

How well do you know your water
storage tanks?

Managing the evidence trail

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Why an inspection program?

Important for safe drinking water

- Understanding how the storage works
- What are the risks
- How the risks are managed
- Documentation

=> Water Quality Management Plans

NSW Office Of Water

2009 -2010 NSW Water Supply and Sewerage Benchmarking report page 22

www.water.nsw.gov.au/Urban-water/Country-Towns-Program

Summary of boil water alerts in non-metropolitan NSW – May 2006 to June 2008

No. of alerts	Reason for alert
9	Inadequate chlorine residual in the distribution system.
8	Failure of bird proofing which allowed bird entry through gap in reservoir roof contaminating the treated water.
3	Highly turbid raw water, no filtration plant, ineffective disinfection.
1	Failure to properly clean and disinfect the main after replacement of valves and fittings.
1	Backflow in the mains due to inadequate backflow prevention device.

36%

- *“These incidents highlight that almost 80% of the alerts were due to an **inadequate chlorine residual** in the water supply distribution system or bird entry through **failure of the bird proofing** of a reservoir roof. They also show that a number of LWUs have been using **reactive** measures to protect public health. Preventive management on the basis of a sound risk management plan, with associated work procedures and process controls would have avoided the need for 86% of these boil water alerts”*

- *“A number of important lessons have been learnt from the above boil water alerts as tabulated below:*

Storage (service reservoirs/tanks)

- *Ensure entry hatches to service reservoirs are secure and that hatches are not left open; particular care is required if third parties (e.g. telephone companies) have been given access to your LWU’s reservoirs.*
- *Regular inspection is essential to ensure the roof and the bird and vermin proofing of each service reservoir is effective and has not been damaged; early repairs must be effected to ensure integrity of the bird-proofing. “*

