WASTEWATER PLANNING DRIVEN BY ENVIRONMENTAL EFFECTS

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ABSTRACT (500 WORDS MAXIMUM)

Southland District Council (SDC) operate twenty wastewater schemes throughout the District, each servicing between 30 and 2,500 people (totalling about 12,000 people). This large number of schemes spread over a large geographic area combined with a relatively low rating base poses challenges, particularly as existing resource consents expire and new legislation, such as the National Policy Statement for Freshwater Management (NPS-FM), requires improved freshwater quality.

To proactively address this, SDC embarked on a journey of developing a Wastewater Strategy (the Strategy) that would prioritise scheme upgrades on a District-wide perspective based on the overall adverse environmental effects in the wider catchment. In parallel, SDC, as part of the Southland Economic Project, worked with the other Southland territorial authorities to develop high-level upgrade scenarios for 'representative' wastewater schemes to meet a range of potential freshwater quality outcomes of the NPS-FM and Environment Southland's response (ie limit setting process for freshwater catchments).

This paper outlines the two-staged approach SDC is using to develop the Strategy and outlines how the outputs from the Southland Economic Project underpin the approach to develop and cost wastewater treatment and disposal options for the District.

Stage 1 is now complete and pulls together information from a wide variety of sources. Uniquely it uses a ranking in the form of a traffic light system to identify potential issues for each scheme and summarises the results for all schemes on a single table. The categories considered include population change, feasibility of land disposal, existing consent compliance and ability to meet current and potential future receiving water quality standards. The categories and the ranking basis for each category are outlined in this paper.

This paper outlines the overall rankings for the twenty wastewater schemes resulting from the assessment in Stage 1. Six schemes are ranked 'red', ten are ranked 'orange', two are 'green' and two are 'white' (private treatment plant or newly constructed). This overall scheme ranking provides a scientific basis to inform decisions on which wastewater schemes to prioritise for upgrades to enable SDC to realise the greatest environmental benefit for a given expenditure. The paper then outlines the approach to be used in Stage 2 to develop wastewater treatment and disposal options for each overall ranking.

Stage 2 of the Strategy is in progress, however SDC is using outputs from Stage 1 and the Southland Economic Project to inform strategic planning, including the 30 year Infrastructure Strategy and the Long Term Plan. This paper describes how the outputs have been used as well as next steps.

KEYWORDS

Wastewater Treatment, Strategic Planning, NPS-FM, Consenting, Science, Environmental Effects, Infrastructure Planning, Asset Management Planning

PRESENTER PROFILE

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Ian Evans is the Strategic Manager Water and Waste at Southland District Council. He has 25 years experience within the water sector in New Zealand and the UK, where he held various roles within operations as well as asset and project management, including several multi-million dollar upgrades, primarily across wastewater.

1 INTRODUCTION

1.1 BACKGROUND

Southland District Council (SDC) operate twenty wastewater schemes throughout the District, each servicing between 30 and 2,500 people (totalling about 12,000 people). This large number of schemes spread over a large geographic area combined with a relatively low rating base poses challenges, particularly as existing resource consents expire and new legislation, such as the National Policy Statement for Freshwater Management (NPS-FM), requires improved freshwater quality.

The future requirements for each scheme were considered on an individual basis, generally as resource consents expire. This was leading to concerns such as:

- Uncertainty on the conditions of new resource consents and any upgrades that may be required to meet these conditions
- Lack of prioritisation of scheme upgrades on a holistic, District-wide perspective to minimise the overall adverse environmental effects in the wider catchments whilst being affordable
- Difficulty in planning future capital and operational expenditure, including timing and extent of future scheme upgrades.

To proactively address this, SDC decided to embark on a journey of developing a Wastewater Strategy (the Strategy) that would prioritise scheme upgrades on a District-wide perspective based on the overall adverse environmental effects in the wider catchment. It was intended that the Strategy would also underpin the resource consent applications for the discharges from the schemes and inform strategic planning documents required under the Local Government Act.

1.2 METHODOLOGY AND SCOPE

A two-staged approach was adopted by SDC to develop the Strategy as outlined below.

