Dam Management Guide

Government of South Australia
Department for Environment and Water

LANDSCAPE SOUTH AUSTRALIA

For emergency help in flood and storm contact the SES on 132 500.

For life-threatening emergencies call 000.

Dam owners can view an Emergency action plan flow chart by visiting *environment.sa.gov.au/topics/flood/flood-resources/private-dams*

Disclaimer: Information provided in this guideline is for general advice only. It should be used in conjunction with other resources, including those on the Department for Environment and Water webpage: *www.environment.sa.gov.au/topics/flood/flood-resources/private-dams*

Appropriate professional advice may need to be sought, particularly in areas concerning dam condition where the failure of the dam may endanger life, property or important environmental assets. Further information on how to access this advice can be found at the end of the document.

How to inspect your dam and keep it safe

Owning a private dam comes with great benefits, such as increasing water security and enhancing the health of the surrounding environment when managed well.

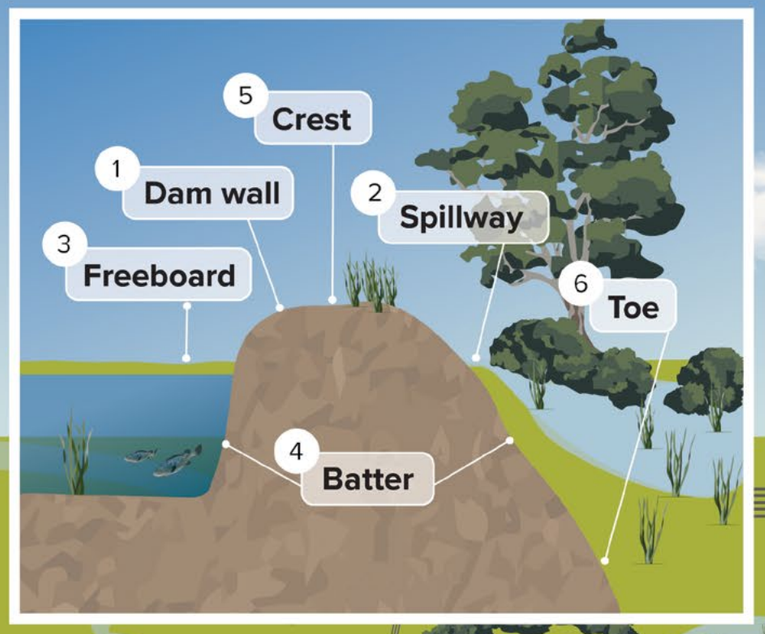
However, it's important to be aware of your responsibilities to ensure the safety of life, property and the environment. Regular inspection and maintenance will not only extend the life of your dam, but also prevent costly repairs and reduce the risk of failure.

If you have a dam on your property, whether you've owned the property for years or recently moved there, you're responsible for its routine inspection and maintenance. If a dam fails, you can be held legally liable for all associated damages.

It's also important to note that some dam maintenance activities require a permit, so if you are unsure contact your local Landscape Board for advice.

This guide is designed to help you monitor and maintain your dam effectively. It outlines when and how to conduct inspections, what to look for during your checks, common issues that can compromise dam safety, who to contact for further advice, and general guidance on repairs to keep your dam in good condition.

What's what on a dam?



Sill
The height at which water begins to flow over the spillway.

2 Spillway
A channel that discharges water from the dam safely, once the dam is at full capacity.

3 Freeboard
The space between the top of the dam and the spillway level (the sill), should be at least half a metre (500mm)

Overflow
Where water exits through the spillway when the dam is full.

Low flow bypass
A device used to divert water around the dam and back to its normal course during low flows.

Main inflow
Where water enters the dam.

5 Crest
The top of the dam wall.

4 Batter
The sloping bank of the wall/embankment.

6 Toe
The line where the edge of the wall or embankment touches the surrounding ground (upstream and downstream toes are referred to separately).

Trickle pipe
A small pipe to release water slowly.

1 Dam wall or embankment
The main barrier holding the water in place.

Cut off trench
A trench beneath the dam wall/embankment that prevents water from leaking.

