THE WEST COAST REGIONAL COUNCIL

State of the Environment

WEST COAST REGION | SUMMARY 2018

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Introduction

The West Coast natural environment is generally in good shape. While our land, water, air, and ecosystems are healthy compared to other parts of the country, there is still plenty of work to be done on improving things, particularly with certain aspects of water quality in some catchments.

The Council is constantly collecting information on the quality of our natural resources. Council monitors groundwater, lakes, rivers, coastal beaches, and air quality across the region at 85 sites. In addition, Council collects a range of environmental data on the quantity of water on the West Coast, including rainfall, river flows, and groundwater levels. We generally focus our monitoring efforts in areas where resource use and pressure is highest.

We are continually improving our monitoring programmes to gain a better understanding of our natural resources and environment. Better data allows us to make more informed decisions when setting appropriate rules and limits on resource use.

In partnership with Poutini Ngāi Tahu, Council facilitates a growing number of community groups who focus on a range of environmental topics. Through these groups we seek to understand community values and encourage the groups to make recommendations to Council for potential non-regulatory or regulatory solutions.

We need to maintain and, where possible, improve the current state of our natural resources. The West Coast Regional Council is committed to leading this work, and with your help, we can improve things together.

We hope this document provides a useful summary for understanding the state of our natural environment and the pressures the West Coast faces. Additional information will be available on the Council website for those wanting more technical detail on water quality, so please visit our website or contact us directly.

Hadley Mills
Planning, Science and Innovation Manager

Mike Meehan
Chief Executive

What we are doing

The West Coast Regional Council is the smallest Regional Council in New Zealand, managing the fifth largest area in the country, yet must deliver the same services and functions as the other regions of New Zealand. Resourcing is therefore one of our biggest challenges. Council prioritises its resource management efforts in areas where the greatest resource pressures occur and in specific areas as directed by Central Government policy.

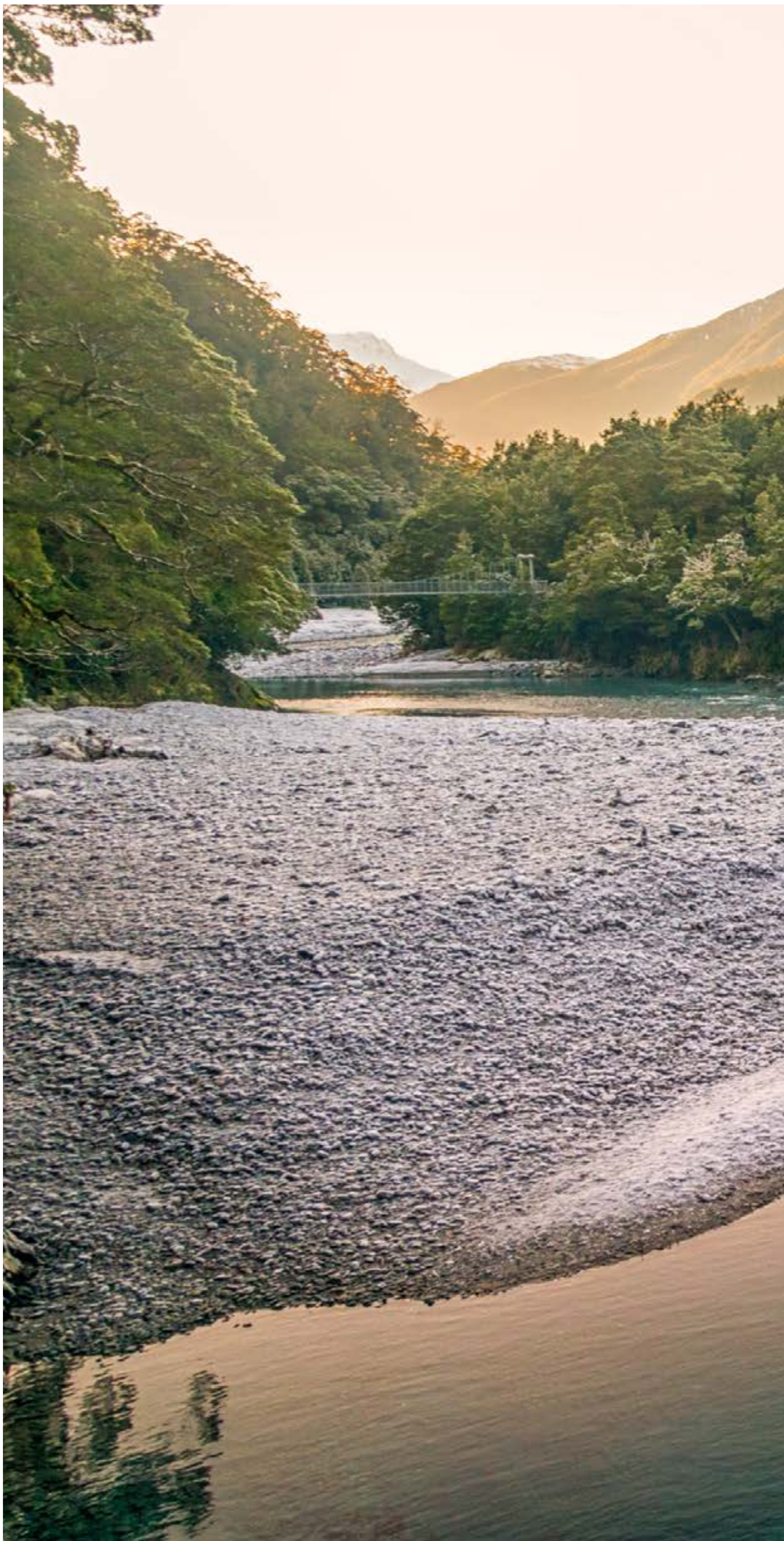
National resource management policy is currently focusing attention on freshwater quality and subsequently Council continues to expand planning and science capacity in this area.

The National Policy Statement for Freshwater Management (NPSFM) requires Councils to work with communities to understand how they value waterways, and to set goals based on economic, social, cultural, and environmental factors. The NPSFM recognises Te Mana o te Wai and sets out objectives and policies that direct local government to manage water in an integrated and sustainable way. A key requirement of the NPSFM is that the quality of our rivers, lakes, and groundwater must be maintained or improved.

In May 2018, the Council's Resource Management Committee approved the West Coast Regional Council National Policy Statement for Freshwater Management – Regional Implementation Strategy 2018. This document sets out the Councils strategy for implementing the NPSFM and includes a detailed Progressive Implementation Program (PIP), which outlines key milestones for achieving full implementation of the NPSFM by 2030. The strategy has been reviewed by the Ministry for the Environment (MfE), which has resulted in minor adjustments to the PIP. The updated PIP has been publicly available since November 2018. Both the strategy and PIP are available on our website: https://www.wcrc.govt.nz/our-services/resource-management-planning/Pages/Freshwater-Management.aspx

Six Freshwater Management Units (FMUs) have been identified by Council across the West Coast region in order to effectively manage water resources among areas where issues and community values may vary. In partnership with Poutini Ngāi Tahu, Council initiated the first FMU in July 2018 – the Grey FMU, which encompasses the Grey River catchment. The Grey FMU group held their first meeting in October 2018. The remaining five FMU groups will be established over the next few years.

A key purpose for the FMU groups is to represent local community interests within their local catchments. Having locals involved is really important for

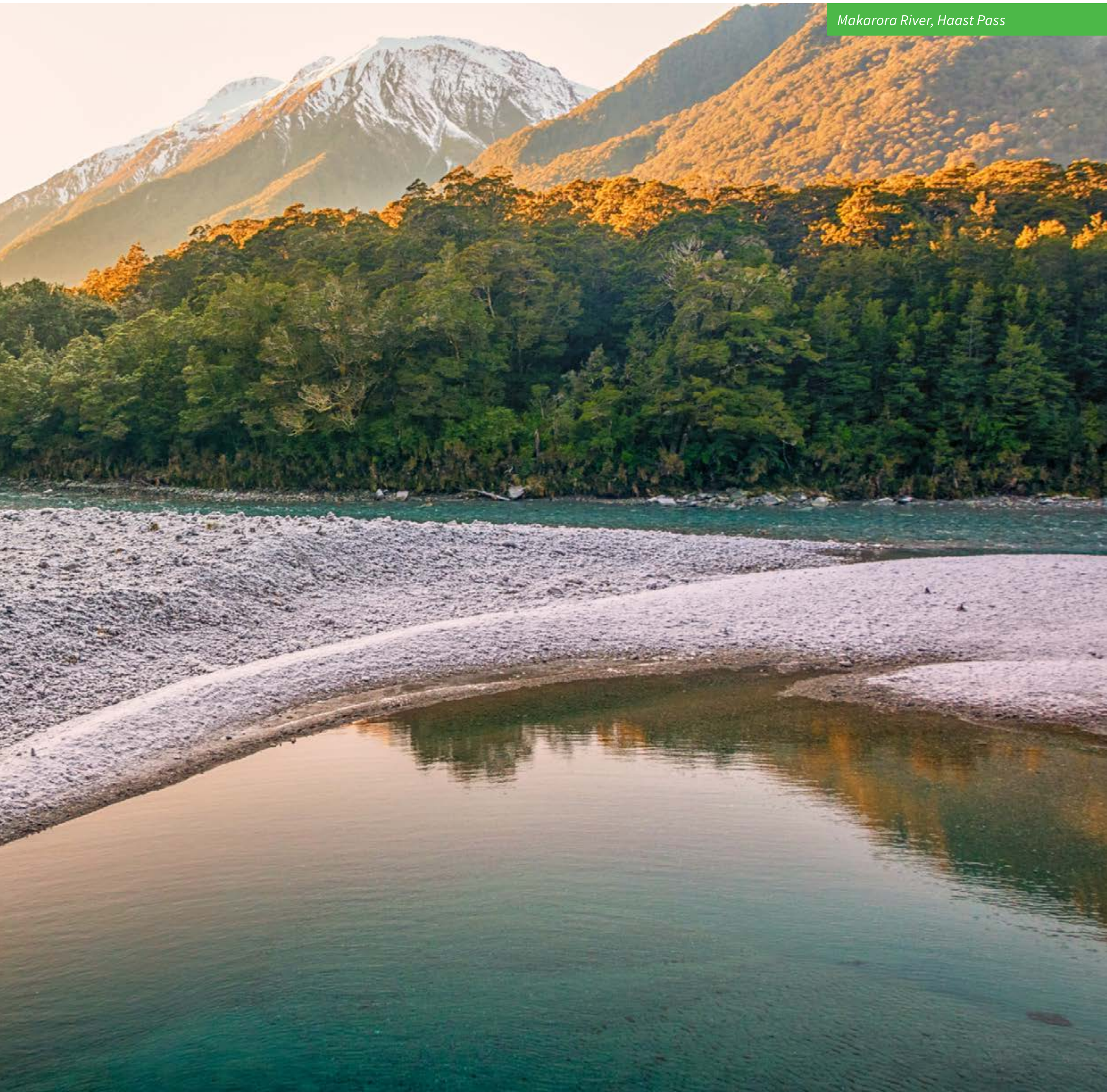


assisting Council in identifying the community values within their FMU. Each FMU group will make recommendations to Council's Resource Management Committee regarding future plan provisions and work programmes, which in turn will direct water resource management within their FMU.

FMU Groups will operate in partnership with either Te Rūnanga o Ngāti Waewae or Te Rūnanga o Makaawhio to recognise and respect the principles of the Treaty of Waitangi and develop recommendations that consider manawhenua cultural values.

FMU groups are officially appointed by the Council's Resource Management Committee and will include up to eight members from the community who encompass a range of backgrounds and interests that relate to the community' land and water values. The selection process ensures that an adequate cross section of community values are represented and a broad range of perspectives are considered.