Stage 1, or the Information Summary, involved reviewing existing information available about the twenty schemes, outlining the regulatory framework and scheme compliance with existing and potential future waste quality standards, identifying potential issues for

wastewater management, and establishing an approach for developing the Wastewater Strategy, including a ranking system to prioritise schemes. Stage 1 is now complete.

Stage 2, or the Wastewater Strategy, will involve developing high level options, costs and implementation timeframes for each scheme based on the scheme rankings from Stage 1. This will be used to outline a long-term, high-level, District-wide Wastewater Strategy that provides a direction for wastewater management for the next 30 years.

This paper summarises the methodology and findings of Stage 1, describes how the outputs of Stage 1 have been used to date, and outlines the approach to be used in Stage 2.

2 SUMMARY OF WASTEWATER SCHEMES

2.1 NATURE OF SCHEMES

2.1.1 LOCATION AND OWNERSHIP

The location of the twenty wastewater schemes in the Southland District covered by the Wastewater Strategy are shown in Figure 1.

Figure 1: Southland District Wastewater Schemes

The wastewater treatment plant (WWTP) sites are typically designated, with the majority on land owned by SDC. The exceptions are Wallacetown, which discharges to and is treated at Alliance's Lorneville WWTP, and Curio Bay WWTP, which currently only services the camping ground. The majority of the WWTPs are located within rural areas, surrounded by pastoral land uses, providing possible scope to expand the WWTPs to allow for upgrades.

2.1.2 POPULATION

Census population data and projections were used to provide a perspective on current and predicted future (2043) scheme demand and hence potential issues with scheme

capacity. The catchments for each wastewater scheme are predominantly domestic, and so an increase in population will be related to an increase in flow (and load) to the wastewater treatment plant. The majority of existing plants will be able to accommodate some increase in population, but most may require upgrades to accommodate significant population increases. The population increase from 2001 to 2013 provides a perspective on current scheme demand, whilst the population increase from 2001 to 2043 provides a perspective on future demand. Some schemes are also expected to be significantly impacted by tourist populations.

Ranking: The current and predicted future demand for each scheme was ranked using a traffic light system, with green indicating no issue (static or declining population, predominantly domestic), orange indicating possible issue (some population growth, predominantly domestic) and red indicating likely issue (significant population growth or industrial/commercial contribution).

Results: No schemes were ranked red based on current demand, however four were ranked red based on predicted future demand.

2.1.3 TREATMENT PROCESS AND DISCHARGE ROUTE

For each wastewater scheme, the current treatment process and the discharge route (ie to water or land) was reviewed. The larger schemes are largely oxidation pond-based treatment processes, whilst the smaller schemes utilise a range of treatment technologies (septic tanks and trickling filters to activated sludge and membrane bioreactor). Currently about half the schemes generally discharge to land. The remainder discharge to fresh water, except one that discharges to the Coastal Marine Area.

2.2 CONSENTING POSITION

2.2.1 CURRENT DISCHARGE CONSENTS

The treated wastewater discharge consents held by each wastewater scheme were reviewed to understand the current consent conditions and consent expiry date. The existing discharge consents had expired or were due to expire soon for several schemes and so the current status of any replacement consents being sought was also considered.

2.2.2 CURRENT CONSENT COMPLIANCE

The consent compliance information available from Environment Southland for each scheme was reviewed for the past three years. Treated wastewater and receiving water quality data available for each scheme were also reviewed and compared with applicable consent limits.

Ranking: The current consent compliance of each scheme was ranked using a traffic light system, with green being good to excellent (fully compliant, minor to no exceedances with no environmental impact), orange being moderate to technical issues (minor exceedances over period of time or moderate exceedances with minor impact on the environment), and red being significant non-compliance (exceedances with measurable impact on the environment). This ranking system is consistent with that used by Environment Southland in their annual environmental compliance monitoring reports

Results: No schemes were ranked red. Twelve schemes were ranked orange, half of which were due to high flow breaches largely related to wet weather and half due to other breaches (two of which are either going through the consenting process or have recently been renewed with modified conditions).

