

Makarewa Headwaters Catchment Group

Fresh water health and landscape influences in
Makarewa Headwaters Catchment



**THRIVING
SOUTHLAND**

*Tōtū ana te whenua. Tōtū ana te takata.
A thriving, prosperous land. A thriving, prosperous people.*

AS AT MAY 2022
Further updates will be included as new
information becomes available.

Welcome to Makarewa Headwaters Catchment brochure

This Makarewa Headwaters Catchment Group brochure is one of a series of brochures on catchments in Southland.

Catchment Groups have been asking for more detailed insights into their individual catchments. This brochure provides insights based on available information, bringing together published science, research, data and information on the state of water, soil and land in the Makarewa Headwaters Catchment.

It provides details on what affects water quality and how these impact the rest of the catchment, including out-of-catchment areas that may be impacted by what goes on in the catchment, such as the estuary.

Although this brochure collates all the available information that has been brought together in a literature review commissioned by Thriving Southland – called the Science Report thrivingsouthland.co.nz/science-report - it may not have all the details you know about in your catchment or the research you may have done on your farm or in your catchment group.

How to use this brochure

This brochure sets out publicly available details on:

- » Water quality
- » Landscape influences
- » Physiographic zones
- » Groundwater management zones (GMZs)
- » Measuring what lives in streams and rivers
- » Macroinvertebrate community index (MCI)
- » Estuary health
- » Where to get more information.

If you are not familiar with the terms and language used, read the brochure in conjunction with this glossary environment.govt.nz/publications/environmentaoteaaroa-2019-glossary.

We also recommend you check out the Catchment Group page on thrivingsouthland.co.nz/makarewa-headwaters to learn more about the catchment and what projects the Catchment Group has underway or planned.

Interpreting what the data in the brochure means

Because this brochure brings together the data available, we have deliberately not interpreted that data or explained what the trends may mean for your catchment.

We recommend you contact an environmental consultant, your Thriving Southland Catchment Group coordinator or Environment Southland to speak to experts who can explain what these trends and data may mean for your catchment, or for your farm specifically.

You can also check out a range of information on the Thriving Southland Information Resource Hub thrivingsouthland.co.nz/info-hub/ which will connect you with tools and resources from many different organisations to help with understanding limit setting, environmental contributing factors, mitigations and options available to you.

A little bit about Thriving Southland

Thriving Southland supports Southland's catchment groups to understand challenges and opportunities in their catchments and create innovative and exciting solutions.

We have a vision to create a prosperous Southland, healthy people, and a healthy environment, and believe that by working together, Thriving Southland's communities will create a better future for all by protecting the region's prosperity, heritage, environment and health.

Thanks

Thank you to the farmers who supported the development of this brochure, and to the Ministry of Primary Industry for their Sustainable Land Use Programme which supports the work Thriving Southland is delivering for farmers and communities in Southland. Thank you also to Environment Southland who reviewed the content of this brochure.



Water quality in Oreti Catchment

Oreti Catchment

Makarewa Headwaters is part of the Oreti Catchment which outflows into the New River Estuary. The Oreti River and the New River Estuary are an important source of mahinga kai, particularly waterfowl, eels and inanga (whitebait).

Currently the New River Estuary is considered to be in poor condition as a result of rural, urban, industrial and historic practices.

Summary of Makarewa Headwaters Catchment

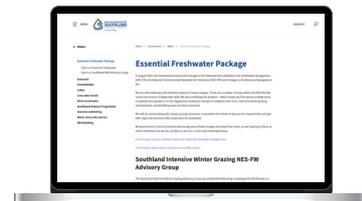
The hydrology, health and functions of a stream/ river or area of groundwater is directly linked to the characteristics of its catchment, including the landscape, soils and human activities.

- » This catchment covers a mosaic of four different physiographic zones that differ greatly in nitrate and phosphorus levels from land use.
- » Low-lying areas of this catchment overlie part of the Makarewa GMZ, which generally has low nitrate and phosphorus levels.
- » Water quality in this catchment is showing high stress in terms of *E. coli* (faecal bacteria) (surface water). Surface water is also showing some stress in terms of phosphorus and the MCI.
- » Neighbouring farms on different zones may have very different water quality outcomes with similar farm practices, due to different contamination movement and attenuation pathways (reducing the effects of contaminants).