There are many areas where Council is working to improve resource quality on the West Coast, and the NPSFM is currently one of our main focus points.



Makarora River, Haast Pass

The West Coast's land cover

The West Coast's land cover profile is characterised by:

A predominance of forest cover (about two thirds of land area), of which most is indigenous forest

A substantial area of grassland and herbaceous vegetation (almost 20% of land area), of which more than half is tussock grassland

A relatively substantial area of natural bare/ lightly vegetated surfaces (e.g. gravel or rock, permanent snow and ice) (Figure 1)

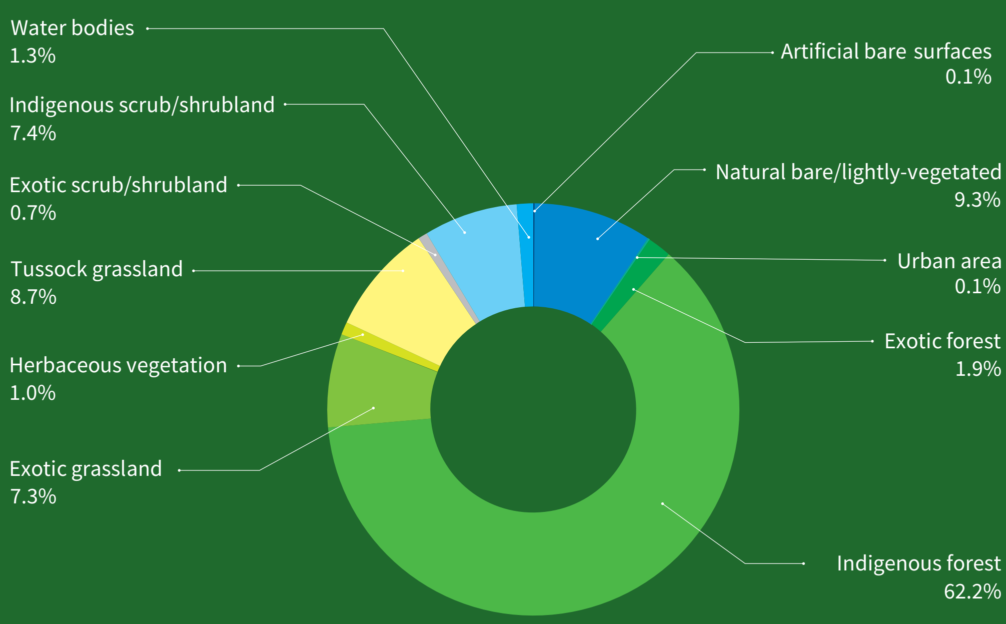
The key changes in land cover between 1996 and 2012 in the West Coast region are:

Native forest and scrub/shrubland (both exotic and indigenous) have decreased in area by 5,300ha and 6,800ha, respectively.

Exotic grassland and exotic forest have increased in area by 10,000ha and 2,700ha, respectively.

Figure 1:

Landcover by percentage cover for the West Coast region as of 2012



Mangatini Falls. Photo Hami Tangiora

Our regions water quality

The West Coast region is renowned for its natural and physical attributes, including its lakes, rivers, and coastal areas. Our water resources provide a range of benefits that support agriculture, industry, tourism, and the health and well-being of people and communities. Reduced water quality increases risks to public health and affects our ability to use freshwater environments for recreational and commercial purposes. Freshwater ecosystems on the West Coast are rich in animal and plant biodiversity and work via complex processes. Modified freshwater environments, and reduced water quality and quantity, have negative consequences for ecosystem health.

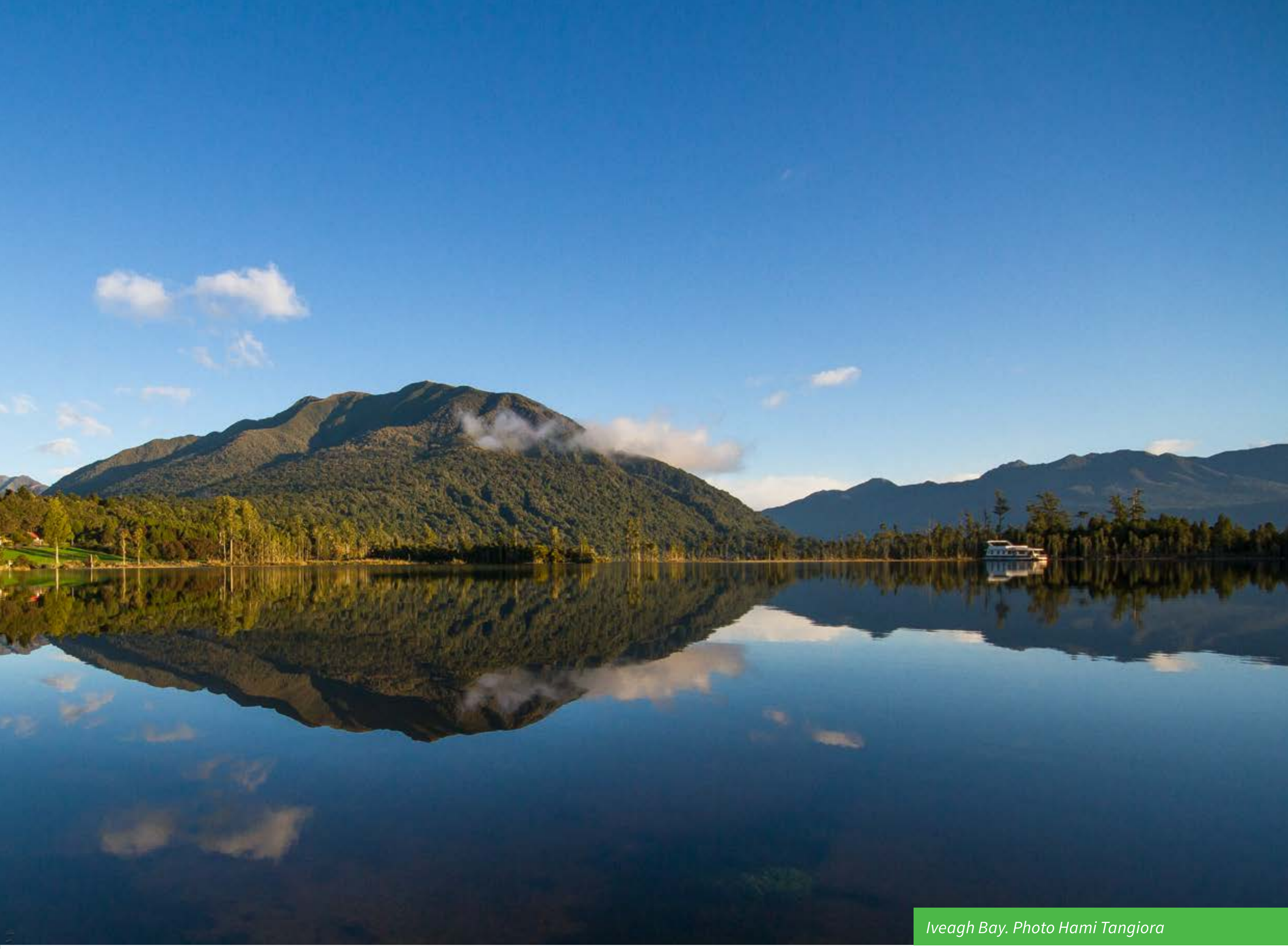
Natural factors, such as climate, geology, and topography help determine how human pressures affect the state of water quality and ecosystem health in a particular waterbody. The types of pressures vary, for example, faecal contamination versus nutrients versus sediment discharges, which will impact on a waterbody's values in different ways. Finally, values themselves will differ among waterbodies, for example, popular for swimming versus important whitebait habitat. What this demonstrates is a need to consider the site-specific context of each water body when assessing river quality and health.

The majority (88%) of waterways in the West Coast region drain catchments with indigenous landcover (for example native bush, tussock, ice, and rock). Most of these waterways come from higher altitude headwaters that have good water quality, and which often buffer the impact of contaminants entering downstream. Council maintains ground and surface water quality monitoring programmes for assessing state and trends in a variety of catchment types. Most of these are from the smaller subset of more variable, lowland catchments that are affected by agricultural, industrial, and urban pressures. Trends for the last 10 years, where significant, have been calculated for many water quality attributes. Water quality state is determined over a 5 to 10 year period depending on the method required.

Agricultural landcover and intensity has increased as native forest and shrubland has decreased by the same amount. This may explain some of the increasing trends observed for nitrogen and Escherichia coli (E. coli), especially as most monitoring sites have some agricultural activity in their catchment. Similar to the rest of New Zealand, decreasing ammonia and phosphorus levels might reflect improved handling of point source contaminants and better soil nutrient management. However, this has been offset by an increase in diffuse pollutants. Nitrates have increased in

DID YOU KNOW...

IRRIGATION ALLOCATION *has increased by* **161% SINCE 2012**



Iveagh Bay. Photo Hami Tangiora

both ground and surface waters, although they are below toxicity thresholds for people and aquatic life. Nitrogen levels in rivers are usually high enough to support prolific algal growth but this is not particularly common due to frequent, high rainfall events and a potential lack of other key nutrients like phosphorus.

Faecal contamination and swimmability is currently a hot topic in New Zealand. Faecal contamination and pathogen risk, as indicated by (E. coli) levels in ground and surface waters, is an ongoing issue for West Coast water quality.

Despite the West Coast's predominantly cool, wet climate, the occasional hot, dry period can drive up temperatures in intrinsically vulnerable streams where stress on the aquatic animals is likely. Intrinsic factors that make waterways susceptible to warming include: smaller size, lower altitude catchments, brown water colouration, warm and dry summer microclimates, and a lack of recharge sources. Warmer waterways tend to be inland and to the north of the region. Dissolved oxygen is important for all aquatic animals. It is influenced by intrinsic factors like temperature, turbulence, and aquatic plant biomass. Significantly low dissolved oxygen was recorded at 10% of Councils monitoring sites. The majority of aquatic animals living in streams are freshwater invertebrates, which include organisms such as crustaceans, molluscs, worms, and freshwater insects. Invertebrates perform important ecosystem functions and become food for fish, birds, and people. They are affected by impacts on water and habitat quality, therefore they are useful indicators of stream health. Invertebrate communities indicative of poor water quality were encountered at 13% of sites, with another 18% having fair quality but typical of moderate impacts from pollution.

E. coli

Water contaminated with faeces from warm blooded animals can be a risk for people and stock that are drinking or coming into contact with it. The presence of E. coli in water indicates contamination from faecal matter. Concentrations of E. coli are used to estimate the risk of disease causing organisms like campylobacter.

From November to March, Council monitors E. coli and Enteroccocci at rivers, lakes, and coastal beaches used for swimming. Council applies criteria from the Ministry for the Environments (MfE) microbiological water quality guidelines for marine and freshwater recreational areas to this data. Rivers were more frequently unsuitable for swimming, particularly during, and shortly after, rain events (Figure 2).

The Council also measures E. coli in all its monitored rivers, and during summer at a range of swimming locations. Two thirds of river sites monitored year round met the National Policy Statement for Freshwater Management (NPSFM) annual criteria for swimmability, being above the bottom line (a D or E grade) (Figure 3). Few sites have displayed strong trends in E. coli over the last ten years, with 10% of them declining and 3% of them improving.

