



WQPN 31, OCTOBER 2006

Subsoil monitor drains and water recovery sumps

Purpose

Subsoil monitor drains and recovery sumps enable representative water samples to be collected when monitoring the quality and quantity of fluids percolating downward through the soil, following irrigation or rainfall. These samples are used to determine the effects of the broad scale surface application of fertilisers, wastewater or slurries, or potentially polluting wastes deposited on or near the soil surface in circumstances where it is impractical to use groundwater monitoring bores (ie. water table too deep or soil hydrogeology makes bore monitoring results difficult to interpret). These monitor facilities are generally requested where information is needed on land use activities that could harm sensitive water resources. These sensitive water resources are described at [Appendix C](#).

The Department of Water is responsible for managing and protecting the State's water resources. It is also a lead agency for water conservation and reuse. This note offers:

- this Department's current views on monitoring drains used to determine the volumes or properties of water leaching below the plant root zone following rainfall or irrigation; and
- guidance on acceptable practices used to protect the quality of Western Australian water resources.

This note provides a general guide on issues of environmental concern, and offers potential solutions based on professional judgement and precedent. The recommendations made do not override any statutory obligation or Government policy statement. Alternative practical environmental solutions to suit local conditions may be considered. Regulatory agencies should not use this note's recommendations without a site-specific assessment of any project's environmental risks. Any conditions set should consider the values of the surrounding environment, the safeguards in place, and take a precautionary approach. The note shall not be used as this Department's policy position on a specific matter, unless confirmed in writing.

Scope

This note applies to rural or industrial sites where samples of leachate are required below a vegetated root zone following rainfall or surface application of fertilisers, chemicals or waste matter. In particular, these notes apply in the following circumstances:

- Where water seepage quantity needs to be measured;
- Where the effects of surface soil filtration and microbiological degradation in the topsoil are to be examined for materials that have been applied to the land surface; and/ or

- Where monitor bores may not be appropriate due to the depth to the groundwater or there is uncertainty about the direction of movement of groundwater.

This note is not intended to cover residential sites or municipal recreation facilities, but may offer some useful guidance on potential risks to the environment and good practice.

Recommendations

1. The layout of a typical monitor drain and recovery sump is shown on Plan No. 1 (see [Appendix D](#)).
2. Subsoil monitor drains are generally established in shallow sandy excavated pits with a minimum base area of 22 metres long by four metres wide, within areas where irrigation of land occurs and/or chemicals to be monitored are, or have been, applied to the land surface.
3. Subsoil monitor drains are not suited to sites where low permeability (less than five centimetres per hour) soil layers occur within two metres of the land surface, or the water table rises to within three metres of the land surface.
4. The base of the pit should be located in stable soil which has had any waste matter, stones larger than 20 millimetres in diameter, residual organic matter and plant roots removed. The base of the pit should be compacted to deliver a smooth load-bearing surface.
5. A piped drain system should be placed centrally on a four metre (minimum width) impervious plastic membrane designed to capture percolating waters and deliver them into a drain and sampling sump. The pit base should grade towards the pipework at a minimum slope of one in 100.
6. For systems designed to operate for five years or longer, the plastic liner membrane with a minimum thickness of 0.5 millimetres should cover the base of the pit. For short duration monitoring projects, the minimum thickness of the plastic sheet should be 0.2 millimetres thick. The plastic membrane should extend as a single sheet over the full base area of the pit and should be turned up at the ends and sides to form an effective fluid capture basin. Where the local soils contain sharp or angular stones likely to perforate the pit liner, a protective base layer of compacted sand or filter fabric should be installed immediately below the plastic membrane.
7. The drain system should be constructed of 80 millimetre (minimum) internal diameter slotted pipework, resistant to deterioration which may be caused by contact with contaminants in the sampled waters. A mechanical joint (such as a flanged water stop) should be provided in the pipework where it passes through the pit liner immediately upstream of the sampling sump.
8. A monitor drain system should grade uniformly at a minimum grade of one in 60 to an impervious sampling sump that permits ease of access for collection of water samples for analysis.
9. A multiple drain system (herring-bone configuration) should be used where leachate generation or applied water quality is likely to be variable.

