DRAFT Water Supply Asset Management Plan 2015-2025

Nelson City Council
te kaunihera o whakatū

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WATER SUPPLY
Asset Management Plan

2015-2025

Author:

Phil Ruffell, Senior Asset Engineer Utilities

Review and Approval:

Alec Louverdis

Group Manager Infrastructure

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Cover Photos:
375mm diameter Butterfly Valve
Stoke High Level Reservoir

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INTRODUCTION

This Asset Management Plan is produced for the public water supply assets owned and managed by the Nelson City Council and provides a 12 year outlook commencing July 2015. The Plan identifies issues that underpin expenditure and documents the features, risks and levels of service associated with the effective, sustainable management of the water supply assets.

Central Government has signalled a likely requirement for Councils to develop an infrastructure strategy covering the foreseeable issues associated with key infrastructure for a 30 year future timeframe.

In order to contribute to this strategy financial tables for the 30 year period have been prepared for this asset management plan.

Assets included in this Plan

Nelson City Council abstracts water from the Roding, Maitai South Branch and Maitai North Branch Rivers for supply to the urban areas of the City. The water is coarse screened at the intakes and conveyed by raw water trunk mains to the Water Treatment Plant at Tantragee Saddle which was commissioned in August 2004. Supply to the lower levels of Stoke and Tahunanui is available in an emergency from Tasman District Council.

The water supply asset extends from the source water intakes in the water catchments, to the point of supply at individual customer's property boundaries. It includes dams, intake structures and screens, tunnels, a Water Treatment Plant, trunk mains, secondary mains, rider mains, services, valves, hydrants, non-return valves, pressure reducing valves, pumps, reservoirs, and water meters.

The replacement value (2012) of the water supply infrastructural assets is $225.5million.

Goal of the water activity

To provide a water supply to Nelson City that is capable of abstracting, treating and distributing potable water in an efficient, safe, reliable and sustainable way whilst ensuring that the cultural interests, ecological and recreational values of water sources are recognised and enhanced.

Rationale for Council's involvement

The Nelson City Council is the predominant supplier of reticulated water in Nelson City. The Councils role in this area has been established since the earliest days of the city's history.

Support for Council continuing in this role comes from the following legislation.

Public Health and Safety: Adequate potable water is essential for community well being - The Health Act 1956 places an obligation on Council to improve, promote and protect public health within the District.

Legislative requirements:

The Nelson City Council is a local authority established under the Local Government Act 2002 (the Act) with purpose and responsibilities set out in the Act. In particular the purpose as it relates to infrastructure is as follows:

10 Purpose of local government

(1) The purpose of local government is—

a) to enable democratic local decision-making and action by, and on behalf of, communities; and

b) to meet the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions in a way that is most cost-effective for households and businesses.

(2) In this Act, ***good-quality****, in relation to local infrastructure, local public services, and performance of regulatory functions, means infrastructure, services, and performance that are—*

(a) efficient; and

(b) effective; and

(c) appropriate to present and anticipated future circumstances.

and the Act further defines core services to the community as:

11A Core services to be considered in performing role

In performing its role, a local authority must have particular regard to the contribution that the following core services make to its communities:

(a) network infrastructure:

(b) public transport services:

(c) solid waste collection and disposal:

(d) the avoidance or mitigation of natural hazards:

(e) libraries, museums, reserves, recreational facilities, and other community infrastructure.

Water supply is a network infrastructure (sec 197(2)) and a water service (sec 124).

Council has specific obligations under section 130 of the Act to continue to provide existing water services. These also recognise the requirement to take a sustainable development approach, set out in section 14 of the Act, which takes into account:

- the social, economic and cultural interests of people and communities; and
- the need to maintain and enhance the quality of the environment; and
- the reasonably foreseeable needs of future generations

Reliable provision: Human health, tourism and industry, in particular, rely on the reliable provision of this service - The Local Government Act 1974 provides the authority for the Council to own and operate the water supply service.

Water Supply Priorities for the period 2015 to 2025

Council's priorities between 2015 and 2025 for the water supply activity will focus on the following areas:

- Fire Flows are lower than desired in many areas as a result of the 2008 NZ Fire Service changes to how distances from hydrants are measured;
- Renewal of the resource consents for water extraction from the Maitai and Roding rivers by 2017;
- Te Tau Ihu Settlement Bill
- Water losses;
- Natural Hazard Security of the network in light of the recent Canterbury Earthquakes and storm events, including wider network hazards- Earthquake fault line, liquefaction and climate change;
- Higher than desirable pressures still exist in parts of the network resulting in greater maintenance costs and water losses;

- Microbiological and chemical Water Quality issues have been identified in previous water supply grading exercises;
- Ongoing risks of backflow contamination exist;
- Waimea Water Augmentation Committee's proposed dam on the Lee River at Brightwater;
- Integrating supply with Tasman District Council;
- Renewals Strategy;
- Recovery works following extreme rainfall event in December 2011, expected to be completed by July 2015;
- Condition Assessment of older pipework;
- Supply to elevated areas and future development areas;
- Existing Maitai concrete pipeline between the treatment plant and the city;
- SCADA (Supervisory Control And Data Acquisition). Review and upgrade of radio telemetry;
- Additional storage reservoir in Atawhai Area;
- Sustainable Development;
- Water Treatment Plant. Membrane replacement and move to using carbon dioxide for the foreseeable future to moderate acidity of the raw water and improve the effectiveness of treatment chemicals;
- 30 year Infrastructure Strategy signalled in the Local Government Act 2002 Amendment Bill (No 3).

Fire Flows

The public supply is designed to provide an effective fire fighting network. Hydrants are installed on all service mains in urban supply areas in accordance with the New Zealand Fire Service Firefighting Water Supplies Code of Practice.

The New Zealand Fire Service issued a revised Firefighting Water Code of Practice in 2008 with the result that fire flows in the city are now lower than desired in many areas largely as a result of the changes to how distances from hydrants are measured.

The required flow for single or multi-unit housing (but excluding multi-storey apartment blocks) is 25 litres per second with a minimum of 12.5 litres per second from a hydrant within 135 metres of the risk and a further minimum of 12.5 litres per second from another hydrant within 270 metres of the risk.

Previous versions of this code of practice measured the distances from properties to fire hydrants as a radius centred on the property, the current version now measures the true "along the road" distance. This has had the effect of now increasing the number of properties that do not currently meet the distance requirement. The exact number of properties affected are expected to be confirmed in 2013/14.

The Fire Service Code of Practice confirms that where there is a reliably calibrated and accepted system for computer modelling of flows in a reticulated water system, the Fire Service may accept the outputs from such modelling in place of testing certain fire hydrants.

$600,000 is included in the Renewals budget over the first six years of this plan i.e. $100,000 per year from 2015/16-20/21, for upgrades to the water network in areas where the fire flows are not being delivered. The areas to be upgraded will be identified using the water network model.

Resource consents for water extraction

Nelson City draws its public water supply from three sources:

- A run of river source from a weir on the Roding River;
- A run of river source from a weir on the South Branch of the Maitai River;
- An intake tower in a storage dam on the North Branch of the Maitai River;

Nelson City Council has three Resource Consents for the water supply covering the abstraction of raw water from both the Roding and Maitai rivers, the continued operation of the Maitai Dam on the North Branch and intake weir on the South Branch of the Maitai River and the Dam/ intake weir on the Roding River. The consents and expiry dates are as follows:

- RM 960396 Maitai River expires 1/02/2017;
- RM 025151 Maitai River expires 1/02/2017;
- RM 975374 Roding River expires 1/10/2017.

A single new resource consent application will need to be lodged in 2015/16 to allow for a hearing and possible appeals, prior to the expiry of the existing resource consents.

In 2013 Council approved the engagement of Cawthron Institute to provide professional advice to Council through the resource consent process.
Professional planning advisers and water engineers were engaged in 2013 to begin the preparation of the consent application.

The existing Maitai and Roding sources can provide sufficient water to meet the City's needs in a 1 in 60 year drought for the foreseeable future. Provision of a rubber weir on top of the Maitai Dam spillway could increase the water storage by 10,000m^3 (if required), equivalent to 20 years demand growth. Sufficient water of high quality is therefore available for urban supply for the foreseeable future.

The removal of gravel from behind the Roding dam and the possible enhancement of lake storage have been identified by Council as areas to be investigated.

Te Tau Ihu Settlement Bill

The Te Tau Ihu Claims Settlement Bill (The Bill) provides statutory obligations for Council in respect to general decision making processes. The Bill is the culmination of Central Government's resolution of claims lodged by eight iwi for redress of past wrong's and provides for Cultural, Relationship and Financial redress.
Statutory acknowledgments may impact works programmes within the Asset Management Plan and the eight iwi will potentially be considered as affected parties under section 95E of the Resource Management Act, which the settlement legislation provides for. The proposal to establish a Freshwater Advisory Committee under the settlement legislation would be a potentially effective tool for achieving a forum to involve the iwi of Te Tau Ihu in the development of future asset management planning, infrastructure strategies and Long Term Plans.

Water Losses

All water reticulation networks are prone to leakage to some extent. Leakage occurs both from the public system and from individual customer's plumbing. Council estimates that the city network has water losses of approximately 30% of the water that leaves the treatment plant. This amounts to an average 2.4 million cubic metres per year. The level of losses is arrived at by comparing the volume of water leaving the treatment plant with the volume that is recorded by customer's meters. Being able to quantify this figure is very important and improving the accuracy of records is currently a focus of the activity. A programme of repairing reported leaks and proactive leak detection is included in the activity budgets.

Networks also have other losses which include:

- Fire fighting and hydrant flow testing;
- Overflows at reservoirs and losses during cleaning;
- Mains testing and flushing;
- Unknown connections;
- Use by contractors.

Collectively this total water loss is referred to as Unaccounted for Water (UFW).

Controlling UFW can significantly reduce demand. UFW control also has an environmental benefit as it reduces the quantities of water that are required to be abstracted from the river sources.

Natural Hazards

Because the Maitai Water Supply Scheme (Dam and Pipeline) is a vulnerable asset, it was designed to withstand 1 in 1000 year seismic and flood events without damage.

Key structures are designed to withstand maximum credible earthquake and probable maximum flood without collapse (but not without some damage, possibly requiring decommissioning and major repair work).

Recent work by Council has focussed on natural hazards that might impact on the city, in particular:

- Direct damage from Earthquake shaking;
- Damage from liquefaction in susceptible areas;
- Damage from Tsunami;
- Damage from Flooding and major storm events;
- Impact of potential climate change and sea level rise.

The Maitai pipeline between the Dam and Brook Street has been identified as an extreme risk from damage due to earthquake displacement, windfall trees or slips.

The pipeline supplies two thirds of Nelson's water, is above ground, on a sidling bench along the hillside. Repair/replacement of, for example, a 5m length of damaged pipe would take 24-48 hours depending on location (and has proved to be the case in 2008 when high winds brought down trees onto the pipeline). When full, city reservoirs can hold sufficient water for approximately 24 hours average consumption. The more usual capacity, allowing for filling time and continuing use, is 8-10 hours of daytime demand.

Construction of a new buried pipeline between the dam and the Water Treatment Plant was completed in 2013/14.

Design of a new pipeline between the Water Treatment Plant and Westbrook Terrace is scheduled for 2014/15 with construction to begin in 2017/18.

The Roding Water Scheme has low and moderate risks to structures, other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank. A 30m section was washed out in the large flood of January 1986. Subsequently the pipes were more securely fixed and rock armouring was constructed in front of the piers. There is a possibility that a similar large flood could damage the pipe again. Reinstatement would take 2-3 days, during which time the Maitai river and Tasman District Council would be the only sources supplying the City. This risk is acceptable given the large storage volume of the Maitai dam.

While automatic chlorination exists at the water treatment plant, a stand-alone portable chlorinator unit, run by a small petrol generator and using sodium hypochlorite is also held there in case of emergency. This has the capacity of dosing 30l/h of sodium hypochlorite, which is sufficient to treat the full Maitai flow of 37,000m3/day.

A separate Emergency Management Plan has been developed covering Risks and Actions specific to Water Treatment Plant.

A portable chlorinator alternatively powered by either a petrol motor or an electric motor is held at Princes Drive for emergency chlorination using High Test Hypochlorite (HTH) powder. This has a capacity of dosing 24kg of chlorine per hour. This is sufficient to treat 12,000 m3/hour of water at 2 g/m3 (= 2ppm or 2mg per litre).

