



Government of **Western Australia**  
Department of **Health**

# Guidelines for the Laboratory testing of water to ensure Western Australian Department of Health Compliance

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## INTRODUCTION

These guidelines collate chemical, physical and microbiological analytical requirements for the following sample types.

- Aquatic Facilities
- Biosolids
- Drinking water
- Food business water supply
- Natural Waters
- Poultry Processing Water
- Recycled Water
- Shellfish Harvesting Waters
- Wastewater
- Legionnaire's disease

Testing of samples for these analytes should ensure compliance with relevant guidelines and regulations as determined by the Department of Health (DOH).

To ensure confidence in Laboratory testing and analysis results this document should be read in conjunction with *Laboratory Capabilities Summary* (DoH 2016) which provides details of suitable accredited testing and analysis laboratories .

This document is for public release.

## MORE INFORMATION

More information is available from:

Water Unit  
Environmental Health Directorate  
Department of Health  
PO Box 8172  
PERTH BUSINESS CENTRE WA 6849  
Telephone: (08) 9388 4999  
Email: [ehinfo@health.wa.gov.au](mailto:ehinfo@health.wa.gov.au)



## ACRONYMS

<b>Abbreviation</b>	<b>Definition</b>
ADWG	Australian Drinking Water Guidelines
APHA	American Public Health Association
AS	Australian Standard
AS/NZS	Australian and New Zealand Standard
ASTM	American Society for Testing and Materials
CFU	Colony Forming Units
DoH	Western Australian Department of Health
USEPA	United States Environmental Protection Agency
HU	Hazen Units
ISO/IEC	International Organisation for Standardisation/International Electrotechnical Commission
kg	kilogram
L	Litre
mm	millimetre
mg	milligram
mL	millilitre
MPN	Most Probable Number
MU	Mouse Unit
NATA	National Association of Testing Authorities
NEPC	National Environmental Protection Council
NHMRC	National Health and Medical Research Council
NEPM	National Environmental Protection Measure
NTU	Nephelometric Turbidity Unit
PFU	Plaque Forming Units
PCU	Platinum Cobalt Units
WHO	World Health Organisation



## TESTING AND ANALYSIS REQUIREMENTS

Laboratories undertaking testing and analysis have to be accredited by the National Association of Testing Authorities (NATA), Australia (website - <http://www.nata.com.au/nata/>) for ISO/IEC 17025:2005 – General requirements for the competence of testing and calibration laboratories. Relevant NATA accreditation classes and subclasses for each sample type are summarised in Table 1 below.

TABLE 1 SUMMARY OF NATA ACCREDITATION REQUIREMENTS BY THE DOH

Sample Type	Analyte group	Relevant Nata Accreditation Class and Subclass	
Aquatic Facilities	Swimming Pools	Microbiology 8.70 Waters .15 Bacteriological condition of swimming pools and spas	
		Amoebae	8.65 Aquatic Biology .41 Identification of freeliving protozoa to specified level
			8.65 Aquatic Biology .42 Enumeration of freeliving protozoa to specified level
	Chem	7.66 Waters .01 Waters for potable and domestic purposes	
	Spas	Microbiology 8.70 Waters .15 Bacteriological condition of swimming pools and spas	
		Amoebae	8.65 Aquatic Biology .41 Identification of freeliving protozoa to specified level
			8.65 Aquatic Biology .42 Enumeration of freeliving protozoa to specified level
	Chem	7.66 Waters .01 Waters for potable and domestic purposes	
	Hydrotherapy Pools	Microbiology 8.70 Waters .15 Bacteriological condition of swimming pools and spas	
		Amoebae	8.65 Aquatic Biology .41 Identification of freeliving protozoa to specified level
			8.65 Aquatic Biology .42 Enumeration of freeliving protozoa to specified level
	Chem	7.66 Waters .01 Waters for potable and domestic purposes	
	Float Tanks	Microbiology 8.70 Waters .15 Bacteriological condition of swimming pools and spas	
		Amoebae	N/A
		Chemical	N/A
Biosolids	Microbiology 8.19 Microbiological tests on other materials .50 Soils – Including sludges/biosolids		
	Amoebae	N/A	
	Chemical	7.81 Constituents of the environment 34 Biosolids	
Drinking Water	Microbiology 8.70 Waters .11 Bacteriological condition of potable waters		
	Amoebae	8.65 Aquatic Biology .41 Identification of freeliving protozoa to specified level	
		8.65 Aquatic Biology .42 Enumeration of freeliving protozoa to specified level	



