Action for Healthy Water

Proposal for new national direction for freshwater management

Otago Regional Council

www.orc.govt.nz

No longer business as usual

Paradigm shift for community and ORC

Requires overnight behaviour changes

Farming within tighter controls

Implications for Otago expected to be significant

Framing Submissions - Key Messages:

- ORC supports the intention – improving water quality is important
- Not a four "well-being" approach (as per s5 of the RMA), the proposal lacks consideration of economic and social impacts
- There are likely significant capacity constraints for all parties who will need to respond to the proposed regulations, e.g. landowners, Councils, iwi
- (Un)Certainty of expectations - further clarity is required on the regulations as drafted
- The requirement to maintain current environmental quality, where appropriate, is supported by ORC
- National DIN and DRP target attribute states - ORC has concerns that these attributes are not always demonstrative of ecological health
- Tangata whenua values and interests are supported by ORC
- It is important that Central Government recognises work already done by farmers and catchment groups
- Prescriptive approach can stifle innovation and innovation that is happening needs to be supported or it risks being stopped.

Structure of the presentation

- Overview of proposed regulations, consultations and timelines
- Summary of proposed changes and implications
  - Setting a clear policy direction
  - Raising the bar on ecosystem health
  - Better managing drinking water, stormwater and wastewater
  - Improving farm practices
- Impacts on ORC
  - Processes
  - Systems
  - Resourcing
- Discussion

Proposed regulations, consultations and timelines

3 Proposals for consultation

National Policy Statement for Freshwater Management

National Environmental Standard for Freshwater

Stock Exclusion Section 360 Regulations

… **more changes on the way, including**

RMA reforms

New National Environmental Standard for Wastewater

Amendment to NES for Sources of Drinking Water

New Water Services Act

3 Objectives:

Stop further degradation *– material improvement within 5 years*

Reverse past damage *– healthy waterbodies within a generation*

Address water allocation issues *- having regard to all interest including Maori and existing and potential new users*

Implications for ORC

Sets clear policy direction (Te Mana o te Wai) and ambitious targets

Increased monitoring and reporting requirements

Focus on education, engagement, enforcement

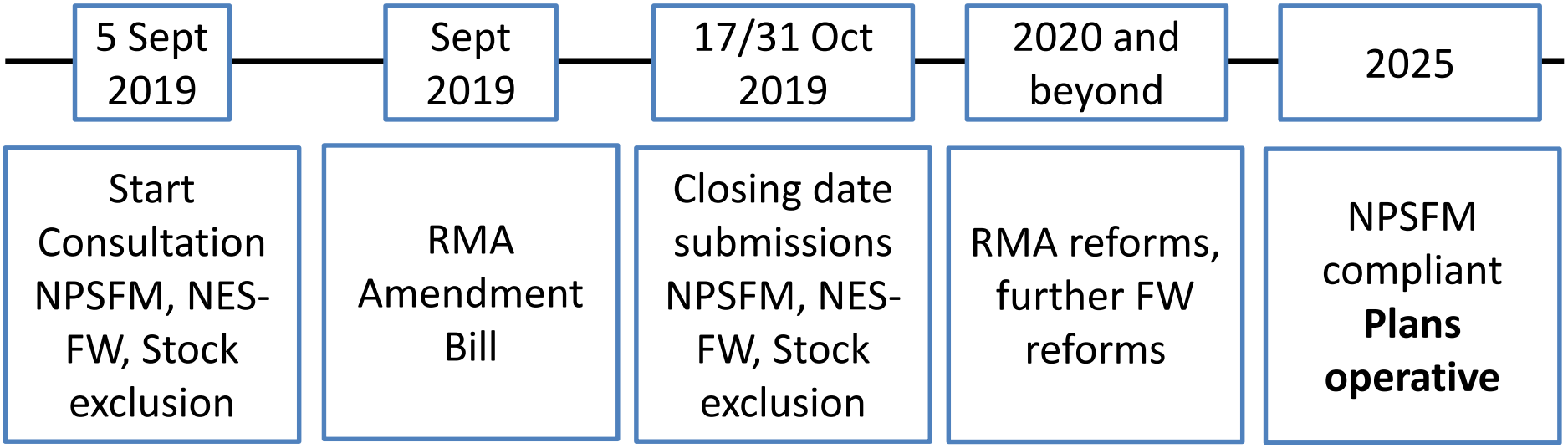
Implications for Community

Ecosystem health comes first

Drive towards consenting regime (license to operate)

Tighter controls on resource use and rural intensification

Greater efforts (and investment) required to manage (potential) impacts of activities

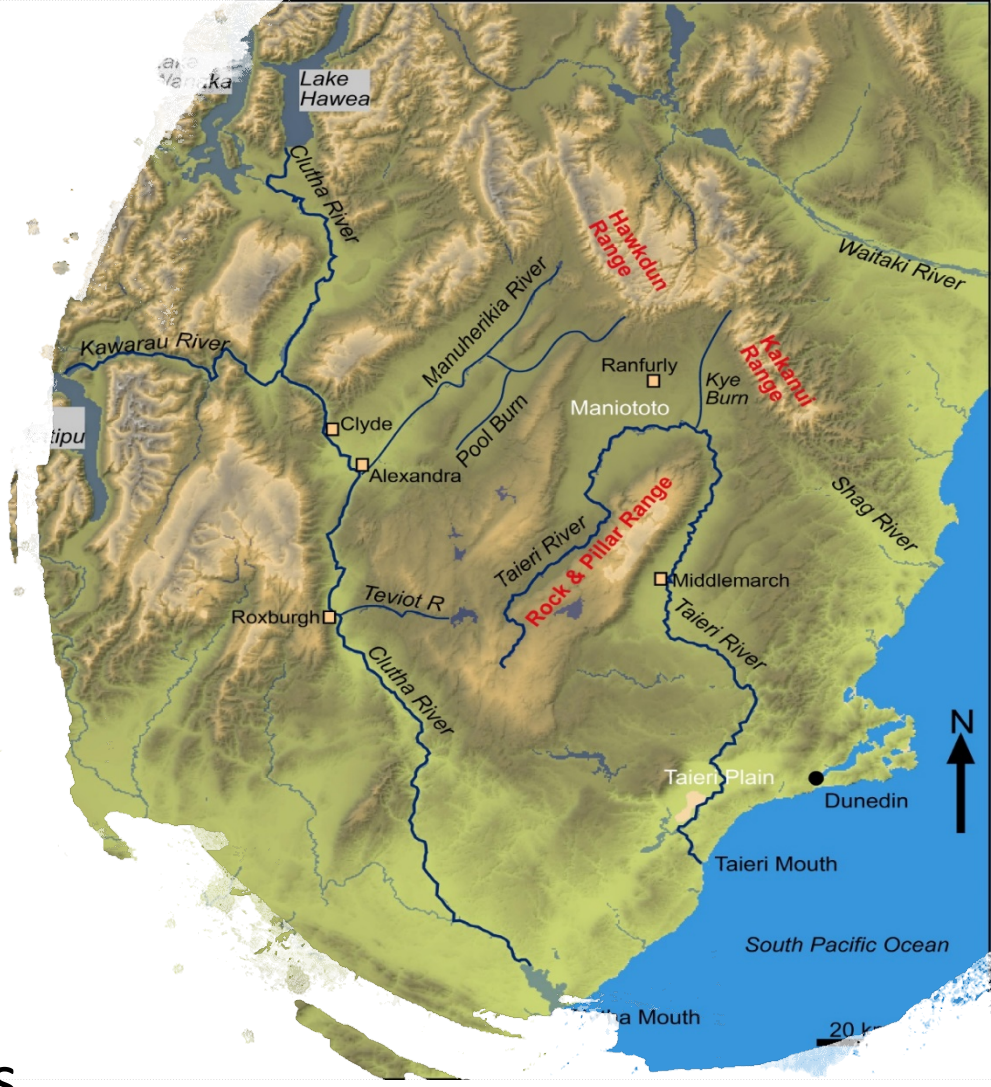

5 Sept 2019
Sept 2019
17/31 Oct 2019
2020 and beyond
2025
Start Consultation NPSFM, NES-FW, Stock exclusion
RMA Amendment Bill
Closing date submissions NPSFM, NES-FW, Stock exclusion
RMA reforms, further FW reforms
NPSFM compliant **Plans operative**

Our region

Geographically diverse (climate, land uses, pressures)

230,000 people & 4,800 farms (>10 ha)

5 FMUs but approx. identified 40 catchments and 40 known aquifers



Policy Directions

RMA Changes - Stage 1 (Reform Bill 2019)

- New freshwater planning process
- Standard Schedule 1 RMA process up to/including public notification
- Hearing panels consisting of:
  - local councillors,
  - tangata whenua representatives
  - government appointed commissioners with specialist skills
- Restricted avenues for appeal

RMA Changes - Stage 2 (2020)

- Comprehensive RMA review:
  - Urban development
  - Environmental bottom lines
  - Effective public participation (including with Iwi)

NPSFM Changes: New structure

- Improve clarity & focus (from 12 objectives to 1)
- Integration of freshwater management, land use and development and infrastructure provision
- Introduce adaptive management

NPSFM Changes: Te Mana o te Wai

- Freshwater must be managed in a way that gives effect to *Te Mana o te Wai*
- Hierarchy of obligations:

1. Health and wellbeing of water bodies and ecosystems
2. Health needs of people
3. Social and economic and cultural wellbeing of people and communities

NPSFM Changes: Iwi values

- Holistic approach to freshwater management (Ki Uta ki Tai)
- Engage with Tangata Whenua and communities
- Values-based decision-making
- Elevate the status of Mahinga kai or Tangata Whenua values (compulsory value)

NPSFM changes: Exempting hydro-schemes & naturally occurring processes

- Allow for attribute states to be set below national bottom lines
- Applies to:
  - 6 largest hydro schemes (incl. Clutha/Mata-Au, Waitaki)
  - Waterbodies with natural state < national bottom line
- Have regard to hydro-generation when setting limits & developing action plans

Raising the bar on ecosystem health

Raising the bar on ecosystem health

1. Higher standard for swimming in summer
2. Protection for urban and rural wetlands and streams
3. Protection of indigenous species
4. Providing for fish passage
5. Improvements to minimum flow setting and water use reporting
6. Monitoring a new set of attributes

1. Higher standard for Swimming

- **Identify:** 'regularly used' swimming spots (or where people would swim if water quality was better)
- **Mandatory monitoring**
  - Representative sites weekly between 1 Nov - 31 March (extended season)
- **Notify public** if 1 sample > national bottom line (540 E.Coli/100 mL)
- **Increase efforts to improve water quality where people want to swim** (e.g. stricter controls on discharges and stock access)

2. Wetland & Stream Protection

- Identify inland wetlands (> 0.05ha)
- Develop and maintain wetland inventories
- Amend RPS and Plans to:
  - Avoid wetland loss & degradation
  - Restore wetlands
  - Tighter controls on activities in and near wetlands (e.g. vegetation removal, disturbance, drainage)
- Requirement for councils and consent holders to increase wetland monitoring
- Avoid infilling and piping of streams

3. Improve minimum flow setting & water use reporting

- Clarify requirements for setting environmental flows/levels and allocation limits
- Mandatory daily telemetry for all consented water takes (> 5 l/s)
- Develop publicly accessible freshwater quality and quantity accounting systems for each FMU.

4. Protecting threatened indigenous species

- New compulsory value: Protection of threatened indigenous freshwater species
- Threatened species includes invertebrates, plants, fish and birds.
- Currently limited distributional and ecological understanding on all of these values.
- Regional planning must identify and manage threatened species

5. Providing for fish passage

Regional councils to:

- Undertake work programme to:
  - identify existing instream structures and evaluate risk to fish migrations
  - remedy issues with noncompliant existing structures

- Include in regional plans:
  - Objectives to achieve diversity and abundance of fish
  - Policies that guide consenting of instream structures

6. Monitoring new attributes

- Schedule 15 attribute states more stringent than National Objectives Framework limits
- Additional monitoring required and costly
  - Submerged plants, continuous D.O., periphyton, Fish IBI, cyanobacteria, etc.
- Some attributes are difficult to monitor for our region
  - MCI, Fish IBI

Safe drinking water and stormwater/ waste water management

Drinking Water

Amendment to NES Drinking Water:

- Identify & map: source water risk management areas (SWRMA).
- Identify activities in SWRMAs that pose potential risk
- Tighter controls on land use and development in SWRMAs.
- Expand scope of regulations (all registered water supplies > 25 people)

Increased number of applications publicly notified and declined.

Wastewater & stormwater

- New NES on wastewater discharges and overflows.
  - Prescribed requirements for consent conditions.
  - Targets or limits for wet weather overflows
- Network operators required to develop risk management plans.
- New Water Services Act:
  - Annual reports on nationally-prescribed performance measures.
  - Nationally-consistent measures for stormwater

Improving farm practices

Improving farm practices

1. Farm management plans with Freshwater module
2. Restrict further intensification
3. Reduce N-loss in catchments with high N levels
4. Excluding stock from water ways
5. Standards for intensive grazing, feedlots and stock holding areas

1. Farm Management Plan with Freshwater Module

- Every farm owner to have a farm plan by 31 Dec ‘25 to manage risks associated with land use activities.

- Mandatory freshwater module to include:
  - Farm map
  - Risk assessment
  - Schedule of actions to manage:
    - identified features
    - risks of contaminant loss
    - risk to threatened species

2. Restricting rural land use intensification (Interim measures until 31 Dec 25)

Restrictions on activities:

- increase in irrigated, arable, or horticultural production > 10 ha
- changes in land use > 10 ha from:
  - Arable, sheep, beef to dairy support
  - Arable, deer, dairy-support, sheep to dairy
  - Woodland/forestry to pastoral use
- Increases in forage cropping beyond:
  - area in intensive winter grazing in past 5 years
  - minimum threshold

Consent only granted if no net increase in P, N, sediment or pathogen discharges

3. Reducing nitrogen loss

By 2025 - requirement to have measures to reduce N leaching

Some catchments need to take interim measures. (Regions with (proposed) N leaching rules exempt, incl. Otago)

3 alternative proposals:

1. Set cap in catchments with high nitrate-nitrogen levels (some farms will have to reduce N losses).
2. Set national nitrogen fertiliser cap.
3. Require FMPs in catchments with high nitrate-nitrogen levels to take action on reducing N leaching.

4. Stock exclusion

- Applies to dairy, beef cattle, pigs and deer - Not sheep.
- Requires fencing of all water bodies (wetlands, lakes and rivers, except ephemeral rivers and rivers < 1 m wide)
- Requirements for stock exclusion on “low slope land”- <10 degrees and “non-low slope land “ >10 degrees
- Implementation timeframe between now and 1 July 2023
- Landowners can apply for exemption, but criteria unclear.

5. Controlling intensive winter grazing

Two options proposed

- Nationally set standards
  - Restrictions on area, slope, pugging depth and waterway setbacks
- Industry set standards
  - Restrictions on slope, waterway setbacks, pugging depth
  - Farm Plan with emphasis on good management

Key conclusions, take away messages and discussion points

Positive consequences

Sets clear direction and expectations

Expected improvement to environmental outcomes

Opportunity to show leadership, connect with communities and foster innovation

Questions remain around…

Practicality of the proposals (monitoring and reporting requirements, timeframes)

Clarity of the proposed provisions (ambiguity)

Cost for community and ORC

Implications – Review current monitoring program and data management systems

Ensure ORC's monitoring network:

- represents all FMU's
- includes key water bodies (at risk)
- addresses gaps

Invest in development of:

- Data quality review processes
- Data management strategies/systems (incl. freshwater accounting, consents information, land management data, farm plans).

Implications – Plan development and enforcement

Requirement to:

- Amend existing Water Plan and Policy Statement
- Develop new Water Plan to give effect to new NPSFM
- Develop action plans and management strategies (adaptive management)
- Enforce compliance with new plan provisions

Implication: Review current staff resourcing

Communications : Development of comms strategies & campaigns
Customer Services : Responding to enquires from the rural community.
Rural Liaison : Educational initiatives and integrated catchment management
Consents Officers : Public advice and applications for activities previously permitted
Consent Admin/Environmental Data: Handling of farm plans, consents info, FW accounting
Compliance: Monitoring & enforcing compliance with new regulations & consents
Policy: Changes to the operative RWP and RPS, Water Plan review
Science team: SOE monitoring and reporting

Example: Resourcing needs

Environmental Monitoring

Quality Measurement: data management, technical advice, relationship development

Science

Trusted Research: Identify appropriate measures, monitoring, analysis, reporting, issue/problem identification, recommendations

Rural Liaison

Integrated catchment implementation approach:

Education, relationship connection, implementation, review - **behaviour change**

Adaptive Management: Action and Management Plans

Capacity constraints: additional 30 – 50 FTE required

Possible ways to respond to new package

Establish strategic partnerships (with community and stakeholders)

Target efforts for address environmental issues in key areas (prioritisation)

Streamline monitoring and reporting programme : improve efficiency and cost-effectiveness

DISCUSSION

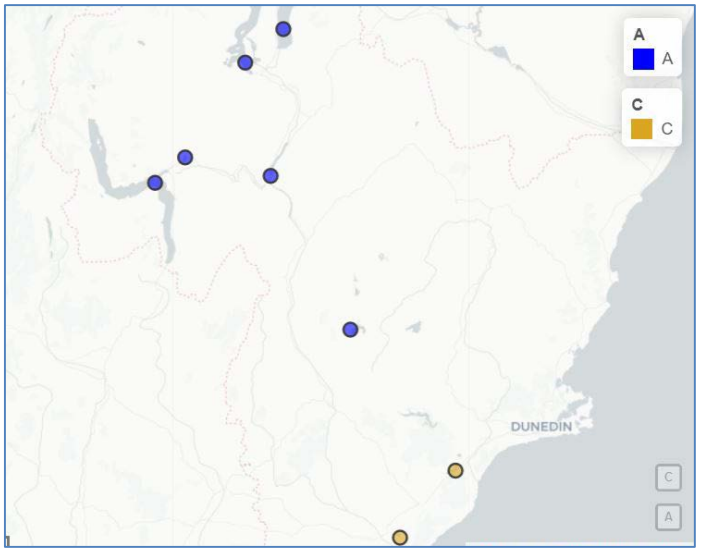
Handout science slides

2. Attribute monitoring

NPSFM requirements & current state: Phytoplankton

Table 1 - Phytoplankton (Trophic state)

Value (and component)	Ecosystem Health (Aquatic Life)	
Freshwater Body Type	Lakes	
Attribute Unit	mg chl-*a*/ m³ (milligrams chlorophyll-*a* per cubic metre)	
Attribute band and description	Numeric attribute state	
	Annual median	Annual Maximum
A Lake ecological communities are healthy and resilient, similar to natural reference conditions.	≤2	≤10
B Lake ecological communities are slightly impacted by additional algal and/or plant growth arising from nutrient levels that are elevated above natural reference conditions.	>2 and ≤5	>10 and ≤25
C Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above natural reference conditions. Reduced water clarity is likely to affect habitat available for native macrophytes.	>5 and ≤12	>25 and ≤60
National Bottom Line	**12**	**60**
D Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state (without native macrophyte/ seagrass cover), due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.	>12	>60
For lakes and lagoons that are intermittently open to the sea, monitoring data should be analysed separately for closed periods and open periods.		