What does this mean?

- » In August 2020, the Government announced changes to the National Policy Statement for Freshwater Management (NPS-FM), the National Environmental Standard for Freshwater (NES) and changes to the Resource Management Act. These outline changes in regulations relating to wetlands and rivers, intensive winter grazing, intensification, stockholding areas and stock exclusion
- » More about Environment Southland's response to the Government's Essential Freshwater Package is here es.govt.nz/environment/water/essential-freshwater-package



Environment Southland, in partnership with Te Ao Mārama Inc*, has indicated that a proposed limits and targets' plan change (LTPC) will be notified in 2023. This will establish nutrient limits and targets to improve the quality of groundwater and surface water. waterandland.es.govt.nz/about/values-and-objectives

- » Environment Southland and Te Ao Mārama Inc have established a community-based regional forum to consider and advise on limits, targets and methods
- » Plan changes will result in additional controls and rules in Southland that will be focused on reducing the loss of nutrients, specifically nitrogen and phosphorus, and reducing discharges of sediment and faecal microorganisms, from land to groundwater and surface water.
- » In the Environment Southland Proposed Water and Land Plan there is a focus on good management practices (GMPs) and farm environmental management plans (FEPs). You can view GMP factsheets for each physiographic zone on
- » The Environment Southland website es.govt.nz

*Te Ao Mārama Incorporated looks after mana whenua interests in resource management and other aspects related to local government in Southland. It is authorised to represent three Ngāi Tahu papatipu runanga in Murihiku/Southland. It is involved in the protection of the spiritual and cultural values of the region, including wahi tapu (sacred places), mahinga kai (gathering of food and resources) and other natural resources.

Makarewa Headwaters water quality

Surface water quality is assessed by testing how much nitrogen, phosphorus and *E. coli* is present. LAWA summary results from for this catchment are (lawa.org.nz):

Total oxidised nitrogen (TON)

Monitoring site	5-year median	5-year trend	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	0.65 mg/L			
Makarewa River at Lora Gorge Road	0.75 mg/L			

^ Total oxidized nitrogen (TON) is the sum of nitrate and nitrite. Nitrite is generally a very small fraction of the TON concentration in rivers, TON is taken to be equivalent to the nitrate concentration

* 2016-2020 LAWA median per NPS-FM 2020 using TON as surrogate for NO³-N

Too much TON can contribute to excessive algal growth in waterways

Ammoniacal nitrogen

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	0.005 mg/L	A			
Makarewa River at Lora Gorge Road	0.005 mg/L	A			

* If ammoniacal nitrogen reaches very high concentrations it can become toxic under certain temperature and pH conditions.

Dissolved reactive phosphorus

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	0.014 mg/L	C			
Makarewa River at Lora Gorge Road	0.012 mg/L	C			

* Dissolved reactive phosphorus concentrations are an indication of a waterbody's ability to support nuisance algal or plant growths (algal blooms).

Total phosphorus

Monitoring site	5-year median	5-year trend	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	0.036 mg/L			
Makarewa River at Lora Gorge Road	0.032 mg/L			

* Too much phosphorus can encourage the growth of nuisance plants such as algal blooms.

KEY (STATE) <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> A Very good </div> <div style="text-align: center;"> B Good </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;"> <div style="text-align: center;"> C Fair </div> <div style="text-align: center;"> D Poor </div> </div>		KEY (TREND) <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;"> <div style="text-align: center;"> Very likely improving </div> <div style="text-align: center;"> Likely improving </div> <div style="text-align: center;"> Indeterminate </div> </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;"> <div style="text-align: center;"> Very Likely degrading </div> <div style="text-align: center;"> Likely Degrading </div> <div style="text-align: center;"> Not Assessed </div> </div>		
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E. coli

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	360 n/100ml	E			
Makarewa River at Lora Gorge Road	410 n/100ml	E			

