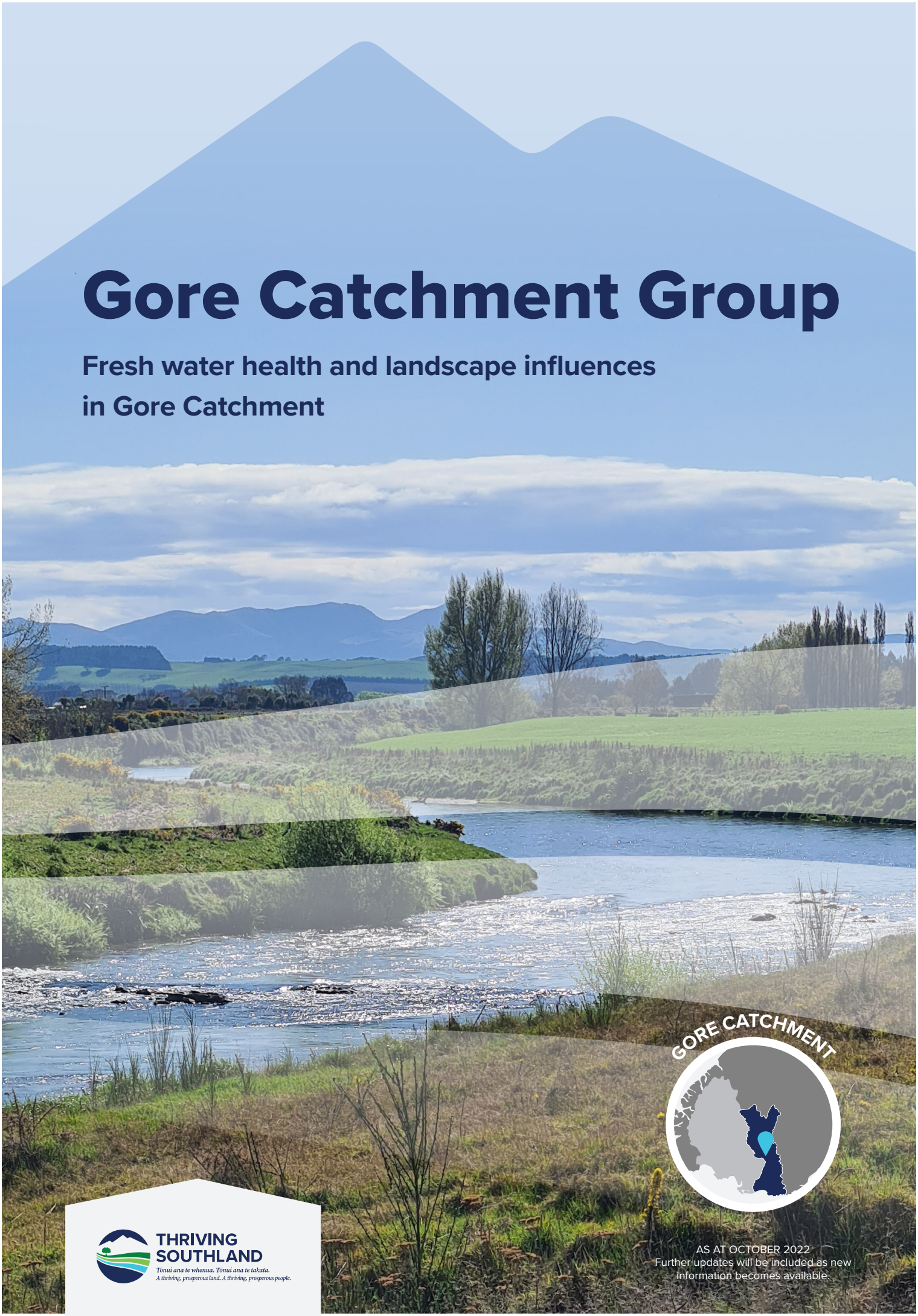
Gore Catchment Group

Fresh water health and landscape influences in Gore Catchment



THRIVING SOUTHLAND

Tōnui ana te whenua. Tōnui ana te takata.
A thriving, prosperous land. A thriving, prosperous people.

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

Welcome to the Gore Catchment brochure

This Gore 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 Gore 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 - 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/environment-aotearoa-2019-glossary***.

We also recommend you check out the catchment group page on ***thrivingsouthland.co.nz/gore*** 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 you 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 its 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 Mataura Catchment

Mataura Catchment

Gore is part of the Mataura Catchment which outflows via the Mataura River into the Toetoes (Fortrose) Estuary. The Mataura River and the Toetoes Estuary are an important source of mahinga kai, particularly kanakana (lamprey), inanga (whitebait) and tuna (eels).

Land use and various industrial and municipal water discharges are key contributors to the degradation of water quality in the Mataura catchment. Currently the Toetoes Estuary is considered to be in poor condition.

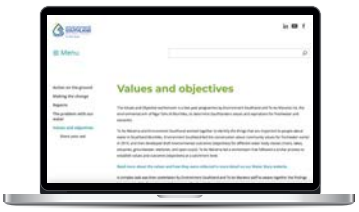
Summary of Gore Catchment

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 six different physiographic zones that differ greatly in nitrate levels from land use.
- This catchment overlies the whole or parts of the following GMZs:
  - Knapdale GMZ, moderate to very high nitrate levels
  - Croydon GMZ, moderate to high nitrate levels
  - Lower Mataura GMZ, variable nitrate levels, depending on physiographic zone
  - Makarewa GMZ, generally low nitrate levels
  - Edendale GMZ, moderate to very high nitrate levels
- Water quality in this catchment is variable, with some areas showing signs of stress. In places it is degraded in terms of nitrogen (particularly groundwater), *E. coli* (faecal bacteria) (surface water) and is showing stress with regard to 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
- Environment Southland, in partnership with Te Ao Marama Incorporated (as the environmental arm of Ngāi Tahu Ki Murihiku), is working towards updating the Water and Land Plan in line with the 2020 NPS-FM. This update is known as Plan Change Tuatahi (first plan change), and will set limits, targets and methods (for discharges to and abstractions from waterways) that will help achieve hauora, a state of healthy resilience, for waterbodies. There will be an opportunity for public submissions to this plan in 2023 before it is finalised in 2025. ***waterandland.es.govt.nz/about/values-and-objective***



- 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.

