Manaaki Whenua
Landcare Research

Potential reporting commonality of regional council data collected for soil conservation, riparian protection, and Farm Environmental Plans

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Potential reporting commonality of regional council data collected for soil conservation, riparian protection, and Farm Environmental Plans

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List of Abbreviations

AP	Agroforestry Plan
Arable FEP	Arable Cropping Farm Environment Plan
BLNZ	Beef+Lamb New Zealand
BoP	Bay of Plenty
BP	Biodiversity Plan
CFP	Comprehensive Farm Plan
DFP	Dairy Farm Plans
DNZ SMP	DairyNZ Sustainable Milk Plan
ECan	Environment Canterbury
EFP	Environmental Farm Plan
EPA	Environmental Programme Agreement
FAFP	Focus Activity Farm Plan
FAR	Foundation for Arable Research
FEMP	Farm Environmental Management Plans
FEP	Farm Environment Plans
FFEP	Fonterra Farm Environment Plan
FP	Farm Plan
FWQIP	Farm Water Quality Improvement Plan
GHG	Green House Gases
GIS	Geographic Information System
HCFP	Hill country farm plans
Int. FEP	Intensive Farming Farm Environment Plan
KHCEP	Kaipara Hill Country Erosion Plan
LAWA	Land, Air, Water Aotearoa
LMF	Land Monitoring Forum
LMG	Land Managers Group
LMO	Land Management Officer
LO3A	Land Overlay 3A
LUC	Land Use Capability
MS	Microsoft
NMP	Nutrient Management Plan
PC	Personal computer
RERE	Rere Water Quality Enhancement
RMP	Riparian Management Plan
SBD	Sheep, beef, deer farming
SC	Soil conservation
SHCWP	Sustainable Hill Country Works Plan
SHP	Soil Health Plans
SLUI	Sustainable Land Use Initiative
WFP	Whole Farm Plan
SoE	State of the Environment
TDC	Tasman District Council
TRC	Taranaki Regional Council
W&L Plan	Water and Land Plan
WCS	Whanganui Catchment Strategy
WMZ	Water Management Zone
WQ	Water Quality
WRC	Waikato Regional Council

Summary

Project and Client

Horizons Regional Council, on behalf of the Land Monitoring Forum (LMF) and the Land Managers Group (LMG), have contracted Landcare Research to undertake a survey of New Zealand regional authorities, to establish what types of information and data they hold on *soil conservation*, *riparian protection*, and *Farm Environmental Plans* (FEPs). The project is funded by Envirolink.

Objectives

- Identify the types of information and data that NZ's 16 regional authorities collect regarding their soil conservation, riparian protection, and FEP programmes.
- Provide commentary on the collective ability of regional authorities to report – in a national indicator sense – on the state of soil conservation, riparian protection, and FEP progress in NZ.

Methods

Three separately themed questionnaires (soil conservation, riparian protection, and FEPs) were designed as PDF forms. The questionnaires were sent to key council representatives from each of NZ's 16 regional authorities. Responses are collated and discussed by survey question. Detailed conclusions are provided within the report, while the key overarching conclusions are made at the end of the report.

Results

- Fifteen regional authorities responded to the survey, returning a total of 45 questionnaires from a potential total of 48. West Coast did not respond.
- Of the 15 councils, 13 have riparian programmes; 10 have soil conservation programmes; and 11 councils have one or more FEP programmes (a further 4 have used FEPs in the recent past).
- The greater majority of councils with programmes record a range of data that are suitable for developing indicators across all environmental programme types. There is, however, considerable variation between councils.
- Data accessibility is also variable between councils and programmes. A small number of councils have advanced centralised systems to record data from all programmes. The other end of the spectrum is characterised by hardcopy-based systems and/or individual files or datasets managed project-by-project by individual Land Management Officers. Most councils sit somewhere between these extremes.
- Few councils monitor environmental outcomes that can be directly attributed back to riparian protection or soil conservation activities.

Conclusions

- We conclude that sufficient opportunity exists for regional authorities to report collectively on indicators describing the state and progress of riparian protection, soil conservation, and FEPs.
- A small number of councils are not in a position to easily contribute because either data are not in readily accessible forms, or will require an internal manual compilation exercise before they can contribute.
- Data for indicator development sourced from multiple councils will likely have differences in definition, quality, and completeness.

Recommendations

- We propose a set of indicators for consideration (Table A). These are all response type indictors that provide evidence that work is being done towards environmental improvement. Several councils already report these indicators (i.e. they are already useful), and we regard them as the least onerous for those councils with data in the least accessible forms.

Table A: Recommended indicators

Riparian protection	Soil conservation	Farm Environmental Plans (FEPs)
Number of riparian protection initiatives (as jobs or sites).	Number of soil conservation poles planted.	Targeted coverage of FEPs (number or area).
Number of riparian plans prepared.	Number of soil conservation plans prepared.	Number of FEPs prepared.
Number of riparian protection grants allocated.	Length of fencing installed for soil conservation.	Number of FEPs by type.
Net value of riparian protection grants allocated.	Area of land treated for soil conservation.	Number of active FEPs.
Length of riparian fencing installed.	Area of forestry established for soil conservation.	FEP coverage (area of land under FEPs).
Number of riparian trees or shrubs planted.	Area of land retired from grazing (for soil conservation).	
Length of waterway with riparian protection.	Number of soil conservation grants allocated.	
	Net value of soil conservation grants allocated.	

- Provide advice on data management systems to councils who are currently developing, or looking to develop, systems to better manage environment programme data. Good examples exist, and it is in the best interests of all councils to have data management systems that promote council-to-council interoperability.
- Undertake a standardisation exercise to ensure council-to-council consistency with data provided for indicator development. A National Environmental Monitoring Standard (NEMS) for each indicator group is recommended.
- Consider the development of generic national targets for environmental programmes. Targets provide important benchmarks for gauging progress, but targets currently used by councils have little value for national comparison.
- Consider the inclusion of non-council initiatives especially those involving riparian protection, land retirement, and FEPs. Alternatively, explicitly qualify any reporting as pertaining to regional authorities only.

1 Introduction

Regional authorities are responsible for promoting the sustainable management of resources while avoiding, remedying, or mitigating any adverse effects on the environment. Towards this end, councils have various programmes and tools that are used to promote environmental improvement with those who manage natural resources such as land and water.

Council environmental programmes are generally monitored, both for accounting purposes to support ongoing rate-payer or tax-payer investment, and for performance reasons to track if policy targets and ambitions are on-track and being achieved. Monitoring produces data (environmental programme monitoring data) of a type and standard tuned to an individual council's requirements.

Environmental programmes differ widely between councils. This arises primarily from the depth of autonomy afforded under both the Resource Management Act (1991) and the Local Government Act (2002), which allows councils to largely self-determine how best to accommodate council-by-council differences in financing, environmental issues, and community priorities. A side effect is diversity in the type and character of environmental programmes provided, and differences in how programmes are monitored and how the monitoring-data are collected, managed, and stored.

Council monitoring data have considerable potential to contribute toward more accurate and efficient national reporting initiatives, such as State of the Environment (SoE) reporting, Environmental Monitoring and Reporting (EMaR) initiatives (Jones et al., 2015) and Land, Air, Water Aotearoa (LAWA) monitoring. This is a laudable proposition, but one currently constrained by a lack of knowledge regarding the type of programmes provided by different councils, and uncertainty around the potential for data assembly and integration to a single national standard.

This report describes an investigation commissioned by the Land Monitoring Forum (LMF) and the Land Managers Group (LMG), to examine the national reporting potential of the three most common types of environmental programme:

1 Riparian protection programmes.
2 Soil conservation programmes.
3 Farm Environmental Plan (FEP) programmes.

2 Objectives

The project aims to identify the types of information and data that NZ's 16 regional authorities collect regarding their soil conservation, riparian protection, and FEP programmes and initiatives. Overall purpose is to determine if councils are currently in a position to report collectively on these three activities in a national sense. If this is not currently possible, then it is important to establish what is needed to improve the potential for collective reporting in the future.

3 Methods

3.1 Questionnaire design

Three separately themed questionnaires were prepared (riparian protection, soil conservation, FEPs), to accommodate situations where responses from more than one individual within a council may be appropriate (i.e. the three activities could be managed by different teams or different people within some councils).

Each questionnaire was designed as a PDF form. Base questions were prepared in Microsoft Word, and then converted to PDF forms using Adobe Acrobat X (10.1.14). Two form versions were produced – an editable version of each questionnaire that could only be modified in Acrobat, and a distribution version that has editing functionality removed but 'fillable PDF form' functionality embedded so user responses can be added and saved from any PDF viewer.

PDF forms are versatile in that they can be filled in on-line, off-line, or printed off as hardcopies and filled in manually. Likewise, forms can be quick to fill out through the use of pre-populated options and drop down boxes. Multiple responses can also be quickly collated into a database or spreadsheet.

Total number of questions per questionnaire ranged from 11 to 21, and included a mixture of yes/no, dropdown, and tick box type questions. Almost all questions had the additional option for providing comments, and space was available at the end of each questionnaire to give respondents the option of making more detailed replies if required. The three questionnaires are appended to this report.

3.2 Questionnaire iteration and testing

Each questionnaire underwent several iterations to discard 'interesting but non-essential' questions, and to minimise repetition between questionnaires. FEPs, in particular, can include both soil conservation and riparian components. Different stages of Word questions and PDF forms were distributed for comment and feedback among both LMF and LMG members, and a penultimate set of versions was sent to key LMF members for final checks (riparian and soil conservation as PDF forms, and FEP questions in Word form as final edits were necessary).

Questions were reviewed by Landcare editors, and form integrity was extensively checked in editable version mode. Compatibility with different brands of PDF viewers was checked in distribution version mode. Despite these checks, an unresolved bug was created when the conversion was made to the distribution versions, whereby some radio buttons (yes/no type checkboxes) became linked between questions when they should have remained independent. Fortunately, most respondents were able to accommodate this bug by signalling responses via comments boxes, or resorting to hard-copy responses.

3.3 Survey implementation

The survey was implemented on 7 August 2017 and ran until 25 August 2017 (18 days). Questionnaires were firstly emailed to LMF and LMG council representatives, who were encouraged either to fill in the questionnaires themselves, or to distribute to the most appropriate person or persons within their respective councils. Follow up reminders were made on the 14th and 23rd of August 2017.

4 Response rate

Fifteen of the 16 regional authorities responded to the survey, returning a total of 45 questionnaires from a potential total of 48. This equates to a survey success rate of 94%. West Coast RC was not able to respond within the targeted return period. Two councils made slightly late returns (Fig. 1).

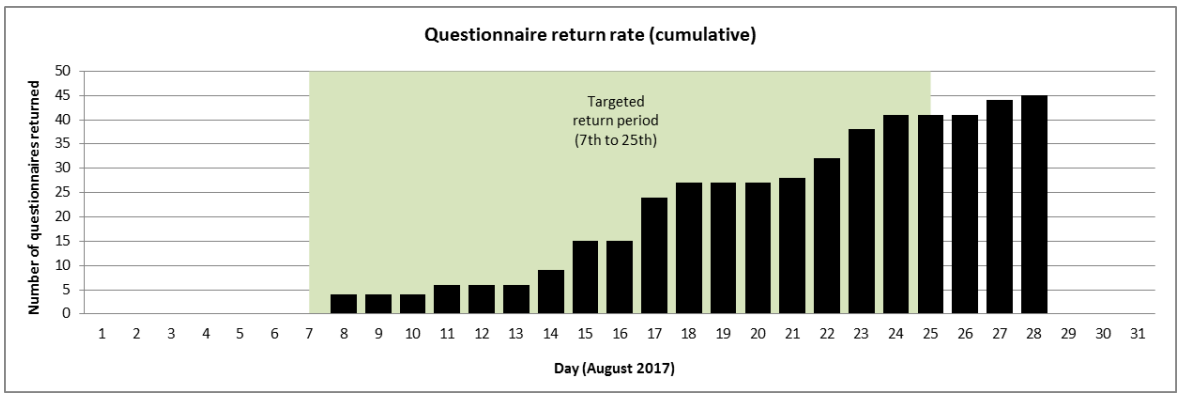

Figure 1 Questionnaire return rate. Maximum potential number of returns is 48 (3 questionnaires per council x 16 councils).

5 Results –- Riparian

5.1 Extent and focus of riparian practice

Fourteen regional authorities either undertake or assist with riparian protection activities (Table 1). West Coast did not respond. Otago RC indicated that while they may occasionally support riparian planting initiatives, they have no specific riparian programme or active policy in place at this time. Southland support riparian initiatives through other mechanisms or programmes. Eight respondents indicated that their councils have more than one riparian or riparian-related initiative.

Councils vary widely regarding the focus and availability of riparian activities and services between regions. For the 23 riparian programmes listed (Table 1), 8 are interpreted as being focused on specific catchments, 5 are focused on specific land types or land uses, and 10 are available on a region-wide basis although they may include an element of prioritisation for particular areas, catchments, land uses, or land management activities.

Table 1 Riparian programmes and their focus by regional authority

Council	Available?	Programme name(s)	Programme focus and notes
Auckland	✓	Waterway Protection Fund	Specific catchments rather than specific land uses. Currently includes: Lower Kaipara, Hoteo, Wairoa, Henderson, and Papakura.
		Rodney Local Board Healthy Harbours Waterway Fund	Targets former Rodney District area, with special focus on specific catchments or partnership projects (e.g. Fonterra).
Bay of Plenty	✓	Environmental Programmes	Prioritise all land uses except those less common to BoP (e.g. arable, cropping).
		Advisory service	Prioritise all land uses except those less common to BoP (e.g. arable, cropping).
Canterbury	✓	Immediate Steps and Canterbury Biodiversity Strategy	Specific freshwater and water-use affected ecosystems rather than specific land uses.
Gisborne	✓	Gully erosion protection (land overlay 3a - worst eroding land)	Focus on SBD[2] as it relates to erosion-prone land (Overlay 3a). New plan will shift focus to dairy and cropping uses.
		Wharekopae water quality improvement project	Confined to the Wharekopae Catchment.
Hawke's Bay	✓	Riparian Plant Programme (RPP)	No specific land use targeted, but mostly SBD[2] and some dairy farms. Programme available region wide, but priority given to Tukituki catchment.
		Regional Landcare Scheme (RLS)	Available region wide to properties >6ha, but with (current) priority given to the Tukituki catchment.
Manawatu-Wanganui	✓	Manawatu River Accord	Specific to the Manawatu catchment, prioritising dairy, lowland SBD[2], and urban over arable and hill SBD.
		Regional programme	Emphasis on dairy and lowland SBD[2], followed by other land uses. Focus catchments include: Manganui o te Ao river, Hautapu river, Mowhanau stream, Awarua stream, Kaitoke stream, Waiwiri stream, Ohau river, Waikawa river, Coastal Rangitkei, Makotuku stream, Porewa stream, and Lake Horowhenua.
Marlborough	✓	Significant Natural Area Protection	Available region wide where SNAs have been identified. Independent of land use.
Nelson	✓	Provision of fencing	All relevant landowners. Fencing support only available to rural landowners.
		Wakapuaka catchment	All land uses including forestry, in partnership with Landcare Trust, Iwi, and forestry interests. Confined to Wakapuaka catchment.
Northland	✓	Farm Water Quality Improvement Plans	First priority is lowland SBD[2] followed by hill SBD. Dairy specifically targeted from 2012-2015, but still receives some assistance.
Otago	✗[1]	-	-
Southland	✗[1]	General programme via Land Sustainability Officers	Includes dairy, lowland SBD[2], hill SBD[2], and cropping (especially where it applies to intensive winter grazing of e.g. fodder crops).
		Focus Activity Farm Plans	Available region wide to pastoral farms and cropping (especially intensive grazing of winter crops) where a *focus activity farm plan* has been completed.
Taranaki	✓	Transforming Taranaki	First priority is dairy followed by lowland SBD[2]. Targeted the Taranaki ring-plain and coastal terraces, and may include some frontal hill country.
Tasman	✓	Riparian Land Management Strategy	Priority is given firstly to dairy and lowland SBD[2], followed by hill SBD[2].
Waikato	✓	Component of the Catchment Management Programme	Focus on pastoral uses (dairy, SBD[2]) but accommodates other land uses on a case-by-case basis. Specific streams and catchments are prioritised.
		River Management Programme	Available to all land uses, with a specific focus on bank stability and channel capacity in additional environmental outcomes (i.e. more issue focused). Specific streams and catchments are prioritised.
Wellington	✓	Riparian Programme (Stock Exclusion)	Targets stock exclusion from Category 1 and 2 streams identified in the regional plan. First priority is dairy and lowland SBD, followed by hill SBD[2].
		Farm and Environment Plan Contestable Fund	Targets intensive land use throughout the region (dairy, lowland SBD[2], and arable, then hill SBD[2]and intensive cropping).
West Coast	-	-	-

[1] Whereas a council may have no dedicated riparian programme, they will generally support riparian activities through other council and non-council programmes.

[2] Sheep, beef, and deer farming (SBD).

5.2 Types of services and activities available within riparian programmes

Respondents were asked to indicate types of services available through their council's riparian programmes. The purpose is to provide insight into the types of data that could be available in cases where councils may have limited recording or monitoring. Services and grant-rates differ between programmes and councils (Table 2) although several common themes are apparent. Grant systems can be complicated and many respondents explained them with detailed comments (included as Appendix 1).