2.3 DESCRIPTION OF THE ENVIRONMENT

2.3.1 CURRENT DISCHARGE METHOD AND ROUTE

The current consented discharge method (ie to land or to water) and discharge pathway (ie from groundwater or surface water to sea) were identified for each scheme to understand potential contaminant flow pathways.

2.3.2 POTENTIAL DISCHARGES TO LAND

Environment Southland has identified nine physiographic zones for Southland. Physiographic zones provide a perspective on how contaminants more through the landscape. Each zone has common attributes that influence water quality, such as climate, topography, geology and soil type. Zones differ in the way sediment, microbes, and nutrients (such as nitrogen and phosphorus) build up and move through the soil, through areas of groundwater, and into rivers and streams.

Each physiographic zone has different potential implications for future land application of treated wastewater within that zone. Limitations range from poor infiltration (eg due to impermeable soils or high ground water table) and overland flow of contaminants to limited removal of contaminants and nitrogen accumulation in groundwater.

The main physiographic zone(s) in the vicinity of the existing WWTPs were identified to provide a perspective on ease of land application for a scheme. For many schemes the physiographic zone map is complex, with considerable variability in the size and type of physiographic zones near the WWTP. Only physiographic zones of a sufficient size for future land application were assessed as part of the ranking.

Ranking: The potential ease of land application of treated wastewater for each scheme was ranked using a traffic light system, with green being suitable (unlikely to be an issue if sufficient land area of suitable soil type available), orange being potential issue (inadequate infiltration and/or contaminants), and red being likely issue (inadequate infiltration and/or high groundwater). Ranking was done on the basis of a continuous discharge of treated wastewater to land. For schemes located near more than one physiographic zone, it was assumed any future land application system would be located within the zone most favourable for land application.

Results: For all schemes covered by this Strategy, there are potential issues or likely issues with inadequate infiltration and/or contaminants discharging into the underlying aquifer or to the nearby stream via overland flow for a continuous discharge of treated wastewater to land. It does not mean that land application is not possible for a given scheme. However, it does indicate that a scheme specific site and soils investigations would be required to confirm on a scheme-by-scheme basis if land application is a technically feasible, long-term solution for a given scheme, what type(s) of land application is suitable (eg rapid infiltration, spray irrigation, drip irrigation), and what level of wastewater treatment is required to minimise adverse environmental effects.

2.3.3 SURROUNDING LAND USE

To understand the current and future impact of the treated wastewater discharges (both to land and to water), it is important to better understand the wider environmental setting within which the existing wastewater schemes are sited in.

Published GIS information that was reviewed on a scheme-by-scheme basis included land use data from LINZ, current consents granted by Environment Southland from Beacon (See Figure 2) and water quality data from Environment Southland's State of Environment monitoring sites from Beacon (See Figure 3).

In general, the reviewed information indicated:

- there is significant pastoral land use near most wastewater schemes
- there are a large number of resource consents granted near most wastewater schemes, particularly in Aparima, Mataura and Oreti Freshwater Management Units
- the number of resource consents progressively increases from the top of the catchment to the bottom of the catchment as well as increases closer to rivers
- the water quality at the monitoring sites progressively decreases from the top of the catchment to the bottom of the catchment
- there are often a large number of resource consents between monitoring sites, which suggest multiple activities are contributing to a decline in river water quality (eg in the vicinity of the urban area of Winton).