* 2016-2020 LAWA median graded as per NPS-FM 2020

Results from lawa.org.nz (October 2021)

KEY (STATE)			KEY (TREND)		
A Very good (infection risk is 1%)	B Good (infection risk is 2%)	C Fair (infection risk is 3%)	 Very likely improving	 Likely improving	 Indeterminate
D Poor (infection risk is >3%)	E Very Poor (infection risk is >7%)		 Very Likely degrading	 Likely Degrading	 Not Assessed

MCI

Macroinvertebrates include the caddisflies, mayflies, stoneflies, worms and snails that live in rivers. They are an important food source for fish and birds and sensitive to the combination of nutrients, sediment and habitat. Due to this sensitivity, they are considered to be a good representation of overall water quality and ecosystem health. The different macroinvertebrates present can be identified and then converted to a score called the MCI.

A higher MCI score generally indicates a healthier stream. Generally, MCI scores range from >150 (very good water quality) to as low as 20 (very poor water quality).

Results for this catchment are below (LAWA October 2021).

MCI

Monitoring site	5-year median	State	10-year trend	15-year trend
Otapiri Stream at Otapiri Gorge	109.5	C		
Makarewa River at Lora Gorge Road	97.0	C		

KEY (STATE)		KEY (TREND)		
A Macroinvertebrate community indicative of pristine conditions with almost no organic pollution or nutrient enrichment.	B Macroinvertebrate community indicative of mild organic pollution or nutrient enrichment. Largely composed of taxa sensitive to organic pollution/nutrient enrichment.	 Very likely improving	 Likely improving	 Indeterminate
C Macroinvertebrate community indicative of moderate organic pollution or nutrient enrichment. There is a mix of taxa sensitive and insensitive to organic pollution/nutrient enrichment.	D Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.	 Very Likely degrading	 Likely Degrading	 Not Assessed

National bottom line: MCI score 90



Estuary health

Table: Estuary state information (provided by Environment Southland July 2021, es.govt.nz state and outcome map).

Although the New River Estuary is not in the Makarewa Headwaters Catchment, it is an important factor in understanding the impacts of water quality in Makarewa Headwaters. Decisions made in this catchment that affect water quality, flow downstream and impact on water quality in the estuary.

The New River Estuary has been significantly affected by urban and rural development over the past 150 years. This includes large areas of reclaimed land, urban discharges including treated sewage and untreated stormwater, past landfill leaching, and agricultural activities and run-off further up the catchment.

The below assessment of estuary health based on the sediment quality gives a good indication of what is happening upstream across all catchments that feed into waterways supplying the estuary and therefore impact on the ecosystems and the cultural values of the area.

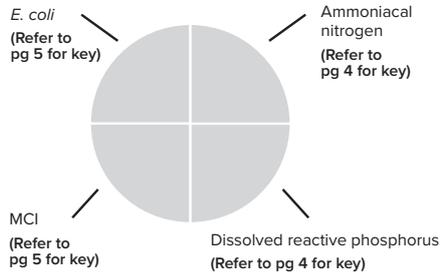
Estuary	Soft mud	Nutrients in sediment	Oxygen in sediment	Macroalgae cover	Seagrass loss	GEZ*
Waiau Lagoon/Te Wae						
Lake Brunton						
Waituna Lagoon/Waiparera (not assessed)						
New River Estuary						
Jacobs River Estuary						
Waikawa Estuary						
Haldane Estuary						
Freshwater Estuary						
Waimatuku Estuary						
Toetoes Estuary						

KEY Very Good Good Fair Poor

* Gross Eutrophic Zone (GEZ) is defined as an area that has low sediment oxygenation (<1cm aRPD), soft mud (>25% mud content) and the presence of high macroalgal cover (>50% cover). These areas are in poor condition and can no longer support most estuarine animals and shellfish.