Family at Lake Brunner. Photo Stewart Nimmo

Figure 2:
Swimming suitability on the West Coast based on MfE single sample microbial guideline criteria for freshwater and marine swimming areas

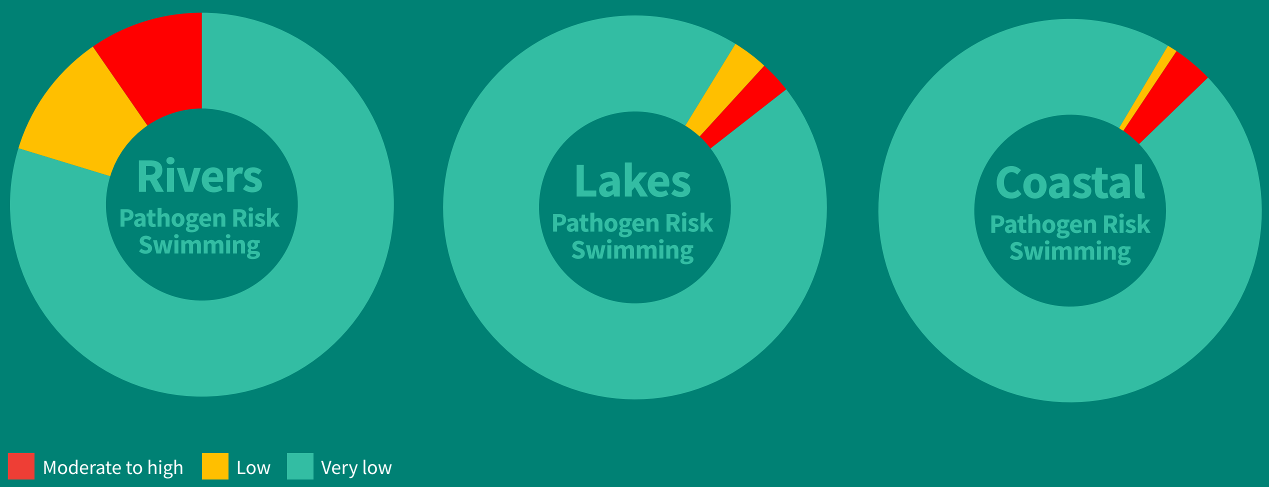
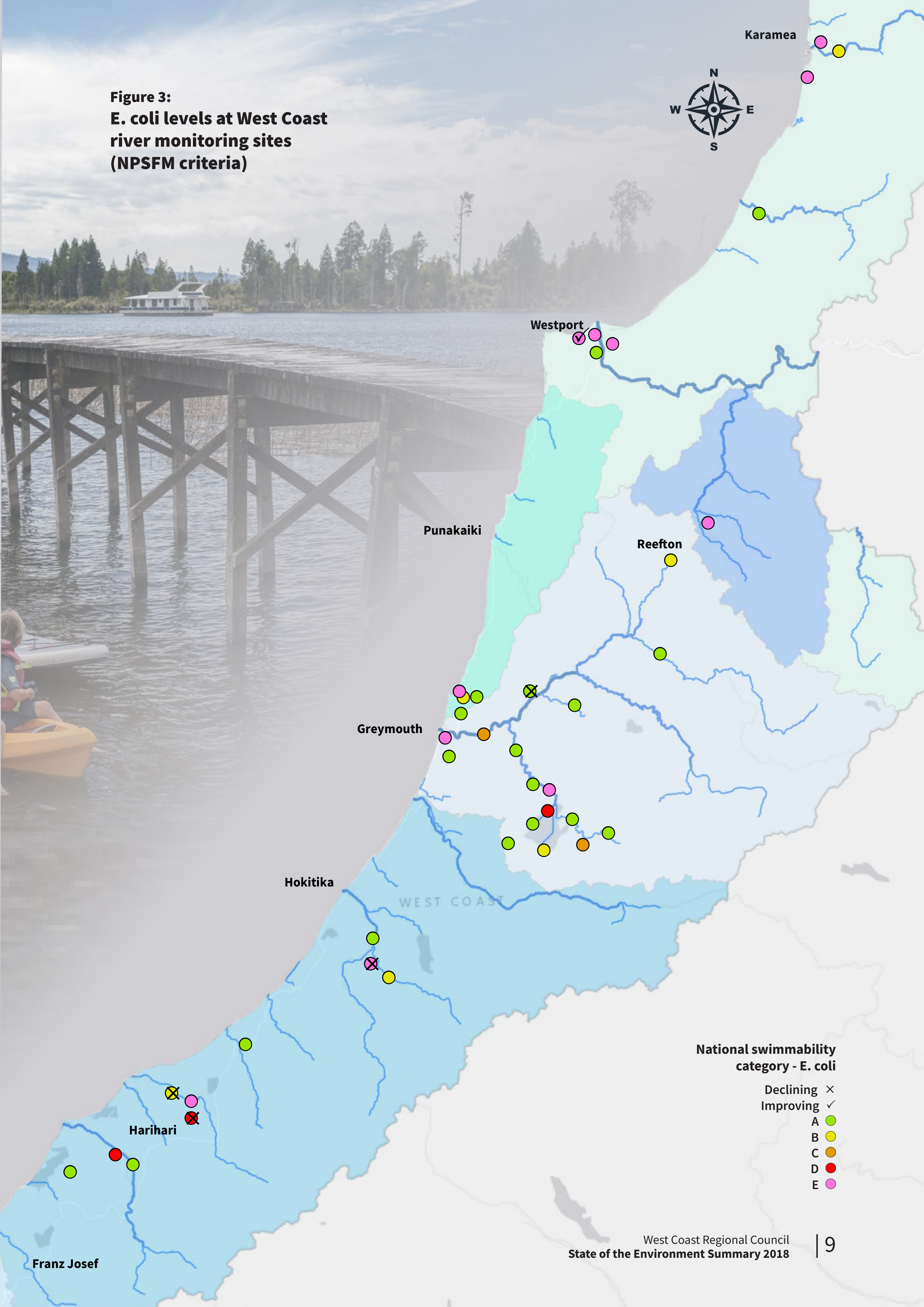


Figure 3:
E. coli levels at West Coast river monitoring sites (NPSFM criteria)



Water clarity and turbidity

Fine particles, like suspended silts, reduce clarity and make water more turbid. There are also dissolved substances that reduce clarity, some of which occur naturally, for example, the brown 'tea staining' seen in many West Coast forest streams. Elevated suspended sediment is the main cause for poorer clarity and turbidity, and is generated by any activity that involves land disturbance. Associated problems include diminished amenity value and impacts on stream ecology from reduced vision, light, and streambed smothering.

The majority of West Coast river monitoring sites have human activity within their catchments and approximately half had clarity and turbidity similar to that found in pristine streams around New Zealand. Two thirds of these had visibility suitable for safe contact recreation (Figure 4). The remaining 20-30% had clarity and turbidity that would have affected safe swimming and water sports. A subset of these, approximately 5%, were likely to have had reduced ecological health as a result of sediment loads.

Changes in turbidity and clarity over time can relate to quite specific activities, particularly in smaller catchments, for example, development associated with individual farms and mines. Statistically significant deterioration was measured at 16% of sites, while 6% showed improvement.

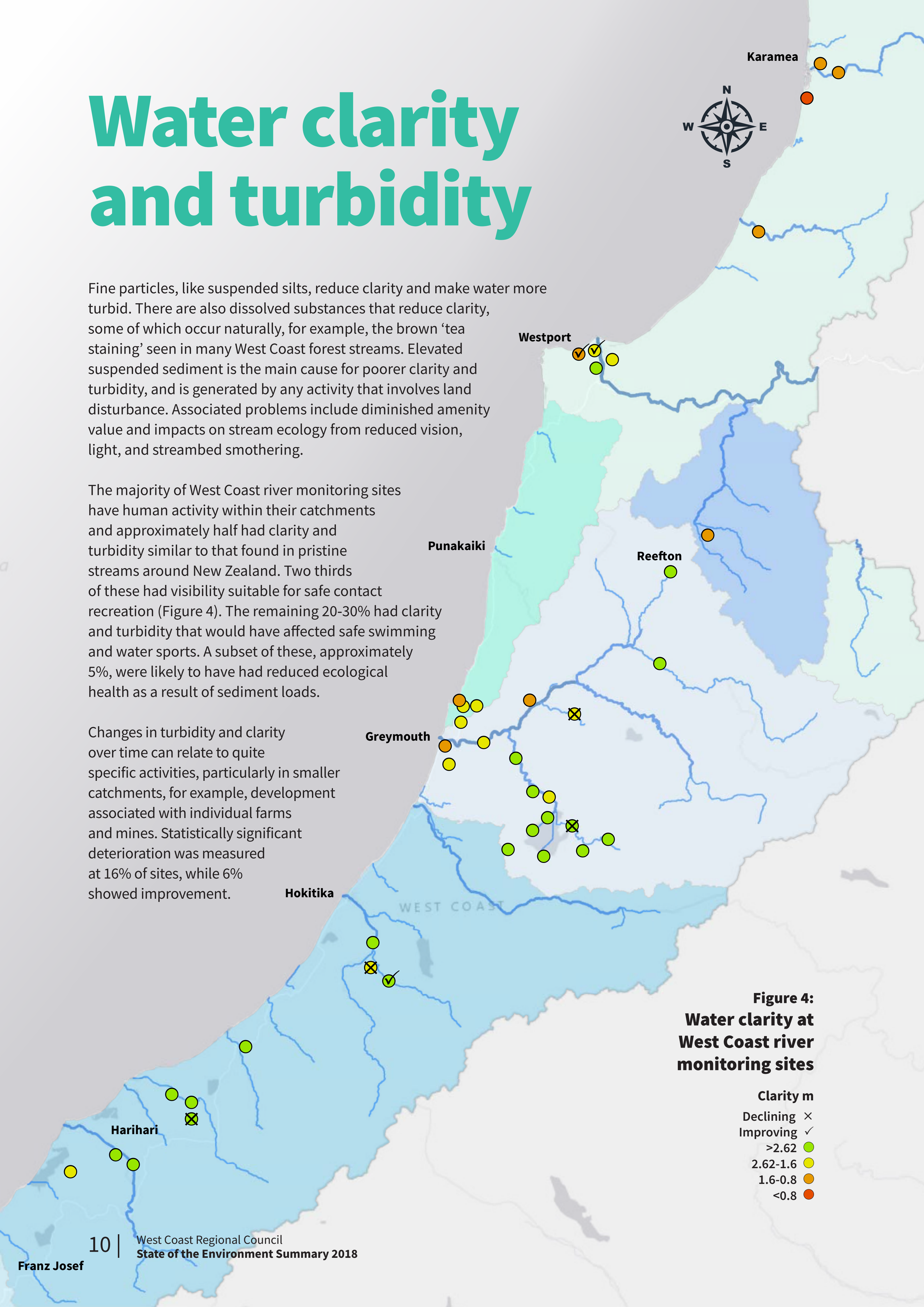


Figure 4: Water clarity at West Coast river monitoring sites

Nitrogen

Nitrogen is an essential nutrient required for plant growth. Total nitrogen consists of all nitrogen forms found in waterways. Nitrate and ammonia are highly soluble components of total nitrogen and are readily used by plants and algae to help them grow. They can leach from land to rivers, particularly when conditions are wet. Too much nitrogen can cause excessive algal growth or be toxic. In agricultural catchments, nitrate generally comes from nitrogen fertilizer and livestock urine, while ammonia comes more from point-sources such as discharges from sewerage treatment plants, farm dairy effluent, and industrial operations.

Ammonia levels improved at 38% of West Coast monitoring sites, which might indicate improvements in the way discharges have been managed. Ammonia and nitrate levels tended to be between low and moderate in most West Coast waterways, with no toxic levels of either measured among routine monitoring sites (Figure 5). Most waterways with human activity in their catchments had dissolved nitrogen levels sufficient for prolific algal growth, but other factors are required before this will occur, including stable weather patterns, light, and sufficient phosphorus. Various forms of nitrogen have increased in around a third of West Coast waterways affected by urban and agricultural activity, most likely in response to an intensification of these activities.