Risks posed to the trunk mains range from low to high. The high risk is from earthquake and storm events where sections of key mains could be damaged. Presently stocks of repair materials are held to allow single repairs to each main.

Mutual aid would be required from other water supply authorities to reinstate trunk mains in the event of multiple major breaks. Refer to section 4.5.2 for details of the Mutual Aid Plan.

The Clearwater, Stoke, Walters Bluff, and Observatory Hill Reservoirs have been constructed to category 2. The large and small Thompson Terrace Reservoirs have been strengthened to category 2 and category 3 respectively.

Note: Category 2 is a 1 in 1000 year earthquake and category 3 is a 1 in 333 year earthquake.

All large reservoirs have been fitted with automatic seismic shut off valves. When excess flow from the reservoir is detected (such as from a broken outlet or damaged trunk main) the outlet valve is automatically shut and an alarm sent to the Duty Officer via the SCADA system. This acts to protect structures and ground adjacent any failure and maximises the volume of water retained in reservoirs during emergencies.

As a result of the Christchurch earthquakes Council is currently undertaking a seismic review of the critical elements of the above ground network, starting with the storage reservoirs and sections of the Maitai Dam to the treatment plant trunk main looking at the direct impact of earthquake shaking. Future work will focus on near fault proximity of the network, possible impacts of liquefaction on existing and future infrastructure, impacts of flooding and the long term planning required as a result of climate change.

Water Pressure

With the exception of hillside development served by local storage tanks and pressure pumps, provide a water supply of suitable pressure such that:

i) The maximum fluctuation between the pressure at the lowest and highest draw times of the day at each property does not exceed 35% from the mean value.

ii) The minimum working head at the ground floor level of each property is not less than 300kpa (30m head) excluding friction losses in the private pipework.

iii) The maximum static head at the ground floor level of each property does not exceed 900kPa (90m head).

There are parts of the network that do not meet these criteria. Higher pressures cause premature failure of pipes and fittings while lower pressures can impact on the use of modern appliances such as washing machines, dishwashers and mains pressure hot water cylinders. Households affected by these issues currently make their own arrangements by installing pressure reduction valves or small pressure pumps.

Water Quality and Grading

Each year the water supply and reticulation is able to be graded by the Ministry of Health against the Drinking Water Standards for New Zealand 2008. The grading is voluntary and arrived at by the review of the source, treatment and distribution against set criteria. Demerit points are awarded when the criteria are not met.

The Ministry of Health suggests that the minimum water supply grading for a community size over 10,000 be:

- Source and treatment B (satisfactory, very low level of risk when the water leaves the treatment plant)
- Distribution a (completely satisfactory, extremely low level of risk).

However, it stresses that irrespective of size a community should aim for as high a grade as possible. Nelson City Council water supply was last graded in 2011 and was assessed as:

- Source and treatment A (completely satisfactory, extremely low level of risk)
- Distribution b (satisfactory, very low level of risk)

The construction of the Water Treatment Plant achieved A for source/treatment, but the present b for distribution is below the Ministry of Health suggested standard.

The grading assessment carried out in 2011 identified issues with the following areas of the distribution network:

- Pipe age and condition. 1 demerit.
- Leak detection and water loss. 2 demerits.
- Backflow prevention. 4 demerits.
- Supply (high) pressure. 1 demerit.
- Free available chlorine monitoring. 1 demerit.

- Microbiological compliance. 4 demerits.
- Chemical compliance. 2 demerits.

The above issues highlight the emphasis placed on a secure reticulation network and the need to keep the network at a good level of maintenance and condition.

In addition to the water supply grading scheme the Ministry of Health monitors networked water suppliers to ensure that their supply meets the Drinking Water Standards under the Health Act 1956.

The Nelson City Council supply is assessed by the Ministry of Health on an annual basis for compliance with the drinking water standards.

Backflow Prevention

The protection of the quality of the water supplied to customers is a vital responsibility of any water supply authority. While the quality of the water entering the system is known, chemical or microbiological contamination can occur in some circumstances from water re-entering the system from consumer's premises should fittings be wrongly connected or a temporary vacuum develop in the line. The risk from activities such as undertakers, doctors and dentist surgeries are readily understood, however similar issues can also arise in commercial kitchens where food is prepared and cleaning chemicals are used.

Increased emphasis has been placed on Risk Management by the Ministry of Health in recent years. The 2007 amendments to the Health Act require that water suppliers prepare Public Health Risk Management Plans for their systems, and include the management of risk from backflow. Council's Public Health Risk Management Plan was completed in 2012.

Installation of backflow prevention devices is programmed for the next ten years.

Lee River Dam (Tasman District Council)

The Waimea Water Augmentation Committee (WWAC) was formed to pursue an additional water source for the Waimea Plains. Nelson City Council is represented on WWAC and has provided approximately $270,000 to support their work. In 2013 WWAC recommended the construction of a 14 million m3 detention dam on a site on the upper Lee River at Brightwater. Water would be released from the dam and enter the underground aquifer via the tributaries of the Waimea river. It would then be pumped from the aquifer by users on the Waimea Plains. Bores for the Waimea area of the Tasman District Council water supply are sited near the Appleby Bridge and will benefit from a more secure volume of water in the aquifer as a guard against salt water intrusion. Volumes required for urban supply are small when compared with agriculture and horticulture irrigation requirements, so the latter are likely to be responsible for funding the major portion of the construction costs.

Tasman District Council is in the process of considering submissions to a proposed plan change that would make provision for the construction and operation of the dam.

Nelson City Council is yet to decide on whether or not to provide further monetary support for the project. From a strict asset management point of view Nelson City's current raw water supply from the Maitai and Roding rivers is expected to be able to supply the needs of the city for the foreseeable future. The trend in water intensive processing industries in Nelson is also away from the traditional areas of fin-fish and shellfish activities. Efficiency in water use is also a feature of new processing facilities constructed in recent years. The cost of Nelson City establishing separate water bores at the Appleby Bridge well field and piping the water to Nelson for treatment has previously been estimated at $14.7million (2008).

For the city to need access to a further water source, demand would have to exceed approximately 50,000m3 per day. This would be a considerable increase in the 2011/12 peak daily demand of 28,000m3.

The removal of gravel from behind the Roding dam and the enhancement of lake storage has been identified by Council as an additional source of water storage for the city that may also provide benefits to Tasman District.

Integrating supply with Tasman District Council

Historically Nelson City and Tasman District have linked water supplies with Tasman District supplying a small section of the southern part of Nelson City as well as the Wakatu Industrial Estate. Nelson City supplies Richmond the lesser of 909m3 of water/day or 1/15 of the Roding supply rate, arising from legislation covering the construction of the Roding Dam.

Nelson City Council and Tasman District Council have entered into an Engineering Services Agreement (2005) formalising the above. This agreement combines the other cross boundary infrastructural service of sewer reticulation to a small number of properties adjacent Champion Road, but excludes the supply of water to ENZA and the Alliance Group processing plant as separate agreements remain in place between these industries and the Tasman District Council.

As of March 2014 the agreement is being re-negotiated. Tasman District Council's preferred option is to become a bulk water supplier to Nelson City Council for the residential areas with status quo continuing for the commercial/industrial areas. In that capacity Tasman District Council would supply water to a metered point and Nelson City Council would become responsible for the reticulation and customer billing/enquiries.

This approach would require some adjustment of the restrictions that are put in place by Nelson City Council in times of water shortage (drought/emergency) in order to reflect the different raw water supply source of the Tasman District Council scheme.

The current agreement remains in force until such time as a new agreement is finalised.

Renewals Strategy

The reticulation system has to reliably transport the required volumes of water from the trunk mains and reservoirs to the consumers, at sufficient pressure while maintaining quality. The water network is made up a range of materials such as cast iron, asbestos cement, concrete, uPVC, polyethylene, concrete lined steel and ductile iron. Currently Council's renewal strategy is based on replacing asbestos cement pipes that were installed in the 1950's and are showing higher than expected failure rates. Further investigation of the older sections of the network are needed in order to confirm the condition of the steel and iron pipes. As the current asbestos cement pipe renewal programme is expected to continue for the next 8-10 years, enhanced condition assessment of the other pipe types is expected to be part of the renewal strategy from years 5-8.

Recovery works post December 2011 and April 2013 storm events

As with buildings and fittings Council insures items of infrastructure for damage in these events. Infrastructure is insured through the LAPP (Local Authority Protection Programme Disaster Fund) scheme. This is a mutual pool created by local authorities in 1993 to cater for the replacement of infrastructure following catastrophic damage by natural disaster. The recent earthquakes in Christchurch coupled with the flooding events throughout the country have reduced the funds ability to support Councils' with their recovery works after disasters.

December 2011

An extreme rainfall event occurred throughout Nelson and Tasman in December 2011. The event was notable for the total volume of rain that fell over a 48 hour period, being the greatest for at least the past 220 years anywhere in the urbanised areas of New Zealand. The long duration of relatively low intensity rainfall led to hillsides becoming saturated, with multiple slips occurring throughout the city.

The water network itself generally coped very well with this event as flows in rivers were even and at levels that did not threaten reticulation. The greatest impact was on pipework from the Maitai dam to the treatment plant and a small section of main at the Glen where slips came close to undermining sections of pipe. Repair works at the Glen were completed in 2013. Repairs to the Maitai pipeline at Poleford Bridge and the Arboretum adjacent the Maitai Camp are ongoing in 2014.

April 2013

No damage was sustained by water network during the April 2013 storm event.

Condition Assessment

Historically asset monitoring to determine condition has been subjective based on local knowledge and experience. Formal procedures now exist to assess asset condition.

The development and continued use of condition assessment data will support preparation of predictive decay curves for particular asset types and hence permit prediction of remaining life. Consideration of economic influences and other factors will also be required in the adopted life for the asset type.

By considering the current condition point on an assumed decay curve, the profile can predict the effective life (time) before failure. This failure time can be the physical end of life, minimum level of acceptable service, or limit of capacity of the asset.

Supply to elevated areas and future development areas

In some of the more recent hill top developments above the reliable water supply contour level of 110m, the issues of continuity of supply and pressure fluctuations have been resolved by the installation of storage tanks and in some cases pump stations (e.g. Observatory Hill, Austen Ward Heights, Panorama Drive, Springlea, Wastney Terrace). To avoid the need for water towers and allow maximum land development, the standards have been eased so that dwellings with ground floor level less than 30m below the floor of the reservoir are required to install a domestic pressure pump and tank to ensure adequate pressures. Oversize service connections are provided to minimise friction losses. The system works well as the presence of the storage tank ensures continuity of supply.

Council property database contains entries advising of these special circumstances.

A Map of the areas zoned for growth but constrained by lack of services is attached in Appendix I. Construction of services to these areas should be carried out in line with Council's prioritisation policy. Appendix I sets out a draft "INFRASTRUCTURE PLANNING TOOL FOR GROWTH PROJECTS" that reflects infrastructure prioritisation factors. In 2014 Council is expected to consider a proposal to review the Nelson Resource Management Plan and look at wider prioritisation criteria for future development areas. Infrastructure planning will align with any new policy that is developed.

A specific project has been identified to update desktop investigations, carried out in the past, looking at servicing constraints to areas currently zoned for residential development but restricted by a services overlay.

Existing Maitai concrete pipeline

The Maitai pipeline between the Maitai Dam and the Water Treatment Plant transports the majority of the water used in the City. It has numerous small shrinkage cracks and is vulnerable to slips from above and below the pipeline.

Council completed the construction of a duplicate Maitai pipeline between the dam and the Water Treatment Plant in 2014 but will continue to use and maintain the existing pipeline, to reduce pumping costs, for as long as it is viable to do so. The replacement of the section between the Water Treatment Plant and Westbrook Terrace is shown in this Asset Management Plan for construction in 2017/18.

Supervisory Control And Data Acquisition (SCADA) Review and Upgrade

All of the Nelson City Council's strategic utility components are monitored remotely, at Civic House or by duty staff using laptop computers at home, utilising a telecommunication system called SCADA. SCADA has given Council the ability to ascertain faults and instigate repairs without affecting the service to the consumer and has significantly increased efficiency and reliability of the utility schemes. This function has become critical to the operation of the network and has been supported by Council's

in-house Information Management team up to now. There is a need to upgrade this package and at the same time consider how the technical requirements can be accommodated within the essentially office based computer packages used by the majority of Council staff.