10. The slotted portion of the main drain should have a minimum length of 20 metres.
11. The drains should be located at least one metre above the highest groundwater table and grade uniformly from a minimum of 500 millimetres below the finished ground surface.
12. The drains should be established in either reinstated excavated soil or imported permeable soil that has the same characteristics as the natural soil profile. The soil in the drain pit should be re-compacted to the surrounding soil density to prevent subsidence.
13. The drain system should be wrapped in filter fabric or surrounded by graded gravel media to protect the pipework from silt intrusion.
14. A vertical seepage collection sump should be constructed of, or lined with, impervious materials that do not contaminate samples or deteriorate when exposed to the collected waters. The base of the sump should be set at a minimum of 500 millimetres below the incoming drain invert. It should be sufficiently large to permit manual collection of water samples and periodic removal of any sludge from the sump. The sump should be located, constructed, covered and secured to prevent soil intrusion, direct contamination from the surface and vandalism. A weather-resistant tag should be securely attached to the sump cover identifying its use for leachate monitoring. Protective bollards should be installed where the pit may be damaged by machinery operating on site.
15. The sump should be provided with either a submersible pump or a means to discharge any captured water. The drain entry point into the sump should be provided with either a stop valve or easily removable cap to aid in maintenance and permit measurement of the time taken for water accumulation.
16. The monitoring system location and construction details should be retained by the site owner for scrutiny by regulatory authorities if requested.

More Information

We welcome your views on this note. Feedback provided on this topic is held on file No: **13180**.

This note will be updated periodically as new information is received or industry/activity standards change. Updates are placed on the department's internet site www.water.wa.gov.au select *Drinking water > Publications > Water Quality Protection Notes*.

To comment on this note or for more information, please contact the Water Source Protection Branch at our Atrium offices in Perth, phone (08) 6364 7600 (business hours), fax 6364 7601 or use *Contact us* at the Department's internet site, citing the note topic and version.

Where a conflict arises between the Department of Water's recommendations and any proposed activity that may affect a sensitive water resource, this note may be used to assist negotiations with stakeholders. The negotiated outcome should not result in a greater risk to water quality than if the Department's recommended measures were used.

In October 2005, the State Government announced the formation of the Department of Water. From January 2006, the Department of Water has assumed primary responsibility for managing the State's water resources.

Once the Department of Water is legally established, it will replace many of the present functions of the present Water and Rivers Commission and operate in parallel (with separate powers) to the Department of Environment and Conservation.



Appendices

Appendix A - References and further reading

1. Australian Government – National Water Quality Management Strategy
 - a. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000*;
 - b. *Australian Guidelines for Water Quality Monitoring and Reporting 2000*;
see web page www.deh.gov.au/water/quality/nwqms/index.html.
 - c. *Australian Drinking Water Guidelines 2004*;
see web page www.nhmrc.gov.au/publications/synopses/eh19syn.htm.
 - d. *Policies and Principles 1994*;
 - e. *Implementation guidelines 1998*;
 - f. *Rural land uses and water quality- a community resource 2000*;
see www.awa.asn.au, email bookshop@awa.asn.au, or request from a library service.
2. Standards Australia
 - a. AS 1726 Geotechnical site investigations;
 - b. AS 5667 *Water Quality – Sampling*;
see web page <http://www.saiglobal.com/shop/script/search.asp>.
3. Institution of Engineers Australia
Australian Rainfall and Runoff;
see web page www.engaustralia.com.au/bookshop/ebookspub.html.
4. Natural Resource Management Ministerial Council (Australia)
Minimum construction requirements for water bores in Australia, September 2003,
see web page www.iah.org.au/pdfs/mcrwba.pdf.
5. Australian Bureau of Meteorology
Climate information eg rainfall and evaporation data;
see web page www.bom.gov.au/climate/averages/

6. Department of Water (WA)

Water Quality Protection Notes

- *Irrigation of vegetated land with nutrient-rich wastewater;*
- *Land use compatibility in Public Drinking Water Source Areas;*
- *Liners for containing pollutants, using synthetic membranes;*
- *Nutrient and irrigation management plans;*

see web page <http://drinkingwater.water.wa.gov.au>, select *Water Quality Protection Notes*.

Appendix B - Statutory requirements and approvals relevant to this note include:

What's regulated	Statute	Regulatory body/ agency
Impact of significant development proposals on the values and ecology of land or natural waters	<i>Environmental Protection Act 1986: Part IV, Environmental Impact Assessment</i>	Minister for the Environment advised by the Environmental Protection Authority
Regulation of prescribed premises that could pollute; Prohibited discharge of specified contaminants	<i>Environmental Protection Act 1986: Part V, Environmental Regulation and Part VIII, Unauthorised discharge Regulations 2004</i>	Department of Environment and Conservation – regional office
Industrial sites in existing public drinking water source areas	<i>Metropolitan Water Supply, Sewerage and Drainage Act 1909</i>	Department of Water - regional office
	<i>Country Areas Water Supply Act 1947</i>	

Note: Copies of relevant statutes are available from the State Law Publisher at internet site www.slp.wa.gov.au.