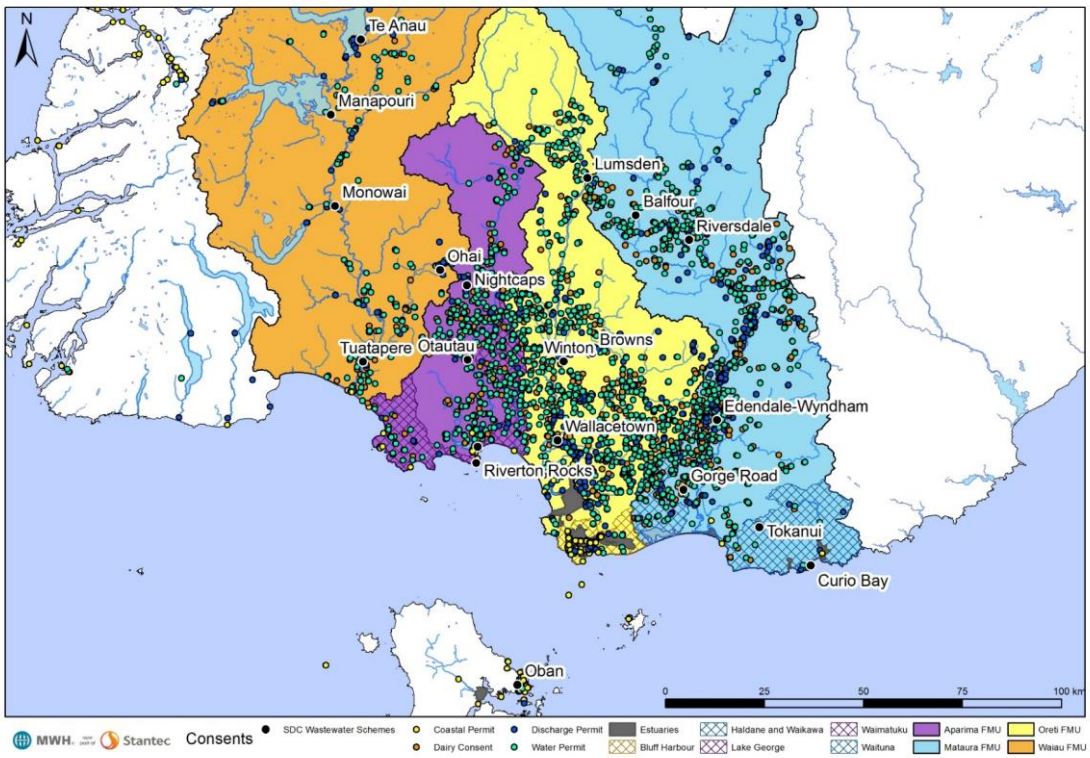

Figure 2: Current Resource Consents Granted by Environment Southland

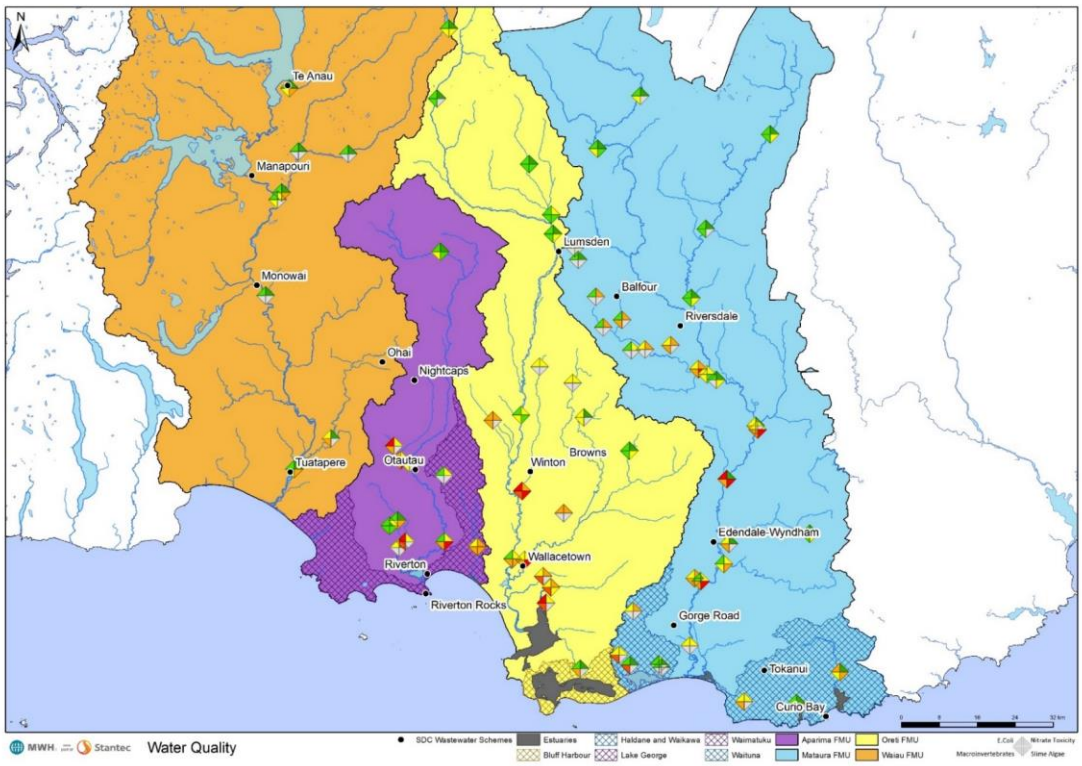

Figure 3: Water Quality at Environment Southland Monitoring Sites. Top left: E.Coli, top right: nitrate, bottom left: macroinvertebrates, bottom right: algae

3 STATUTORY FRAMEWORK

3.1.1 EXISTING RECEIVING WATER QUALITY STANDARDS

Receiving water quality monitoring data available from SDC for each scheme was reviewed and compared with the relevant water quality standards under the current planning framework for considering treated wastewater discharges. For discharges to water, or to land in a manner that may enter water, the water quality standards in the Regional Water Plan for Southland and the proposed Southland Water and Land Plan apply. The water quality standards are the same in both plans and are specified for each water body class. It is noted that the water quality standards may be more stringent than the current consent limits for a given scheme.

Ranking: The compliance of each scheme with the existing receiving water quality standards (WQS) was ranked using a traffic light system, with green being complies with WQS for all parameters, orange being exceeds one or more WQS but similar concentrations upstream and downstream of the treated wastewater discharge, and red being exceeds one or more WQS and increase in concentrations downstream of the discharge. For schemes ranked orange, it means other upstream activities are adversely impacting the receiving water quality, and the wastewater discharge does not worsen the water quality. Ammonia and microbiological parameters were considered separately to other water quality parameters.

Results: The majority of schemes either comply with the existing receiving water quality standards or, if they do not comply, then do not result in significant further degradation of the receiving water quality (ie upstream and downstream quality is similar or considered minor noncompliance). However, there were three schemes where ammonia and faecal coliforms are elevated downstream and are above the receiving water quality standard. Of these, one has an upgrade proposed and one is going through the consenting process which should address at least some of the issues identified.

