

Christchurch City Council

Draft

Wastewater Management Plan 2004

Part 2 - Asset Management Plan

Draft
January 2004

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Existing Collection System

1 Introduction

Christchurch Wastewater System

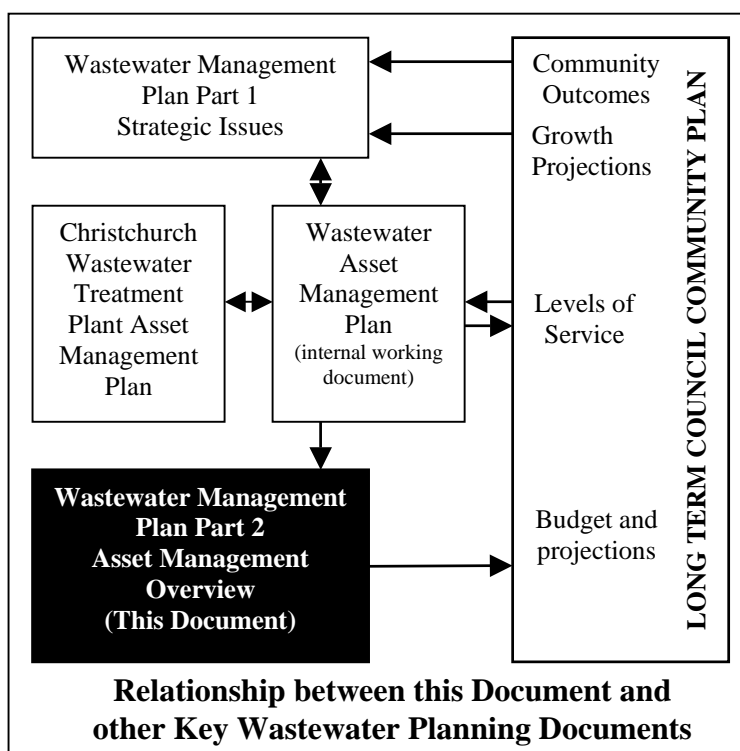
The Christchurch City Council collects wastewater from more than 120,000 customers via some 1,600 km of water pipelines and pumps through 84 pump stations to two wastewater treatment plants. The current replacement value of these assets is over \$700 million.

The cost to provide this service to the average Christchurch household (500 litres collected daily) is around 40 cents per day.

The Asset Management Plan

This document is a summary of the Wastewater Asset Management Plan 2004, which is a cornerstone document that guides the work of the City Water and Waste Unit. The strategic context for the Asset Management Plan is derived from the Wastewater Management Plan Part 1: Strategic Issues, which considers integrated management, the application of waste management principles and alternative methods of wastewater treatment and disposal.

The Asset Management Plan is reviewed regularly to provide assurance to Council, customers and other stakeholders that the assets are being managed efficiently and sustainably. The full Plan has recently been reviewed. It is detailed and comprehensive for use on a day to day basis by staff. It forms the basis for this overview document.



The Plan delivers a considered and planned approach to the long term management of wastewater assets. By optimising current and future expenditure to match the community's desired levels of service, the Plan enables the most efficient allocation of resources. This has the following two key benefits:

1. The right service is provided at the lowest long term cost.
2. The Plan provides a business planning tool to maximise efficiency.

The Asset Management Plan is intended to:

- Following consultation with consumers, define the levels of service that the Council is purchasing on behalf of the community
- Match wastewater volumes with an adequate reliable network
- Link operations and renewals strategies to risk management
- Identify growth issues, loading trends and loading reduction strategies
- Define the long term financial requirements
- Define a continuous improvement programme

In 2006, the Asset Management Plan will again be reviewed, and the community will be consulted on the appropriate levels of service for wastewater assets.

Purpose of this Summary Document

The purpose of this summary plan is to provide an overview, so that the Council can consider and adopt the 2004 review of the Asset Management Plan. It is also intended that it provide the basis for expenditure levels and a summary of asset information that is required for the Council’s Long Term Council Community Plan.

It has been written to provide a simple, easy to understand overview of wastewater assets, the levels of service delivered by those assets, and the medium to long term financial requirements.

An important objective is to provide sufficient information to enable Council and the community to fully understand the value of wastewater services. This document will therefore form an important basis for ongoing consultation and information sharing.



Mike Stockwell
City Water and Waste
Manager

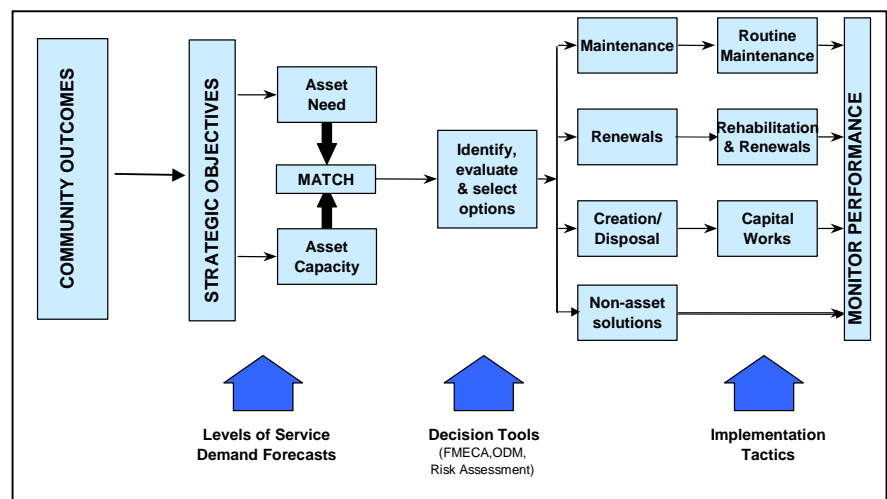
In Summary

This Plan

This Plan links the Strategic issues presented in Part 1 of the Plan to the implementation of works programmes.

It includes a summary of wastewater assets and highlights the key issues, such as growth, loading, asset age and condition trends.

It identifies the key levels of service being provided to business and residential customers, current and future financial costs, asset valuation, and the key performance measures by which the Council can assess the sustainability of the assets and wastewater services.



Wastewater Services

The collection and treatment of wastewater is an important part of the City infrastructure that enables key social, economic and environmental goals such as community health and well-being, to be achieved.

Development of the Christchurch wastewater system began in the 1880’s with the construction of a sewer system connected to sedimentation tanks at Bromley that infiltrated via field tile drains into the Avon Heathcote Estuary. The present Christchurch Wastewater Treatment Plant (hereafter CWTP) began operating in 1962 and is in the latter stages of an upgrade programme. An oxidation pond treatment system was installed to serve the Templeton township in the 1950’s and continued until it was decommissioned in 2001 when wastewater was pumped into the CWTP system. A similar system was installed to serve the township of Belfast in the 1970’s. This plant will also be decommissioned in the near future.

The Assets

The assets described in this Plan work together as a complete system to efficiently and reliably collect and treat wastewater from residential and business customers.

The collection system comprises seven principal catchments, each with sewer mains and laterals, manholes, flush tanks pump stations. The catchments served by the CWTP are shown in Appendix A. Each catchment drains to a terminal pump station that pumps to the treatment plant.