Appendix C - Sensitive water resources

Clean water resources used for drinking, sustaining aquatic and terrestrial ecology, industry and aesthetic values, along with breathable air, rank as the most fundamental and important needs for viable communities. Water resources should remain within specific quality limits to retain their values, and therefore require stringent and conservative protection measures. Guidance on water quality parameters necessary to maintain water values are published in the Australian Government's *National Water Quality Management Strategy Guidelines* (see web page www.deh.gov.au/water/quality/nwqms/index.html).

The Department of Water strives to improve community awareness of catchment protection measures for both surface water and groundwater as part of a multi-barrier protection approach to maintain the quality of water resources.

To be considered sensitive, water resources must support one or more of the environmental values described below. Human activity and land uses pose a risk to water quality if contaminants could be washed or leached into sensitive water resources in discernible quantities. These water resources include shallow groundwater accessed by water supply wells, waterways, wetlands and estuaries. Community support for these values, setting of practical management objectives and implementation of sustainable protection strategies are seen as key elements in protecting and restoring the values of these water resources.

Sensitive water resource values include:

- a. Public Drinking Water Source Areas (ie Water Reserves, Catchment Areas or Underground Water Pollution Control Areas) proclaimed or assigned under the *Metropolitan Water Supply, Sewerage and Drainage Act 1909*, the *Country Areas Water Supply Act 1947* or the *Health Act 1911*.
- b. Private water supply sources, including the following uses:
 - human or stock consumption;
 - commercial or industrial water supplies (with specific qualities that support the activities eg aquaculture, cooling, food or mineral processing or crop irrigation); and
 - garden or municipal water supplies (which can affect people's health or wellbeing).
- c. Groundwater aquifers that sustain important ecological functions eg cave ecology.
- d. Waterways (excluding engineered drains or constructed features) with ecological and / or social values such as aesthetic appeal, boating, fishing, tourism, and swimming, including:
 - waterways of High Conservation Significance as described in the Environmental Protection Authority's Draft Guidance Statement 33 *Environmental Guidance for Planning and Development* (Section B5.2.2) see www.epa.wa.gov.au, select EIA > *Guidance statements*;
 - waterways managed under the *Waterways Conservation Act 1976*, ie the Avon, Peel-Harvey, Leschenault, Wilson Inlet and Albany Waterways Management Areas; and
 - waterways managed under the *Swan and Canning Rivers Management Act, 2006*.