3.1.2 POTENTIAL FUTURE RECEIVING WATER QUALITY STANDARDS

As part of the Water and Land 2020 and Beyond project, Environment Southland have split up the Southland Region into catchments or Freshwater Management Units (FMUs). Southland District is distinct from the other territorial authorities in Southland in that it spans five FMUs.

Environment Southland will go through a limit setting process for each catchment (or FMU), which is due to be completed for Southland catchments by 2021. There is the potential for this process to result in varying receiving water quality standards across the five FMUs that Southland District spans and so the schemes have been grouped by FMU in this Strategy. In the interim, current national guidelines have been used to provide a perspective on potential future receiving water quality standards relevant to treated wastewater discharges that could apply in the future, either as a result of Environment Southland's limit setting process for each FMU or future policy changes.

Receiving water quality monitoring data available from SDC for each scheme was reviewed and compared with potential future water quality standards.

Ranking: The compliance of each scheme with the potential future water quality standards was ranked using a traffic light system, with green being complies with potential guideline values (GV) for nutrients and microbiological contaminants, orange being exceeds one or more potential GV but similar concentrations upstream and downstream of the treated wastewater discharge, and red being exceeds one or more potential GV and increase in concentrations downstream of the discharge.

Results: The majority of schemes would not comply with the potential future receiving water quality standards but do not result in significant further degradation of the receiving water quality (ie upstream and downstream quality is similar). The exceptions to this are six schemes where nutrients and/or micro-organisms are elevated downstream and are above the receiving water quality standard. Proposed upgrades at three of these six schemes should address at least some of the issues identified.