Additional storage reservoir in Atawhai Area

To maintain reasonable security of supply Council has a network of larger water storage reservoirs throughout the central city and Stoke. Currently there is approximately 21,000 m3 of storage throughout the city providing approximately 1m3 for every property in the city. Current maximum one day demand for the city is approximately 28,000m3. The Atawhai area has one large (2,500m3) reservoir at Walters Bluff and a number of small tanks in the various valleys beyond. As growth increases in the North of the city there is the need to install an additional large reservoir further North to provide for future growth and enhance the level of water stored close to urban areas in event of emergencies. Construction of an additional reservoir is programmed for 2021-2023.

Sustainable Development (Nelson 2060)

Overview of Sustainability

The Local Government Act 2002 requires that local authorities take a sustainable development approach to everything they do. The publication, Nelson 2060 (June 2013) was developed by Council through an inclusive process called “Framing our Future” and sets out Nelson’s sustainability strategy.

The framework and checklist outlined in this document will be used to guide the management of the city’s infrastructure.

Infrastructure is installed and maintained on the understanding that the assets are provided in perpetuity for the benefit of future generations. Longevity of an asset is a prime consideration when design and planning is undertaken for new or replacement components in the network.

Actions for Future Improvement

Further action in promoting the sustainability of this activity is considered to centre on the following areas:

- More strategic monitoring of the condition and operation of the asset to identify most appropriate renewal priorities;
- Enhanced network modelling to aid prediction of performance and renewal strategies;
- Additional effort to reduce water losses through renewal of pipelines, reduced water pressures and proactive water loss detection;
- Duplication of the trunk main from the treatment plant to the city centre;
- Renewal of resource consents for the city water supply;
- Ongoing monitoring of water quality in the Maitai and Roding rivers.

Water Treatment Plant. Membrane replacement and changes to use of chemicals

Commissioned in August 2004, the Water Treatment Plant is an ultra-filtration plant with limited use of chemicals in the operation. Chlorine is used for residual disinfection. Fluoride is not added to the Nelson water supply, but the treatment plant could be retrofitted to accommodate this if any future Council makes this decision.

The plant was designed and constructed with the ability to install five filtration “trains” to cope with future demand. The treatment plant can currently supply approximately 41,000m3/day from the four trains that are in place.

Large portions of the plant and individual components are computer monitored 24 hours and alarms are raised if the process goes outside predetermined performance limits.

The filter manufacturer also monitors performance of the process from Canada on a daily basis.

Water Treatment Plant Filters – Renewal of the filters will be required between 2014/17. The filters have been in place since 2004 and the 10 year guarantee period ended in August 2014. Installation of the final fifth "train" is programmed for 2014/15. This will provide greater maintenance flexibility within the plant and will extend the life of the existing membranes.

Council and the plant operators are also trialling the use of carbon dioxide in 2013/14 as a means of adjusting the acidity of the water in an effort to further reduce the use of chemicals. Lowering the pH of the water improves the efficiency of the chemicals used to remove organic material from the raw water, with a consequent reduction in the amount of chemical required in the process.

The plant and water works reserve (includes the Maitai and Roding catchments) is operated and maintained on behalf of Council, under contract, by Fulton Hogan Ltd.

The close control of the catchment and the water treatment plant are the primary reasons that the city received an "A" grade from the Ministry of Health for the water source.

30 year Infrastructure Strategy

The requirement for an infrastructure strategy arose from advice provided by Better Local Government programme advisory groups. The strategy is intended to improve local authorities' delivery of core infrastructure and management of physical assets. It should identify strategic issues facing the council and the future implications and is intended to add transparency for residents and ratepayers about these issues and their consequences.

The strategy is included in the LGA 2002 Amendment Bill (No 3) which is expected to be passed in its current form in June 2014.

This Asset Management Plan contains the information that would form the basis of the water utility section of an integrated strategy. Detailed information relating to the specific components of the strategy is set out in the appropriate sections of this asset management plan and is either shown directly or as an area that will require future work.

Appendix H sets out the specific areas to be covered in a 30 year strategy, with the reference to the appropriate sections of this asset management plan. The appendix also contains the 30 year budget tables.

LEVELS OF SERVICE

It is Council's responsibility to provide Nelson City with a water supply network which meets public health and safety standards and is environmentally sustainable. The Council's objectives are to:

- Provide a water supply of acceptable quality, suitable pressure, flow and reliability, with sufficient water to meet reasonable (in compliance with resource consent conditions and Water Bylaw) peak demand through a 1 in 60-year drought.
- Ensure that Nelson's water supply is sustainably managed.
- To provide water in a cost-effective manner.

The levels of service are consulted on during the Long Term Plan submission process and are reflected in this Asset Management Plan.

The Proposed levels of service 2015-25 are:

What Council will provide	Performance Measures	Current Performance 12/13	Targets			Targets in Years 4-10
			Year 1 15/16	Year 2 16/17	Year 3 17/18	
Good quality water	~~Grading under~~ Meeting Drinking Water Standards for NZ 2005/08 sampling and test standards	On Track	Maintain Ab grading "A"for source and "b" for reticulation and ensure potable water supplied to customers	Maintain	Maintain	Maintain
A reliable supply of water	Day to day continuity of supply	Achieved	1 in 60 year drought security until at least ~~the next 50 years~~ 2035. Supply 99.5% available at any property under normal operating conditions. Max 24 hr outage under normal operating conditions.	Maintain	Maintain	Maintain
Acceptable water pressure	Percentage of customers with acceptable pressure, defined as minimum 30m head, max 90m head and maximum fluctuation <35% from the average pressure received by each customer	Achieved	Computer model identifies 80% of properties with acceptable pressure	Maintain	Maintain	18/19 85% 24/25 90%
Adequate flows of water	~~Proportion of properties with NZ Fire Service fire minimum flows of 24 litres/s~~ Meet NZFS fire flows (and therefore domestic and commercial/industrial flows) to all parts of the city	Achieved	Computer model identifies at least 95% of properties served by the network with acceptable flows and 99% by 2021/22	Maintain	Maintain	21/22 99%
A prompt emergency response	Meet response times for emergencies identified in external works contract	Achieved	Contractor to meet maximum response times under the contract for Urgent Works	Maintain	Maintain	Maintain
A network that protects the natural environment	~~Level of compliance with~~ Comply with resource consents RM025151 and RM975374 conditions for allowable water abstraction rates, revegetation of stream banks and eel and fish passage requirements.		100% compliance	Maintain	Maintain	Maintain

Water System Overview

Background

Historically, the Nelson City Council has been the predominant water provider to the residents of Nelson. The Council's authority to undertake water supply is contained in Section 12 of the Local Government Act 2002. Under Section 25 of the Health Act 1956, the Minister of Health may require a Council to provide sanitary services, which includes waterworks. Although it is discretionary whether or not it provides water, the Council has a long term commitment to carrying out this activity.

Nelson City Council does not operate separate rating areas for its water supply zones as they are essentially operated as one large zone.

This Asset Management Plan is written on the basis that water supply is an ongoing core responsibility of Council.

The replacement costs of the water supply assets are $225.5M (as shown in the 2012 valuations) detailed below.

Summary of Water Services Assets (June 2012)

Asset Category	Quantity	Unit	Replacement Value $,000s
Reticulation High Pressure	107	km	26,732
Reticulation Low Pressure	213	km	46,678
Trunk Mains	37	km	16,898
Maitai Pipeline	9	km	16,392
Roding Pipeline	6	km	2,995
Maitai Water Supply Scheme			20,098
Roding Dam			2,767
Treatment Plant			24,780
Tunnels	3	No	11,308
Reservoirs and Tanks	37	No	11,835
Pump Stations	9	No	2,262
Pressure Reducing Valves	33	No	401
Air & Non Return Valves	123	No	293
Gate Valves	3,249	No	7,464
Manholes	94	No	343
Hydrants	2,459	No	5,631
Meters	20,122	No	2,931
Customer Connections	20,122	No	25,726
Total			**225,535**

Reticulation

The primary purpose of the reticulation system is to distribute water to customers throughout the city and provide a constant source of fire fighting water. In many locations the need to meet minimum fire flows dictates the size of the reticulation. Because Nelson has limited areas of flat land many of the residential properties are established on the surrounding foothills. The variation in height between the upper levels and sea level presents a real issue for maintaining reasonable pressures in the reticulation. Council endeavours to provide water to the city at the lowest practical pressure to avoid damage to residential fittings and reduce losses. Pressures falling in the range between 30 and 90 metres of head have been adopted for the Level of Service.

Trunk Mains

Trunk mains are typically larger diameter direct supply lines to the various water reservoirs in the city. As these mains are critical parts of the network, connections to them are limited in order to reduce the time when the water supply has to be interrupted. The two major supply pipelines from the Maitai and Roding Dams to the water treatment plant are separately identified.

Pump Stations

The Nelson City Council operates 9 water pump stations throughout the city. The majority of these are lift stations that supply water to reservoirs at higher levels for storage as well as pressure enhancement. A small number are solely pressure pumps that boost supply pressure to the reticulation. These are generally used where the cost to install a reservoir would not be justified for the small numbers of users affected.

Reservoirs and Tanks

There are 37 reservoirs and tanks connected to the network. Seven of these hold between 2500m^3 and 5500m^3 of water with the remaining holding volumes ranging from 25m^3 to 900m^3.

All but one of the seven larger tanks are constructed from pre-stressed or reinforced concrete, with one tank being of bolted steel plate construction.

When full the tanks will hold approximately one day's supply of drinking water for the city.

Currently the larger tanks are positioned close to the central city area and Stoke. To provide a better level of security for the north of the city a further larger reservoir is proposed for the Bayview/Marybank area within the term of this plan.

Within the next 30 years it is anticipated that development will require additional reservoirs for supply of potable water in emergencies at the Northern and Southern ends of the city.

FINANCIAL SUMMARY

The projected operating and maintenance costs, renewals and capital expenditure for the water supply system over the next twelve years are shown in Table ES2.

Table Years 1-12 of the 2015/25 Long Term Plan- Financial Summary

Note: The figures for Renewals and Capital Works are in 2015 dollars - the Long Term Plan figures are adjusted for inflation

Year		1	2	3	4	5	6	7	8	9	10	11	12
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**		
O&M Expense	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Administration	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760
Depreciation	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326
Electricity	458	458	456	456	456	456	456	456	456	456	456	456	456
Water Treatment	1,479	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Physical Works – Programmed	204	200	200	200	200	200	200	200	200	200	200	200	200
Physical Works – Reactive	2,080	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300
Engineering Services	343	343	343	343	343	343	343	343	343	343	343	343	343
Headworks	310	216	179	179	204	179	179	179	179	204	400	179	179
Roding Dam Gravel		50	50	50	250								
Scada		60	70										
Fish Passage		20											
PHRMP		50											
Total [a] ($,000s)	**11,960**	**12,315**	**12,184**	**12,114**	**12,371**	**12,064**	**12,064**	**12,121**	**12,064**	**12,089**	**12,317**	**12,064**	**12,064**
Renewals Project Area	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
Pipeline	838	794	794	794	850	850	850	900	900	900	950	950	950
Pump Stations - Renewals		0	528	70	3	21	0	13	137	495	498	0	3
Headworks - renewals	60	60	60	60	60	60	60	60	60	60	60	60	60
Reservoir Refurbishment Programme					50	50	50						
Residential Meters	50	100	100	1,000	1,000	1,000							
Commercial Meters	301	300	300	300	300	300	300	300	300	300			
Backflow Prevention Renewals												350	350
Water Treatment Plant Renewals	0	0	1,000	1,030	1,135	1,000	4	0	0	4,375	0	1,000	1,000
Total ($,000s)	**1,249**	**1,254**	**2,782**	**3,254**	**3,398**	**3,281**	**1,264**	**1,273**	**1,397**	**6,130**	**1,508**	**2,360**	**2,363**

