8.0 LIFECYCLE MANAGEMENT PLAN

8.1.1 OUR DISTRICT

Our district is located in the centre of the North Island of New Zealand and within the Waikato Region. Sitting at the heart of our district is the biggest freshwater lake in New Zealand, which is surrounded by mountains, forests, rivers and national parks. Complementing our natural environment are the vibrant and diverse communities that make up our urban places.

Taupo has become a key visitor and event destination possessing many unique attributes such as its panoramic stunning lake and volcanic landscape.

Lake Taupo is the biggest lake in the southern hemisphere and it is rated by the district as our most important asset

The Taupō District occupies a large proportion of the Central North Island Volcanic Plateau together with the complete catchment area of Lake Taupō and Upper Waikato River areas.

Whilst the majority of the District is situated within the Waikato Region, a small proportion also intrudes into the Bay of Plenty, Hawkes Bay and Manawatu-Wanganui regions. The District comprises 6354sqkm of land and 616sqkm of lake.

Prior to 1950, the District was largely undeveloped and sparsely populated. Since that time, population has increased rapidly to approximately 37,200 (2017/18). Urban growth has focused on Taupō Township and various lakeshore settlements, whilst rural land development has been dramatic with the conversion of scrub wastelands to productive farmlands and vast exotic forest plantations and future conversion to lifestyle properties.

Lake Taupō and its surrounds have also become an important national and international tourist destination, renowned for its scenic attractions and wide ranging recreational activities.

Stormwater collection and disposal is required to prevent flooding in areas where human activities take place. However, the collection of Stormwater flows can have adverse effects to both public health and the environment. Stormwater flows entrain material that can adversely affect human health including animal faeces, heavy metals and chemicals and deposit them into areas where water may be used for drinking, recreation or other purposes. Stormwater flows can also contribute to erosion because the collection of water flows and their subsequent discharge provides the flows with energy, which can erode land, gravel, river and lakeshores. For these reasons, management of Stormwater is important in both urban and rural areas.

Taupō District Council provides stormwater service's as part of the roading network or off road via gullies and overland flow paths in the urban areas with in the district (Taupō, Turangi (and Tokaanu), Acacia Bay, Kinloch, Motuoapa, Waitahanui, Omori (Kuratau and Pukawa included), Whareroa, Motutere, Whakamaru, Atiamuri and Mangakino).

This section contains life cycle management plans for the following stormwater asset components:

- Quality Improvement devices
- Reticulation (pipes, manholes, detention ponds, gullies, overland flow paths)

Council has undertaken a criticality assessment that allows council to focus maintenance and renewal expenditure as well as regular asset inspections.
Background data for the asset type including asset description, capacity, performance, condition and valuations is included in the Asset Data section.

This section contains the general *management strategies,* to achieve the levels of service defined in the Level of Service section. These strategies are divided into three main work categories (routine maintenance, renewal, capital and disposal) as illustrated in the following figure.

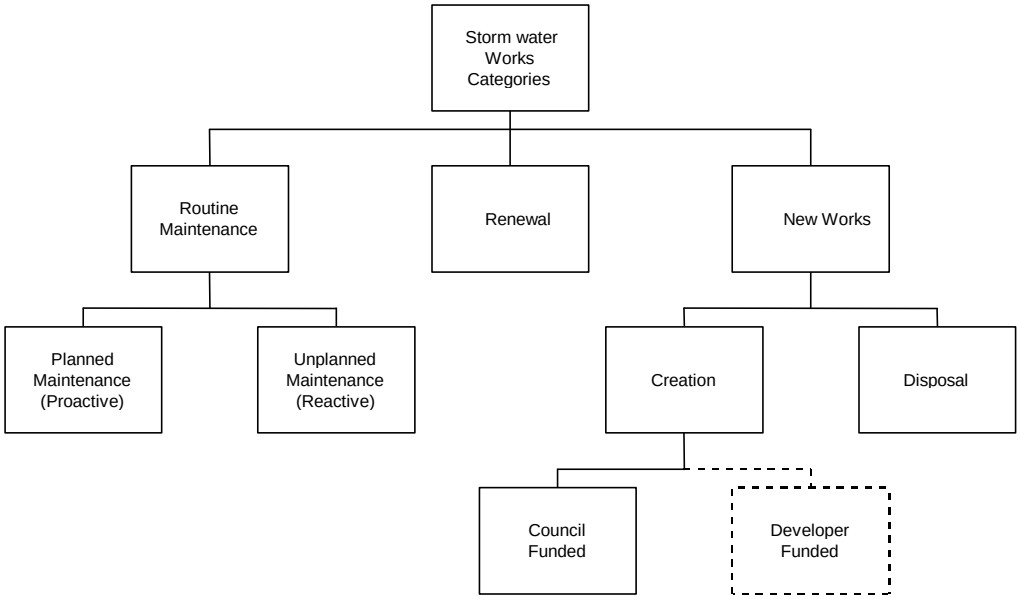


Figure 8-1: Asset Works Categories

The work categories are defined as follows:

Routine Maintenance

Routine maintenance falls into two broad categories as follows:

- Planned (Proactive) Maintenance: Proactive inspection and maintenance works planned to prevent asset failure.

- Unplanned (Reactive) Maintenance: Reactive action to correct asset malfunctions and failures on an as required basis (i.e. emergency repairs).

A key element of asset management planning is determining the most cost-effective blend of planned and unplanned maintenance as illustrated in the following figure.

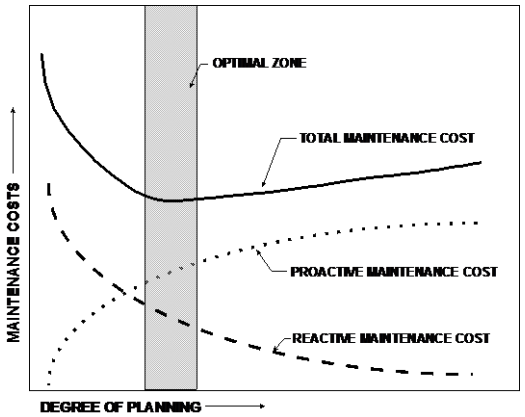


Figure 8-2: Balancing Proactive and Reactive Maintenance

Renewals
This includes replacement and rehabilitation of existing assets to their original condition and capacity.

