Setting sediment target attribute states

Keep the soil on the land!

Our position in a nutshell

Your regional plans must contain limits on resource[1] use to ensure sediment is managed for ecosystem health and to provide for trout and salmon fishing and spawning where this is valued. There are numerous co-benefits for keeping the valuable and nonrenewal soil resource on land, for example to support more productive agricultural and horticultural activities.

Current management practices do not effectively control the impact of sediment well enough to provide suitable habitat for some species to live in. These effects extend from rivers and lakes down to estuaries and out to offshore fisheries.

High levels of sediment in rivers and streams above normal levels impact water quality and are a serious issue that contributes to degraded ecosystem health (e.g., reduced habitat conditions appropriate for both native species and trout fishing and spawning) and amenity values (e.g., unfavourable water conditions for humans to swim, kayak, and enjoy other water-based recreation activities). The levels of suspended and deposited fine sediment in rivers and streams have reached ecological tipping points in many parts of Aotearoa. While this degradation is partly due to historical practices and management approaches, not enough has been done recently to improve the condition of waterbodies.

Reducing the rate of riverbed aggradation (when riverbeds fill up and have less space for floodwaters) will reduce flood risk, and also protect our marine environments and fisheries by appropriately managing sediment right up front on the land.

To meet your regional plan's environmental outcomes, you must include rules that manage activities that lead to sediment generation, and that may include restrictions on earthworks, farming, and forestry.

NPS-FM directive and the NZCPS

The National Policy Statement for Freshwater Management (NPS-FM) specifies two sediment-related attributes: suspended fine sediment[2] and deposited fine sediment[3]. Clause 3.25 directs how you need to manage deposited sediment in rivers. If a riverbed has become soft-bottomed because of excess sedimentation you must assess if it is appropriate to return it to its natural hard-bottomed state.

The NPS-FM expects you to take an integrated approach to implementing the NPS-FM through the concept of ki uta ki tai[4]. This applies to managing sediment in freshwater ecosystems. An integrated management approach must recognise the sensitivity of receiving environments and consider the interconnected link between healthy rivers and the outcomes identified in other water bodies such as healthy wetlands and lakes.

[1] Link to: Clause 3.14 of the NPSFM

[2] Link to: Table 8, Appendix 2A to the NPS-FM

[3] Link to: Table 16, Appendix 2B to the NPS-FM

[4] Link to: Clause 3.5 of the NPS-FM 2020 & Link to: Ecosystem Health PN section: ki uta ki tai

The New Zealand Coastal Policy Statement (NZCPS) also has provisions directly relevant to managing sediment on land and freshwater so that it achieves coastal outcomes. Policy 22 of the NZCPS directs you to reduce sediment loadings and ensure that there are no significant increases in sedimentation, through controls on land use, and vegetation removal (including plantation forestry). Where coastal water quality has declined to a state that it is having a significant adverse effect on ecosystems, natural habitat, or water based recreational activities[5] or restricting activities like aquaculture, shellfish harvest or cultural activities, improving that water quality must be prioritised.

The NPS-FM also applies to estuaries and wider coastal waters[6], and you must manage sediment on land and in freshwater so that the objectives of both the NPS-FM and the NZCPS are met.

Limits on water takes and environmental flows and limits must be set to achieve environmental outcomes[7]. This means making sure there is enough water, and enough flushing flows, to move sediment through systems so it doesn't deposit on the bed of the river.

An action plan must be developed to achieve the target attribute states for *deposited* fine sediment[8]. This may also include resource use limits. The NPS-FM requires limits on resource use to achieve *suspended* fine sediment[9] target attribute states.

What do we want to see?

The overarching goal for managing sediment is to avoid clogging up rivers and streams with deposited and suspended sediment. Many streams that would have naturally had a stony bed (dominated by relatively coarse (gravel or larger) substrate) now appear soft bottomed, which is leading to habitat loss and decreased ecosystem resilience. Around 20% of the length of rivers in New Zealand are currently classified as soft-bottomed. However, research indicates that the number should be around 2%[10].

Where rivers and streams are already 'clogged', sediment entering those systems must be reduced. We want to see all rivers and streams that originally had stony beds restored from being soft-bottomed streams to hard-bottomed streams.