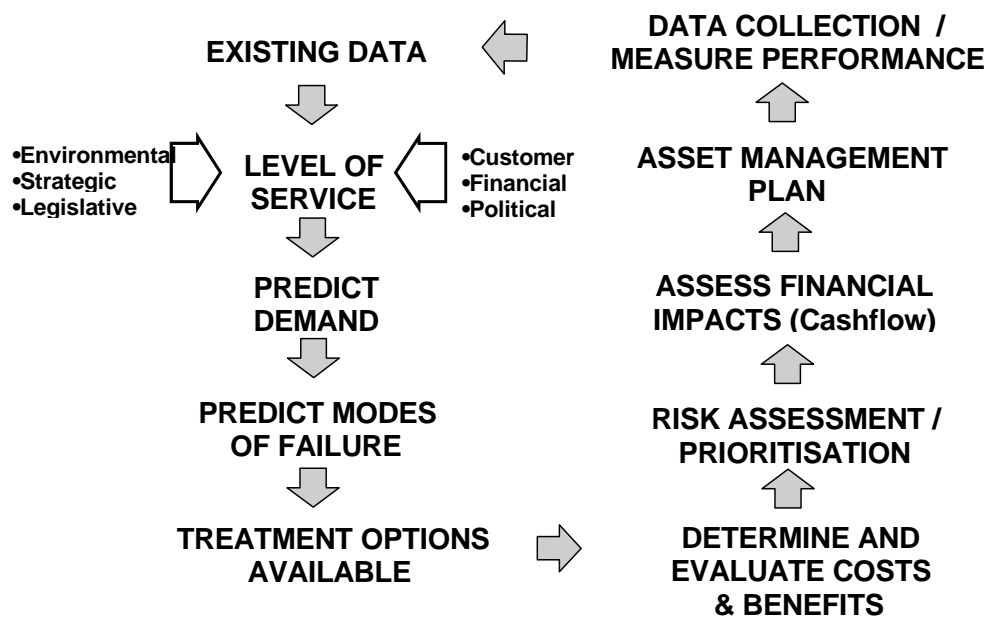
Our Overall Strategy

The asset management planning process begins with such things as data, customer needs, and strategic goals. Data provide information on the type, size, age and condition of assets.

The Council regards community consultation as extremely important, and this is a key feature of the Plan.

Together, these inputs define the levels of service which are the cornerstone of the Plan.

The planning process is a cycle, and incorporates a number of key tasks. The outcome is an Asset Management Plan with financial projections to at least 20 years in the future. Ongoing improvement and monitoring is an important step in completing this cycle.



2. Wastewater Business Issues

Objectives and Goals

The Council's desired outcomes, key strategic objectives relevant to the wastewater system are stated in Part 1: Strategic Issues. The resulting goals of the City Water and Waste Unit are repeated below.

1. Appropriate plans are in place to show that wastewater will be managed to meet the agreed levels of service.
2. System risks are understood and managed to appropriate and agreed levels.
3. The system addresses the public health needs of the community in a way that is socially and culturally acceptable.
4. Environmental impacts are recognised and minimised.
5. The effects of growth and other change projections are recognised and planned for.
6. The linkages between wastewater management and the management of natural and man-made systems are recognised and accounted for.
7. Projections for the cost per connection of providing wastewater services in Christchurch are maintained below the average for similar communities.

Significant Issues and Business Drivers

The CWTP is in the final stages of a 5 year upgrade to increase capacity by 40 percent.

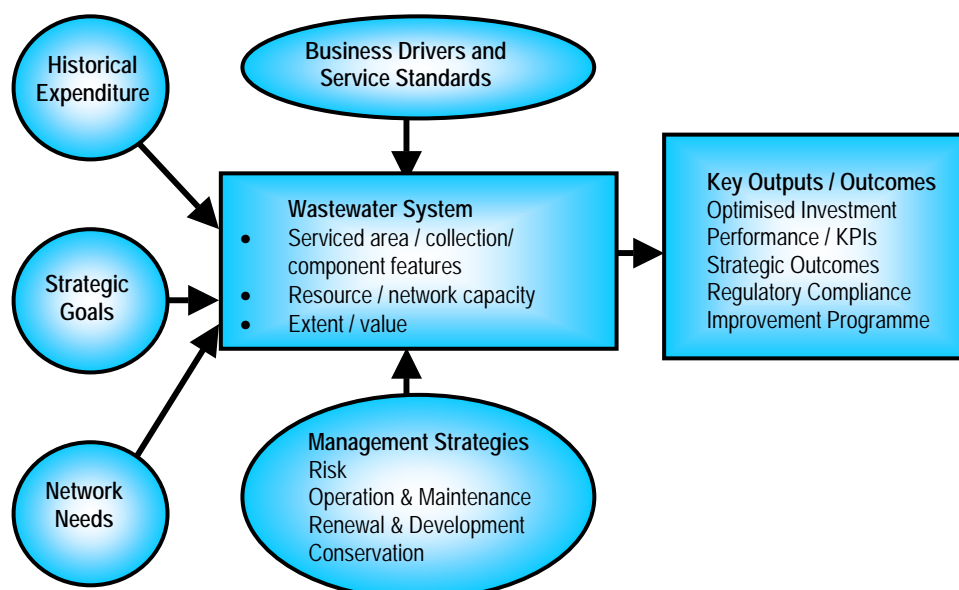
The City Council is carrying out planning work for an ocean outfall after a resource consent application for continued discharge of treated wastewater was turned down by Environment Canterbury in 2002.

Wet weather overflows are a major issue for all urban wastewater systems. Christchurch has recently committed to reducing overflows from the trunk sewer system to no more than once every two years (on average) over a ten year period and obtained a resource consent on that basis. This commitment along with city growth requires a substantial upgrade of the collection system.

Odours from the wastewater system are an ongoing issue for a significant minority of the City's residents and warrants further investigation and effort for improvements to be made.

An Integrated Management Approach

The Asset Management Plan is developed using an integrated approach, as shown in the following diagram.



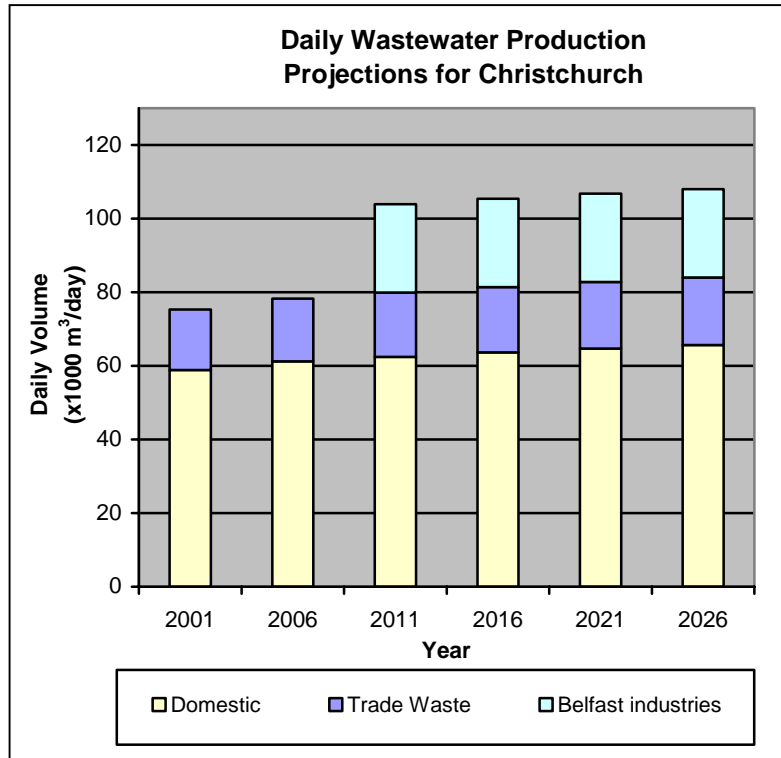
Strategic goals have been developed through the Wastewater Management Plan Part 1: Strategic Issues. These are considered within the Asset Management Plan along with historical trends and infrastructural needs and integrated with key business drivers and service levels. Management strategies are defined, covering new investment, day to day programmes, and risk. All of these are applied to knowledge of the assets, both physical and financial. Key outputs and outcomes are defined to enable ongoing monitoring of the Plan's effectiveness

Wastewater Volumes

At present, approximately 90,000 cubic metres of wastewater from residents and businesses is collected daily by the Christchurch sewerage system.