New Works
Creation Works: New works, which extend or upsize assets, which are required to cater for new development and growth and new works that form part of Councils quality improvement program as required by the Comprehensive Consent and identified by the monitoring program. Creation works fall into two separate categories as follows:

- Council funded - Works funded and constructed by TDC.
- Developer funded - Works funded by developers as part of sub divisional development or by way of contributions that are then vested in Council.

Future developments are funded by developers who must increase the capacity of the downstream network if their development requires additional capacity.

Asset disposal: Retirement or sale of surplus assets. Council has no plans to dispose of any of the Stormwater assets over the period of this Ten-year plan.

A forecast of the 10-year expenditure for each asset group in each of the categories outlined above has been provided in the Financial Summary section.

8.2 Overarching Issues/Strategies for stormwater

Council in 2009 adopted the "Taupō District Council Stormwater Strategy" which identified and provided policy direction for a number of issues relating to stormwater in the district.
These issues fell under the following broad headings.

- Flooding
- Degradation of overland flow paths
- Degradation of Lake Taupō and aquatic environments
- Public health and safety

The strategy adopts 1:10 and 1:100 flow regimes for future development. Capex programs include identification, protection and enhancement of overland flow paths as well as new quality improvement devices. Maintenance programs have become proactive with the ongoing condition assessment of the underground network. Council will continue to protect gully walls from erosion by additional planting. Lake outfalls that silt up when there are high lake levels are inspected prior to bad weather warnings. The coordinated CCTV program, which has assessed at least 10% of the underground network per year, has enabled Council to match age with condition, criticality, and past maintenance history to enable more accurate renewal forecasting.

The strategy provides clear direction around making sure that people and property are not affected by flooding, and the document sets policy around infrastructure design requirements that feed into the review of the Code of Practise.

Overland flow paths have previously not been adequately protected and this has seen in some cases building development that now impedes natural flow paths. Council will endeavour to identify overland flow paths in urban areas and then where they are not council owned, provide some protection over them. This protection measure may be undertaken by negotiation with the property owners or by legal means if necessary.

Council has so far identified the overland flow paths in the urban environments by way of Lidar survey and the intention is for this information once signed off, will be placed on to property files. Progress is still required to enable the data to be released to the public and these are:

1. Field verify flood extents (taking special care around culverts and bridges)
2. Develop a comprehensive log (including pictures and sizes of all culverts. This can be completed during the field verification stage and will be required for any detailed modelling
3. Survey at risk properties making sure that you get both the first floor and garage level (if applicable). It will need to be determined at what level will water start to inundate the property. An identification of the property type / purpose is also needed as this will assit in the damage assessment.
4. The development of a flood damage assessment for a 100-year future climate event, ensuring that the analysis is set up to be re-used for several model runs with varying level of details. The analysis will provide damage estimates during the event based on generic damage vs flood depth curves for varying property types.
5. Model anomalies need to be fixed that were identified in field verification with the inclusion of culverts.
6. Development of model sensitivity runs i.e. (100-year future climate – 10-year event to simulate perfect pipe network). To determine effects of including the network on the flood levels
7. Review of any sensitivity results and re run damage assessments.
8. Damage assessments will enable determination of further diversion and remediation works
9. The formation of a Council team to advance the project through to information appearing on property LIMs if Council sees this as the preferred outcome.

Quality Improvement
The avoidance of degradation of Lake Taupō and aquatic environments is making sure that Stormwater quality does not affect receiving environments. This is underpinned by conditions set in Councils comprehensive stormwater consent. (Section 30 Quality Improvement Program)
Stormwater quality will drive some of Councils capital expenditure on Stormwater quality improvement devices, such as Enviropods and CDS units (Hynds Down Stream Defenders) and the use of best practise.

The long-term goal is to provide Stormwater quality improvement to all of the direct Lake and River discharges and this will be achieved over time starting with the larger diameter outlets and working progressively working through the network.

A number of factors need to be considered when identifying appropriate outlets:

- Does the pipe discharge directly to a Lake or River
- Size of the upstream catchment
- If the catchment includes any high risk sites
- If the catchment includes any commercial and industrial sites
- Potential contaminant load

- If the discharge is connected directly to the network (does the discharge go to ground prior to the receiving environment)
- Is the area where the discharge occurs significant to the community

The current plan is to identify and treat Stormwater from pipe outlets 750 diameter and above as these outlets are seen as discharging the largest containment load to receiving environments. Over time, this improvement program will focus on the smaller discharge points.

Public safety
The safety of the public has also set some design criteria around open stormwater systems for Council and developers in the future, and has identified specific network reticulation issues such as inlets and outlets and their requirement for them to be safe.

Council will continue to monitor the reticulated network to identify manhole lids that are popping and look to either bolt them down or provide a grate on the top to allow flow to flow over land. This is to reduce the risk of people falling down the manhole after high rainfall events.

Councils comprehensive discharge consent also sets a number of conditions that impact on how Stormwater services are delivered in the future, such as the requirement for Catchment Management Plans for green fields' developments as well as the ongoing monitoring program for stormwater quality.

8.3 Service Delivery and Rationale

The Stormwater service is carried out by a number of providers as shown in Table 8.2.