Gore water quality

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

Total oxidised nitrogen

Monitoring site	5-year median	5-year trend	10-year trend	15-year trend
Mataura River at Gore	0.92 mg/L			
Mataura River 200m d/s Mataura Bridge	0.91 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 NO_3-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
Mataura River at Gore	0.005 mg/L	A			
Mataura River 200m d/s Mataura Bridge	0.041 mg/L	B			

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
Mataura River at Gore	0.006 mg/L	B			
Mataura River 200m d/s Mataura Bridge	0.009 mg/L	B			

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
Mataura River at Gore	0.016 mg/L			
Mataura River 200m d/s Mataura Bridge	0.024 mg/L			

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

KEY (STATE)

A Very good

B Good

C Fair

D Poor

KEY (TREND)

 Very likely improving

 Likely improving

 Indeterminate

 Very Likely degrading

 Likely Degrading

 Not Assessed

E. coli

Monitoring site	5-year median	State	5-year trend	10-year trend	15-year trend
Mataura River at Gore	350 n/ 100ml	E			
Mataura River 200m d/s Mataura Bridge	990 n/100ml	E			

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

KEY (STATE)

A **Very good** (infection risk is 1%)

B **Good** (infection risk is 2%)

C **Fair** (infection risk is 3%)

D **Poor** (infection risk is >3%)

E **Very Poor** (infection risk is >7%)

KEY (TREND)

Very likely improving

Likely improving

Indeterminate

Very Likely degrading

Likely Degrading

Not Assessed

Results from lawa.org.nz (September 2022)

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 MCI score.

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).

The MCI scores for the Gore Catchment are (LAWA September 2022):

MCI

Monitoring site	5-year median	State	10-year trend	15-year trend
Mataura River at Gore	100.0	C		
Mataura River 200m d/s Mataura Bridge	-	N/A		

KEY (STATE)

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.**

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.**

National bottom line: MCI score 90

D **Macroinvertebrate community indicative of severe organic pollution or nutrient enrichment. Communities are largely composed of taxa insensitive to inorganic pollution/nutrient enrichment.**

KEY (TREND)

Very likely improving

Likely improving

Indeterminate

Very Likely degrading

Likely Degrading

Not Assessed

Estuary Health

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

The Toetoes (Fortrose) estuary is at the bottom of the Mataura Catchment, and receives water from the Upper Mataura, Gore and Lower Mataura catchments. Decisions made in Gore that affect water quality, flow downstream and impact on water quality in the estuary.

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.

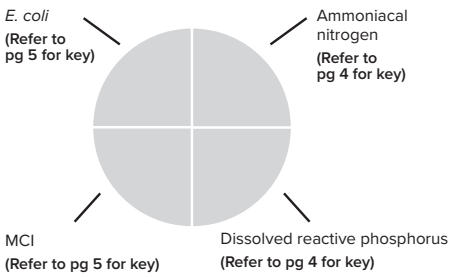
Estuary	Soft mud	Nutrients in sediment	Oxygen in sediment	Macroalgae cover	Seagrass loss	GEZ*
Waiau Lagoon/Te Wae						
Lake Brunton						
Waituna Lagoon/Waiparera (not assessed)						
New River Estuary						
Jacobs River Estuary						
Waikawa Estuary						
Haldane Estuary						
Freshwater Estuary		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

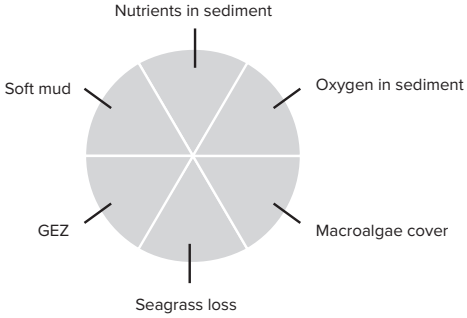
Mataura Catchment with estuaries and surface water quality monitoring sites

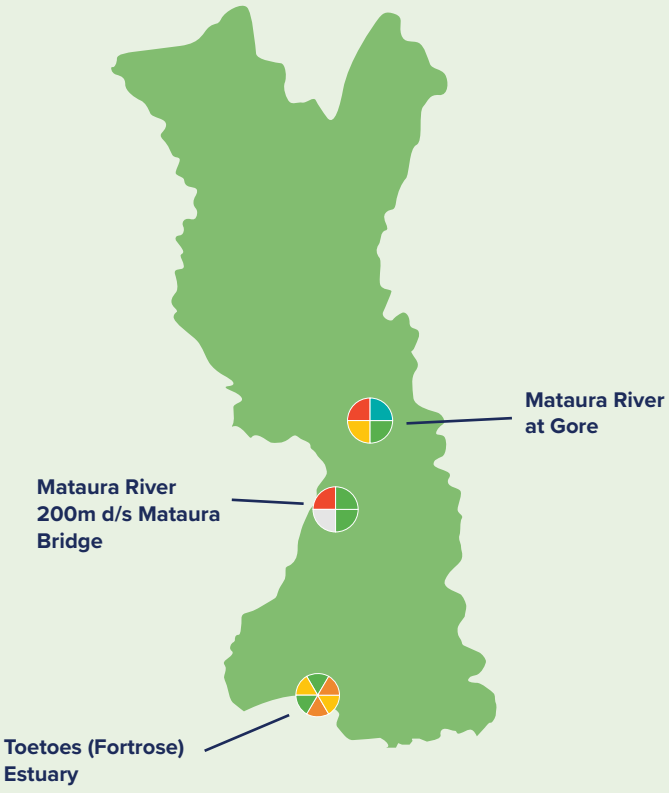
Water quality state and MCI



Estuary risk indicators

(Refer to pg 6 for key)





*sites in Gore 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 Gore catchment area falls into a mosaic of physiographic zones that vary greatly in their influences on water quality. Extensive areas of this catchment fall into the bedrock/hill country and lignite/marine physiographic zones. Lower lying areas are mainly classified as oxidising, gleyed, riverine or old Mataura (see map below). These zones differ in the way contaminants are transported and attenuated within the catchment.