Year		1	2	3	4	5	6	7	8	9	10	11	12
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**		
Capital Works – Project	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**2023/24**	**2024/25**	**2025/26**	**2026/27**
Malvern Hills - Atawhai Pump & Ridge Reservoir	21	67	150										
Backflow Prevention	375	350	350	350	350	350	350	350	350	350	350		
Maitai Pipeline (WTP-Westbrook Tce)	100	100	100	4,000									
Maitai Planting	10	10	10	10	10	10	10	10	10	10	10	10	10
Maitai Resource Consent Renewal	80	150	60										
Roding Resource Consent Renewal	80	150	60										
Roding Pipeline		100							1,000	1,500	1,500	1500	
Telemetry / Control upgrades													
Pressure Enhancement											100		
NCC - TDC Link		100	100	1,000	1,000	1,000							
DMA establishment		50	100	100									
Water Loss Reduction Programme		100	100	100	100	100	100						
Hira extension											100	150	1,000
Future Growth Additional Storage													
Seismic Risk Upgrades		100	100	100									
Water Treatment Plant Membranes	1,200	1,000											
Natural Hazards Risk Assessment		50	50		100	100	100						
Network Capacity Confirmation for Growth Areas		50	100						100	100	100	1,250	
Network Upgrades Nelson North													
Network Upgrades Nelson Central													
Network Upgrades Nelson South													
Fire Flow Upgrades	100	100	100	100	100	100	100						
Pipe Improvements/Pressure Reduction	50	50	50	50	50	50	50	50	50	50	50	50	50
Ridermains	155	155	155	155	155	155	155	55	55	55	55	55	55
System Improvements & Misc Pipes & Fittings	60	60	60	60	60	60	60	50	50	50	50	50	50
Water Treatment Plant Upgrades										150	500	500	500
Dam Upgrades		0	0	0	100	100	100	0	0	0	100	0	100
Total ($,000s)	**2,231**	**2,742**	**1,645**	**6,025**	**2,175**	**2,405**	**1,525**	**4,815**	**2,865**	**3,515**	**2,915**	**3,565**	**1,765**

1. INTRODUCTION

1.1 BACKGROUND

1.1.1 Purpose of the Plan

An Asset Management Plan combines management, financial, engineering and technical practices to ensure that the level of service required by the community is provided cost-effectively.

This is the Asset Management Plan for the Nelson City Council water supply network.

1.1.2 Relationship with Other Documents

The Asset Management Plan is a key component of the Council's strategic planning function.

Financial projections from the Asset Management Plan support and justify the financial forecasts in Council's Long Term Plan.

Similarly the Asset Management Plan provides the basis for preparation of each Annual Plan.

1.1.3 Water Sources

Nelson City Council abstracts water from the Roding, Maitai South Branch and Maitai North Branch Rivers for supply to the urban areas of the City. The water is coarse screened at the intakes and conveyed by raw water trunk mains to the Water Treatment Plant at Tantragee Saddle which was commissioned in August 2004. Supply to the lower levels of Stoke and Tahunanui is available in an emergency from Tasman District Council.

1.1.4 Area Covered

The Nelson City water supply area extends to Saxton Field in the south. (The Wakatu Industrial Estate, the north side of Champion Road, Hill Street North, Alliance Group and ENZA Foods, are within Nelson City, but are supplied by Tasman District Council).

In the north the area extends to Todds Valley, The Glen and Hillwood on the Wakapuaka side of the Gentle Annie Hill.

Properties in Marsden Valley, the Maitai motorcamp and a few of the adjacent houses in the Maitai Valley are also supplied.

A population of approximately 45,000 is served by the Nelson City Council reticulated water supply. There are approximately 18,000 residential connections and 2,000 commercial/industrial connections.

1.1.5 Asset Description

The assets covered are from the source water intakes in the water catchments to the point of supply at individual customers' boundaries. This includes dams, intake structures and screens, control equipment, the Water Treatment Plant, tunnels, trunk mains, secondary mains, rider mains, services, valves, hydrants, non-return valves, pressure reducing valves, pumps, reservoirs, and water meters.

1.1.6 Key Stake Holders

The plan recognises the following stake holders:

External

- The community including iwi, ratepayers and residents,
- Residential and commercial consumers,
- Government departments and agencies, including Ministry for the Environment, Ministry of Health, Audit NZ.

- Nelson Marlborough District Health Board.
- New Zealand Fire Service
- Consultants and Contractors

Internal

- Mayor and Councillors
- Council staff

1.1.7 Nelson City Council Arts Strategy

Where opportunities present themselves, consideration will be given to the incorporation of artwork in the water network.

1.2 GOALS AND OBJECTIVES OF WATER SUPPLY ASSET OWNERSHIP

1.2.1 Links to Nelson City Community Outcomes

The Nelson community has six community outcomes. The Council's provision of a water supply to Nelson contributes to three of these outcomes:

Outcomes	How the activity contributes
Healthy land, sea, air and water	Ensures water resources are well managed and reduces the human impact on the environment. Council complies with water consent conditions to protect the environment.
A strong economy	Supports economic development, business and tourism sector in Nelson. Council measures progress towards addressing risk, quality and sustainability, including increasing storage capacity.
Kind, healthy people	Prevents disease, which improves public health. Water grading results are updated regularly.

1.2.2 History and Justification for Asset Ownership

The Nelson City Council and its forebears have been responsible for water supply in the City since the initial Brook Scheme was constructed in 1874.

- The Roding supply was introduced in 1940.
- The Maitai scheme was commissioned in the early 1960s with a river intake
- The Maitai Dam was completed in 1987
- Subsequently the Brook system was decommissioned in 2000
- The Water Treatment Plant at Tantragee Saddle was commissioned in 2004.

The City has expanded by amalgamation of adjoining areas.

- Tahuna Town Board joined to the City in 1950.
- Stoke was transferred from Waimea County Council in 1958
- Atawhai in 1968
- Wakapuaka and Stoke Rural in 1989
- Subsequently the Glen reticulation was connected in 1991.

Historically, therefore, the Nelson City Council has been the predominant water provider to the residents of Nelson. The Council's authority to undertake water supply is contained in Section 12 of the Local Government Act 2002. Under Section 25 of the Health Act 1956, the Minister of Health may require a Council to provide sanitary services, which includes waterworks. Although it is discretionary whether or not it provides water, the Council has a long term commitment to carry out this activity.

Nelson City Council does not operate separate rating areas for its water supply zones as they are essentially operated as one large zone.

This Asset Management Plan is written on the basis that water supply is an ongoing core responsibility of Council.

1.3 BACKGROUND

Over the last 25 years the Nelson City Water Supply has been significantly improved from a basic supply with a Ministry of Health water supply grading of Ed (Unacceptable level of risk for source/treatment, Unsatisfactory Level of risk) for distribution to a modern system with a grading of Ab (Completely satisfactory – extremely low level of risk, Satisfactory – very low level of risk).

These significant improvements have been:

- Construction of the Maitai Dam to provide storage and the ability to select the best raw water
- Construction of four 2,500 cubic metre reservoirs (Atawhai, Stoke #1, Stoke #2 and Stoke High Level)
- Construction of the Tantragee water treatment plant and second trunk main to Stoke
- Renewal of all 75mm diameter cast iron pipes

The work proposed in this Asset Management Plan:

Makes provision for the renewal of water abstraction resource consents

- Increases resilience to civil emergency by completing the duplication of key pipelines
- Continues the work to reduce water losses and monitor demand reduction through new technology, to defer the need for a future additional raw water source
- Provides for growth
- Provides timely renewal of assets as they reach the end of their economic life
- Manages risk
- Achieves and maintains the levels of service

1.3.1 Source

The existing Maitai and Roding sources can provide sufficient water to meet the City's needs in a 1 in 60 year drought for the foreseeable future. By provision of a rubber weir on top of the Maitai Dam spillway the water storage can be increased by 10,000m3, equivalent to 20 years demand growth at current levels. Future wider demand strategies will enable the existing supply to be adequate until into the 22nd Century for current projected population increases. Sufficient water of high quality is therefore available for urban supply for the foreseeable future.

The Council's extraction of water from the Maitai and Roding rivers is controlled by resource consents issued by both the Tasman District and Nelson City Council's. As the current consents expire in 2017 it is proposed to lodge applications for new consents by the end of June 2016.

Council will also investigate the feasibility of removing gravel that has built up behind the Roding Dam, in order to improve storage capacity.

1.3.2 Maitai Pipeline

The Maitai pipeline between the Maitai Dam and the Water Treatment Plant transports the majority of the water used in the City. It has numerous small shrinkage cracks and is vulnerable to slips from above and below the pipeline.

Current demand projections show that the Maitai pipeline has sufficient capacity to supply the City (in conjunction with the Roding pipeline and foothills link) through a 1 in 60 year drought until at least 2023 (refer Section 3). The Maitai pipeline has been identified as the highest risk asset and is a "Lifeline" for the city. In 2007 Council established a Working Party to consider long term water options and replacement, refurbishment and duplication options for the Maitai pipeline. Council subsequently resolved that the Maitai pipeline between the dam and the Water Treatment Plant be replaced with a new main down the Maitai Valley Road, but that the existing pipeline be kept in use to reduce pumping costs, for as long as it is viable to do so. The replacement of the section between the Water Treatment Plant and Westbrook Terrace was deferred and is shown in this Asset Management Plan for 2017/18.

1.3.3 Trunk Mains and Reservoirs

With increasing development, demand is spreading north and south beyond the current trunk main system. Typically demand is spread over a 16 hour period, whereas water treatment plants and trunk mains function most effectively with demand spread over 24 hours. Also, in times of emergency water should be available in the locality it is needed.

A network of trunk mains and reservoirs is therefore necessary to transport and store water overnight so that peak demand during the day can be met from instantaneous flow and local storage.

Additional trunk mains and reservoirs are therefore proposed to cope with demand from growth.

1.3.4 Reticulation Condition

The reticulation system has to reliably transport the required volumes of water from the trunk mains and reservoirs to the consumers, at sufficient pressure while maintaining quality.

Ongoing condition assessment of the reticulation network is therefore necessary, and timely proactive refurbishment or renewal of the pipes and fittings is proposed.

1.3.5 Backflow Prevention

The protection of the quality of the water supplied to customers is a vital responsibility of any water supply authority. While the quality of the water entering the system is known, chemical or microbiological contamination can occur in some circumstances from water re-entering the system from consumer's premises.

Increased emphasis has been placed on Risk Management by the Ministry of Health in recent years. The 2007 amendments to the Health Act require that water suppliers prepare Public Health Risk Management Plans for their systems, and include the management of risk from backflow.

The Nelson City Council Public Health Risk Management Plan (now named Water Safety Plan under the 2013 amendment to the Health Act 1956) was completed and approved by the Ministry of Health in 2012. This plan references the proposal to install backflow prevention devices on all commercial/industrial activities by 2024/25.

1.3.6 Critical Assets

Critical Assets are defined in the Asset Management Plan as assets that are essential to providing a water supply in times of emergency (albeit at a reduced level of service), or have an unacceptable consequence in event of failure.

Critical assets have been identified as:

- Headworks including dams and intakes
- Raw water trunk mains
- Raw water pump stations
- Water Treatment Plant including Clearwater Reservoir
- Treated water trunk mains
- Treated water pump stations
- Reservoirs

With these assets operating, treated water will be available in each suburb for distribution by water tanker or personal collection and by watermain as damaged reticulation is repaired and brought back into service.

1.3.7 Water Supply Grading

The Ministry of Health suggests that the minimum water supply grading for a community size over 10,000 be

- Source and treatment B (satisfactory, very low level of risk when the water laves the treatment plan)
- Distribution a (completely satisfactory, extremely low level of risk).
- However, it stresses that irrespective of size a community should aim for as high a grade as possible.

The Nelson City water supply was last graded in 2011 and was assessed as:

- Source and treatment A (completely satisfactory, extremely low level of risk)
- Distribution b (satisfactory, very low level of risk)
- The construction of the Water Treatment Plant achieved A for source/treatment, but the present b for distribution is below the Ministry of Health suggested standard.

When the works proposed in this Asset Management Plan for water loss reduction and backflow prevention are complete the water supply distribution “demerit” points assessed in the grading process will be reduced such that an “a” grading for distribution may be achieved.

1.4 PLAN FRAMEWORK

The plan is structured as follows:

Section 1 Introduction: sets out the philosophy and scope of the plan and water supply asset.

Section 2 Levels of Service: outlines the current and target levels of service with regard to customer expectations, water quality, reliability, pressure, and flow rate, systems operation, and emergency response.

Section 3 Future Demand: outlines existing demand, demand projections, demand management, impact of changing demand on assets.

