Key Sediment Trap Information

These guides heavily reference the sediment trap sections of the 'Technical guidelines for constructed wetland treatment of pastoral farm run-off' (2021) prepared for DairyNZ by NIWA (see 'more information' at the bottom of the document).

Decision tree:

- Obtain a farm plan - Aparima Community Environment (ACE), Environment Southland or your industry representative can help.
    - Identify points of contaminant loss (nitrogen (N), phosphorus (P), sediment, e-coli)
    - Identify the contaminant pathway (overland flow, artificial drainage, leaching / deep drainage)
- Consider the significance and options to reduce the contaminant loss in order of:
    - Prevention. This can be achieved through aspects such as paddock selection, permanent fencing and retiring marginal areas.
    - Management of high-risk areas by protecting critical source areas, temporary exclusion, and minimum tillage techniques for cultivation.
    - Treatment which could include the installation of a sediment trap, retirement and planting of marginal land areas, creating a detainment bund and/or a constructed wetland.
- A sediment trap is appropriate when targeting contaminants such as phosphorus and sediment, where there is a clear overland flow contaminant pathway identified, and prevention and management mitigations have been undertaken or are not appropriate. Treatment should be considered as the last option. Things to take into consideration include:
    - Local regulations
    - Location
    - Access for excavation
    - Catchment size
    - Size of sediment trap
    - Design (excavate vs bund)
    - Design principles (see below) - depth, width, length, inlet, outlet, whether its keyed in
    - Post construction works such as fencing, planting, visual assessment of effectiveness

Sediment trap versus a constructed wetland

A sediment trap targets sediment and phosphorus contaminants and is usually 1-1.5 metres deep and sized around 40m^2 per hectare of catchment for course sediment capture in areas of low intensity rainfall like Southland (Tanner et al., 2021). Figure 1 below shows how different regions across NZ are classified as having lower, medium and higher intensity rain events which affects sediment trap sizing.

A constructed wetland on the other hand primarily targets nitrogen, as well as phosphorus, sediment and e-coli. As shown in figure 2 includes a sediment trap at the higher end where flows initially come in as part of the design. Then the water flows into shallow 0.2-0.3m areas with growing vegetation (Tanner et al. 2021).

