores.

Septic tanks can be considered as a point source of pollution with a plume of nutrients extending downgradient from the leach drain of the septic tank. Nutrient concentrations often decrease sharply away from the leach drain. Any plume is expected to elongate in the direction of groundwater flow (westwards) with little lateral spread (except for diffusion that would be relatively slow).

Although establishment of further septic tanks does not conform to the Commission's policy for management of P1 areas, the Commission will tolerate the installation of a septic tank at the Western Australian Field and Game Association as:

- The facilities are located 200 metres east of the existing facilities and so will not contribute to any nutrient plume developing from the line of toilets on the northern side of the access track.
- The facilities will result in a decreased use of existing facilities and will disperse the nutrient loading across a wider area.

The Commission will also tolerate the installation of septic tanks that were approved before January 1996.

Chemical toilets would be the preferred option to be used at the complex. However, maintenance should involve the waste being deposited off-site at an approved location.

The following approaches could be adopted by the Commission for future site amenities:

1. A total ban on additional toilet and ablution facilities.
2. Only toilet and ablution facilities that have zero discharge to groundwater are allowed. A suitable system would be a sealed tank with the effluent being regularly pumped out and disposed of at a government approved liquid waste disposal facility.
3. Additional dispersed septic tanks allowed with restrictions on numbers using the site or alternative treatment units which can achieve superior effluent quality.

The results of groundwater sampling and nutrient loadings calculated in section 6.1 highlight that the area should be managed into the future as septic tank densities approach the limit allowed for Priority 1 areas. To achieve this, the Commission should adopt a combination of approach 2 and 3. Each new proposal to upgrade or install toilet facilities should be evaluated on a case by case basis. This differential approach implies that approach 2 would be adopted towards the Perry Road frontage of the site (where septic tank densities are already high and are closer to production bores) and approach 3 *may* be adopted further away from the production bores. Factors that the Commission will consider in evaluating the decision include:

1. Proximity to production bores.
2. Number of existing facilities.
3. Frequency of use of existing facilities (i.e. club attendance).
4. Area over which the facilities are spread (considering the buffer areas required around the rifle range).

When determining these approaches the Commission has assumed that there are no other nutrient sources at the site e.g. fertiliser application.

Any sealed tank storage facility needs to be carefully managed through regular maintenance and effluent disposal outside any public drinking water source areas.

The Commission should issue permits to all existing ablution facilities. The conditions on the permit should address the maintenance of toilet and ablution facilities including the disposal of waste from chemical toilets.

If there is any evidence that any of the existing toilet and ablution facilities are having an adverse impact on water resources at any time in the future, the Commission will require that existing facilities be upgraded to a superior treatment technology or sealed tank system.

7.2 Diesel storage

Permit approval from the Commission is required for all diesel storage facilities. All the sheds should be secure and of adequate construction to reduce the chance of access by thieves or vandals and eliminate the chance of diesel storage tanks being punctured by intruders.

A concrete bund (or similar) should be constructed for each diesel storage. The existing permeable bunds may slow the lateral movement of diesel but will not stop infiltration of diesel to groundwater. Use of permeable compounds is not satisfactory within any Public Drinking Water Source Area.

The bund design shall be in accordance with the Commission's Water Quality Protection Note – *Above*

– Ground Chemical Storage Tanks in Public Drinking Water Source Areas.

Any proposed bunded compound design should be submitted for approval by the Commission before construction. Any requirements for bund maintenance, security and actions for clean up will be incorporated as conditions of a permit.

7.3 Accidental contamination

Education is an important tool to minimise the contamination from vehicle spills. Members should be advised on the importance of groundwater in the area and the risks that are associated with activities taking place within the complex. This could be incorporated into the complex's environmental policy.

Security fences should be maintained around the site and club facilities secured to prevent any deliberate or accidental acts of vandalism that could lead to groundwater contamination.

The Commission encourages the installation of signs at the complex to highlight the importance of the water source to users of the complex.