Service	Provider	Rationale
Asset Management	Council	To maintain the knowledge of the asset in house
Management of Maintenance Contracts	Council	To maintain control of the costs of the services.
Minor Design	Council	In house knowledge and resource available
Major Design	Tendered	To capitalise on external expertise resource/ experience and take advantage of competitive pricing/competition.
Bylaw development	Council	To capitalise on internal expertise resource/ experience.
Strategy Development	Council	To capitalise on internal expertise resource/ experience

Table 8.2: TDC Service and Providers

The following table shows the TDC Three Waters maintenance and renewals contract

Contract Name	Contract No.	Approx. Value ($)	Term (yrs)	Comments	Maintenance /Renewal/ Creation
Three Waters Maintenance Contract Contractor: Downer Construction	1516/155	11.4 mil	5+2+2	Start date was 1 July 2016 Includes: Water, Wastewater, Stormwater	Mostly Maintenance but includes some renewal and creation aspects

Table 8-2.1: TDC Maintenance and Renewal Contracts

8.2.1 Contract types

Lump sum and measure and value contracts are the two types of contract procurement Taupō District Council utilise for project tendering. Where the estimated cost of the project is less than $50,000, a lump sum contract is generally used. If greater than $50,000, a schedule of quantities is provided to enable a measure and value contract be tendered.

Lump sum contract: More than one contractor is asked to supply a fixed price quote for the project. The contractor is responsible for the measurement of quantities.

Measure and value contract: The quantities in the Schedule of Prices are measured by the Engineer, which is provided for evaluating tenders. Each item of work is carried out at the fixed rate set out in the Schedule of Prices. The sum shall be adjusted by any additions or deductions under the contract.

Methods for tendering and evaluation

Tender Evaluation Method	Contract $ Value		
	$0-50,000	$50,001-$100,000	$100,000+
Expedited Procedures (Negotiation)	√	×	×
Expedited Procedures (Limited Invitation to Tender)	√	√	×
Lowest Price Confirming Tender	√	√	√
Quality-Price Trade Off Method	√	√	√
Weighted Attribute Method	√	√	√

Table 8-2: Physical Works - Method Selection Matrix

Key (×) = not permitted (√) = permitted

Note: For projects with a dollar value of less than $100,000 the expedited procedures are generally the most appropriate methods because administration costs will be less and hence a more reasonable proportion of total contact value.

8.4

Asset Type

8.4.1 STORMWATER NETWORK

Overall Asset Objective:	Council will manage its urban area stormwater systems to avoid, remedy or mitigate adverse effects of Stormwater discharges and in particular to: • Comply with conditions of its Comprehensive discharge consents • Minimise adverse effects of overland flow and flooding • Reduce sediment and contaminant discharges to the receiving environment • Protect and enhance the state of our Lake, rivers, wetlands and natural overland flow paths including Gully systems • Ensure provision of effective stormwater systems as far as practicable, taking into account long-term operability and whole of life costs.

Key network issues are:

- Pipe capacity
- Overland flow path provision
- Stormwater quality

Council has adopted a new service level through the code of practise of network provision of 1:10yr event but has not retrospectively upgrade the network unless there is a known flooding or erosion issue. To understand the current network capacity and identify the under capacity areas that are causing problems, the contract reports and service requests and the overland flow path model are analysed.

Council lacks an operational model of the stormwater network, which hinders Councils ability to determine the networks effect on overland flow path levels, and without a comprehensive model, Council does not have an accurate understanding of the networks capacity.

In general terms, most of the network is sized for 2 to 5 year events but climate change lessens the capacity over time. The litmus paper test in regards to network capacity is have we had any floods. A number of areas, mostly in depressions where the network is shown to be inadequate in less than a two-year event, and these sites will need to be addressed over time and when funding permits.

The Lidar survey data is another good indicator of the levels of flooding and inundation that could occur, and by completing the Hazard Work, Council will be able to determine where capacity improvement funding may be best spent.

The current Taupō CBD stormwater network does not have the capacity to match the current Code of Practice requirements, but a look at the Lidar data identifies that in a 1/100 event the

roads are able to convey the majority of flow thus negating the need in the short term to increase pipe network capacity. Council is able to use the flow path model to identify where capacity issues are and this Amp provides options to limit their impact.

8.4.1.1 Historical Expenditure

Historical operational and maintenance expenditure for the Stormwater asset is shown below

	2015-2016	2016-2017	2017-2018
Operations and Maintenance	1,677,000	1,667,000	1,697,000
New Works	175,000	127,000	111,000
Renewals	125,000	155,000	325,000
Total	**1,977,000**	**1,949,000**	**2,133,000**

Table 8-3: Historical Expenditure

8.4.1.2 Stormwater Network Operations and Maintenance

Maintenance is carried out on the Stormwater network to ensure that the levels of service outlined in the Level of Service section of this document are met. A summary of the change in operations and maintenance due to demand is included in Section 6, with a full financial summary in Section 9.

The network is maintained under the maintenance contract. Some Specialist maintenance such as CCTV and gully planting works are carried out by specialist contractors.

Council has implemented an ongoing CCTV condition assessment program that has to date compiled data for most of the urban networks apart from the Taupo Township. The CCTV program requires the contractor to clean the network as they go which has resulted in a significant amount of roots and sediment being removed from the network.

The contractor undertakes regular inspections of outlets and ephemeral gully systems, this report data along with service requests and CCTV data are then collated and analysed for maintenance and renewal requirements.

Council will CCTV at least 10% of the pipe network per year to enable conditions assessments to be undertaken.

Council's service levels have been included in the three waters maintenance contract in the form of schedule works with differing levels of priority, which are impacted by health and safety aspects as well as cost and environmental impacts. Council's criticality assessment also enables council to perform proactive maintenance on specific high criticality assets.

Gap analysis is undertaken when reviewing maintenance data and costs as well as service requests. This data is collected in Asset Finda the Three Waters asset data system. This database allows council to consider asset age, condition assessment data and criticality to allow council to focus on proactive and preventative maintenance.

Where gaps in achievement of desired service levels are identified, this results in an options analysis process with possible funding options provided to senior management, and then through to Council.

CCTV data is viewed internally to validate condition assessment and to determine asset maintenance requirements. Priority is given to the worst affected pipes with a consideration to the size of the catchment and the amount of properties affected if the network was to fail.