Gore Catchment showing physiographic zones

Bedrock/hill country – overland flow

This zone is found on rolling to steep land below 800 metres. This zone 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.

Lignite/marine terraces

Organic-rich sediments like lignite, are found at depth within this zone. The presence of these sediments has a strong influence on reducing the amount of nitrate in groundwater.

Denitrification* rates are high, meaning that much of the nitrate leached to groundwater in this zone is converted to nitrogen gas via various reactions involving bacteria.

Lignite/marine terraces – artificial drainage

Located on gently undulating land that has slow subsoil permeability and may be seasonally wet. heavy rain.

Lignite/marine terraces – overland flow

Located on gently undulating to rolling land that have a high potential for overland flow.

Oxidising – overland flow

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

Riverine

Located along the margins of major rivers, this zone is characterized by shallow, stony soils that drain quickly to underlying shallow aquifers. This zone transports contaminants, particularly nitrogen, to coastal estuaries and lagoons.

Old Mataura

This zone has low denitrification* potential in soils and aquifers. As a result, nitrate levels can accumulate to high concentrations.

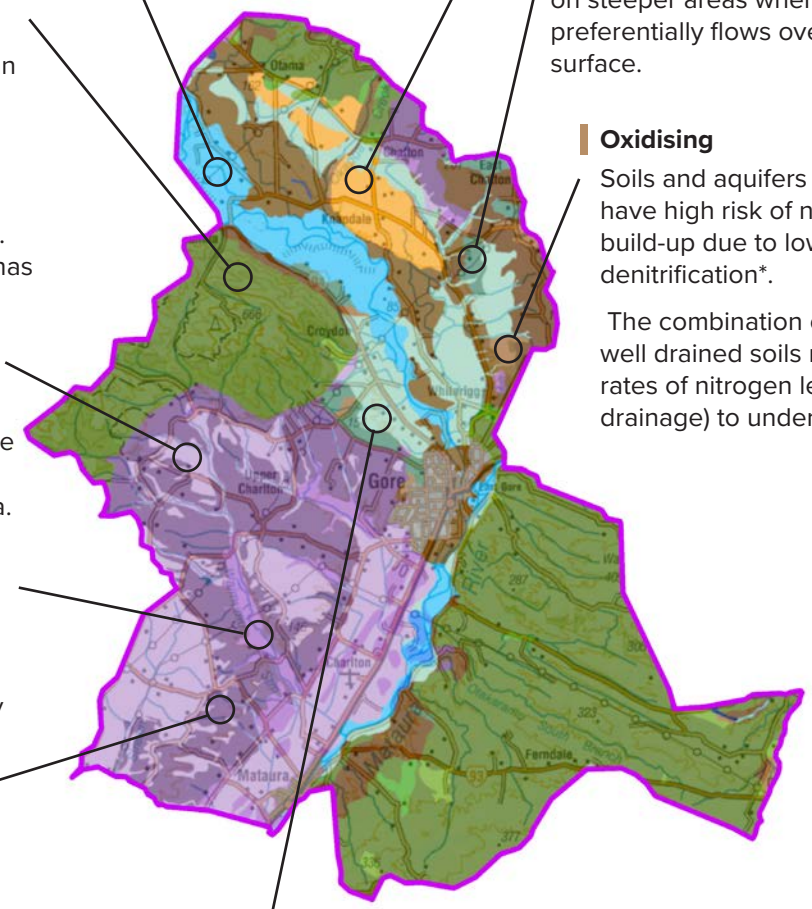
Gleyed – overland flow

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

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.



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.