7.4 Lead contamination

The clubs should investigate the economic and environmental benefits of the removal of lead. New clubs should design their ranges in a way as to facilitate the collection of spent bullets. The management of lead should be addressed as part of the complex's environmental policy. In the event of the site or individual range being closed, clean-up should occur to return the range to a predeveloped state. This will include the off-site removal of detrital lead and all infrastructure associated with the clubhouses and ranges.

7.5 Tyre storage

Tyre storage on site should be modified so that there is no risk of contamination from this source. This should include

- Removal of tyres that are not being used for practical purposes.
- Replacement of tyres where alternative materials can be used.
- Introducing measures to minimise the risk of any tyres catching fire. e.g. firebreaks.

All tyre removal and disposal shall be done in consultation with the Department of Environmental Protection's Waste Management Division.

8. Conclusions

The Wanneroo Shooting Complex is incompatible with the management objectives of Priority 1 areas. However, it is recognised that the complex was established before the declaration of the Gnangara UWPCA and can continue to operate by implementing appropriate water quality protection measures.

The site has merit from the perspective of the club members as there are buffers from residential areas and the site is close to the northern suburbs of Perth.

Potential water quality impacts from the complex include nutrient and microbiological contamination from septic tanks, spills from diesel tanks used to power generators, fuels and oils from vehicles, lead contamination from used bullets and tyre storage.

Increased nutrient loadings to septic tanks as membership grows presents a significant contamination risk. The Commission plans to establish appropriate practices for proposed modifications or installations of toilets. The impact of existing facilities on groundwater quality needs to be monitored by the Commission. The Commission is opposed to any improvements in the complex that will significantly increase occupancy time at the complex such as camping grounds.

Diesel storage tanks are not adequately bunded and in the event of a spill present a serious risk to water resources.

The Commission will agree to allow further membership growth at the complex provided that mechanisms are implemented to facilitate protection of the important water resources in the area. These mechanisms include:

- Use of sealed septic tank systems or superior waste treatment technologies.
- Construction of bunded compounds for all diesel storage tanks.
- Provision of improved security measures.
- Education of complex users of the importance of protecting water quality.
- General clean-up of site including management of tyre storage.
- No establishment of permanent camping facilities at the complex.

9. Recommendations

1. The City of Wanneroo should refer all development proposals and building applications within the complex to the Water and Rivers Commission for comment.

2. No new club facilities should be built without prior approval of the Commission. The Commission will only support refurbishment/replacement of existing facilities if there is no increased risk of groundwater contamination.

3. The Commission needs to issue permits to each of the clubs for approved management facilities to control potentially contaminating activities such as ablution facilities, diesel storage and tyre storage.

4. The Commission needs to arrange monitoring at selected monitoring bores in the complex on a 6 monthly basis for nutrients including total nitrogen, nitrate, ammonia, total phosphorus and total petroleum hydrocarbons.

5. Bunding should be constructed for all of the diesel storage facilities in the complex.

6. The land tenure of the complex should not be converted to freehold.

7. Diesel generators should be converted to electricity, if this is cost effective.

8. Boundary fences should be regularly maintained to deter access by unauthorised intruders.

9. Further details of the proposed caretaker's residence should be submitted to the Commission for evaluation of the potential pollution risk from such a development.

10. All proposed modification or new ablution facilities should be referred to the Commission for assessment and will only be approved if there is no increased risk to water resources in the area.

11. No permanent camping facilities should be established at the complex.

12. The Committee responsible for the complex should involve the Commission in the development of a environmental policy for the area.

13. Users of the complex should be educated on the importance of the area for public drinking water supply and the potentially contaminating activities that take place within the complex.

14. Signs should be placed at the complex to educate users on the importance of the water source.

15. No pesticides or fertilisers should be used at the complex.

10. References

ARMCANZ & NHMRC 1996, *Australian Drinking Water Guidelines*, National Water Quality Management Strategy.