Sample Type	Analyte group	Relevant Nata Accreditation Class and Subclass	
Natural Waters	Chemical	7.66 Waters .01 Waters for potable and domestic purposes	
	Microbiology	8.70 Waters .16 Bacteriological condition of environmental waters	
	Amoebae	8.65 Aquatic Biology .41 Identification of freeliving protozoa to specified level	
	Chemical	8.65 Aquatic Biology .42 Enumeration of freeliving protozoa to specified level	
Poultry Processing Waters	Chemical	7.81 Constituents of the environment .11 Waters other than saline	
	Microbiology	7.81 Constituents of the environment .12 Saline waters	
	Amoebae	8.70 Waters .14 Bacteriological condition of trade wastes	
Recycled Waters	Microbiology	8.70 Waters .17 Bacteriological condition of recycled waters	
	Amoebae	N/A	
	General	Chemical	7.66 Waters 01 Waters for potable and domestic purposes (HIGH RISK)
		Chemical	7.66 Waters 02 Waters for irrigation and stock (MED & LOW RISK)
	Wash down waters	Microbiology	8.70 Waters .17 Bacteriological condition of recycled waters
		Amoebae	N/A
Chemical		7.66 Waters 03 Waters for industrial and steam-raising purposes	
Shellfish Harvest Waters	Microbiology	8.70 Waters .16 Bacteriological condition of environmental waters	
	Amoebae	N/A	
	Chemical	N/A	
Wastewaters	Microbiology	8.70 Waters .13 Bacteriological condition of sewage	
	Amoebae	N/A	
	Chemical	N/A	
Legionnaire's Disease	Microbiology	8.70 Waters .12 Bacteriological condition of industrial waters (treated, recirculating)	
	Amoebae	N/A	
	Chemical	N/A	



# AQUATIC FACILITIES

## Swimming Pools

A swimming pool is defined as a man-made structure capable of being filled with water, and intended to be used for swimming, diving, wading or paddling, that cannot be emptied by a simple overturning of the structure. The definition does not include individual therapeutic tubs or baths used for cleaning of the body (Department of Health, 2013)

Testing and analysis requirements are specified by the *Code of practice for the design, construction, operations, management and maintenance of aquatic facilities* (Department of Health, 2013) and are summarised in Table 2.

Note: when the temperature of a pool is greater than than 32°C it needs to be tested as per the spa testing suite in Table 3.

TABLE 2 TESTING REQUIREMENTS FOR SWIMMING POOLS (TEMPERATURE LESS THAN 32°C).

Microbiological Analyte	Guideline Level	Chemical and physical analytes	Guideline levels
<i>Escherichia coli</i>	<1 CFU/100 mL	Total Dissolved Solids	< 1,000 mg/L
Thermophilic Amoebae	Not Detected		Absolute max. 3,000 mg/L
Thermophilic <i>Naegleria</i>	Not detected	pH	7.2-7.8
<i>Naegleria fowleri</i>	Not detected		7.2-8.0 (When bromine is used as a sanitiser)
		Cyanuric Acid	30-50 mg/L
		Alkalinity	60-200 mg/L
		Calcium Hardness	50-400 mg/L
		Total Chlorine (maximum level)	<10 mg/L
		Chlorine:	Water Temp. < 26°C
			Water Temp. > 26°C.
		Unstabilised pools – cyanuric acid not used. (minimum level)	1.0 mg/L
		Stabilised pools – where cyanuric acid is used (minimum level)	2.0 mg/L
		(Swimming Pools, Wave Pools, Water Slide Receiving Pools) (minimum level)	2.0 mg/L
		Free Bromine (Wading Pools) (minimum level)	4.0 mg/L
			6.0 mg/L



## Spas

A spa is defined as a man-made pool or other water-retaining structure designed for human use, which has a capacity of not less than 680 litres, which may or may not be heated. It incorporates, or is connected to, equipment for heating the water contained in it and injecting air bubbles or jets of water under pressure, so as to cause general turbulence in the water (Department of Health, 2013).

Testing and analysis requirements are specified by the *Code of practice for the design, construction, operations, management and maintenance of aquatic facilities* (Department of Health, 2013) and are summarised in Table 3.

TABLE 3 TESTING REQUIRED FOR SPAS

Microbiological Analyte	Guideline Level	Chemical and physical analytes	Guideline levels
<i>Escherichia coli</i>	<1 CFU/100 mL	Total Dissolved Solids	< 1000 mg/L
Presumptive <i>Pseudomonas aeruginosa</i>	Not detected in 100 mL of pool water		Absolute Max 3000 mg/L
Thermophilic Amoebae	Not Detected	pH	7.2-7.8
Thermophilic <i>Naegleria</i>	Not detected		7.2-8.0 (When bromine is used as a sanitiser)
<i>Naegleria folweri</i>	Not detected	Cyanuric Acid	30-50 mg/L
		Alkalinity	60-200 mg/L
		Calcium Hardness	50-400 mg/L
		Total Chlorine (maximum level)	<10 mg/L
		Free Chlorine (minimum level)	3.0 mg/L
		Free Bromine (minimum level)	<b>Water Temp. &lt; 26°C</b> 4.0 mg/L <b>Water Temp. &gt; 26°C.</b> 6.0 mg/L





## Hydrotherapy pools

A hydrotherapy pool is defined as a pool containing heated water, designed to meet the therapeutic needs of persons of any age with impairments due to illness, injury, disease, intellectual handicap, congenital defects, or for fitness exercising, recreational and educational purposes (Department of Health, 2013).