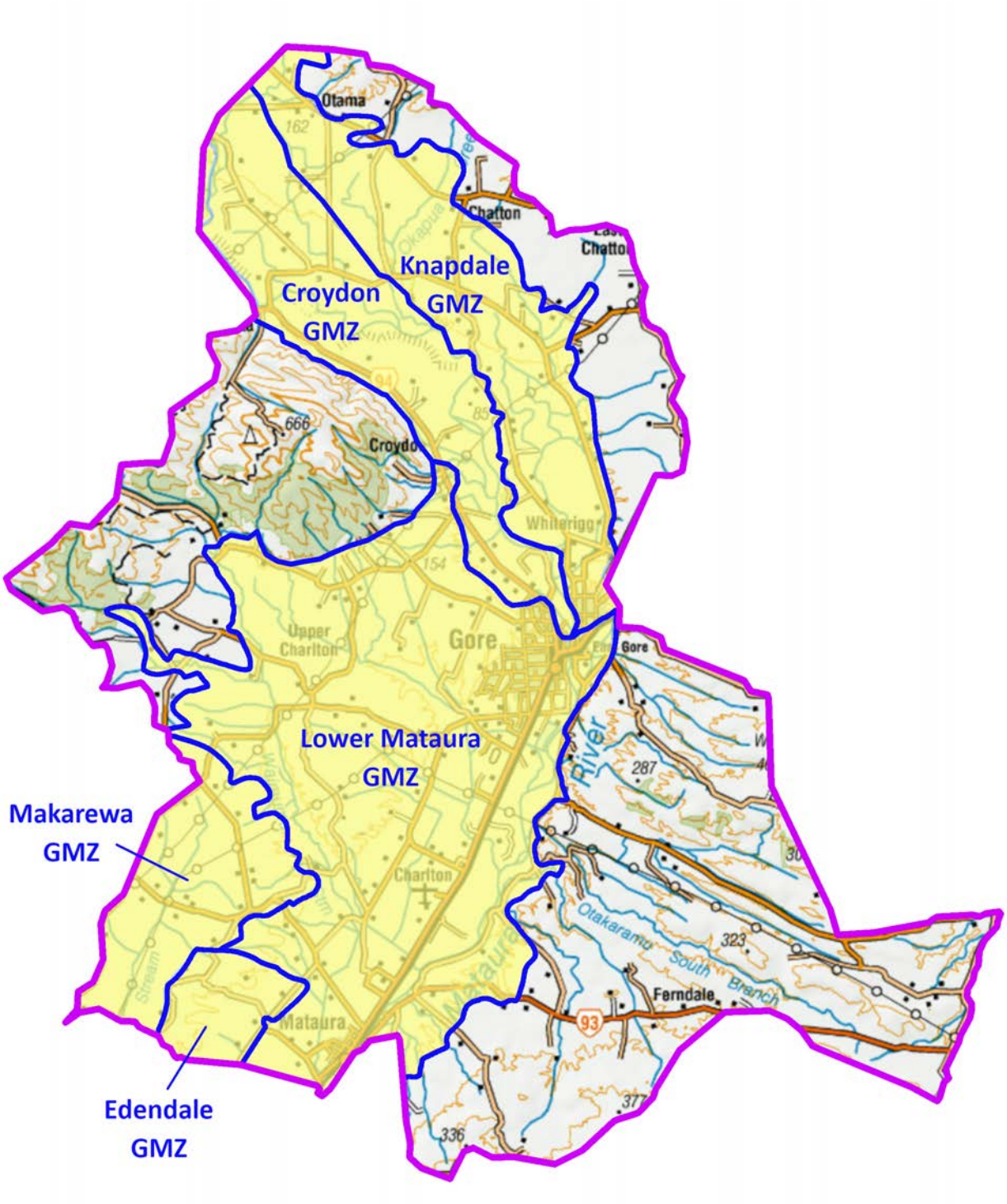
Soils are prone to waterlogging and have some denitrification* ability, which reduces build-up of soil nitrogen. However, an extensive network of artificial drainage rapidly transports nitrogen, phosphorus, sediment and faecal microbes to surface water, particularly during heavy rain.

*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'.

Map Source: Environment Southland *maps.es.govt.nz/index.aspx?app=water-and-land*

GMZ – Gore

Lower lying areas of the Gore catchment area overlie all or parts of five GMZs (see map below). These zones differ in their geology and contaminant levels.

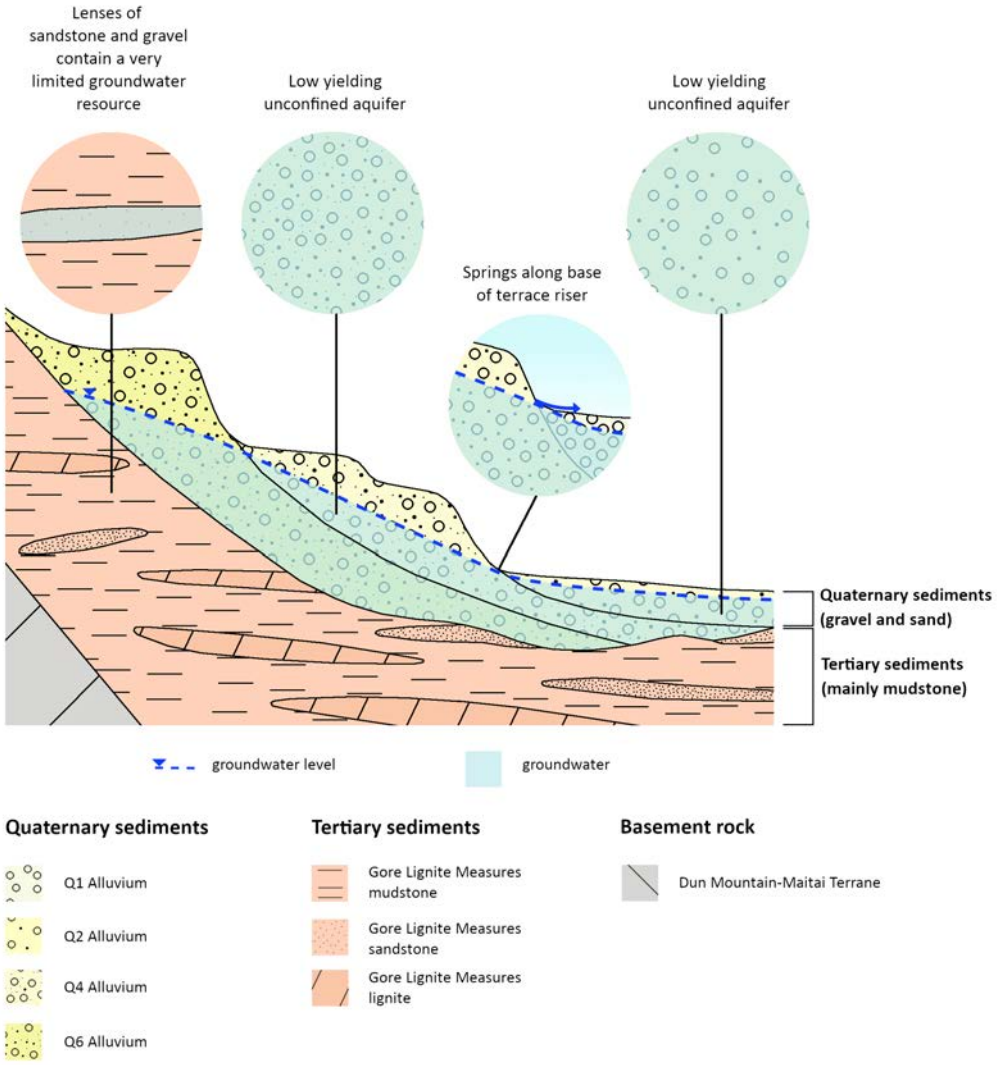


Map Source: Environment Southland *maps.es.govt.nz/index.aspx?app=water-and-land*