Borrow pit or basin
Excavated pit within the dam where a bulk of water storage is.

Pump
Redirects and filters water for other purposes, such as stock access or domestic use.

What's what on a dam?

Think of your dam as a system where every part has a job to do. Here are the important features to know. These apply to all dams of different shapes and sizes, and regardless of whether they are on-stream or off-stream.

Dam wall or embankment: The main barrier holding the water in place.

Toe: The line where the edge of the wall or embankment touches the surrounding ground (upstream and downstream toes are referred to separately).

Crest: The top of the dam wall.

Borrow pit/basin: Excavated pit within the dam where a bulk of water storage is.

Batter: The sloping bank of the wall/embankment.

Cutoff trench: A trench beneath the dam wall/embankment that prevents water from leaking.

Spillway: A channel that discharges water from the dam safely once it is at full capacity.

Freeboard: The space between the top of the dam and the spillway level (the sill). This should be at least half a metre (500mm).

Main inflow: Where water enters the dam.

Low-flow bypass: A device used to divert water around the dam and back to its normal course during low flows.

Sill: The height at which water begins to flow over the spillway.

Overflow: Where water exits through the spillway when the dam is full.

Trickle pipe: A small pipe to release water slowly.

Pump: Redirects and filters water for other purposes, such as stock access or domestic use.

How to inspect your dam

The first and most crucial step in maintaining your dam is regular inspections. By inspecting your dam consistently, you can:

- Spot minor defects early and address them before they escalate (minor defects are also cheaper and more easily fixed than repairing a failed dam).
- Extend the lifespan of your dam.
- Familiarise yourself with the dam's condition to notice changes during times of stress on the dam (e.g. during floods).

Inspections should be undertaken over summer when water levels and weed coverage are low. This will allow you to spot issues and access the dam if repairs are necessary.

Other recommended times to inspect your dam include:

- Following maintenance and repair.
- Before any significant rainfall (more than 20mm).
- Shortly after any significant rainfall event.
- After earthquakes or tremors.
- Dry conditions can increase the risk of dam failure, especially in older earth dams and clay based dams. As soil (especially clay soil) dries out, it can shrink and form deep cracks in the dam wall.

When heavy rain follows, water can quickly enter these cracks, leading to erosion inside the dam or increased leakage. Regular checks during dry conditions are important.

Watch for cracks, keep vegetation healthy, and repair any damage early.

A handy tip for spotting changes over time is taking notes and photos. For identifying seepage, it can be handy to use a water level indicator. You may also like to use other tools and equipment, such as stakes and marking tape, to identify areas needing attention.

Step-by-step inspection

The illustration below is an overview of what to look for and which parts of the dam to check.

1. Dam wall / embankment
2. Spillway and outlet
3. Storage base and rim
4. Downstream areas

Disclaimer: A high degree of caution should be exercised when carrying out dam inspections. Landholders are advised to stay well clear of the embankment and downstream area if there is any potential for failure.

Checklist

Use this checklist to inspect your dam. Tick off each item as you complete it. Write notes if you notice any issues.

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit **Yes**/No
Dam wall (Earth embankment)	**Are there signs of cracks?** (Vertical, horizontal, diagonal and transverse cracks)	☐	Cracks typically result from clay soils drying out, shrinking due to thermal expansion and contraction and settlement of earth materials. The cracks along the dam wall crest or down the wall could weaken the dam's structure.	**Small cracks:** Backfill with compacted layers of clay and allow groundcover to establish.	No
				Large cracks: Use machinery to reconstruct the dam wall. Consult an experienced professional prior to repairing the cracks.	**Yes**
	Are there signs of slumps or slips? (The downward movement of a section of the dam wall)	☐	Slumps or slips typically occur due to steep batters, poor soil type, or heavy rainfall. If you've observed sections of the dam wall slumping or slipping, this indicates instability that requires attention.	**Slumps or slips:** Engage a suitably qualified contractor to repair the dam wall using machinery.	**Yes**
	Are there signs of settlement? (Gradual sinking or subsiding of the dam wall)	☐	Settlement - is particularly due to the settling of materials.	**For minor settlement:** Backfill and re-compact the area using appropriate fill in layers such as clay or other suitable soil.	No
				For significant settlement: Engage a suitably qualified contractor to re-grade the dam wall or crest. Check for signs of continuing settlement before proceeding. If seepage is present, drainage may need to be improved. To prevent the issue recurring, you can monitor the affected area using photo points or other surveying methods.	**Yes**