To achieve this, your plan should set sediment target attribute states to reflect a natural, healthy environment that supports recreational activities and healthy freshwater ecosystems. This means deposited sediment cover in most places should be no higher than 20% and below 10% in important habitat/spawning areas for both native fish and trout and salmon. Suspended sediment should provide for water clarity of at least 0.61 - 2.22m, with this varying depending on the waterbody. It also needs to be much higher where threatened species, trout fishing and spawning, or swimming are identified values. More detail relating to specific values is in Table 1.

[5] Link to: Policy 21 Enhancement of water quality, NZCPS 2010

[6] Link to: Clause 1.5 of the NPS-FM

[7] Link to: Clause 3.16 of the NPS-FM: Setting environmental flows and links // cross reference: Flows and Limits PN

[8] Link to: NPS-FM Appendix 2B – Attributes requiring action plans – Table 16

[9] NPS-FM Appendix 2A – Attributes requiring limits on resource use – Table 8

[10] Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

We want to see monitoring showing an increase in the number of rivers and streams restored to 'hard-bottomed' over time. This progress will indicate that your limits and action plans to control sediment loads are effective.

Downstream environments, such as lakes, wetlands, estuaries and out to coastal waters, may be more sensitive to sediment than the rivers that flow into them. Lakes, wetlands, and estuaries are 'sinks' for sediment. Sediment does not flush out, but instead may remain indefinitely. To protect them, sustainable sediment loads need to be calculated and that load managed in the whole catchment, to protect the lake, wetland or estuary (and for truly integrated planning, coastal environments and fisheries). Rivers and streams that flow into these sensitive waterbodies must be managed to protect those sensitive downstream receiving environments. This may mean that more stringent target attribute states need to be set in these rivers and streams than would otherwise be required if you were only considering the river or stream.

Sediment is naturally transported downstream through a river network and will 'settle out' when flows and river morphology slow the water. This means sediment deposition is strongly related to the flow and the natural characteristics of a river[11] (or reach of the river). You must ensure environmental flows are managed to ensure sediment moves through the river system naturally. This means there must be enough water in a river to move the sediment through it and prevent it settling on the bed of the river. There must be sufficient small floods or 'flushing flows' to move any deposited sediment through the river and prevent it accumulating.

Coastal waters (including bays, beaches and reefs) and offshore fisheries should also be identified as a receiving environment and coastal outcomes that are affected by freshwater should be clear. You can then set sediment attributes and controls on sediment discharges at a level that prevents significant increases in coastal water sedimentation.

How should the NPS-FM be implemented?

Set Target Attribute States that provide for freshwater values[12]

The target attribute states for sediment should, at a minimum, consider instream and downstream ecosystem health requirements. Where there are other values that require a more stringent target attribute state, like trout fishing or spawning or swimming spots, target attribute states that provide for those values should be included. The target attribute states in Table 1 are the minimum we would expect to see in your plan for rivers. Where there are sensitive downstream receiving environments, like lakes, wetlands and estuaries, target attribute states may need to be even more stringent to manage the loads of sediment entering these sensitive environments.

[11] Hyperlink to: Natural Form and Character PN.

[12] Hyperlink to: Clause 3.11 of the NPS-FM

Table 1 Expected target attribute states of sediment for identified values

Value	Deposited sediment minimum TAS (sediment cover %) [13][14]	Suspended sediment minimum TAS (black disc clarity)[15]
Ecosystem health	<20	3.5
Contact recreation – swimming spots	<25	1.6[16]
Trout fishery regionally significant	<10	5
Trout fishery other	<10	3.5
Trout spawning	<10	3.5

Set limits on resource use including land use controls

Sediment inputs to freshwater systems must be controlled by limiting human activities that make soil more vulnerable to erosion and transporting soil into waterbodies.

To reduce the amount of sediment entering waterbodies, you must set **limits** that control the amount of sediment entering water from activities.

Some high-risk activities[17] that are likely to require limits that reduce sediment loss include:

- stock accessing waterways[18];
- harvesting trees;
- intensive winter grazing[19];
- feedlots and other concentrated areas of stockholding;
- hill country forage cropping;

[13] Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand.

[14] https://www.envirolink.govt.nz/assets/R4-1-Sediment-Assessment-Methods-Protocol-and-guidelines.pdf

[15] Water Quality Guidelines To Protect Trout Fishery Values. Cawthron Report No. 1205. September 2006. https://www.horizons.govt.nz/HRC/media/Media/One%20Plan%20Documents/Water-Quality-Guideline-to-protect-Trout-Fishery-Values.pdf?ext=.pdf

[16] https://www.envirolink.govt.nz/assets/R4-1-Sediment-Assessment-Methods-Protocol-and-guidelines.pdf

[17] Ministry for the Environment. 2022. Guidance for implementing the NPS-FM sediment requirements. Wellington: Ministry for the Environment.