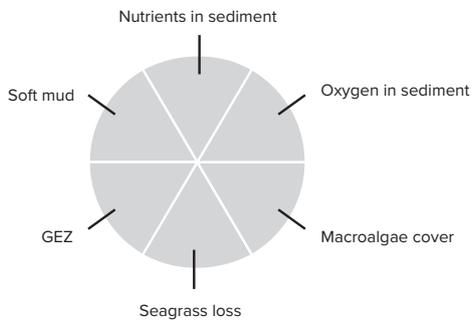
Oreti Catchment with Estuaries and Surface water quality monitoring sites*

Water quality state and MCI

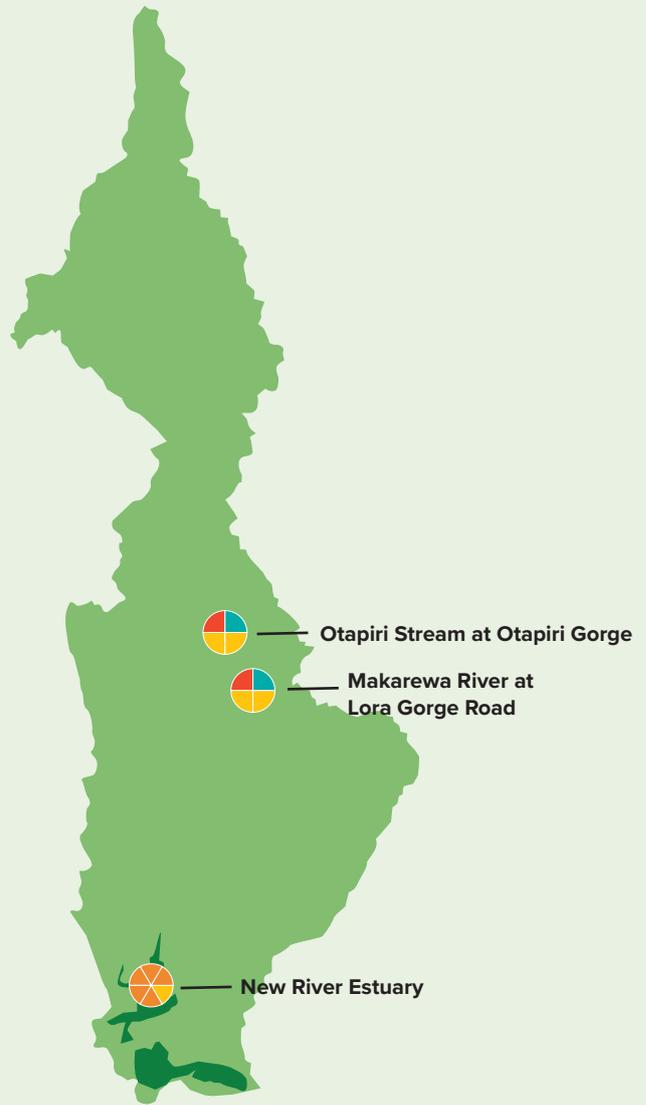


Estuary risk indicators

(Refer to pg 6 for key)



*sites in Hedeghope Makarewa Catchment only shown



Landscape influences

What we do on the land can affect our water, but how it affects our water depends on a range of factors, including how our landscape works. It is useful to look at:

- » Physiographic zones which help to explain how nitrogen, phosphorus, sediment and faecal microorganisms (such as *E. coli*) move and are attenuated (reduced, e.g. by biological or chemical processes).
- » GMZs which highlight the connectivity between land, surface water and groundwater.

Physiographic zones

Southland has been divided into nine physiographic zones to help understand how water moves across the landscape and why water quality is better in some places than others. Each physiographic zone represents an area that has similar factors influencing water quality, such as climate, topography, geology and soil type.

The hilly areas of Makarewa Headwaters Catchment area predominantly fall into the bedrock/hill country physiographic zone, although there are some areas of oxidising and peat wetlands physiographic zones. Lower lying areas are dominated by gleyed and peat wetlands physiographic zones (see map below). These zones differ in the way contaminants are transported and attenuated within the catchment.



Makarewa Headwaters Catchment showing physiographic zones

Peat wetlands

This zone features poorly drained, peaty soils that are extremely acidic. The water table in these areas is high. Developed areas require extensive artificial drainage. Soluble phosphorus concentrations are high in acidic, oxygen depleted ground- and surface waters; conversely nitrate concentrations are low.