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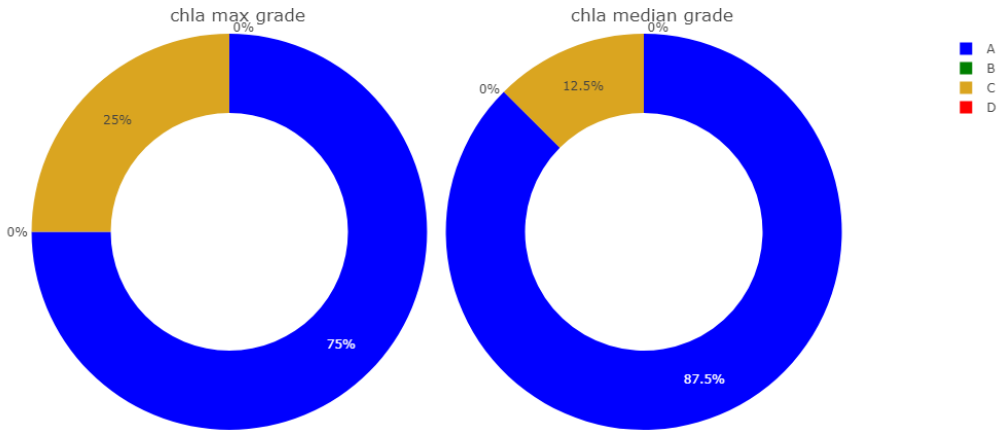


2. Attribute monitoring

NPSFM requirements & current state: River Periphyton

Table 2 - Periphyton (Trophic state)

Value (and component)	Ecosystem health (Aquatic Life)	
Freshwater Body Type	Rivers	
Attribute Unit	mg chl-*a*/m^2 (milligrams chlorophyll-*a* per square metre)	
Attribute band and description	Numeric Attribute State (default class)	Numeric Attribute State (productive class)
	Exceeded no more than 8% of samples	Exceeded no more than 17% of samples
A Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.	≤50	≤50
B Occasional blooms reflecting low nutrient enrichment and/ or alteration of the natural flow regime or habitat.	>50 and ≤120	>50 and ≤120
C Periodic blooms reflecting moderate nutrient enrichment and/ or moderate alteration of the natural flow regime or habitat.	>120 and ≤200	>120 and ≤200
National Bottom Line	200	200
D Regular and/or extended-duration nuisance blooms reflecting very high nutrient enrichment and/or very significant alteration of the natural flow regime or habitat.	>200	>200
Classes are streams and rivers defined according to types in the River Environment Classification system (REC). Numeric attribute states must be derived from the rolling median of monthly monitoring over five years.		

- 30 sites monitored
- 1 year of data by January 2020

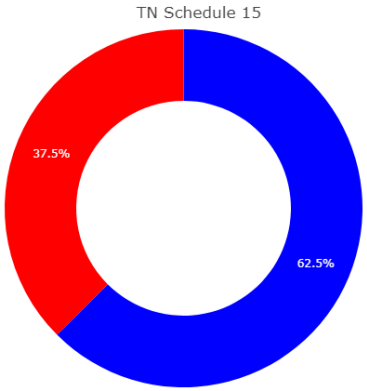
2. Attribute monitoring

NPSFM requirements & current state: Total Nitrogen

Table 3 – Total Nitrogen (Trophic state)

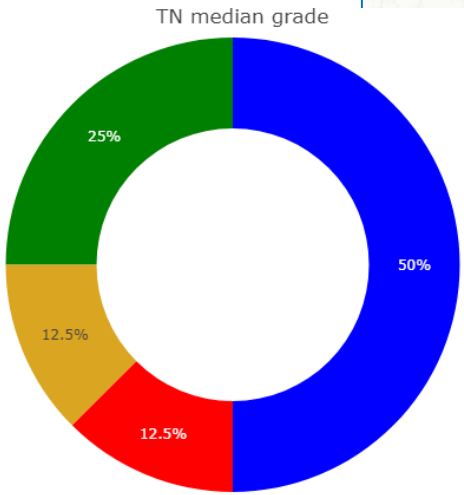
Value (and component)	Ecosystem Health (water quality)	
Freshwater Body Type	Lakes	
Attribute Unit	mg/m³ (milligrams per cubic metre)	
Attribute band and description	Numeric attribute state	
	Annual Median	Annual Median
	Seasonally Stratified and Brackish	Polymictic
A Lake ecological communities are healthy and resilient, similar to natural reference conditions.	≤160	≤300
B Lake ecological communities are slightly impacted by additional algal and/ or plant growth arising from nutrient levels that are elevated above natural reference conditions.	>160 and ≤350	>300 and ≤500
C Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above natural reference conditions.	>350 and ≤750	>500 and ≤800
National Bottom Line	**750**	**800**
D Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state (without native macrophyte/seagrass cover) due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.	>750	>800
For lakes and lagoons that are intermittently open to the sea, monitoring data should be analysed separately for closed periods and open periods.		

Schedule 15



S15 Limit
550 mg/m³ (Group 4)
100 mg/m³ (Group 5)

NPSFM



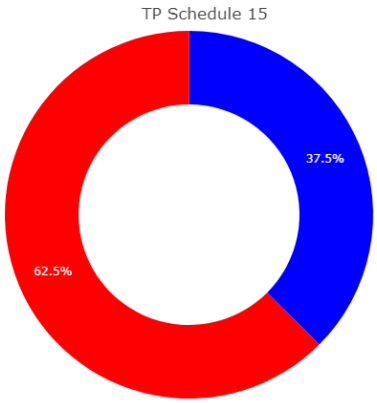
2. Attribute monitoring

NPSFM requirements & current state: Total Phosphorus

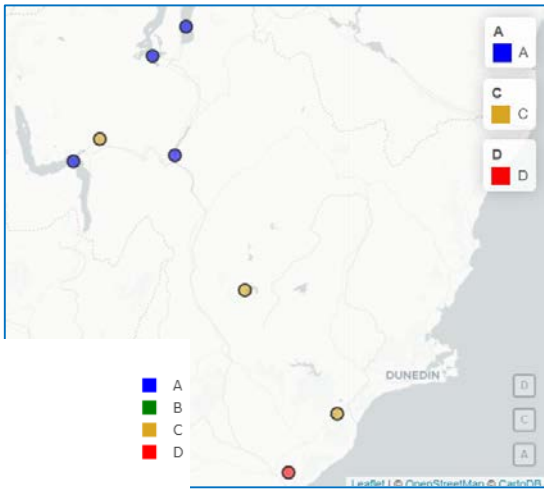
Table 4 – Total Phosphorus (Trophic state)

Value (and component)	Ecosystem Health (water quality)
Freshwater Body Type	Lakes
Attribute Unit	mg/m³ (milligrams per cubic metre)
Attribute band and description	Numeric attribute state
	Annual Median
A Lake ecological communities are healthy and resilient, similar to natural reference conditions.	≤10
B Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrient levels that are elevated above natural reference conditions.	>10 and ≤20
C Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrient levels that are elevated well above natural reference conditions.	>20 and ≤50
National Bottom Line	**50**
D Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state (without native macrophyte/seagrass cover), due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.	>50
For lakes and lagoons that are intermittently open to the sea, monitoring data should be analysed separately for closed periods and open periods.	