Testing and analysis requirements are specified by the *Code of practice for the design, construction, operations, management and maintenance of aquatic facilities* (Department of Health, 2013) and are summarised in Table 4.

TABLE 4 TESTING REQUIRED FOR ALL HYDROTHERAPY POOLS

Microbiological Analytes	Guideline Level	Chemical and Physical Analytes	Guideline minimum level
<i>Escherichia coli</i>	<1CFU/100 mL	Total Dissolved Solids	< 1,000 mg/L
Presumptive <i>Pseudomonas aeruginosa</i>	Not detected in 100 mL of pool water		Absolute Max 3,000 mg/L
Heterotrophic plate count	<100 CFU/mL	pH	7.2-7.8
Thermophilic Amoebae	Not Detected		7.2-8.0 (When bromine is used as a sanitiser)
Thermophilic <i>Naegleria</i>	Not detected	Cyanuric Acid	30-50 mg/L
<i>Naegleria fowleri</i>	Not detected	Alkalinity	60-200 mg/L
		Calcium Hardness	50-400 mg/L
		Total Chlorine (maximum level)	<10 mg/L
		Free Chlorine (minimum level)	3.0 mg/L
		Free Bromine (minimum level)	<b>Water Temp. &lt; 26°C</b>
			<b>Water Temp. &gt; 26°C.</b>
			4.0 mg/L
			6.0 mg/L



## Floatation Tanks

Floatation tanks, sometimes referred to as sensory deprivation tanks are small clamshell enclosed pods that contain roughly 1000L of water, contain very high concentrations of Epsom salts (Magnesium Sulfate) at around 30-40% by weight, and are usually heated to around 30°C - 35°C. The pods are designed to be used by one person at a time, are often marketed as providing a sensation of floating and possible health benefits from the magnesium salt, and are becoming more popular in Western Australia. The current testing requirements are summarised in Table 5.

TABLE 5 TESTING REQUIRED FOR FLOAT TANKS

Microbiological Analyte	Guideline Level	Chemical and physical analytes	Guideline values
<i>Escherichia coli</i>	N/A		Not applicable
<i>Pseudomonas aeruginosa</i>	N/A		
<i>Enterococci</i>	N/A		
Heterotrophic plate count	N/A		



## **BIOSOLIDS**

Testing and analysis requirements of Biosolids is informed by the *Western Australian Guidelines for Biosolids Management* (Department of Environment and Conservation, 2012) and are summarised in Table 6; testing is done on final dry biosolids.

Biosolids are graded one of four pathogen grades: P1, P2, P3 and P4. The Pathogen grade is based on the level of treatment undertaken to achieve desired microbial limits and a reduction in odour and vector attraction for biosolids and biosolids products. All biosolids are assumed to be pathogen Grade P4 unless proven otherwise.

Biosolids are graded one of three chemical grades: C1, C2 and C3. This contaminated grade is based on the concentration of chemical contaminants in the biosolids and the product containing biosolids. All biosolids are assumed to be Chemical Grade C3 unless proven otherwise.



TABLE 6 TESTING REQUIRED FOR BIOSOLIDS

Microbiological Analytes	Guideline Level				Chemical and Physical Analytes	Guideline Level		
	Grade P1	Grade P2	Grade P3	Grade P4		Grade C1	Grade C2	Grade C3
<i>Escherichia coli</i>	<100 counts / gram	<1000 counts / gram	<2,000,000 counts /gram	>2,000,000 counts /gram	Cadmium	1 mg/kg	20 mg/kg	Untested or greater than grade C2
Somatic Coliphages	<10 pfu/ 10 grams	Not required	Not required	Not required	Chromium (VI)	1 mg/kg	1 mg/kg	Untested or greater than grade C2
Helminth	<1 ova/ 10 grams	<1 ova/ 10 grams	<1 ova/ 10 grams	Not required	Copper	100 mg/kg	2,500 mg/kg	Untested or greater than grade C2
<i>Strongyloides</i> & Hookworm	<1 viable ova /50 gram	<1 viable ova /50 gram	<1 viable ova /50 gram	Not required	Zinc	200 mg/kg	2,500 mg/kg	Untested or greater than grade C2
					Dieldrin	0.02 mg/kg	0.5 mg/kg	Untested or greater than grade C2
					Chlordane	0.02 mg/kg	0.5 mg/kg	Untested or greater than grade C2

Note: *Strongyloides* & Hookworm (viable ova) only required for biosolids north of the 26<sup>th</sup> parallel



## DRINKING WATER

Drinking water testing requirements are informed by the *Australian Drinking Water Guidelines Paper 6* (NHMRC, 2011) and the *Amoeba response protocol* (Department of Health, 2014). The ADWG (NHMRC, 2011) analytes (excluding pesticides) are summarised in Table 7.