Gleyed

This zone is generally found in areas that were once wetlands. It is characterized by a dense network of streams and a high water table during winter.

Soils are prone to waterlogging and have some denitrification* ability, which reduces build-up of soil nitrogen. However, an extensive network of artificial drainage rapidly transports nitrogen, phosphorus, sediment and faecal microbes to surface water, particularly during heavy rain.

Bedrock/Hill country – overland flow

This zone is found on rolling to steep land below 800 metres. It is characterized by high rainfall and a dense network of branching streams.

Water quickly flows down-slope to nearby streams following high or prolonged rainfall. Nitrogen, phosphorus, sediment and faecal microorganisms are all carried with water, particularly during late autumn and winter.

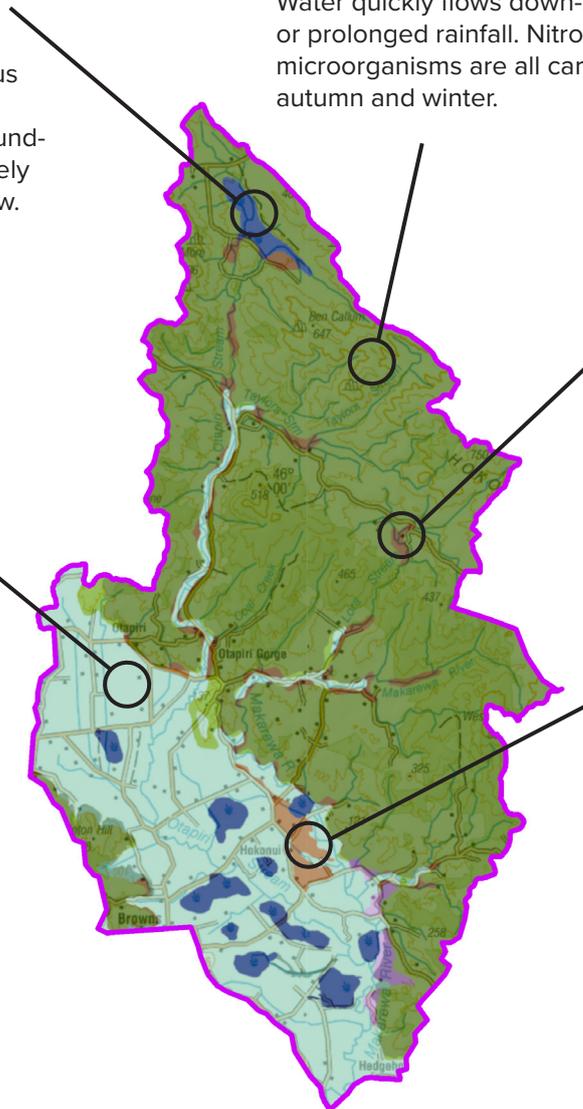
Oxidising

Soils and aquifers in this zone have high risk of nitrogen build-up due to low rates of denitrification*.

The combination of flat land and well drained soils results in high rates of nitrogen leaching (deep drainage) to underlying aquifers.