Schedule 15



S15 Limit
33 mg/m³ (Group 4)
5 mg/m³ (Group 5)



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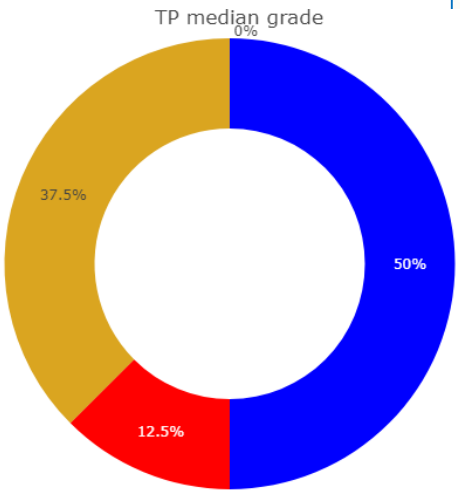


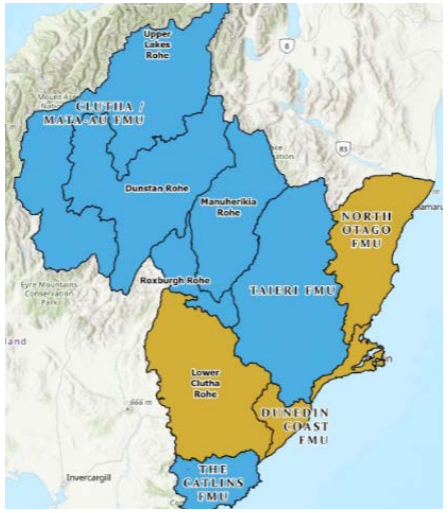
2. Attribute monitoring

NPSFM requirements & current state:

Dissolved Inorganic Nitrogen (NNN) (Median & 95th percentile)

Table 5 – Dissolved inorganic nitrogen

Value (and component)	Ecosystem health (water quality)	
Freshwater Body Type	Rivers	
Attribute Unit	DIN mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State	
	Median	95th percentile
A Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to DIN enrichment are expected.	≤ 0.24	≤ 0.56
B Ecological communities are slightly impacted by minor DIN elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.	> 0.24 and ≤0.50	> 0.56 and ≤01.10
C Ecological communities are impacted by moderate DIN elevation above natural reference conditions, but sensitive species are not experiencing nitrate toxicity. If other conditions also favour eutrophication, DIN enrichment may cause increased algal and plant growth, loss of sensitive macroinvertebrate & fish taxa, and high rates of respiration and decay.	> 0.5 and ≤ 1.0	> 1.10 and ≤ 2.05
National Bottom Line	**1.0**	**2.05**
D Ecological communities impacted by substantial DIN elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DIN enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia and nitrate toxicity are lost.	>1.0	>2.05



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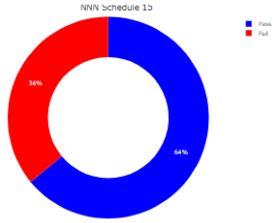

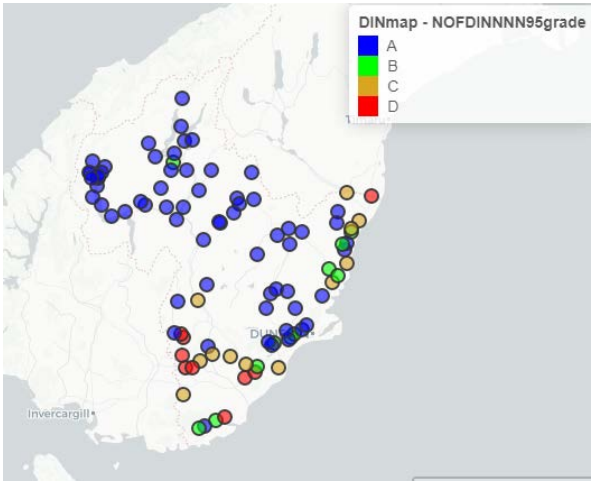

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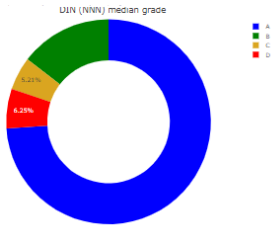
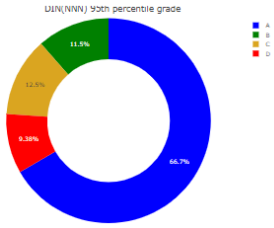




2. Attribute monitoring

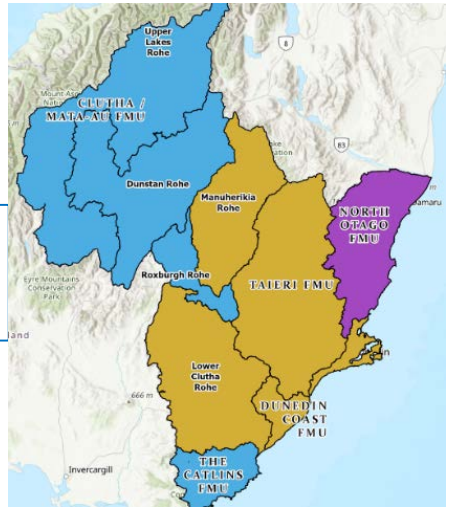
NPSFM requirements & current state:

Dissolved Reactive Phosphorus (DRP) (Median & 95th percentile)

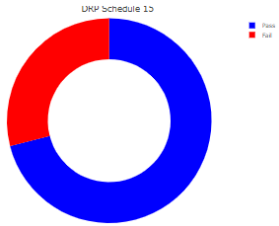
Table 6 – Dissolved reactive phosphorus

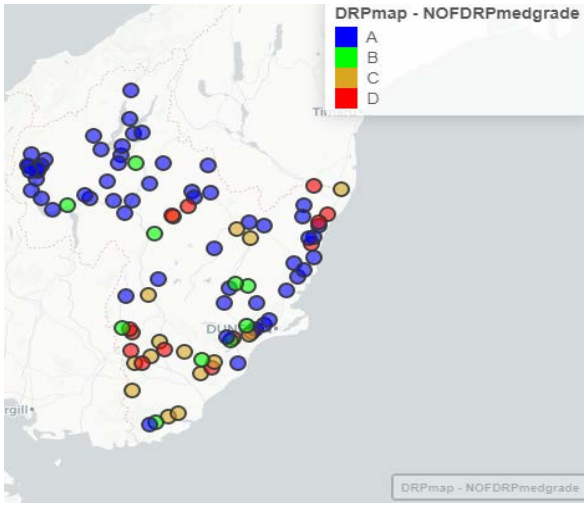
Value (and component)	Ecosystem health (water quality)	
Freshwater Body Type	Rivers	
Attribute Unit	DRP mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State	
	Median	95th percentile
A Ecological communities and ecosystem processes are similar to those of natural reference conditions. No adverse effects attributable to DRP enrichment are expected.	≤ 0.006	≤ 0.021
B Ecological communities are slightly impacted by minor DRP elevation above natural reference conditions. If other conditions also favour eutrophication, sensitive ecosystems may experience additional algal and plant growth, loss of sensitive macroinvertebrate taxa, and higher respiration and decay rates.	> 0.006 and ≤0.010	> 0.021 and ≤0.030
C Ecological communities are impacted by moderate DRP elevation above natural reference conditions. If other conditions also favour eutrophication, DRP enrichment may cause increased algal and plant growth, loss of sensitive macro-invertebrate & fish taxa, and high rates of respiration and decay.	> 0.010 and ≤ 0.018	> 0.030 and ≤ 0.054
National Bottom Line	**0.018**	**0.054**
D Ecological communities impacted by substantial DRP elevation above natural reference conditions. In combination with other conditions favouring eutrophication, DRP enrichment drives excessive primary production and significant changes in macroinvertebrate and fish communities, as taxa sensitive to hypoxia are lost.	>0.018	>0.054
Numeric attribute state must be derived from the rolling median of monthly monitoring over five years.		

S15 Limit
0.026 mg/l (Group1)
0.010 mg/l (Group 2)
0.006 mg/l (Group 3)



Schedule 15





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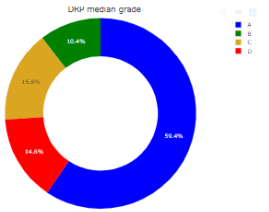
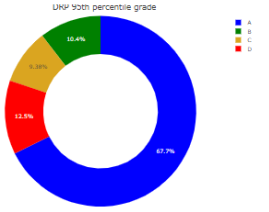




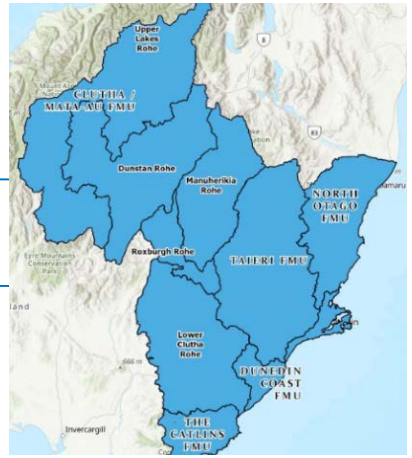
2. Attribute monitoring

NPSFM requirements & current state: Ammonia (Annual median & annual maximum)

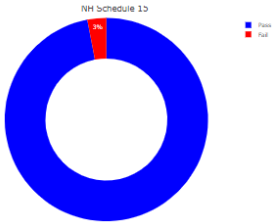
Table 7 – Ammonia (Toxicity)

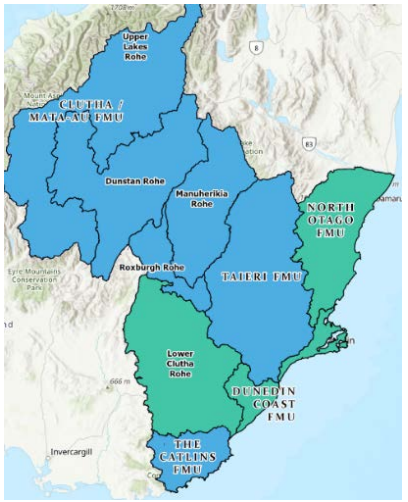
Value (and component)	Ecosystem Health (Water Quality)	
Freshwater Body Type	Rivers	
Attribute Unit	mg NH4-N/L (milligrams ammoniacal-nitrogen per litre)	
Attribute band and description	Numeric Attribute State	
	Annual Median	Annual Maximum
A 99% species protection level: No observed effect on any species tested	≤0.03	≤0.05
B 95% species protection level: Starts impacting occasionally on the 5% most sensitive species	>0.03 and ≤0.24	>0.05 and ≤0.40
C 80% species protection level: Starts impacting regularly on the 20% most sensitive species (reduced survival of most sensitive species)	>0.24 and ≤1.30	>0.40 and ≤2.20
National Bottom Line	**1.30**	**2.20**
D Starts approaching acute impact level (ie risk of death) for sensitive species	>1.30	>2.20
Numeric attribute state is based on pH 8 and temperature of 20°C. Compliance with the numeric attribute states should be undertaken after pH adjustment.		