Pipe maintenance options for damaged pipes vary from dig it up to reline or renew altogether. These options are considered on a case-by-case basis depending on the location issues and pipe sizes and available funding.

Council funds a mix of proactive and reactive maintenance budgets, with the proactive budget applying to regular asset inspections, CCTV, root cutting programs and sediment removal. The reactive maintenance budgets are prioritised from the inspection results. Any deferred maintenance that is not critical is documented and reprioritised in the follow financial year once the budget is available.

Asset Finda can produce maps of the Stormwater network that show geo- spatially where CCTV inspections have occurred which aids the programming process. The database can also record pipe condition rating in the form of different coloured pipes for different condition rating. The ability to represent condition data in the form of a map greatly enhances the ability at the political level to understand the funding requirements.

Asset Finda can also include all projected renewal and capex expenditure for the Three Waters in map form to enable asset managers to determine where construction synergies might occur.

Root intrusion and sediment build up are the main issues with Turangi Township having a large verge tree stock.
A process of locating all trees on verges is being undertaking in Turangi to enable council to focus its root cutting and removal program going forward.

The improvement of Stormwater quality and the reduction of degradation of receiving environments is achieved by the installations of various improvement mechanisms, such as enviropods in the urban high use areas and Hynds Downstream Defenders above outlets as well as the use of ephemeral gullies where waters are detained to allow sediment / contaminants to drop out.

The maintenance of these mechanisms is shared with the roading division of council who maintain the enviropods and the Three Waters (Downers) contractor who maintain the CDS units. Both Council and Downers have the operational manuals for the Hynds Downstream Defenders. Ephemeral gullies are maintained with a mix of internal parks staff for mowing and selected contractors for gully plant maintenance.

Downers routinely inspects Stormwater outlets that discharge directly to the Lake as these outlets suffer sand build up in certain wind directions, this proactive maintenance reduces the amount of localised flooding incidents from blocked outlets. Ephemeral gullies are also regularly inspected to identify potential blockages and bank instability as well as for mowing and plant maintenance and planting.

Quality improvement devices are scheduled to be emptied twice per year, but are inspected after periods of high rainfall to make sure they still have capacity.

The customer service staff log network faults directly into Asset Finda, which links directly to Downers call centre. They then dispatch this information to their field staff.
Depending on the priority of the fault, Downers have differing response times for arrival on site and completion of the fault. High priority faults are also copied to the relevant Council staff and Asset Managers.
Downer field staff when completing the fault log identifies which scheduled items are to be paid and make any changes to the field information pertaining to the network and update the network data if incorrect.

Council can then analyse the historic maintenance spend on specific assets to determine future options if needed for improvement.

OPERATION AND MAINTENANCE PLAN

The Comprehensive Discharge Consents for urban stormwater runoff have a significant impact on the management, operations and maintenance of the stormwater system in the coming years. The consent requires the following:

A monitoring program to:

- Investigate actual and potential adverse effects of stormwater discharges on the receiving environment.
- provide information to develop stormwater initiatives
- determine compliance

A Stormwater Management Plan that records the way in which the municipal stormwater system is operated.

Operational Tactics
The Network maintenance engineers are responsible for the operation of the Stormwater system and are being supported by the Stormwater Management Contractor under the maintenance contract.

Performance measurement of Councils storm water infrastructure is by way of the annual report to WRC as required by council comprehensive discharge consent and by periodic satisfaction surveys. The consent focuses on discharge quality but also recognises the need for adequate flood protection.

Network performance is reported to Council on a monthly basis, with level of service achievement being the focus. This reporting process is also an opportunity for identification of service gaps and network issues.

Overall performance reporting is recorded in the Council annual plan document.

Maintenance Strategy
Maintenance falls into two categories, planned and unplanned, each having quite different triggering mechanisms and objectives;

Unplanned maintenance:	• Corrective work carried out in response to reported problems or defects with the stormwater system (e.g. blocked drain, flooding, scouring, etc.) and analysis of CCTV data.
Planned maintenance	• Preventative maintenance carried out to a predetermined schedule with the aim of ensuring Level of Service, preserving asset design life and, if economic, extending asset life (e.g. the inspection and cleaning of critical system components). • On-condition maintenance carried out because of condition or performance evaluations of assets and asset components (e.g., catchpit cleaning).

Maintenance work on stormwater assets include:

Asset inspections
Clearing of pipe blockages and constrictions (sediment build up and root intrusion)
Minor Repairs (joint sealing)
CCTV program
Dealing with the effects of erosion activity
Vegetation and Weed Control (Inlets, Outlets and Gully drainage)
Maintenance of quality improvement devices and the removal of deleterious materials.
Planting of gully walls and the removal of plant pests
Removal of sand build up from lake shore outlets

A formal maintenance contract (Contract TDC/1516/155– Three Waters Maintenance Contract) has been awarded to provide maintenance, inspections, and reporting work for the stormwater network. The benefits that the maintenance contract for the Stormwater assets are: -

- Regular inspection and reporting on assets will allow the asset management system to be populated with condition assessment data (in accordance with the New Zealand Water and Wastes Pipe Inspection Manual (3rd edition, 2006) – thereby allowing optimal decision making (maintenance and renewals) in the future.
- Regular maintenance of stormwater assets – thereby minimising the risk of asset failure resulting in loss of service level and / or flooding / property or environmental damage.
- Addressing day-to-day issues.

The maintenance contract has been reviewed in light of the Comprehensive Discharge Consents that have been granted to ensure that they comply with the conditions of these Resource Consents and enable integration of condition monitoring and electronic data management systems and processes as they are developed.

The contractor is responsible for the placement and maintenance of Councils stormwater quality monitoring devices that collect samples of storm flows that are then analysed to determine flow quality.

Additional expenditure is required in the 25/26 year to renew the three comprehensive consents.

8.4.1.3 Stormwater Network Renewals

Renewal expenditure is major work that restores an existing asset to its original capacity or the required condition. By renewing plant equipment as required the quality level of service is met.