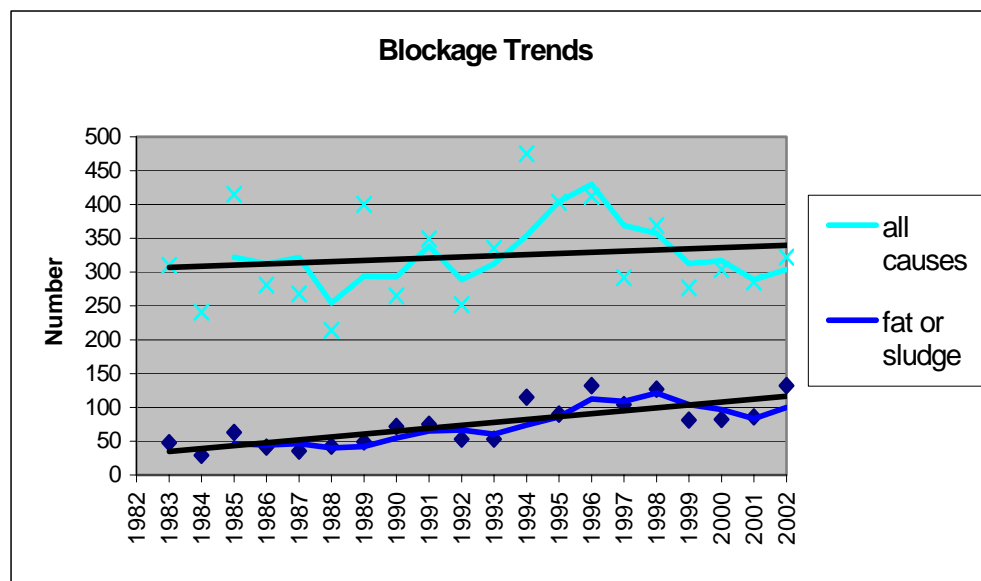
In addition to a gradual rise due to population growth, an increase in trade waste around 2008 has been planned for (due to wastewater from industry at Belfast when the discharge consent for the private outfall to the Waimakariri River expires).

In addition to the wastewater, the system must accommodate groundwater and stormwater that can enter the reticulation. This is considered under Asset Capacity and Levels of Service



Wastewater Composition

The increase in blockages over the last 20 years shown in this chart has been due to fat or sludge which occurs predominantly in commercial areas



As wastewater decomposes, H₂S (hydrogen Sulphide) is produced which can cause rapid corrosion and offensive odours. This is particularly an issue where there are flat gradients (as for most of Christchurch) and where flows are comparatively low (which can occur commonly in growth areas before design flows are reached).

Other components of Christchurch wastewater are considered in Part 1: Strategic Issues.

Treatment Issues

Nitrogen and Sea Lettuce

Sea lettuce a seasonally prolific alga that decays in deep extremely smelly beds on shoreline. This is a significant nuisance for Estuary users and nearby businesses and residents especially during the summer months.

Nitrogen is the significant nutrient for growth of sea lettuce and was one of the key issues preventing estuary discharge consent renewal for the CWTP. Removal of the effluent from the estuary into



an ocean pipeline will not eliminate sea lettuce as there is still a significant quantity of Nitrogen from the urban rivers so a management plan is being prepared with cooperation of estuary user groups, local residents and other interested parties to deal with the nuisance.

Pathogen removal from the effluent will still be variable even with the upgrade to the CWTP and ponds. This is due to a range of causes including the population of birds occupying the ponds and the amount of sunshine available for disinfection. Ultraviolet disinfection could improve this markedly for the remaining term of estuary discharge, but it is expensive to build and operate such a plant. Studies have shown that the open sea is better able to dilute and disinfect and so once the ocean outfall is operating, pathogen risk to beach and ocean users will be extremely low and UV will not therefore be necessary. Despite this the public is currently being asked whether it is prepared to pay for UV within a survey as to what standards are required from the end of the proposed ocean pipeline.

Odour from the operation of the Plant will be reduced by the current upgrade of treatment processes. However there remains some risk of outbreak due to process upset. Therefore there is an ongoing and extensive programme of targeted reduction measures such as the covering of open water bodies, sludge tanks and other high risk sources where the odour is extracted to a large onsite underground soil filter. The council has an air discharge consent for the output of odour from Plant operation.

The wastewater treatment produces 20,000 tonnes of **biosolids** each year. This used to be sprayed on a nearby Council owned farm, but now a dewatered product is used to cap retired sections of the City Landfill and consent has been obtained to apply it to pine forests as a soil conditioner. The Council continues to seek a broader more valuable use for this resource.

3. The Assets

Key Facts

Sewer pipes (including laterals in the roadway) are the most significant asset, accounting for over 80% of asset value.

Trunk mains and pump stations are critical system assets as there is little storage capacity in the system and their failure requires prompt attention to avoid the potential for adverse environmental and public health consequences.

At the Christchurch WTP, wastewater passes through a series of assets where processes remove biological loadings, some nutrients, chemical pollutants and suspended solids. Further disinfection and some nutrient removal occurs in the oxidation ponds. Process solids are dewatered and sent to the landfill for use as rehabilitation capping.

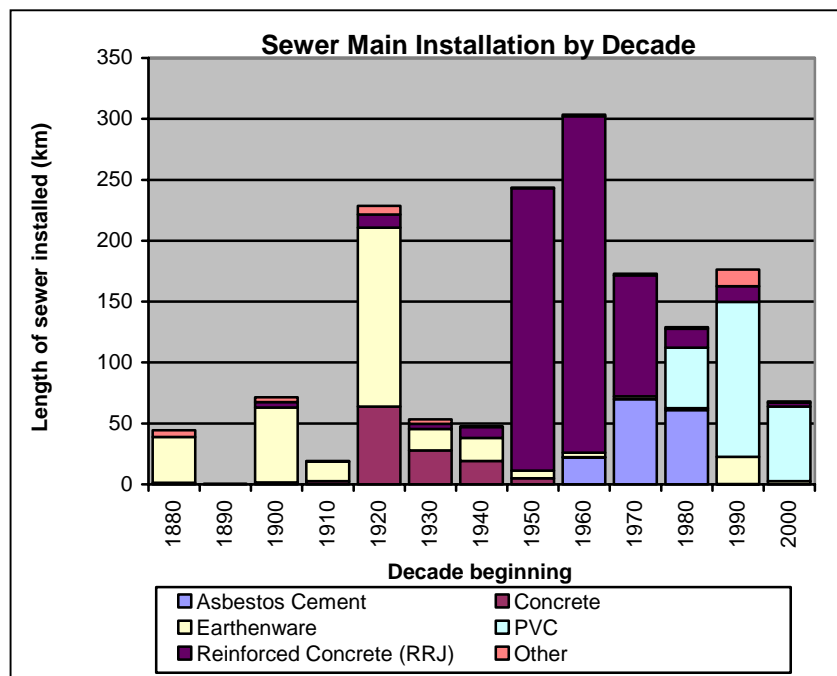
Asset Description	Quantity	Optimised Depreciated Replacement Value (\$m)
Sewer pipe network (excluding laterals)	1,569 km	376
Lateral connections in public roads	944 km	61
Manholes	22,679	0.5
Pumping stations (including mechanical, electrical)	84	14
Christchurch WTP	ea	56
Belfast WTP	ea	0.2
Land (incl. Improvements)	various	
Total		508