S15 Limit
0.10 mg/l (Group1 and 2)
0.01 mg/l (Group 3)

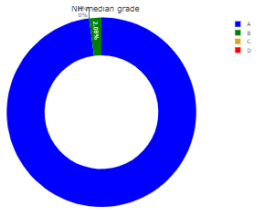


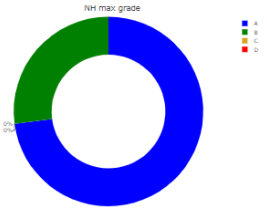
Schedule 15





NPSFM





2. Attribute monitoring

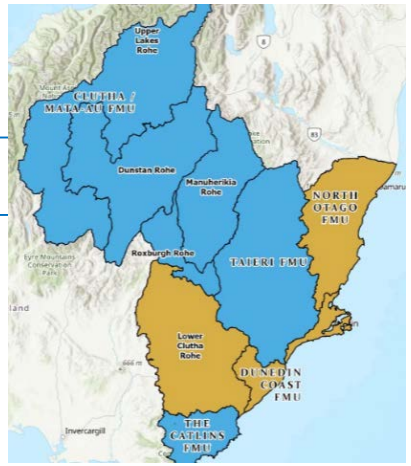
NPSFM requirements & current state:
Nitrate (Toxicity) (Annual median & annual 95th percentile)

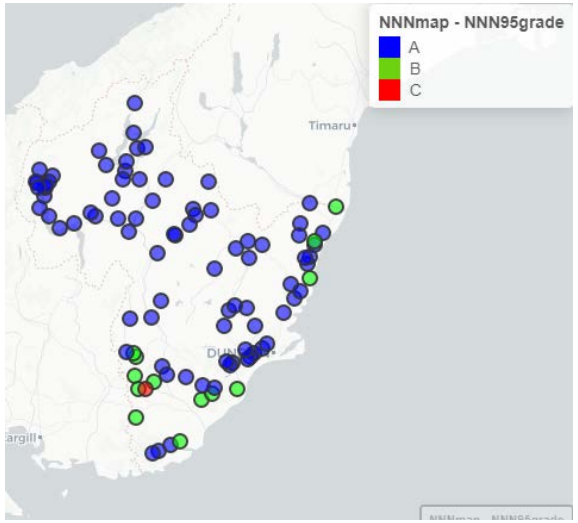
Table 8 – Nitrate (Toxicity)

Value (and component)	Ecosystem Health (water quality)	
Freshwater Body Type	Rivers	
Attribute Unit	mg NO_3 - N/L (milligrams nitrate-nitrogen per litre)	
Attribute band and description	Numeric Attribute State	
	Annual Median	Annual 95th Percentile
A High conservation value system. Unlikely to be effects even on sensitive species.	≤1.0	≤1.5
B Some growth effect on up to 5% of species.	>1.0 and ≤2.4	>1.5 and ≤3.5
C Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.	>2.4 and ≤6.9	>3.5 and ≤9.8
National Bottom Line	**6.9**	**9.8**
D Impacts on growth of multiple species, and starts approaching acute impact level (ie risk of death) for sensitive species at higher concentrations (>20 mg/L).	>6.9	>9.8

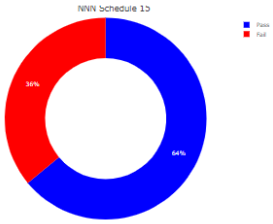
Note: This attribute measures the toxic effects of nitrate, not the trophic state. Where other attributes measure trophic state, for example periphyton, freshwater objectives, limits and/or methods for those attributes will be more stringent.

S15 limit
0.444mg/l or 0.075mg/l

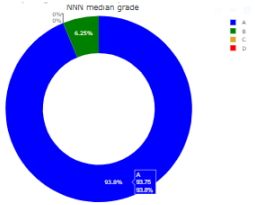


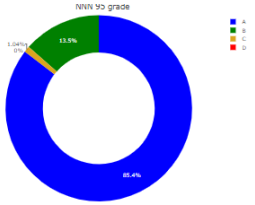


Schedule 15



NPSFM





2. Attribute monitoring

NPSFM requirements & current state: Dissolved Oxygen Below Point Source

Table 9 – Dissolved oxygen

Value (and component)	Ecosystem health (Water Quality)	
Freshwater Body Type	Rivers (below point sources only)	
Attribute Unit	mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State	
	7-day mean minimum (Summer Period: 1 November to 30th April)	1-day mean minimum (Summer Period: 1 November to 30th April)
A No stress caused by low dissolved oxygen on any aquatic organisms that are present at matched reference (near-pristine) sites.	≥8.0	≥7.5
B Occasional minor stress on sensitive organisms caused by short periods (a few hours each day) of lower dissolved oxygen. Risk of reduced abundance of sensitive fish and macroinvertebrate species.	≥7.0 and <8.0	≥5.0 and <7.5
C Moderate stress on a number of aquatic organisms caused by dissolved oxygen levels exceeding preference levels for periods of several hours each day. Risk of sensitive fish and macroinvertebrate species being lost.	≥5.0 and <7.0	≥4.0 and <5.0
National Bottom Line	**5.0**	**4.0**
D Significant, persistent stress on a range of aquatic organisms caused by dissolved oxygen exceeding tolerance levels. Likelihood of local extinctions of keystone species and loss of ecological integrity.	<5.0	<4.0
The seven day mean minimum is the mean value of 7 consecutive daily minimum values. The one day mean minimum is the lowest daily minimum across the whole summer period.		

- Not monitored at present

2. Attribute monitoring

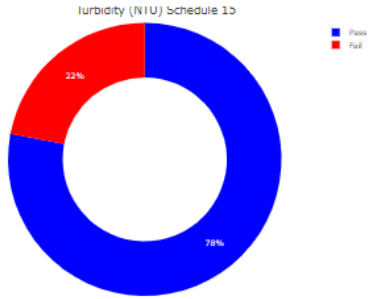
NPSFM requirements & current state:
Suspended fine sediment

Table 10 – Suspended fine sediment

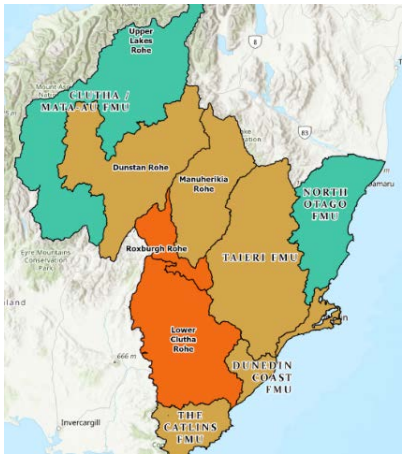
Value (and component)	Ecosystem Health (water quality)											
Freshwater Body Type	Rivers and streams											
Attribute Unit	Turbidity (FNU)											
Attribute band and description	Numeric attribute state by Suspended Sediment Class											
	1	2	3	4	5	6	7	8	9	10	11	12
A Minimal impact of suspended sediment on instream biota. Ecological communities are similar to those observed in natural reference conditions.	<2.0	<6.2	<1.3	<3.3	<7.5	<4.8	<2.3	<4.3	<1.2	<1.1	<1.1	<2.4
B Low to moderate impact of suspended sediment on instream biota. Abundance of sensitive fish species may be reduced.	<2.5	<7.9	<1.6	<3.9	<9.8	<6.3	<2.8	<5.2	<1.4	<1.3	<1.3	<2.7
C Moderate to high impact of suspended sediment on instream biota. Sensitive fish species may be lost.	<3.2	<10.5	<2.0	<4.8	<13.1	<8.3	<3.3	<6.4	<1.6	<1.5	<1.6	<3.1
National Bottom Line	**3.2**	**10.5**	**2.0**	**4.8**	**13.1**	**8.3**	**3.3**	**6.4**	**1.6**	**1.5**	**1.6**	**3.1**
D High impact of suspended sediment on instream biota. Ecological communities are significantly altered and sensitive fish and macroinvertebrate species are lost or at high risk of being lost.	>3.2	>10.5	>2.0	>4.8	>13.1	>8.3	>3.3	>6.4	>1.6	>1.5	>1.6	>3.1
The minimum record length for grading a site is two years of at least monthly samples (at least 24 samples). See Appendix 2C Tables 1 and 3 for the definition of each suspended sediment class and its River Environment Classification composition.												