Table 2 Types of services and grant rates associated with council riparian programmes

	Services available					Grants available (% of total cost)					
	Design and planning	Materials - plants	Planting (contractor)	Materials – fencing	Fencing (contractor)	Design and planning	Materials - plants	Planting (contractor)	Materials – fencing	Fencing (contractor)	Other services and grants (grant rate in parentheses)
Auckland 1		✓	✓	✓	✓		50	50	50	50	
Auckland 2		✓	✓	✓	✓		50	50	50	50	
Bay of Plenty 1	✓	✓	✓	✓	✓	50	50	50	50	50	Alternative water supply ($/trough), pest plant control (50), stream bank erosion (50), landowner labour ($/hr), culverts (50), willow/poplar poles (50)
Bay of Plenty 2	?	?	?	?	?						
Canterbury	✓	✓	✓	✓	✓						Pest animal control, weed control, and native fish passage
Gisborne 1	✓					100					
Gisborne 2		✓	✓	✓	✓		75	75	75	75	
Hawke's Bay 1		✓									
Hawke's Bay 2	✓	✓	✓	✓	✓						
Manawatu-Wanganui 1		✓	✓	✓	✓		50	50	50	50	Fish passes (100), education, community projects
Manawatu-Wanganui 2	✓	✓	✓	✓	✓	50	50	50	50	50	Fish passes (100), education, community projects
Marlborough	✓	✓	✓	✓	✓	50	50	50	50	50	
Nelson 1		✓		✓	✓		100		50	50	
Nelson 2		✓	✓	✓	✓						Advice
Northland		✓		✓			50		100		
Otago	-	-	-	-	-	-	-	-	-	-	
Southland 1	?	?	?	?	?						
Southland 2	✓	✓	✓	✓	✓	50	50	50	50	50	
Taranaki	✓	✓	✓			100					Ongoing advice (100)
Tasman		✓		✓			100		100		
Waikato 1	✓	✓	✓	✓	✓	100	35	35	35	35	Weed control (35)
Waikato 2	✓	✓	✓	✓	✓	50	50	50	50	50	Erosion control works, channel training etc (50)
Wellington 1	✓	✓	✓	✓	✓	100	30	30	50	50	
Wellington 2	?	?	?	?	?						
West Coast	-	-	-	-	-	-	-	-	-	-	

? = Respondent indicated a riparian programme but detail was expressed as a comment and could not be reported in the table above.

The provision of riparian services and grant support is variable between programmes and councils (Figs 2 and 3). Design and planning services appear to be least prevalent (available in 55% of programmes; 67% of councils), while the supply of riparian plants appears to be consistently high in terms of services (95% of programmes and 93% of councils provide support).

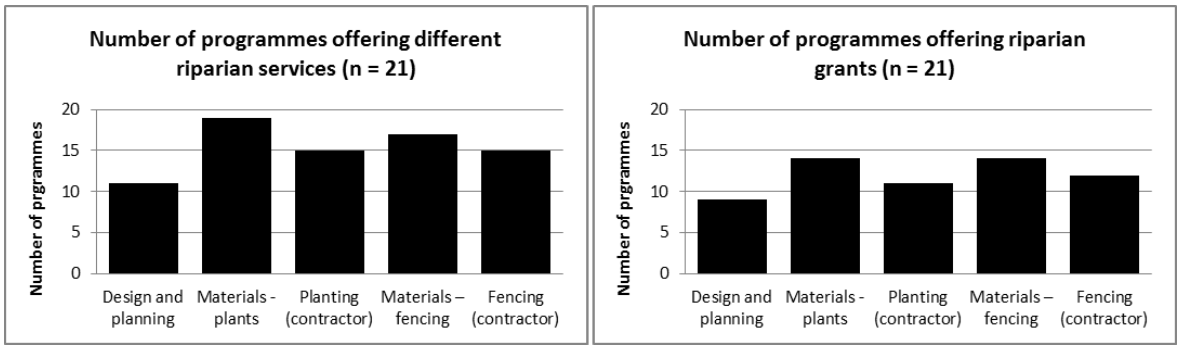

Figure 2 Number of riparian programmes offering different services and grants (useable number of responses was 21 of a possible 25).

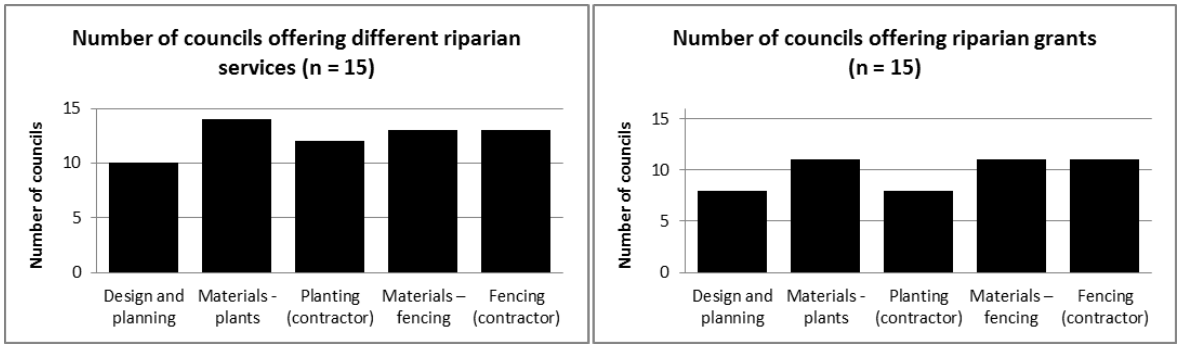

Figure 3 Number of councils offering different services and grants (useable number of responses was 15 of a possible 16).

5.3 Riparian protection targets

Ten of the 15 councils who responded indicated that they have targets for riparian protection (Table 3), or are about to have new targets when new plans become operative. Some targets are concise and straightforward (e.g. Wellington, Taranaki), while others are less well defined, and those embedded in plan rules and policies tend to be comprehensive.

Table 3 Riparian targets specified by council

Council	Riparian targets specified
Auckland	LTP measure: Length of waterways (kms) protected annually with riparian planting and/or fencing [currently under review].
Bay of Plenty	10 km of fencing per year in the Eastern Catchments and 10 km in the Rangitaiki Catchment, for the coming financial year. We do achieve some securing of waterways/waterbodies through our Environment Programmes for biodiversity as well.
Canterbury	These can be found in the Canterbury Water Management Strategy and Canterbury Biodiversity Strategy, and in the Canterbury Land and Water Regional Plan (and other regional river plans). See https //apps canterburymaps govt nz/S()r/Biodiversity html for information about these targets and reporting
Gisborne	No targets specified.
Hawke's Bay	Protect 5 km of riparian margins in the priority catchments within the Tukituki catchment.
Manawatu-Wanganui	e.g. 45 km of stream fencing in the Manawatu Catchment for 16–17 (= 25 km of stream). Other catchments do not have annual plan targets.
Marlborough	No targets specified.
Nelson	No targets specified.
Northland	These rules are proposed in the new regional plan: All natural wetland and lakes excluded from dairy cows, pigs, beef cattle, dairy support cattle and deer by 2021? (when new plan becomes operative). All permanently flowing drains, rivers and streams excluded from dairy cows and pigs by 2021? (when the new plan becomes operative, or 3 years after the new plan becomes operative for permanent drains <1m wide and 30 cm deep). All permanently flowing rivers and streams in lowland areas excluded from beef cattle, dairy support cattle and deer by 2026? (5 years after the new plan becomes operative, or 10 years after the new plan becomes operative for permanent drains <1 m wide and 30 cm deep). No exclusion for hill country areas.
Otago	No targets specified.
Southland	See Rule 70 http://www.es.govt.nz/Document%20Library/Consultations/2016/Proposed%20Southland%20Water%20and%20Land%20Plan/Supporting%20Documents/9%20-%20proposed%20Southland%20Water%20and%20Land%20Plan%20Part%20A.pdf
Taranaki	All waterways including regionally significant wetlands fenced and planted by 2020.
Tasman	No targets specified.
Waikato	90% of funded works undertaken in priority catchments/locations. Although we are working towards full coverage of our priority catchments – Targets like these and number of pole/plants or length of fence are indicative and provide direction rather than an absolute.
Wellington	All Category 1 streams will have stock excluded by June 2018, Category 2 by June 2022.
West Coast	-

5.4 Councils with riparian targets captured in GIS form

For the 15 councils, 7 indicated that they had riparian targets recorded in GIS form (Table 4). Five councils are in a position to report *the mapped extent of catchments targeted for riparian protection*. At least 6 councils indicated they have detailed GIS representation of targeted riparian features or works (e.g. fence lines, wetlands, project sites, culverts). However, the ability to use these data for reporting may be limited by completeness and availability depending on council. Often these types of data are project-specific, and stored by individual users rather than being part of a central dataset.

Table 4 Councils who record riparian targets using GIS

Council	GIS data type (for riparian targets)					Notes	Central dataset?	GIS coverage
	Catchments (as polygons)	Farms (as polygons)	Works areas (as polygons)	Points	Lines			
Bay of Plenty	✓		✓		✓	Fences recorded as lines		Region-wide mapping of works programmes. Many catchments also have ground truth data identifying what is fenced and what is not, but not all catchments.
Canterbury	✓	✓	✓	✓	✓	Project sites as points. Braided rivers as lines.	No. Recorded in specific GIS files and layers depending on the topic/ domain and purpose of use.	The Canterbury region, its catchments; the coastal marine environment GIS files are extensive – See Canterbury Maps for details/ inventory https://canterburymaps.govt.nz/
Manawatu-Wanganui	✓						Yes (as targeted catchments).	Work gets done in all the catchments, but can you can look up the target catchments in the WMZ shp.
Northland			✓		✓	Lines representing proposed and recommended fencing works		Raw GIS data is reported on when required.
Taranaki	✓	✓	✓	✓	✓	Bridges and culverts recorded as points. Polys for wetlands, lines for waterways. Eventually will get riparian margins encapsulated by polys.		98.8 % of dairy farms have plans; the majority of the target area has plans.
Waikato	✓		✓				Multiple datasets by management zone.	Approximately 20–30%.
Wellington			✓					100% of the region.

We can only infer a limited understanding of council datasets through a broad scope survey. More focused investigations are required to elicit the full indicator potential (e.g. see Basher et al., 2016). We are, however, confident that a small number of councils will have well-developed GIS systems, while others will be in the process of developing their systems. Taranaki, Bay of Plenty, and Waikato – in particular – appear to maintain well-developed riparian GIS datasets, while others are developing/growing.

Of the 8 councils who do not have targets in GIS form, only Auckland indicated the use of a non-GIS system for managing targets (MS Excel spreadsheet).

5.5 Planned riparian works for individual farms

Six councils prepare works plans for individual farms. Five councils have access to works plans prepared by 3rd party interests. Overall, nine councils have access to works plans for individual farms irrespective of source (Table 5). The remainder (6 councils) generally cite either limited access due to reasons of farmer privacy (Hawkes Bay), or limited access due to small numbers of works plans being prepared.

Table 5 Availability of planned riparian works for individual farms

	Riparian works plans			Notes
	Prepared by council	Prepared by 3rd party but we have access	Other	
Auckland			✓	Council has access to those plans submitted as part of a grant application.
Bay of Plenty	✓			
Canterbury		✓		
Gisborne		✓		
Hawke's Bay			✓	No. Riparian work plans are a requirement of the farm environment management plans (FEMP) in the Tukituki – as these are done by third party (providers) we may not be able to access this.
Manawatu-Wanganui		✓	✓	The team mostly does not do or view riparian management plans, but have helped farmers do a few of their own, and encouraged them to use the dairy NZ planner.
Marlborough			✓	(no comment on council's situation or approach).
Nelson			✓	Limited extent of FP. Currently working through 2 riparian plans likely to be part of this work.
Northland	✓			We don't prepare specific riparian work plans other than identify areas which are 'planted'. No record of plant types or numbers but fencing operations are proposed and recommended on a farm by farm basis.
Otago	-	-	-	
Southland	✓			Yes, as per the Focus Activity Farm Plans – relatively limited, and excludes land in LUC classes 5–8.
Taranaki	✓			
Tasman			✓	We do not currently provide resources for riparian work plans. We are developing a catchment officer role that will take on this responsibility.
Waikato	✓	✓		Where provided we have access to third party prepared plans.
Wellington	✓	✓		Regional Council or the landowner.
West Coast	-	-	-	

5.6 Riparian planning tools

Five councils indicated they used the DairyNZ Riparian Planner (Auckland, Hawkes Bay, Manawatu-Wanganui, Tasman, and Wellington), while one council uses the NIWA Focus tool (Auckland). Bay of Plenty and Waikato also offered that they draw heavy on previous experience, landowner discussions, and expertise to help design riparian protection.

5.7 Systems used to record planned works

Respondents were invited to indicate the types of systems used to record planned riparian works. Responses were variable, so are summarised by individual council (Table 6).

Table 6 Systems used by regional authorities to record planned riparian works

Council	Recording system(s) for planned works
Auckland	100% of planned works are recorded using digital documents (e.g. Word files) and/or spreadsheets.
Bay of Plenty	Planned works are available in all listed formats. Hard copy records date back to pre-1991. Digital documents are more numerous post-1991. Individual LMOs develop and hold farm GIS files, which migrate to a central GIS layer when a plan is drafted. The centralised GIS database should contain most, if not all riparian plans, accumulated over a long period of time. However, the data were described as 'not very clean', which contributes to known 'significant issues for analysis'. BoP also maintains a Microsoft Access database 'containing a significant number of farm plans of various types/names/iterations. We also now have a new database which contains most of what was in the first database, and any new programmes since it went live earlier this year.' No percentage estimate provided for any of the recording systems.
Canterbury	Approximately 1,098 farms have already been recorded in digital document and/or spreadsheet form. Planned works, including riparian works, are recorded as part of Farm Environment Plans. No percentage estimate.
Gisborne	All planned works (100%) are recorded in digital document format (document and/or spreadsheet). This applies only to plans prepared by 3rd parties.
Hawke's Bay	Tukituki FEMP only (as digital documents and/or spreadsheets) - once a plan is completed the provider must fill in Nintex FEMP Summary Information form which records some information regarding riparian planting and stock exclusion. Needs more development and is not always filled in. No percentage estimate.
Manawatu-Wanganui	Recorded as a combination of hard copy and digital documents, and farm GIS files. No percentage estimate.
Marlborough	100% as digital documents and/or spreadsheets.
Nelson	100% as hard copies only, although there are plans to shift to GIS-based recording.
Northland	All new plans will be digital documents. Depends on individual authors as to whether the data are recorded (correctly) into a centralised GIS data-layer. An estimated 25% of plans are recorded/mapped into GIS.
Otago	No riparian programmes.
Southland	Generally as hard copy plans or letters stored in a property file. No percentage estimate. An estimated 10% may be captured as GIS files for individual farms (i.e. non-centralised GIS), but this would only apply to properties involved in the council's Focus Activity Farm Plans (FAFPs).
Taranaki	Planned works are 100% available from all the recording systems listed in the survey (hard copy, digital documents/spreadsheets, individual GIS, centralised GIS).
Tasman	No reply for this question. This may suggest that no record of planned works is made.
Waikato	Planned works are available in all listed formats, including hard copy (70% of farms), digital documents/spreadsheets (70%), individual GIS (80%), and centralised GIS (80%).
Wellington	Varies by programme. Planned works for 'FEP contestable-fund farms' are all recorded as farm GIS files stored individually, while planned works for the Riparian Programme are recorded in a centralised GIS (90% of Programme farms).
West Coast	Did not respond to survey.

Recording systems provide a degree of insight regarding how accessible the information or data may be for reporting purposes. Hard copy plans are common with councils that maintain property folders (a collection of paper documents particular to a farm, often accumulated overtime). Property folders represent an effective system of recording and managing farm information and data, and were widely used in the pre-digital resource management era by catchment boards. They often represent a rich source of data, especially legacy data, but are the least accessible recording system when it comes to the extraction and integration of data for reporting purposes (Basher et al., 2016).

Digital documents, as reports or spreadsheets, are the most common recording system. Twelve of the 13 councils who responded to this question use digital documents for

recording. Only one council indicated the use of digital spreadsheets as a key recording mechanism (Auckland).

Documents can contain important data not otherwise captured in databases (e.g. farming intensity data in Horizons SLUI Whole Farm Plans) but are similar to hard copy data in that it is generally difficult to extract for reporting. While automated extraction is possible, it requires the use of a well-designed report template that is always correctly populated, and a format amenable to extraction routines (e.g. Word rather than PDF).

Spreadsheets have more immediate utility in that the data are already centralised, and carry the advantages inherent to databases (see discussion below). However, as with databases they can be bespoke in terms of the data types recorded, and spreadsheets require more attention during data entry to ensure data uniformity.

Seven of the 13 responding councils indicated they have riparian protection works recorded as *farm GIS files stored individually*. This is expected, as maps are effective mediums for expressing riparian plans (the where and what), and GIS tend to have strong map-making functionality. GIS systems also have strong database functionality for recording both geometries and attribute records. As such, the data can be readily extracted and compiled, and the geometry data component is already standardised.

Farm GIS files stored individually refers to the use of GIS specifically for a farm, with the resulting GIS files stored under individual user accounts (or PCs) rather than being added and stored in a central dataset. We queried how challenging it may be to collate *farm GIS files stored individually* into a single dataset. For the three councils who replied, all regarded it as a challenging proposition. Hence, while *farm GIS files stored individually* may represent potentially useful data for reporting, it is unlikely to qualify as an easy to access data source.

Riparian planning data stored in central datasets or databases holds the greatest promise. Five councils indicated the use of a centralised database for recording riparian planning in a GIS format. We infer that Taranaki, Waikato, and Bay of Plenty have relatively well-developed systems. Bay of Plenty describes their central GIS dataset as 'uncleaned', but they also manage an aspatial database (MS Access) also for recording riparian plan data. Wellington maintains a project-specific central dataset that accounts for most of their targeted riparian activities, while Northland maintains a repository type system dependent on user input (and standards).

5.8 Implemented riparian works

Implemented works indicate the amount riparian protection that is actually put in place on the ground. Respondents were invited to indicate the type of riparian protection that is implemented, and how these works are recorded.

Most councils record implemented works relating to stock exclusion (11 councils) and riparian planting (10) (Table 7), but few record works that concern managed stock crossings (4) largely because this is an uncommon activity (rarely funded). For Hawkes Bay, what is recorded varies across 3 different riparian-related programmes.