Oxidising – overland flow

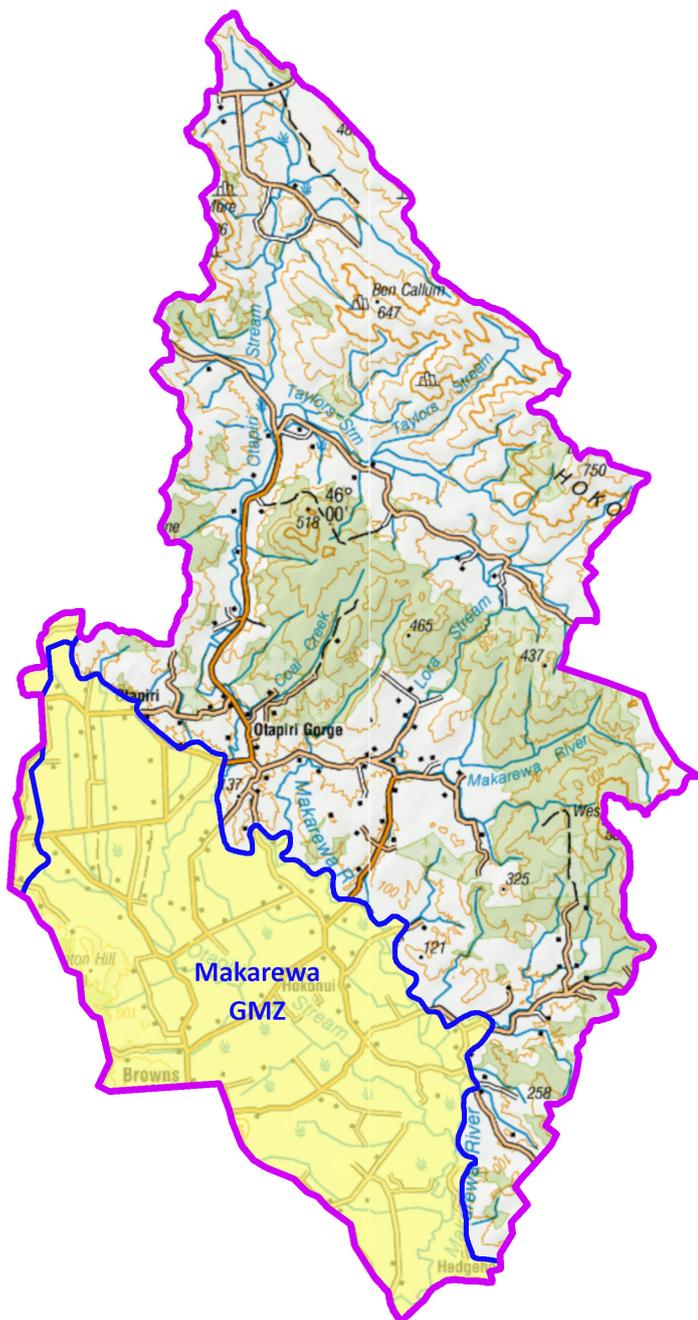
The overland flow variant is found on steeper areas where water preferentially flows over the land surface.



*Denitrification occurs when nitrate is converted to nitrogen gas via various reactions involving bacteria. Where denitrification occurs, nitrogen is effectively 'lost' from soil and water as a gas. This is a form of 'attenuation'.