Knapdale GMZ

The Knapdale GMZ covers an area of approximately 4,900 ha on the east side of the Mataura River. The zone extends along the northern margin of the Mataura Valley, between Pyramid and East Gore:

- Depth to groundwater typically ranges from 2 to 10 metres below the ground surface, increasing in depth under higher alluvial terraces.
- Groundwater levels are generally highest in winter and lowest in early autumn, with seasonal variations of 1 to 1.5 metres.
- See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/knapdale).***
- Groundwater recharge in this zone is derived from local rainfall that soaks through the soil. Most surface waterways in this zone are 'perched' above the water-table, meaning they are not connected to the underlying groundwater. There is a high risk of groundwater contamination from leaching in this zone.
- Most groundwater discharge occurs as flow to the neighbouring Croydon GMZ. Some discharge also occurs as baseflow to low elevation streams such as Okapua Creek and Gold Creek.



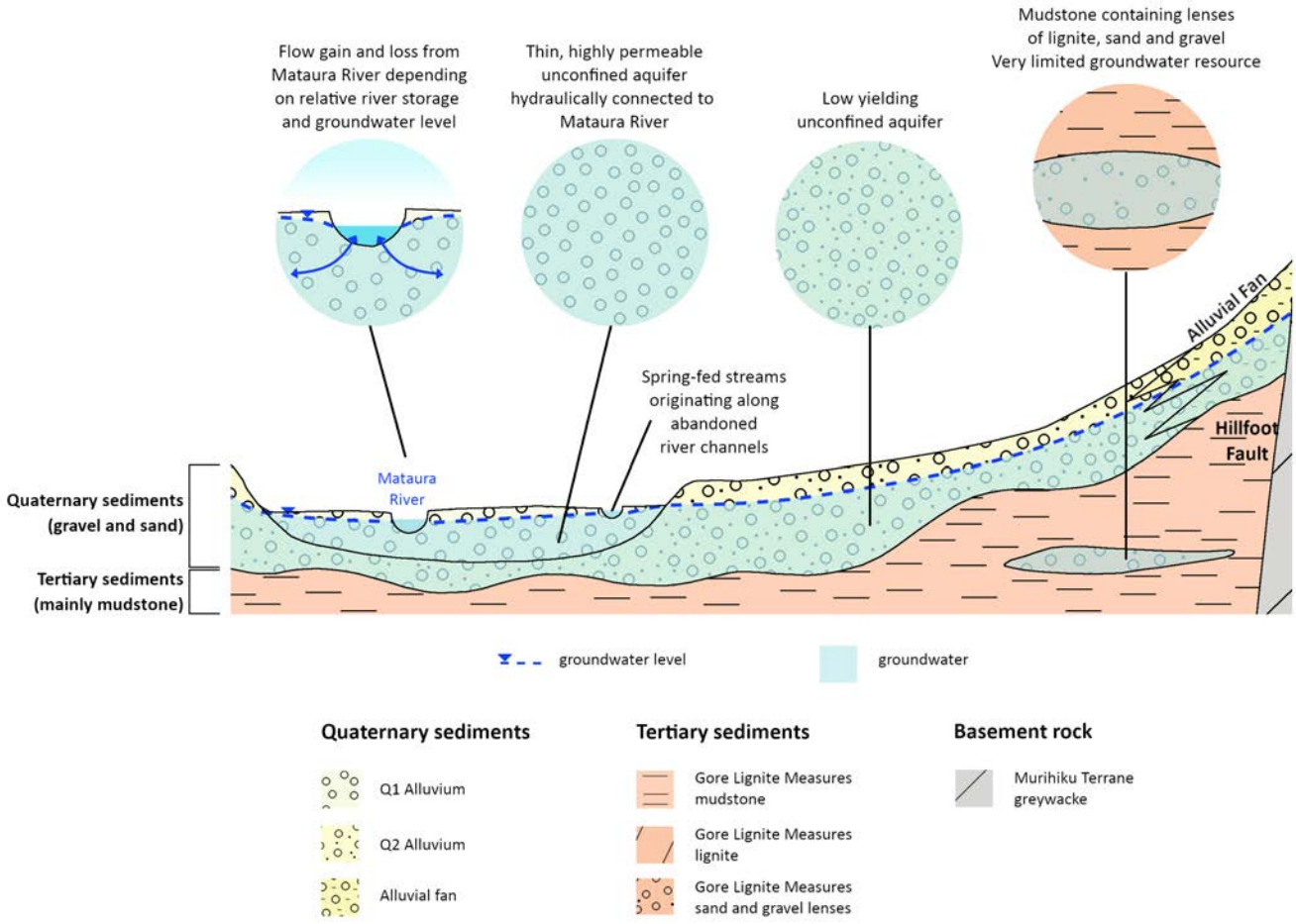
Groundwater quality Knapdale GMZ

- Nitrate = moderate to very high
- Phosphorus = low
- *E. coli* = low, but risk can be elevated close to source.

Croydon GMZ

The Croydon GMZ covers an area of approximately 4,600 ha. It encompasses the low-lying terraces that follow the Mataura River between Gore and Pyramid:

- Depth to groundwater is generally less than 3 metres, increasing under higher areas along the base of the Hokonui Hills.
- Seasonal groundwater level variation is typically less than 1 metre, reflecting the high level of connectivity to the Mataura River.
- See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/croydon***).
- Groundwater recharge in this zone is derived from local rainfall and runoff from the Hokonui Hills that soaks through the soil. Groundwater recharge also comes from the Knapdale GMZ to the north, and from the Mataura River during times of high flow.
- Discharge mostly occurs to the Mataura River. Therefore, groundwater quality affects the Mataura River in this zone.