Council has undertaken comprehensive CCTV program to determine network condition. This program has concentrated on the older pipes and areas where trees would have effects on the integrity of the pipe network.

A large proportion of the stormwater asset is made up of a pipe network predominantly under ground, with a life expectancy of some 80-100yrs and a current age of the network is well below this. To date this has meant that there has been little in the way of a renewal program for this asset. There will continue to be the need for renewal expenditure on Lake Outlets, and this has mainly come from erosion damaging the outlet structures.

Condition data reflects that the underground asset is in a good condition with only localised issues. Due to the flat grade in Turangi, a significant amount of sediment was removed during the CCTV programed works.

Council has found numerous areas where the fibre cable recently laid has passed through either manholes or the piped network, which has generated localised flooding or sediment build up. Council is working with the network owner when these are identified to enable their removal.

Condition assessment of TDC storm-water infrastructure by area

CCTV condition assessments of approximately 35% of the storm-water assets across the Taupō district have been carried out to enable a basic determination of asset condition by area for renewal purposes. Each areas asset condition assessment carried out has been graded 1 – 5 as described in the table below. As more condition assessments are undertaken in the coming years a clearer picture will be achieved, and from this an improved renewal program for these assets.

Grade	Condition description and approximate remaining life assessment
1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
2	**Good condition:** Storm-water asset showing first signs of deterioration, asset is expected to meet (80 - 100%) of original life expectation

3	**Average condition:** Storm-water asset has deteriorated and the asset is expected to have (60 - 80%) of original life expectation
4	**Poor condition:** Storm-water asset has deteriorated significantly and the asset is expected to have (40 - 60%) of original life expectation
5	**Very poor condition:** Storm-water asset failing or high risk of imminent failure renewal needed within 0 - 3 years (0 – 40%) of original life expectation

Most storm-water assets had an install date of 1960/70s and had a life expectancy of 80-100 years. Most of the assets are now 40+ years old, 50% through their expected design life.

Storm-water condition assessment by area:

Area	Grade	Condition description/approximate remaining life assessment
ACACIA BAY	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
TAUPŌ	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
HATEPE	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
MOTUOAPA	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
TURANGI	3	**Average condition:** Storm-water asset has deteriorated and the asset is expected to have (60 - 80%) of original life expectation
PUKAWA	3	**Average condition:** Storm-water asset has deteriorated and the asset is expected to have (60 - 80%) of original life expectation

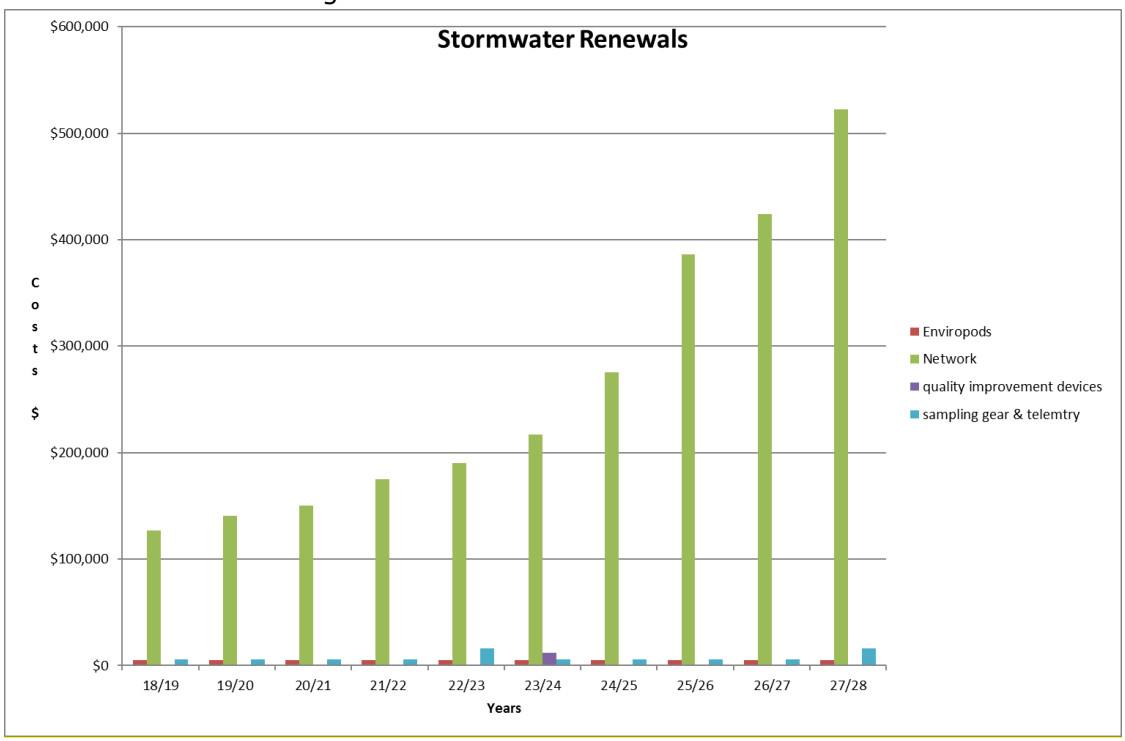
OMORI	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
KURATAU	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
WHAREROA	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)
WAIRAKEI	2	**Good condition:** Storm-water asset showing first signs of deterioration, asset is expected to meet (80 - 100%) of original life expectation
KINLOCH	2	**Good condition:** Storm-water asset showing first signs of deterioration, asset is expected to meet (80 - 100%) of original life expectation
MANGAKINO	2	**Good condition:** Storm-water asset showing first signs of deterioration, asset is expected to meet (80 - 100%) of original life expectation
WHAKAMARU	3	**Average condition:** Storm-water asset has deteriorated and the asset is expected to have (60 - 80%) of original life expectation
ATIAMURI	1	**Very good condition:** Storm-water asset should meet or exceed designed life expectation (100 % +)

Conclusion: From the information received so far the condition of the storm-water assets across the district is generally very good and it is expected that the bulk of the assets will meet or exceed their designed life expectation. There are some areas were the storm-water assets have deteriorated quicker than expected due environmental factors such as local soil conditions and ground movement.