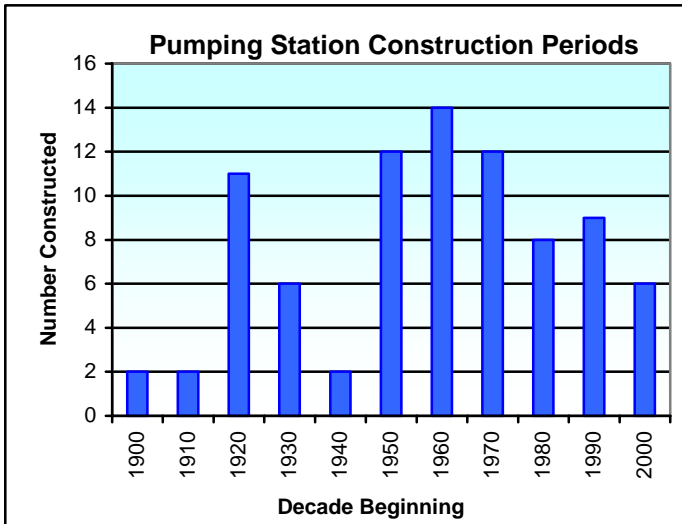
Asset Age and Condition Data

Reticulation assets are expected to last between 70 and 150 years, with some pipes replaced earlier for non-structural reasons like roading or under capacity.

Christchurch sewers are up to 120 years old, with most pipes having been installed within the last 50 years in rubber ring jointed reinforced concrete, asbestos cement or PVC.

Closed Circuit Television (CCTV) inspection is used to identify sewers that need renewing. CCTV records cover 25% of the reticulation, and most pre 1930 sewers. The records are used for condition assessment ratings that are stored in the Council's database.

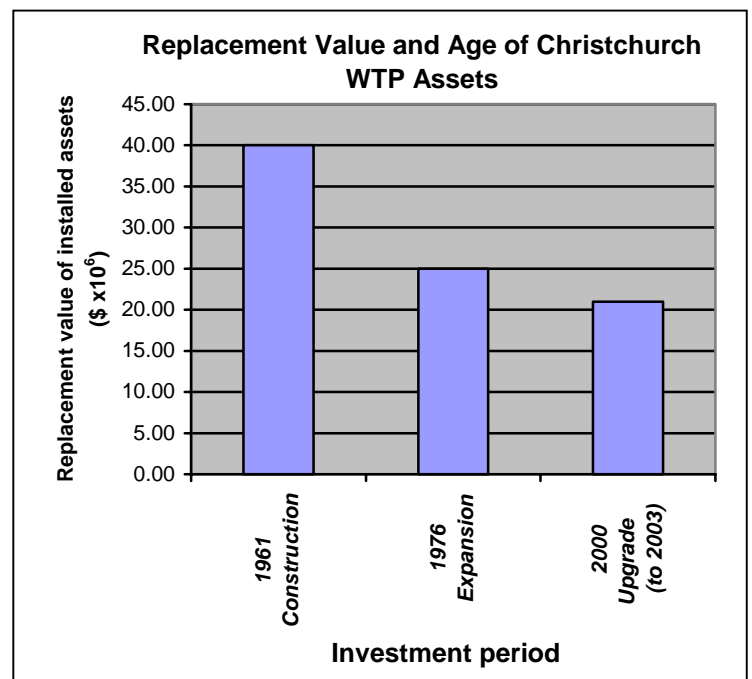




Pump station assets have a similar age profile. The stations are often purpose built to suit large, long-life pumps, so these pumps have the same expected life as the building. They need to be regularly overhauled (every 20,000hrs) to maintain performance and reliability.

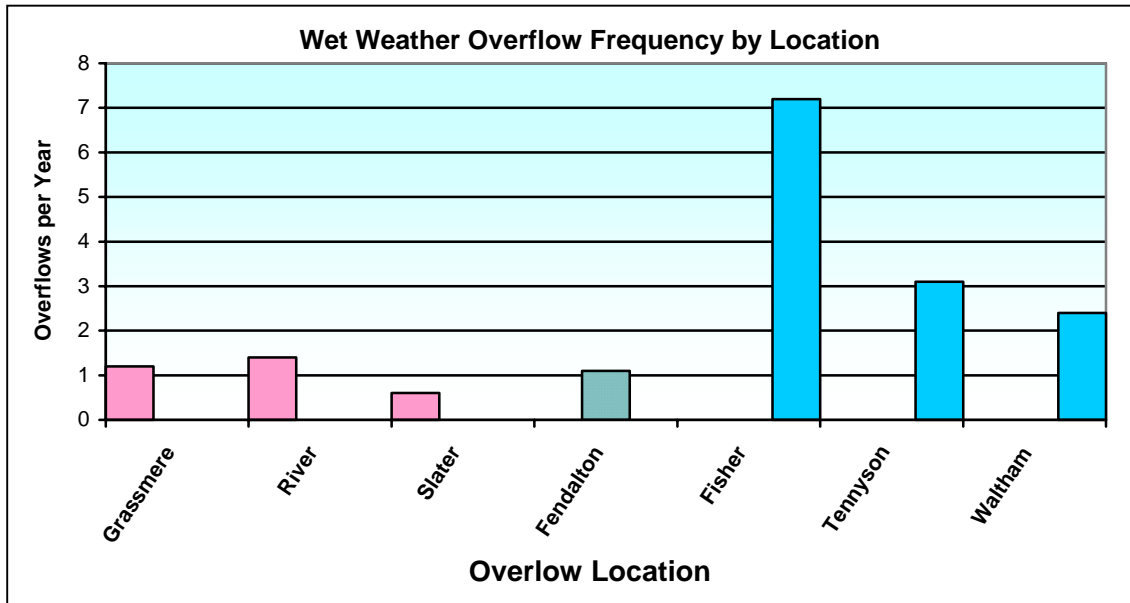


Christchurch Wastewater Treatment Plant investment has occurred in three main stages with additional infrastructure (up to \$5 million current value) added in any one year.



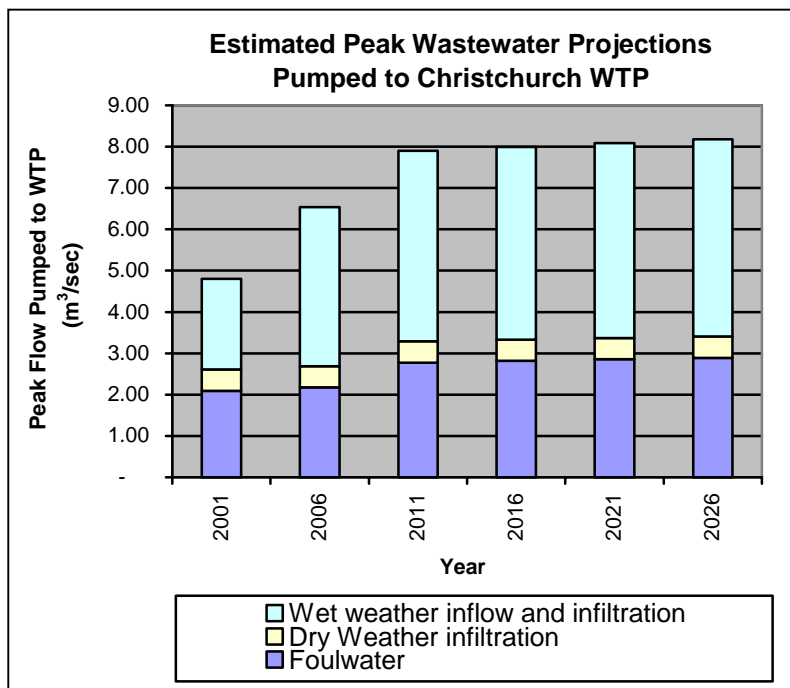
Asset Capacity

The peak flow resulting from wet weather inflow and infiltration is the primary driver in matching wastewater flows to system capacity. During infrequent storm events, the sewer pipes fill to capacity, additional stormwater is unable to enter the system and overflows are likely at pumpstations or upstream of sewers that are under capacity. Approximately 85 overflow events have occurred in the past 10 years, with overflows corresponding to the locations shown in Appendix A.