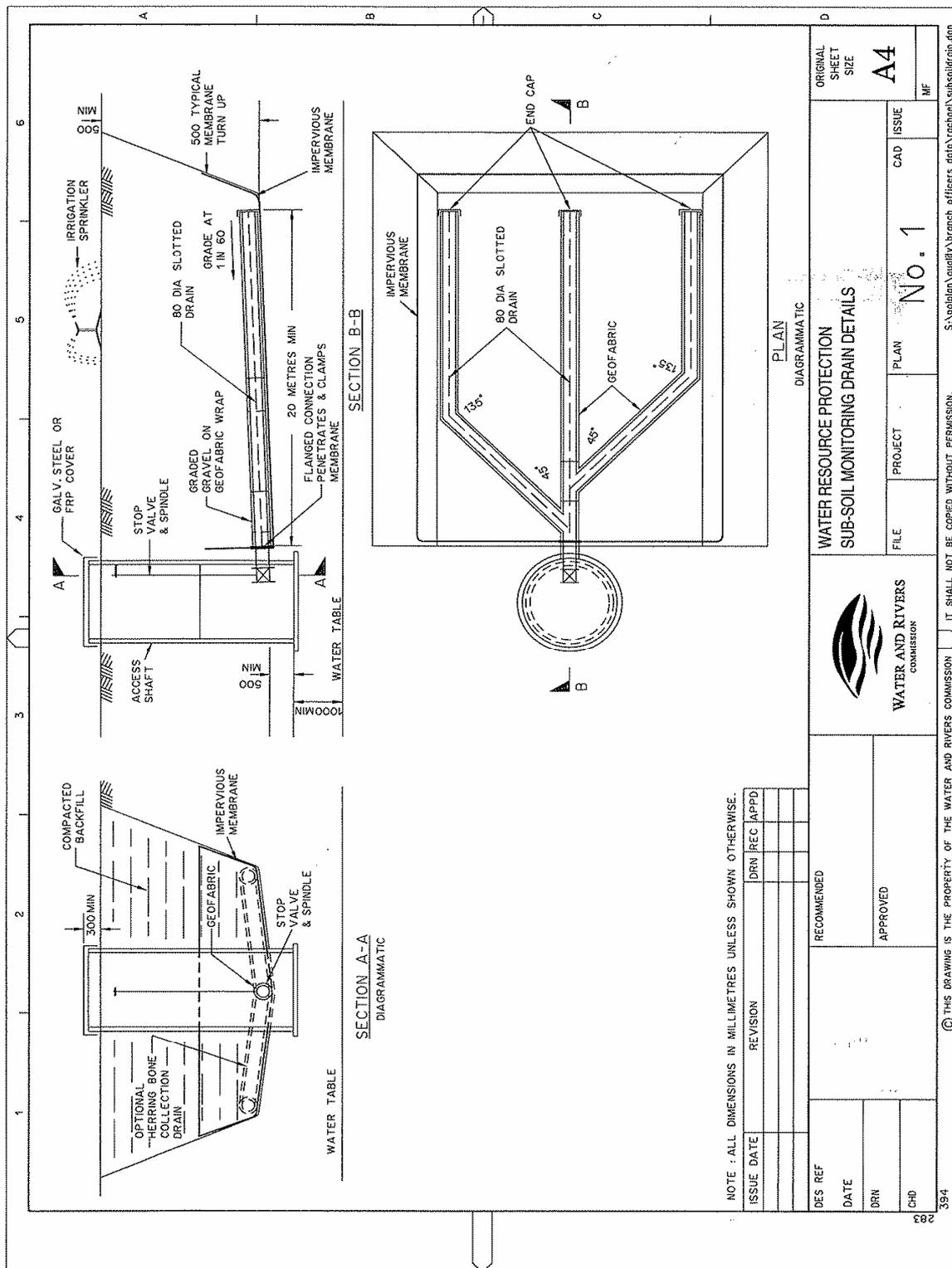
Note: many waterways in the State remain to be scientifically evaluated and their value classified. Any such waterways that are substantially undisturbed by human activity, should be considered to have high conservation value unless proven otherwise.

- e. Wetlands possessing recognised or probable conservation values (generally excluding those highly disturbed, unless subject to active management to restore specified environmental values), and including:
 - RAMSAR wetlands (see internet site www.ramsar.org);
 - Wetlands of High Conservation Significance as described in the Environmental Protection Authority's Draft Guidance Statement 33 *Environmental Guidance for Planning and Development* (Section B4.2.2), see www.epa.wa.gov.au, select EIA > *Guidance statements*;
 - Wetlands described by Department of the Environment and Heritage (Australia) in *A Directory of important wetlands in Australia*, (see web page www.deh.gov.au/water/wetlands/databases.html, or the Department of Environment and Conservation web page www.naturebase.net/national_parks/wetlands/wa_wetlands.html);
 - Conservation and Resource Enhancement category wetlands identified in the *Geomorphic Wetlands of the Swan Coastal Plain* dataset, all wetlands identified in the *South Coast Significant Wetlands* dataset and high value wetlands identified in the *Geomorphic Wetlands Augusta to Walpole* dataset.

Note: many wetlands in the State remain to be scientifically evaluated and classified. Any such wetlands that are generally undisturbed by human activity, should be considered to have high conservation value, unless proven otherwise. The Augusta to Walpole wetland dataset to date has not been subject to a detailed evaluation process.

The Department of Conservation and Environment is the custodian of wetland datasets and is responsible for maintaining and updating the information within them. The datasets can be viewed or downloaded from the internet site www.dec.wa.gov.au, select *Department of Environment > Tools, systems and data > Geographic Data Atlas > Inland waters > Wetlands*. Guidance on viewing the wetlands is provided on the same website at *Water > Wetlands > Data > Wetland mapping > How to view wetland mapping* or phone the Department on 6364 6500.

Appendix D - Subsoil monitoring drain details



NOTE : ALL DIMENSIONS IN MILLIMETRES UNLESS SHOWN OTHERWISE.

ISSUE DATE	REVISION	DRN REC APPD

DES REF	RECOMMENDED
DATE	APPROVED
DRN	
CHD	

WATER AND RIVERS COMMISSION

WATER RESOURCE PROTECTION
SUB-SOIL MONITORING DRAIN DETAILS

FILE PROJECT PLAN CAD ISSUE

No. 1

ORIGINAL SHEET SIZE **A4**

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