Table 7 Councils that record the implementation of riparian works (including riparian works type and method of recording)

Council	Implemented riparian works type				Recording system(s)	Comments
	Stock exclusion	Planting	Mgtd stock crossings	Other		
Auckland	×	×	×	–	na	Auckland do not record implemented works.
Bay of Plenty	✓	✓	✓	Water supply	Spreadsheet; Database; GIS	Spreadsheet system being replaced with new database ("Accela").
Canterbury	✓	✓	×	–	Database	Stock crossing may be recorded elsewhere, but uncommon.
Gisborne	✓	✓	✓	Water supply; debris dams	Paper records	
Hawke's Bay	½✓	½✓	½✓	–	Spreadsheet	Spreadsheet for the Regional Landcare Scheme. No equivalent recording for the Riparian Plant Programme. Mgtd stock crossings recorded for FEMPs.
Manawatu-Wanganui	✓	✓	×	–	GIS	Mgtd stock crossing may be recorded for dairy with a land use consent.
Marlborough	✓	✓	×	–	GIS	Limited range of attributes are recorded.
Nelson	✓	✓	×	Weed control	GIS	
Northland	✓	✓	×	–	Paper records; GIS	Mgt stock crossing not generally recorded.
Otago	×	×	×	na	na	No riparian programme, but support external initiatives.
Southland	×	×	×	na	na	No dedicated riparian programme (advice only). Some planting but mostly for flood mgt purposes.
Taranaki	✓	✓	✓	–	GIS	
Tasman	✓	×	×	–	Paper records; spreadsheet; GIS	
Waikato	✓	✓	✓	–	Database; GIS	Mgt stock crossing recorded by paper and database, but this type of works is rarely funded.
Wellington	✓	✓	×	–	Spreadsheet; GIS	
West Coast	–	–	–	na	na	No reply.

The potential for reporting implemented riparian works is increased for councils with centralised recording systems (notably Bay of Plenty, Waikato, Taranaki, and Canterbury). Those reliant on paper records (e.g. Gisborne) would likely find it difficult to readily contribute to reporting in a collective sense.

The specific metrics (indicators) that could be reported is variable between councils (Table 8). For stock exclusion, most record location and date (11 councils), fence type (11), and length of bank protected (9). Recording buffer width (how far away from the waterway protection extends) and 'which side of the waterway is protected' is less prevalent (4 and 6 councils, respectively).

Standout metrics for planting include location and date (10 councils), the number of riparian trees planted (10), and the area of land planted (9). Recording planted bank length and species is moderately common (6 councils), while only 4 councils record planted buffer width. Similarly, only 3–4 councils record metrics for managed stock crossings.

Table 8 Metrics recorded for different types of implemented riparian works

Council	Stock exclusion					Planting						Crossings			Comments and notes
	Location & Date	Buffer width	Bank length	Side of waterway	Fence type	Location & Date	Buffer width	Bank length	Species	Trees planted (no.)	Area planted	Location & Date	Type	Number	
Auckland	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
Bay of Plenty	✓	×	✓	✓	✓	✓	×	×	×	✓	✓	✓	✓	✓	Bank length and plant species is recorded elsewhere and is not readily accessible (cf. database access).
Canterbury	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	
Gisborne	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Other metrics recorded relate to stock water, debris dams, future works, and E.coli reduction.
Hawke's Bay	✓	×	✓	×	✓	✓	×	✓	×	✓	✓	✓	✓	✓	Varies between programmes (not universal).
Manawatu-Wanganui	✓	×	×	×	✓	✓	×	×	✓	✓	✓	×	×	×	
Marlborough	✓	×	×	×	×	✓	×	×	×	×	×	×	×	×	
Nelson	✓	✓	✓	×	✓	✓	✓	✓	×	✓	✓	×	×	×	Other metrics recorded relate to weed control (location, date, area, and contractor).
Northland	×	×	×	✓	✓	×	×	×	×	✓	✓	×	×	×	
Otago	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No dedicated riparian programme.
Southland	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No dedicated riparian programme.
Taranaki	✓	×	✓	×	✓	✓	×	✓	✓	✓	×	×	✓	✓	
Tasman	✓	×	✓	×	✓	×	×	×	×	×	×	×	×	×	Also record stock type, stocking rate, erosion, water quality observations, and additional fencing details.
Waikato	✓	×	✓	✓	✓	✓	×	×	✓	✓	✓	×	×	×	Stock crossings may be recorded elsewhere, but uncommon.
Wellington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	
West Coast	–	–	–	–	–	–	–	–	–	–	–	–	–	–	Did not respond.

5.9 Monitoring methods

Councils were asked to indicate which method best describes how implemented riparian works are monitored (Table 9). Of the 14 councils who responded, all undertake riparian monitoring. In most cases this involves a follow up check (7 councils) or ad hoc checks as needed (3). A smaller group undertakes regular annual checks (4).

Table 9 Riparian monitoring approaches used by different councils

Monitoring approach	Council	Count
No formal monitoring or checking of implemented works is undertaken.	–	0
Once-off checks are performed within the first 6 months of works implementation.	Auckland, Hawke's Bay, Manawatu-Wanganui, Marlborough, Nelson, Northland, Wellington	7
Checks and monitoring are undertaken on an ad hoc basis (e.g. as requested, or as deemed necessary).	Canterbury, Tasman, Waikato	3
Regular annual checks as part of council's ongoing relationship with farmers.	Bay of Plenty, Gisborne, Taranaki, (Southland)	4

Monitoring allows councils to check if works have actually been implemented, and implemented to an acceptable standard. This type of monitoring is generally undertaken for auditing purposes associated with grant payments (the 'once-off checks' approach in Table 9). Monitoring also allows councils to check on the condition of works and whether said works are continuing to achieve their intended purpose (plants die, fences break, weeds invade, etc.). Councils who undertake this type of monitoring are better positioned to report on the state (condition) and longer term effectiveness of riparian works. Monitoring can involve more than one method (full table of responses in Appendix 1).

5.10 What is monitored?

Respondents were invited to indicate what is monitored as part of their riparian programme(s), and how any monitoring is recorded (Table 10). Four councils monitor plant survival, but only 2 of these have the monitoring data in a readily accessible recording system (Canterbury, Taranaki). Results for weed monitoring are similar: 4 monitor but only 2 have ready access to the data (Bay of Plenty, Taranaki).

Monitoring the 'condition of physical works' (e.g. fencing) is common (10 councils), but ease of access to the data is unclear (possibly 3–4 councils with ready access). We also suspect some respondents included 'post-implementation checks for grant payment' as monitoring (cf. monitoring the condition of physical works).

Table 10 Types of riparian works monitored and recorded

Council	What is monitored?			Recording system(s)	Comments
	Plant survival	Weeds	Condition (physical works)		
Auckland	×	×	×	na	Works on land owned by ARC may be monitored but not private land.
Bay of Plenty	×	✓	✓	Database; GIS	Plant survival monitoring and the practice of "photo points" may be done by some LMOs.
Canterbury	✓	×	✓	Database	
Gisborne	✓	×	✓	Paper records	
Hawke's Bay	½✓	½✓	½✓	Spreadsheet (comments)	Applies to the Riparian Landcare Scheme. (we infer recording is as general comments rather than metrics).
Manawatu-Wanganui	×	×	×	na	
Marlborough	×	×	✓	Spreadsheet	
Nelson	×	×	×	na	For plant survival: If specified in a contract with council it would be checked and recorded.
Northland	×	×	✓	Paper records; GIS	Check involves that the type of fence and location is what was agreed.
Otago	×	×	×	na	No riparian programme, but support external initiatives.
Southland	×	×	✓	na	No dedicated riparian programme (advice only).
Taranaki	✓	✓	✓	Database; GIS	Auditing process will record in GIS, all details of plant survival, weeds etc when operational in Dec 2017.
Tasman	×	×	½✓	Paper records	Notes collected during site visit for fencing fund around other fences on property.
Waikato	×	½✓	½✓	Database (comments)	Weeds and physical condition may be recorded as a general comment.
Wellington	×	×	×	na	
West Coast	–	–	–	na	No reply.

The specific detail that is recorded for monitoring is similarly sparse (Table 11). Based on these results, we are not confident that data from the monitoring of riparian works is currently suitable for collective reporting. Only a small number of councils appear to have good monitoring and recording systems in place.

Table 11 Metrics recorded for different types of monitored riparian works

Council	Plant survival					Weeds				Physical works			Comments and notes
	No. plant deaths	Location (deaths)	Cause of death	Bank length	Buffer width	Location	Species	Bank length	Buffer length	Location	Bank length	Buffer width	
Auckland	×	×	×	×	×	×	×	×	×	×	×	×	
Bay of Plenty	×	×	×	×	×	✓	✓	×	×	✓	✓	×	
Canterbury	✓	✓	✓	×	×	×	×	×	×	✓	×	×	
Gisborne	✓	✓	✓	✓	✓	×	×	×	×	✓	✓	✓	
Hawke's Bay	✓	×	×	×	×	✓	×	×	×	✓	×	×	Plant deaths recorded as % survival. Weeds and condition recorded as notes.
Manawatu-Wanganui	×	×	×	×	×	×	×	×	×	×	×	×	
Marlborough	×	×	×	×	×	×	×	×	×	✓	×	×	
Nelson	×	×	×	×	×	×	×	×	×	×	×	×	
Northland	×	×	×	×	×	×	×	×	×	✓	×	×	
Otago	×	×	×	×	×	×	×	×	×	×	×	×	No dedicated riparian programme.
Southland	×	×	×	×	×	×	×	×	×	✓	×	×	No dedicated riparian programme.
Taranaki	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Tasman	×	×	×	×	×	×	×	×	×	✓	×	×	
Waikato	×	×	×	×	×	×	×	×	×	×	×	×	Any of the 3 may be recorded as a comment.
Wellington	×	×	×	×	×	×	×	×	×	×	×	×	
West Coast	–	–	–	–	–	–	–	–	–	–	–	–	Did not respond.

5.11 Riparian indicators currently used for reporting

Riparian indicators that councils currently report offer the greatest potential for collective reporting, as the process of compilation to a standard has already been developed and used (albeit in an individual council sense).

The most commonly reported riparian indicators (Table 12) can be summarised as *length of waterway fenced* (8 councils) or *length of fencing* (10), *length of waterway protected* (8), and *number of seedlings or trees planted* (9). Less common indicators relate to the area of riparian land that is protected (4–5 councils) and the number or proportion of riparian plans prepared (3–5).

Three councils offered additional indicators. Two of these are similar to the listed indicators (i.e. Southland and Tasman), but the third is quite different. Wellington's *stages of change behaviour model* indicator reports landowners' behavioural inclinations toward environmental activity and progress on their farms.

Table 12 Riparian reporting indicators currently in use

Council	Listed indicators								Extra			Comments and notes
	Number of riparian plans prepared	**Length of waterway fenced (1 side)**	**Area of waterway fenced (1 side)**	**Length of waterway protected (2 sides)**	**Area of waterway protected (2 sides)**	**% of targeted riparian plans prepared**	**Length of fencing**	**Number of seedlings or trees planted**	***Number of focus activity farm plans***	***# of poplar/willow poles for waterways***	***Stages of change behaviour model***	
Auckland				✓								
Bay of Plenty	✓	✓					✓	✓				BoP hold a rich dataset and could possibly report more if needed. They also report on *stream margin protected with land use change (ha)*
Canterbury		✓	✓	✓	✓		✓	✓				
Gisborne	✓	✓	✓	✓	✓	✓	✓	✓				
Hawke's Bay		✓	✓	✓	✓		✓	✓				
Manawatu-Wanganui							✓	✓				
Marlborough												Not reported publicly.
Nelson				✓	✓							Not reported publicly.
Northland							✓	✓				
Otago												No dedicated riparian programme.
Southland									✓			No dedicated riparian programme.
Taranaki	✓	✓		✓		✓	✓	✓				
Tasman		✓		✓			✓			✓		
Waikato	✓	✓	✓				✓	✓				
Wellington	✓	✓		✓		✓	✓	✓			✓	
West Coast												Did not respond.
Total count	5	8	4	8	4	3	10	9	1	1	1	

Five councils also directed us to published riparian indicators:

- Canterbury Regional Council report riparian protection activities as part of their mapping application for biodiversity reporting[1]. Location and project type are reported by site. More broadly, Canterbury aims to report the number, location, type of project, grant amount, and length of waterways that have riparian management (ECan 2015).
- Manawatu-Wanganui Regional Council produces bimonthly riparian programme reports. The most recent Freshwater Management report (HRC 2017) includes maps showing proposed and completed 'freshwater jobs' (fencing and planting projects), and summarises riparian targets and progress in terms of grants (number), sites (number), fencing (length), and plants (number planted).
- Southland Regional Council has a forthcoming report that, at the time of the survey, was not ready for publication.

[1] https://apps.canterburymaps.govt.nz/SOE/Biodiversity.html

- Tasman District Council may generate indicators for planting, fencing, and bridging streams for stock crossings (TDC 2001).
- Taranaki Regional Council (TRC) prepares Quarterly Operational Reports (TRC 2018) that detail riparian targets and progress. Relevant indicators include riparian plans prepared (number), implemented fencing (length), and implemented planting (number of plants). Indicators are reported annually (TRC 2017), including maps that show riparian protection status (percent of riparian plan completed).

5.12 Monitoring demand for riparian protection services or advice

Respondents were asked if their council reports on indicators that describe *demand for riparian protection services or advice*. Five councils replied in the affirmative (Table 13), three of whom monitor expressions of interest as the indicator (Manawatu-Wanganui, Southland, and Taranaki). The balance monitors new applications or projects (we suspect several other councils could also report this type of indicator).

Table 13 Indicators describing demand for riparian protection services or advice

Council	Response	Comments
Auckland	×	
Bay of Plenty	✓	We would report number of new programmes and/or advisory in catchment work programmes or as narrative alongside reporting to the long-term plan KPIs.
Canterbury	×	
Gisborne	×	
Hawke's Bay	×	No. RPP is only been active 3 years, so still in the early stages but slowly gaining momentum.
Manawatu-Wanganui	✓	Yes. Enquiries/advice given per year. Grant clients/ projects per year.
Marlborough	×	
Nelson	×	
Northland	✓	Yes. Number of successful applications. Km of fencing funded and $$ spend on farm. Number of plants subsidised.
Otago	×	
Southland	✓	Yes. Enquires per year entered in iris.
Taranaki	✓	Yes. Enquiries register and number of people commissioned onto waiting list. The latter being the most important.
Tasman	×	
Waikato	½✓	Maybe. No reporting as such, but most queries are logged, which may be used within each management zone.
Wellington	×	No. Potentially in the future.
West Coast	×	

5.13 Monitoring environmental outcomes

Few councils monitor environmental outcomes **directly attributable** to riparian protection activities (Table 14). Such monitoring appears to be project or trial specific.

Table 14 Councils monitoring environmental outcomes attributable to riparian protection

Council	Response	Comments
Auckland	×	No. Not currently doing so in consistent manner.
Bay of Plenty	×	Not really, beyond SOE water quality monitoring, although some catchments might. For example, Waiotahe Catchment E coli contamination has a higher intensity of water monitoring to establish baseline and look for improvements over time as a result of interventions. We tend to report results more than outcomes especially for water quality/ecological outcomes.
Canterbury	½✓	Yes. For some sites (e.g. Te Waihora)/a number of projects/ecosystem types (e.g. wetlands) but not for all project sites/comprehensively. Work is underway to implement consistent project outcomes monitoring for biodiversity funds projects.
Gisborne	✓	Yes. E.coli economic model. Water quality sampling at falls and rockslides. Some on farm.
Hawke's Bay	×	No, however, the Science team have or are undertaking trials of riparian vegetation e.g. shade trials.
Manawatu-Wanganui	×	Not really. We monitor the effectiveness of some of the fish passes to make sure they work. There is intensive regional fish and MCI monitoring but this is not targeted to the riparian works.
Marlborough	×	No
Nelson	×	No
Northland	×	No
Otago	×	No
Southland	×	No
Taranaki	×	SOE monitoring programmes linked to physicochemical water quality parameters and MCI monitoring.
Tasman	×	Water quality monitoring.
Waikato	½✓	We have some water temperature monitoring sites in place, associated with early riparian works - to record the change in temperature from a control site to monitoring site, and the effect a developing riparian margin has. There may be ecological monitoring associated with this dataset also. We do have a lot of SoE monitoring - WQ, ecological, etc., but unlikely to cover "directly attributable".
Wellington	×	Potentially in the future. Farmer monitoring or observations may play a role here.
West Coast	×	No reply.

5.14 Conclusions and discussion – Riparian

- The majority of regional authorities operate one or more riparian protection programmes (13 councils). Nine councils have more than one riparian initiative.
- Availability within regions is variable. The majority of identified programmes (57%) have targeted availability by priority catchment or land use, while the balance are available region-wide but may include an element of sector or location prioritisation.
- Potential reporting indicators based on the types of services included in riparian protection programmes include:
  - *Number of riparian plans prepared* (10 councils).
  - *Number of riparian plants supplied* (14 councils) *and number of riparian plants planted* (at least 12 councils).
  - *Length of riparian fencing erected* (at least 11 councils).
- Twelve councils offer riparian protection grants, and could thus potentially report on *level of annual grant expenditure on riparian protection*.
- Approximately 10 councils have measurable targets for riparian protection, and could thus potentially report on *the rate of targeted riparian protection*. The ideal would be rate of progress against the absolute level of required protection, but we suspect in

many cases any 'absolute target' would be in a constant state of flux as science and community values continue to evolve.