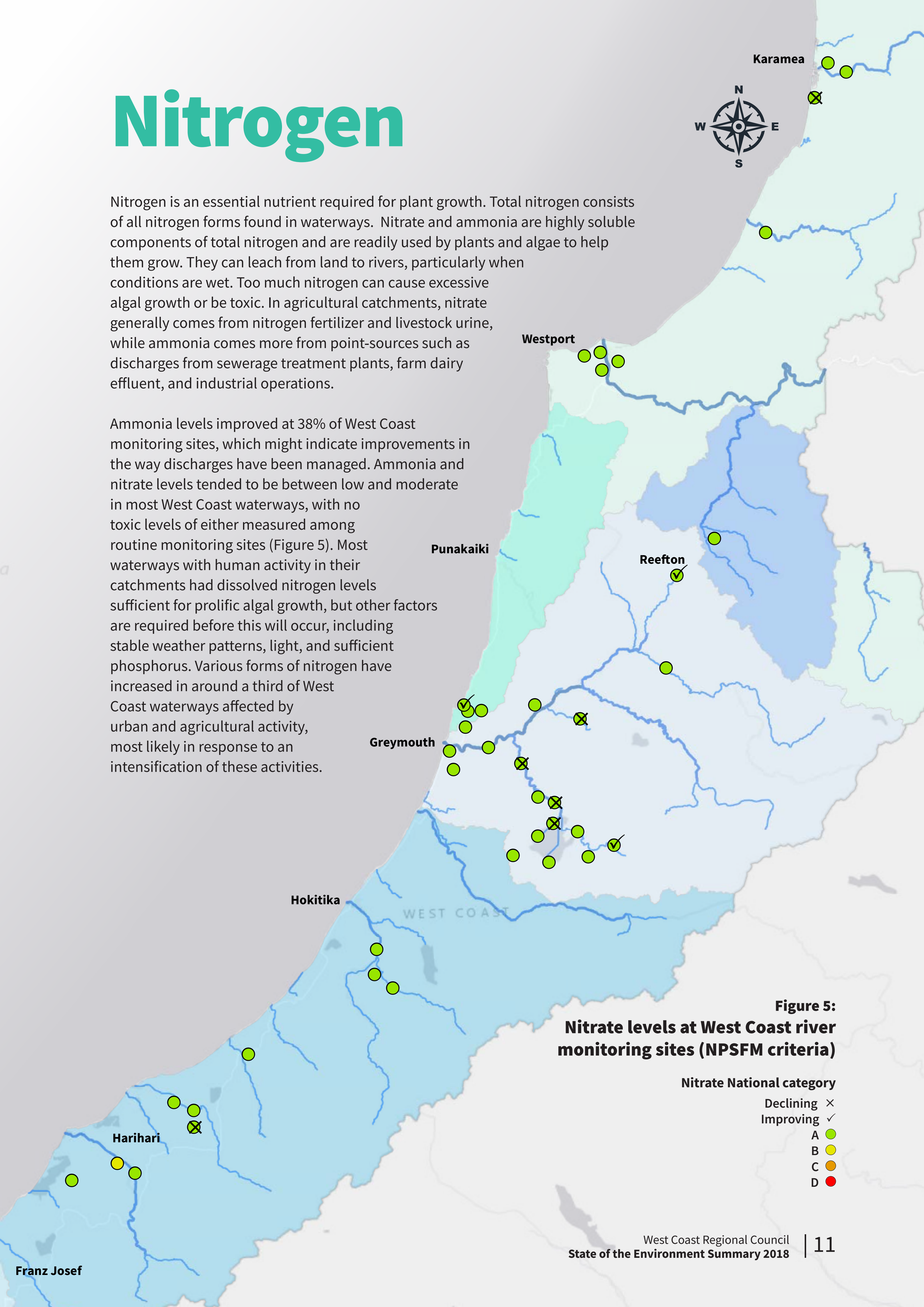


Figure 5:
Nitrate levels at West Coast river monitoring sites (NPSFM criteria)

Phosphorus

Phosphorus is an essential nutrient for plants and is a natural component of healthy rivers. Agricultural and urban land use can add more phosphorus to waterways, which may cause excessive algal growth having a negative effect on river habitats. Council monitors the state and trends for both total phosphorus and dissolved reactive phosphorus. Dissolved reactive phosphorus (DRP) is the form of phosphorus immediately available to support plant and algae growth.

A threshold of 0.01 mg/L has been used to indicate whether DRP might contribute to nuisance algal growth in a river (Figure 6). The number of sites that exceeded this more than half of the time was 10%.

Phosphorus levels improved at a third of monitoring sites, declining at 7% of them. Improved stock and nutrient management, and greater use of phosphorus by algae as a result of increased nitrogen and algae, may be responsible for decreasing phosphorus levels.

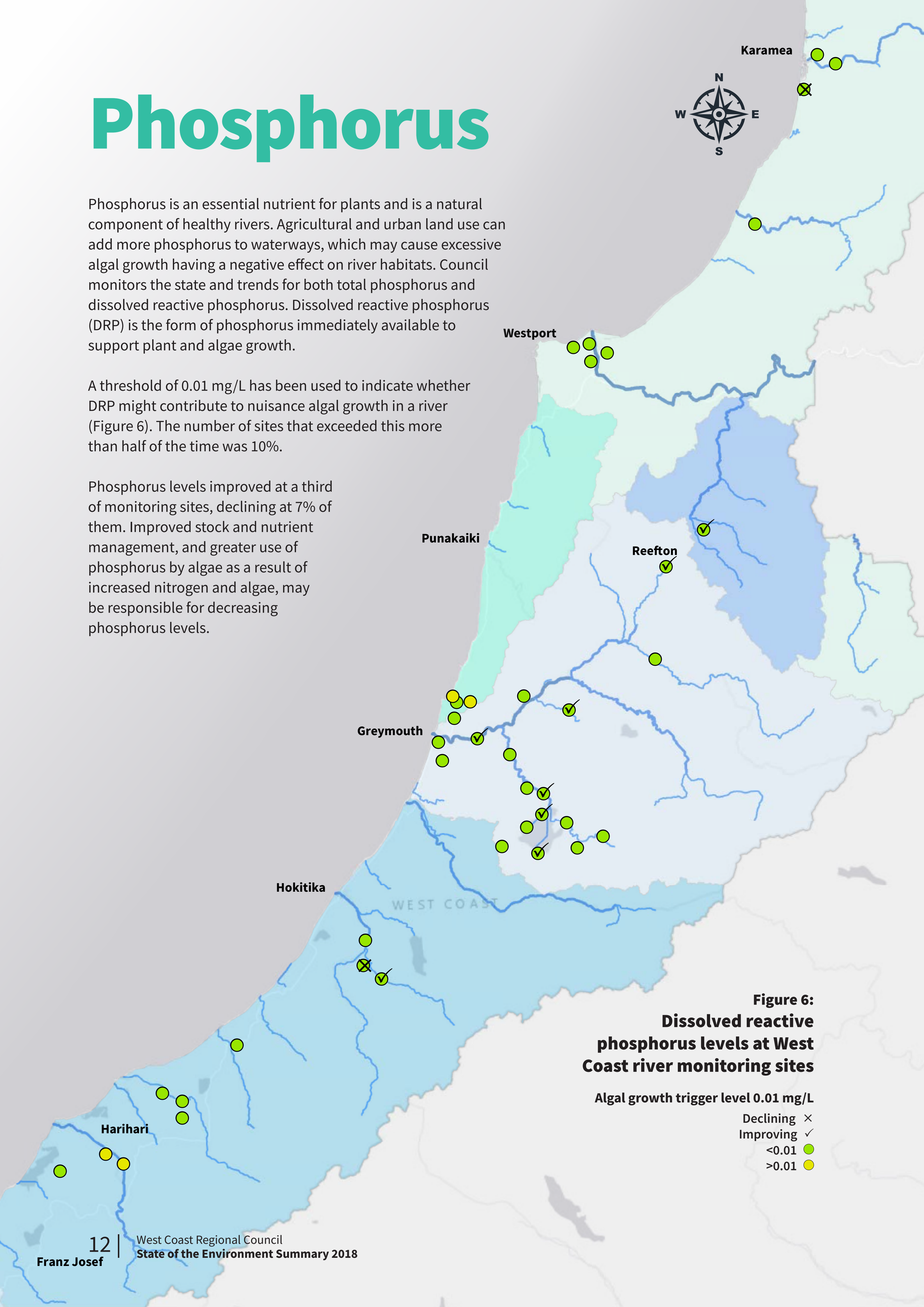


Figure 6: Dissolved reactive phosphorus levels at West Coast river monitoring sites

Invertebrates and periphyton

Freshwater invertebrates include organisms such as crustaceans, molluscs, worms, and freshwater insects. Invertebrates perform important ecosystem services, become food for native fish and birds, and some become food for people. They are affected by impacts on water and habitat quality, therefore they are useful indicators of stream health. Invertebrate communities indicative of poor water quality were found at 13% of sites, with another 18% having fair quality but typical of moderate impacts on water quality (Figure 7).

Periphyton is the algae growing on the bed of streams and it plays a key role by turning dissolved nutrients into nutritious food for invertebrates that are themselves food for fish and birds. However, too much periphyton can cause problems. Periphyton blooms (thick slimy mats or long filamentous growths that cover much of the streambed), can make a stream unsuitable for water sports and reduce biodiversity by making the streambed habitat unsuitable for many sensitive invertebrate species. Periphyton blooms are most likely to occur during periods of long, dry summer weather. Significant blooms have not been common on the West Coast, possibly due to the wet climate. No measured periphyton abundances were likely to be below the National Policy Statement for Freshwater Management (NPSFM) national bottom line.