[18] Link to: riparian margins and stock access PN

[19] Link to: Winter grazing PN

- building tracks, roads and culverts;
- cultivating soil[20];
- construction earthworks;
- poor drainage management that may accelerate run-off and channel erosion; and
- areas of pasture cover or other high-risk land use on erosion-prone or steep land in a catchment[21].

These limits must be expressed as *rules* in your regional plan.

The rules must achieve the target attribute states, including for downstream sensitive receiving environments like lakes and wetlands. Where the receiving environment is the coastal environment, limits must ensure that the NZCPS objectives are achieved. You may need to manage sedimentation from the land that reaches the coastal marine area (CMA)[22] more stringently than you would to achieve freshwater outcomes required by the NPS- FM, in order to achieve outcomes for the coastal environment as directed by the NZCPS.

Limits that are more stringent than those contained in the NES-Freshwater and Stock Exclusion Regulations will be required for land use conversion or intensification, intensive winter grazing[23] and for setbacks for stock exclusion to provide for vegetation riparian margins[24]. For plantation forestry, rules limiting clearance extent and slope, erosion susceptibility zoning and riparian setbacks need to be more stringent than those specified in the NES-Plantation Forestry.

Limits should be set clearly in the regional plan, including the outcome that is sought and the methods by which it will be achieved. Achieving target attributes states should not be delegated to the consent or farm-planning processes.

Manage your sediment problem in the right order

When more sediment has been identified in the water body than is outlined by a target attribute state in your plan, you have a sediment problem. You should take the steps set out in Table 2, in the correct order, to manage sediment.

This approach is similar to the effects management hierarchy. It means you must seek to first avoid sediment being generated as much as practicable, and then mitigate it at source, before looking to edge of field or catchment based options. Each step in the process involves increasingly more expensive and risky (for the environment) options, so it's important that they are implemented in order.

Table 2 Sediment management hierarchy

[20] Link to: Nutrient inputs PN

[21] e.g., https://www.marlborough.govt.nz/your-council/latest-news-notices-and-media-releases/all-news-notices-and-media-releases?item=id:2mvwgch2u17q9skvus0t

[22] Link to: Policy 22 Sedimentation, NZCPS

[23] Link to: intensive winter grazing PN

[24] Link to: Riparian PN

1.	Find the sediment source:	Firstly, you must identify the sources of sediment in your catchment and how the sediment is being lost.
2.	Reduce or stop sediment from being generated:	Then, take measure to prevent sediment generation in the first place, or reduce its extent. This may require changing the activity practice to reduce sediment generation. For example, limiting: - the amount or location of vegetation clearance, - the amount or type of soil cultivated, - the timing and quantity of earthworks, - the location or quantity of intensive winter grazing.
3.	Put measures in place to mitigate sediment transport on site:	Once everything has been done to prevent or reduce sediment generation, take steps on site to reduce any sediment from being transported to waterways. This includes requiring: - stormwater control measures on earthworks sites, - detention and settling dams, - detention bunds. For example, sediment attention through near or instream measures, like: - riparian planting to filter run-off, - constructing an end of catchment wetland to settle sediment from the wider catchment.
4.	Proactively manage risk:	You need to actively manage activities that risk creating sediment, including through: - ensuring resource consent conditions are monitored and enforced, - Ensuring drainage networks are adequately maintained.

Measures 2-3 above should be identified as limits in the regional plan and systematically actioned in that order of preference.

Use methods like riparian setbacks to effectively manage sediment

Riparian setbacks[25], with appropriate riparian vegetation, are a key tool to filter sediment generated from land use activities and restrict it from entering waterways, where other methods such as source reduction and on-site mitigation are ineffective.

The effective width of a vegetated riparian margin varies depending on the slope of the land adjacent to the waterbody and the soil type. They should, however, be at least 10 metres on slopes less than 10 degrees and 20m on land steeper than 10 degrees[26].

Riparian setbacks also need to be vegetated with appropriate low-lying vegetation, so the vegetation is an effective filter.