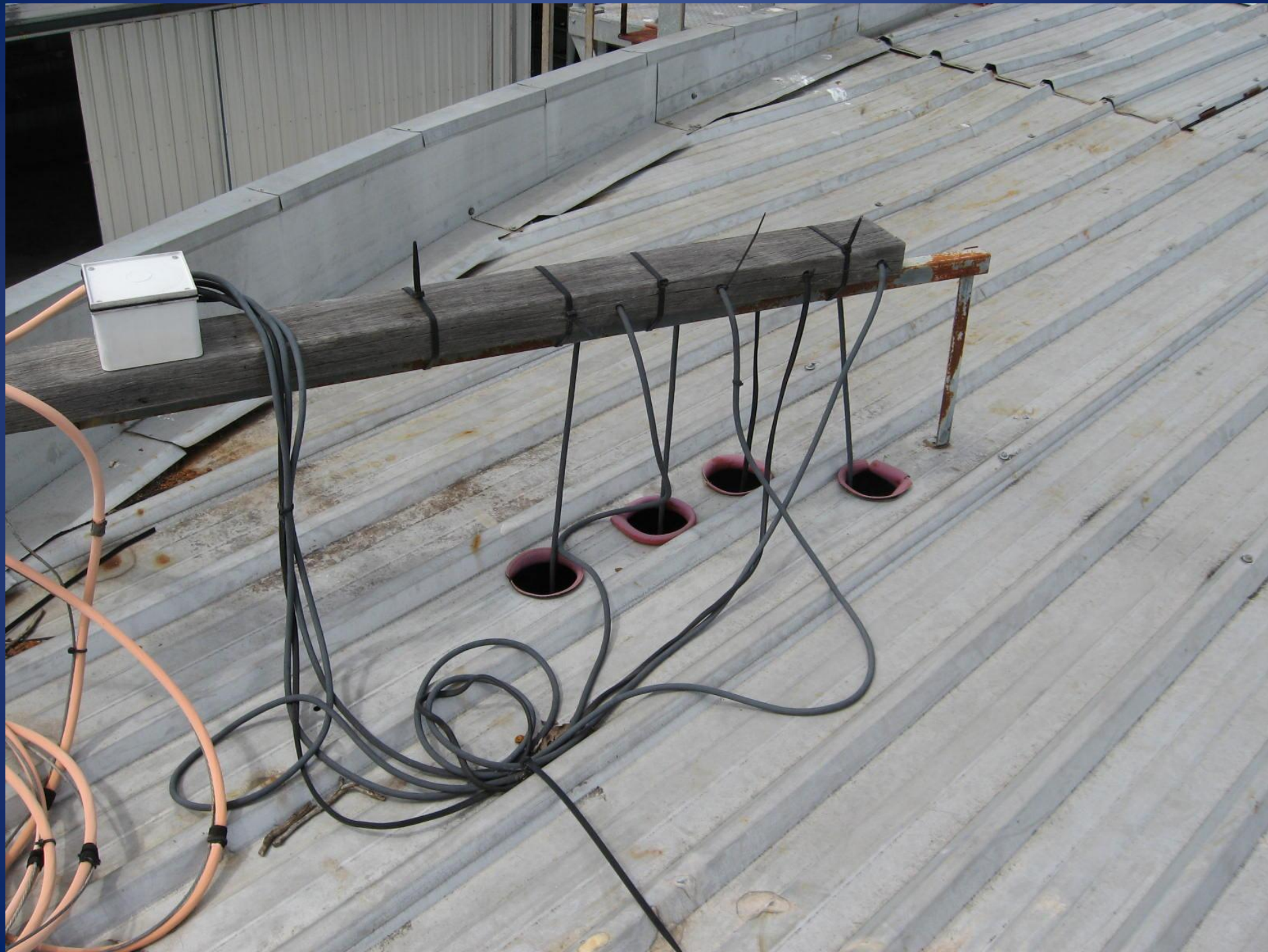






Vermin access points





Why an inspection program?

- Identify future maintenance programs
- Solving or understanding specific problems
- A continual improvement process



The inspection process

Define: Who - What - When

- Who will collect the information
- Who will use the information
- What information is to be collected
- Frequency

Four key areas

- Site Security
- Water Quality
- OH&S
- Structural



Inspection template


Inspection Information				
Date _____	Job No. _____	Project No. _____		
Client _____	Name _____	WS No. _____		
Inground	Semi-Inground	Onground	Standpipe	Elevated
Construction:	Walls - Steel / Concrete / Other:	Floor Steel / Concrete / Other:		
Roof Material:				
Diameter: _____ m	Depth: _____ m	Area: _____ m ²	Capacity: _____ ML	
GPS Datum:	Latitude: S	Longitude: E		
Environment Type:				
EMF Hazard	Notification Period :			
Vehicle Access	Tanker Access	Site Access		
Lifting Access	Entry Hatch	Entry Hatch Size		
Work Platform	Rescue Hatch	Rescue System Type		
External Ladder:	Type	Length:		
Internal Ladder:	Type	Length:		
Material	Cage	Confined Space Compliant		
C.P.: Y / N	Mixer: Y / N	DIN Y / N		
Type Of Pipe work	Inlet: Top / Wall / Floor	Outlet	Wall / Floor	Scour Wall / Floor
Other:				
Position Of Pipework	Inlet	Outlet	Scour	
Position Of Valves	Inlet	Outlet	Scour	
Size Of Pipework	Inlet	Outlet	Scour	
Screen	Inlet Y / N	Outlet Y / N	Scour Y / N	
Screen Material	Inlet	Outlet	Scour	
Benchmark	Rank	Comment		
Security				
Contamination				
COF Water Quality				
Safety				
Confined Space				
COF OH&S				
External Structural				
External Coatings				
Internal Structural				
Internal Coatings				

External and Internal Inspection				
AREA	PRIORITY	STATUS	COMMENTS	
Compound				
Vandalism				
Walls				
Ladder				
Entry Hatch				
Platforms				
Walkways				
Roof				
Roof Hatches				
Handrails				
Davit				
Ventilation				
Bird Proofing				
Electrical				
Level Indicator				
Walls				
Columns				
Roof Spider				
Roof Framing				
Floor				
Inlet				
Outlet				
Scour				
Overflow				
Flow Meter				
Mixer Motor				
Motor Type				
Supports				
Electrical				
CP				
Ladder Platform				
Floor Seals	Bitumen	Mastic	Welded	N/A
Leakage	External- Nil	Slight	Trickle	Flowing
	Internal - Leak detected	Yes / No	Position:	
Sediment Depth	Type			
Comments:				