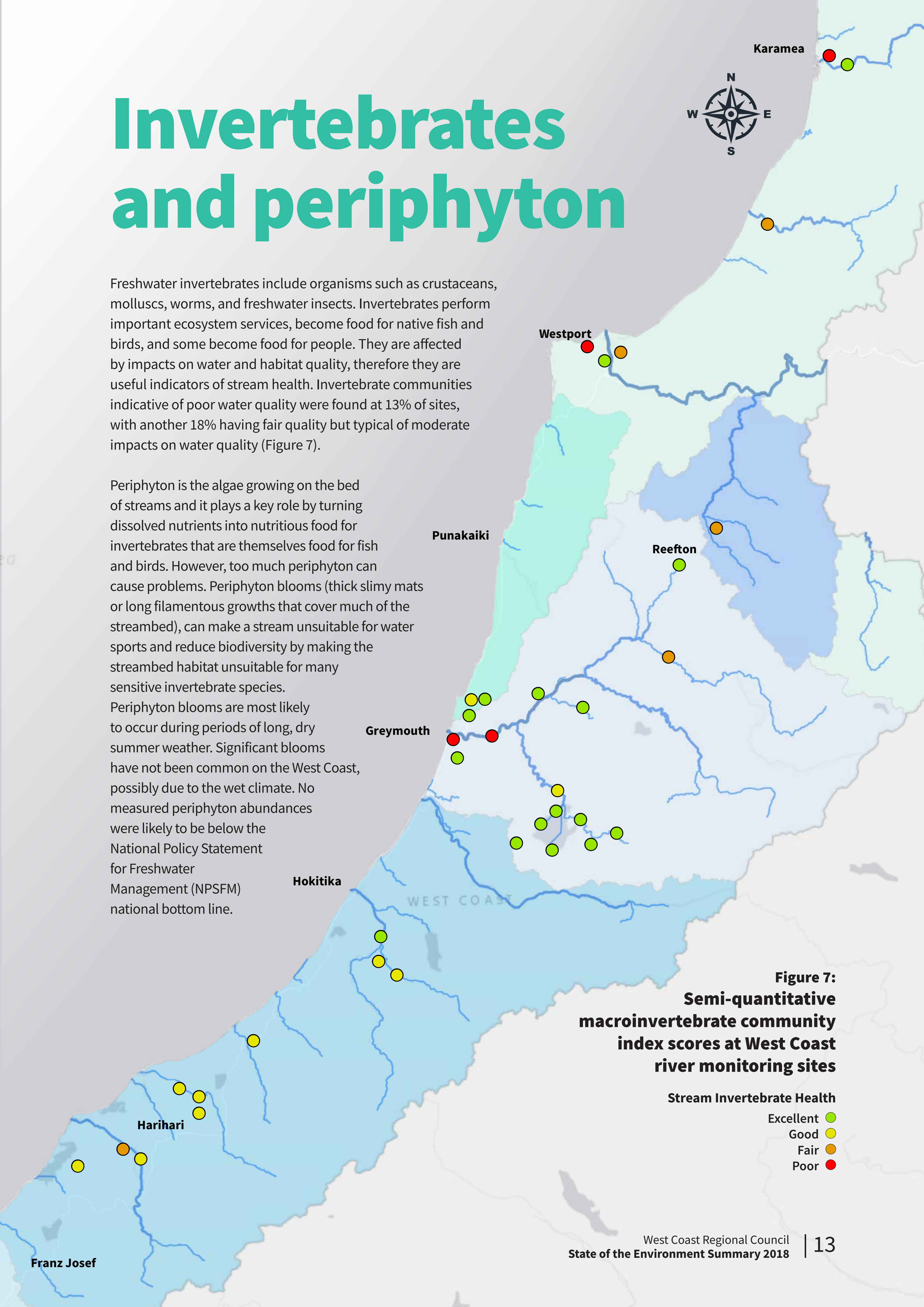


Figure 7: Semi-quantitative macroinvertebrate community index scores at West Coast river monitoring sites

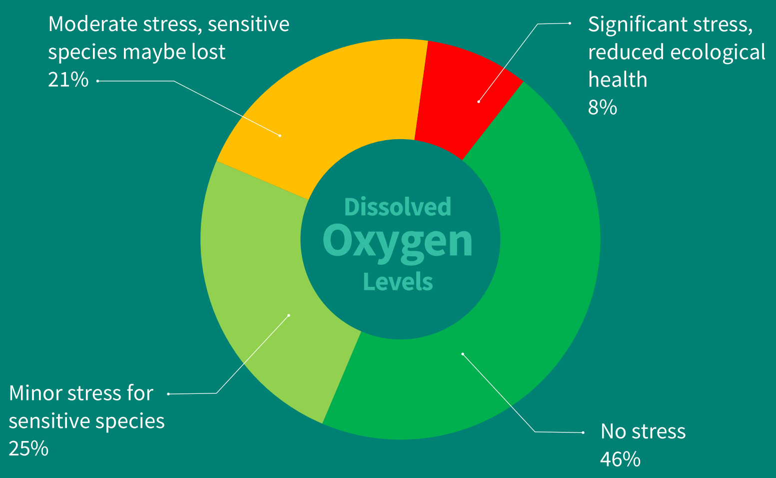
Water temperature and dissolved oxygen

Aquatic fauna experience stress from high water temperatures. Temperature also affects water composition including the solubility of oxygen and toxicity of ammonia. While late December has the longest and strongest sunlight, peak stream temperatures on the West Coast can occur from late November through March depending on weather patterns. Intrinsic factors that make waterways susceptible to warming include: smaller size, lower altitude catchments, brown water colouration, warm and dry summer microclimates, and a lack of recharge sources. Temperature has been continuously measured at 31 sites, 33% of which have experienced periodic summer temperatures high enough to cause significant thermal stress to a range of organisms. Of these sites, 62% have periodically had temperatures sufficient to affect sensitive species (Figure 9).

Dissolved oxygen has been measured continuously at 24 sites over several summers. Reduced oxygen impairs the growth of aquatic organisms and very low oxygen levels will kill them. Consequently, dissolved oxygen concentrations are critical to stream ecosystem health. Poor oxygen levels often occur when there are: high temperatures, low water turbulence, and an abundance of plants or algae (plants use oxygen at night). A total of 8% of sites experienced significantly low dissolved oxygen concentrations (Figure 8). While some streams are naturally disadvantaged, increasing riparian shade and reducing nutrients will be beneficial. Trends have not been evaluated for temperature or oxygen.

Figure 8:

Dissolved oxygen levels in some West Coast Rivers



Arahura Cess Pool. Photo Hami Tangiora

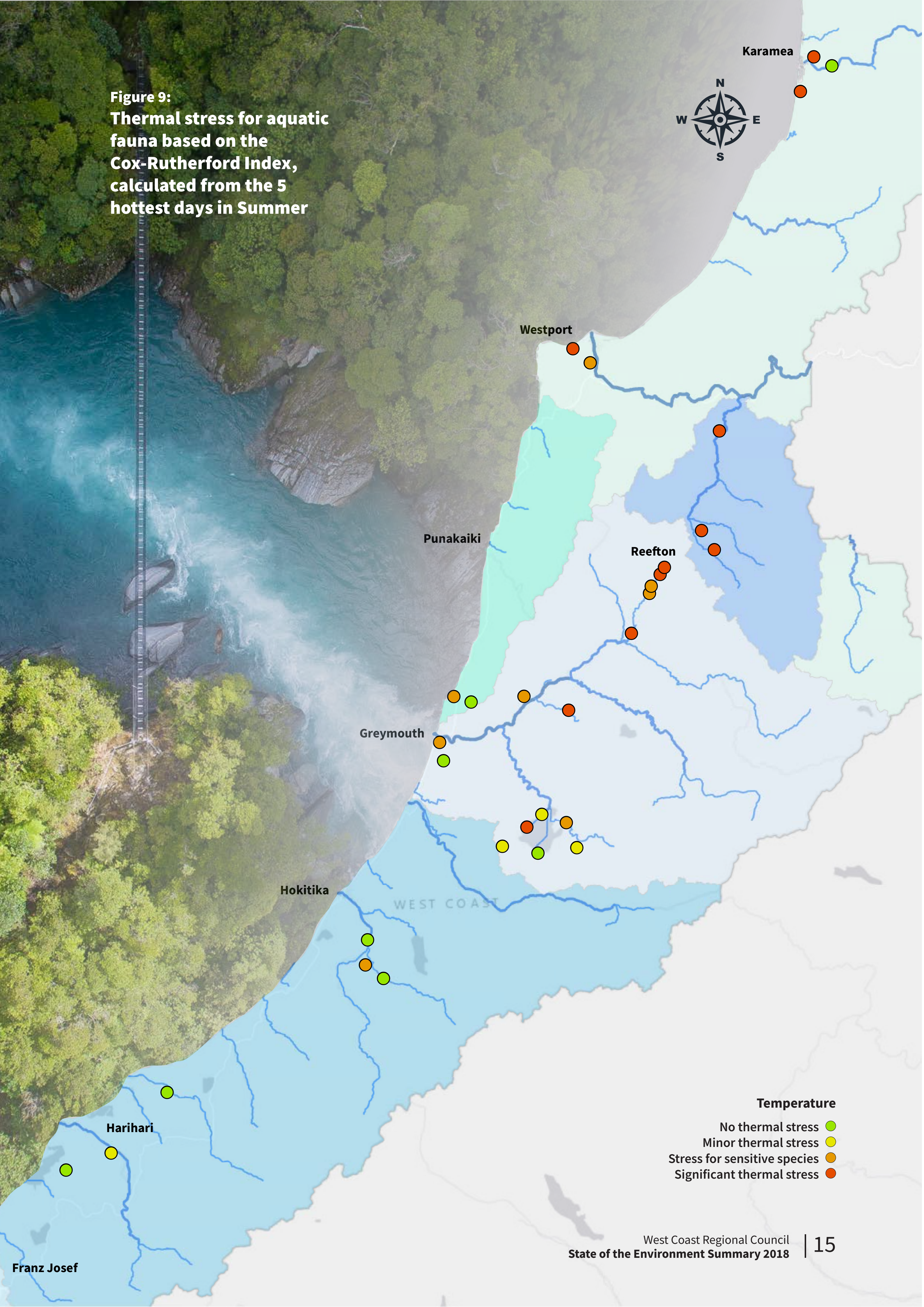


Figure 9:
Thermal stress for aquatic fauna based on the Cox-Rutherford Index, calculated from the 5 hottest days in Summer

Lake Brunner

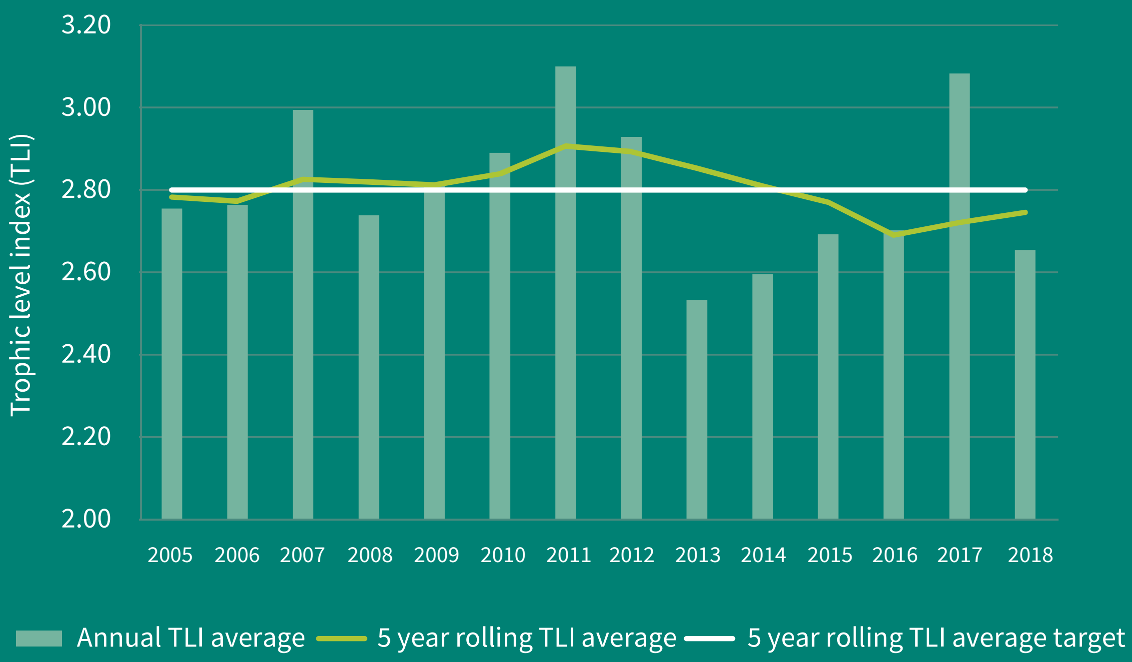
Lake Brunner is an oligotrophic (low nutrient) lake that is a popular recreational destination for people within and beyond the region. The lake has been monitored by Council since the 1990's and a comprehensive data record has been created – one which Council continues to build on. Nutrient increases observed since the 1990's have caused Council to intensify monitoring, and have led to improved environmental mitigations among the farming community. An increase in nutrients can lead to levels of algal growth that could threaten the lakes health.

Central government policy ascribes A to D attribute states for important lake attributes. Of these, total phosphorus, ammonia, and chlorophyll were in the best category of "A". Total nitrogen was a "B". Higher lake nitrogen relative to phosphorus and chlorophyll could be due to elevated nitrogen leaching as a result of the cool, wet climate.