Schedule 15

S 15 limits
5NTU (Gp 1 + 2)
3 NTU (Gp 3)



NPSFM



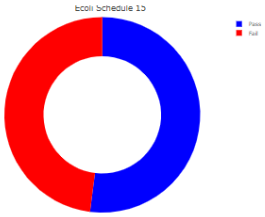
Turbidity by FNU and by suspended sediment class (based on REC)
Otago has sediment classes 3, 4, 7, 8, 9, 12,
Otago mainly in 3 and 9 which have the lowest turbidity limits

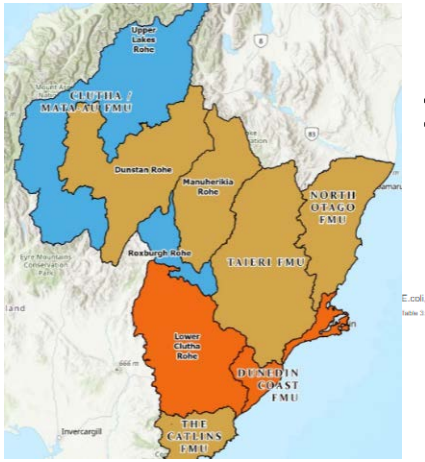
2. Attribute monitoring

NPSFM requirements & current state: E. Coli

Table 11 – *Escherichia coli* (*E. coli*)

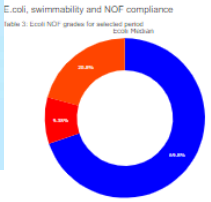
Value (and component)	Human contact (human health)			
Freshwater Body Type	Lakes and rivers			
Attribute	Escherichia coli (*E. coli*)			
Attribute Unit	*E. coli*/100 mL (number of *E. coli* per hundred millilitres)			
Attribute band and description	**Numeric Attribute State**			
Description of risk of Campylobacter infection (based on *E. coli* indicator)	% exceedances over 540 *E. coli*/100 mL	% exceedances over 260 *E. coli*/100 mL	Median concentration *E. coli*/100 mL	95th percentile of *E. coli*/100 mL
A (Blue) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 1%	<5%	<20%	≤130	≤540
B (Green) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 2%	5-10%	20-30%	≤130	≤1000
C (Yellow) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 3%	10-20%	20-34%	≤130	≤1200
D (Orange) 20-30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >3%	20-30%	>34%	>130	>1200
E (Red) For more than 30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >7%	>30%	>50%	>260	>1200



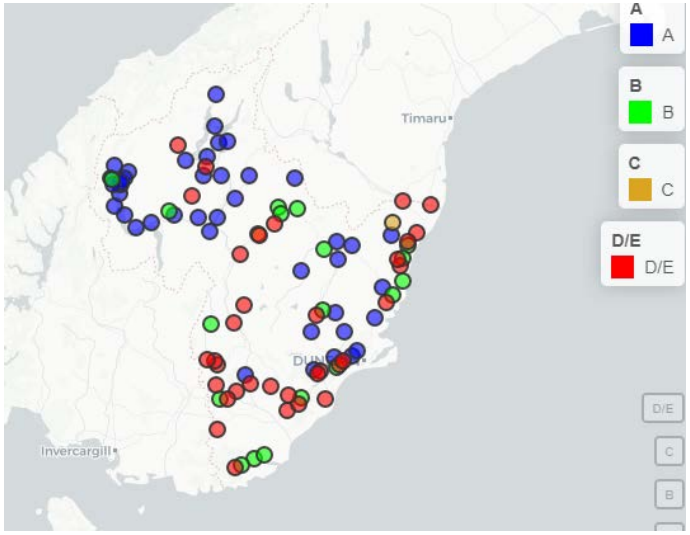


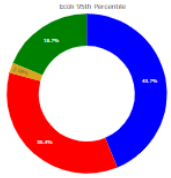
Schedule 15

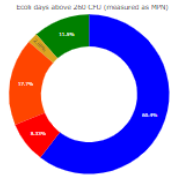
S15 Limits
260 MPN (Group1+2)
50 MPN (Group 3)

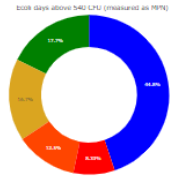


NPSFM









2. Attribute monitoring

NPSFM requirements & current state: E. Coli

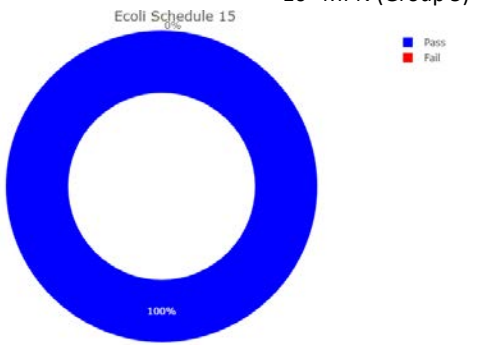
Lakes

Table 11 – *Escherichia coli* (*E. coli*)

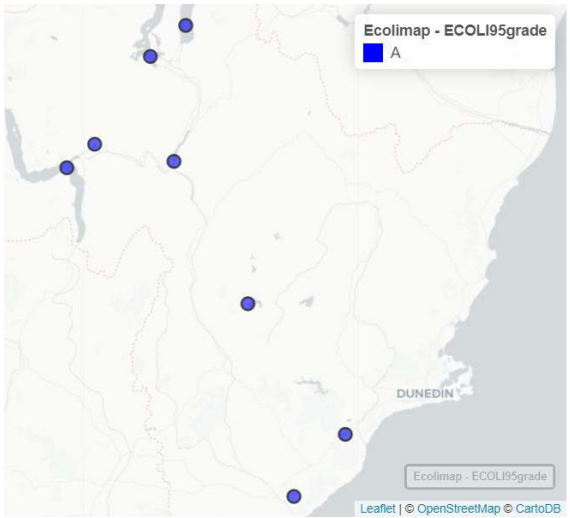
Value (and component)	Human contact (human health)			
Freshwater Body Type	Lakes and rivers			
Attribute	Escherichia coli (*E. coli*)			
Attribute Unit	*E. coli*/100 mL (number of *E. coli* per hundred millilitres)			
Attribute band and description	Numeric Attribute State			
Description of risk of Campylobacter infection (based on *E. coli* indicator)	% exceedances over 540 *E. coli*/100 mL	% exceedances over 260 *E. coli*/100 mL	Median concentration *E. coli*/100 mL	95th percentile of *E. coli*/100 mL
A (Blue) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 1%	<5%	<20%	≤130	≤540
B (Green) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 2%	5-10%	20-30%	≤130	≤1000
C (Yellow) For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 3%	10-20%	20-34%	≤130	≤1200
D (Orange) 20-30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >3%	20-30%	>34%	>130	>1200
E (Red) For more than 30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >7%	>30%	>50%	>260	>1200

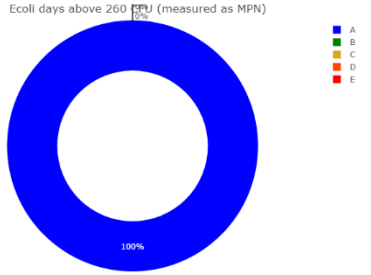
Schedule 15

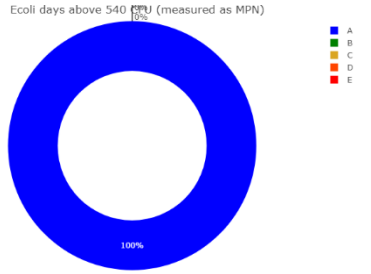
S15 Limits
126 MPN (Group 4)
10 MPN (Group 5)

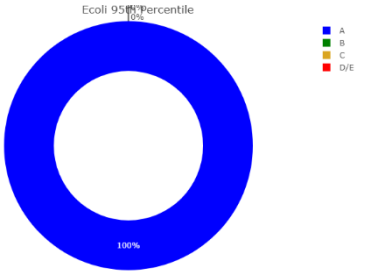


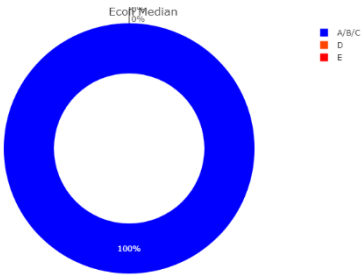
NPSFM









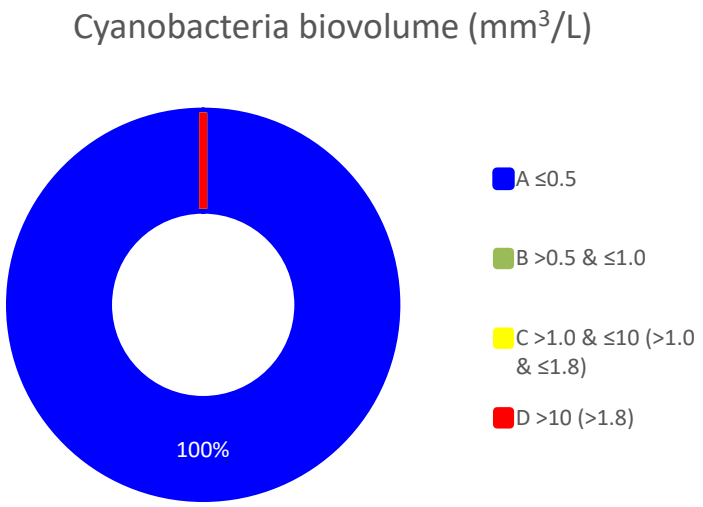


2. Attribute monitoring

NPSFM requirements & current state: Cyanobacteria (Planktonic)

Table 12 – Cyanobacteria (Planktonic)

Value (and component)	Human contact (human health)
Freshwater Body Type	Lakes and lake fed rivers
Attribute Unit	Biovolume - mm^3/L (cubic millimetres per litre)
Attribute band and description	**Numeric Attribute State**
	80th percentile
A (Blue) Risk exposure from cyanobacteria is no different to that in natural conditions (from any contact with freshwater).	≤0.5 mm^3/L biovolume equivalent for the combined total of all cyanobacteria
B (Green) Low risk of health effects from exposure to cyanobacteria (from any contact with freshwater).	>0.5 and ≤1.0 mm^3/L biovolume equivalent for the combined total of all cyanobacteria
C (Yellow) Moderate risk of health effects from exposure to cyanobacteria (from any contact with freshwater).	>1.0 and ≤1.8 mm^3/L biovolume equivalent of potentially toxic cyanobacteria OR >1.0 and ≤10 mm^3/L total biovolume of all cyanobacteria
National Bottom Line	**1.8 mm^3/L biovolume equivalent of potentially toxic cyanobacteria** **OR** **10 mm^3/L total biovolume of all cyanobacteria**
D (Orange/Red) High health risks (eg, respiratory, irritation and allergy symptoms) exist from exposure to cyanobacteria (from any contact with freshwater).	>1.8 mm^3/L biovolume equivalent of potentially toxic cyanobacteria OR >10 mm^3/L total biovolume of all cyanobacteria
The 80th percentile must be calculated using a minimum of 12 samples collected over 3 years. 30 samples collected over 3 years is recommended.	