The Council negotiated a resource consent for overflows from the trunk system that included upgrading the system and reducing the average recurrence of overflows to less than once every two years by 2013. Projected total wastewater volumes that must be accommodated at the CWTP are indicated in this chart.

The CWTP has recently been upgraded to cater for the additional volumes resulting from the planned system upgrade. The effect of city growth on the trunk system has also been accommodated within these upgrades.



Asset Performance

Asset performance is measured in a variety of ways. This table shows the methods used to monitor asset performance.

Method	What is Measured	Frequency
SCADA	Alarm levels	
Pump station records	Power use, pump run hours	Monthly
Treatment Plant Records	Total Flow	As required
Laboratory	Influent and effluent quality	
Flow monitoring	Flow to investigate problem areas and calibrate models	As required
Hydraulic Modelling	Calculated flows anywhere in system for given rainfall conditions	As required
Reactive maintenance Contract reports	Blockages, pump failures	Monthly



4. Levels of Service

Wastewater Service Levels

Levels of service (LOS) must be meaningful and address the issues customers believe to be important.

The LOS in this Plan have been developed from:

- Wastewater goals and strategies
- Environment Canterbury plans and policies
- Knowledge of key wastewater issues
- Standards and legislative requirements
- Customer expectations

Customer expectations

Consultation is a key to understanding expectations, and includes:

- Individual customer contact on a day to day basis
- Annual CCC Ratepayer Satisfaction surveys
- Focus group meetings held for the first AM Plan
- ‘Your City Your Choice’ Consultation Process (1997)
- Wastewater customer research study (2003)



The research conducted in 2003 was more in-depth and covered levels of service, key wastewater environmental issues, customer service, costs and general issues.

The present levels of service are outlined below, along with planned changes arising from the most recent consultation and strategies to achieve them.

Characteristic	Issue	Current LOS Measure	Desired LOS from 2003 Research	Strategy
Odours	Perception issue not previously investigated in detail	1% of population experience odours originating from system (not achieved)	Regular offensive odours eliminated from reticulation	Develop proactive odour detection and management strategy
Overflows	Resource consent	Improve to an average of one event every two years by 2003	No change	System upgrade and inflow management to programme
Response times	Response times and standards for customer service	Urgent – (blockages) on-site within one hour of request Non-urgent - (e.g, odours) on-site within 1 day	Non-urgent improved to response within 4 hours	Strategy developed for overall council response to non-urgent call-outs
Nutrient removal	Sustainability	20% removal	No change	Investigate options for biological removal (through Green Edge project).

When asked about their overall satisfaction with the Christchurch sewerage system, 97% said they were satisfied or very satisfied. Given the wastewater rates for their particular property, 91% thought this was good or very good value for money.

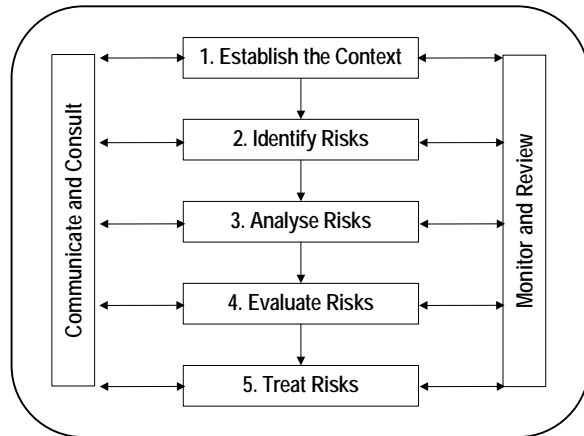
5. Managing Risk

Christchurch wastewater assets are exposed to a range of hazards and the resulting risks have consequences for service delivery and the community. The City Water and Waste Unit must therefore

- be aware of the hazards that exist
- understand the risks and consequences
- take action to minimise the risks and consequences.

A risk management framework consistent with the joint Standard, AS/NZS 4360:1999 Risk Management has been applied.

This process has involved the systematic identification, analysis and evaluation of risks across all assets, from the water source to the distribution system. Risk action plans have been developed, with the priority being based on the probability and consequences of individual risks. These risks include events such as natural hazards, product risks, and asset risks.



The recent focus for wastewater risk planning has been preparedness for a major hazard event such as a large earthquake in order to be satisfied that the City Water and Waste Unit has done, and is continuing to do, all that can be reasonably expected of them to reduce the impact of the hazard on the community. If the City is well prepared before, and for the period during and after such an event, more routine and localised asset failures are also likely to be less problematic.

The following table summarises the results of the analysis and the risk action plan for those risks categorised as “High”. These include mitigation measures that have arisen through the Engineering Lifelines Project, and also cover Business Continuance and Emergency Response plans.

Event Risk

Asset /Event	Risk Description	Risk Action Plan	Investment required	Financial year
Earthquake	Serious city-wide damage to most of the Christchurch collection system	Ferry Road and Pages Road Bridges – pipe replacements.	\$116,700	2005/6
		Replacement of vulnerable brick barrel sewers in central city.	\$2.74m	2004-2007
		Programmed earthquake proofing of pump stations (structural strengthening, securing plant, flexible couplings).	Awaits costings from risk management consultant (mainly pipework)	2004/5
Tsunami	Inundation of pumpstations near coast	Complete raising of sills above inundation level Completed except for PS 15	\$10,000	2004/5
Wetweather overflow	Raw wastewater discharged from sewer onto land or into waterway during rainfall event	Sewer renewal	\$17.45m	2003/4 – 2012/13
		Sewer Grouting	\$0.662m	each year
		Construct emergency storage (Grassmere Street and Maidstone Road)	\$3.460m	2009-2012
		Increase capacity of existing lines		
		Northern Relief	\$0.8m	2009/10
		Riccarton Interceptor	\$1.925m	2010-2012
Southern Relief	\$15.974m	2005 –2010 and 2012/13		
		Upgrade of PS11/20 catchment		
		PS11 Upgrade	\$4.2m	2003-2005
		PS11 pressure main upgrade	\$3.5m	2003-2005
		Fisher Ave to PS20 Trunk	\$1.4m	2004/5

Collection Risks

Asset	Risk Description	Risk Action Plan	Investment Required	Financial Year
Sewers with high infiltration	Infiltration of groundwater and percolating stormwater into sewer via broken pipes and/or deteriorated pipe joints	CCTV inspection followed by grouting or renewal as above.	\$200,000 for CCTV	each year

Treatment Plant Risks

Asset	Risk Description	Risk Action Plan	Investment Required	Financial Year
Influent Wastewater Quality	Toxicity to plant operations	Continue Trade Waste monitoring and enforcement of	\$290,000	Each year
Trickling Filters	Condition of the covers deteriorating and resulting in failure or odours	Programmed painting	\$75,000	2006/7
Sludge digesters	Capacity limitations and associated odour from poorly digested sludge	Additional digester capacity	\$6m	2004-2006
Biosolids Lagoons	Odour	Cover and or cease to use for digested biosolids.	\$1.08m	2003/4