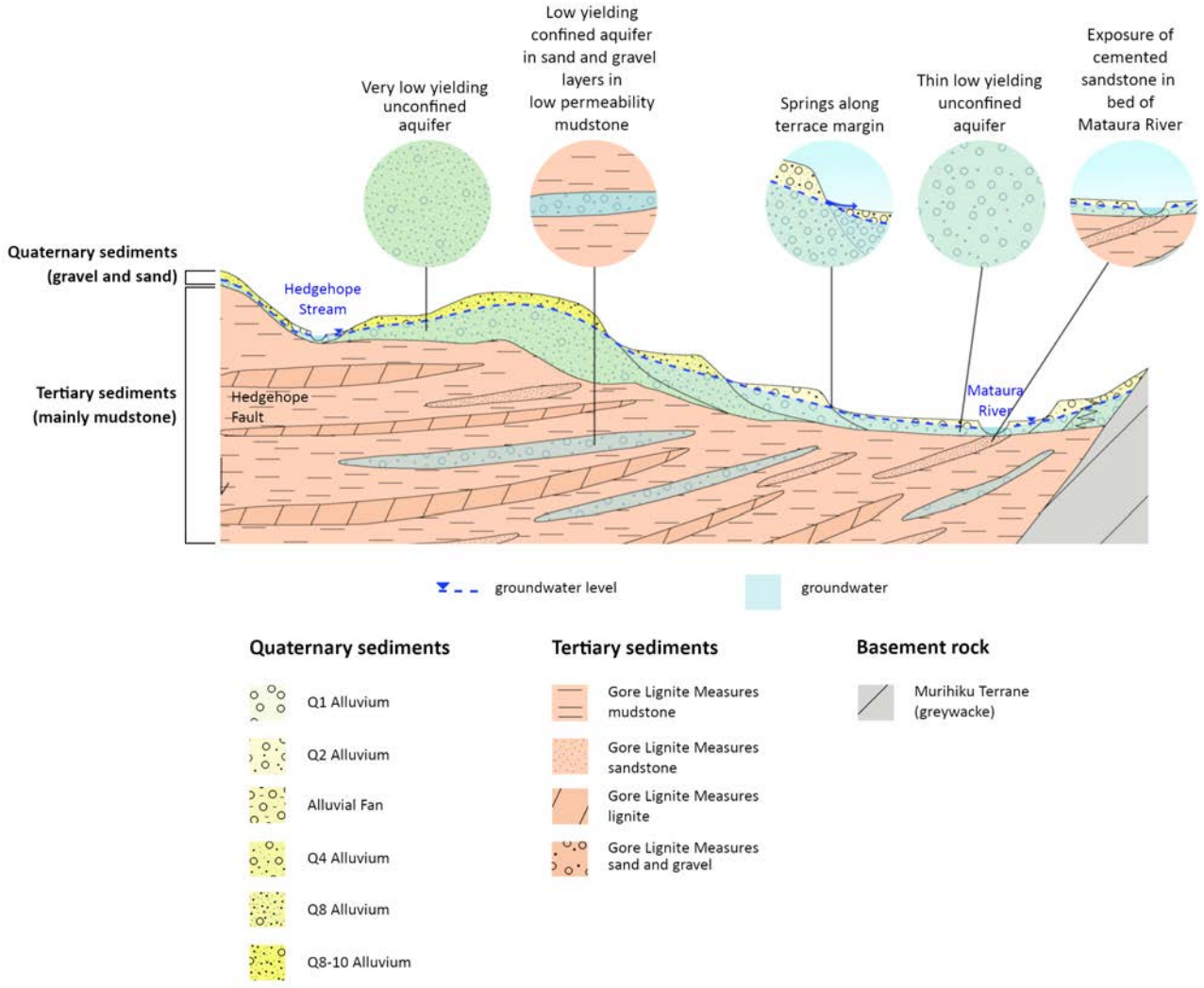
Groundwater quality Croydon GMZ

- Nitrate = moderate to high
- Phosphorus = low
- *E. coli* = low, but risk can be elevated close to source.

Lower Mataura GMZ

The Lower Mataura GMZ covers an area of approximately 35,000 ha in the lower reaches of the Mataura River catchment, downstream from Gore. Soils in this zone are predominantly deep, fine-grained and poorly drained. This increases the potential for runoff in sloping areas, and the use of artificial drainage on flatter-lying areas:

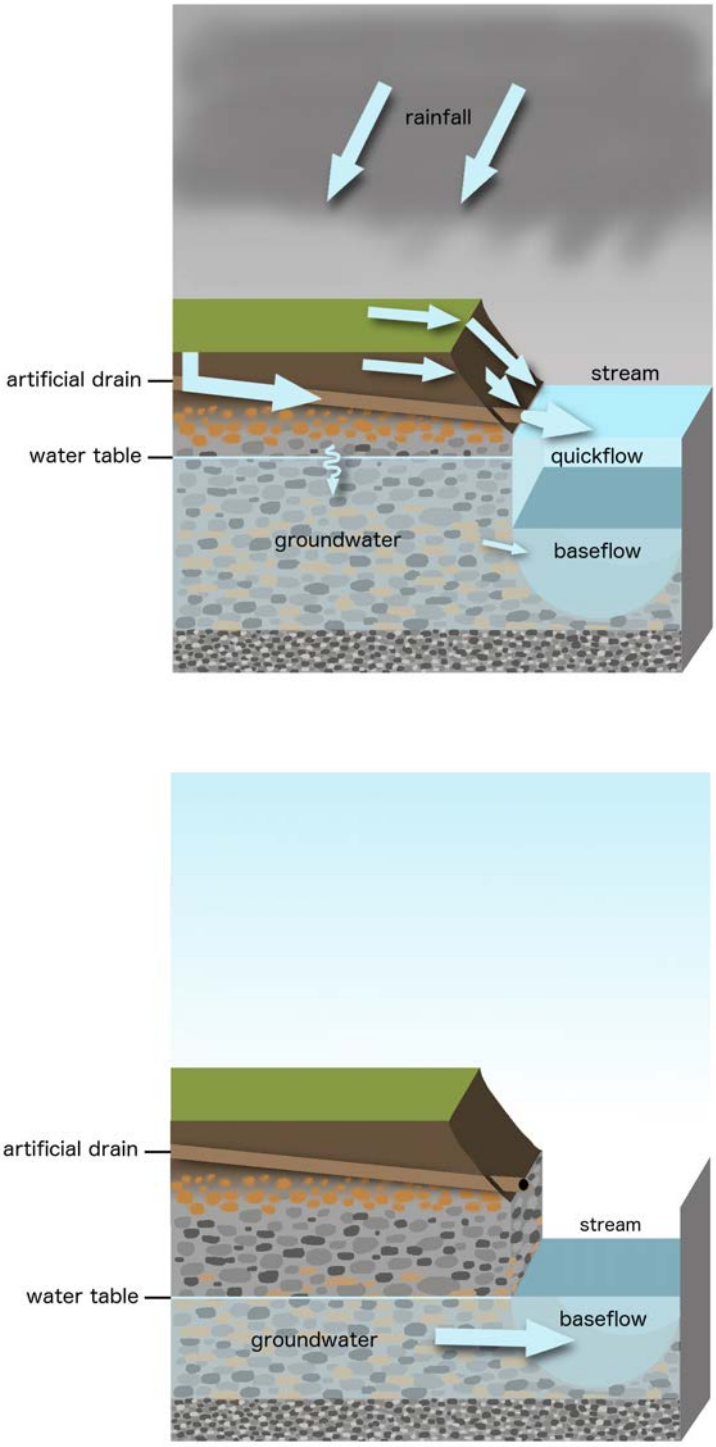
- Depth to groundwater generally ranges from 2 to 3 metres below ground level. On the higher terraces groundwater depth increases to between 5 and 10 metres below ground level.
- Groundwater level varies seasonally, usually fluctuating by 1-2 metres, depending on rainfall.
- See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/lower-mataura***).
- Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, that soaks through the soil. Therefore, there is a high risk of groundwater contamination from leaching.
- Groundwater discharge occurs to the Mataura River downstream of Mataura township. Groundwater discharge also provides baseflow to the lower reaches of many of the large tributary streams (e.g. Charlton Stream, Titipua Stream).



Groundwater quality Lower Mataura GMZ

- Nitrate = variable, reflecting the mixed oxidizing and reducing aquifer conditions
- Phosphorus = low but can be elevated where reducing conditions exist in shallow groundwater
- *E. coli* = low, but risk can be elevated close to source.

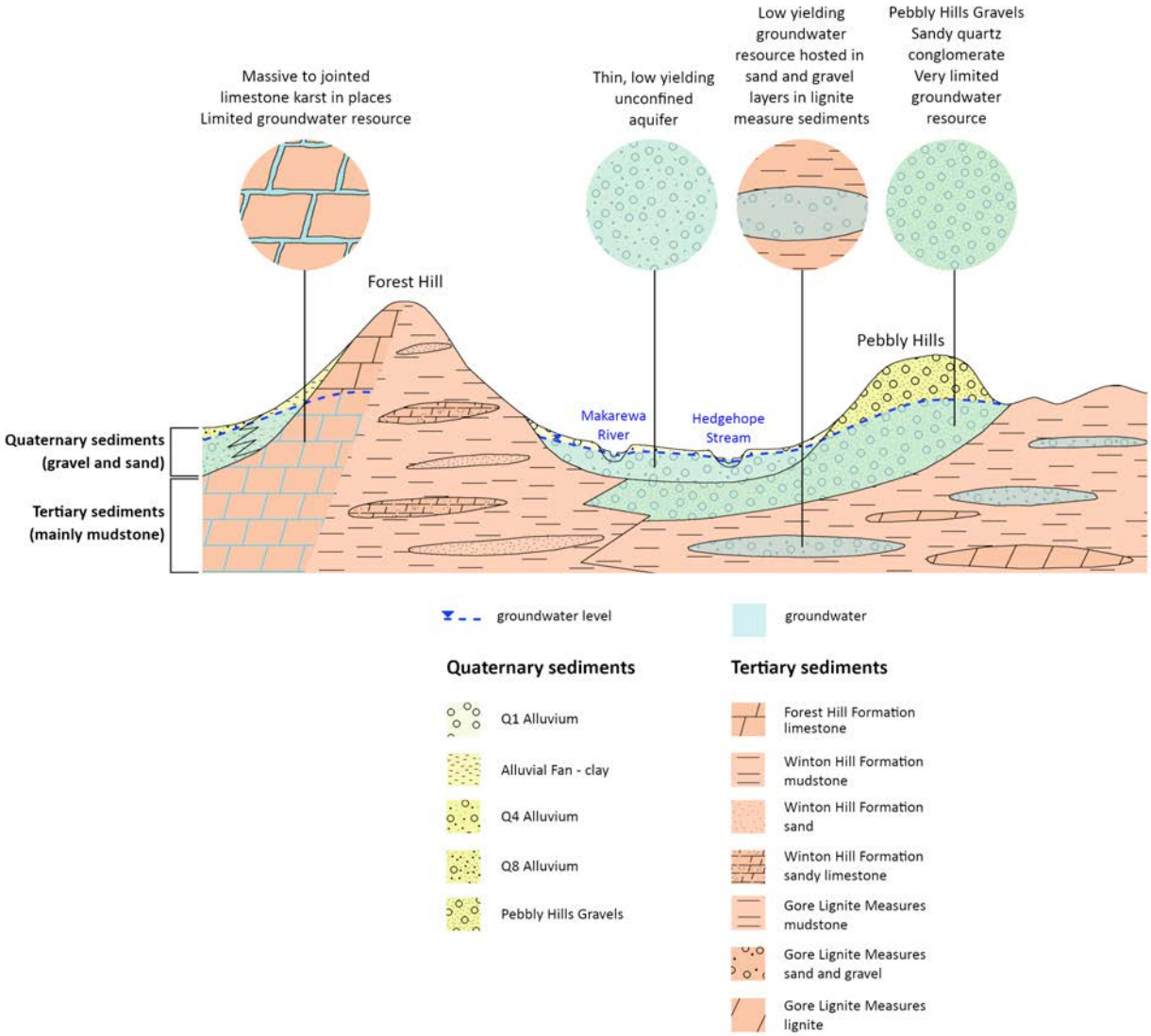
The connection between groundwater and the baseflow of streams and rivers is illustrated below (source: Environment Southland).