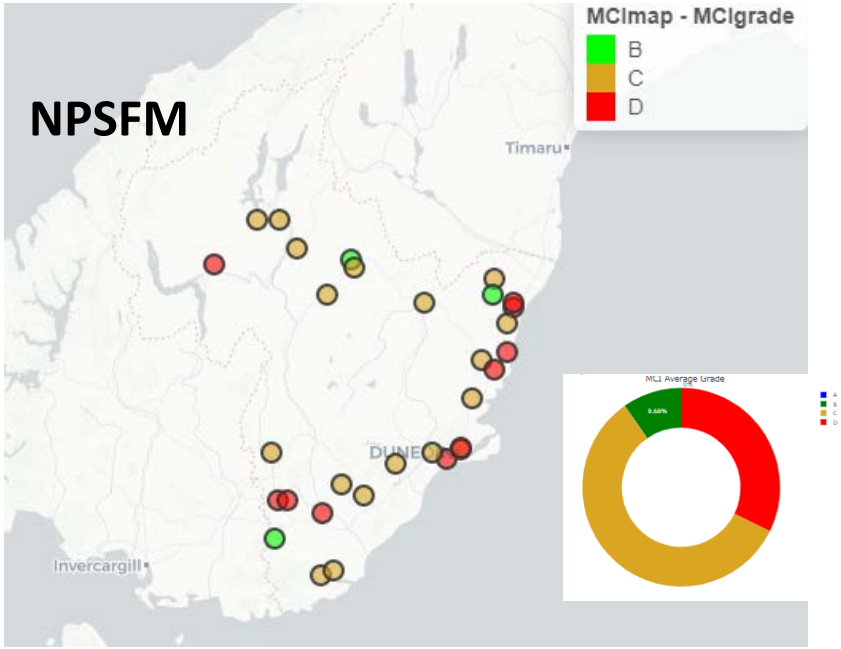
2. Attribute monitoring

NPSFM requirements & current state: Macroinvertebrates

Table 13 – Macroinvertebrates (1 of 2)

Value (and component)	Ecosystem health (aquatic life)	
Freshwater Body Type	Wadeable streams and rivers	
Attribute Unit	Macroinvertebrate Community Index (MCI) score; Quantitative Macroinvertebrate Community Index (QMCI) score	
Attribute band and description	Numeric Attribute States	
	QMCI	MCI
A Macroinvertebrate community, indicative of pristine conditions with almost no organic pollution or nutrient enrichment.	≥6.5	≥130
B Macroinvertebrate community indicative of mild organic pollution or nutrient enrichment. Largely composed of taxa sensitive to organic pollution/nutrient enrichment.	≥5.5 & <6.5	≥110 & <130
C Macroinvertebrate community indicative of moderate organic pollution or nutrient enrichment. There is a mix of taxa sensitive and insensitive to organic pollution/nutrient enrichment.	≥4.5 & <5.5	≥90 & <110
National Bottom Line	4.5	90
D Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.	<4.5	<90

Stark & Maxted 2004	Grade	NOF	NOF Grade
>119	Excellent	>130	A
100-120	Good	110-130	B
80-100	Fair	90-110	C
<80	Poor	90	NBL



Stark & Maxted (2004, 2007) quality class	Stark (1998) descriptions	MCI MCI-sb
Excellent	Clean water	> 119
Good	Doubtful quality or possible mild pollution	100–119
Fair	Probable moderate pollution	80–99
Poor	Probable severe pollution	< 80

2. Attribute monitoring

NPSFM requirements & current state: Macroinvertebrates

Table 14 – Macroinvertebrates (2 of 2)

Value (and component)	Ecosystem health (aquatic life)
Freshwater Body Type	Wadeable streams and rivers
Attribute Unit	Macroinvertebrate Average Score Per Metric (ASPM)
Attribute band and description	Numeric Attribute States ASPM score
A Macroinvertebrate communities have high ecological integrity, similar to that expected in reference conditions.	≥0.6
B Macroinvertebrate communities have mild-to-moderate loss of ecological integrity.	<0.6 & ≥0.4
C Macroinvertebrate communities have moderate-to-severe loss of ecological integrity.	<0.4 & ≥0.3
National Bottom Line	0.3
D Macroinvertebrate communities have severe loss of ecological integrity.	<0.3

- Not reported on historically
- Working on historic data to calculate these metrics.

2. Attribute monitoring

NPSFM requirements & current state
Fish Index of Biotic Integrity (F-IBI)

Table 15 – Fish (rivers)

Value (and component)	Ecosystem health (aquatic life)
Freshwater Body Type	Wadeable
Attribute Unit	Fish Index of Biotic Integrity (F-IBI)
Attribute band and description	Numeric Attribute State (Average)
A High integrity of fish community. Habitat and migratory access have minimal degradation.	≥34
B Moderate integrity of fish community. Habitat and/or migratory access are reduced and show some signs of stress.	<34 and ≥28
C Low integrity of fish community. Habitat and/or migratory access is considerably impairing and stressing the community.	<28 and ≥18
National Bottom Line	18
D Severe loss of fish community integrity. There is substantial loss of habitat and/or migratory access, causing a high level of stress on the community.	<18

- Some data available
  - Not in format to enable easy conversion to IBI
  - Currently reviewing network
  - More sites likely needed
- Concerns:
  - Works well on coastal sites (high diversity)
  - Central Otago problematic (no diversity)

2. Attribute monitoring

NPSFM requirements & current state

Submerged Plants (native and invasive)

Table 16 – Submerged plants (natives)

Value (and component)	Ecosystem health (Aquatic life)
Freshwater Body Type	Lakes
Attribute Unit	Lake Submerged Plant Indicators: Native Condition Index
Attribute band and description	Numeric Attribute State (% of maximum potential score)
A Excellent ecological condition. Native submerged plant communities are almost completely intact	>75%
B High ecological condition. Native submerged plant communities are largely intact	>50 & ≤75%
C Moderate ecological condition. Native submerged plant communities are moderately impacted	≥20 & ≤50%
National Bottom Line	20%
D Poor ecological condition. Native submerged plant communities are largely degraded or absent	<20%
Monitoring to be conducted at least once every three years, following the method described in Clayton J, and Edwards T. 2006. LakeSPI: A method for monitoring ecological condition in New Zealand lakes. User Manual Version 2. Hamilton, New Zealand: National Institute of Water & Atmospheric Research Ltd p57 Scores are reported as a percentage of maximum potential score (%) of the Native Condition Index, and lakes in a devegetated state receive scores of 0.	

Table 17 – Submerged plants (invasive species)

Value (and component)	Ecosystem health (aquatic life)
Freshwater Body Type	Lakes
Attribute Unit	Lake Submerged Plant (Invasive Impact Index)
Attribute band and description	Numeric Attribute State (% of maximum potential score)
A No invasive plants present in the lake. Native plant communities remain intact.	0%
B Invasive plants having only a minor impact on native vegetation. Invasive plants will be patchy in nature co-existing with native vegetation. Often major weed species not present or in early stages of invasion.	>1 & ≤25%
C Invasive plants having a moderate to high impact on native vegetation. Native plant communities likely displaced by invasive weed beds particularly in the 2 – 8 m depth range.	≥26 & ≤90%
National Bottom Line	90%
D Tall dense weed beds exclude native vegetation and dominate entire depth range of plant growth. Species concerned likely hornwort and Egeria.	>90%
Numeric attribute state to be calculated annually following the method described in Clayton J, and Edwards T. 2006. LakeSPI: A method for monitoring ecological condition in New Zealand lakes. User Manual Version 2. Hamilton, New Zealand: National Institute of Water & Atmospheric Research Ltd.	

Table 16 and 17 – not done historically.