Manning, P. I 1997a, *Assessment of the Potential for Groundwater Contamination from a Rifle Range, Pinjar, Perth Metropolitan Area*, Water and Rivers Commission, Hydrogeology Report No. HR 94, September 1997.

Manning, P. I 1997b, *Assessment of the Potential for Groundwater Contamination from a Pistol Range, Banjup, Perth Metropolitan Area*, Water and Rivers Commission, Hydrogeology Report No. HR 51, January 1997.

Kinhill 1995, *Nitrogen Application Limits for Various Land Uses*, Prepared for the Water Authority of Western Australia, November 1995.

Wanneroo Shooting Complex Committee 1996, *Wanneroo Shooting Complex — 5 Year Development Plan 1997-2002*, November 1996.

Appendix A

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.

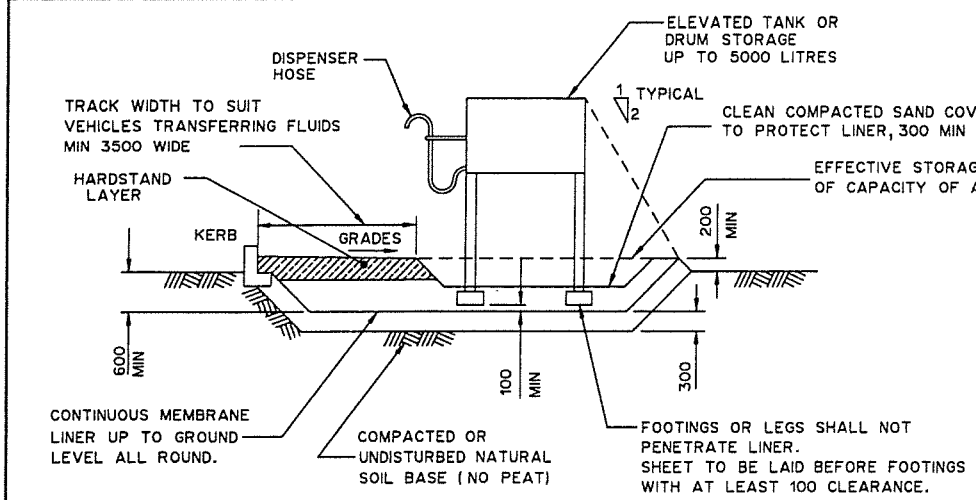
In **P3** areas, adoption of one of the following measures is recommended:

- 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
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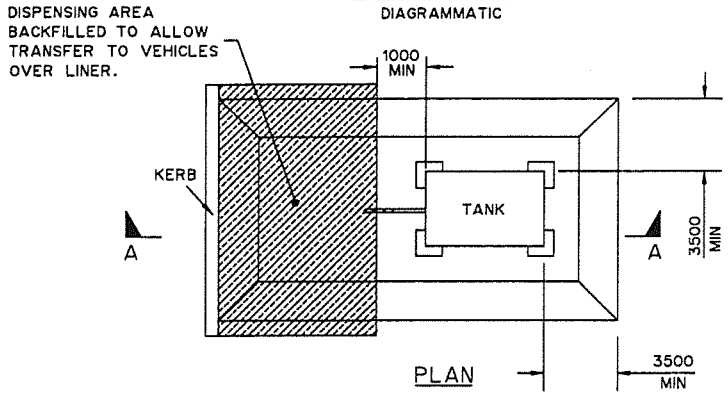

PLAN
DIAGRAMMATIC

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.E.P. - 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
DATE
DRN
CHD

RECOMMENDED
APPROVED

WATER AND RIVERS COMMISSION

PUBLIC DRINKING WATER SOURCE PROTECTION AREAS - SPECIFICATION FOR ELEVATED CHEMICAL AND FUEL STORAGE TANKS

FILE	PROJECT	PLAN	CAD	ISSUE
		No. 1		A

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