Vegetated riparian margins provide other benefits to waterbodies in addition to sediment filtering, such as providing shade and inputs of wood, leaves and insects into the waterbody, biodiversity benefits and carbon sequestration. They also reduce erosion and ensure fences are set far enough back from waterbodies so that banks and sediment are not lost during floods. Taking all these benefits into account, planting vegetated riparian margins exceeds their costs, especially for vegetated riparian margins up to 20 metres in width[27]. They really are a win, win, win!

Action Plans

Action plans are a tool to identify and co-ordinate the actions of different parts of council and other agencies as well as landowners. They can identify and prioritise non-regulatory measures and proactive initiatives (e.g., planting, fencing watercourses, afforestation). Action plans are an important tool, but do not replace the need for effective limits.

While the NPS-FM only requires limits on resource use to be set to achieve suspended sediment targets (and allows councils to have only action plans to achieve deposited sediment targets), limits should be set to achieve both suspended and deposited sediment targets – particularly as these limits manage the same pollutant.

How we know the NPS-FM is being achieved

A successfully implemented NPS-FM will see rivers and streams being returned to their natural sediment state to support habitat for native species, for trout and salmon and ecosystem resilience.

By focusing on a healthy environment, the work to reduce sedimentation will also benefit those land use activities that rely on the soil resource, support recreational activities and other values people hold for our waterways.

[25] Hyperlink to: Riparian margins and stock exclusion

[26] Fenemor, A., and Samarasinghe, O. (2020). Riparian setback distances from waterbodies for high-risk land uses and activities. Manaaki Whenua – Landcare Research. Prepared for Tasman District Council, p. 38.

[27] Daigneault et al A national riparian restoration programme in new Zealand: Is it value for money Journal of Environmental Management 187 166-177

Implementation toolbox

The toolbox will continue to be developed as new information becomes available:

Tools:	are helpful diagrams, processes, or ways to support how you should implement the NPS-FM.
Examples:	provide text suggestions to help draft objectives (values and environmental outcomes), policies, and rules (limits) in your regional plans, including how monitoring could be achieved. It includes examples of how attributes and base line states, target attribute states, environmental flows and levels, and other criteria, where appropriate, can be written or presented to help achieve environmental outcomes.
Case studies:	illustrate where the NPS-FM has been well applied (or not) throughout the country and provide national or international lessons to help implement the NPS-FM.
Evidence:	provides relevant case law to support how the NPS-FM must be applied.
Resources:	provide links to supporting literature and best information available to implement the NPS-FM.

Tools

[When available]

Examples

[When available]

Case studies

[When available]

Evidence

Resources

Ministry for the Environment Guidance[28]: Workflow – Key Steps and Questions (Figure 2-1: Decision tree for implementing the NPS-FM fine sediment requirements)

Clapcott, J.E., Young, R.G., Harding, J.S., Matthaei, C.D., Quinn, J.M. and Death, R.G. (2011) Sediment Assessment Methods: Protocols and guidelines for assessing the effects of deposited fine sediment on in-stream values. Cawthron Institute, Nelson, New Zealand

McKergow, L., Matheson, F., Goeller, B. and Woodward, B. (2022) *Riparian buffer design guide: Design to meet water quality objectives*. NIWA Information Series 103. 16pp

Sediment background and impacts on ecosystem health - Report to the Minister for the Environment (2019) Freshwater Science and Technical Advisory Group

[28] Ministry for the Environment (2022) *Guidance for implementing the NPS-FM sediment requirements*. Wellington: Ministry for the Environment.

Riparian buffers – Daigneault, A.J., Eppink, F.V. and Lee, W.G.(2017) A national riparian restoration programme in New Zealand: Is it value for money? Journal of Environmental Management 187

Fenemor, A. and Samarasinghe, O. (2020) *Riparian setback distances from water bodies for high-risk land uses and activities*. Manaaki Whenua – Landcare Research. Contract Report: LC3832.

Monitoring resource use limits and land use management actions - Doehring, K., Roger G. Young, R.G., and Robb, C. (2020) Demonstrating efficacy of rural land management actions to improve water quality - How can we quantify what actions have been done? *Journal of Environmental Management* 270:110475

Fish and Game, Forest and Bird and Choose Clean Water have written this practice note to communicate their expectations on how regional councils should implement the National Policy Statement for Freshwater Management 2020 (NPS-FM) into their regional plans. This is one in a series of practice notes which have been prepared on various topics relating to NPS-FM implementation.