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit **Yes**/No
Cont... **Dam wall** (Earth embankment)	**Is there internal erosion (e.g. water seepage)?**	☐	Internal erosion - water travels through the dam. This can lead to catastrophic failure of the dam over time.	First inspect outlet pipes as a potential seepage path, and repair or replace as needed.	Permits may apply in some regions. Check with your local Landscape Board.
				For minor seepage, install toe drains or filters to control flow.	Permits may apply in some regions. Check with your local landscape board.
				For persistent/increasing seepage, fill in seepage paths with low-permeability materials such as clay-cement slurry or chemical grouts, depending on soil conditions.	Permits may apply in some regions. Check with your local Landscape Board.
				For severe seepage, engage a suitably qualified contractor to reconstruct affected areas.	**Yes**
	Is there surface erosion?	☐	Surface erosion - leading to erosion of the dam's surface. Heavy rainfall can wash away soil particles.	Consider regrading the wall if significant erosion has occurred.	**Yes**
				Plant deep-rooted native grasses to improve soil stability, or fill affected areas with small rock riprap.	No
				You may also wish to consider erosion matting on freshly repaired areas, or install small diversion banks to redirect flow in areas where erosion has occurred.	Permits may apply in some regions. Check with your local Landscape Board.
	Are there holes in the dam wall?	☐	Holes may occur for a number of reasons, including clay soil shrinkage, animal burrows or tree roots in the dam wall. Over time, holes can become larger, weakening integrity of the dam wall and increasing risk of failure. It is very important to address as soon as possible.	For smaller holes, you may be able to backfill with compacted clay or clay-bentonite mix to improve sealing.	No permit required.
				Larger holes will usually require engineering advice, as remediation or reconstruction of the wall may be needed.	**Yes**

Checklist continued

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Cont... **Dam wall** (Earth embankment)	**Is the dam wall sparse, lacking healthy vegetation, or overgrown?**	☐	*Problems with vegetation on or around a dam can affect its safety and performance. These issues may include:* **Lack of vegetation cover.** This can be caused by overgrazing, drought, poor soil quality, or lack of maintenance. Without enough ground cover, the soil becomes more prone to surface erosion and less stable, which can weaken the dam structure. It may also allow too much water to soak in, leading to internal erosion.	Reseed bare areas with fast-growing grasses suited to local climate and soil and improve soil quality by adding topsoil and organic matter. For overgrown vegetation, thin out vegetation (preferably using the Cut and Swab method)	No
			Overgrown vegetation Tall grasses, shrubs and trees can damage the dam wall. Their roots may grow deep into the structure, creating channels that weaken the dam.		No
	Are there trees growing on the dam wall?	☐	Tree roots can decay, creating tunnels and weak points that allow water infiltration. If you've noticed trees on or near the dam wall, they may compromise the dam's integrity over time.	Trees may or may not need to be removed, and this depends on a number of factors. *See SA Water's guide*[1] for more information, or contact a suitably qualified dam engineer for advice. This is important to prevent any further damage.	Consult a qualified dam engineer or your local Landscape Board. Approval may be required.
	Is there seepage? (is water leaking, cloudy, or flowing differently after rain, or are there noticeable patches of green vegetation?) Note: Many dams naturally have some level of seepage. However, it's important to monitor for any major changes. Turbidity (changes in water colour or transparency) is a key sign of potential issues.	☐	Seepage is often caused by cracks, tree roots or poor-quality soil used during dam construction (e.g. loose or unsuitable material or poorly compacted clay lining). If you've found pooling water, particularly at the toe of the dam wall, it may be a sign of seepage — which could indicate structural weakness.	Backfill cracks with compacted clay layers.	No
				Reline the internal basin with compacted clay.	Permits may apply in some regions. Check with your local Landscape Board.
				Consider reconstructing the dam wall if seepage is extensive (contact a suitably qualified dam engineer for advice).	**Yes**