Note: Testing and analysis is not necessarily required for all the chemical and physical analytes listed.

TABLE 7 ANALYTES OF INTEREST FOR THE SAFE PROVISION OF DRINKING WATER

Microbiological Analytes	Guideline values	Chemical and Physical Analytes	Guidelines values			
			Health Value	Aesthetic value		
<i>Escherichia coli</i>	Not Detected	Acrylamide	0.0002			
Thermophilic Amoebae	Not Detected	Aluminium, Al		0.2		
Thermophilic <i>Naegleria</i>	Not Detected	Ammonia as NH <sub>3</sub>		0.5		
<i>Naegleria fowleri</i>	Not Detected	Antimony, Sb	0.003			
		Arsenic, As	0.01			
		Asbestos				
		Barium, Ba	2			
		Benzene	0.001			
		Beryllium, Be	0.06			
		Boron, B	4			
		Bromate, BrO <sub>3</sub>	0.02			
		Cadmium, Cd	0.002			
		Carbon Tetrachloride (Tetrachloromethane)	0.003			
		Chloral Hydrate (Trichloroacetaldehyde)				
		Chlorate				
		Chloride, Cl <sup>-</sup>		250		
		Chlorinated furanones (MX)				
		Chlorine	5			
		Chlorine Dioxide	0.4			
		Chlorite	0.8			
		<b>Chloroacetic acids</b>				
		Chloroacetic acid	0.15			
		Dichloroacetic acid	0.1			
		Trichloroacetic acid	0.1			
		Chlorobenzene	0.3		0.01	



Microbiological Analytes	Guideline values	Chemical and Physical Analytes	Guidelines values	
			Health Value	Aesthetic value
		<b>Chloroketones</b>		
		1,1-dichloropropanone		
		1,3-dichloropropanone		
		1,1,1-trichloropropanone		
		1,1,3-trichloropropanone		
		<b>Chlorophenols</b>		
		2-Chlorophenol	0.3	0.0001
		2,4-Dichlorophenol	0.2	0.0003
		2,4,6-Trichlorophenol	0.02	0.002
		Chromium, CR(VI)	0.05	
		Colour (true)		15
		Copper, Cu	2	1
		Cyanide	0.08	
		Cyanogen chloride (as cyanide)	0.08	
		<b>Dichlorobenzenes</b>		
		1,2-Dichlorobenzene	1.5	0.001
		1,3-Dichlorobenzene		0.02
		1,4-Dichlorobenzene	0.04	0.0003
		<b>Dichloroethanes</b>		
		1,1-dichloroethane		
		1,2-dichloroethane	0.003	
		<b>Dichloroethenes</b>		
		1,1-Dichloroethene	0.03	
		1,2-Dichloroethene	0.06	
		Dichloromethane (methylene chloride)	0.004	
		Dissolved oxygen		> 85% saturation
		Epichlorohydrin	0.1	
		Ethylbenzene	0.3	0.003
		Ethylenediamine tetraacetic acid (EDTA)	0.25	
		Fluoride, F-	1.5	
		Formaldehyde	0.5	
		<b>Haloacetonitriles</b>		
		Dichloroacetonitrile		



Microbiological Analytes	Guideline values	Chemical and Physical Analytes	Guidelines values	
			Health Value	Aesthetic value
		Trichloroacetonitrile		
		Dibromoacetonitrile		
		Bromochloroacetonitrile		
		Hardness as CaCO <sub>3</sub>		200
		Hexachlorobutadiene	0.0007	
		Hydrogen sulfide		0.05
		Iodide	0.5	
		Iodine		
		Iron, (Total) Fe		0.3
		Lead, Pb	0.01	
		Manganese, Mn	0.5	0.1
		Mercury (Total), Hg	0.001	
		Molybdenum, Mo	0.05	
		Monochloramine	3	0.5
		Nickel, Ni	0.02	
		Nitrate (as NO <sub>3</sub> )	50	
		Nitrioltriacetic acid	0.2	
		Nitrite (as NO <sub>2</sub> )	3	
		N-Nitrosodimethylamine (NDMA)	0.0001	
		<b>Organotins</b>		
		Dialkyltins		
		Tributyltin oxide	0.001	
		pH		6.5-8.5
		<b>Plasticisers</b>		
		Di (2-ethylhexyl) phthalate	0.01	
		Di (2-ethylhexyl) adipate		
		<b>Polycyclic Aromatic Hydrocarbons (PAHs)</b>		
		Benzo[a]pyrene	0.00001	
		Selenium (Total), Se	0.01	
		Silica		80
		Silver, Ag	0.1	
		Sodium		180
		Styrene (vinylbenzene)	0.03	0.004