6. Financial Projections and Programmes

Asset Lifecycle Management

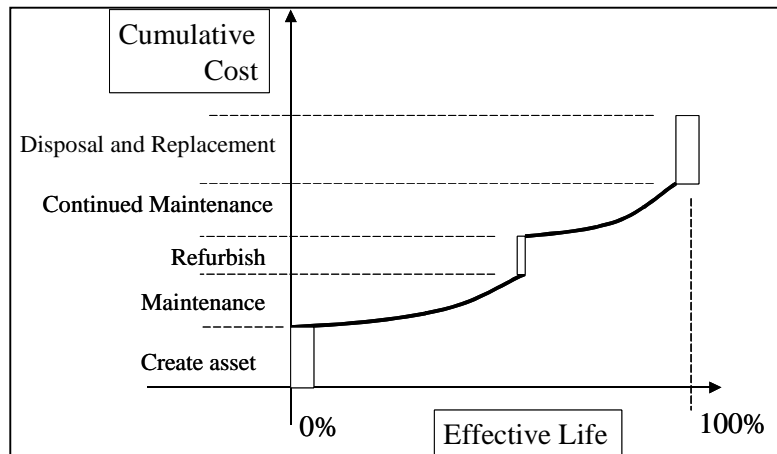
Asset management defines the following four major types of expenditure. (The difference between each is important, and it is necessary to monitor expenditure in each area in order to be able to optimise future costs and to recognise changes in “service potential”):

- **Operational:** utilisation of assets, such as electricity, cleaning, monitoring. These activities do not change the physical nature of the assets.
- **Maintenance:** day to day work on assets to keep them functioning at the desired service levels. Maintenance activity involves physical changes to the assets, and the cost is expensed in the period.
- **Renewals:** replacement or rehabilitation to original size and capacity. Renewals are “capitalised”, so that the cost can be depreciated over the future life of the asset. Renewals restore “service potential”.
- **New assets:** creation of new assets or an upgrade or expansion of an existing asset beyond its original size and capacity. New assets are also “capitalised”, but they do not restore “service potential”. Rather, they increase the asset base. New assets can be further categorised as (a) assets required for system expansion, and (b) assets required to improve the level of service.

In addition, where asset **disposal** involves expenditure, this must also be accounted for, along with any residual value.

The Asset Management Plan identifies the programmes that are needed to minimise the total expenditure needed on the assets over their whole of life.

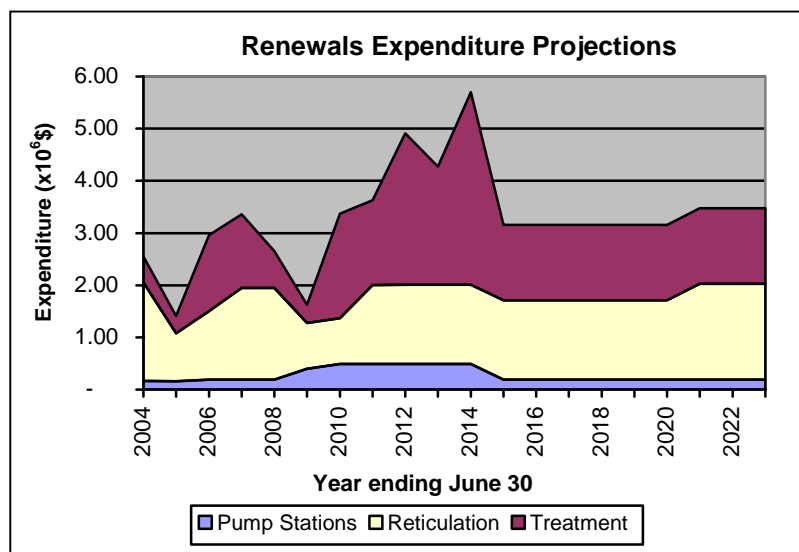
This diagram shows how the long term costs typically far exceed the initial construction costs, and the timing of major works such as refurbishments or renewals is critical to economic efficiency.



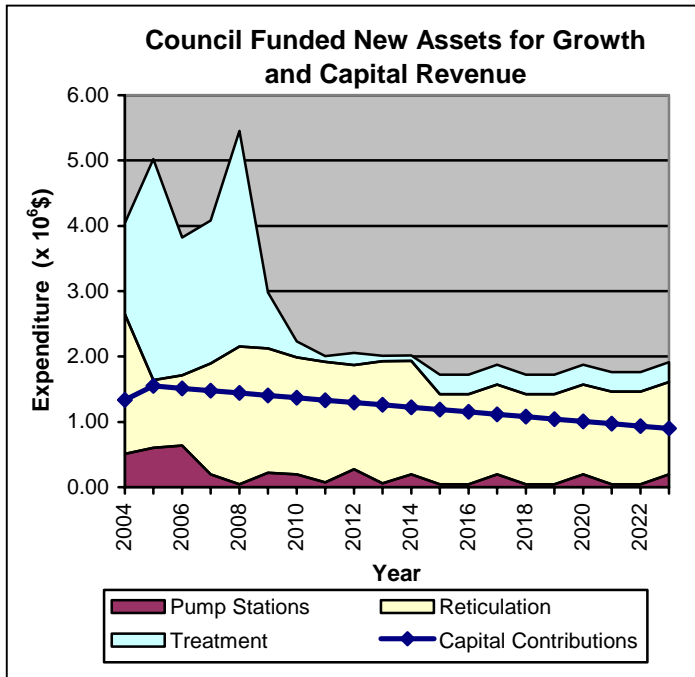
Asset Renewals

A long-term renewals strategy has been developed to define the requirements outlined in this Plan.

Some expenditure items like sewer renewals have been reduced slightly in this plan. There are however some large renewal projects looming in 10 to 15 years as some of the treatment plant infrastructure installed in the early 1960’s reaches the end of its life.



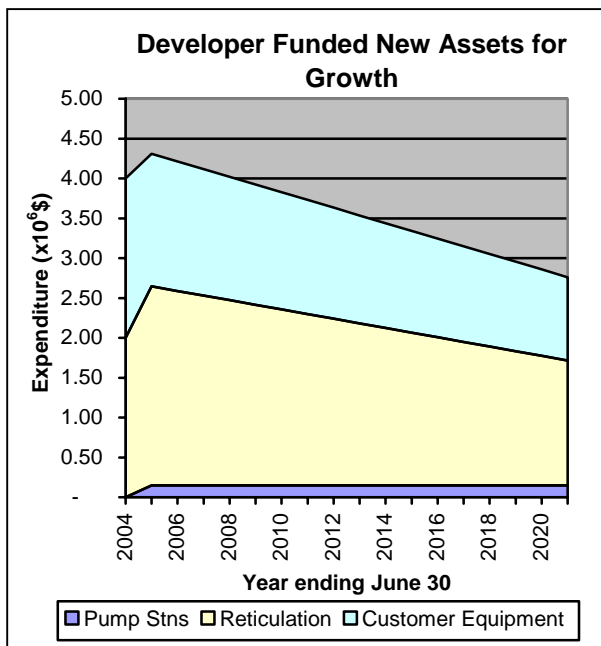
New Assets



New Assets for Growth

The Council will need to invest in new assets for growth, as shown in the top graph. This graph includes the cost of providing additional growth capacity for assets required for renewal or improved levels of service. For example, the growth proportion of the ocean outfall project (10%) and upgrading the trunk system (27%) is included in these projections.