- Only five councils are in a position to report the GIS-*mapped extent of catchments targeted for riparian protection*. A small number of councils record targets as detailed features (e.g. targeted waterways) but identifying completeness and accessibility of these datasets would require further investigation.
- The *number of 'riparian works plans' prepared* can be reported by at least 9 councils. Simply having a plan in place can be considered as an indicator of environmental responsibility (Manderson et al., 2007).
- Eleven councils monitor and record the implementation of riparian works. Of this 11, we estimate that at least 4 have ready access for reporting (Bay of Plenty, Waikato, Taranaki, and Canterbury), six have a strong potential for reporting but will likely require an unknown degree of internal compilation (Hawke's Bay, Manawatu-Wanganui, Marlborough, Nelson, Northland, and Tasman), and Gisborne could report but have the least accessible recording system (paper records). Collectively, this represents a strong potential, and indicators related to the implementation of riparian protection works are recommended for further investigation.
- Based on responses, examples of 'implemented works indicators' with the highest reporting potential include:
  - *Location of riparian works*
  - *Length of bank protected from stock*
  - *Area of land under riparian stock exclusion*
  - *Type of stock exclusion fencing (indicative of the degree of protection afforded)*
  - *Number of riparian trees or shrubs planted*
  - *Area of riparian land planted*.
- Fourteen councils undertake some form of riparian monitoring, mostly for once-off auditing purposes associated with grant payments. Four councils undertake regular annual checks, and are thus better positioned to monitor long term changes.
- The monitoring and recording of riparian plant survival and weeds is uncommon. We estimate that only 3 councils could readily report on plant survival and weed-related indicators (Canterbury, Taranaki, and Bay of Plenty). Monitoring and recording the 'condition of physical works' (e.g. fences) is common (10 councils) but we suspect the result is skewed by the inclusion of once-off post-implementation checks associated with the release of grant payments.
- Common riparian indicators already reported by councils can be summarised as *length of waterway fenced* or *length of fencing*, *length of waterway protected*, and *number of seedlings or trees planted*.
- Additional or similar indicators used in published council reports include: *number of projects/jobs/sites, location of projects/jobs/sites, number of riparian plans prepared, grants (number allocated), grant value ($), fencing (length), plants (number planted), and length of waterways that have riparian management*.
- Few councils monitor environmental outcomes **directly attributable** to riparian protection activities. Such monitoring is either project or trial specific, or bundled into generic water quality and biodiversity monitoring.

6 Results – Soil Conservation

Ten regional authorities have soil conservation programmes (Table 15). Four have well-established long-running programmes (Gisborne, Taranaki, Wellington, Manawatu-Wanganui), and 5 have significant programmes (Bay of Plenty, Hawkes Bay, Northland, Tasman, Waikato). Marlborough DC has a small programme focused on Wither Hills Farm Park. Five councils do not have dedicated programmes, but may integrate soil conservation activities within other council initiatives. West Coast did not respond.

Programmes are generally available on a region-wide basis where erosion is recognised as a problem. Eight councils prioritise erosion on hill and steep-land farms over lowland farms, with only Bay of Plenty indicating a balanced prioritisation of hill/steep and lowlands. Several councils have strong prioritisation mechanisms at one or more scales (e.g. priority catchments, priority farms, priority LUC/land).

Table 15 Soil conservation programmes and their focus by regional authority

Council	Available?	Programme name(s)	Programme focus and notes
Auckland	×	-	No specific soil conservation programmes in place. Focus on research and monitoring.
Bay of Plenty	✓	Sustainable land use/riparian funding policy	Available region-wide. Equal priority on both hill country and lowlands.
Canterbury	×	-	No dedicated soil conservation initiatives, although work related to sediment-mitigation can be supported by environment grants.
Gisborne	✓	Sustainable Hill Country Project (grant assisted by MPI)	Available district-wide. Targeted priority according to Land Overlay 3A (mapped at farm scale) and Regional Target Land at (mapped at 1:50,000). Focus on hill country and the "worst eroding land".
Hawke's Bay	✓	Soil Con. - Pole Programme	Both programmes available region-wide. First priority is hill country; second priority is lowlands (incl. wind erosion on cultivatable wind-risk soils).
		Regional Landcare Scheme	
Manawatu-Wanganui	✓	Sustainable Land Use Initiative (SLUI)	Regionally available. Targeted application by SLUI catchment priority, farm priority, and LUC priority. Primarily focused on hill country farms, although some non-hill country farms may be included.
		Whanganui Catchment Strategy (WCS)	Focus on the Whanganui Catchment. Grant jobs anywhere in the catchment. WCS farm plans are concentrated in the Ohura Catchment. First priority is hill country; second priority is lowlands.
Marlborough	✓	Wither Hills	Focus on Wither Hills Farm Park where council carries out its own soil control measures. Otherwise no soil conservation initiatives other than land disturbance rules within the Resource Management Plans.
Nelson	×	-	
Northland	✓	Northland Soil Conservation Programme	Available region-wide. First priority is hill country; second priority is lowlands.
		Kaipara Hill Country Erosion Project	Focus on Kaipara Catchment. First priority is hill country; second priority is lowlands.
Otago	×	-	-
Southland	×	-	While we do soil conservation work ....it is not the same focus as for our colleagues in the north.
Taranaki	✓	South Taranaki and Regional Erosion Support Scheme (STRESS)	Available to hill country farms across the region, excluding the Egmont Ring plain. First priority is hill country; second priority is lowlands.
Tasman	✓	Land management	Available region-wide. First priority is hill country; second priority is lowlands; generally applies to any erosion.
		Soil Intactness Monitoring	
Waikato	✓	Component of the Catchment Management Programme	Targeted availability according to the Catchment Management Programme. First priority is hill country; second priority is lowlands.
Wellington	✓	Wellington Regional Erosion Control Initiative (WRECI)	Available region-wide, but funding is confined to LUC of 6e and above. First priority is hill country; second priority is lowlands.
West Coast	-	-	-

6.1 Types of services available within soil conservation programmes

Councils with soil conservation programmes provide a range of services and grants to landowners (Table 16). The provision of fencing and planting materials is most common (9–10 councils) followed by contractor services (7–8 councils). Grants are available from all councils with soil conservation programmes (10 councils), although variation exists between grant types and percentages (Table 16).

Table 16 Types of services and grant rates associated with soil conservation programmes

	Services available						Grants available (% of total cost)						Other services and grants (grant rate in parentheses), and notes
	Farm plan	Materials – plants etc.	Planting (contractor)	Materials – fencing	Fencing (contractor)	Earth works	Farm plan	Materials – plants etc.	Planting (contractor)	Materials – fencing	Fencing (contractor)	Earth works	
Auckland	-	-	-	-	-	-	-	-	-	-	-	-	
Bay of Plenty		✓	✓	✓	✓	✓		50	50	50	50	50	
Canterbury	-	-	-	-	-	-	-	-	-	-	-	-	
Gisborne	✓	✓	✓	✓	✓		?	100	100	100	100		Reversion Grant ($1500 - $2000/ha).
Hawke's Bay 1		✓						40					30–40% depending on source of poles.
Hawke's Bay 2		✓	✓	✓	✓	✓		50	50	50	50	50	Up to 50% of project cost. Structures (50%).
Manawatu-W 1	✓	✓	✓	✓	✓	✓	100	50	50	50	50	50	Grant rates vary. 50% is a typical rate.
Manawatu-W 2	✓	✓	✓	✓	✓	✓	100	50	50	50	50	50	
Marlborough			✓	✓	✓	✓			100	100	100	100	Applies to Wither Hills Farm Park only.
Nelson	-	-	-	-	-	-	-	-	-	-	-	-	
Northland 1	✓	✓		✓			?	50		50			
Northland 2	✓	✓		✓			?	100		50			3,800 poles/yr provided free (2016–2019).
Otago	-	-	-	-	-	-	-	-	-	-	-	-	
Southland	-	-	-	-	-	-	-	-	-	-	-	-	
Taranaki	✓	✓		✓	✓		100	80		50	50		Forestry establishment costs (75%).
Tasman	✓	✓		✓		✓	100	100		100		50	
Waikato	✓	✓	✓	✓	✓		100	35	35	35	35	35	Works – design and planning (100%).
Wellington	✓	✓	✓	✓	✓	✓	100	60	60	60	60	60	Erodible land LUC 6+ (30%).
West Coast	-	-	-	-	-		-	-	-	-		-	

6.2 Soil conservation targets

Six of the 10 councils with programmes indicated that they have targets for soil conservation (Table 17). Targets are measurably but different in character, and thus difficult to aggregate for reporting purposes. Manawatu-Wanganui and Wellington provided detailed and specific targets, while others provided clear but overarching or singular targets.

6.3 Councils with soil conservation targets captured in GIS form

Five councils indicated that soil conservation targets are recorded in GIS form (Table 18). "Works area" (or "land identified for treatment") as polygons is the most common GIS data type. Two councils record their targets in a central GIS dataset. Manawatu-Wanganui maintains comprehensive soil conservation targets as part of their SLUI Database.

Table 17 Soil conservation targets specified by councils

Council	Soil conservation targets specified
Auckland	(no programme)
Bay of Plenty	No targets specified.
Canterbury	(no programme)
Gisborne	The Council target is to have all properties with more than 5 ha of Land Overlay 3A covered by a SHCP 'Works Plan' by 2022.
Hawke's Bay	Increase the poplar and willow dales into the Southern HB by 20% for the 2018/19 season – pole programme (average nursery production between approx. 20-30k poles per year).
Manawatu-Wanganui	SLUI Targets 2018 are 20,000 ha of farm plans (14,000 within priority catchments) and 2700 ha of works. Targeted works include 26,000 poles, (720 ha) 1080 ha afforestation, 350 ha retirement 450 ha riparian retirement and 100 ha managed retirement.
Marlborough	No targets specified.
Nelson	(no programme)
Northland	No targets specified.
Otago	(no programme)
Southland	(no programme)
Taranaki	69% of hill country in private ownership with a farm plan by 2025.
Tasman	No targets specified.
Waikato	90% of funded works undertaken in priority catchments/locations (although we are working towards full coverage of our priority catchments – Targets like these and number of pole/plants or length of fence are indicative and provide direction rather than an absolute).
Wellington	400 ha of erodible land is treated per year. 60 ha of erodible land will be afforested/ reverted to natives for 2016/17 with targets eventually reaching 100 ha.
West Coast	-

Table 18 Councils who record soil conservation targets using GIS

	GIS data type (for SC targets)						
Council	Catchment polygons	Farm polygons	Works areas polygons	Points	Lines	Central dataset?	GIS coverage
Gisborne			✓			Yes	LO3A layer which identifies the 'worst eroding land' contains polygons that cover the whole region.
Manawatu-Wanganui	✓	✓	✓			Yes	SLUI catchments are 1M ha of the 2.2M ha region. Top and High priority farms are 630,000 ha. Within mapped farm plans, Top priority land is 14% and Highly Erodible is 24%. Whanganui is 720,000 ha. WCS & SLUI catchments overlap.
Taranaki			✓			Yes	66.8% of hill country in private ownership is covered by a farm plan.
Waikato	✓		✓			Multiple datasets by management zone.	Approximately 20–30% (of region)
Wellington			✓			Yes	Region wide

6.4 Systems used to record soil conservation works

Nine of the ten councils with soil conservation programmes provided feedback on how they record recommended or agreed works data (Table 19). Results are presented in the original questionnaire format (i.e. are not summarised) to provide the clearest picture of where councils are at with their recording systems (for soil conservation).

Table 19 Systems used to record soil conservation works

Recording system	System is used for…	% of farms	Comments
Bay of Plenty			
Hard copy (paper) plans	Both R & A works[1]	?	I can't quantify % of farms represented. It will vary depending on age of plans.
Digital documents or spreadsheets	Both R & A works	?	
Farm GIS files stored individually	Agreed works	?	I'm not certain about this – agreed works should be in the central GIS layer, but recommended or advisory would likely sit with individual LMOs.
Centralised GIS layer or GIS database	Both R & A works	?	As above.
Database	Both R & A works	?	To a point. Going forward, advisory will be in the database, but I'm not sure how much past advisory (recommended works) is in there.
Gisborne			
Hard copy (paper) plans	Both R & A works	?	% of farms not known, as of 2015 still 40% of regions LO3A still needed one.
Digital documents or spreadsheets	Both R & A works	?	% of farms not known, as of 2015 still 40% of regions LO3A still needed one.
Hawkes Bay			
Hard copy (paper) plans	Both R & A works	?	Catalogue on a spreadsheet of old farm plans/soil conservation plans
Manawatu-Wanganui			
Hard copy (paper) plans	Recommended works	?	Historical farm plan documents generally no longer operative.
Digital documents or spreadsheets	Recommended works	100	SLUI Whole Farm Plans (documents)
Centralised GIS layer or GIS database	Recommended works	100	SLUI Database
Northland			
Hard copy (paper) plans	Both R & A works	10	Historic farm/soil con plans.
Digital documents or spreadsheets	Both R & A works	70	
Centralised GIS layer or GIS database	Both R & A works	20	
Taranaki			
Hard copy (paper) plans	Both R & A works	100	
Digital documents or spreadsheets	Recommended works	100	
Centralised GIS layer or GIS database	Both R & A works	100	
Tasman			
Hard copy (paper) plans	Both R & A works	1	Farm plans for a few catchment groups only. Too resource intensive to provide with current staffing.
Waikato			
Hard copy (paper) plans	Both R & A works	5	
Digital documents or spreadsheets	Both R & A works	95	
Farm GIS files stored individually	Both R & A works	95	
Centralised GIS layer or GIS database	Both R & A works	80	
Wellington			
Digital documents or spreadsheets	Both R & A works	100	
Centralised GIS layer or GIS database	Both R & A works	100	

[1] Recommended and Agreed works.

The nine councils vary in how they record recommended and/or agreed works. Six of the 9 have centralised databases or GIS datasets, and would thus be best positioned for collective reporting (Bay of Plenty, Manawatu-Wanganui, Northland, Taranaki, Waikato, and

Wellington). Manawatu-Wanganui RC do not record agreed works, but we expect any difference between agreed and actually implemented/funded works would be minor. Centralised recording is also partial within Northland and Waikato, but previous comments suggest both are aiming for full centralised reporting.

6.5 Implemented soil conservation works

Eight councils monitor and record implemented soil conservations works (Table 20). Pole planting, afforestation, and land retirement are the three works types consistently recorded by the eight councils. However, only 5–6 of the 8 use recording systems amenable to collective reporting. Other recorded implemented works include active revegetation (5 councils) and earthworks (7 councils). Tasman's dataset applies to '10 year intactness monitoring' rather than the operational component of works implementation.

Table 20 Councils that record the implementation of soil conservation works (including works type and method of recording)

Council	Implemented works type						Recording system(s)	Comments
	Pole planting	Afforestation	Active revegetation	Land retirement	Earthworks	Other		
Auckland	×	×	×	×	×			No programme.
Bay of Plenty	✓	✓	✓	✓	✓	Stream erosion control	Spreadsheet; Database; GIS	
Canterbury	×	×	×	×	×		na	No programme.
Gisborne	✓	✓	×	✓	✓		Paper records; some GIS	GIS in development. MPI record ECFP afforestation outside of LO3A. Earthworks recorded via resource consents.
Hawke's Bay	✓	✓	×	✓	✓		Spreadsheet; some GIS	GIS for afforestation. One spreadsheet per RLS project.
Manawatu-Wanganui	✓	✓	✓	✓	✓	SLUI riparian	GIS	
Marlborough	–	–	–	–	–		na	No reply for this question.
Nelson	×	×	×	×	×		na	No programme.
Northland	✓	✓	×	✓	×		Paper records; GIS	Recording afforestation and 'active revegetation' is occasional.
Otago	×	×	×	×	×		na	No programme.
Southland	×	×	×	×	×		na	No programme.
Taranaki	✓	✓	✓	✓	✓		GIS; some paper records	Paper records for earthworks.
Tasman	×	½ ✓	½ ✓	½ ✓	½ ✓	Change in vegetation cover (monitoring)	Database; GIS	Refers to data available form 10-yearly land intactness monitoring (% of landscape).
Waikato	✓	✓	✓	✓	✓		Database; GIS	
Wellington	✓	✓	✓	✓	✓		GIS	
West Coast	–	–	–	–	–		na	No reply

Number of poles planted and *area of land retired* are the most commonly recorded metrics for implemented soil conservation works (8 councils), closely followed by pole planting and land retirement location (7 councils) (Table 21).

Table 21 Metrics recorded for different types of implemented soil conservation works

Council	Pole planting						Afforestation						Active revegetation						Land retirement							Comments and notes
	Location	Species	# poles planted	# poles /unit area	Area planted	Planting date	Location	Species	# trees planted	# trees /unit area	Area planted	Planting date	Location	Species	# trees planted	# plants /unit area	Area planted	Planting date	Location	Retirement type	Area retired	Fence type	Fence length	Date	Earthworks (Location)	
Auckland	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Bay of Plenty	✓	✓	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Canterbury	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Gisborne	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	×	×	×	×	×	×	✓	×	✓	×	×	✓	✓	
Hawke's Bay	×	×	✓	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	✓	✓	✓	✓	✓	
Manawatu-Wanganui	✓	✓	✓	×	✓	×	✓	✓	✓	×	✓	×	✓	✓	✓	×	✓	×	✓	✓	✓	×	✓	×	×	
Marlborough	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	Small programme (Wither Hills only).
Nelson	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Northland	✓	✓	✓	×	✓	×	×	×	×	×	×	×	×	×	×	×	×	×	✓	×	✓	×	×	×	×	Afforestation and active revegetation are only recorded occasionally.
Otago	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Southland	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Taranaki	✓	✓	✓	✓	×	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	✓	✓	×	✓	✓	✓	
Tasman	×	×	×	×	×	×	×	×	×	×	✓	×	×	×	×	×	✓	×	×	×	✓	×	×	×	✓	Refers to data available form 10-yearly land intactness monitoring (as % of landscape).
Waikato	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	×	✓	×	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Wellington	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
West Coast	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	No reply.

As a ranked summary, **eight councils** record metrics for *# poles planted* (Pole planting) and *Area retired* (Retirement). **Seven councils** record metrics for *Location* (Pole planting) and *Location* (Retirement). **Six councils** record Area planted (Pole planting), *Location* (Afforestation), *Species* (Afforestation), *# trees planted* (Afforestation), *Area planted* (Afforestation), *Retirement type* (Retirement), *Fence length* (Retirement), *Date* (Retirement), and *Earthworks* (Location). **Five or less** councils record the other metrics.

6.6 What is monitored?

Respondents were invited to indicate what is monitored as part of their soil conservation programme, and how any monitoring is recorded (Table 22). Eight councils undertake soil conservation monitoring, 4 of whom use recording systems with high relevance for collective reporting. *Plant survival* is most commonly monitored (7 councils), followed by the *condition of physical works* (4), *weeds* (3), and *plant condition/performance* (2).