Microbiological Analytes	Guideline values	Chemical and Physical Analytes	Guidelines values	
			Health Value	Aesthetic value
		Sulfate		250
		Tetrachloroethene	0.05	
		Toluene	0.8	0.025
		Tin	Not necessary	
		Total Dissolved Solids		600
		Trichlorobenzenes (total)	0.03	0.005
		1,1,1-Trichloroethane		
		Trichloroethylene (TCE)		
		Trihalomethanes (total, including chloroform)	0.25	
		Turbidity		5
		Uranium, U	0.017	
		Chloroethene (vinyl chloride)	0.0003	
		Xylenes	0.6	0.02
		Zinc, Zn		3
		<b>Radiological Characteristics</b>		
		Gross Alpha	0.5	
		Gross Beta	0.5	





## **FOOD BUSINESS WATER SUPPLY**

Food businesses need to use potable drinking water in their food production. See the details in the Drinking water section for the testing requirements.

Note: It is the responsibility of the business owner to complete the correct testing as required by the Food Act to ensure compliance.



## NATURAL WATERS

This section deals with samples from naturally occurring bodies of water that may be used for activities such as boating, wading and swimming and may include oceans, rivers, lakes, brooks, creeks, streams, estuaries, inlets, drains, marina's, boat harbours, recreational reservoirs and farm dams. Natural waters that are used as source water are dealt within the Drinking water section.

The guideline that informs testing is the *Guidelines for Managing Risks in Recreational Water* (NHMRC, 2008). In addition, the DoH also requires testing of some natural waters for *Escherichia Coli* and Thermophilic Amoebae (summary shown Table 8). A summary of microbiological, chemical and physical analytes and their associated guideline values are shown in Table 9.

TABLE 8 NATURAL WATER MICROBIOLOGICAL TESTING REQUIREMENTS BASED ON WATER TYPES (DEPARTMENT OF HEALTH TESTING REQUIREMENTS)

Fresh to Brackish Water Environments	Estuarine Water Environments	Marine Water Environments
Enterococci	Enterococci	Enterococci
<i>Escherichia coli</i>	<i>Escherichia coli</i>	
Thermophilic Amoebae		
Thermophilic <i>Naegleria</i>		
<i>Naegleria fowleri</i>		



TABLE 9 TESTING REQUIRED FOR NATURAL WATERS: MICROBIOLOGICAL, CHEMICAL AND PHYSICAL PARAMATERS

Organism	Guideline values				DoH Trigger Values		Chemical Parameter	Guideline value
	Category A	Category B	Category C	Category D	Primary Contact	Secondary Contact		
Enterococci	≤40 organisms/100mL (95 <sup>th</sup> percentile)	41-200 organisms/100mL (95 <sup>th</sup> percentile)	201-500 organisms/100mL (95 <sup>th</sup> percentile)	>500 organisms/100mL (95 <sup>th</sup> percentile)	≥ 700 (any 1 sample) > 100 & < 700 (2 consecutive samples)	≥ 7000 (any 1 sample) > 1000 & < 7000 (2 consecutive samples)	pH	Between 6.5-8.5
<i>Escherichia coli</i>	No guideline value				≥ 550/100mL		Dissolved oxygen	> 80%
Thermophilic Amoebae	No guideline value				N/A			
Thermophilic <i>Naegleria</i>	No guideline value				Detected			
<i>Naegleria fowleri</i>	No guideline value							



## POULTRY PROCESSING WATER

These samples include discharge waters used during the factory production of Poultry. Depending on where the sample is taken, the analyte tested for changes. Testing requirements are determined by the DoH and have been summarised in Table 10

Note: Whole birds are tested for *Salmonellae* and *Campylobacter* spp; however this testing falls outside the scope of this document

TABLE 10 TESTING REQUIRED FOR POULTRY PROCESSING WATER

Microbiological Analyte	Testing requirements	Guideline value	Chemical and Physical Analytes	Guideline value
<i>Escherichia coli</i>	Spin Chiller Water Tub	N/A	None required	
<i>Salmonellae</i>	Spin chiller Wash tub Post evisceration drain	N/A		



## RECYCLED WATER

### General

Testing and analysis required for recycled water is informed by the *Guidelines for the Non-potable uses of recycled water in Western Australia* (Department of Health, 2011) with the details of the testing requirements shown in Table 11.

Recycled water use has been classified into four exposure risk levels: High, Medium, Low and Very Low. The details of what types of end-uses these exposure risk levels relate to are described below.