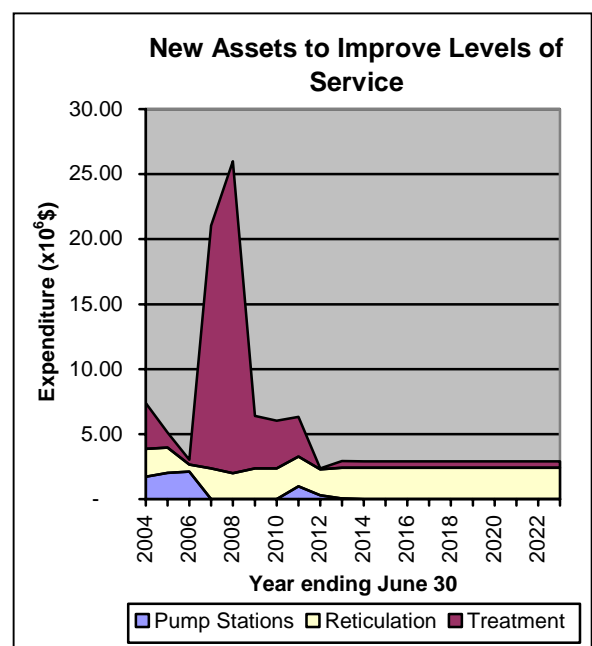
Total projected expenditure on new assets is some \$48m over 20 years, which is funded in part from capacity upgrade contributions and cost share contributions levied as conditions of subdivision through the Council's Contributions Policy.



In addition, developers of subdivisions are expected to vest some \$65m of assets over the next 20 years.

Assets to Improve Levels of Service

The main purpose of the ocean outfall and trunk main upgrading projects is to improve the environmental levels of service. The proportion that is not due to renewal or urban expansion is shown in this chart.



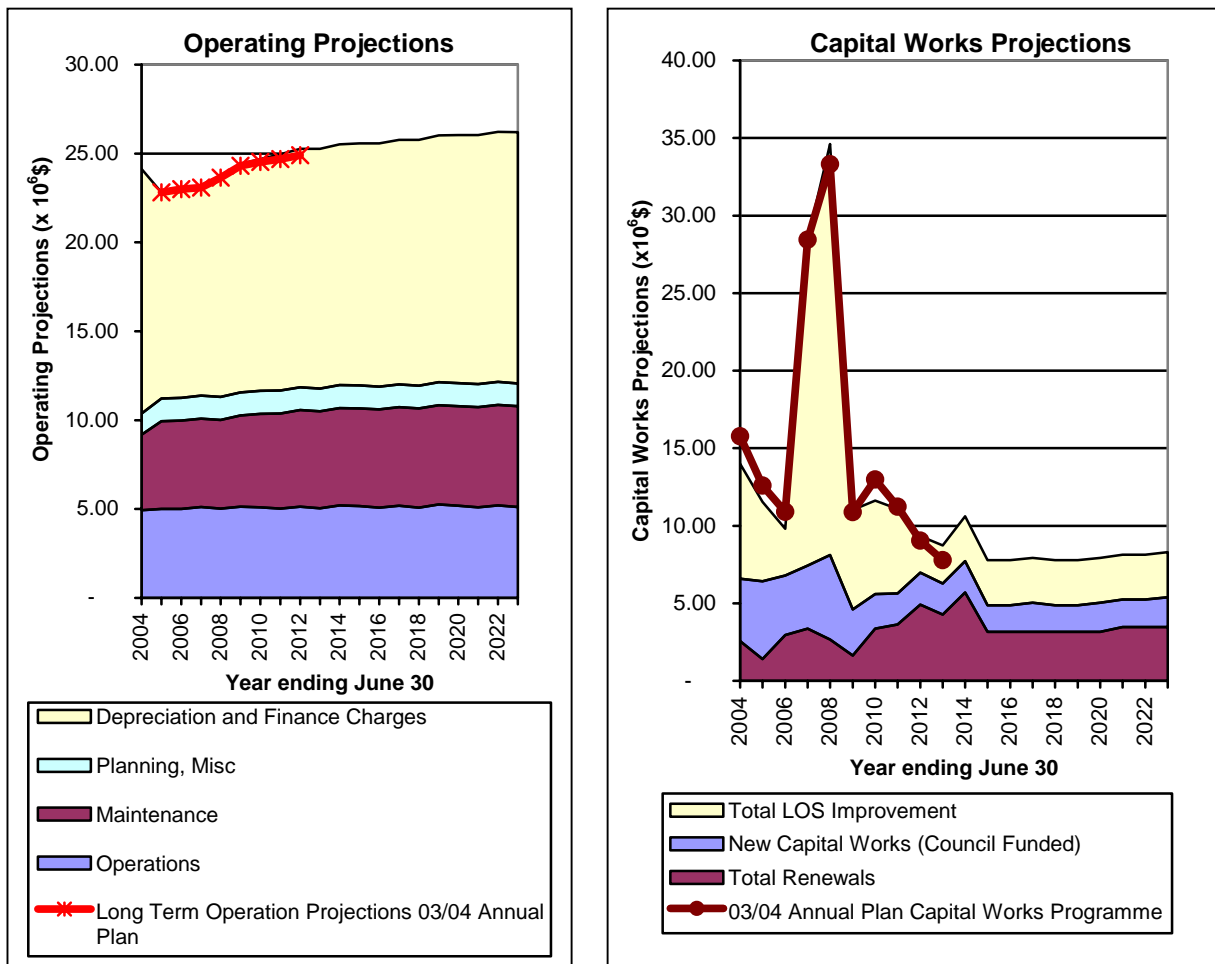
Financial Projections

Proposed long term financial projections based on a minimum 20 year timeframe have been developed from:

- Levels of service
- An analysis of the likely growth in population and household distribution and the resulting future demand
- Assumptions on the effectiveness of the Council’s Demand Management Programme
- An assessment of the risks (eg asset failure, natural hazards) that the assets are exposed to, and the possible mitigation measures
- Recognition of lifecycle asset management needs – for example, the Renewals Strategy
- Review of historical cost trends

CCC budgets are presented as:

- *Operational*, which includes General, Operations, and Maintenance expenditure as defined in the AMP, as well as Depreciation.
- *Capital*, which includes Renewals and New Assets expenditure.



The long term forecast fits within the Council’s Long Term Financial Strategy, with Operational being on target and Capital below target, as shown below.

General expenditure includes planning, financial charges, planning, asset information systems, demand management education programme, water loss reduction programme, quality assurance, water supply control and operations, water billing, monitoring and meter reading.

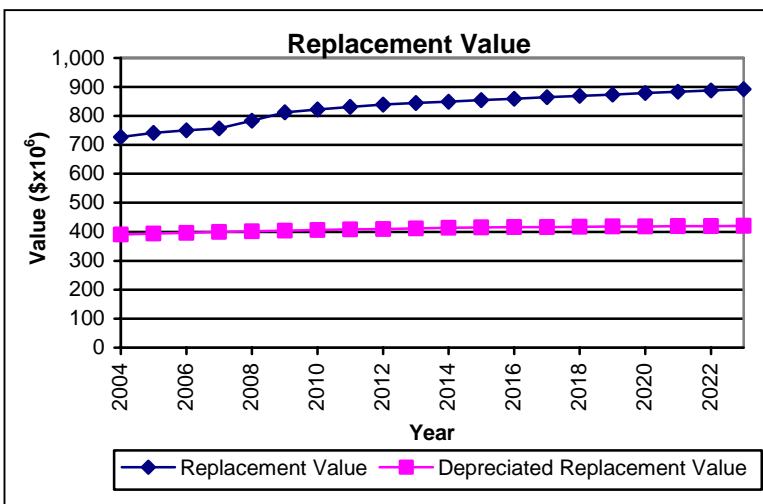
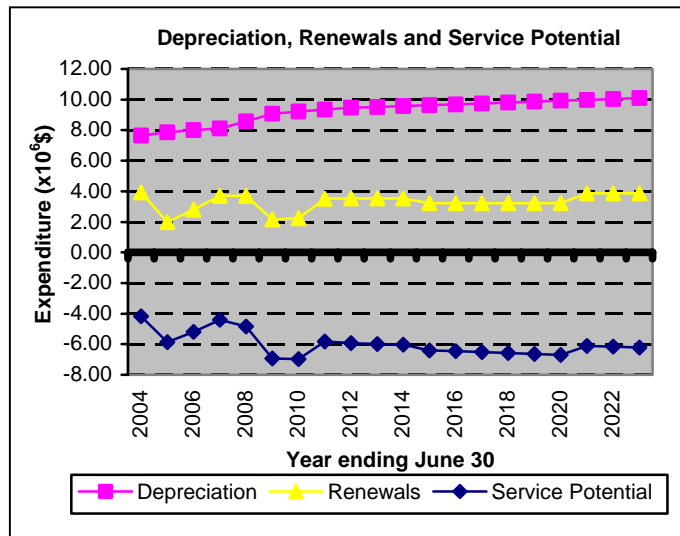
“Capital” expenditure does not include subdivisional works constructed by developers, but does include improvement works for which a financial contribution or cost sharing mechanism applies.