Groundwater Management Zones – Makarewa Headwaters Catchment

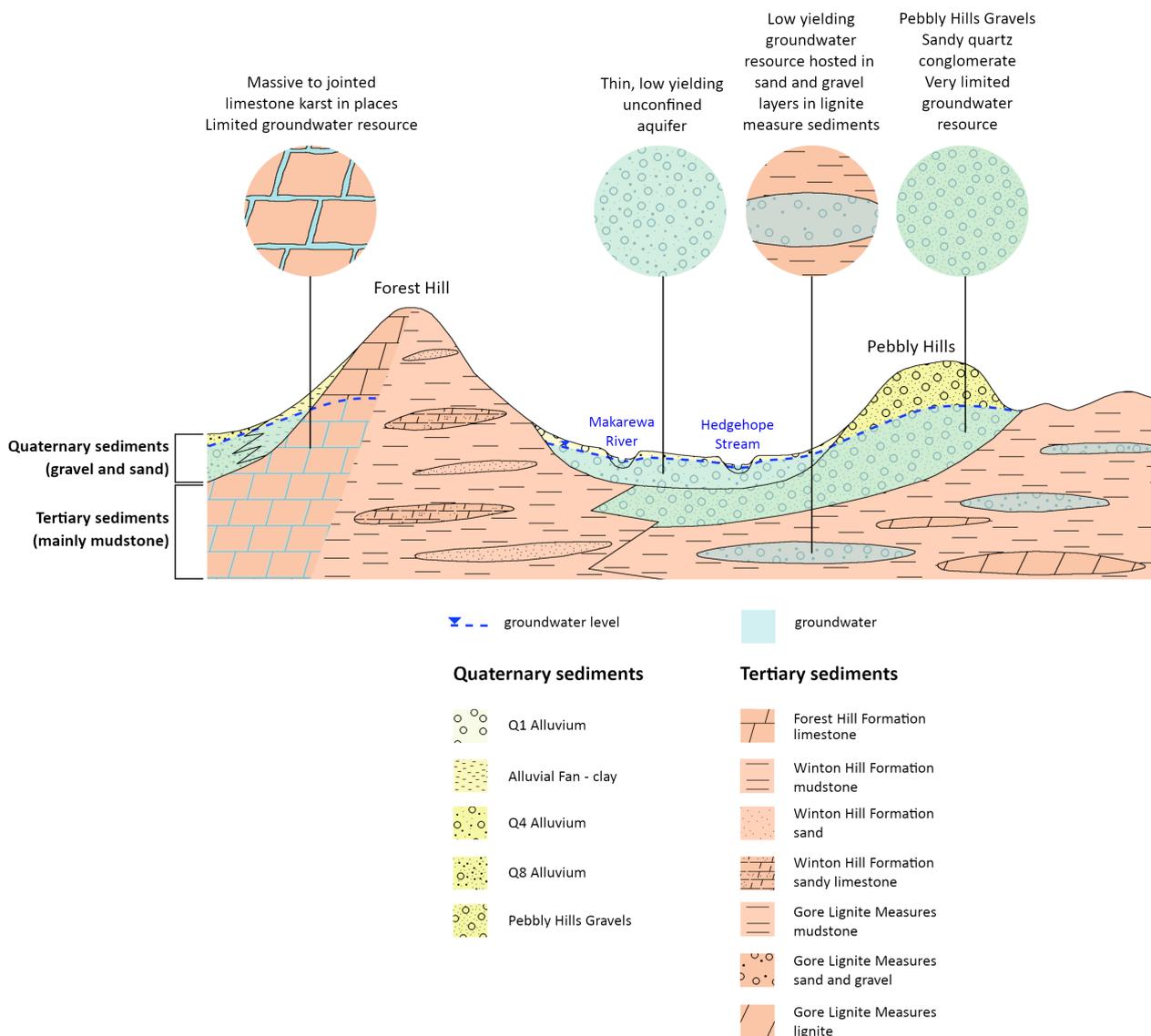
Low-lying areas of this catchment overlies part of the Makarewa Groundwater Management Zone (GMZ).



Makarewa GMZ

The Makarewa GMZ covers an area of approximately 66,000 ha in the Makarewa River Catchment.

- » Depth to groundwater is close to the ground surface near streams and rivers, increasing to up to 10 metres on higher ridges.
- » Groundwater level varies seasonally, with levels highest in winter and lowest in early autumn. Groundwater levels usually fluctuate by one-two metres.
- » A diagrammatic cross-section of this GMZ showing areas of groundwater is provided below (source es.govt.nz/environment/water/groundwater/groundwater-management-zones/makarewa).
- » Groundwater recharge in this zone is derived from local rainfall that soaks through the soil. Discharge mostly occurs as baseflow to a network of small streams. Extensive areas of artificial drainage also divert water from the land surface to waterways.



Groundwater quality Makarewa GMZ

- » Nitrate = generally low, but can be elevated due to intensive land use where groundwater is more oxidic (has more oxygen)
- » Phosphorus = low, but can be elevated where reducing conditions exist in shallow groundwater
- » *E. coli* = low, but risk may be elevated close to source.



Find out more

Find out more about physiographic zones

bit.ly/2OI7z7F

Find out more about Southland's groundwater

bit.ly/30Db5g1

Find out more about stream health

Environment Southland

es.govt.nz/environment/water/rivers-and-streams

Land Air Water Aotearoa (LAWA)

lawa.org.nz

Ministry for the Environment

environment.govt.nz/facts-and-science/freshwater

Link to iwi freshwater objectives

bit.ly/2P4HsBV

Get in contact

For more information about your catchment and to contact your local catchment coordinator

021 466 700 | office@thrivingsouthland.co.nz

thrivingsouthland.co.nz/catchment-groups



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