### High

- Multi-unit dwellings, internal use and external surface irrigation
- Agricultural irrigation - unprocessed foods (e.g. salad crops)
- Urban irrigation with unrestricted access and application
- Communal use – flushing toilets and designated cold tap washing machines

### Medium

- Urban irrigation with some restricted access and application
- Fire fighting
- Fountains and water features
- Industrial use with potential human exposure
- Dust suppression

### Low

- Communal sub-surface irrigation
- Urban irrigation with enhanced restricted access and application
- Agricultural irrigation; non-edible crops

### Extra Low

Note: no monitoring is required for the extra low risk category

- Woodlots
- Sub-surface irrigation (non-food crops)



TABLE 11 TESTING REQUIRED FOR RECYCLED WATER

Microbiological Analytes	Guideline Values Exposure Risk Level			Chemical and physical Analytes	Guideline Values Exposure Risk Level		
	High	Medium	Low		High	Medium	Low
<i>Escherichia coli</i>	< 1 MPN or CFU/100 mL	< 10 MPN or CFU/100 mL	< 1000 MPN or CFU/100 mL	BOD	<10 mg/L	<20 mg/L	<20 mg/L
Somatic Coliphages	< 1 pfu/100 mL	Not required	Not required	Suspended Solids	<10 mg/L	<30 mg/L	<30 mg/L
<i>Clostridium</i>	< 1 pfu/100 mL	Not required	Not required	pH	6.5-8.5	6.5-8.5	6.5-8.5
Helminths	<1 ova/larvae/100mL	<1 ova/larvae/100mL	<1 ova/larvae/100mL	Turbidity	< 2 NTU (95%ile) < 5 NTU (max)	< 5 NTU (95%ile)	

It should be noted that Helminth control is only necessary in the following locations:

- north of the 20th parallel to irrigate public open spaces (parks, sports fields and municipal areas) or
- where the recycled water is used to irrigate pasture and fodder for beef cattle; or
- where the recycled water is used to irrigate pasture and fodder for dairy animals; or
- where the recycled water is used for drinking water for stock (except pigs) or
- where the recycled water is used to wash down water for dairies.



## Washing Waters

Washing waters are informed by the *Guidance note for wash down facilities using recycled water* (Department of Health & WorkSafe, 2011). Testing requirements and associated guideline values are summarised in Table 12.

TABLE 12 TESTING REQUIRED FOR WASHING WATERS

Microbiological Analytes	Guideline Values	Chemical and Physical Analytes	Guideline values	
			Health Value	Aesthetic Value
<i>Escherichia coli</i>	<10 MPN or CFU/100 mL	pH	6.5 - 8.5	
		Turbidity	<5 NTU (95%ile)	
		Benzene	<0.01	
		Toluene	<8	<0.25
		Ethyl-benzene	<3	<0.03
		Xylenes	<6	<0.2



## SHELLFISH HARVESTING WATERS

Testing and analysis requirements are informed by the *Western Australian Shellfish Quality Assurance Program (WASQAP) Operations Manual* (Department of Health, 2015). This manual is intended to apply to the WA aquaculture industry that currently produces clams, mussels and edible oysters for the domestic and export markets. Testing requirements are summarised in Table 13.

This section only relates to the Harvesting waters testing requirements. Any testing of flesh falls outside the scope of this document.

TABLE 13 TESTING REQUIREMENTS FOR SHELLFISH HARVESTING WATERS

<b>Microbiological Analytes</b>	<b>Guideline values</b>	<b>Chemical and Physical Analytes</b>	<b>Guideline values</b>
Total Coliforms	70 CFU/ 100 mL		Not applicable
<i>Escherichia coli</i>	14 CFU/ 100 mL		





## WASTEWATER

### General

In times of drying climate and limited water supply wastewater is starting to be considered as a water source. This section relates to in-stream wastewater (generally pre-treatment) to determine the treatment requirements for the water's intended future use. An example of a location where sampling may occur is at a potential sewer mining location.

Testing requirements have been determined by the DoH and are shown in Table 14.

Note: This section does not relate to post treatment effectiveness.

TABLE 14 TESTING REQUIREMENTS FOR WASTEWATER

Microbiological Analytes	Guideline Values	Chemical and Physical Analytes	Guideline values
<i>Escherichia coli</i>	N/A	Not Applicable	

### Wastewater Spills

There are no guidelines to inform wastewater spill testing requirements. The DOH requires testing to be done as shown Table 15.

TABLE 15 TESTING REQUIREMENTS FOR WASTEWATER SPILLS

Microbiological Analytes	Guideline Values	Chemical and Physical Analytes	Guideline values
<i>Escherichia coli</i>	N/A	Not Applicable	
<i>Enterococci</i>	N/A		



## LEGIONNAIRE’S DISEASE

Legionnaire’s disease is caused by bacteria belonging to the genus *Legionella*. The guideline to inform testing and analysis is the *Code of practice for the prevention and control of Legionnaires’ disease* (Commission for occupational safety and health, 2010).