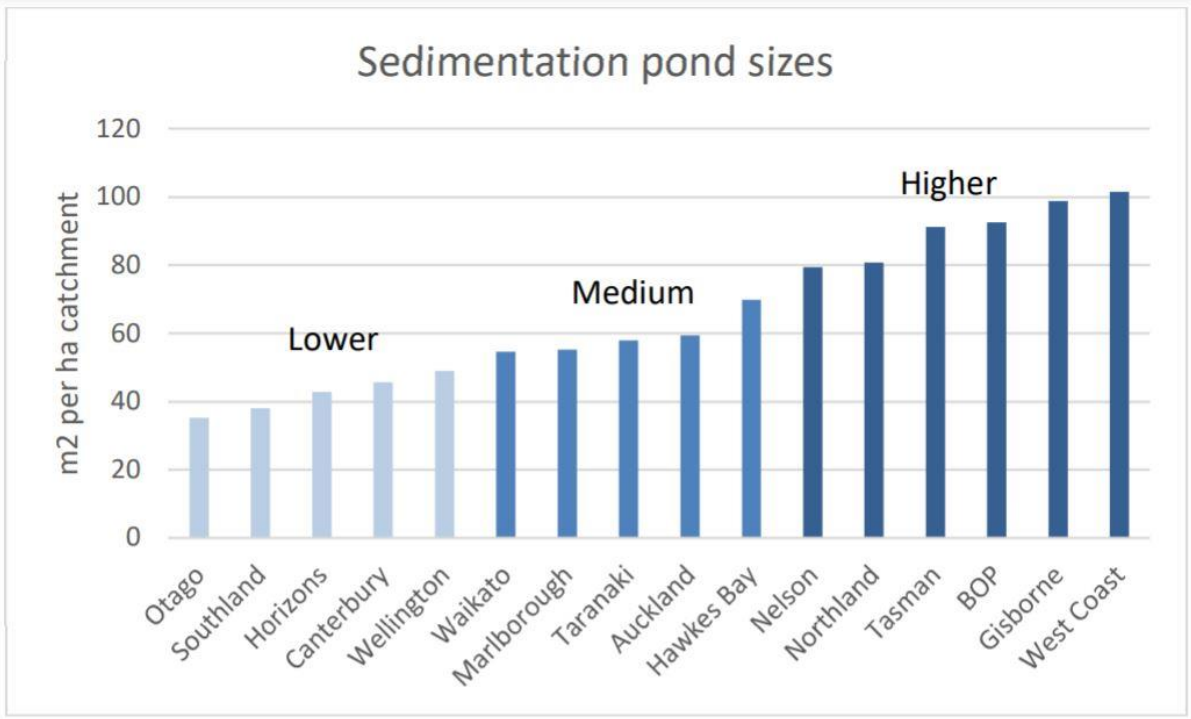

Figure 1: Sediment trap sizing relative to the catchment from Tanner et al. (2021, pg. 47) referencing Hudson (2002).

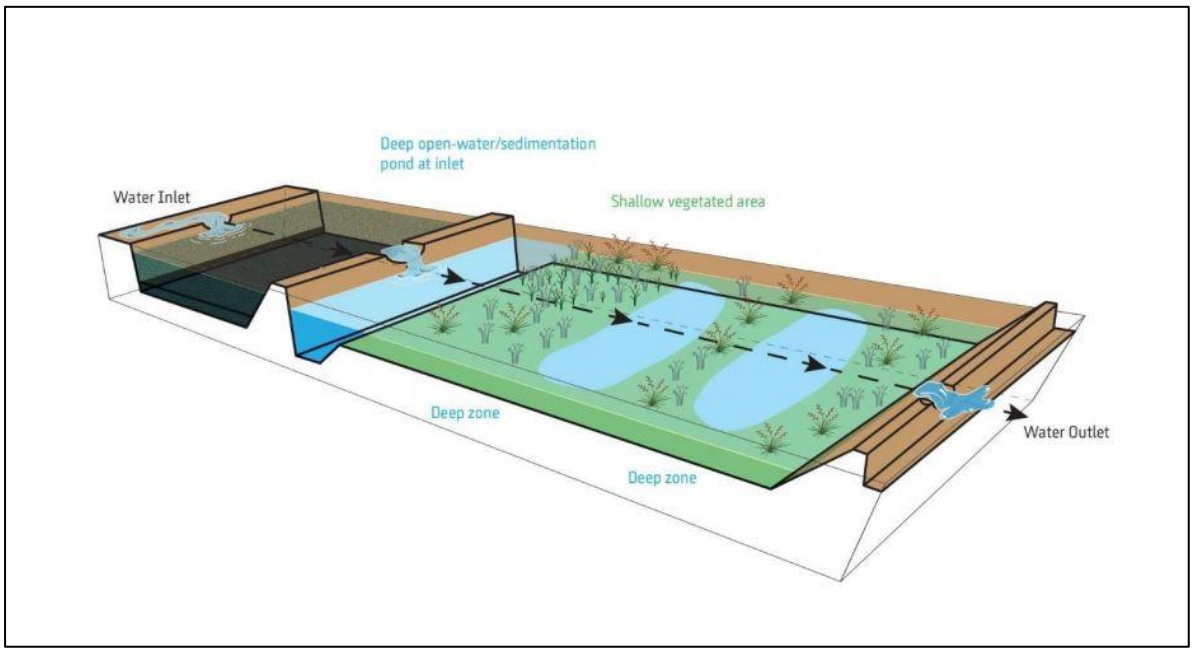

Figure 2: Schematic example of a sediment trap and constructed wetland from Tanner et al (2021 pg. 23).

Why build a sediment trap?

When completing your farm plan with the aim of improving water quality, the risk of a particular contaminant loss needs to be identified and then the appropriate mitigations specific to those contaminants chosen.