2. Attribute monitoring

NPSFM requirements & current state

Deposited fine sediment

Table 18 – Deposited fine sediment

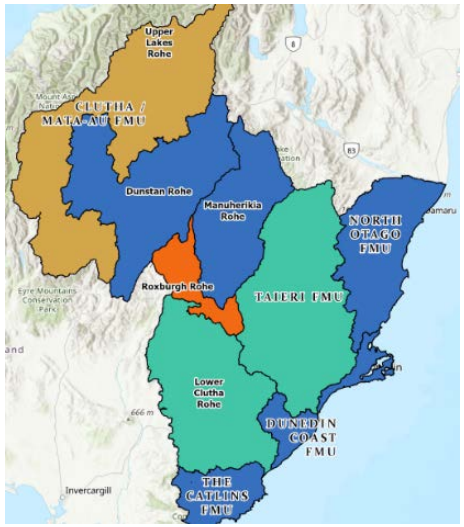
Value (and component)	Ecosystem Health (Physical Habitat)											
Freshwater Body Type	Wadeable Rivers and Streams											
Attribute Unit	% fine sediment cover											
Attribute band and description	Numeric attribute state by Deposited Sediment Class											
	1	2	3	4	5	6	7	8	9	10	11	12
A Minimal impact of deposited fine sediment on instream biota. Ecological communities are similar to those observed in natural reference conditions.	<84	<9	<42	<12	<80	<30	<41	<22	<48	<15	<76	<27
B Low to moderate impact of deposited fine sediment on instream biota. Abundance of sensitive macroinvertebrate species may be reduced.	<90	<15	<50	<17	<86	<38	<48	<33	<54	<22	<82	<36
C Moderate to high impact of deposited fine sediment on instream biota. Sensitive macroinvertebrate species may be lost.	≤97	≤21	≤60	≤23	≤92	≤46	≤56	≤45	≤61	≤29	≤89	≤45
National Bottom Line	97	21	60	23	92	46	56	45	61	29	89	45
D High impact of deposited fine sediment on instream biota. Ecological communities are significantly altered and sensitive fish and macroinvertebrate species are lost or at high risk of being lost.	>97	>21	>60	>23	>92	>46	>56	>45	>61	>29	>89	>45

The indicator score is percentage cover of the streambed in a run habitat determined by the instream visual method, SAM2, and the monitoring method is defined in p. 17-20 of 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.

The minimum record length for grading a site is 24 samples taken over 2 years of monthly monitoring, or longer for sites where flow conditions only permit monthly monitoring seasonally.

See Appendix 2C Tables 2 and 3 for the definition of each class' River Environment Classification composition.

NPSFM



- %DFS by deposited sediment class (based on REC)
- Otago has sediment classes 3, 6, 7, 10, 12,
- mainly in 10 and 12

2. Attribute monitoring

NPSFM requirements & current state

Dissolved Oxygen (7-day and 1-day minimum)

Table 19 – Dissolved oxygen

Value (and component)	Ecosystem health (Water Quality)	
Freshwater Body Type	Rivers	
Attribute Unit	mg/L (milligrams per litre)	
Attribute band and description	Numeric Attribute State	
	7-day mean minimum	1-day mean minimum
A No stress caused by low dissolved oxygen on any aquatic organisms that are present at matched reference (near-pristine) sites.	≥8.0	≥7.5
B Occasional minor stress on sensitive organisms caused by short periods (a few hours each day) of lower dissolved oxygen. Risk of reduced abundance of sensitive fish and macroinvertebrate species.	≥7.0 and <8.0	≥5.0 and <7.5
C Moderate stress on a number of aquatic organisms caused by dissolved oxygen levels exceeding preference levels for periods of several hours each day. Risk of sensitive fish and macroinvertebrate species being lost.	≥5.0 and <7.0	≥4.0 and <5.0
National Bottom Line	**5.0**	**4.0**
D Significant, persistent stress on a range of aquatic organisms caused by dissolved oxygen exceeding tolerance levels. Likelihood of local extinctions of keystone species and loss of ecological integrity.	<5.0	<4.0
Seven-day continuous dissolved oxygen monitoring to be collected at least once during summer (December to March inclusive). Objectives apply year-round.		

Not monitored

2. Attribute monitoring

NPSFM requirements & current state

Lake-bottom Dissolved Oxygen (annual minimum)

Table 20 – Lake-bottom dissolved oxygen

Value (and component)	Ecosystem Health (water quality)
Freshwater Body type	Lakes
Attribute Unit	mg/L (milligrams/litre)
Attribute band and description	Numeric attribute state
	Measured or estimated annual minimum
A No risk from bottom DO of biogeochemical conditions causing nutrient release from sediments.	≥7.5
B Minimal risk from bottom DO of biogeochemical conditions causing nutrient release from sediments.	≥2.0 and < 7.5
C Risk from bottom DO of biogeochemical conditions causing nutrient release from sediments.	≥0.5 and < 2.0
National Bottom line	0.5
D Likelihood from bottom DO of biogeochemical conditions resulting in nutrient release from sediments.	<0.5
To be measured less than 1m above sediment surface at the deepest part of the lake using either continuous monitoring sensors or discrete DO profiles.	

Not monitored

2. Attribute monitoring

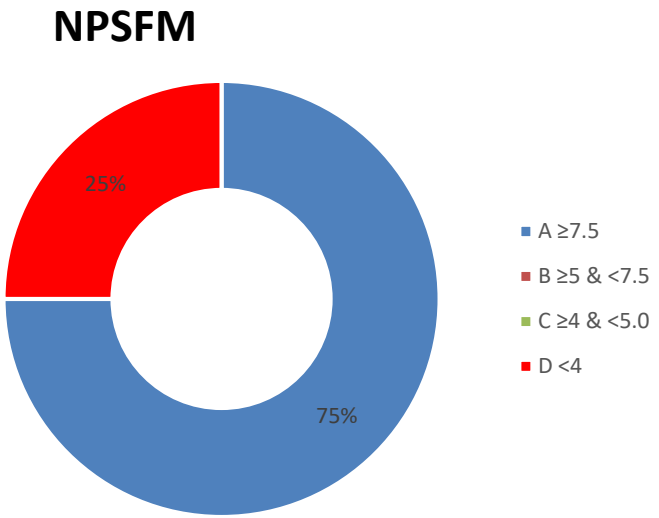
NPSFM requirements & current state

Mid-hypolimnetic dissolved oxygen (annual minimum)

Table 21 – Mid-hypolimnetic dissolved oxygen

Value (and component)	Ecosystem Health (water quality)
Freshwater Body type	Seasonally stratifying lakes
Attribute Unit	mg/L (milligrams/litre)
Attribute band and description	Numeric attribute state
	Measured or estimated annual minimum
A No stress caused to any fish species by low dissolved oxygen.	≥7.5
B Minor stress on sensitive fish seeking thermal refuge in the hypolimnion. Minor risk of reduced abundance of sensitive fish and macro-invertebrate species.	≥ 5.0 & <7.5
C Moderate stress on sensitive fish seeking thermal refuge in the hypolimnion. Risk of sensitive fish species being lost.	≥ 4.0 & <5 .0
National Bottom line	4.0
D Significant stress on a range of fish species seeking thermal refuge in the hypolimnion. Likelihood of local extinctions of fish species and loss of ecological integrity.	< 4.0
Numeric attribute state to be measured using either continuous monitoring sensors or discrete DO profiles.	

- 4 lakes monitored



2. Attribute monitoring

NPSFM requirements & current state

Ecosystem metabolism

Table 22 – Ecosystem metabolism

Value (and component)	Ecosystem health (ecosystem processes)
Freshwater Body Type	Rivers
Attribute	Ecosystem metabolism (Both Gross Primary Production and Ecosystem Respiration)
Attribute Unit	g O_2 m^{-2} d^{-1} (grams of dissolved oxygen per square metre per day)

Derived from at least seven days of continuous dissolved oxygen monitoring to be collected at least once during summer (December to March inclusive), using the method of Young RG, Clapcott JE, Simon K 2016. Ecosystem functions and stream health. Advances in New Zealand Freshwater Science. NZ Freshwater Sciences Society, NZ Hydrological Society.

Councils are to monitor, and develop an action plan to respond to deteriorating trends.

- Not monitored - should tie in with Table 19 (some sites programmed for this summer)
- Emerging field with strong scientific support
- 7-day monitoring will not provide a reliable dataset over a short-timeframe, must be continuous over the full year
- Extra resource required

2. Attribute monitoring

NPSFM requirements & current state
E. Coli (primary contact sites)

Table 23 – *Escherichia coli (E. coli)* (primary contact sites)

Value (and component)	Human contact (recreation)
Freshwater Body Type	Primary contact sites in lakes and rivers (during the bathing season)
Attribute Unit	95th percentile of *E. coli*/100 ml (number of *E. coli* per hundred millilitres)
Attribute Band and description	**Numeric Attribute State**
Excellent Estimated risk of Campylobacter infection has a < 0.1% occurrence, 95% of the time	≤ 130
Good Estimated risk of Campylobacter infection has a 0.1 – 1.0% occurrence, 95% of the time	131 - 260
Fair Estimated risk of Campylobacter infection has a 1 – 5% occurrence, 95% of the time	261 – 540
National bottom line	540
Poor Estimated risk of Campylobacter infection has a > 5% occurrence, at least 5% of the time	> 540
The narrative attribute state description assumes "% of time" equals "% of samples"	

- Makes contact recreation monitoring compulsory (was a guideline)
- An additional 'A grade' of ≤130
  - Most sites would not achieve this grade over 3 years of monitoring as a 95th percentile
- Additional month of monitoring (extra resource required)