Table 22 Types of soil conservation works monitored and recorded

Council	What is monitored?				Recording system(s)	Comments
	Plant survival	Plant condition/ performance	Weeds	Condition (physical works)		
Auckland	×	×	×	×	na	No programme.
Bay of Plenty	✓	×	✓	✓	Database; GIS; some spreadsheet	Includes blanking and photo-points. Weed monitoring is occasional. Physical works can be monitored for compliance reasons. Weeds and physical works may be recorded as hardcopy only.
Canterbury	×	×	×	×	na	No programme.
Gisborne	✓	✓	×	×	Paper records	Plant survival managed by MPI. Plant performance by *effective tree cover*.
Hawke's Bay	✓	×	✓	✓	Spreadsheet	
Manawatu-Wanganui	✓	×	×	×	GIS	Plant survival may be recorded in GIS in comments field. These types of monitoring only happen as part of SLUI farm audits.
Marlborough	×	×	×	×	na	No formal works monitoring programme.
Nelson	×	×	×	×	na	No programme.
Northland	×	×	×	×	na	No formal works monitoring programme.
Otago	×	×	×	×	na	No programme.
Southland	×	×	×	×	na	No programme.
Taranaki	✓	×	×	×	GIS	
Tasman	×	×	×	✓	Spreadsheet; GIS; Paper records	
Waikato	✓	✓	✓	✓	Database (comments)	Most variables recorded but generally as notes or comments.
Wellington	✓	×	×	×	na	
West Coast	–	–	–		na	No reply

The depth of monitored metrics is, however, limited (Table 23). The *location of plant deaths is most common* (but only 4 councils), which is possibly associated with the procedure of 'blanking' (checking on plant survival and replacing dead plants or poles to ensure original planting design and effectiveness is maintained). Similarly, *number of plant deaths* rated relatively highly (3 councils), along with *location of physical works* (3 councils) although some of this monitoring is associated with resource consent compliance.

Metrics for plant survival and health/condition are particularly important as they provide a truer representation of actual protection or enhancement. For example, a metric such as *number of poles planted* is useful, but means little if poles die or become diseased and provide less protection than was initially required.

Table 23 Metrics recorded for different types of soil conservation works

Council	Plant survival			Plant condition and performance						Weeds		Physical works (location)	
	No. plant deaths	Location (deaths)	Cause of death	Location	% bare ground	% canopy cover	Health	Height	Trunk diameter	Location	Species		
Auckland	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Bay of Plenty	×	✓	×	×	×	×	×	×	×	×	×	✓	Weeds are informally monitored.
Canterbury	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Gisborne	✓	×	×	×	×	✓	×	×	×	×	×	×	
Hawke's Bay	✓	×	×	×	×	×	×	×	×	×	×	×	Plant survival recorded as an estimate (%) for RLS. Presence of weeds may be noted. Fence condition is recorded.
Manawatu-Wanganui	×	×	✓	×	×	×	×	×	×	×	×	×	Plant survival may be recorded in GIS in comments field. These types of monitoring only happen as part of SLUI farm audits.
Marlborough	×	×	×	×	×	×	×	×	×	×	×	×	Small programme (Wither Hills only).
Nelson	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Northland	×	×	×	×	×	×	×	×	×	×	×	×	No formal works monitoring programme.
Otago	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Southland	×	×	×	×	×	×	×	×	×	×	×	×	No programme.
Taranaki	×	✓	×	×	×	×	×	×	×	×	×	×	
Tasman	×	×	×	×	×	×	×	×	×	×	×	✓	
Waikato	×	✓	×	×	×	×	×	×	×	×	✓	✓	Recording is in the form of comments for plant survival and condition/performance. Physical works may involve notes if repair or replacement is required.
Wellington	✓	✓	✓	×	×	×	×	×	×	×	×	×	
West Coast	–	–	–	–	–	–	–	–	–	–	–	–	No reply.

6.7 Monitoring demand for soil conservation services or advice

Respondents were asked if their council reports on the *demand for soil conservation services or advice*. Nine councils replied (Table 3), with five in the affirmative. However, we suspect only Manawatu-Wanganui and Bay of Plenty truly monitor demand (e.g. enquiries per year, number of people on a waiting list, etc.) independently from actuals.

Table 24 Monitoring demand for soil conservation

Council	Response	Comments
Bay of Plenty	×	We'd only report number of programmes, or that we built x number of detention dams as part of the narrative against KPIs, and/or in catchment work programmes for those that have them.
Gisborne	✓	Pole planted per year, area in forestry, and area of reversion.
Hawke's Bay	×	No.
Manawatu-W	✓	Yes. As demand for farm plans or works.
Northland	✓	#poles distributed and # of individual projects annually.
Taranaki	✓	Yes. Logged into database.
Tasman	✓	Requests for plant material, changes to the areal extent of bare land and change in associated land use activities, applications to the fencing fund (materials to protect waterways from stock erosion).
Waikato	×	Some data is recorded within each management zone, although very limited value.
Wellington	×	No.

6.8 Soil conservation indicators currently used for reporting

Respondents were invited to indicate what soil conservation indicators are currently used by their council (Table 25). There exists high commonality between councils for the listed indicators, especially in regard to trees/poles/seedlings planted, afforestation, fencing, and land retirement.

Table 25 Soil conservation reporting indicators currently in use

Council	Listed indicators											Comments and notes
	# Soil conservation plans prepared	# Operational soil conservation plans	# Farms with soil conservation treatments	# Poles planted	# Seedlings or trees planted	Tree or pole survival rate	Percent of soil conservation plans prepared	Length of fencing	Area of land treated/protected	Area of forestry	Area of land retired from grazing	
Auckland												
Bay of Plenty	✓	✓	✓	✓	✓			✓	✓	✓	✓	Many of the indicators are recorded against protection areas so would be about GIS or database queries. Noting that our database reporting capability is still being developed.
Canterbury												
Gisborne	✓		✓	✓	✓	✓			✓	✓	✓	
Hawke's Bay				✓	✓			✓	✓	✓	✓	
Manawatu-Wanganui	✓		✓	✓	✓			✓	✓	✓	✓	Other indicators could be reported.
Marlborough												
Nelson												
Northland	✓			✓								
Otago												
Southland												
Taranaki	✓	✓		✓				✓	✓	✓	✓	
Tasman								✓				
Waikato	✓		✓	✓	✓			✓	✓	✓	✓	
Wellington	✓	✓		✓	✓		✓	✓	✓	✓	✓	
West Coast												
Total count	7	3	4	8	6	1	1	7	7	7	7	

Nine councils also receive central Government support via the Hill Country Erosion Fund (HCEF), and several made reference to milestone reports containing soil conservation indicators. While the nature of HCEF contracts differs between councils and projects, we were able to extract several indicator examples:

- Farm plans mapped (no. and ha)
- Farm plans mapped in priority areas (no. and ha)
- Properties under active management (no. and %)
- Forestry established (ha)
- Land retired or indigenous forest retired (ha)
- Riparian retirement (ha)
- Managed retirement (ha)
- Land protected with space planting (ha)
- Poles planted (no.)
- Grants (no. and $) and land-owner contribution ($)
- Active farm plans (%)
- Fencing (km)

6.9 Monitoring environmental outcomes (soil conservation)

Respondents were asked to indicate if their councils monitor environmental outcomes *directly attributable* to soil conservation activities. While seven councils replied, most in the affirmative, we are not confident the replies are comparable as they spanned several concepts or techniques. This included modelled estimates of effectiveness, stratified sampling of intactness, and general water quality monitoring with particular regard to sediment. Other than with modelling, there was no suggestion that results from monitoring had been related to soil conservation activity (i.e. the *directly attributable* part).

Table 26 Councils monitoring environmental outcomes attributable to soil conservation

Council	Response	Comments
Bay of Plenty	½✓	In some catchments, but this would mostly be SOE level water quality reporting. Sedimentation relating to high risk catchments or receiving environment eg areas where sediment isn't flushing, occurs in some Tauranga Harbour catchments. There is no sampling strategy as such.
Gisborne	½✓	Yes. Effective tree cover.
Manawatu-Wanganui	½✓	Yes and no. Landcare Research has modelled it with Sednet and now SLUI sednet. Plus this year, I will be completing the LMF point sample monitoring technique, which will tell us about change in % bare ground due to slips, etc., and we may then be able to relate that back to changes in land cover.
Taranaki	½✓	SOE report on sustainable land use in the hill country.
Tasman	½✓	Water quality monitoring.
Waikato	½✓	WRC has sediment load monitoring sites throughout the region, although not sure that fits the "directly attributable" category.
Wellington	×	Potentially in the future.

6.10 Conclusions and discussion – Soil Conservation

- Ten councils indicated they have one or more soil conservation programme in operation.
- Programme availability is widespread within regions or districts where erosion is present (especially hill and steepland). Several councils have well-developed prioritisation mechanisms at different scales (catchment, farm, land unit).
- Potential reporting indicators based on the types of services included in soil conservation programmes include:
  - *Planting materials and fencing materials distributed* (12 councils).
  - *Planting and fencing undertaken by contractors* (8 and 9 councils).
  - *Farm plans prepared* (9 councils).
  - *Soil conservation earthworks undertaken* (7 councils).
- Ten councils offer soil conservation grants, and could thus potentially report on *level of annual grant expenditure on soil conservation*.
- Six councils have their own defined targets for soil conservation, and can thus report on their rate of progress. However, targets between councils differ on several levels, making the use of general soil conservation targets for aggregate reporting difficult.
- Five councils record their soil conservation targets in a centralised GIS, principally as areas of land identified for treatment. These data are likely to be more specific and representative than similar data available from existing national datasets. However,

the data are limited to 5 councils, and different techniques have been employed to identify and prioritise areas. Problems arising from this type of approach are well recognised, and lend weight to the proposal for an improved, nationally-consistent method of mapping erosion susceptibility (Basher et al. 2015).

- Nine councils record recommended or agreed soil conservation works (for individual farms), but only six could contribute to collective reporting by drawing on centralised recording systems (GIS or database). At least a further two councils are working towards improved centralised recording.
- Eight councils record implemented soil conservation works, although only 5–6 use centralised recording systems. Potential reporting indicators based on the most common implemented works include:
  - *Number of poles planted* (8 councils).
  - *Area retired from production* for soil conservation purposes (8 councils).
  - *Location of pole planting* (7 councils), *retirement* (7 councils), *forestry establishment* (6 councils), and *earthworks* (6 councils).
  - *Area treated by pole planting* (6 councils), and *area afforested* (6 councils).
  - *Length of fencing* installed for soil conservation (6 councils).
- Eight councils undertake post-implementation monitoring, 4 of which use centralised recording systems. However, the depth of monitored metrics is limited, with the most common metrics including:
  - *Location of plant deaths* (4 councils; all with centralised recording).
  - *Number of plant deaths* (3 councils; 1 with centralised recording).
  - *Location of physical works* (3 councils; 2 with centralised recording).
- We infer that only two councils could truly report on demand for soil conservation services (e.g. enquires per year, number on waiting list), over and above demand indicated by grants allocated or work undertaken.
- Nine councils currently report using soil conservation indicators. There is a high level of commonality between the use of six indicators:
  - *Number of poles planted* (8 councils).
  - *Number of soil conservation plans prepared* (7 councils).
  - *Length of fencing* (7 councils).
  - *Area of land treated* (7 councils).
  - *Area of forestry established* (7 councils).
  - *Area of land retired from grazing* (7 councils).
- We are not confident that any council monitors environmental outcomes that are **directly attributable** to soil conservation activities.

7 Results – Farm Environmental Plans

7.1 FEP types and general focus

The use of Farm Environmental Plans (FEPs) is widespread, with 11 councils having one or more FEPs available (Table 27). Four of the 5 remaining councils have used FEPs in the past and/or were reconsidering their use as a policy instrument. West Coast Regional Council did not respond.

Table 27 FEPs and their focus by regional authority

Council	FEP?	FEP name(s)	Character	Programme focus and notes
Auckland	½✓	*(Farm Plan)*	*(Voluntary)*	Previously used for priority catchments. Farm plans have been completed by council in the last 5 years, but there is no monitoring (exception of 2) and no intent to prepare more plans.
Bay of Plenty	✓	Nutrient Management Plan	Regulatory	Targets a priority catchment (Lake Rotorua Catchment). Targets all farms >40 ha from 2017 and all farms 5–40 ha from 2022.
		Fonterra Farm Environment Plan	Voluntary	Targets dairy farms in a priority catchment (Greater Lake Tarawera Catchment).
		BLNZ Land and Environment Plan	Voluntary	Targets SBD[1] farms in a priority catchment (Greater Lake Tarawera Catchment).
Canterbury	✓	BLNZ Land and Environment Plan	Regulatory	Targets all farms across the Region that require land-use consent to farm under Plan Change 5 of the Land and Water Regional Plan. ECan accepts FEPs prepared from at least 18 different FEP templates[2]. Only the top 3 are listed here.
		DNZ Sustainable Milk Plan		
		FAR FEP		
Gisborne	✓	Rere Water Quality Enhancement Project	Both	Targets a priority catchment (upper Wharekopae catchment). Targets all farms.
		Arable Cropping	Regulatory	Targets all commercial vegetable growing and cropping activities across the Region.
		Intensive Farming	Regulatory	Targets intensive sheep or deer (irrigated or break-fed crop), dairy, and pigs (>9 pigs/ha), across the Region.
		Sustainable Hill Country Works Plan	Regulatory	Soil conservation plans that target Land Overaly 3A 'worst eroding land', regulated through the Tairawhiti Resource Management Plan (all LO3A land needs to be treated by 2022).
Hawke's Bay	✓	Farm Environmental Management Plans	Regulatory	Targets a priority catchment (Tukituki Catchment) involving all farms >4ha except for low intensity properties <10ha. Plan Change 6.
Manawatu-Wanganui	✓	Sustainable Land Use Initiative	Voluntary	Primarily targets hill country farms across the Region, prioritised by catchments and farms (greatest focus on Top and High Priority farms).
		Whanganui Catchment Strategy	Voluntary	Targets a priority catchment (Whanganui Catchment, but particularly the Ohura Catchment). Targets hill country farms.
		Nutrient Management Plans	Regulatory	Targets 'intensive' farms (dairy, irrigated SBD, arable, vegetables) in several prioritised catchments, and new intensive farms including dairy conversions, anywhere in the Region.
		Soil Health Plans	Voluntary	Focus on land uses where soil health may require monitoring (e.g. cropping).
		Environmental Farm Plans	Voluntary	EFPs are used for farms that are not eligible for other programmes.
Marlborough	½✓	*(Dairy Farm Plans)*	*(Voluntary)*	Targeted priority catchments, but no longer operative as up-take from users was low.
Nelson	½✓	*(Farm Environment Plan)*	*(Voluntary)*	Currently no farm plan programme, but this was in review at time of the survey. Previously Farm Environment Plans in 2015.
Northland	✓	Farm Water Quality Improvement Plan	Voluntary	Available to all farms across the Region.
		Kaipara Hill Country Erosion Plan	Voluntary	Targets hill country by priority catchment (Kaipara Catchment).
		Biodiversity Plan	Voluntary	Available to all farms across the Region.

Council	FEP?	FEP name(s)	Character	Programme focus and notes
Otago	×	-	-	No farm plan programme.
Southland	✓	Focus Activity Farm Plan	Voluntary	Targets all farms across Southland >20ha, and focuses on LUC classes 1-4 (i.e. more intensive farming).
		Farm Environment Plan	Regulatory	Targets farms across the Region under Rule 20 of the Proposed Water and Land Plan (Rule 20), or as part of a consent application (e.g. for effluent discharge). Also known as the 'Appendix N farm plan'.
Taranaki	✓	Comprehensive Farm Plan	Voluntary	Targets all hill country properties across the Region (excluding Egmont Ring-plain).
		Agroforestry Plan	Voluntary	Targets properties with a significant component of commercial forestry anywhere within the Region.
		Riparian Management Plan	Both	Primarily targets dairy and dairy support in the intensively farmed zone of the Egmont Ring-plain and the coastal terraces. Initially voluntary, there is now greater emphasis on audits to achieve 2020 expectations.
Tasman	✓	Environmental Farm Plan	Voluntary	Used when deemed necessary (discretionary application) for special purposes. Can be selectively used anywhere in the District. Primary focus is water quality management.
Waikato	✓	Environmental Programme Agreement	Voluntary	Target is all farms in prioritised catchments (but occasionally EPAs in non-priority catchments also). EPAs cover a works plan and funding agreement - focused on particular agreed issues or areas on farm. They are not as comprehensive as traditional 'farm plans'.
		Farm Plan	Voluntary	Occasionally prepared comprehensive farm plans, usually only undertaken for intensive, high risk, or demonstration farms in priority catchments. Special project farm plans.
Wellington	✓	Farm Environment Plans	Voluntary	Targets intensive farms in priority catchments. Approximately 15% of FEPs are non-dairy farms.
		Hill country farm plans	Voluntary	Programme targets erodible hill country mostly in the western Wellington Region, and includes several generations of farm plans; most recently WRECI farm plans.
West Coast	-	-	-	

[1] Sheep, beef, and/or deer farms (breeding or drystock).
[2] https://www.canterburywater.farm/fep/

Eight councils have more than 2 FEPs available, while two councils indicated that they use more than 3 FEP types (Gisborne and Manawatu-Wanganui). Hawke's Bay and Canterbury are different in that they accept a diversity of FEPs prepared by third-party providers. For example, Canterbury will accept FEPs prepared according to at least 18 different FEP templates. Templates often vary according to the land use systems they associate with.

The number of regulatory FEPs has increased in recent years. Of the 30 FEP types listed (Table 27), 20 are based on voluntary uptake, 8 are wholly regulatory, and 2 are both voluntary and regulatory. Previously, nine of NZ's 16 regional authorities had FEP programmes involving 20 different types of FEP in 2004. All programmes were voluntary (Manderson et al., 2007). In principle, regulatory FEPs could have a stronger emphasis on FEP-holders providing accurate and potentially detailed information to councils as part of the FEP process, and thus hold a strong potential for the development of quality indicators. However, this depends on council requirements, monitoring systems, and recording systems.