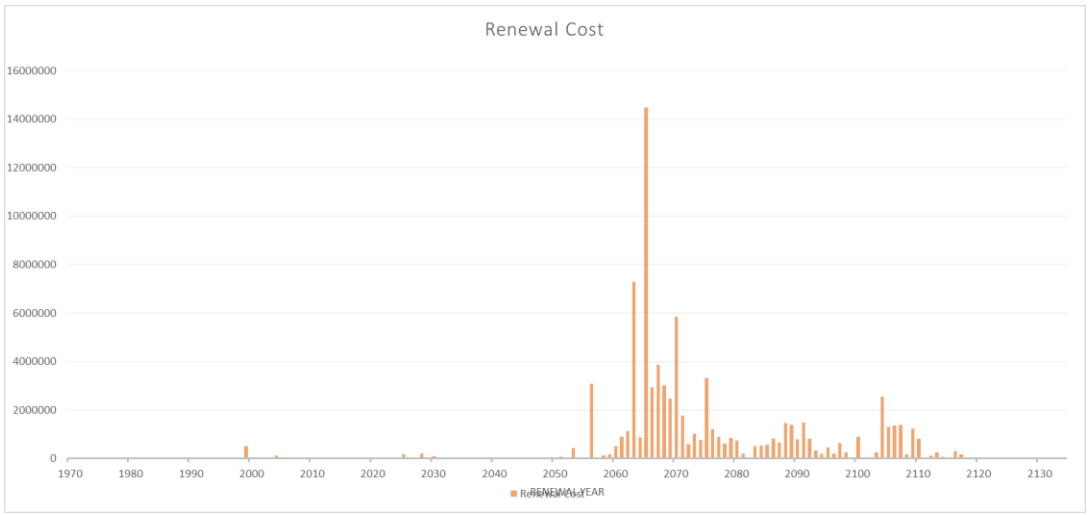
Renewal Spending

The CCTV condition assessment has identified pipes in Turangi, Whakamaru and Mangakino that require renewal over the next three years and so appropriate funding has been provided.

10 Year Renewal funding



The above graph shows the required funding levels over the next ten years based on condition, criticality and age. As Council has concentrated the CCTV work in areas outside of the Taupo Township, which makes up 60% of the overall network, the funding level outside of the ten-year window has been estimated to plateau. This is due to the bulk of the age based renewal cost not being until 2060. Long term funding estimates will change as more condition information is obtained.



Above graph identifies the age-based renewal funding, reflecting the 100 life given to a majority of the piped network. This funding profile will be adjusted, with some good quality condition assessed pipes having extended lives.

Forward CCTV program

Council has provided funding to allow for 10% of the stormwater network to be condition assessed each year. Data provided from this work will allow ongoing improvement to long-term renewal expenditure.

Over the next three years, the condition assessment program will concentrate on the network from Waitahanui around to Acacia Bay, concentrating first on the older network where the pipe grades are shallow. The works undertaken in Turangi has removed large amounts of sediment out of the network, so by focusing on the flatter grades Council should be able to remove sediment, restoring capacity and acquire good condition information.

8.4.1.3.1 Future Renewals 10yr only

	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
Enviropods	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Network	$ 126,757	$ 140,308	$ 150,096	$ 175,111	$ 190,351	$ 216,805	$ 275,346	$ 386,387	$ 423,697	$ 522,308
quality improvement devices						$ 12,000				
sampling gear & telemtry	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 16,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 16,000
inlets										
Total	$137,757	$151,308	$161,096	$186,111	$211,351	$239,805	$286,346	$397,387	$434,697	$543,308

8.1.1.4 Stormwater Network Creation

The Capex program maintains the ability of the Stormwater network to continue to provide for Stormwater disposal in the district. The capital program provides for pipe capacity issues, which are therefore backlog expenditure as well as stormwater quality improvement and erosion control measures.

The District stormwater network is created through a number of drivers, firstly by developers providing stormwater infrastructure as required by Councils code of practise and secondly by Council due to insufficient capacity or treatment ability.

Council's infrastructure strategy and growth model require consideration in regards to network development, but most infrastructure development is provided by developers and are consented through the Regional Council. Council then takes ownership of the new network after the development has been approved the infrastructure is adopted into Councils comprehensive consent.

Developer Created
This has seen in recent time more above ground stormwater networks that provide stormwater treatment prior to final disposal into receiving environments, meaning that Council will in the future inherit potentially less piped networks and more pond and gully based systems. Above ground, systems while far better at providing quality improvement inherently cost more to maintain but provide better environmental outcomes.

New developments may also incorporate other types of quality improvement devices that fit into the piped network; these will require ongoing maintenance expenditure.

Developments in previously undeveloped catchments (Green Fields) have to provide a Catchment Management Plan, these plans will provide development conditions based on the ability for the catchment to treat and dispose of stormwater adequately.

Council Created
The second driver for new or enlarged development of the stormwater network is due to changes in legislation (Resource Consents) which require better treatment than the existing network can provide.

Lack of capacity is also a driver, this may be due to changes in the disposal options for selected areas, such as Commercial and CBD areas that would want to fully develop properties, but must connect to a network to do so, thus requiring the network to be improved to provide the desired capacity.