Lake algal growth is primarily limited by the availability of phosphorus. Currently, oxygen at the bottom of the lake remains high enough to avoid undesirable cycles of phosphorus release from the lake bed. In the last ten years phosphorus levels have improved in two of the lakes main tributaries, and deteriorated in none. Trends are regularly assessed for lake water quality attributes and despite a significant increase in dissolved forms of nitrogen, clarity and algal levels have improved between 2001 and 2018.

The Trophic Level Index (TLI) is a key measure used by Council to assess the health of Lake Brunner. Council has a target TLI threshold in its Land & Water Plan, which is currently being met (Figure 10). Lower TLI scores indicate better water quality. In New Zealand, lakes with TLI scores between 2–3 have low levels of nutrients and algae.

Figure 10:
Trophic Level Index for Lake Brunner



Water quantity at a glance

Hydroelectric power is the largest water user in the region

2012-2017 was generally a period of lower summer flow conditions and less than average rainfall

On the back of drier years and reduced summer flows, demand for water for irrigation has increased significantly since 2012

The Grey River catchment has the largest amount of consented water takes in the region

Managing water use and values

The West Coast is the wettest part of New Zealand with annual rainfall amounts between 1,745mm - 11,228mm recorded across the region (Figure 19). Across the region there is generally very little pressure on water resources with only small percentages of the mean annual low flow allocated. The main areas where higher amounts of water are allocated are the driest parts of the region: the top of the Northern Grey River catchment (Mawheraiti, Stony, and Rough), Inangahua, and Waimangaroa Catchments. The lowest flows generally occur during summer (December-February), with the exception of the alpine/glacier sourced catchments (such as Hokitika, Whataroa, and Haast Rivers) where winter flows are the lowest (June-August).

Where significant amounts of surface water are taken the following impacts can occur:

- Changes in flow characteristics (e.g. flow is very low for longer)
- Reduced dissolved oxygen/increased water temperatures
- Increased nuisance algae
- Changes in flow suitability for fish and insects
- Reduced reliability of supply for existing takes.

Where significant amounts of ground water are taken the following impacts can occur:

- Reduction of flow of nearby surface water
- Lowering of groundwater levels of existing bores.

There have been no significant impacts, as a result of over allocation, identified across the region. As water demand increases, the Councils Planning and Science teams will work with the community to identify values, determine allocation amounts, and set flow limits across the region.

Regional water usage

Demand for water has increased across the region, with water being used for irrigation, drinking, stock water, industry, and hydroelectric power generation (Figures 11 and 12). There is currently 2,508 million m^3/year of water allocated (groundwater and surface water). Hydroelectric power generation is the largest user of water with 1,792 million m^3/year allocated, or 87 % of all allocated water. The majority of takes are located between the Hokitika and Karamea River catchments (the top half of the region), with the largest concentration of takes in the Grey River catchment (Figure 15).

Figure 11:
West Coast consented consumptive water takes by use type

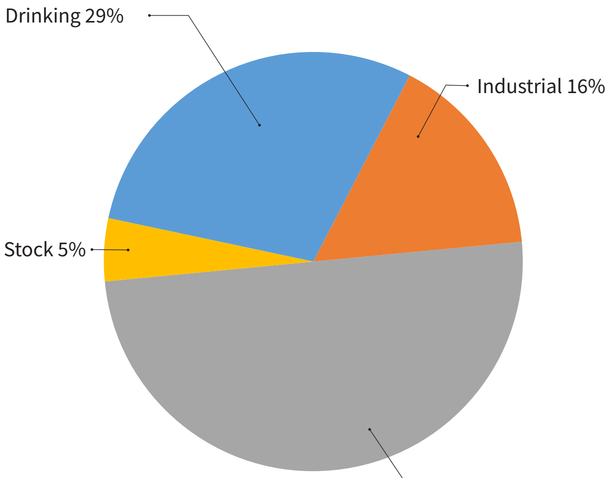
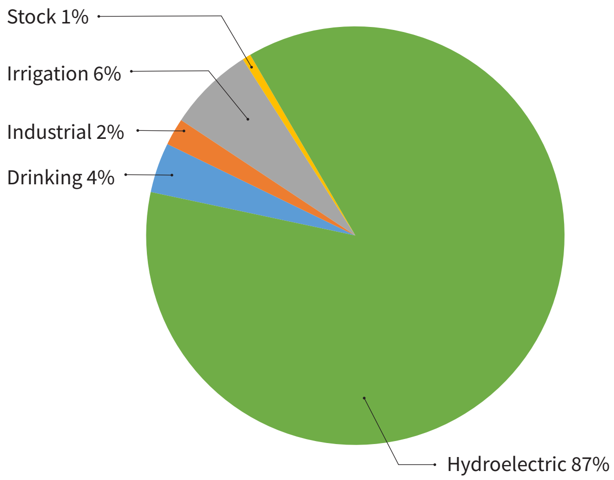


Figure 12:
West Coast consented water takes by use



Drinking Industrial Irrigation Stock Hydroelectric

Demands for irrigation, drinking water, and industrial water use has steadily increased. The current combined annual allocation of 274.5 million m³/year is a 92% increase on that measured in 2012 (Figure 13). Surface water makes up the largest amount of allocated water at 66%. Demand for groundwater has steadily risen with groundwater allocations increasing by 117% since 2012 (Figure 14). Currently, irrigation makes up 6% of all water allocated (Figure 12), and 50% of all water when hydroelectric use is excluded from analysis (Figure 11). Growth in demand for irrigation has been significant. There is currently 137.3 million m³/year allocated for irrigation, an increase of 161% since 2012 (Figure 14).

Figure 13:
Changes in consented water takes (1997-2017)

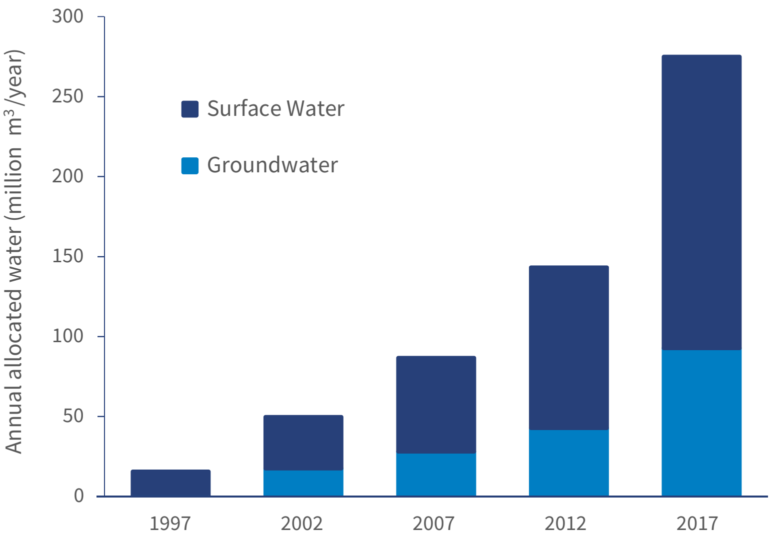
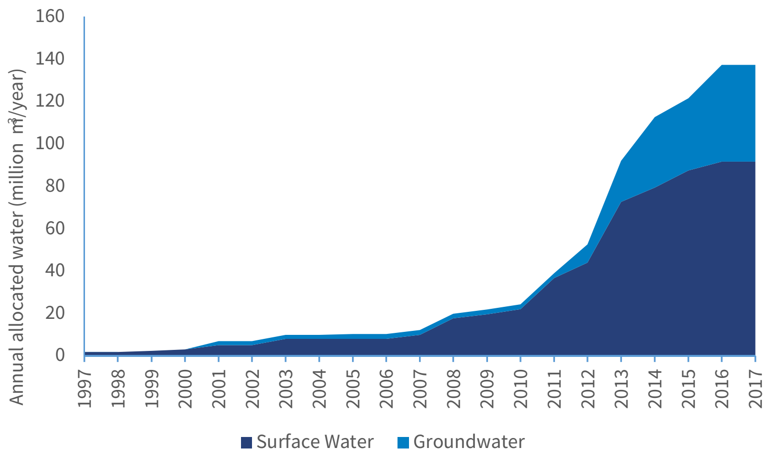
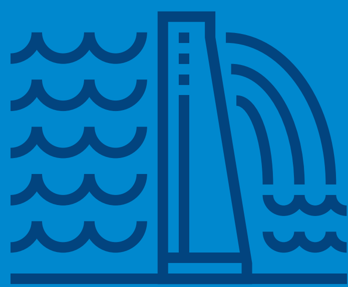


Figure 14:
Cumulative irrigation allocation over time



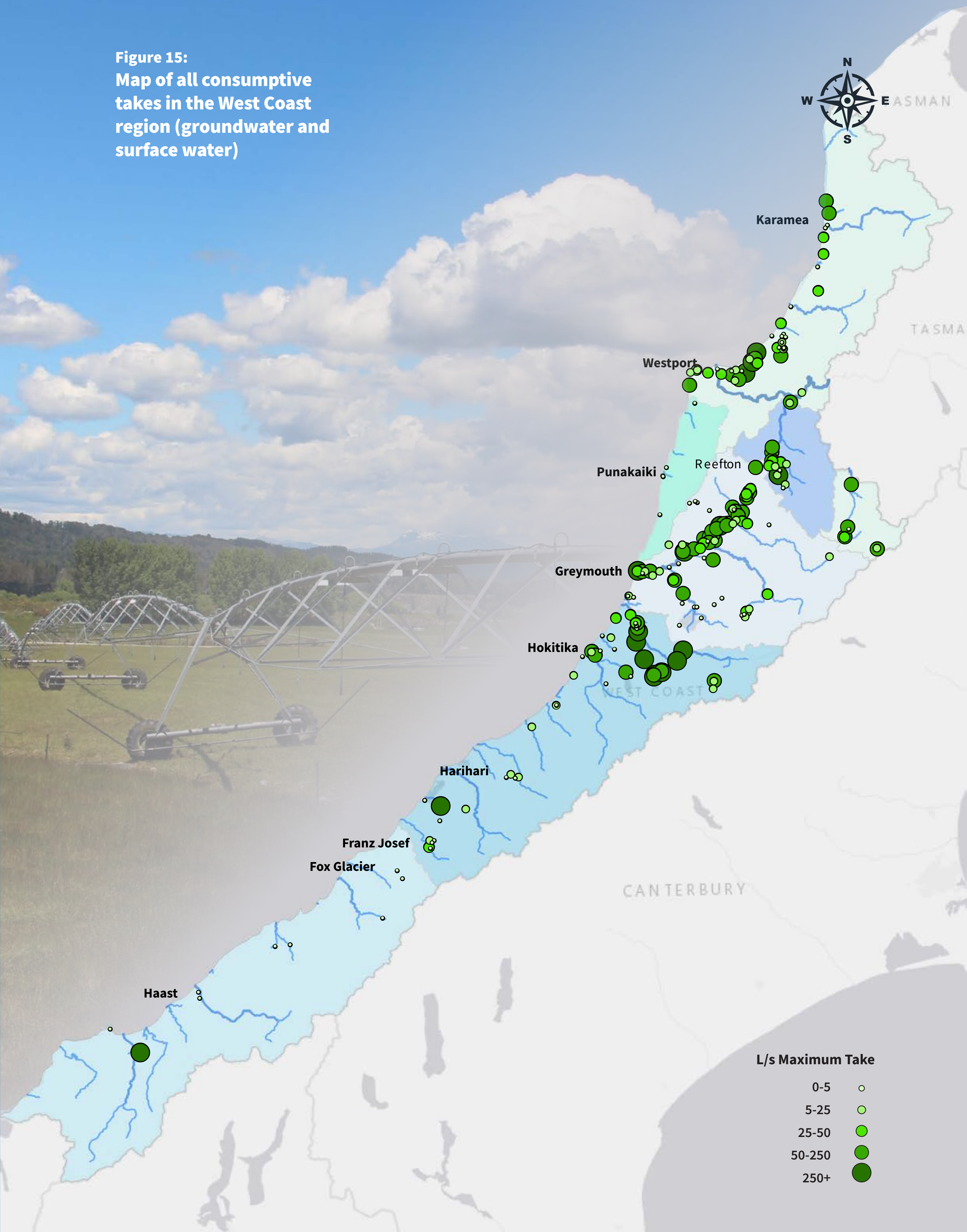
DID YOU KNOW...