7.2 FEP targeted and current numbers

Before the formation of regional authorities, there existed a national target to prepare 9,556 FEPs (as soil conservation farm plans) over a 50-year period. More than 6,000 plans had been prepared at the 25-year midpoint, demonstrating the initiative was on target

and making large gains on the original ambition (Manderson, 2005). Today, there is a soft expectation that an estimated 25,000 commercial pastoral farms will eventually require farm plans through increasing freshwater compliance requirements.

Survey participants were asked if their councils' have targets and current numbers for FEPs as of August 2017 (Table 28). For the 11 councils with operative FEP programmes, 7 can definitely report on targeted FEP numbers, and a further 2 could potentially report if targeted area (e.g. 20,000 ha of land coming under programme management) was translated into a targeted number of farms.

Table 28 FEP targeted number and progress (August 2017)

Council	FEP name (abbrev.)	Target (# FEPs)	Progress (# FEPs)	Comments and notes
Auckland	*(FP)*	*0*	*? (more than 2)*	*(programme not operative)*
Bay of Plenty	NMP	350	57	
	FFEP	31	?	
	BLNZ LEP	16	?	
Canterbury	BLNZ LEP	est. 3,800 FEPs required	431	ECan (2018) suggest a minimum 3,800 FEPs are required.
	DNZ SMP		479	
	FAR FEP		188	
Gisborne	Rere FEP	~50	21	
	Arable FEP	~300	0	Progress initiates when the GRF Plan becomes operational.
	Intensive FEP	~50	0	
	SHC WP	other	234	Targeted area (of LO3A) is used rather than targeted FEP#.
Hawke's Bay	FEMP	~1,100	~200	
Manawatu-Wanganui	SLUI WFP	other	+650	Targeted area (20k ha/yr).
	WCS FEP	2–4/yr	38	Target 2–4 FEPs/yr.
	NMP	~400	220	Required for consents.
	SHP	2/yr	31	Target 2 SHPs per year.
	EFP	other	32	Prepared as required.
Marlborough	*(DFP)*	*0*	*11*	*(programme not operative)*
Nelson	*(FEP)*	*0*	*?*	*(programme not operative)*
Northland	FWQIP	+181/yr	600–700	Target +181 FWQIPs and KHCEPs per year.
	KHCEP			
	BP	?	?	
Otago	-	-	-	No programme.
Southland	FAFP	200/yr	461	
	FEP	Est. 3,900	0	Progress initiates when the W&L Plan takes effect.
Taranaki	CFP	450	415	
	AP	other	71	Prepared as required.
	RMP	3,000	2,700	
Tasman	EFP	other	?	Prepared as required.
Waikato	EPA	0	?	Not target driven with regard to the number of plans.
	FP	0	?	
Wellington	FEP	170	60	
	HCFP	?	+364	From Basher et al. (2016).
West Coast	-	-	-	No response.

A conservative national estimate of targeted FEP numbers is 15,845. This is an under-estimate because several councils – including large councils such as Waikato – either do not use FEP numbers as a target, or the target is expressed annually as a rate rather than a total. In terms of actual progress, the number of FEPs that have been prepared is estimated 7,265 (August 2017).

Targeted and number of FEPs provides a simple high-level indication of one facet of national environmental uptake. It is straight-forward to calculate, and the results in Table 28 suggest that most councils could collectively report on this indicator without too much trouble. It is, however, far from being a perfect indicator, as FEP scope and detail can be highly variable (not all FEPs are created equal), and regional FEP targets are often policy-specific and may therefore be invalid when aggregated nationally. For example, if Canterbury's Plan Change 5 was applied to all of NZ then the total number of targeted FEPs would likely be far higher than numbers aggregated from regional targets. We currently have no existing national targets for FEP numbers. Also, national tallies may be higher if industry-only FEPs are included.

7.3 FEP focus (environmental issues)

Respondents were asked to prioritise environmental issues associated with FEP type. Full results are included in Appendix 1. The frequency rating of different priorities is presented as Table 29.

Table 29 FEP priority ratings for different environmental issues (rated by frequency)

Environmental issues	Frequency				Total number of FEPs
	1st Priority (count)	2st Priority (count)	3st Priority (count)	Zero or no priority (count)	
Water quality	22	4	1	0	27
Erosion	11	10	2	4	27
Biodiversity	6	8	3	10	27
Soil health	3	3	3	18	27
Water use	6	6	9	6	27
GHG	0	1	3	23	27
Cultural heritage[1]	*0*	*1*	*0*	*26*	*27*
Pest management[2]	*0*	*1*	*2*	*24*	*27*

[1] Auckland Regional Council only.
[2] Northland Regional Council only.

Water quality was rated as first priority of councils' FEPs 22 times. Only occasionally was water quality rated as 2nd or 3rd, and of all the issues listed, it was the only issue that consistently attracted a definite priority rating (i.e. no zero priority). Erosion follows, rated as 1st priority 11 times and 2nd priority 10 times. We suggest water use closely followed by biodiversity as the next most prioritised issues.

The environmental focus of FEPs at any given time provides a snapshot of what is currently important regarding environmental management. At this time, it is clearly water quality, but in previous decades soil conservation has been dominant, and issues such as biodiversity and soil health would likely have qualified as having higher priority ratings.

7.4 Access and sharing permissions regarding types of FEP data

This survey can only provide a degree of insight into the compatibility of data and indicators between councils. Actual compilation would require a standardisation evaluation at some point. We have endeavoured to pre-empt the initial requirement for

this scenario by asking respondents about their councils' level of access and potential for sharing data related to FEPs. The full tabulated results for 13 councils and 27 FEPs are included in Appendix 1.

Councils understandably have almost universal access to FEP reports (Table 30), with the few examples of nil access presumably referring to industry-prepared FEPs. Access to GIS files or data is also reasonably high (16 FEPs from 9 councils), more so if the "Potentially" responses were included (would represent a total of 24 FEPs from 12 councils).

Three councils have access to Overseer files for 5 types of FEP (Canterbury, Manawatu-Wanganui NMP, and Bay of Plenty NMP). We reinterpret this as Canterbury having access to Overseer files for all their approved FEPs (i.e. access to a large number of files within one region). Likewise, Manawatu-Wanganui has a similar access to Overseer files regarding intensive farms across the Region, while Bay of Plenty has a catchment-confined access regarding NMPs in the Rotorua Catchment.

Nationally, we conclude that council access to Overseer files is limited and confined to 3 councils, although this may be slightly higher if the "Potentially" and "Don't know" responses were included (other Bay of Plenty FEPs, some Gisborne FEPs, Waikato FPs, and Wellington FEPs). Overseer files prepared for regulatory purposes often represent a rich source of farm production and environmental management data, available in an already standardised form that can be readily extracted and summarised for reporting.

Table 30 Councils' access to types of FEP-related data by FEP count

Council holds the data or has data access?	Data type		
	FEP reports	Overseer files	FEP GIS files or data
Yes	22	5	16
Potentially	1	4	8
No	2	8	1
Don't know	0	2	0
(no reply)	2	8	2
Total response	**27**	**27**	**27**

Table 31 Types of permissions required to share FEP-related data by FEP count

What is the key permission required for data sharing?	Data type		
	FEP reports	Overseer files	FEP GIS files or data
Council has full discretion to share	6	4	6
Farmer permission required	13	2	9
"It's complicated"	4	4	4
No council access to the data	2	7	1
Don't know/untested	0	0	3
(no reply)	2	10	4
Total response	**27**	**27**	**27**

The potential for sharing data is more complicated. While a small number of councils can share all or some of their FEP data at their own discretion (2 councils), a higher proportion require individual farmer permission regarding FEP reports, and FEP GIS files or data (Table 31). However, in many cases we suspect that most councils are in a position to at least share aggregate data, whereby data cannot be traced back to individual farm properties (thus protecting confidentiality). In this scenario, individual councils would need to

undertake the aggregation activity themselves, which in turn requires a pan-council method or protocol to ensure comparability between councils. It can also be difficult in many instances to remove individuality where GIS data are involved, as GIS data are generally explicit with regard to location.

7.5 Potential indicators from FEP data

Respondents were invited to nominate indicators that could potentially be reported using data from their council's FEPs. Twelve councils replied, representing a total of 26 different FEPs. The full tabulation of results is included in Appendix 1. A summary ranked by FEP count presented as Table 32.

Table 32 Potential indicators from FEP data (summary)

FEP indicators	# of FEPs	General theme
# FEPs prepared	24	Generic indicators applicable to all FEP types (mostly response indicators).
Area of FEPs prepared	20	
# or area of FEPs prepared in priority areas	19	
# FEPs completed	19	
# FEPs actively implementing works	18	
Land use class	16	
Farm effective area	15	
Area of FEPs actively implementing works	14	
# FEPs waiting to be prepared	13	
Length of streams requiring protection	12	Activity/works related indicators applicable to broad FEP types (riparian, nutrient, soil conservation). Mostly response and response-state indicators.
Length of streams protected	12	
Area of land that is retired from production	12	
Area of land requiring erosion control	12	
Area of land with erosion control	12	
Farm N-loss to water	10	
Area of land that could/should be retired	10	
Annual pasture production	9	Occasional or specific indicators. Mostly pressure and response-state indicators.
Stocking rate	8	
Irrigation area size	7	
Soil fertility (e.g. Olsen P)	7	
Fertiliser use	7	
Farm N-use efficiency	7	
Farm P-loss to water	7	
Water use rate	6	
Area cropped annually	6	
Effluent area size	4	
Farm GHG emissions	3	
Behaviour change	*1*	(additional indicator included by Wellington).

The greatest potential is for indicators describing FEP numbers and areas, which is understandable as these types of indicators encompass all FEP types. Hawke's Bay was the only council not indicating FEP number and area as potential indicators (outhland FEPs at the time were not yet operational).

The net potential decreases as indicators become more strongly associated with broad FEP types (riparian, soil conservation, intensive farming), although in the context of types of environmental issues or FEP types, they are still very eligible indicators. Lastly, indicators with the lowest potential tend to relate to land use intensity and contaminant losses.

We were somewhat surprised with the low apparent ranking for land use intensity and contaminant losses as potential indicators. Both provide strong insight into pressure and state, and could thus contribute well to any regional monitoring programme. N-loss to water is rated slightly higher than other contaminants, but is only recorded by 5 councils as part of FEPs. Only two councils include Greenhouse Gases (GHGs) as part of their FEPs.

7.6 Types of GIS layers or GIS data are used in the preparation of FEPs

Twelve councils representing 26 FEPs provided a response when invited to indicate the types of GIS layers or GIS data used in the preparation of FEPs (Table 33).

Table 33 Types of GIS layers or GIS data used in the preparation of FEPs

GIS features	# of FEPs	Comments
Farm parcels (i.e. polygons)	25	
Farm location	23	
Paddock boundaries	20	
Farm waterways	19	
Features of biodiversity value	17	
Recommended or required works	17	
Farm drains	15	
Farm tracks and races	13	
Critical source areas (N, P, or bugs)	13	
Implemented works	13	
Farm-scale soil layer	12	
Stock yards & other stock facilities	12	
Farm-scale LUC layer	11	
Nutrient management blocks	11	
Features of cultural significance	11	
Farm-scale land cover layer	10	
Crop area	10	
Artificial drainage areas (subsurface)	9	
Effluent application area	8	
Irrigated area	8	
Contaminated sites	6	
Riparian vegetation	*3*	(additional GIS features included by Canterbury).
Fences adjacent to water bodies	*3*	
Flood protection	*3*	
Public access	*3*	
Access routes used to maintain waterways	*3*	
Stock access/crossing	*2*	
Soil fertility transects/sites	1	

Results provide some insight into the potential for indicators to be expressed in map form.

7.7 Online data collection applications

Online data collection applications are increasingly common, and offer great potential for indicator development as data are already standardised. Respondents were asked if their councils use online data collection applications, and what degree of access they may have (Table 34).

Table 34 Accessibility of online data collection applications

	Online data collection applications				*Other suggested applications*
	DairyNZ Riparian Planner	**AgFirst Landbase**	**Farm Portal (ECan)**	**Overseer Online**	
Auckland	No access				
Bay of Plenty	Council has full database access	No access	No access	Council has partial data access	
Canterbury	No access	No access	Council has partial data access	No access	
Gisborne					Beef+LambNZ data. FAR data (and ProductionWise).
Hawke's Bay	No access	No access	No access	No access	
Manawatu-Wanganui	Don't know/untested				
Marlborough					
Nelson					
Northland	No access				
Otago					
Southland					Farm IQ, environment module.
Taranaki					
Tasman	Don't know/untested			Don't know/ untested	
Waikato					
Wellington	Council has full database access			Council has partial data access	S-map.
West Coast					

The depth and character of the responses suggest to us that online data collection applications have limited immediate potential.

7.8 Conclusions and discussion – Farm Environmental Plans

- The use of FEPs is widespread, with 11 councils having one or more FEPs available, while 4 of the other 5 councils have used FEPs in the past. Thirty different types of FEP were identified.
- Most FEPs are voluntary (20 of the 30), two are both voluntary and regulatory, while eight are wholly regulatory. In 2004 all FEPs were voluntary.
- We believe that that at least 9 councils can report on *targeted numbers of FEPs*. This has potential as a response indicator, but requires improved definition between councils. Conservatively, we estimate *targeted numbers of FEPs* at 15,845.
- Ten councils can report *current number of FEPs* for most of their FEP programmes. This is likely the easiest and most consistent FEP indicator for national reporting.

- The *current number of FEPs* prepared is conservatively estimated at 7,265 (based on numbers supplied as part of the survey).
- The *environmental focus of NZ FEPs* is currently dominated by water quality (rated 1st priority 22 times out of 27) followed by soil erosion. In previous years the focus has been dominated by erosion.
- Council access to FEP reports is high. The few instances where councils have nil access are likely related to industry-prepared FEPs. Access to GIS files or data is also reasonably high (applies to 16 FEPs from 9 councils).
- Only 3 councils have access to Overseer files associated with certain types of FEPs (total of 5 FEPs nationally). Overseer files represent a rich source of already standardised data. However, limited national access to Overseer data limits its current use for indicator development. Canterbury has good access to Overseer data for an increasing number of farms, and could in principle develop powerful indicators for regional purposes.
- We expect that eventual compilation of national indicators from council data would require an exercise or project of standardisation. Councils generally appear to be comfortable sharing pre-aggregated data, but most require FEP-holder permission to share individual data. Only 2 councils indicated they have full discretion to share some or all of their FEP data. Standardisation and preparation of indicators would therefore need to be undertaken by each council.
- Generic high-level indicators such as *number of FEPs prepared* could be reported on quickly.
- More specific indicators such as *area of land treated for erosion* would require an element of standardisation which is readily achieved through definition. Individual councils would need to apply these definitions.
- FEP indicators that carry the greatest immediate potential for reporting include:
  - *Number of FEPs prepared.*
  - *Area of FEPs prepared.*
  - *Number and/or area of FEPs prepared in priority areas.*
  - *Number of FEPs completed.*
  - *Number of FEPs actively implementing works*.
- A high proportion of councils indicated they use GIS data in the preparation of FEPs, and these GIS relate well to the FEP indicators listed above. This suggests many of these indicators can be expressed in map form.
- There is considerable overlap between the three types of environmental programme examined in this study. Issue-specific indicators that could be drawn from FEPs (e.g. *length of streams protected*, *area of land with erosion control*) are addressed under the riparian protection and soil conservation parts of this report.
- We are confident that additional useful indicators could be developed from FEP data, but at this time reporting would be confined to a small number of FEPs (indicators listed below). Realising the potential of these indicators would require a greater number of councils to include them as part of their FEP programmes:
  - *Farm N-loss to water*
  - *Stocking rate*

- *Irrigation area size*
- *Soil fertility (e.g. Olsen P)*
- *Fertiliser use*
- *Farm P-loss to water*
- *Water use rate*
- *Area cropped annually*
- *Effluent area size*

- Currently online data collection applications such as Overseer and the DairyNZ Riparian Planner have limited potential for collective indicator reporting because of nil or limited access by many councils. Such applications have considerable potential for the future as data are already in a standardised form.

8 Discussion

8.1 Potential indicators

The three surveys implemented in this project were designed as information gathering surveys rather than statistical surveys. The key advantage is that respondents have the option to convey a depth of context or detail not otherwise available with more closed survey methods, and can respond with useful information that the survey designers may not have otherwise foreseen and drafted questions about. Disadvantages include more time required to compile responses, and more recognisable uncertainty in replies (e.g. cf. yes/no answers that convey nil insight into uncertainty). Drawing definitive conclusions from such results can also be a challenge.

We are, however, confident that – based on our interpretation of respondents' replies – that sufficient opportunity currently exists to report on the state of soil conservation, riparian protection, and FEP progress in NZ. However, specific indicators may not be available from 100% of councils, and a little further work is suggested to ensure quality reporting (Sections 8.2–8.5). The greatest immediate opportunity rests with high level indicators, some of which are already in use:

Riparian protection

- Number of riparian protection initiatives (as jobs or sites).
- Number of riparian plans prepared.
- Number of riparian protection grants allocated.
- Net value of riparian protection grants allocated (or total value to recognise in-kind contribution).
- Length of riparian fencing installed.
- Number of riparian trees or shrubs planted.
- Length of waterway with riparian protection.

Soil conservation

- Number of soil conservation poles planted.
- Number of soil conservation plans prepared.
- Length of fencing installed for soil conservation.
- Area of land treated for soil conservation.
- Area of forestry established for soil conservation.
- Area of land retired from grazing (for soil conservation).
- Number of soil conservation grants allocated.
- Net value of soil conservation grants allocated (or total value).

Farm Environmental Plans (FEPs)

- Targeted coverage of FEPs (number or area).
- Number of FEPs prepared.
- Number of FEPs by type.
- Number of active FEPs.
- FEP coverage (area of land under FEPs).

These are all response-type indicators that provide evidence that work is being done toward environmental improvement.

Post-implementation indicators are under-represented at present (e.g. plant deaths, plant condition, area of stream shaded) and we did not identify any monitoring initiatives that could directly relate riparian protection or soil conservation activity to environmental outcomes (e.g. changes in water quality). Likewise, in most cases we have avoided recommending targets as indicators. While targets have value (Section 8.7), the differences regarding targets between regions is too great to ensure consistency.