Define the ratings

Priority 0  - Item requires immediate attention












Priority 1  - Item is in poor condition or otherwise non functional

Priority 2  - Item is to receive precedence during maintenance

Priority 3  - Item is functional but deteriorated











Priority 4  - Item is in good condition

Comments are critical

Area	Priority	Status	Comments
Compound	 2	F	There is a compound around the external ladder, but it will not keep out determined persons - there has been dumping activity around the site so regular checks are required
Vandalism	 3	F	Graffiti is an ongoing problem with this site, as it is used as a parking and dumping area
Walls	 2	A	There is concrete spalling under three of the rafter connection areas - a more detailed structural inspection should be carried out and repairs made as necessary
Ladder External	 4	D	Appears to be in good order
Entry Hatch	 1	A	The hatch cover is sealed but the roof is draining in under the hatch frame area, where the roof sheets join the platform
Roof Platforms	 1	A	There is an open area under the platform where it sits on top of the wall - this needs to be sealed off ASAP to stop possums from entering the tank
Roof	 1	A	Water is ponding and draining back into the tank, where the roof joins the entry hatch frame - a gutter flashing needs to be fitted to drain the water away
Handrails	 4	D	Appears to be in good order
Davit	 Na	Na	There is no davit fitted
Ventilation	 4	D	Appears to be in good order
Bird Proofing	 0	A	Possums have been entering this tank on a frequent basis - the area under the platform, where it sits on top of the wall has been identified and needs to be sealed off ASAP

Library of information

- Photos
- Reports
- Plans

Installed Attachments	
SELECT	FILENAME
	4983 Ladder base
	4983 Ladder external
	4983 Ladder platform
	4983 Outlet
	4983 Outlet valve external
	4983 Overflow base
	4983 Overflow bracket
	4983 Overflow riser
	4983 Overflow scour external
	4983 Platform area

Frequency

Scheduled -> Operational / Management

weekly, 3 monthly, annual

Scheduled -> External Contractors

1-4 year

Event Based



Site Security

- Compound area
- Access control
- Evidence of vandals



Water Quality

- Contamination entry points
- Sediment levels
- Vermin entry



Water Quality



Safety

Client Name: All State City Council

Access

Vehicle Access	Good	Tanker Access	Fair	Lifting Access	Fair
Site Access	Good	Work Platform	Good	Cage	<input type="checkbox"/>
Screen	<input type="checkbox"/>	EMF Hazards	<input type="checkbox"/>	EMF Notification	<input type="checkbox"/>
Davit	<input type="checkbox"/>	Davit Type	None	CS Compliant	<input type="checkbox"/>
Ext Ladder Type	Aluminium Vertical	Int Ladder Type	Galvanized Steel Angled		
Ext Ladder Cond	Fair	Int Ladder Cond	Poor		
Ext Ladder Length (M)	0.00	Int Ladder Length (M)	0.00		
Comments	No Comment				

Hatches

Entry Hatch	Good	Rescue Hatch	Good
Entry Size (M by M)	0.80 by 0.80	Rescue Size (M by M)	0.00 by 0.00
Vent Hatches	<input type="checkbox"/>		
Hatch security	Poor	Hatch sealing	Poor
Comments	The hatches are unsealed around the edges.		