The demand for **GROUND WATER** *has more than* **DOUBLED SINCE 2012**



HYDROELECTRIC POWER *is the largest consented user of water in the region with* **1,963 OLYMPIC SWIMMING POOLS OF WATER USED PER DAY**

Figure 15:
Map of all consumptive takes in the West Coast region (groundwater and surface water)



Monitoring our water quantity

Council operates a network of flow and rainfall recorders across the region (Figure 16). This network is used for flood warning, consenting, water allocation, and limit setting. Some of the flow recorders have been recording data for 55 years.

The current monitoring program consists of:

- 20 rainfall sites
- 14 flow sites
- 16 water level sites
- 22 manual groundwater level sites

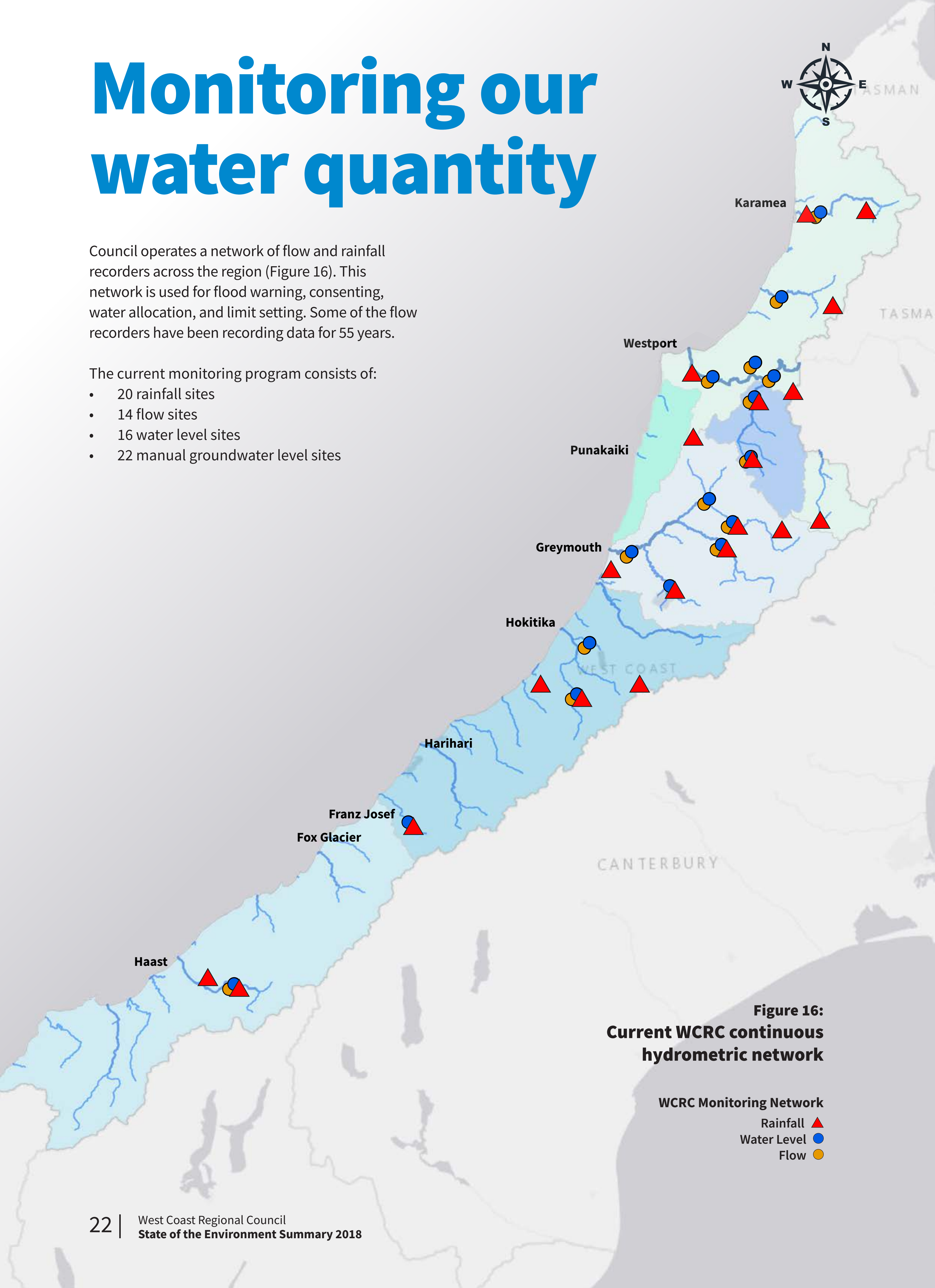


Figure 16: Current WCRC continuous hydrometric network

Flow summary
for the 2012-2017 period

Summer river flows over the 2012-2017 period have been generally average to below average (Figure 17). Individual years where summer flows were at or below average across the region were 2011/12 and 2014/15. The summer of 2016/17 was wetter than average and had significantly higher than average summer river flows (Figure 17).

Figure 17:
Regional river flow summary – 2012-2017 percentage of long-term average summer river flows

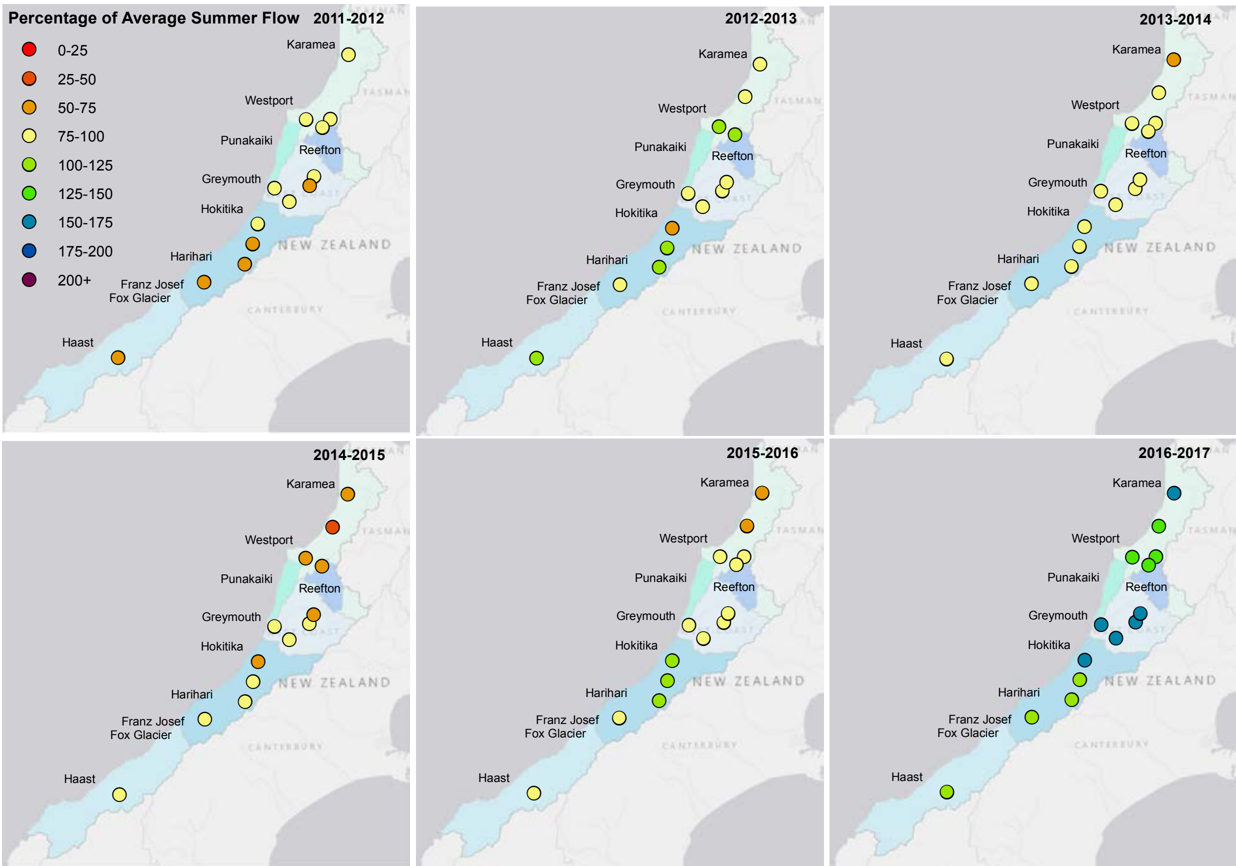


Table 1: Summary of flow statistics across region

Site	7 day mean annual low flow (m^3/s)	Mean flow (m^3/s)	Maximum recorded flow (m^3/s)	2012-2017 Maximum recorded flow (m^3/s)	2012-2017 Maximum recorded flow (Date)	2012-2017 Maximum recorded flow (Return period)
Ahaura River at Gorge	26.45	99.77	3,972.06	2,555.66	19/01/2017 6:45	15.9
Arnold River at Moana	23.57	59.58	343.00	259.29	20/06/2015 2:40	6.6
Buller River at Te Kuha	105.85	428.20	8,497.83	7,980.36	15/07/2012 10:15	25.8
Buller River at Woolfs	75.62	258.98	5,044.05	4,187.17	15/07/2012 15:00	13.7
Butchers Ck at L Kaniere Rd	0.013	0.323	54.86	53.68	18/06/2015 20:30	38.2
Grey River at Dobson	91.15	357.80	5,951.11	5,304.54	19/01/2017 11:10	12.4
Grey River at Waipuna	14.73	57.38	2,074.65	1,546.28	19/01/2017 5:40	20.9
Haast River at Roaring Billy	43.85	190.01	6,325.88	4,889.08	2/01/2013 5:45	6.6
Hokitika River at Gorge	23.90	99.99	3,070.25	3,037.22	2/01/2013 9:15	44.3
Inangahua River at Landing	12.99	73.95	2,759.55	2,109.48	11/09/2013 11:45	9.3
Ivory Lake at Ivory Glacier	3.73	0.74	37.56	19.93	2/01/2013 8:20	1.8
Karamea River at Gorge	25.80	121.97	3,279.75	3,279.75	14/10/2013 21:15	22.8
Mokihinui River at Welcome Bay	13.95	90.31	2,874.92	2,405.27	14/10/2013 19:45	10.5
Whataroa River at SH6	25.38	128.17	4,006.53	3,964.28	2/01/2013 7:00	14.9