Data accessibility is regarded as the greatest challenge (Section 8.3). Whereas the greater proportion of councils should be able to contribute to these indicators in a reporting sense, a smaller proportion may require a significant compilation exercise. We feel data accessibility over the longer term is likely to improve as councils further develop their data management systems.

8.2 Programme variability between councils

There are considerable differences between councils in terms of programme extent and depth. For example, prioritisation is more common than blanket regional application, and the area of land within a region that is actively targeted (and thus treated and qualifying for indicator inclusion) will be quite different between councils. This is entirely understandable (e.g. differences in resourcing), but it does imply a question regarding the representativeness of any given response indicator between councils. As an example, and as an extreme, whereas Tasman could report some soil conservation indicators they would likely pertain solely to a small number of farms, while Manawatu-Wanganui could report the equivalent indicators but for over 670 farms.

Similar representativeness questions may apply to other indicators developed from council datasets (e.g. see LAWA). We do not have an immediate answer, and we suspect any answer would be impractical to implement. It is, however, important to highlight as it may affect indicator quality (Section 8.5).

8.3 Data management systems

The state of data management and recording systems is also variable between councils (for riparian, soil conservation, and FEPs). At one extreme, a small number of councils appear to have well-developed centralised and powerful database systems capable of meeting a wide gamut of environmental programme data and reporting needs. At the other, individual LMOs hold their own collections of project-by-project datasets as hardcopy or locally stored digital files, or a combination of the two. Most councils sit somewhere in between. We infer, also, that the greater proportion of councils are continually looking to improve their data management systems for environmental programmes.

The state of data management will affect councils' ability to contribute to collective reporting because of differences in ease of data access. Those with centralised systems will be in a position to quickly access the required data, while those without centralised systems would likely need to undertake a substantial data collation and translation exercise. We see two options to manage this situation:

1 Focus only on the easy-to-collate indicators, with a view to add more indicators overtime as council data systems improve. FEP numbers and coverage are an example.

2 Report on more indicators accepting there will be regional gaps, with a view that the gaps will be addressed in time.

For councils working towards the development of centralised databases and datasets, we would strongly recommend talking with councils who have already been through the process. In particular, Bay of Plenty, Waikato, and Manawatu-Wanganui regional councils appear to have well-developed systems for some or all their environmental programmes. They would have figured out what works, what doesn't, and how to avoid mistakes that they've had to resolve post-implementation.

8.4 Standardisation

Data type and management differences between councils would necessitate an exercise of standardisation as a critical part of indicator compilation. This is to ensure all data are equal and thus technically comparable. This need not be a large exercise, depending on the number and type of indicators. At the very least, indicator definitions should be proposed. For example, whereas the national number of FEPs could quickly and easily be reported, there are very wide differences in what the term 'farm environmental plan' can encompass.

A higher level of standardisation would be achieved if the indicators were developed within the National Environmental Monitoring Standards (NEMS) framework.[2] Standards for *Riparian Characteristics Monitoring* are currently proposed.

8.5 Indicator rigour

Statistics NZ provide a list of principles and protocols for Tier 1 statistics (Statistics NZ, 2018) that is useful for evaluating the rigour of indicators used for national reporting. The ten principles (Appendix 2) are applied to our indicators in a general manner to gain a degree of initial insight regarding suitability for national reporting.

1 **Relevance**: The indicators described in this report are largely response and response-state type indicators. They provide evidence that work is being done to address environmental issues, and thus we consider that they carry high relevance toward national reporting.

2 **Integrity**: This is largely about the objectivity and transparency of compilation methods, which we believe could be addressed through standardisation (Section 8.4).

3 **Quality**: Indicator development should be based on 'relevant and reliable data sources', and developed 'using sound statistical methodology'. While council data sources should satisfy the first condition, the second condition requires expert advice. We suspect it would be a challenge to ensure true statistical rigour for all potential indicators (e.g. see Section 8.2). However, even with existing national SoE indicators, this condition can be subject to differences in interpretation (hence the need for expert advice).

4 **Coherence**: This is likely to be achieved if the developed indicators sit within existing national frameworks (e.g. NEMS).

5 **Accessibility**: We expect the intent is to publish indicators so accessibility by default is high.

6 **Efficiency**: Using existing data sources to generate new indicators rates highly in terms of efficiency and value for money.

7 **Protecting respondent information**: We foresee data aggregation as necessary (indeed, many councils are reluctant to share individual information), but further consideration is desirable for indicators tagged with a location (i.e. expression of indicators in map form).

8 **Minimising respondent load**: This is influenced by choice of indicators, and will vary between councils according to data system stage of development. Some will likely require a degree of investment (time and effort) to manually collate material, but the indicators suggested in this report are for the most part indicators that several councils already report on, suggesting that a (manual) compilation exercise could have internal merit also.

9 **Maximising existing data sources**: Scores highly.

10 **International participation**: Not applicable in this context.

[2] http://www.nems.org.nz/

Overall, we believe the indicators proposed in this report have a promising potential to meet principles of Tier 1 statistics, although further work is required.

8.6 Non-council initiatives

Councils are certainly not the only organisations promoting on-farm environmental improvement and FEPs. For example, Fonterra aim to prepare 1,000 dairy FEPs in the 2018 financial year, with an ambition to have FEPs for all Fonterra farms by 2025 (Fonterra, 2017). Similar initiatives are promoted in the sheep/beef, deer, arable, and horticultural industries, and the wider dairy sector. Other mechanisms also exist for retiring or enhancing land (e.g. QEII Open Space Covenants, Ngā Whenua Rāhui kawenata, Lottery Grants).

Many of these initiatives overlap with council environmental programmes, and it can be difficult to differentiate the two for obtaining a clear picture of NZ state and progress. Either an attempt is necessary to differentiate or include non-council initiatives, or any developed indicators need to be continually qualified as relating only to regional authorities.

In a similar context, other agencies are reporting indicators that overlap with those investigated in this report. For example, nutrient management planning is now monitored by Statistics NZ and Ministry for Primary Industries through the Agricultural Production Survey (approximately 39% of farms have nutrient management documentation, but less than 6% have a Nutrient Management Plan). Likewise, approximately 44% of sheep and beef farmers already have a FEP (Corina Jordan, pers. comm.). NIWA have recently begun exploring the development of a National Riparian Restoration Database that proposes to draw on council data (Storey and Valois, 2018). This suggests there may be some merit in investigating the inclusion of non-council initiatives.

8.7 National targets

Indicators are most useful when they can be compared to a baseline or a targeted state. Many councils indicated that they have targets for soil conservation, riparian protection, and FEPs. However, not all had targets; the targets were not necessarily comparable between regions; and targets were often focused and not regionally applied. We are not confident that absolute targets for a required or desired state have yet been established by all councils.

It is not an infeasible proposition to have broad targets at national and regional scales, with a view that more detailed or specific programme targets can fit into (and contribute to) an encompassing targets framework. For example:

- The area of land requiring erosion protection, and the type of protection required.
- The length of streams requiring protection, and the type of protection required.
- The number and type of FEPs required.

While national and regional scale targets obviously lack the operational detail that is achievable within farm-by-farm environmental programmes, they would provide sufficient context to better judge the representation of existing council targets, and thus add greater meaning or understanding of works type indicators.

9 Conclusion

We conclude that sufficient opportunity exists for regional authorities to collectively report on indicators describing the state and progress of riparian protection, soil conservation, and Farm Environmental Plans. However:

- Environmental programmes differ widely between regional authorities in terms of programme types, extent of availability, what is monitored, and how any planning, implementation, and monitoring data are recorded and managed. A spectrum of capability exists regarding the potential for collective reporting of environmental programme indicators. A small number of councils may not be able to easily contribute because their data are not in readily accessible forms, or will require an internal manual compilation exercise before they can contribute.
- Differences extend to what is recorded and how it is recorded. Data for indicator development sourced from multiple councils will likely have differences in definition or meaning, quality, and completeness.

We do not regard these as insurmountable problems; indeed, we expect they are likely common problems that have already been encountered in the development of similar indicators (e.g. LAWA). Further, our recommendations are largely proposed solutions to the two key problems listed above.

10 Recommendations

- Adopt the following indicators (Table 35) as an initial first step toward collectively reporting on the state and progress of riparian protection, soil conservation, and Farm Environmental Plans. They are all response type indicators that provide evidence that work is being done toward environmental improvement. Several councils already report on these indicators, and we regard them as the least onerous set of indicators for councils with data in the least accessible forms.

Table 35 Recommended indictors for collective reporting

Riparian protection	Soil conservation	Farm Environmental Plans (FEPs)
Number of riparian protection initiatives (as jobs or sites).	Number of soil conservation poles planted.	Targeted coverage of FEPs (number or area).
Number of riparian plans prepared.	Number of soil conservation plans prepared.	Number of FEPs prepared.
Number of riparian protection grants allocated (or total value of works)	Length of fencing installed for soil conservation.	Number of FEPs by type.
Net value of riparian protection grants allocated.	Area of land treated for soil conservation.	Number of active FEPs.
Length of riparian fencing installed.	Area of forestry established for soil conservation.	FEP coverage (area of land under FEPs).
Number of riparian trees or shrubs planted.	Area of land retired from grazing (for soil conservation).	
Length of waterway with riparian protection.	Number of soil conservation grants allocated.	
	Net value of soil conservation grants allocated (or total value of works).	

- Provide advice on data management systems (relating to environmental programmes). Enhancing data usability is an explicit goal of the Strategic Roadmap for Land and Water Research (Phillips et al., 2018), and ultimately it is in the best interests of all councils to have data management systems that promote council-to-council interoperability of data. A small number of councils have developed impressive data management systems, and it would be beneficial if their designs and experiences were shared with those currently developing, or looking to develop, systems to better manage their environmental programme data.
- Standardisation of indicators and indicator-data within the National Environmental Monitoring Standards (NEMS) framework. This is an unavoidable and essential recommendation given the diversity between councils.
- Consider the development of a framework that proposes national targets for riparian protection, soil conservation, and Farm Environmental Plans. Targets provide an important benchmark for gauging progress, but targets currently used by councils tend to be regionally specific with nil value for national comparison. Technically we believe this is an achievable proposition, and one that would clarify the realities of environmental management in NZ. We acknowledge some political difficulties would likely be encountered.
- Consider the inclusion of non-council initiatives especially those involving riparian protection, land retirement, and FEPs. Alternatively, explicitly qualify any reporting as pertaining to regional authorities only.

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12 References

Basher L, Lynn I, Barringer J 2015. Options for updating the erosion information in the NZLRI: a discussion document. Landcare Research Contract Report LC2103.

Basher L, Manderson A, McIvor I, McKergow L, Reid J 2016. Evaluation of the Effectiveness of Conservation Planting and Farm Plans: a discussion document. Landcare Research Contract Report LC2546.

Environment Canterbury (ECan) 2015. Canterbury Water Management Strategy Targets. Progress Report June 2015. https://ecan.govt.nz/your-region/your-environment/water/measuring-progress/ (accessed January 2018).

Environment Canterbury (ECan) 2018. Farming to limits and Farm Environment Plan audits report. September 2018. https://ecan.govt.nz/reporting-back/farm-environment-plan-audits/ (accessed September 2018).

Fonterra 2017. Sustainability Report. For the year ending 31 July 2017. https://view.publitas.com/fonterra/sustainability-report-2017/page/1 (accessed March 2018).

Horizons Regional Council (HRC) 2017. Freshwater Management. http://www.horizons.govt.nz/HRC/media/Media/Agenda-Reports/Environment-Committee-2017-11-04/1767%20Annex%20A%20Freshwater%20Progress%20Report.pdf (accessed January 2018).

Jones H, Drewry J, Burton A, Burgess D, Wyatt J 2015. Knowing our land – a review of land and soil state of the environment monitoring and reporting in New Zealand. Scoping report of the Environmental Monitoring and Reporting (EMaR) Land project. Unpublished report.

Manderson A 2005. A National Perspective on Farm Planning In New Zealand. Growing Sustainably. New Zealand Association of Resource Management Conference, Napier, New Zealand, October 2005.

Manderson A, Mackay A, Palmer A 2007, Environmental whole farm management plans: their character, diversity, and use as agri-environmental indicators in New Zealand, Journal of Environmental Management 82(3) 319-31.

Phillips C, Collins A, Hill R, Jones H, Drewry J, Watt S 2018. Research Roadmap – Land and Soil 2018–2020. Landcare Research Contract Report LC 3122.

Statistics NZ 2018. Summary of Principles and Protocols for Producers of Tier 1 Statistics. https://www.stats.govt.nz/assets/Uploads/Principles-and-protocols-for-producers-of-tier-1-stats/summary-principles-protocols-for-producers-of-tier-1-stats.pdf (accessed March 2018).

Storey R, Valois A 2018. Building a National Riparian Restoration Database. NZARM Broadsheet. Newsletter of the New Zealand Association of Resource Management. October 2018, Issue 32.

Taranaki Regional Council (TRC) 2018. Quarterly Operational Report March 2018. https://www.trc.govt.nz/council/plans-and-reports/financial-and-operational-reports/quarterly-operational-reports/ (accessed March 2018).

Tasman District Council (TDC) 2001. Riparian Land Management Strategy. March 2001. http://www.tasman.govt.nz/policy/strategies/riparian-land-management-strategy/ (accessed January 2018).

Appendix 1 – Full tables

Table 36 Respondent's comments regarding riparian services and grant systems

Programme	Comments
Bay of Plenty 1	Riparian management is generally 50:50. Alternative water supply is for farmers who are relying on streams for stock water. Rate is set per trough $500.00. Landowner labour is also incorporated into the costs. We will fund contractors to do work, or the landowner can do the work themselves and this goes towards their share of the costs. We occasionally fund other works or provide subsidies for other activities in specific catchments for specific reasons that may be outside the standard riparian funding policy. For example, nutrient management group in Nukuhou Catchment, a group of farmers looking at refining their farming operations to improve environmental outcomes. We don't fund infrastructure like bridges.
Bay of Plenty 2	As for initiative #1 – we provide advice for all and any enquiries at no charge.
Canterbury	We do not provide these services directly unless they are on council owned/ managed lands A biodiversity project proposal (private/ public land tenure) would be submitted and assessed in terms of ecological criteria for the biodiversity values 'on site' A funded project may have any/ all of these activities associated with it A successful project applicant would engage needed services for the approved project A land owner must cover 1/3rd of total project costs (cash or in kind).
Gisborne 1	The financial assistance comes from MPI - the Erosion Control Funding Programme (ECFP). This includes funding for materials, planting, labour – up to 100% (further information on this fund can be found on MPI website). GDC inputs involve in-kind labour which includes planning, mapping, some supervision of planting.
Gisborne 2	There will be a community liaison officer for this project hired in 2018 who will carry out 10 hours per week. This funding comes from MFE (50%) (freshwater improvement fund) and GDC (and Beef and Lamb, as well as other partners) (50%).
Hawke's Bay 1	The riparian plant programme supplies plants, at a lower cost to farmers specifically for riparian planting fenced off waterways on farms - we use a tender process to achieve this. Advice for design and planting on an as required basis.
Hawke's Bay	The grant is 50% of the total cost of the project up to $5000 grant. Projects are assessed by a LMA, who then ranks the projects according to the criteria/priorities that are set. Higher ranking projects are funded. Landowners have from approx. July to May/June the following year to complete the project. Landowners can use RLS to fence off waterways (excluding Tukituki catchment) and undertake planting (all costs included plants, contractors to plant or labour, spraying, etc.). Cannot double dip between riparian protection initiatives (cannot use RLS to buy plants from RPP)
Manawatu-Wanganui 1	Also finding fish barriers in streams, prioritising for action and actually fixing them – 100. the community projects are mostly riparian fencing and planting and education.
Manawatu-Wanganui 2	Focus catchments get up to 50% subsidy whereas other catchments get up to 30%.
Northland	Plants = up to $1,000 towards plants, cost of plants but landowner plants them (equivalent of 50 % subsidy) Fencing = estimated 100% cost of materials, landowners pay for their time (or contractors) to put them in.
Southland 1	Advice only.
Tasman	Materials for plants generally only includes poplar and willow varieties for erosion control.
Waikato 1	Limited resourcing and funding – so prioritisation occurs.
Wellington 1	Farmers are encouraged to do their own design and planning using the Dairy NZ riparian tool.
Wellington 2	A sliding scale of grant rates is applied depending on the relative on farm/off farm benefit of 30%, 50% or 70%. The grant rate applies to all parts of the project (excluding consent fees).