A list of the proposed capital works is detailed below and is a mix of backlog works to minimise flooding effects and Stormwater quality improvement.
These projects include:

- Enviropod protection 5 new enviropods per yr. as required by section 30 of consent
- Brentwood gully culverts
- Kohineheke (Cresent) Reserve improvement device
- Two Mile Bay quality improvement device
- Turanga Place improvement device
- Opposite Mobile station Taupo lake front improvement device
- Hawaii street improvement device
- Puataata Rd improvement device

- Te Ritukehu street improvement device
- Kimberly Reserve pond and house removal
- Koha Rd detention
- Hawaii reserve detention pond
- Mangakino Golf Club pond & retic upgrade
- Northern Brentwood Gully Lakeshore erosion control contribution
- Paenoa RD pipe diversion single barrel to south gully
- Henry Hill Rd Investigation
- Overland flow path remediation / flood model
- Rangatira Drive retic upgrade
- Quality Improvement Device's selected outlets
- Kahu Rd Mangakino Retic
- Norman Smith Control gates improvement device
- Redoubt street improvement device
- Elisabeth street flooding options

Capital Program validation

Enviropod Protection
The 5k per year allows five additional enviropods to be installed into the Stormwater network in the district per year. Council's Comprehensive consent has condition 30, which requires Council to have a quality improvement program.

Enviropods will be placed along high trafficked areas progressively working away from the central CBD areas in the district.
Enviropods are catch bags that fit into storm water cesspits and capture gross pollutants prior to them entering receiving environments.

Driver is resource consent and level of service

Mangakino pond and retic upgrade
The December 2009 report undertaken by CPG for Council identified that the stormwater network in Mangakino is sized generally for a 2-year event. The report also identified the stormwater manhole and infrastructure near the Golf course will regularly flood in under a 1-year event, this is supported by erosion on the access Rd and a large rock that has been placed onto the manhole lid to keep it from lifting.
The infrastructure at this point has multiple lines joining the single discharge line to the lake, thus causing back up in the line and causing the manholes up stream to lift regularly. This project will divert stormwater into a stormwater detention pond nearby that will have a high-level discharge to the golf course as an overland flow.

Driver is level of service

Quality improvement devices
The placement of enviropods was the first of the treatment train to provide quality improvement from the main stormwater outlets to the Lake. The second part of this treatment process was to install CDS or similar units as recommended by the Opus report to further capture gross pollutants before they reach the receiving environment.

A recent beach inspection after a period of no rainfall identified a large number of gross pollutants around the major outlets to the Lake. Most of the gross pollutants were plastic in

nature ranging from plastic bags to bottles and other material that had washed down the network.

Councils monitoring program identifies that the first flush is still placing significant amount of contamination into the lake, with first flush readings above parameters for a number of indicators.

CDS units being the second part of the treatment train will capture heavy metals as they are attached to the fine sediments. (Opus, Taupō Contaminant Modelling and Treatment Options 2008)

The installation of the "Hole In One" Downstream Defender has resulted a visual quality improvement of the storm flows out of this outlet. Comments from the golf ball divers reflects a significant increase in water quality. The first clean out of the device removed four cubic metres of sediment and floatable contaminates.

Treatment Efficiency	Total Sediment (TSS) % Reduction	Total Zinc % Reduction	Total Copper % Reduction	Total Hydrocarbons % Reduction
Enviropods and CDS Units	81.8	73.5	77.5	85.1

Stormwater quality improvement devices are programed for the major outlets that feed directly into the lake or river receiving environments and that have large upstream catchments, which convey significant contaminant loads.

This Asset Management Plan builds on the original quality improvement program and looks to improve discharge quality from large catchments and high usage i.e. where there are high vehicle numbers or industrial areas where the pollutant load is high. Areas where outlets discharge to gullies and ponds are excluded as these areas allow for pollutant capture.

The provision of quality improvement devices would fall under condition 30 of the resource consent that requires a quality improvement program

The driver is Resource consent and level of service.

Overland Flow Path Remediation

Council has a responsibility to manage the way land is used to avoid or mitigate the effects of natural hazards (s31 of the RMA1991)

Section 35 of the Resource Management Act (1991) requires Councils to monitor the environment, and maintain records of natural hazards.

Councils Lidar survey work to date has identified where flow paths will be in a 1:100-year event and can provide water depth and velocity. This work has not been validated as the piped network has not been included, but the model has identified a number of areas where stormwater will effect property and lead to flooding. The funding identified is to allow on site field verification works to continue.

To get this project to the final stage of placing information on to Lim report there needs to be a cross organisational team established which builds on the experience of the Lake flooding process as well as part of the IT team to make sure that the information captured is in the most usable form. To fully validate the model assumptions Council may need to develop a model of the storm water network, which would come at considerable cost.

An alternative option is to develop a model of the network for areas at risk only, which would reduce the overall cost and this could be funded over time prioritised on the overall risk to properties. This would mean that the Lim information would not be available in the short to medium time frame but the model would still be a great asset to determine where flooding exists and to plan for remedial actions. Further funding needs to be allocated to undertake further modelling.

Driver is risk and level of service

Brentwood Gully culverts / contribution to Lake Outlet
The northern Brentwood gully currently does not have any outlet and relies on soakage, this has seen a number of large Tomo's develop in the bottom of the gully that have been continually filled over time but Tomo's place significant risk to nearby houses.

The provision of the culverts is set to coincide with the development of the land to the East of Acacia Bay and nearer to the lake. The culverts would go under Acacia Bay Rd with stormwater flowing down the incised gully and into the Lake. Some agreement around the project with the developer would have to be undertaken, and the project timing has to be finally determined.

The timing of the current culvert infrastructure is an assessment of the current housing market, which could change which means that funding may need to move depending on the developer's decision to develop the land.

There are also issues around the outlet to the Lake and ensuring that the flow is accommodated down the gully system if flows from other catchments were included.

Funding contribution towards a Lake outlet has also been allowed for, with negotiations around funding still required with the developer. The funding provided is a part share of the outlet cost.

Driver is Health & Safety

Kimberly Reserve House Removal / Pond

Overland flow path maps as well as historic data show that the house at the bottom of the reserve has and will flood above the habitable floor level.

The project purchases the house for removal as uses a portion of the Reserve to provide additional detention of storm flows.