Mixer

Exists Size

Safety



Structural

- Roof and framing
- Floor/wall seals and leakage
- Carbonation testing

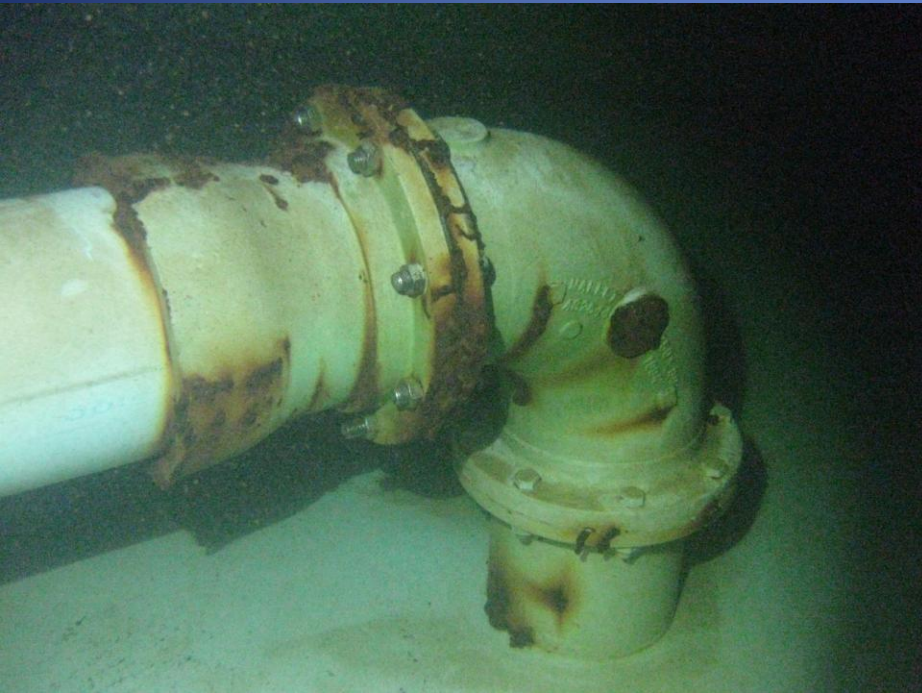


Structural











Penetrations

		Types	Location	Pipework	Valves	Size	Screened	Material	Comment	D.I.N Exists	D.I.N Suitable
<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	Inlet	Wall	4	4	200	False	None		False	False
<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	Inlet	Top	8	8	200	False	None	This is the raw water inlet and the pipework should be disconnected to avoid accidental usage.	False	False
<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	Outlet	Wall	9	9	200	False	None		False	False
<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	Outlet	Wall	6	6	200	True	Stainless Steel mesh	This outlet is pumped and has a SS footvalve and screen fitted	False	False
<input type="button" value="Edit"/>	<input type="button" value="Delete"/>	Scour	Wall	1	1	150	False	None		False	False



Coatings

Area Inspected	Anti Graffiti	Wall	Roof	Roof Walkways
Type	Acrylic	Alkyd	?	Alykd
System	Taubmans White Enamel	Dimetcote 15/Armourdor 910	?	Sigmacover CM ZP/Supamiox
Supplier	Taubmans  View	Dimet  View	Unknown  View	British Paints  View
Applicator	Painting Enterprise  View	Painting Maintenance Services  View	Unknown  View	Painting Maintenance Services  View
Date Applied	01/10/2010	01/10/2004		18/11/2004
Previous Coatings	Unknown	1987-Dulux-Ferrodor F	Unknown	Unknown
Service Life	10	25	0	15
Years To Run	8	17	Unknown	8

Anti-Graffiti Comments

[This is a trial system - it will need further evaluation before being used on a larger scale.](#)

Wall Comments

[The coating system is working well - there are some minor stone chips but these can be patch repaired when resources are available.](#)

Roof Comments

[No Comment.](#)

Roof Walkway Comments

[The walkways have ponding present and will need regular coating touch ups.](#)

Information storage

- Data reviewed
- Asset registry updated

➤ Available to others

Client name: All State City Council

Cleaning and Inspection

Next Clean Due	11/05/2012	Next Inspection Due	11/05/2012
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Details

Construction Wall	Concrete	Construction Floor	Concrete	Construction Roof	Aluminium
Shape	OnGround	Depth (M)	6.20		
Length (M)	0.00	Breadth (M)	0.00	Diameter (M)	13.50
Floor Area (sq m)	143.06	Capacity (ML)	0.89		
Commissioned	-	Service Life (Years)	100	Years to Run	-
Heritage listing	Unknown	Conservation M. Plan	Unknown		
Valuation (A\$)	-				

Benchmarks

1  Security	2  Safety	1  CoF Water Quality
1  Contamination	2  Confined Space	2  CoF OH&S

Comments:

Security	There is no secure compound around the tank
Contamination	The entry hatch is not secure against unauthorized access and contamination events can easily occur.
Safety	Guard rails are required around the platform area.
Confined Space	The internal ladder is heavily corroded and unsafe to use in a confined space entry or rescue situation.