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Cont... **Dam wall** (Earth embankment)	**Is there damage from animals?** (livestock or pests).	☐	Burrowing animals can create pathways for water seepage, leading to instability. If animal burrows are present, they pose a risk to the dam's structural stability.	Backfill burrows with compacted clay and allow vegetation to regrow.	No
			Livestock can destabilise the dam wall by creating erosion through constant access. If you've seen signs of erosion caused by livestock, this can accelerate the dam wall's deterioration.	Exclude or limit stock access, particularly to the downstream wall, by installing fencing.	No
	Has the dam crest sunk or settled unevenly?	☐	**Uneven settling and sinking** can be caused by poor soil compaction, water infiltration or changes in soil composition. This weakens the dam wall and may create low spots that increase the risk of overtopping and erosion during high inflows.	Fill low or sunken areas with compacted clay to restore the dam crest to its original level and maintain freeboard.	No
				Investigate and address seepage issues using cutoff trenches, clay cores, or grouting to stabilise the dam foundation.	Permits may apply in some regions. Check with your local Landscape Board.
			Weight of vehicles or machinery can compact soil unevenly leading to low spots and reduced freeboard.	Limit the use of vehicles or heavy machinery on the crest to prevent damage.	No
			Seepage where the water moves through the dam foundation or wall can also erode soils and lead to dam failure.	Consider constructing sections of the dam wall with machinery to ensure even compaction and structural integrity (contact a suitably qualified dam engineer for advice).	**Yes**

Checklist continued

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Spillway and outlet	**Is the spillway free from obstructions?** (e.g. debris, foreign objects, vegetation etc.)	☐	Blockages often result from floodwaters carrying debris (trees, branches, or other materials) from the catchment.	Clear debris using hand tools or machinery.	Permits may apply in some regions. Check with your local Landscape Board.
				Ensure the spillway is protected with groundcover or rock riprap to prevent future blockages.	No
			An obstructed spillway can reduce flow capacity and increase the risk of dam overtopping.	Remove any debris that could block the spillway when the dam becomes full again.	No
	Are there any signs of erosion within the spillway channel?	☐	Erosion in spillways is often due to inadequate size (not enabling the spillway to handle high flows) or lack of erosion protection.	Use erosion control measures like grass cover, rock riprap, or matting.	No
			If your spillway is eroded, it may not function effectively during heavy rainfall, increasing the risk of dam failure.	Redesign the spillway to ensure it can handle appropriate flood flows (contact a suitably qualified dam engineer for advice).	**Yes**
	Is the spillway channel lined with erosion protection? (E.g. rock or grass cover)	☐	Over time, the spillway can erode if not lined properly. This can lead to problems with handling high flows and increase the risk of dam failure.	Add rock riprap, grass cover or matting to the bottom of the spillway.	No
	Is there at least 500mm freeboard between the top of the dam wall and the channel bed of the spillway?	☐	Poor initial design, soil settlement, or erosion at the spillway channel. An insufficient freeboard reduces the dam's capacity to safely contain and pass excess flood water during heavy rains, leading to potential dam wall erosion or failure due to overtopping.	The spillway may need to be lowered, ensuring it is also concave and protected from erosion with grass, rock riprap or matting. Check with your landscape board for advice and to arrange approval.	**Yes**