Section 4 Risk Management: Contains Risk Management Philosophy; Risk Register for Water Assets; Risk Treatment Plan and Schedule for water asset lifelines.

Section 5 Lifecycle Management Plan: Contains, asset details (including capacity, performance, condition and valuations), maintenance and renewal strategies, capital programme and asset disposal strategy.

Section 6 Financial Summary: Outlines where funds will be sourced from.

Section 7 Asset Management Practices: contains details of the Accounting/ Financial, Geographical Information System, Information Flow, and Asset Management Systems.

Section 8 Plan Improvement Programme: provides detail on planning to monitor the performance of the Asset Management Plan and to improve Asset Management systems that will improve the level of confidence in the Asset Management Plan, provides details in proposed chronological order of the processes to be improved in the management of the water asset.

Section 9 Action Plan: Summary of actions, including deadlines, identified in the Asset Management Plan.

1.5 ASSET MANAGEMENT PLANNING

1.5.1 Benefits

Asset Management Plans summarise the Council's management, financial, engineering and technical processes and procedures for the management of the Council's water supply assets.

- The benefits of Asset Management planning are:
- Improved understanding of levels of service objectives and standards
- Life cycle (long term) costs are identified for agreed levels of service
- Showing that necessary maintenance work will be undertaken
- Prevention or the reduction of risk of system failure
- Better understanding and forecasting of asset related management options and costs
- Improved decision making based on historic records, performance data and cost benefit analysis
- Justification of future capital programmes
- Improved accountability to the Community for funding requirements
- Increased customer satisfaction and improved public perception of the Nelson City Council
- Overcoming institutional memory loss
- Ensuring a proactive approach to Asset Management
- Prolonged life of water assets through optimisation and proactive maintenance
- Meeting the principles of sustainable development
- Meeting the requirements of the Local Government Act 2002, by supporting Long Term Plan funding requirements
- Co-ordination with other asset groups when construction is programmed for the same location

1.5.2 Core to "Core Plus" Approach

Asset Management plans evolve in a continuous cycle of review and improvement so the quality of outputs matches the changing business and legislative needs. The International Infrastructural Management Manual 2006 details criteria for assessing conformity to "core" and "advanced" levels of Asset Management in New Zealand.

Features of Core Asset Management are:

- A lifecycle approach is taken;
- Core Asset Management plans are developed based on;
- best available current information and random condition sampling,
- simple risk assessment,
- existing levels of service,

- contrasting existing management strategies with opportunities for improvement;
- Capital works are prioritised using a simple ranking criteria;
- Long term cash flow predictions for maintenance, rehabilitation and replacement are calculated based on local knowledge of assets and options for meeting current levels of service;
- Financial and critical service performance measures against which trends and Asset Management plan implementation and improvements can be monitored are provided.

Features of Advanced Asset Management are:

- Asset Management strategy is clearly derived from corporate strategic plan;
- Long term, whole life plans and cost/risk/benefit optimisation;
- Objectives and performance measures are aligned and complementary;
- IT systems are integrated, used, and understood;
- Competencies and training is aligned to roles, responsibilities and collaborative requirements;
- Strategies are risk based, with appropriate use of predictive methods, optimised decision making;
- Iterative continuous improvement.

1.5.3 Core to "Core Plus" Gap Analysis

In recent years it has been recognised that a new rating level of "Core Plus" is the most appropriate rating for cities of Nelson's size. This rating reflects that parts of the asset can be managed at a Core level and parts at an Advanced level. The resultant provides an effective asset management tool without becoming un-necessarily expensive.

At a January 2006 workshop a gap analysis between "Core" and "Advanced" Asset Management was undertaken for each asset group. The Water Supply Asset Management Plan was considered to be midway between "core" and "advanced". The detailed assessment is included in Appendix D.

1.6 SUSTAINABLE DEVELOPMENT

1.6.1 Overview of Sustainability

The Local Government Act 2002 sets out principles that local authorities must act in accordance with. The legislation requires local authorities to ensure prudent stewardship and the efficient and effective use of its resources in the interests of its district or region; and in taking a sustainable development approach, take into account:

- The social, economic, and cultural interests of people and communities; and
- The need to maintain and enhance the quality of the environment; and
- The reasonably foreseeable needs of future generations

In 2011 Council began work on a 50 year vision of what Nelson could become, using sustainability principles. The vision statement was adopted in the Long Term Plan 2012-22 and the full Strategy in 2013. It identified ten goals that the Nelson community said were priorities for action and Council is now working to ensure that these goals and sustainability principles are integrated into all the decisions made about its activities.

Sustainable development actions and approaches are embedded throughout this asset management plan in the sections on: Levels of Service, Demand Management, Lifecycle Management Plans, and Financial. These include the following:

Goal Three

Our natural environment – air, land, rivers and sea – is protected and healthy

- Environmental Level of Service (section 2.7)

  100% compliance with resource Consent Conditions is specified;

- Ongoing investigation of impacts of the operation of the Maitai dam on the ecology of the Maitai river;

  Ongoing revegetation programme for the banks of the Maitai river

Goal Seven

Our economy thrives and contributes to a vibrant and sustainable Nelson

- Funding (section 6.8)

Water metering was implemented in 1999. The overall pricing structure encourages water conservation by recovering 70% of the operating cost from metered water volume charges and 30% by annual fixed charges. Very large consumers (greater than 100,000 m3 per year) are provided with a lower step charge reflecting the importance of these larger industries to the local economy and the funding of the water supply activity;

Goal Nine

Everyone in our community has their essential needs met

- Ensuring a reticulated water supply network is available to the greatest number of residents;

Goal 10

We reduce our consumption so that resources are shared more fairly

- Pressure Level of Service (section 2.4)

  Lowering of pressures reduces losses, increases pipe life, and reduces demand;

- Emergency Response Level of Service (section 2.7)

  Prompt response to broken and leaking pipes and fittings reduces water losses and reduces consequential damage;

- Demand Forecast (section 3.2)

  The demand forecast reflects a decreasing demand into the future due in part to improved plumbing technology, reduced supply pressures, consumer education, and use of alternative (non potable) sources for irrigation;

- Demand Management (section 3.3)

  Demand was significantly reduced by the introduction of universal water metering in 1999. Other demand management methods as outlined in Section 3.3 will be implemented in the future to give effect to community or statutory initiatives to reduce demand. Reduction of unaccounted for water (water losses) is evaluated and an action plan outlined. The Water Supply Conservation Strategy (Appendix B) is to be implemented in times of drought;

- Lifecycle Management (section 5.1)

  Sustainability is most easily implemented during the planning of an asset;

  Sustainability actions already implemented and those that have already been identified are listed. Of significance is the replacement of the existing Maitai pipeline with optimised pipe-size/pumping to manage risk and to provide for growth, but maintaining the existing pipeline as long as it is viable to do so, to reduce pumping costs;

- Capital Expenditure (section 6.5)

  System and pipe improvements are proposed to allow pressures to be reduced, with consequential benefits to reduction of demand and losses;

- Water supply Conservation Strategy (Appendix B)

  This is the approved strategy for the implementation of hosing and other restrictions during a drought;

- Water Loss Evaluation (Appendix E)

  Evaluates the loss components and evaluates their impact on the losses and defines the work required to reduce each aspect;

- Active Leakage Control Plan (Appendix F)

  The proposed methodology to detect and repair leaks to reduce water losses;

- Pressure Reduction Plan (Appendix G)

  The proposed plan to reduce water pressures throughout the city which will lessen pipe failures, reduce water losses, and lower demand.

- Where appropriate, use of longer pipe sections, either coiled polyethylene or uPVC replacing shorter cast iron, concrete and asbestos cement pipes, leading to quicker installation and fewer joints;
- Water pump stations with variable speed drive units for pumps, leading to more economical use of pumps and longer service life;
- Maximising elevated storage reservoirs and gravity reticulation to reduce reliance on pumps;
- Investing in new technologies to rehabilitate existing reticulation, where appropriate, rather than excavate and replace;
- Identification and rectification of losses from the network leading to reduced volumes of water to be treated and pumped;

Growth and demand predictions show that with -

- Implementation of demand and loss reduction measures;
- Construction of an inflatable weir on the Maitai Dam spillway;
- Utilisation of the 900,000 cubic metres of dead storage in the Maitai Dam.

The existing Maitai Dam together with the Roding Intake will be able to meet Nelson's foreseeable future water requirements without the need for pumping water from aquifers on the Waimea Plains to the city.

Community infrastructure is installed and maintained on the understanding that the assets are provided in perpetuity for the benefit of future generations. Longevity of an asset is a prime consideration when design and planning is undertaken for new or replacement components in the network.

Council recognises the benefits that come from formalising asset management plans and better monitoring and modelling of the condition and operation of the network.

Actions for Future Improvements

Further action in promoting the sustainability of this activity is considered to centre on the following areas:

- More strategic monitoring of the condition and operation of the asset to identify most appropriate renewal priorities;
- Enhanced network modelling to aid prediction of performance and renewal strategies;
- Additional effort to reduce water losses through renewal of pipelines, reduced water pressures and proactive water loss detection;

- Duplication of the trunk main from the treatment plant to the city centre;
- Renewal of resource consents for the city water supply;
- Ongoing monitoring of water quality in the Maitai and Roding rivers.

1.6.2 Sustainability and Life Cycle

Historically Council has recognised the fundamentals of sustainable development in the water supply activity through the adoption of Engineering Standards and construction practices that lead to the maximisation of gravity reticulation and use of long life materials.

Sustainability has been reflected in the decision making process when designing and constructing the water supply network in the following areas.

- Ensuring a reticulated water supply network is available to the greatest number of residents;
- Where appropriate, use of longer pipe sections, either coiled polyethylene or uPVC replacing shorter cast iron, concrete and asbestos cement pipes, leading to quicker installation and fewer joints;
- Water pump stations with variable speed drive units for pumps, leading to more economical use of pumps and longer service life;
- Maximising elevated storage reservoirs and gravity reticulation to reduce reliance on pumps;
- Investing in new technologies to rehabilitate existing reticulation, where appropriate, rather than excavate and replace;
- Identification and rectification of losses from the network leading to reduced volumes of water to be treated and pumped;
- Ongoing investigation of impacts of the operation of the Maitai dam on the ecology of the Maitai river;
- Ongoing revegetation programme for the banks of the Maitai river.

These initiatives meet the Sustainability Policy criteria to:

- Optimise the efficient use of resources and minimise waste
- Increase the use of renewable resources and reduce greenhouse gas emissions
- Deliver on improved quality of life for the present and future residents of Nelson.

Community infrastructure is installed and maintained on the understanding that the assets are provided in perpetuity for the benefit of future generations. Longevity of an asset is a prime consideration when design and planning is undertaken for new or replacement components in the network.

Council recognises the benefits that come from formalising asset management plans and better monitoring and modelling of the condition and operation of the network.

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2. LEVELS OF SERVICE

This section on levels of service is the vital part of any Asset Management Plan. The levels of service set out the community expectation for the service provided by the water supply asset and therefore determine the amount of resources that are required to maintain, renew and upgrade the water supply infrastructure.

Changes to the levels of service may significantly change funding requirements in some instances.

Levels of service are specified for:

i) Water Quality

ii) Reliability of Supply

iii) Water Pressure

iv) Flow Rates

v) Emergency Response

vi) Protection of the Natural Environment

The 2012/13 performance of the water supply assets in achieving Levels of Service is broadly summarised as follows.

Table 2.1 Asset Performance

	Excellent	Good	Moderate	Poor	Very Poor
Water Quality	100%				
Reliability	99.6%		0.4%		
Pressure	82%		18%		
Flow	99.1%			0.9%	

Note: These percentages refer to the number of customers receiving the level of service.