Kohaihai River. Photo Hami Tangiora

Rainfall summary
for 2012-2017 period

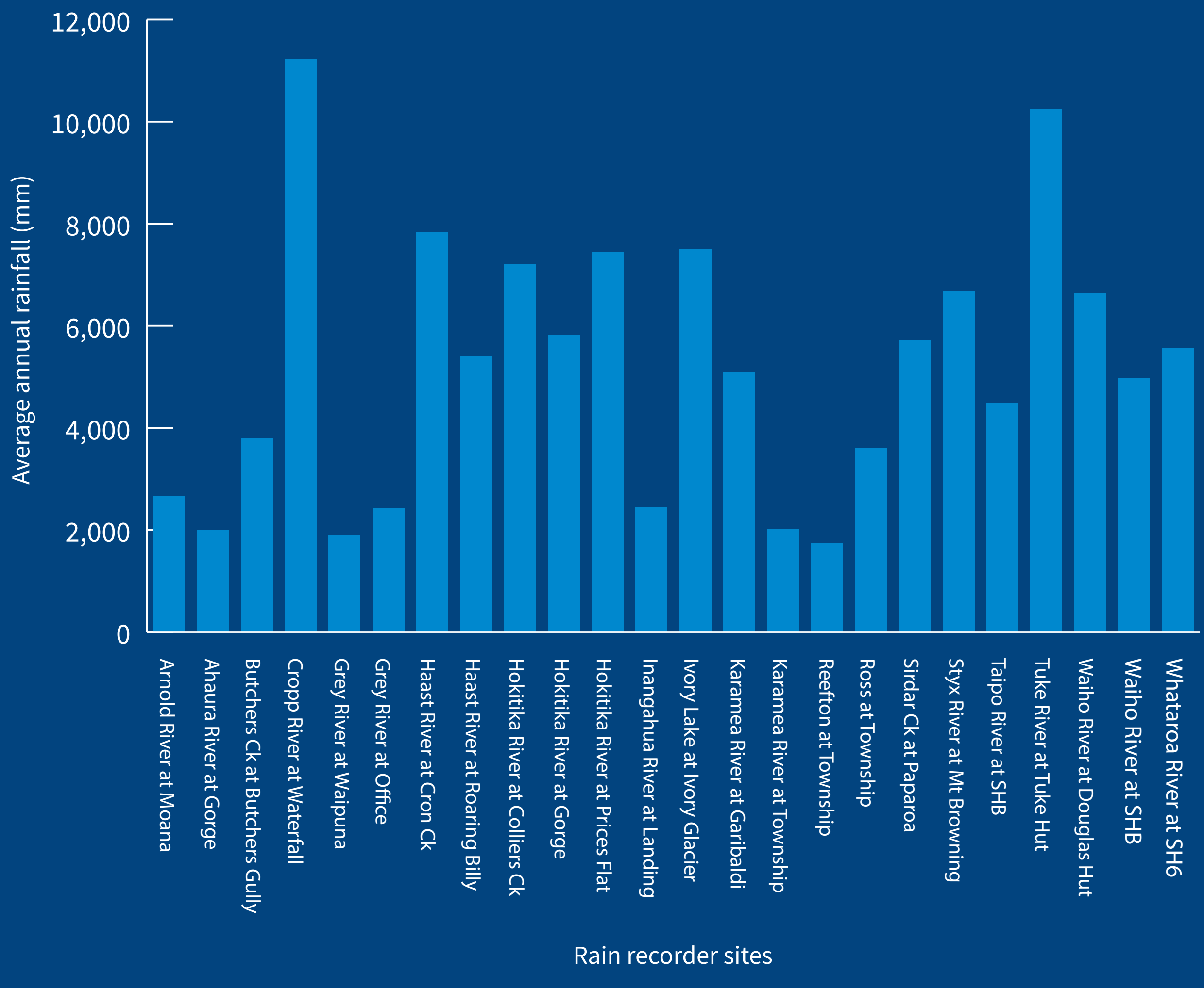
The West Coast is the wettest region in New Zealand with average rainfall totals of between 1,746mm and 11,228mm of rainfall per year (Figure 18). Annual rainfall is generally higher in the mid to southern region, particular in the mountains. The Cropp rain recorder, located in the headwaters of the Hokitika River, has measured New Zealand's highest rainfall with 11,228mm in one year.

Most rain recorders measured lower than average rainfall in 2012, 2013 and 2017 (Figure 18). Rainfall was around average or slightly above for 2014, 2015, and 2016.

Figure 18:
2012-2017 graphs of annual average rainfall percentage compared to long-term annual average rainfall

Leaving the Garibaldi rain gauge site. Photo Karamea Heli Charter.

Figure 19:
Annual rainfall averages across region



Groundwater quality

Groundwater is an important source of drinking water, irrigation water, and a major contributor to surface water flows. The Council monitors a broad range of physical and chemical attributes at a number of wells across the region. This is so Council can track state and trends in groundwater quality.

High nitrate levels are undesirable in drinking water. Nitrate concentrations have increased slightly since 2007 but this increase was only significant at a few sites (Figure 20). West Coast groundwater's remain relatively dilute overall, and exceedances of the NZ Drinking Water Standards maximum allowable limit for nitrate (11.3 mg/L), are rare.

Microbial contamination can be an issue for potable groundwater. E. coli is commonly used as an indicator of pathogen risk. The NZ Drinking Water Standard for E. coli is stringent, requiring there to be no E. coli in the sample (<1 E. coli/100 ml). Of the monitored wells that were used for human consumption, 62% had E. coli detected on average 47% of the time. While often above the guideline, E. coli levels were normally low with an overall average of 2.6 E. coli/100 ml, and a median of <1 E. coli/100ml. Likely causes of contamination were inadequate wellhead protection or the bore being located in close proximity to a potential contaminant source.

While not toxic, high levels of naturally occurring iron can be a nuisance in groundwater used for domestic purposes.

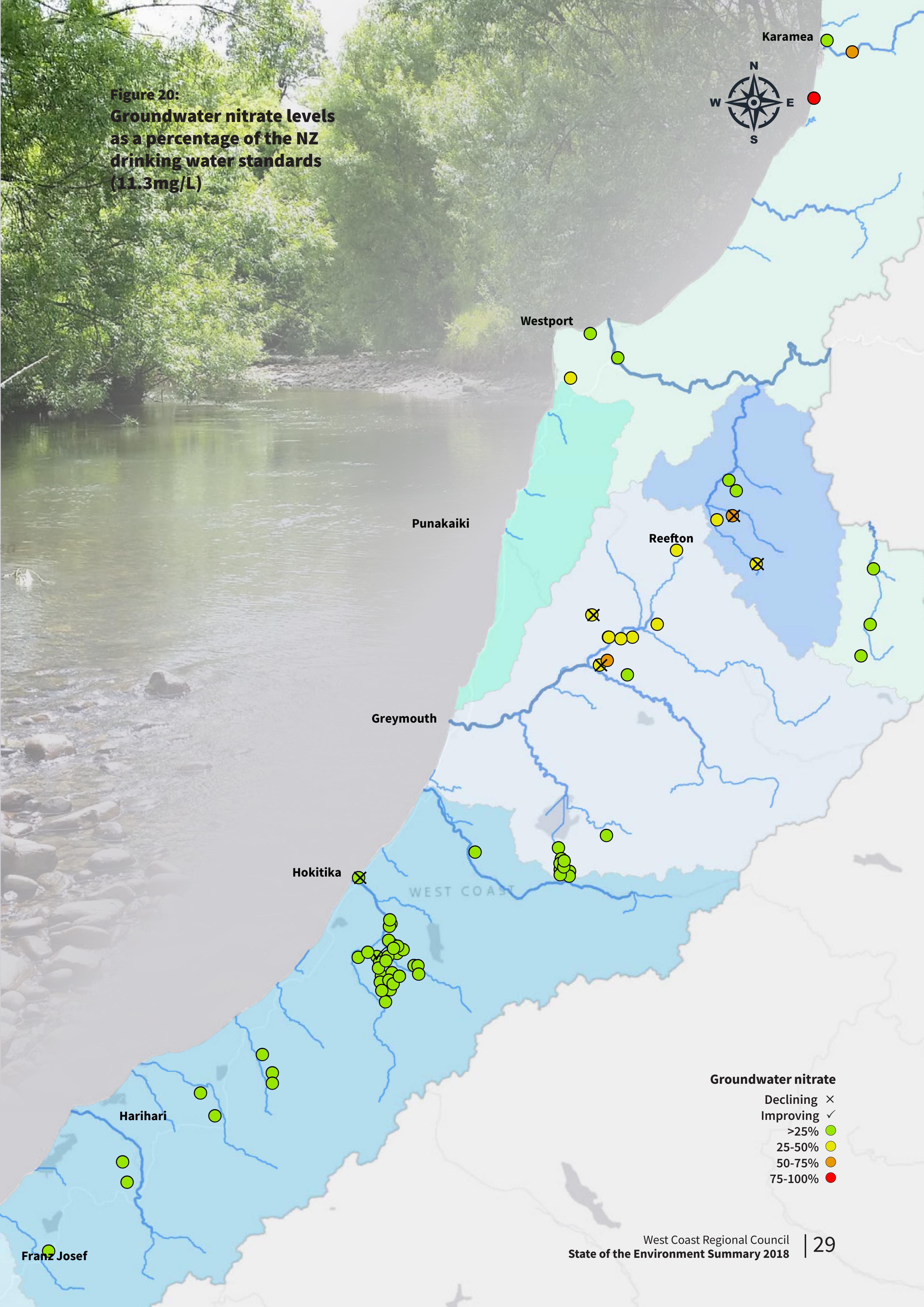
How old is West Coast Groundwater? Of the few studies undertaken on the Coast, times have varied between 2 to 50 years. The majority of water in a river after a few fine days is groundwater, so the age is relevant for how long it takes for contaminants, like nitrates, to move from the land into streams.

93% OF *groundwater bores passed* **NITRATE DRINKING WATER STANDARDS 92% OF THE TIME**

86% OF *groundwater bores passed* **IRON AESTHETIC DRINKING WATER STANDARDS 90% OF THE TIME**

Surveying well heights in the Grey District.

Figure 20:
Groundwater nitrate levels as a percentage of the NZ drinking water standards (11.3mg/L)



Carew Falls. Photo: Hami Tangiora

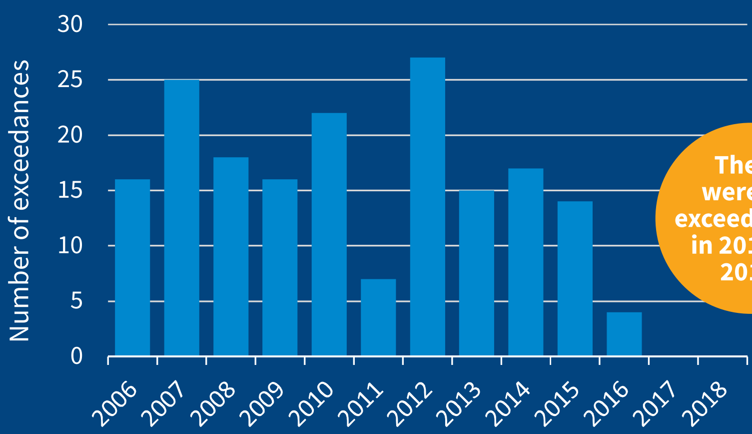
Main Street - Reefton
Photo Stewart Nimmo

Air quality

The West Coast Regional Council has one permanent air quality monitoring site, located in Reefton. As a result of its geography, climate, and domestic heating habits, Reefton suffers from poor air quality over the winter months. Council has monitored PM_{10} in Reefton since 2006. PM_{10} are particles in the air smaller than 10 micrometers in diameter, which affect human health when frequent and abundant. The main source of PM_{10} in Reefton is from domestic heating. Small contributions come from industry, traffic, and outdoor burning. The town is surrounded by hills that impede air movement. During winter, cold temperatures and reduced air flow cause an inversion layer to form, restricting the movement of polluted air.

Reefton generally has satisfactory air quality, but emissions from domestic heating have periodically exceeded the PM_{10} National Environmental Standard (NES) over the winter months (Figure 21). An exceedance occurs when there has been an average of more than 50 micrograms/m^3 of PM_{10} recorded over a 24 hour period. The NES allows one permissible exceedance per year. There were no exceedances in 2017 or 2018, which is positive, but this may relate in part to a shift in the monitoring site. Further work is being undertaken to ensure Council has consistent air quality data for this area.

Figure 21:
Air quality exceedances in Reefton



There were no exceedances in 2017 or 2018

Reefton air quality site.

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THE WEST COAST REGIONAL COUNCIL

Photo Hami Tangiora