4 IDENTIFIED ISSUES AND LOOKING FORWARD

4.1.1 SUMMARY OF SCHEME ASSESSMENT (STAGE 1)

The scheme assessment carried out in Stage 1 pulls together information from a wide variety of sources. A ranking in the form of a traffic light system was used to identify potential issues for each scheme as well as to provide an overall scheme ranking. Such a system enabled the results for all twenty schemes to be readily summarised on a single A4 page. The categories considered include population change (as a surrogate for scheme capacity), feasibility of land disposal, existing consent compliance and ability to meet current and potential future receiving water quality standards. The basis for the category ranking, overall scheme ranking, and results are outlined below.

Category Ranking: The extent to which each scheme had a potential issue under a given category was ranked using a traffic light system. In all cases, green indicated there was no issue or was unlikely to be an issue, orange indicated there was a potential issue or needed reviewing, and red indicated there was likely to be an issue or needed addressing. Having a common ranking system across all categories was an important element of the assessment.

Overall Scheme Ranking: The overall ranking of each scheme was based on whether or not the scheme was likely to require an upgrade to meet current and potential future

receiving water quality standards. A traffic light system was used again, with green indicating a scheme was unlikely to require an upgrade, orange indicating a scheme may require an upgrade, and red indicating a scheme was likely to require an upgrade.

A summary of the scheme assessment is presented in Table 1. The table shows the individual ranking for all seven categories, with annotations to indicate the reason for a red or orange ranking, as well as the overall ranking for all twenty schemes. White indicates where there was insufficient information to rank a category or scheme. Schemes have been grouped by FMU to align with Environment Southland's limit setting process, primarily as there is the potential for the process to result in varying receiving water quality standards across the five FMUs that Southland District spans.

Table 1: Summary of Scheme Assessment

FMU	Discharge Route	Ease of Land Disposal	Popn 2013	Popn 2043	Consent Compliance 2015/16	Existing WQS - Other	Existing WQS – micro/NH_3	Future WQS - micro/N/P	Overall Ranking
Fiordland and Islands	Land	• poor infiltration • overland flow		↑ 24%	DIN, E.coli			DRP, TIN (recent) No upstream data	
Aparima	Water	• poor infiltration • ltd contam. removal • overland flow			Flow	QMCI	Micro	DRP, TN, E.coli	
Aparima	Land	• aquifers linked to rivers		↑ 11%	discharge to aquifer			DRP, TIN, E.coli	
Aparima	Land	• nitrogen in gdwater		↑ 11%	Flow			Missing DRP, TIN, TN & upstream data	(TBC)
Aparima (coastal)	Land	• nitrogen in gdwater		↑ 11%		DO		Missing DRP	
Mataura	Water	• nitrogen in gdwater		↑ 27%	TSS		micro	DRP, TIN, TN, E.coli	
Mataura	TBC	• poor infiltration • overland flow			recently constructed	recently constructed	recently constructed	recently constructed	recently constructed
Mataura	Water	• nitrogen in gdwater					micro	DRP, TIN, E.coli	
Mataura	Water	• poor infiltration • ltd contam. removal • overland flow	↑ 19%, pretreated	↑ 72%, pretreated		pH, DO	micro	DRP, TIN, E.coli	
Mataura	Land/Water	• nitrogen in gdwater	↑ 11%	↑ 52%	flow, DO, ammonia	DO	NH_3, micro	DRP, E.coli Missing TN, TIN	
Mataura	Land/Water	• poor infiltration • overland flow			Flow		micro	DRP, TIN, E.coli	
Oreti	Land/Water	• poor infiltration • ltd contam. removal • overland flow		↑ 28%	Flow		micro	FC No TIN, TN, DRP, E.coli	
Oreti	Land	• aquifers linked to rivers • nitrogen in gdwater			Flow				(TBC)
Oreti	Water	• poor infiltration • ltd contam. removal • overland flow	↑ 8%, ind	↑ 31%, ind	Ammonia	DO, MCI & SQMCI	NH_3, micro	TIN, TN, DRP, E.coli, FC	
Oreti	Water	• nitrogen in gdwater	↑ 8%	↑ 38%, non SDC WWTP and consent	non SDC consent	non SDC consent	non SDC consent	non SDC consent	non SDC consent
Waiau	Land/Water	• nitrogen in gdwater		↑ 64%, ind/ com				DRP, TIN, TN	
Waiau	Land	• nitrogen in gdwater			faecal coliforms, $cBOD_5$				
Waiau	Water	• poor infiltration • overland flow				DO, temp	NH_3, micro	DRP, FC No TIN, TN, E.coli	
Waiau	Water	• nitrogen in gdwater • aquifers linked to rivers	↑ 15%, ind	↑ 73%, ind/com	Flow	DO		DRP	
Waiau	Water	• nitrogen in gdwater • aquifers linked to rivers				DO	micro	DRP, E.coli	