Driver is service level and Health & Safety

Henry Hill Investigation
The removal of the house and the provision of additional detention will not fully reduce the risk of downstream properties and this project is about investigating possible network options.
Driver is service level and Health & Safety

Koha Rd Detention
Overland flow path maps as well as historic data show that storm flows pass through Koha road properties from the low point in Tamatea Rd. this project uses a portion of the Tamatea reserve to provide additional detention to reduce flooding effects downstream.

Driver is service level and Health & Safety

Hawaii Reserve detention pond
Overland flow path maps as well as historic data show that storm flows pass the property at the bottom of the reserve, being a Hotel complex. This project would use a portion of the reserve to retain flow and provide additional detention to reduce flooding effects downstream.
Driver is service level and Health & Safety

Paenoa Rd pipe diversion to southern gully
This project is subject to agreement with a number of parties to lessen the effects on the properties at the end of Paenoa Rd. to date it has been difficult to agreement as to where the storm flow should go. The local landowners do not want flows across their property and consider the upstream developer should accommodate flow over his land to the north. This issue has been exacerbated by the combination of upstream catchments into one.

This project would be a council share of the total solution to take one of the three barrels that take flow under Acacia Bay road to the gully south of the current housing development.

To achieve the outcome the developer or the regional council would need to agree to fund diversion of one of the pipes to the northern gully on the developers land. In addition, Paenoa landowner agreement would also required and to date this has not been feasible as the southern gully has cultural significance.
Driver is service level and Health & Safety

Rangatira Drive Mangakino Retic Upgrade
Overland flow path maps as well as historic data show that storm flows pass the property Downstream of the section or road where the land use changes from rural to urban

This project is to increase the size of the network, which is currently sized for a 1:5yr event.
There is also a need to determine options with the farm owner to divert flows from the rural land away from the town.
Driver is service level

Kahu Rd Mangakino Retic Provision
This project funds the Stormwater portion of an overall street upgrade project undertaken by the roading team. Currently there is not Stormwater infrastructure in the street and the road suffers from surface flooding.

Norman Smith street improvement device
This device extends the quality improvement program to cover the outlet that discharges just upstream of the control gates on the Waikato river an comes from the Nukuhau catchment

Redoubt Street, improvement device

This device extends the quality improvement program to cover the outlet that discharges just upstream of the control gates on the Waikato river an comes from lower Spa road and CBD catchment

Elisabeth Street flooding options

The overland flow path model identifies flooding impacts on properties near Elisabeth Street in a 1-100 year flood event. The funding provides for an investigation into possible mitigation options

Table 8.6 Capital expenditure

		Stormwater Capital Expenditure									
		18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28
1	**Enviropod protection**	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00	$ 5,000.00
2	**Brentwood gully culvert**	$ 15,000.00	$ 10,000.00	$263,000.00							
3	**Kohineheke Cresent Reserve**	$ 133,000.00									
4	**Two Mile Bay (Boat Ramp) Improvement Device**		$ 142,000.00								
5	**Turanga Place Improvement Device**			$137,000.00							
6	**Mobile station Taupo lakefront improvement device**				$ 145,000.00						
7	**Hawaii street improvement device**					$ 257,000.00					
8	**Puataata Rd improvement device**						$ 160,000.00				
9	**Te Ritukehu street improvement device**							$160,000.00			
10	**Kimberly Reserve detention pond & retic solution**								$ 25,000.00	$ 80,000.00	$ 575,000.00
11	**Koha Rd flooding prevention**				$ 10,000.00	$ 80,000.00	$ 760,000.00				
12	**Hawaii reserve detention pond**			$ 10,000.00	$ 50,000.00						
13	**Mangakino Golf Club detention pond & Retic**				$ 18,000.00	$ 127,000.00					
14	**Brentwood Gully Lakeshore eroison control contribution**			$110,000.00							
15	**Paenoa RD pipe diversion single barrel to south gully**			$ 25,000.00	$ 297,000.00						
16	**Henry Hill Rd Investigation**										
17	**Overland flow paths / flood model**	$ 20,000.00	$ 20,000.00	$ 20,000.00	$ 10,000.00	$ 10,000.00	$ 10,000.00				
18	**Rangatira Drive Upgrade**										
19	**Kahu street mangakino retic**	$ 80,000.00									
20	**Quality Improvement devices on selected outlets**										
21	**Norman Smith at Control gates improvement device**								$150,000.00		
22	**Redoubt street improvement device**									$ 150,000.00	
	Elisabeth street flooding options							$ 20,000.00			
	Totals	**$ 253,000.00**	**$ 177,000.00**	**$570,000.00**	**$ 535,000.00**	**$ 497,000.00**	**$ 935,000.00**	**$185,000.00**	**$180,000.00**	**$ 235,000.00**	**$ 580,000.00**

8.1.1.5 Stormwater Network Disposal

Council does not dispose of Stormwater infrastructure, as Council needs to be able to continue to control the infrastructures performance.

Where privately owned gully systems act as overland flow paths, Council will work to protect these flow paths into the future to prevent development in these areas and to remove obstructions from flow paths to avoid the risk of flooding.

Gully systems also provide additional benefits over and above the conveyance of stormwater, in that they can act as passive transport routes and can enhance the natural environment to attract native bird species.

Assets disposed of out of Council's stormwater network will also have to be removed from councils Comprehensive discharge consent, and will need a business case provided to the SLG and or Council to approve.

8.4.2 RESOURCE CONSENTS

TDC have a set of Comprehensive discharge consents from Environment Waikato, which expire in 2027 that cover all discharges from Councils stormwater network in the district.

Site	Resource Consent number	Renewal date
Taupō Urban Areas Taupō (& Eastern Bays) Waitahanui Acacia Bay Kinloch	105048	15 June 2027
Turangi Urban Areas Turangi Tokaanu Motuoapa Omori/Pukawa/Kuratau Whareroa Tauranga-Taupō Hatepe	105049	15 June 2027
Waikato Urban Areas Wairakei River Road Atiamuri Whakamaru Mangakino	105050	15 June 2027