Evidence comes from your stock type, topography and slope, presence of critical source areas, amount of winter grazing and cultivation, stock exclusion fencing, water crossings, extent of bare soil and tracks, local water quality results and farm infrastructure. Environment Southland staff and resources below along with industry representatives are able to help you identify risk.

Once contaminants are known, and the contaminant pathway identified, it is important to assess multiple options to address the contaminants in order to ensure the chosen mitigation is most appropriate in terms of effectiveness, cost, and time to implement. Good management practices, prevention and management should always come before treatments like sediment traps.

What makes a good location for a sediment trap?

- Ensuring there is enough gravity or fall to ensure water flows into the trap and out again.
- Topography & catchment area of the site. Is it an area where water usually flows to?
- Areas with good digger access in order to periodically excavate captured sediment.
- Locations within existing critical source area/gullies/ephemeral streams/tile drain outlets.
- Utilising the topography of the surrounding area to minimise earthworks and reduce costs. Bund vs excavation depends on the site characteristics that meet the requirements with the least cost.
- It's possible there may not be a suitable site to build a sediment trap due to lack of fall, or catchments are too large.

Regulations

- Excavation works within the bed, or adjacent to a waterway, as defined in the Resource Management Act 1991 (RMA), will require a resource consent under Rule 4 and Rule 71 under the Proposed Southland Water and Land Plan.
    - Waterways are classified as having natural features such as substrate material (sand, gravel, boulders), whether there is any presence of aquatic species such as fish, whether the channel flows year round, and whether macrophytes (aquatic plants) are growing.
- If unsure check with Environment Southland to get some advice.

Figure 1: Typical example of a sediment trap with a bund, outlet to one side, keyed in to prevent leaks and located in a critical source area that will collect water from rainfall.

Key design principles

- Size of sediment trap surface area should be 40m^2 per hectare of catchment size for course sediment capture (Tanner et al, 2021).
- Length longer than width (digger reach), depth 1-1.5m & multiple cells if needed.
- Correct soil material and compaction.
- Keyed in below soil level to prevent leakage and failure.
- Outlet off to one side to minimise the risk of blowing out or failure during higher flows, may need some rock reinforcement.
- If building a constructed wetland, try to achieve 1-5% of the catchment area.

Particular challenges include:

- Maintaining sufficient gravity fall (without affecting tile drains or flooding land)
- Managing high flows and avoiding ‘channels’ through appropriate design and maintenance
- Construction during drier times of the year
- Ensuring a 2:1 batter or less on slopes and right soil material
- Planting around the edges and maintaining them to establishment
- Maintenance by periodic excavation to ensure sediment trap continues to function effectively
- Monitoring effectiveness through visual observation to gauge success

Further Information

Aparima Catchment Environment: https://www.thrivingsouthland.co.nz/ace/

Identifying key environmental issues on farm (N, P, sediment, and e coli losses):

1. Contaminant movement and mitigation - https://landscapedna.org/
2. Physiographic factsheets - https://www.es.govt.nz/community/farming/physiographics/introduction-to-physiographics
3. Maps of Southland with Physiographics - https://maps.es.govt.nz/landing.aspx

Sediment Trap Construction:

1. A guide to sediment trap construction - https://www.es.govt.nz/repository/libraries/id:26gi9ayo517q9stt81sd/hierarchy/community/farming/good-management-practice/documents/Land%20sustainability%20guides%20and%20factsheets/A%20guide%20to%20sediment%20trap%20construction.pdf

Constructed wetland advice:

1. Constructed wetland guidelines (Tanner et al., 2021) 'Technical guidelines for constructed wetland treatment of pastoral farm run-off', https://niwa.co.nz/freshwater-and-estuaries/management-tools/restoration-tools/constructed-wetland-guidelines
2. NIWA Tile drain wetland guidelines - https://niwa.co.nz/tile-drain-wetland-guidelines
3. Environment Southland Fact Sheets and Good Management Practices - https://www.es.govt.nz/community/farming/good-management-practice

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