Six schemes are ranked 'red', indicating these existing schemes are likely to require an upgrade to meet current and potential future water quality standards. Currently the receiving water quality downstream of the treated wastewater discharge is worse than the quality upstream for parameters identified, indicating the treated wastewater discharge is resulting in a decrease in receiving water quality. For three schemes, proposed upgrades alongside reconsenting should address at least some issues identified.

Ten schemes are ranked 'orange', indicating these existing schemes may require an upgrade to meet potential future water quality standards. Currently other upstream activities are adversely impacting the receiving water quality, and the wastewater discharge does not appear to worsen the water quality significantly for the parameters identified (ie upstream and downstream water quality is similar). An aspect of Environment Southland's catchment limit-setting process is to better understand the load contributions from different activities and therefore understand where the community as a whole should focus its efforts to improve water quality (if this is required).

Of the remaining four schemes, two are ranked 'green', indicating these existing schemes are unlikely to require an upgrade to meet potential future water quality standards, and two are ranked 'white', indicating there is insufficient information to assess the scheme (one being a private treatment plant and the other a newly constructed plant).

The above overall scheme rankings provide a scientific basis to inform decisions on which wastewater schemes to prioritise for upgrades to enable SDC to realise the greatest environmental benefit for a given expenditure.

4.1.2 THE STRATEGY (STAGE 2)

Stage 2, or the Strategy, will involve developing high level options, costs and implementation timeframes for each scheme based on the scheme rankings from Stage 1 as outlined below.

For red schemes, high-level scheme-specific options and associated costs will be developed to meet receiving water quality standards, considering both wastewater treatment options and discharge to water and land. It is envisioned the upgrades will be implemented in the short to medium term, with individual red schemes prioritised by considering if the scheme meets existing standards, upgrade costs verses benefit (eg relative size of the scheme), and outcome of Environment Southland's limit setting process for each FMU when available.

For orange schemes, high-level options to meet receiving water quality standards will be developed and costed using the most appropriate case-study (town) from the Southland Economics Study. It is envisioned the upgrades will be in the medium to long term, with individual orange schemes prioritised in same manner as the red schemes.

For green schemes, it will be business as usual, with reconsenting carried out as existing consents expire.

The individual scheme options, costs and implementation timeframes will be used to outline a long-term, high-level, District-wide Wastewater Strategy that provides a direction for wastewater management for the next 30 years.

4.1.3 SOUTHLAND ECONOMIC PROJECT

In parallel to the Strategy, SDC, as part of the Southland Economic Project, has worked with the other Southland territorial authorities to develop high-level upgrade scenarios for eight 'representative' wastewater schemes to meet a range of potential freshwater quality outcomes of the NPS-FM and Environment Southland's response (ie limit setting process for freshwater catchments). The methodology and outputs from the Southland Economic Project will underpin the approach to develop and cost wastewater treatment and disposal options for the District (as described in approach for Stage 2).

4.1.4 BENEFITS OF THE STRATEGY PROJECT TO DATE

Stage 2 of the Strategy is in progress, however SDC is using the analysis and outputs from Stage 1 as well as the Southland Economic Project to inform strategic planning, including the 30 year Infrastructure Strategy and the Long Term Plan. It has also been used to inform reconsenting process for several schemes.