Performance Grade:	Excellent	No performance problem
	Good	No significant effect on performance
	Moderate	Performance substandard under peak demand
	Poor	Performance regularly substandard
	Very Poor	Unacceptable performance

Other levels of service are specified for:

i) Customer response (Section 2.1)

ii) Emergency response (Section 2.6)

iii) Environmental (Section 2.7)

Table 2.2 Links Between Levels of Service and Community Outcomes

Water Supply Levels of Service 2012-2022	Proposed Water Supply Levels of Service 2015-2025	Targets	Outcomes	How the activity contributes
Water Quality Grading under Drinking Water Standards for NZ 2005/08 sampling and test standards	**Water Quality** Meeting DWSfNZ 2005/08 sampling and test standards	Maintain Ab grading and ensure potable water supplied to customers		
Reliability Day to day continuity of supply	**Reliability** Day to day continuity of supply	1 in 60 year drought security until at least 2035 Supply 99.5% available under normal operating conditions Max 24 hr outage under normal operating conditions	Kind, healthy people We are part of a welcoming, safe, inclusive and healthy community.	Clean drinking water prevents disease and maintains healthier people
Pressure Percentage of customers with acceptable pressure, defined as minimum 30m head, max 90m head and maximum fluctuation <35%	**Pressure** Percentage of customers with acceptable pressure, defined as minimum 30m head and maximum 90m head with a maximum fluctuation <35% from the average pressure received by each customer	Computer model identifies 80% of properties with acceptable pressure	A strong economy We all benefit from a sustainable, innovative and diversified economy.	High quality water encourages businesses to move to Nelson. It also supports economic growth.
Flow Proportion of properties with NZ Fire Service fire minimum flows of 24 litre/s and therefore adequate domestic, commercial, industrial minimum flows	**Flow** Meet NZFS fire flows (and therefore domestic and commercial/industrial flows) to all parts of the city	Computer model identifies at least 95% of properties served by the network with acceptable flows and 99% by 2021/22		
Emergency response Meet response times for emergencies identified in external works contract	**Emergency response** Meet response times for emergencies identified in external works contract	Contractor to meet maximum response times under the contract for Urgent Works		
Environmental Level of compliance with resource consents.	**Environmental** Comply with resource consents RM025151 and RM975374 conditions for allowable water abstraction rates, revegetation of stream banks and eel and fish passage requirements.	100% compliance	Healthy land, sea, air and water We protect the natural environment.	A city water system ensures that water resources are well managed and reduces the human impact on the environment.

2.1 CUSTOMER RESEARCH AND EXPECTATIONS

2.1.1 Background

Nelson City Council carries out Residents Surveys each year. These telephone interviews are conducted by fully trained interviewers, using a random sample of Nelson residents and a minimum quota set by gender and age to ensure the sample is representative of the Nelson population 15 or more years of age. A weighting procedure is applied to correct minor variations from the ideal in the number of interviews achieved in each quota category, hence ensuring the data is representative of Nelson residents.

In 2009 the survey questions changed from a 4 choice answer (Very Satisfied, Fairly Satisfied, Not Very Satisfied, Don't know) to a 5 choice answer (Very Satisfied, Satisfied, Neither, Dissatisfied, Very Dissatisfied, Don't know), therefore the results from the 2010 residents survey are not directly comparable to the previous years.

2.1.2 1998 Residents' Survey

In November 1998 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant activity areas, residents:

- Were least satisfied with the water supply;
- Rated water supply the most important activity area in contributing to quality of life of Nelson residents.

2.1.3 2001 Residents' Survey

In September 2001 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council. Of the Council's 14 significant activity areas, residents again:

- Were least satisfied with the water supply;
- Rated water supply the most important activity area in contributing to quality of life of Nelson residents.

2.1.4 2004 Residents' Survey

In November 2004 AC Nielsen carried out a residents' survey on behalf of the Nelson City Council. This survey was carried out some three months after the opening of the Tantragee Water Treatment Plant.

Of the Council's 14 significant activity areas, residents:

- Rated water supply as the most important activity area contributing to the quality of life for Nelson Residents;
- Were most satisfied with the water supply and gave it a similar satisfaction to parks and open spaces.

Issues identified within Water Supply were:

- Having a permanent, continuous and reliable supply;
- Quality of water, both from taste and health perspective;
- A fair and affordable cost.

2.1.5 2007 Residents' Survey

In August 2007 the Neilson Company carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Again rated water supply as the most important activity area contributing to quality of life for Nelson Residents;
- Rated water supply second only to Parks and Open Spaces for satisfaction.

Issues identified within water supply were:

- Cost of the Water Treatment Plant/Cost of water too high;
- Adequate and continuous supply necessary;
- Water quality is a necessity of life and health.

2.1.6 2010 Residents' Survey

In June and July 2010 the Key Research carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Perceived water supply as the most important area for Council to focus on;
- Satisfaction is high with regard to water supply with respondents rating this second highest after parks and open space with 73% responding as satisfied or very satisfied.

Issues identified within water supply were:

- Cost of water;
- Quality of water – in terms of taste and smell;
- Security of supply and water pressure.

2.1.7 2011 Residents' Survey

In May 2011 the Key Research carried out a residents' survey on behalf of the Nelson City Council.

Of the Council's 14 significant areas, residents:

- Perceived water supply as the most important area for Council to focus on;
- Satisfaction remained high with regard to water supply with respondents rating this fourth highest with 70% responding as satisfied or very satisfied.

Issues identified within water supply were:

- Cost of water
- Quality of water – in terms of taste

2.1.8 2012 Residents' Survey

In May 2012 the Key Research carried out a residents' survey on behalf of the Nelson City Council. Satisfaction remained high with regard to water supply with respondents rating this fourth highest with 71% responding as satisfied or very satisfied.

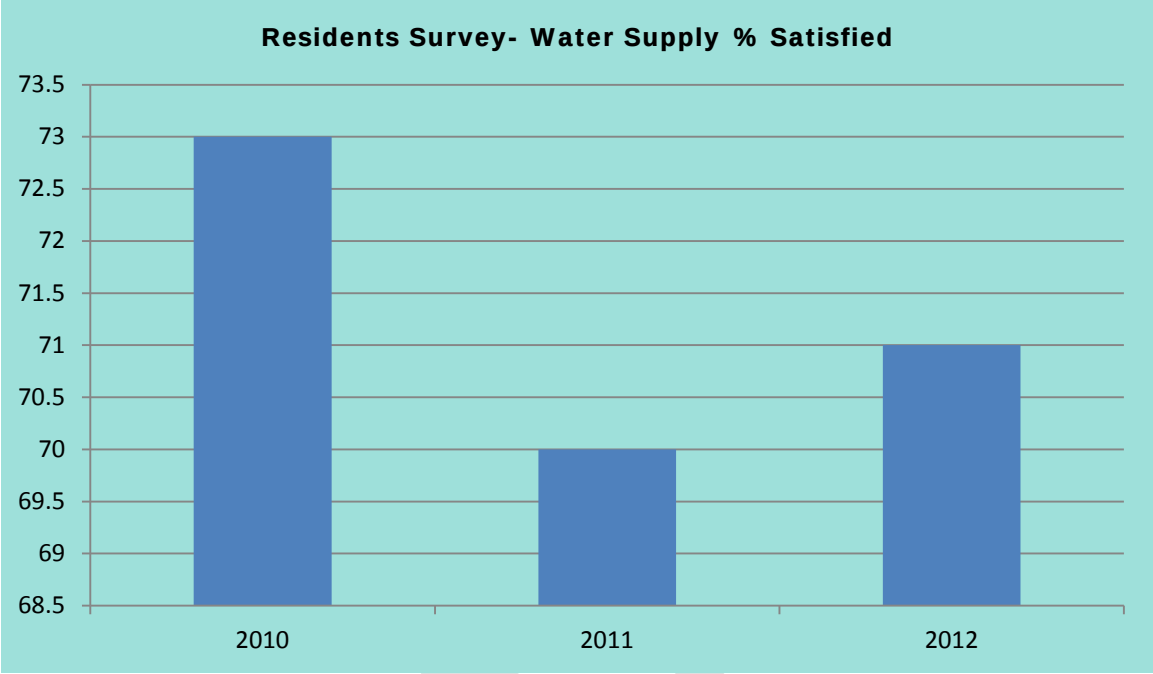
2.1.9 2013 Residents' Survey

In May 2013 a residents' survey on behalf of the Nelson City Council was carried out. This survey was shortened from previous years and did not specifically seek feedback on the water supply activity.

2.1.10 Conclusions from Residents' Surveys

- Satisfaction with the water supply has risen from 48% in 1998 to 60% in 2001, to 81% in 2004 and again in 2007 to 89%. The years 2010, 2011 and 2012 have seen the satisfaction level remain consistent at 70%-73%. The Water Treatment Plant was completed just prior to the 2004 survey;
- Residents continue to want a reliable supply;
- Residents continue to want quality water from a taste and health perspective;
- Residents want an affordable cost for the water supply;

Figure 2.1 Residents' Satisfaction with Water Supply



The target performance measure is 80% satisfied or very satisfied.

2.1.11 Consultation

The levels of service for Quality, Reliability, Pressure and Flow set in this Water Supply Asset Management Plan are based on legislative requirements and Non-Statutory Standards set by government agencies.

These include:

- Local Government Act 2002
- Health Act 1956
- Building Act 2004
- Drinking Water Standards for New Zealand 2005/08
- Public Health Grading of Community Water Supplies 2003 Explanatory Notes and Grading Forms.
- New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008.

There is therefore little discretion for varying these Levels of Service and the Levels of Service are not directly consulted on. The Levels of Service are open to public submission during the Long Term Plan and Annual Plan process.

Public Consultation using a Special Consultative Procedure is however carried out for changes to the Water Supply Bylaw.

2.1.12 Service Level Expectations and Affordability

The levels of service set in this asset management plan are subject to change as legislation changes. The community can also request increases above the minimum levels as long as there is a willingness to fund the financial implications.

As the population changes and economic conditions fluctuate the cost implications of higher than minimum levels of service may create affordability issues for some in the community.

Resolution of these issues is a governance role at both central and local government level.

2.2 WATER QUALITY

2.2.1 Statutory Obligations

The Local Government Act 2002 requires Council to continue to provide water services and maintain its capacity to meet its obligations.

The Health Act 1956 prohibits local authorities from supplying polluted water that is a risk to public health.

The Health Act 1956 prohibits the construction of a dwelling unless an adequate and wholesome water supply is available.

The Building Act 2004 prohibits the use of a building if it does not have an adequate supply of potable water.

The Resource Management Act 1991 does not allow the Council to take, use, dam or divert any water unless it is expressly allowed by a rule in a regional plan or a resource consent.

The Health (Drinking Water) Amendment Act was passed in October 2007. This Act provides a comprehensive regulatory framework for community drinking water supplies and requires water suppliers to have public health risk management plans. It also allows water suppliers to require consumers to pay for the installation and maintenance of backflow prevention devices at the boundary. The Health Amendment Act 2013 changed the name of Public Health Risk management plans to Water Safety Plans.

The National Environmental Standard for Sources of Human Drinking Water regulations came into force on 6 June 2008. The purpose of the regulations is to reduce the risk of contamination of drinking water sources by requiring Regional Councils to consider the effects of granting water abstraction consents or discharge consents upstream of drinking water abstraction points. As all the Maitai and Roding catchments above the intakes are owned by Nelson City Council and managed as a waterworks reserve, there is little benefit to the City's Water Supply from these regulations.

The National Policy Statement- Freshwater Management 2011 (NPSFM) came into effect on 1 July 2011. In 2013 Central Government proposed amendments to the NPSFM. An analysis of the proposed amendments by Local Government NZ concludes that the amendments now broadly require that:

1. *Water quality must be maintained or improved in a region although the proposal provides no additional direction as to when or how trade-offs might be made;*
2. *There is an avoidance of any further over-allocation of water and a phase out of existing over-allocation (water quantity);*
3. *National bottom lines are set for ecosystem health and human health;*
4. *By 2030, regional councils are to have within their plans freshwater objectives that reflect national and local values (there are proposed mandatory national values and attributes). The framework recognises that improving water quality in some places will take some time. While there is a requirement to set objectives there is no timeframe set for their achievement*

The policy will need to be given effect to by regional rules in the Nelson Resource Management Plan (NRMP). It is expected that the greatest impact will come in the form of water quality controls and limits on water extraction.

2.2.2 Non-Statutory Standards

The Drinking Water Standards for New Zealand 2005/08 list the maximum concentrations of chemical, radiological, and microbiological contaminants acceptable for public health in drinking water. The standards also specify the sampling protocols that must be observed to demonstrate that the drinking water complies with the

standards. Although entitled Drinking Water Standards for New Zealand (DWSfNZ) they have no legislative standing.

However there is a provision in the Health (Drinking Water) Amendment Act 2007 that requires water suppliers, when they become aware that the water is not meeting the drinking water standards to take appropriate steps to correct the problem.