Service Potential and Asset Valuation

In accounting terms, the decline (or gain) in service potential is defined as the value of renewals less depreciation.

Depreciation based on the latest valuation (as at 30 June 2003) is projected to significantly exceed the actual volume of asset renewal work undertaken, leading to a significant “decline in service potential” over the 20 year period.

This means that on average the assets are getting older. This is expected, as the assets are relatively new compared to total asset lives.

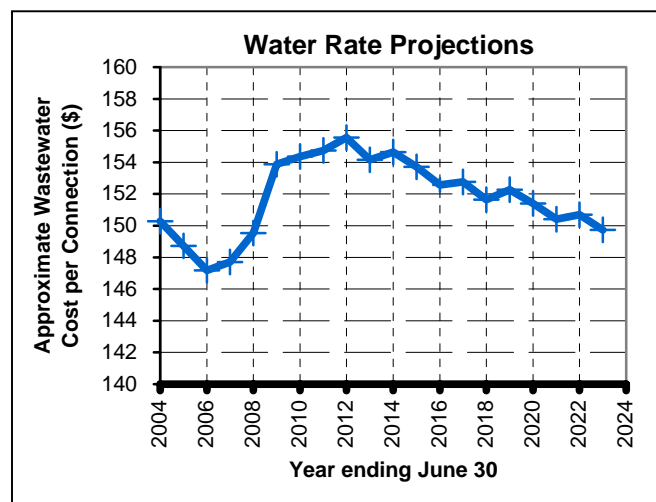


With the overall growth in new assets over the period, an increase in total asset replacement value of 18% to \$355m is anticipated. This includes \$21m of new assets installed within new subdivisions and vested in the City.

Revenue

From 2004, income for capital works (capacity upgrading and cost share contributions) will be used to directly fund capital works rather than offsetting the targeted wastewater rate. Revenue to fund the operating budget will therefore come from trade waste charges (\$2 million annually) and general revenue including charges for accepting wastewater from other authorities (\$0.5 million annually).

The average cost per connection, to be recovered through a targeted wastewater rate, is projected to remain fairly constant at between \$148 and \$156 annually.



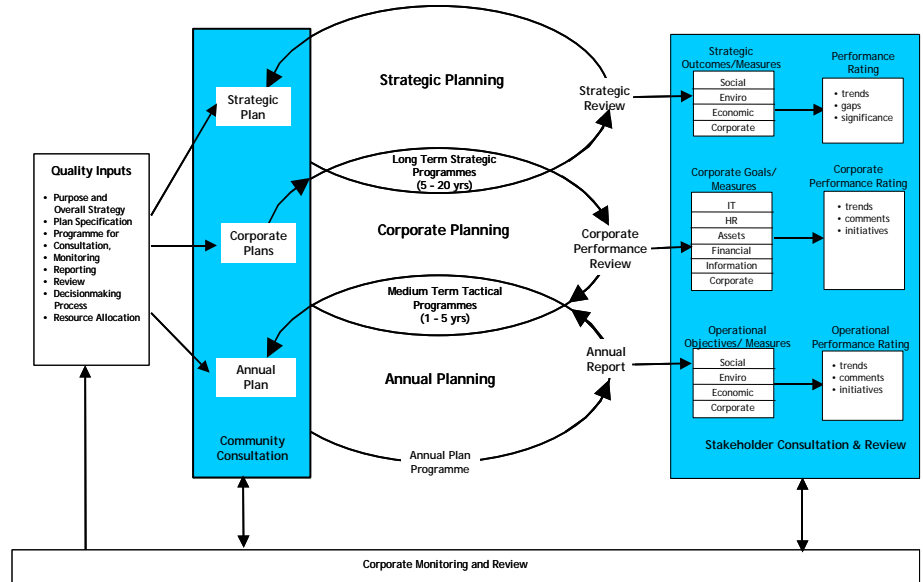
7 Measuring Performance

Performance can be measured at three levels, long term strategic, medium term tactical and short term annual.

The AM Plan provides measures for:

- Triple bottom line outcomes
- LOS achievement
- Network measures
- Legislative standards
- Financial measures, including value for money, and
- Satisfaction ratings

This diagram shows how these planning cycles are linked.



It is intended that an annual report covering asset management performance will be produced.

Attribute	Score	Asset Management Practices						
		Asset Knowledge (Data + Processes)	Strategic Planning Processes	Asset Capital Processes	Ops and Maint Processes	Information Systems	Asset Management Plan	Organisational/Commercial
Excellence	100							
	95							
Competence	90							
	85							
	80							
	75							
	70							
	65							
	60							
Systematic Approach	55							
	50							
	45							
	40							
Awareness	35							
	30							
	25							
Innocence	20							
	15							
	10							
	5							
2001 Score	65	65	60	50	60	65	60	
3-Year Target	85	80	85	75	85	85	90	
Appropriate Practice Score	85	85	85	85	85	90	90	
Gap	20	15	25	25	25	20	30	

The annual report on asset management for water supply assets will cover:

- Achievement of levels of service
- Scope and value of assets
- Asset condition trends
- Asset utilisation and performance
- Useful life remaining
- Service potential and asset consumption
- Expenditure
- AM Improvements

Gap Analysis of AM Practices

This gap analysis chart summarises the position of wastewater asset management practices, as at mid 2003 and currently. It is expected that achievement of the key Improvement Plan tasks below will over the next three years bring performance close to NZ best practice.

2001 Score 3 year Target NZ Best Practice Score

Asset Management Systems Improvement Plan

TASK	Oct-03	Dec-03	Feb-04	Apr-04	Jun-04	Aug-04	Oct-04	Dec-04	Feb-05	Apr-05	Jun-05
Treatment Plant Asset Register	█	█									
Treatment Plant AMP	█	█									
Treatment Plant Operations manual	█	█									
Treatment Asset Age / Lives											
Biosolids Options	█										
Pump Station Data Improvement	█	█									
Retic Operations & Maint. Manuals											
Retic Asset Data (fill gaps)	█	█									
Capacity Modelling											
SLA Monitoring & Control	█										
Contract Monitoring & Control	█	█									
Reporting from GIS and PAMS											
IT Systems Integration											
Reporting from SAP											
Valuation / depreciation linkages Retic											
Valuation / depreciation linkages P/S	█										
CAPEX Project Identification/ Prioritisation											
Lifelines /Emergency Response Plans	█	█									
	Indicates work underway										

Appendix - Existing Collection System