Table 37 Methods used by different councils to monitor implemented riparian works

Council	Method	Comments
Auckland	Once-off checks are performed within the first 6 months of works implementation	A single check is undertaken to confirm grant funded works have been completed, prior to payment.
Bay of Plenty	Regular annual checks as part of council's ongoing relationship with farmers	Works are monitored as they progress - actual work completed vs planned needs to be verified by inspection before the grant funding can be reconciled and payments made as required. We are variably in touch with landowners over time if their programme is completed and not renewed, and there is a programme of ongoing monitoring to ensure that works are being maintained as per the agreement (e.g., fences, pest plant control, stock are not allowed in), which is implemented at catchment level.
Canterbury	Checks and monitoring are undertaken on an ad hoc basis (e.g. as requested, or as deemed necessary)	An audit of completed works is undertaken for all projects, however project outcome monitoring is not carried out across all biodiversity projects at present. This is being addressed through the roll out of a new project outcome monitoring programme.
Gisborne	Regular annual checks as part of council's ongoing relationship with farmers	monitoring before payment and annual reviews.
Hawke's Bay	Once-off checks are performed within the first 6 months of works implementation	RLS projects are inspected once the project is completed (before payment) - this would be immediately after the project is completed. No formal checks are made after this. In the Tukituki riparian works should be identified in FEMPs so these will be checked – compliance to decide on action and manage.
Manawatu-Wanganui	Once-off checks are performed within the first 6 months of works implementation	before payment of claim. a formal programme has been requested by Council for the future, Logan is looking at options.
Marlborough	Once-off checks are performed within the first 6 months of works implementation	
Nelson	Once-off checks are performed within the first 6 months of works implementation	Also selected: "Checks and monitoring are undertaken on an ad hoc basis (e.g. as requested, or as deemed necessary)".
Northland	Once-off checks are performed within the first 6 months of works implementation	Did not check a box so we infer from the comment: "Depending on the property a farm visit might be done annually, but specific works (NRC co-funded) will be checked off once completed."
Otago	na	
Southland	Regular annual checks as part of council's ongoing relationship with farmers	Checks as part of the enablement grant funding are completed to ensure works have been carried out according to the application. Updating and checking on information is intended to occur through the FAFP programme, with revisits scheduled for every 2–3 years. There are some challenges with completing these at the moment. At this point no checking or follow up of one off riparian plans is undertaken, unless the farmer requests a follow up visit.
Taranaki	Regular annual checks as part of council's ongoing relationship with farmers	
Tasman	Checks and monitoring are undertaken on an ad hoc basis (e.g. as requested, or as deemed necessary)	Occasional photos requested of finished works or site visits for follow up.
Waikato	Checks and monitoring are undertaken on an ad hoc basis (e.g. as requested, or as deemed necessary)	During establishment phase for works we have regular contact with landowners, but from then it is very ad hoc and generally responsive. Response and monitoring as such is also determined by initial level of investment.
Wellington	Once-off checks are performed within the first 6 months of works implementation	
West Coast	na	

Table 38 Comments regarding how councils monitor implemented soil conservation works

Council	Comment
Bay of Plenty	[Monitoring approach] probably varies along that range depending on works and risks associated with works. E.g. a pole planting for a hill that's not actually moving massively might not be followed up on as stringently over the following months/years as a large gully head.
Gisborne	[Monitoring is undertaken] as works plans are progressed.
Hawke's Bay	RLS projects are inspected once the project is completed (before payment) – this would be immediately after the project is completed. No formal checks are made after this. For those with FEMPs in the Tukituki more regular annual checks will occur as part of compliance.
Manawatu-Wanganui	[Monitoring implemented works also includes] auditing of works in 3 ways; updating of works polygons with subsequent aerial imagery, later inspections by the works officer and occasional farm inspections for SLUI auditing.
Northland	[No formal monitoring per se; rather] often based on return visits in subsequent years.
Waikato	For some works of significant scale the works are registered on title, and so a more formal monitoring programme is in place with inspections every 3 years. Less significant works are very ad hoc, if at all.
Wellington	Pole survival app is used for audits.

Table 39 Prioritisation of environmental issues by FEP

Council	FEP name (abbrev.)	Environmental issue and priority[1]							
		Freshwater quality	Erosion	Soil health	water use	biodiversity	GHG	Cultural heritage[2]	Pest management[2]
Auckland	(FP)	2	2	2	2	2	2	2	-
Bay of Plenty	NMP	1	2	0	0	0	0	-	-
	FFEP	1	2	0	0	0	0	-	-
	BLNZ LEP	1	2	0	0	0	0	-	-
Canterbury	BLNZ LEP	1	1	1	0	2	0	-	-
	DNZ SMP	1	2	2	1	3	3	-	-
	FAR FEP	1	2	1	1	2	3	-	-
Gisborne	Rere FEP	1	2	0	0	3	0	-	-
	Arable FEP	1	0	2	3	0	0	-	-
	Intensive FEP	1	2	3	0	0	0	-	-
Hawke's Bay	FEMP	1	1	1	2	1	0	-	-
Manawatu-Wanganui	SLUI WFP	2	1	2	0	3	0	-	-
	WCS FEP	1	1	3	0	3	0	-	-
	NMP	1	3	0	0	0	0	-	-
Marlborough	(DFP)	1	0	2	0	2	0	-	-
Northland	FWQIP	1	2	0	0	3	0	-	3
	KHCEP	2	1	0	0	3	0	-	3
	BP	2	3	0	0	1	0	-	2
Southland	FAFP	1	0	0	0	2	0	-	-
	FEP	1	1	1	1	1	0	-	-
Taranaki	CFP	3	1	2	0	3	0	-	-
	AP	1	1	2	0	3	0	-	-
	RMP	1	0	3	0	2	0	-	-
Tasman	EFP	1	1	2	3	3	0	-	-
Waikato	EPA	1	1	0	0	1	0	-	-
	FP	1	1	1	3	1	3	-	-
Wellington	FEP	1	2	1	2	1	0	-	-

[1] 1 = First priority, 2 = Secondary priority, 3 = Third priority, 0 = not targeted.

[2] Additional issues indicated by two councils.

Table 40 Availability of FEP reports, associated Overseer files, and FEP GIS or other data

Council	FEP type	FEP reports		FEP Overseer files		FEP GIS or data		Comments
		Data access	*Permission type*	*Data access*	*Permission type*	*Data access*	*Permission type*	
Auckland	(FP)	(no reply)	(no reply)	(no reply)	(no reply)	(no reply)	(no reply)	
Bay of Plenty	NMP	Yes	Farmer permission	Yes	Farmer permission	Yes	Farmer permission	
	FFEP	No	na	Potentially	(no reply)	Yes	(no reply)	
	BLNZ LEP	No	na	Potentially	NR	Yes	(no reply)	
Canterbury	BLNZ LEP	Yes	Council discretion	Yes	Council discretion	Potentially	Council discretion	All data related to FEP is considered commercially sensitive information and it can only be disclosed on an aggregated/catchment level.
	DNZ SMP	Yes	Council discretion	Yes	Council discretion	Potentially	Council discretion	
	FAR FEP	Yes	Council discretion	Yes	Council discretion	Potentially	Don't know/untested	
Gisborne	Rere FEP	Yes	Farmer permission	No	na	Potentially	"it's complicated"	Many GIS files and data used to create FEPs are sourced from council.
	Arable FEP	Yes	Farmer permission	Don't know	"it's complicated"	Potentially	Council discretion	
	Int. FEP	Yes	Farmer permission	Don't know	"it's complicated"	Potentially	Council discretion	
Hawke's Bay	FEMP	Yes	"it's complicated"	No	na	Yes	Don't know/untested	Currently requesting copy of FEMP as we 'approve' providers and as evidence for subsidy. GIS shape files for property boundary only.
Manawatu-Wanganui	SLUI WFP	Yes	"it's complicated"	No	na	Yes	"it's complicated"	We can share GIS files and WFP reports as long as individual data is not released without permission.
	WCS FEP	Yes	Council discretion	No	na	Yes	Council discretion	
	NMP	Yes	Council discretion	Yes	Council discretion	No	na	
Marlborough	(DFP)	Yes	"it's complicated"	(no reply)	(no reply)	Yes	"it's complicated"	
Northland	FWQIP	Yes	Farmer permission	No	na	Yes	Farmer permission	Overseer is not undertaken for FEPs.
	KHCEP	Yes	Farmer permission	No	na	Yes	Farmer permission	
	BP	Yes	Farmer permission	No	na	Yes	Farmer permission	
Southland	FAFP	Yes	Farmer permission	(no reply)	(no reply)	Yes	Farmer permission	We have permission to share data in aggregate (individual detail remains confidential). Sharing individual plan/gis data requires farmer permission.
	FEP	(no reply)	(no reply)	(no reply)	(no reply)	(no reply)	(no reply)	Yet to be established.
Taranaki	CFP	Yes	Farmer permission	(no reply)	(no reply)	Yes	Farmer permission	
	AP	Yes	Farmer permission	(no reply)	(no reply)	Yes	Farmer permission	
	RMP	Yes	Farmer permission	(no reply)	(no reply)	Yes	Farmer permission	
Tasman	EFP	Yes	Farmer permission	(no reply)	(no reply)	Potentially	Don't know/untested	
Waikato	EPA	Yes	Council discretion	No	"it's complicated"	Yes	Council discretion	
	FP	Potentially	"it's complicated"	Potentially	"it's complicated"	Potentially	"it's complicated"	
Wellington	FEP	Yes	Farmer permission	Potentially	Farmer permission	Yes	Farmer permission	

Table 41 Potential indicators from FEP data (Part 1)

	Bay of Plenty			Canterbury			Gisborne			Hawkes Bay	Manawatu-Wanganui			Marlborough
FEP indicators	**NMP**	**FEP**	**LEP**	**BLNZ**	**DairyNZ**	**FAR**	**Rere**	**Crop**	**Intensive**	**FEMP**	**SLUI**	**WCS**	**NMP**	**DFP**
FEPs prepared	1	1	1	1	1	1	1	1	1		1	1	1	1
Area of FEPs prepared	1	1	1				1	1	1		1	1	1	
# or area of FEPs prepared in priority areas	1	1	1				1			1	1	1	1	
# FEPs actively implementing works	1	1	1				1	1	1		1	1	1	
Area of FEPs actively implementing works	1	1	1				1	1	1		1	1		
# FEPs completed	1	1	1				1	1	1	1	1		1	
# FEPs waiting to be prepared	1	1	1							1	1			
Land use class							1	1	1	1	1	1	1	
Stocking rate							1		1	**	1	1	1	
Farm effective area	1	1	1				1	1	1	1	1	1	1	
Effluent area size									1	**			1	
Irrigation area size							1	1	1	**			1	
Water use rate							1	1	1				1	
Annual pasture production	1						1		1		1	1	1	
Soil fertility (e.g. Olsen P)							1		1	**	1	1	1	
Fertiliser use	1						1		1	**	1	1	1	
Farm N-loss to water	1			1	1	1	1		1	**	1	1	1	
Farm N-use efficiency	1						1		1	**	1	1	1	
Farm P-loss to water	1						1		1	**	1	1	1	
Farm GHG emissions											1	1		
Area cropped annually	1						1	1	1	**			1	
Length of streams requiring protection							1	1	1	**			1	
Length of streams protected							1	1	1	**			1	
Area of land that could/should be retired							1	1	1	**	1	1		
Area of land that is retired from production							1	1	1	**	1			
Area of land requiring erosion control							1	1	1	**	1	1		
Area of land with erosion control							1	1	1	**	1	1		
Behaviour change														

Table 42 Potential indicators from FEP data (Part 2)

	Northland			Southland		Taranaki			Tasman	Waikato		Wellington
FEP indicators	**FWQIP**	**KHCEP**	**BP**	**FAFP**	**FEP**	**CFP**	**AP**	**RMP**	**FEP**	**EPA**	**FP**	**FEP**
FEPs prepared	1	1	1	1		1	1	1	1	1	1	1
Area of FEPs prepared	1	1	1	1		1	1	1	1	1	1	1
# or area of FEPs prepared in priority areas	1	1	1	1		1	1	1	1	1	1	1
# FEPs actively implementing works	1	1	1			1	1	1		1	1	1
Area of FEPs actively implementing works						1	1	1		1	1	1
# FEPs completed	1	1	1	1		1	1	1		1	1	1
# FEPs waiting to be prepared	1	1	1	1		1	1	1				1
Land use class	1	1	1	1		1	1		1		1	1
Stocking rate						1					1	1
Farm effective area						1	1		1		1	1
Effluent area size											1	1
Irrigation area size									1		1	1
Water use rate									1			1
Annual pasture production						1	1					1
Soil fertility (e.g. Olsen P)									1			1
Fertiliser use												1
Farm N-loss to water												1
Farm N-use efficiency												1
Farm P-loss to water												1
Farm GHG emissions												1
Area cropped annually												1
Length of streams requiring protection	1	1	1	1				1	1		1	1
Length of streams protected	1	1	1	1				1	1		1	1
Area of land that could/should be retired		1				1	1				1	1
Area of land that is retired from production	1	1	1	1		1	1				1	1
Area of land requiring erosion control	1	1				1	1		1		1	1
Area of land with erosion control	1	1				1	1		1		1	1
Behaviour change												1

Notes

- Canterbury's response applies to aggregated indicators (i.e. to protect individual confidentiality).
- Hawkes Bay: A proportion of information collected for indicators (marked with **) is collected through the Nintex FEMP Summary Information form (although this needs to and will be reviewed in the near future). All are potential indicators however; are they are nice to have rather than have any use for reporting? HBRC Tukituki plan have a LUC allocation therefore N loss to water and P loss to water only become relevant when required to meet this allocation in 2018. So more a point in time indicator for reporting.
- Northland has proposed 'significant wetland area' as an indicator.
- Southland: Effective area could potentially be derived via GIS analysis. The potential for several indicators (e.g. effluent, irrigation, water use, soil fertility) would relate to whether or not there was a consent associated with the property. As noted previously, the Appendix N FEP is yet to be fully tested or implemented – the plan is in hearings at the moment.
- Waikato: Water use, pasture, losses/emissions, fertility, cropping, etc. are included in some plans only.
- Auckland and Nelson have legacy FEPs but opted not provide a response.
- Manawatu-Wanganui: Potential indicators relating to FEP count or area also apply to Soil Health Plans and Environmental Farm Plans.
- Wellington also prepares soil conservation type farm plans.

Table 43 GIS layers or GIS data are used in the preparation of FEPs (Part 1)

	Bay of Plenty			Canterbury			Gisborne			Hawkes Bay	Manawatu-Wanganui			Marlborough
GIS features	**NMP**	**FEP**	**LEP**	**BLNZ**	**DairyNZ**	**FAR**	**Rere**	**Crop**	**Intensive**	**FEMP**	**SLUI**	**WCS**	**NMP**	**DFP**
Farm location	1	1	1	1	1	1	1	1	1				1	1
Farm parcels (i.e. polygons)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Farm-scale soil layer	1	1	1				1	1	1		1		1	
Farm-scale LUC layer							1	1	1		1	1		
Farm-scale land cover layer							1	1	1		1	1		
Paddock boundaries	1	1	1	1	1	1	1	1	1		1	1	1	
Nutrient management blocks	1	1	1				1	1	1		1		1	
Farm tracks and races				1	1	1	1	1	1		1	1	1	
Stock yards & other stock facilities				1	1	1	1	1	1				1	
Soil fertility transects/sites														
Farm waterways	1			1	1	1	1	1	1		1	1	1	
Farm drains				1	1	1	1	1	1				1	
Artificial drainage areas (subsurface)				1	1	1	1	1	1					
Effluent application area	1				1				1				1	
Irrigated area					1	1	1	1	1				1	
Crop area	1					1	1	1	1				1	
Features of cultural significance	1			1	1	1								
Features of biodiversity value				1	1	1	1	1	1					
Critical source areas (N, P, or bugs)	1			1	1	1	1	1	1				1	
Contaminated sites							1	1	1					
Recommended or required works	1						1	1	1		1	1	1	
Implemented works	1						1	1	1		1	1		
Riparian vegetation				1	1	1								
Fences adjacent to water bodies				1	1	1								
stock access/crossing				1	1									
Flood protection				1	1	1								
Public access				1	1	1								
Access routes used to maintain waterways				1	1	1								

Table 44 GIS layers or GIS data are used in the preparation of FEPs (Part 2)

	Northland			Southland		Taranaki			Tasman	Waikato		Wellington
GIS features	**FWQIP**	**KHCEP**	**BP**	**FAFP**	**FEP**	**CFP**	**AP**	**RMP**	**FEP**	**EPA**	**FP**	**FEP**
Farm location	1	1	1	1	1	1	1	1	1	1	1	1
Farm parcels (i.e. polygons)	1	1	1	1	1	1	1		1	1	1	1
Farm-scale soil layer				1					1		1	1
Farm-scale LUC layer				1		1	1		1		1	1
Farm-scale land cover layer						1	1		1		1	1
Paddock boundaries	1	1	1		1	1	1				1	1
Nutrient management blocks					1						1	1
Farm tracks and races					1			1			1	1
Stock yards & other stock facilities					1	1	1				1	1
Soil fertility transects/sites												1
Farm waterways	1	1	1	1	1			1	1		1	1
Farm drains	1	1	1	1	1			1			1	1
Artificial drainage areas (subsurface)				1	1							1
Effluent application area				1	1						1	1
Irrigated area											1	1
Crop area				1	1						1	1
Features of cultural significance	1	1	1						1	1	1	1
Features of biodiversity value	1	1	1	1	1	1	1		1	1	1	1
Critical source areas (N, P, or bugs)				1	1				1		1	1
Contaminated sites									1		1	1
Recommended or required works	1	1	1	1		1	1	1		1	1	1
Implemented works				1		1	1	1		1	1	1
Riparian vegetation												
Fences adjacent to water bodies												
stock access/crossing												
Flood protection												
Public access												
Access routes used to maintain waterways												

Notes

- Gisborne are considering the inclusion of 'features of cultural significance' in FEPs.
- Hawke's Bay: FEMP maps are created by a third party (Providers) so the only product council cite are the hard/soft copy maps. Providers will have shapefiles/GIS layers for some of the above – not necessarily accessed by council.
- Northland: Waterways and drains are extracted from LINZ Topo50 data.
- Southland crop area. Applies to intensive winter grazing areas, plus areas intended to be cultivated in next 1–2 years.

Appendix 2 – The 10 principles of Tier 1 statistics

The 10 principles which guide the production of Tier 1 statistics are (Stats NZ 2018):

Principle 1 – Relevance

Official statistics produced by government agencies are relevant to current and prospective user requirements, in government and in the wider community.

Principle 2 – Integrity

Official statistics gain public trust by being produced and released using objective and transparent methods.

Principle 3 – Quality

Official statistics are produced using sound statistical methodology, relevant and reliable data sources, and are appropriate for the purpose.

Principle 4 – Coherence

The value of statistical data is maximised through the use of common frameworks, standards and classifications.

Principle 5 – Accessibility

Access to official statistics is equal and open.

Principle 6 – Efficiency

Official statistics agencies strive to be efficient and provide value for money.

Principle 7 – Protecting respondent information

Respondents' rights to privacy and confidentiality are respected and their information is stored securely.

Principle 8 – Minimising respondent load

The costs of compliance are kept to an acceptable level and data are collected only when the expected benefits of a statistical survey exceed the imposition on providers.

Principle 9 – Maximising existing data sources

Maximise the use and value of existing data by integrating or aligning available statistics and administrative sources.

Principle 10 – International participation

Official statistics agencies make use of and contribute to international statistical developments.