Data availability

Access in the field

- Web based
- Smart phone or iPad
- Detail verification
- On site data editing



Act upon the findings

[Client](#)

[Asset](#)

[Search](#)

[Attachments](#)

[Reports](#)

[Config](#)

[Maintenance](#)

[Logout](#)

Client Name: All State City Council

Asset Details

Reservoir Hill No1

General Details

General
Cleaning
Safety
Mixer C.P.
Penetrations
Valuation
Comments

External Inspection

General
Condition
Coatings
Renovations
Comments

Internal Inspection

General
Condition
Coatings
Renovations
Comments





Attachments

View Details
Insert Attachment

Contractors

Contractor Roles

Actions

Compliance Recording System	Area Inspected	P Rating	Status	Comments
	Compound	■ Na	Na	There is no compound around the tank, but security is not a priority as there are houses close by
	Vandalism	■ 4	D	Appears to be in good order
	Walls	■ 2	F	There is a high carbonation factor of 76%, due to shallow steel covering
	Ladder External	■ 2	F	The vertical external ladder has no effective security system fitted and it should only be climbed by experienced personnel
	Entry Hatch	■ 2	A	The hatch cover is not effectively sealed onto the surrounding frame area and contamination can enter the tank
	Roof Platforms	■ 2	A	There is no solid area present on the roof to set up a rescue system
	Walkways	■ Na	Na	No Comment
	Roof	■ 1	A	The asbestos roof is unsafe to walk on and the centre gutter is unsealed and draining back into the tank
	Roof Hatches	■ Na	Na	No Comment
	Handrails	■ 2	A	An improved guard rail system is required to upgrade personnel safety around the platform area
	Davit	■ Na	Na	No Comment
	Ventilation	■ 1	A	Most of the 12 side wall vents are open, as the mesh has corroded away

Search and Reports

- Ability to filter the data
- Extract Reports
 - Current status of Tank
 - Critical maintenance
 - Inspections / Cleans due



Action registry

Compliance Recording System

Date	4/04/2010	Client Name	All States		
WS No		Asset Name	Large Reservoir		
Job No	4579	Project No			
Location	Church Hill Rd Hill Top				
Cleaning Due	May 2012	Inspection Due	May 2012	Register No	
Raised By	Ms Alert			Date	5/04/2010
Map Standard	WGS 84				
Co-Ordinate 1	S 031 29 046				
Co-Ordinate 2	E 145 49 598				

Compliance category - OH&S, Water Quality, Structural

Maintenance Item	Priority	Status	Comments
Roof	1	A	A piece of ridge capping is missing, allowing birds to enter.
Responsible person			Mr Responsible
Staff member/contractor nominated for action			Mr Busy Contractors Pty Ltd
			Date 7/04/2010
			Date 7/04/2010

Action taken by nominated staff member/contractor

A new piece of roof ridge capping has been measured up and placed on order from Bunnings. A temporary cover has been fitted to prevent further bird entry.
Estimate completion of works in 2 weeks time. - Signed: Mr Responsible (7/04/2010)

Progress	Date	Completion
Accepted or modified and approved for action	7/04/10	YES/NO
Finance approved	14/04/10	YES/NO
Work order issued	14/04/10	YES/NO
Work completed and accepted		YES/NO
WAE archived-closed off		YES/NO

Compliance Recording System

Client:

Asset:

Show: All Outstanding Closed

Filter By:

Sort By: None Item P Rating Progress

Reg #	Type	Asset Name	Progress	Job No	Project No	Date	Item	P Rating	
6	External	Gooloogong 15	■	024749	0	06/12/2010	Entry Hatch	■ 2	<input type="button" value="Report"/>
7	External	Gooloogong 16	■	024750	0	06/12/2010	Entry Hatch	■ 2	<input type="button" value="Report"/>
8	External	Woodstock 11	■	024751	0	03/02/2011	Roof Platforms	■ 2	<input type="button" value="Report"/>
9	External	Koorawatha 30	■	024747	0	03/02/2011	Entry Hatch	■ 2	<input type="button" value="Report"/>

Total Results: 4

Conclusion

- Inspection of storages is critical
- Define who, what and when
- Categories
 - Security, WQ, OH&S and Structural
- Storage and retrieval of data
- Projects and Action taken
- Having the evidence

Having evidence of action

Victorian *Safe Drinking Water Act 2003*

Dept of Health Victoria

- Risk Management Plan Audit Guidance
Note -3rd Edition 2011 Appendix 7

Operations – focussed audit elements

“Is the integrity of treated water storages regularly assessed? Are records of storage inspection kept, in particular roofs, hatches for contamination?”

- - If not... Major non compliance

<http://docs.health.vic.gov.au/docs/doc/Risk-Management-Plan-Audit-Guidance-Note---3rd-Edition-June-2011>