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Cont... Spillway and outlet	**Is the spillway size adequate?**	☐	Poor planning and design can result in spillways that are too small or completely absent. If your spillway is undersized or missing, it increases the risk of overtopping and dam failure.	Redesign and construct a properly sized spillway. The spillway should be wide, concave, and lower than the dam wall crest (typically 0.5 m–1 m) to maintain a sufficient freeboard. Any changes to the spillway should be further assessed by a professional, and their recommendations should be obtained before proceeding. As a guide, it is suggested to make sure the spillway is at least three metres wide.	**Yes**
	Are the outlet pipes and devices working and undamaged?	☐	Outlet pipes can be damaged by blockages, corrosion, or structural wear over time. If outlet devices fail, it can compromise the controlled release of water, leading to overtopping or other safety issues	Inspect and clear any blockages in outlet pipes using rods, water jets, or machinery. Replace or repair damaged outlet pipes or valves to ensure proper operation.	Permits may apply in some regions. Check with your local Landscape Board.
	Is there any erosion or silting around outlet pipes?	☐	Erosion may result from high-velocity flows or inadequate protection around outlet pipes, while silting can reduce discharge capacity. These issues can lead to pipe blockages or structural instability.	Add erosion control measures such as riprap or reinforced concrete around outlet pipe discharge areas.	No
				Remove silt buildup around outlet areas manually or using machinery to restore capacity.	Permits may apply in some regions. Check with your local Landscape Board.

Checklist continued

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Storage base and rim (best inspected at times of low water level)	**Are there any holes or cracks at the bottom of the dam and internal walls?**	☐	These issues often stem from settling, clay soil shrinkage or animal burrowing. They can lead to leaks and loss of stored water and reduced structural integrity.	Seal holes or cracks in the bottom or walls with compacted clay or clay-bentonite mixture, depending on severity.	No
	Are there signs of landslips or failures in the walls?	☐	Typically caused by poor soil compaction, steep slopes, or saturation (by water) of the dam wall material. These failures can compromise the dam's structural integrity.	Address landslips by regrading slopes and compacting soil, and adding geotextile matting for stabilisation	Permits may apply in some regions. Check with your local Landscape Board.
	Are there signs of erosion or silting up at the inlet pipe?	☐	Can be caused by debris or poor maintenance, leading to reduced water flow into the dam.	To help prevent erosion and silting at the inlet pipe, follow the below: 1. Have a vegetated buffer zone around the inlet to stabilise the soil and trap sediment. 2. Use rock riprap (large rocks) and geotextile fabric at the inlet to slow down water flow. 3. Build small diversion banks upstream to reduce the speed of water. 4. Shape the inlet area with gentle slopes to avoid fast water movement. 5. Construct a small pond or basin before the inlet to catch sediment before it enters the pipe. 6. Install silt fencing to control sediment runoff. 7. Clean the inlet area regularly to remove built-up debris and sediment.	No
	Are there signs of water leaking from the rim of the dam?	☐	A sign of improper sealing or structural failure, which may result in water loss or dam instability.	Investigate and repair leaking rims using sealing compounds, clay liners, or synthetic membranes.	Permits may apply in some regions. Check with your local Landscape Board.
	Are there whirlpools in the water near the embankment?	☐	These can indicate subsurface leaks or pipe failure, which could destabilise the dam's structure.	Address whirlpools by locating and sealing the source of leaks using clay, grouting (injected sealant), or other suitable materials.	Permits may apply in some regions. Check with your local Landscape Board.

Dam feature	Check for	☑	Causes and consequences	Repair options	Permit Yes/No
Downstream areas	**Is the channel downstream silting up?**	☐	Silting is caused by sediment build up due to reduced water flow. This can reduce channel capacity and lead to overflow or localised flooding.	Remove silt and debris from downstream channels to restore flow capacity. Ensure only silt is removed. Do not deepen channel beyond original level.	No
	Is there erosion or scouring immediately downstream that could threaten the dam wall?	☐	Often results from high velocity flows or inadequate erosion control measures which can threaten the stability of the dam wall or foundation	Add riprap, gabions or grass cover to stabilise eroded areas downstream.	No
	Is there seepage in the area around the toe of the dam wall?	☐	Seepage can indicate potential internal erosion, or the formation of channels in the dam wall, which can weaken the structure of the dam over time.	It's important to keep a close eye on any seepage you notice. If there are changes in the amount of water seeping or the size of the wet area, seek advice from a qualified dam engineer to determine the best options for your dam.	Consult a qualified dam engineer or your local Landscape Board. Approval may be required.
	Note any changes (e.g., new developments or risks to property/ life in flood zones).	☐	Changes to downstream can alter water flow, increase flood risk, and affect dam failure consequences. Regular updates to the *Emergency Action Plan (EAP)*[2] and consequence assessments help manage evolving risks.	Monitor downstream changes and update risk management plans as needed. Consider mitigation measures where necessary.	No