The Ministry of Health carries out regular grading of water supplies to measure compliance. The grading schedule is shown in Table 2.3.

The Water Supply Grading System takes a risk based approach and assesses factors that could affect the quality of the water supplied to consumers. For example excess pressure could result in broken pipes, with contaminants entering the water supply. Insufficient storage could result in low pressures or negative pressures, with contaminants entering the water supply.

Table 2.3 Ministry of Health Grading Schedule

Source and treatment grading

Assessment based on source and treatment factors will result in a grade:

A1	Completely satisfactory, negligible factors will result in a grade;
A	Completely satisfactory, extremely low level of risk
B	Satisfactory, very low level of risk when the water leaves the treatment plant
C	Marginally Satisfactory, low level of microbiological risk when the water leaves the treatment plant, but may not be satisfactory chemically
D	Unsatisfactory level of risk
E	Unacceptable level of risk

Distribution zone grading

Assessment based on source and treatment factors will result in a grade:

Sum of demerit points	Grade	Description
0-10	a1	Completely satisfactory, negligible level of risk; demonstrably high quality; meets Aesthetic Guidelines in Appendix C and has ISO 9001: 2000 accreditation.
0-10	a	Completely satisfactory, extremely low level of risk
11-20	b	Satisfactory, very low level of risk
21-30	c	Marginally satisfactory, moderately low level of risk
31-45	d	Unsatisfactory level of risk
46 or more	e	Unacceptable level of risk

Minimum acceptable grading

Recognising both public health cost considerations, the following table provides guidance for the minimum grading acceptable for different sized communities. However, it should be stressed that irrespective of size a community should aim for as high a grade as possible.

Community Size	Source and Treatment	Distribution
Greater than 10,000	B	a
From 5,001 to 10,000	B	b
5,000 or less	C	c

Reference: Report on Public Health Grading of a Drinking Water Supply – Nelson City Council, Nelson Marlborough District Health Board, May 2008.

2.2.3 Background

The Nelson City water supply was graded "A" for source/treatment (completely satisfactory, extremely low level of risk) by the Ministry of Health in May 2011.

The Nelson City water supply was graded "b" for distribution (satisfactory, very low level of risk) by the Ministry of Health in May 2011.

The Ministry of Health table above suggests that a city the size of Nelson should have a grade of "a" for distribution (completely satisfied, extremely low level of risk).

The reticulation grading system is based on the accrual of "demerit" points for various attributes not present. The sum of the demerit points determines the grading as shown in Table 2.3.

The demerit points in the 2008 - 2011 gradings were received for:

Table 2.4 Demerit Points 2008 – 2011 grading

Question topic	Comment	2008	2009	2010	2011
Pipe age and records	Fair	1	1	1	1
Leak Detection and Water Loss	Poor	2	2	2	2
Backflow Prevention	Not met	4	4	4	4
24 hours storage	Less than	3	3	3	0
Supply Pressure	Excess	1	1	1	1
Free Available Chlorine Monitoring	With E.coli / not continuously monitored	1	1	1	1
Microbiological Compliance	2 positive E.coli samples out of 957 samples taken	0	0	0	4
Chemical compliance	Most	2	2	2	2
	TOTAL	14	14	14	15

The work proposed in this Asset Management Plan for:

- Loss Reduction (refer section 3.3.4)
- Backflow Prevention (refer section 6.5.7 xii)
- New reservoirs (refer section 3.2.4)
- Pressure reduction (refer section 2.4.3)
- Water Quality (refer section 2.2.5)

will contribute to reducing the total demerit points by addressing the issues they represent.

The extreme rain events of December 2011 and April 2013 have reduced the available staff time resource within Council, which together with Central Government proposals to review the grading initiative has lead to suspending grading assessments until the review has been completed.

2.2.4 Levels of Service for Water Quality 2015-25

The targeted water quality grading for the entire City is a minimum of:

i) Source and treatment: Maintain Ministry of Health A grading (Completely satisfactory – extremely low level of risk).

ii) Distribution: Maintain Ministry of Health b grading (Satisfactory – very low level of risk).

iii) A water supply system that fully meets the sampling and test standards of the Drinking Water Standards for New Zealand 2005/08.

iv) Performance Measurement and Monitoring

v) Measure quality in accordance with the Drinking Water Standards for New Zealand 2005/08.

vi) Record compliance with Ministry of Health grading.

vii) Record compliance of premises with backflow prevention requirements.

2.2.5 Water Quality Investigations

As a result of the water grading review 2010/11, 11 demerit points out of the 15 received were attributed to the following areas of water quality and risk:

i) Backflow Prevention (4 demerits). Backflow prevention is required on all high risk activities to protect the water network from contamination. Budgets for the installation of the commercial/industrial backflow prevention devices are shown in this asset management plan. Work will proceed as the expenditure is approved through annual and long term plans.

ii) Free Available Chlorine Equivalent (FACE) Monitoring (1 demerit). Chlorine is added to the final stage of the water treatment plant process as a long lasting disinfection product. Council continuously monitors the levels of chlorine in the water leaving the treatment plant and at the stoke high level reservoir but does not continuously monitor for this in the wider network. Tests for available chlorine levels are carried out multiple times per week on a rotation of sites through the city when samples are taken to test for the presence of E.coli. Undertaking a cost/benefit analysis of continuous chlorine level monitoring would be valuable as a means of comparing the relative merits of the current practice versus the enhanced option.

iii) Microbiological Compliance (4 demerits). E.coli are both pathogens in their own right and also important indicator organisms for the possible presence of other pathogenic material associated with the wastes of animals (including humans). Although the routine sampling that identified the presence of E.coli in the network also confirmed that FACE was also present, a study of the network and some investigation to try and identify possible sources of the contamination would be valuable.

iv) Chemical compliance (2 demerits). A number of chemicals are present in water supplies from natural sources and resulting from reactions of disinfectants and the constituents of the water. Testing of the network has identified levels of Haloacetic acids that need to be monitored. Haloacetic acids result from the interaction of chlorine with the components of water. In large quantities these can be carcinogenic in some people. The link with i), ii) and iii) above should be reviewed.

2.2.6 Action Plan

Over the next three years the following are considered important to complete:

- Public Health Risk Management Plan (Health Amendment Act 2013 changed this name to "Water Safety Plans") was approved by the Ministry of Health in August 2012. This plan has to be reviewed within 5 years of this date ie by August 2017. In addition the implementation of the plan is checked on an annual basis by the District Health Board;
- Backflow Prevention Plan. Installation of backflow prevention devices on commercial and industrial properties to be completed by 2025;
- Review of FACE, Microbiological compliance and Chemical compliance with the aim of identifying ways of reducing demerit points accumulated through the Drinking Water Grading process;
- Review requirements of National Policy Statement- Freshwater Management 2011 (NPSFM) and Proposed 2013 amendments as they impact on the water activity.

2.3 RELIABILITY

2.3.1 Statutory Obligations

Specific consents issued under the Resource Management Act 1991 through the Nelson Resource Management Plan (NRMP) control the abstraction of water from the various sources.

2.3.2 Non-Statutory Standards

The Regional Policy Statement (March 1997) contains the following statements:

"Policy DH1.3.4 To ensure that any proposals for urban subdivision and/or development include adequate and appropriate provision of services including waste disposal, stormwater, water supply, electricity and other network services.

Policy WA2.3.1 To establish minimum flow regimes for the Maitai, Roding, Wakapuaka and Whangamoa Rivers, and any other river or stream under stress from water abstraction

Policy WA2.3.3 To allocate water for abstractive uses, which provide for the social, economic and cultural well being of the people of Nelson City where adverse effects (including impacts on the needs of instream values necessary for the integrity of aquatic ecosystems) can be avoided, remedied or mitigated.

Policy WA2.3.4 To continue to encourage urban water supply conservation.

Method WA2.4.4 Council will continue to educate the public on the need for water conservation and will continue to monitor water use and assess the future needs of the community and ways of meeting these needs in an environmentally sustainable way.

Method WA2.4.5 Council will continue to implement and extend water metering.

Method WA2.4.6 Council, in consultation with Tasman District Council, will investigate and, as appropriate, implement water resource enhancement measures (including storage and/or diversion) where necessary to provide adequate water for public water supplies.

Method WA2.4.8 Subject to Policy 1, surface water shall be allocated to the most efficient and highly valued users of water, on the basis of:

i) The ability to achieve significant community benefit from that use;

ii) The need for the volumes of water sought;

iii) Where appropriate, whether alternative water supplies are available including recycling/reuse;

iv) The likely effects of any abstraction on instream values;

v) Achieve any established minimum flow regimes;

vi) Where appropriate whether mechanisms are available to reduce or suspend abstractions during periods of low flow;

vii) Existing or foreseeable water abstraction requirements for domestic and community supplies, agricultural, industrial and other consumptive needs; and

viii) The impact of the application on any established minimum flow regimes."

Method WA2.4.9 Where flow in a river falls to the conservation flow level, to suspend further non-essential abstraction from that river except where an approved "Water Conservation Plan" exists. Where an approved Water Conservation Plan exists, abstraction between conservation flows and minimum flows will be permitted.

2.3.3 Background

In its strategic goals, Council has determined that the urban water supply should have the capacity to withstand a 1 in 60 year drought.

The Council re-adopted a Water Supply Conservation Strategy in 2003.

An analysis of the flows in the South Branch of the Maitai river by Tasman District Council hydrologists has indicated that low flows for the 1, 50, 90 and 100 year return period droughts are as follows:

1 year: 203 litres per second

50 year: 90 litres per second

90 year: 84 litres per second

100 year: 83 litres per second

The conditions of the Resource Consent for the Maitai abstraction require that a residual flow of 175 litres per second be left in the Maitai River from 1 November to 30 April, and 300 litres per second be left in the river from 1 May to 31 October. However, if the river flow is naturally low during this period, the residual flow may be reduced. When the mean daily flow exceeds 140 litres per second the minimum flow is 300 litres per second. When the mean daily flow is less than or equal to 140 litres per second the minimum flow is 225 litres per second. When the mean daily flow is less than 130 litres per second the minimum flow is 190 litres per second. The storage held in the Maitai dam is used to make up the shortfall in natural flows.

The conditions of the Resource Consent for the Roding abstraction require that from 1 July 2008 a residual flow of 100 litres per second be left in the Roding River.

The Council has entered into an Engineering Services Agreement (2005) with Tasman District Council regarding the supply of Roding water to Richmond and the use of the Waimea Supply to serve the Wakatu Industrial Estate, and development off Champion Road and Hill Street North. The supply of water to ENZA and the Alliance Group processing plant is not part of this agreement and remains the responsibility of Tasman District Council.

This agreement combines the other cross boundary infrastructural service of sewer reticulation into one agreement for a five year term with either party required to give a minimum of two years notice of intention not to renew the agreement.

As of March 2014 the agreement is being re-negotiated with Tasman District Council. The current agreement remains in force until such time as a new agreement is finalised.

Under this asset management plan consideration is given to investigating the supply of these areas by Nelson City.

The Nelson City Council Land Development Manual 2010 sets out requirements for the design and construction of urban water supplies (e.g. material types, size of pipe).

Water supply networks are historically very reliable, with many customers not experiencing a single loss of supply event. This extremely high reliability has tended to make customers assume that reliability is guaranteed.

As a consequence customers are becoming less tolerant of interruptions to the supply. Some industrial and commercial processes which are reliant on a continuous water supply have assumed a continual supply and have no provision for standby facilities.

The continuity of supply can never be guaranteed, in part because many causes of supply failure are beyond the control of the water supply authority. An example is damage to a service main that could be caused by a contractor excavating in the street while working on other utilities (such as electricity, telephone, sewer, etc). Older asbestos cement pipes have deteriorated and are the main source of spontaneous breaks.

The Nelson City Council Water Supply Bylaw warns that continuity of supply is not guaranteed.

Apart from the need to provide very high levels of continuity to meet customer expectations, there are good public health reasons for maintaining pressurised mains at all times.

If watermains are allowed to lose pressure, it is possible that the weight of water in lower sections of mains will reduce the pressure in higher sections of the mains below atmospheric pressure. This will cause a vacuum in pipes which can suck back groundwater into the mains through leaks, or contaminated water from tanks or other containers not properly isolated from the public supply.

Council has established well defined procedures for shutting down watermains by Council staff, the Utilities Maintenance Contractor's staff, and Water Connection Contractor's staff.