### Cooling tower and Air conditioners

Cooling tower water and Air Conditioners testing requirements are informed by the Code of Practice and AS/NZS 3666.6:2011 Air-handling and water system of buildings – Microbial control Part 3: performance-based maintenance of cooling systems (Standards Australia, 2011).

Testing requirements and associated guideline values are summarised in Table 16.

TABLE 16 TESTING REQUIRED FOR COOLING WATERS

Microbiological Analytes	Guideline Value	Chemical and Physical Analytes	Guideline Value
<i>Legionella</i>	Not detected ( $< 10$ CFU/mL)	Not required	
Heterotrophic Plate count	$< 100,000$ CFU/mL		

### General

*Legionella* has also been known to accumulate in:

- evaporative condensers;
- hot and cold water systems;
- spas;
- humidifiers or foggers and water misting systems;
- coolant in industrial milling machines;
- high pressure cooling and cleansing processes;
- potable water aerosols, such as shower heads;
- nebulisers; and
- other domestic and industrial-based water systems.

Should testing for *Legionella* be required for any of the above water types the testing requirements are the same as for cooling towers and air conditioners above.

Note: Testing of Spas is only recommended if there has been an infectious disease notification from the DoH.



## GUIDELINES REFERENCE LIST

- Commission for occupational safety and health. (2010). *Code of practice: Prevention and control of Legionnaires' disease*. Perth: Department of Commerce and Department of Mines and Petroleum, Government of Western Australia.
- Department of Environment and Conservation. (2012). *Western Australian guidelines for biosolids management*. Perth: Government of Western Australia.
- Department of Health & WorkSafe. (2011). *Guidance note for wash down facilities using recycled water*. Perth: Government of Western Australian.
- Department of Health. (2011). *Guidelines for the non-potable uses of recycled water in Western Australia*. Perth: Government of Western Australia.
- Department of Health. (2013). *Code of Practice for the design, construction, operation, management and maintenance of aquatic facilities*. Perth: Department of Health, Western Australian Government.
- Department of Health. (2014). *Amoeba response protocol*. Perth: Government of Western Australia.
- Department of Health. (2015). *Western Australia Shellfish Quality Assurance Program*. Perth: Government of Western Australia.
- NHMRC. (2008). *Guidelines for Managing Risks in Recreational Water*. Canberra: National Health and Medical Research Council, Commonwealth of Australia.
- NHMRC. (2011). *Australian Drinking Water Guidelines Paper 6 National Water Quality Management Strategy*. Canberra: National Health and Medical Research Council, National Resources Management Ministerial Council, Commonwealth of Australia.



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# APPENDICES

## Appendix A – Australian Drinking Water Guidelines 2011 Handling and sampling requirements

TABLE 17 SPECIAL HANDLING REQUIREMENTS IN SAMPLING FOR CHEMICAL, PHYSICAL AND RADIOLOGICAL CHARACTERISTICS (ADWG 2011 – DATA COMPILED FROM AS/NZS 5667.1:1998)

Characteristic	Container	Minimum sample size (mL)	Preservation procedure	Maximum holding period	Comments
Aluminium	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Arsenic	P(A), G(A)	500	Add HNO <sub>3</sub> to pH <2	28 days	
Boron	P	100	None required	28 days	Fill container completely to exclude air
Cadmium	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Chloride	P, G	100	None required	28 days	
Chlorine residual	P, G	500	Analyse immediately	5 minutes	Keep sample out of direct sunlight
Chromium (total)	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Chromium (VI)	P(A), G(A)	100	Refrigerate	24 hours	Sample container should be thoroughly rinsed. Avoid adding reagents
Colour	P, G	500	Refrigerate and store in the dark	2 days	
Copper	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Cyanide	P, G	500	Add NaOH to pH >12. Refrigerate in the dark	24 hours	Remove sulfide
Fluoride	P	200	None required	28 days	PTFE containers are not suitable
Hardness	P	100	None required	7 days	Fill container completely to exclude
			Add HNO <sub>3</sub> to pH <2 and refrigerate	28 days	Fill container completely to exclude air. Acidification permits the determination of calcium and other metals from the same sample
Iron	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Lead	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Manganese	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Mercury	G(A)	500	Add HNO <sub>3</sub> to unfiltered sample to pH <1. Add K <sub>2</sub> Cr <sub>2</sub> O <sub>3</sub>	28 days	Consult analyst for further instruction