[1] *cdn.environment.sa.gov.au/environment/docs/SAW-Tree-Clearance.pdf*
[2] *cdn.environment.sa.gov.au/environment/docs/rapid-risk-assessment.pdf*

Approvals

In South Australia, undertaking repairs and some maintenance work on your dam requires authorisation. This is to ensure that proposed activities use site appropriate design and construction methods, which can minimise environmental harm and improve long-term effectiveness.

Designated zone and subzone overlays affect planning. Check SA Planning Portal or ask council.

Major works and dam removal (change the dam capacity, height or structure)
(e.g enlarging or removing a dam)

Minor maintenance activity (no change in capacity)
(e.g. repairing animal damage)

No approval required

Dam capacity ≤ 5ML &/or dam wall height ≤3m

Dam capacity >5ML &/or dam wall height >3m

Check if dam is in a designated zone, subzone or overlay identified under the Planning and Design Code
(contact your local council planning officer)

Yes

Small dams <5ML &/or dam wall height <3m may require Development Approval if it is in a designated zone, subzone or overlay identified under the Planning, and Design Code.

No

Application to the relevant Landscape Board to obtain a Water Affecting Activity permit

Water Affecting Activity permit approval

Application to your local Council to obtain development approval
(contact your local council planning officer)

Council refers application to the relevant Landscape Board under the *Planning Development and Infrastructure Act 2016* mandatory referral obligation to ensure compliance with the *Landscape South Australia Act 2019*

Development approval

Where to go for further advice:

Landscape Boards

Landscape Board staff provide advice to land managers on understanding their responsibilities, offer general guidance on dam management, and support them in navigating the appropriate approval pathways, particularly with respect to Water Affecting Activity permits.

In many cases, dam maintenance works do require such a permit, so it's best to check early. Contacting your Landscape Board is also a valuable opportunity to ask any questions specific to your situation and receive advice and tips.

To find your local Landscape Board,

visit *environment.sa.gov.au/about-us/boards-and-committees/landscape-boards* and follow the links for contact details.

State Emergency Services (SES)

The State Emergency Service is a volunteer-based agency responsible for providing preparedness information, warnings and responding to requests for assistance during a flood. This may include notifying any downstream residents who may be in danger if a dam failure occurs.

The SES may also be able to assist with action to mitigate dam failure, such as pumping and placement of sandbags. When a significant concern exists that is **non-life threatening, immediately contact the SES on 132 500, so they can respond quickly. If the concern is life threatening, then call 000 for assistance**

Local government

Council's role is to provide advice and guidance to landholders in navigating the development approval pathway.

As outlined above, maintenance works to dams over 5 ML in size or with a wall height of 3 m or greater may trigger the need for a development approval from Councils.

Engineers

Qualified and experienced engineers give expert advice on dam design, safety, and structural issues. This includes civil and geotechnical engineers.

To do this work, engineers must be recognised professionals – such as Chartered Professional Engineers (CPEng), Registered Professional Engineers (RPEng), or listed on the National Engineering Register (NER).

Earthmovers

Some earthmovers provide services that include dam repairs. It is best to engage an earthmover (ensuring all necessary permits are sorted beforehand) with experience in dam repairs, so you can be sure the job is done in an environmentally sensitive manner and to best practice standards. It's okay to ask before you commit to using their services. Ask for a few quotes and consider the best option for your circumstances, as the cheapest option may not always be the best one.

Find out more

Useful guides for preventing dam failures are available at: *environment.sa.gov.au/topics/flood/flood-resources/private-dams*

Government of South Australia

Department for Environment and Water