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 1-2 metres.
- See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (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.



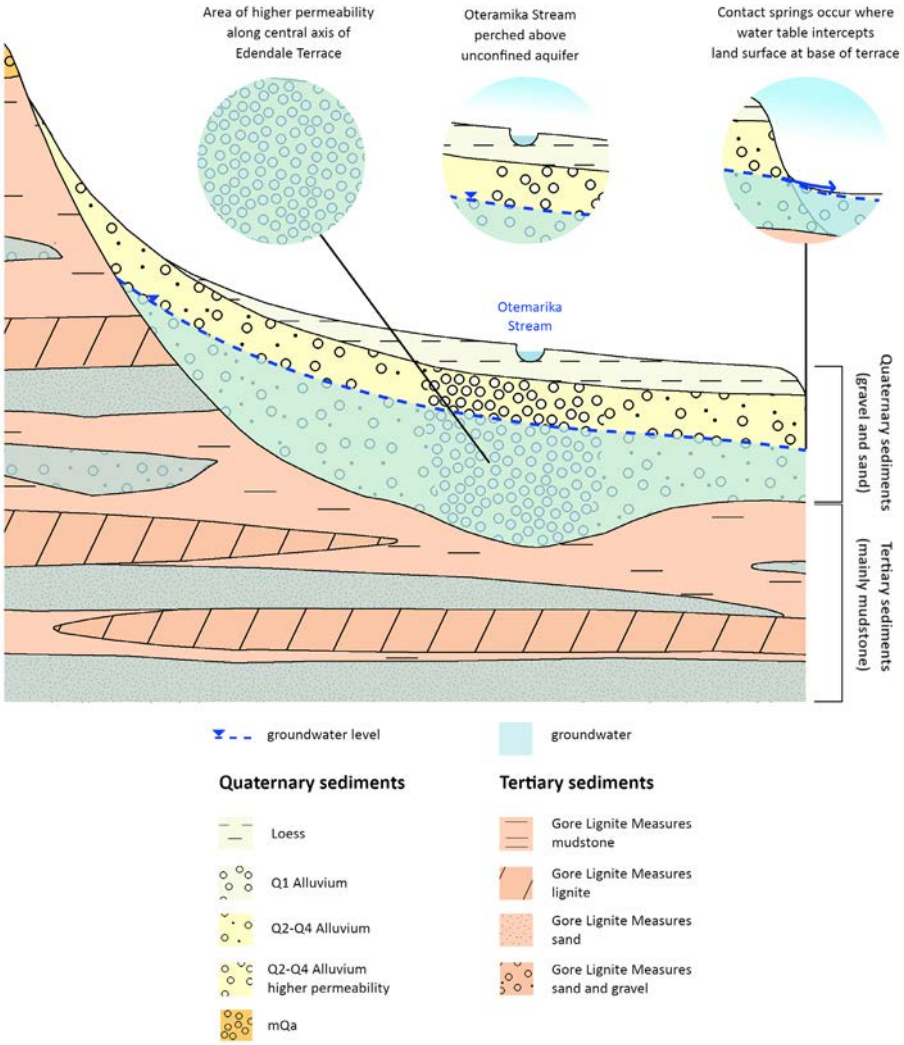
Groundwater quality Makarewa GMZ

- Nitrate = generally low, but can be elevated due to intensive land use where groundwater is more oxic (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.

Edendale GMZ

The Edendale GMZ covers the entire Edendale Terrace:

- Depth to groundwater ranges from over 10 metres below ground level north of Edendale, to around 5 metres at Seaward Downs.
- Streams such as Ota Creek and Oteramika Stream sit above the water table and are not connected to the aquifer below.
- Groundwater recharge in this zone is derived from local rainfall and runoff from surrounding hills, that soaks through the soil. Therefore, there is a high risk of groundwater contamination from leaching.
- Most discharge occurs to spring-fed streams such as Clear Creek and Ives Creek, that originate along the base of the terrace in the Seaward Downs area. Surface waterways such as Ota Creek and Oteramika Stream, also gain baseflow along the base of the Edendale Terrace.
- See below for a diagrammatic cross-section of this GMZ showing areas of groundwater (source ***es.govt.nz/environment/water/groundwater/groundwater-management-zones/edendale***).



Groundwater quality Edendale GMZ

- Nitrate = moderate to very high (from leaching)
- *Phosphorus = low*
- *E. coli* = low, but risk can be elevated close to source.

Notes

Notes

Notes

Find out more

Find out more about physiographic zones
bit.ly/2Ol7z7F

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

THRIVING SOUTHLAND

Tōnui ana te whenua. Tōnui ana te takata.
A thriving, prosperous land. A thriving, prosperous people.