Characteristic	Container	Minimum sample size (mL)	Preservation procedure	Maximum holding period	Comments
Metals (general)	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Metals (filterable)	P(A), G(A)	100	Filter immediately, add HNO <sub>3</sub> to pH <2	28 days	0.45 m filter
Nitrate	P, G	500	Refrigerate	24 hours	Unfiltered samples
			Filter on site (0.45 m cellulose acetate membrane filter) and freeze	1 month	Consult analyst – depends on analytical method
Odour	P, G	500	Refrigerate	6 hours	Analyse as soon as possible
Oxygen, dissolved	P or G	300	None required	Determine in the field	Avoid excessive turbulence, to minimise oxygen entrainment
	G		Winkler acidification	24 hours	Store in dark
Pesticides (organochlorine, organophosphorous, and nitrogen-containing)	G(s)	1000 to 3000	Refrigerate <sup>1</sup>	7 days	Extract on site where practical. Consult with analyst
pH	P, G	100	Refrigerate	6 hours	
Poly aromatic hydrocarbons (PAHs)	G(S)	1000	Refrigerate and store in dark <sup>2</sup>	7 days	Extract on site where practical. Consult with analyst
Radioactivity gross <i>alpha</i> and <i>beta</i> activity	P, G	1000	Add HNO <sub>3</sub> to pH <2	28 days	Fill container completely to exclude air. Consult with analyst
Selenium	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	
Sodium	P	100	None required	28 days	
Sulfate	P, G	200	Refrigerate	7 days	
Taste	G	500	None required	24 hours	Analyse as soon as possible
Temperature	-	-	None required	Analyse immediately	Determine <i>in situ</i>
Total dissolved solids	P, G	500	Refrigerate	24 hours	Fill container completely to exclude air
Trihalomethanes	G, vials with PTFE-faced septum	100	Add 2 mL of 5% ascorbic acid solution	14 days	Fill container completely to exclude air
Turbidity	P, G	100	None required	24 hours	Preferably determine on site or <i>in situ</i>
Zinc	P(A), G(A)	100	Add HNO <sub>3</sub> to pH <2	28 days	

Container P = Plastic (polyethylene or equivalent)

G = Glass

G(B) = Glass, borosilicate

P(A), G(A) = Rinsed with 50% HNO<sub>3</sub>

G(S) = Glass, rinsed with organic solvent, PTFE cap liner

PTFE = Polytetrafluoroethylene

Preservation Refrigerate = Store between 1° and 4°C in the dark, do not freeze

HNO<sub>3</sub> = Nitric acid (hydrochloric acid may be used in this context but nitric acid is preferred)

NaOH = Sodium hydroxide solution (40% w/v)

K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> = Potassium dichromate

**Appendix B – AS 2031-2012 Annex B Recommended ( R ) and acceptable (A) for maximum sample storage times including transport time and temperature unless otherwise specified in specific standards.**

TABLE 18 MICROBIOLOGICAL STORAGE AND HANDLING TIMES (AS 2031-2012)

	Maximum sample time (h) including transport		Storage water temperature °C		Observation
	R	A	R	A	
<b>General</b>					
Culturable microorganisms (22°C, 30°C, or 36°C)	8	12	5 ± 3		
<b>Faecal indicators, vegetative bacteria</b>					
<i>E. Coli</i> (and coliform bacteria)	12	18	5 ± 3		
Enterococci	12	18	5 ± 3		
<i>Clostridium Perfringens</i> (vegetative cells)	12	18	5 ± 3		
<b>Spores</b>					
Spores of sulphite-reducing bacteria ( <i>Clostridium</i> spp)	24	72	5 ± 3		Die-off observed in raw waters after 24 h
<b>Viuses</b>					
Bacteriophages	48	72	5 ± 3		
<b>Faecal pathogens</b>					
<i>Salmonella</i> spp and other <i>Enterobacteriaceae</i>	12	18	5 ± 3		
Enteroviruses	48 1 Month	72	5 ± 3 -70	-20	
<i>Cryptosporidium</i> oocysts	24	96	5 ± 3	Ambient	
<i>Giardia</i> cysts	24	96	5 ± 3		
<b>Other microorganisms</b>					
Amoebae	24	96			
<i>Pseudomonas aeruginosa</i>	8	12	Ambient	5 ± 3	
<i>Legionella</i> spp	24	48	5 ± 3 5 ± 3	Ambient	
Cyanobacteria	48	72	5 ± 3		Lysis sometimes appears within a few hours
<i>Campylobacter</i> (thermophilic spp.)	24		3 ± 2		Oxygen-sensitive
Total bacteria for epifluorescence	1 year		Ambient		Sample to be stabilized in dust-free vial, + formaldehyde (final concentration 3%) in the dark



	Maximum sample time (h) including transport		Storage water temperature °C		Observation
	R	A	R	A	
Helminth eggs	48	72 1 week	5 ± 3 5 ± 3		Sample stabilized at pH=2



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