The objective of the procedures is to minimise the amount of disruption and inconvenience to customers by using good communication skills and by timing the work to avoid times of peak demand.

2.3.4 Level of Service for Reliability

i) Security of Supply

Over a 20 year forward planning horizon, ensure adequate quantities of water to meet reasonable (in compliance with resource consent conditions and Water Bylaw) peak demand through a 1 in 60 year drought.

ii) Continuity of Supply

a) A continuity of supply of 99.5% (this represents maximum interruption of supply to any property of 35 hours in any year).

b) Maximum duration of any disruption in supply – 24 hours.

c) Normal duration of any disruption in supply to not exceed 8 hours on 95% of occasions.

d) Shutdowns for planned work or minor leak repairs (not causing property damage or excessive water loss) will be carried out in a daily off peak time (i.e. not 7.00am–9.00am, 12 noon–1.00pm or 5.00pm–9.00pm any day and not Saturday or Sunday morning 7.00am-11.00am).

e) Shutdowns for planned work that will have major impact on the community will be carried out outside normal business hours.

iii) Notice of Shutdown

a) Verbal advice will be given to schools, hospitals, dialysis patients, industrial and commercial premises of a planned shutdown less than one hour in duration.

b) A minimum of 24 hours notice will be issued to all affected customers of a planned shutdown greater than one hour in duration.

2.3.5 Performance Measurement and Monitoring

The following actions are currently undertaken to monitor the network reliability:

i) Record daily headworks supply and treatment plant supply.

ii) Record the actual time the water supply is interrupted and restored, and number of properties affected.

iii) Record all complaints regarding "out of water".

iv) Record time and type of notice of shutdown given to consumers.

v) Monitor peak daily demands annually and maintain graphical record to develop future demand curve.

2.4 PRESSURE

2.4.1 Statutory Obligations

No defined statutory obligation. However the Public Heath Grading of Community Water Supplies 2003 Explanatory Notes and Grading Forms imposes distribution grading "demerit points" where there is:

- Pressure in excess of 900 kPa in more than 5% of the zone; or
- Pressures less than 100 kPa; or
- Pressures lower than 150 kPa in significant parts of the zone during high demand.

2.4.2 Non-Statutory Standards

New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008 requires 10m head residual running pressure, i.e. pressure remaining in the pipe after abstraction of the fire fighting water.

The Nelson City Council Water Supply Bylaw does not guarantee any specified maximum or minimum pressure.

NZS 4404: 2010 Land Development and Subdivision Engineering recommends water supply pressure shall be between 250 kPa and 800 kPa (25m to 80m head)

Water supply levels were set in the Nelson City Council Resource Management Plan to ensure adequate supply pressure for new developments. These generally are the 67 metre contour where the area is supplied at Low Level Pressure and the 110 metre contour where the area is supplied at High Level Pressure

2.4.3 Background

i) Pressure Fluctuation

At present, Nelson's water supply is predominantly gravity fed from covered storage reservoirs. This means the elevation of the Water Treatment Plant Clearwater reservoir and Stoke High Level Reservoir determines which areas of the City can be supplied and how much pressure is provided.

Each supply area is further broken down into high level and low level areas. The high level areas work on the full mains pressure generated by the difference in elevation between the reservoirs and the point of supply.

The low level areas have the supply pressure stepped down by pressure reducing valves. This is to protect the mains and domestic plumbing installations from continuously operating under excessively high water pressures.

The Clearwater Reservoir at the Water Treatment Plant is normally used to directly supply the area encompassed by Atawhai, the Brook Valley, Bishopdale, the Port Hills, the Port, and via the Thompson Terrace Reservoirs to Tahunanui and the Tahunanui hillside, and at times Stoke. The reservoir has an effective elevation of 155m above City Datum.

The Saddle Break Pressure Tanks and Stoke High Level Reservoir on the foothills cross-City link between the Brook and Enner Glynn Valley are at an elevation of 255m above City Datum (but the pressure is lowered in Marsden Valley by a pressure reducing valve to 170m above City Datum) and is used to supply Stoke.

The difference in elevation between the two systems means that properties on the Stoke high level areas can experience pressure fluctuations of at least 150kPa (15m head). This fluctuation in cold water pressure (and flow rate) adversely affects showers, washing machines, dishwashers, etc.

The maximum available pressure is called the static pressure. This occurs overnight during the low flow period. As demand increases in a pipe network, the friction of the moving water in the mains causes a reduction in pressure known as friction loss.

The working pressure (that experienced by the customer) is the static pressure less the friction loss. Demand varies though the day and year. With increased demand, customers experience lower pressures during the day and in summer. A difference between static pressure and working pressure of more than 35% is considered excessive.

ii) Minimum Pressure

The minimum working pressure at the ground floor level of buildings should ideally be not less than 300kPa (30m head) with an absolute minimum of 150kPa (15 metre head) in exceptional instances. The water supply levels in the 1996 Resource Management Plan were set at 67m (low level zones) and 110m (high level zones) to ensure these standards are met for all new developments.

In some of the more recent hill top developments above the water supply level, the issues of continuity of supply and pressure fluctuations have been resolved by the installation of storage tanks and in some cases pump stations (e.g. Observatory Hill, Austen Ward Heights, Panorama Drive, Springlea, Wastney Terrace.) To avoid the need for water towers and allow maximum land development, the standards have been eased so that:

a) Dwellings with ground floor level less than 30m below the floor of the reservoir are required to install a domestic pressure pump and tank to ensure adequate pressures. Oversize service connections are provided to minimise friction losses.

Conditions Book entries advise of these special circumstances. The system works well as the presence of the storage tank ensures continuity of supply.

iii) Maximum Working Pressure

The maximum pressure normally targeted would be in the order of 600kPa (60m head). Due to Nelson's hilly terrain and the ample pressure generated by the elevation of the headworks, Nelson City Council pressures are substantially higher.

In the lower areas of the city, static pressures can range from 400kPa to 950kPa. (40m to 95m head). Pressures in some of these areas have been reduced over the last 20 years (in particular, the Port and the residential areas of Stoke and Tahunanui on the seaward side of State Highway 6), by installing new pressure reducing valves, adjusting down existing pressure reducing valves, or installing new mains. This can cause difficulties where plumbing and sprinkler systems have been designed for existing water pressures.

Pressures in the 60 to 95m head range are still acceptable for domestic supply, although not ideal, and may need reviewing in the future.

Excessive pressures can lead to early failure of mains and contribute to problems of Unaccounted for Water losses (Section 3.3.3).

Of more concern are the areas on the edge of high pressure zones (in particular, the bottom of the Port Hills, the Tahunanui Hills, Toi Toi Valley, Washington Valley and the Grampians. As a cost saving measure when the City was developed, these areas were served by the high pressure mains that also carry water to the top of the hills. Static pressure in some of these areas is in the range of 1400kPa to 1800kPa (140m to 180m head).

These pressures are in excess of normal working pressures. It is likely that most of these residents have installed their own pressure limiting valves. As mains in these areas are relaid the opportunity is taken to provide additional capacity and change them over into the pressure reduced zone.

$1,476,000 is included in the Capital budget over the next 12 years i.e. $123,000 per year until 2023/24, for system improvements including the installation of new pressure reducing valves and mains to address this problem of excess pressure.

$1,655,000 is included in the capital budget over the next 6 years i.e. $405,000 in 2012 and then $250,000 per year until 2018 to lay new mains to facilitate lower pressures.

2.4.4 Level of Service for Pressure

With the exception of hillside development served by local storage tanks and pressure pumps, provide a water supply of suitable pressure such that:

i) The maximum fluctuation between the static pressure and working pressure at each property does not exceed 35% from the average pressure received by each customer.

ii) The minimum working head at the ground floor level of each property is not less than 300kpa (30m head) excluding friction losses in the private pipework.

iii) The maximum static head at the ground floor level of each property does not exceed 900kPa (90m head).

2.4.5 Performance Monitoring

In 2011 the water network model identified:

i) 4.2% of properties have pressure fluctuations exceeding 35%;

ii) 1.4% of properties have water pressure below 300 kPa;

iii) 18.4% of properties have water pressure in excess of 900 kPa.

iv)

In 2012/13 the water network model identified:

i) 0.2% of properties have pressure fluctuations exceeding 35% of the average pressure supplied;

ii) 1.4% of properties have water pressure below 300 kPa;

iii) 14.9% of properties have water pressure in excess of 900 kPa.

iv)

2.4.6 Action Plan

i) Routinely calibrate the accuracy of the Network Analysis model so that reliable predictions are provided.

ii) Target pressure correction work so that areas of the network with most consumers and greatest pressure problems are corrected first.

2.5 FLOW RATE

2.5.1 Statutory Obligations

New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008 specifies volume and pressure requirements for the water supply system within the Urban Fire District.

2.5.2 Non-Statutory Standards

The Nelson City Council Land Development Manual 2010 specifies minimum demand figures that must be allowed for when designing new work.

2.5.3 Background

The flow rate available to each customer is the greatest influence on the customer's impressions as to the adequacy of the water supply. Low flow rates cause water to dribble from shower heads and fill basins and baths slowly.

Many low flow problems are caused by inadequacies of the plumbing within the property and this is beyond the control of the Nelson City Council. Therefore the level of service is defined at the point of supply (the toby or service valve).

Flow rate requirements can be divided into three categories:

i) Domestic Flow Rates

Customer expectations have changed in the last 35 years and whereas 20 litres per minute was previously considered adequate customers now expect 30 litres per minute.

30 litres per minute is the standard aimed for in Nelson. Provided the minimum pressure standards discussed in Section 2.4.4 are achieved then this flow rate should be readily available.

One of the symptoms of excessive pressure is too high a flow rate. This can cause water from the cold tap to bounce out of sinks and basins and creates water hammer in both the property's plumbing and the water reticulation system when automatic valves in dishwashers and washing machines close off.

To alleviate these symptoms residents partially close the stopcock at the boundary. This practice shortens the life of the stopcock and increases the Council's maintenance costs.

Resolution of the excessive pressure problem will solve this problem.

ii) Industrial/Commercial Flow Rates

The flow rates required by industrial processors are specific to each individual site. These are almost impossible to predict in advance so reticulation systems in industrial areas are provided with additional capacity.

With the exception of the Port Area, any proposal to use large volumes of water will be restricted by the capacity of the existing local mains to deliver the water and the sewerage system to convey and treat the effluent.

Commercial areas as distinct from industrial areas generally have low water demand except for fire fighting.

iii) Fire Fighting Flow Rates

The public supply is designed to provide an effective fire fighting network. Hydrants are installed on all service mains in urban supply areas in accordance with the New Zealand Fire Service Firefighting Water Supplies Code of Practice.

The New Zealand Fire Service issued a revised Firefighting Water Code of Practice in 2008.

The required fire fighting water supply for each building (other than single or multi-unit housing but excluding multi-storey apartment blocks) must now be calculated for the floor area of the building and the fire hazard category involved rather than being read directly from a table as previously. Any deficiencies

identified for particular premises would have to be remedied by the owner by increasing the fire fighting water supply, reducing the fire hazard in order to meet the requirements of the code, or installing a fire sprinkler system.

The required flow for single or multi-unit housing (but excluding multi-storey apartment blocks) is 25 litres per second with a minimum of 12.5 litres per second from a hydrant within 135 metres of the risk and a further minimum of 12.5 litres per second from another hydrant within 270 metres of the risk.

Previous versions of this code of practice measured the distances from properties to fire hydrants as a radius centred on the property, the current version now measures the true "along the road" distance. This has had the effect of now increasing the number of properties that do not currently meet the distance requirement.

The Fire Service Code of Practice allows that where there is a reliably calibrated and accepted system for computer modelling of flows in a reticulated water system, the Fire Service may accept the outputs from such modelling in place of testing certain fire hydrants.

Generally domestic demand is not critical and the supply of water for fire fighting purposes will determine the reticulation pipe sizes required.

Problems with inadequate hydrant flows are experienced in some of the older areas of the City where the original 75mm and 100mm diameter cast iron water mains are incapable of delivering the flow rates required. Renewal work in recent years has concentrated on replacing these mains. The programme of replacing all 75mm diameter cast iron mains in the City was largely completed in 2006/07. This work also helped to address the problems with fluctuating and low pressures outlined in Section 2.4.3.

$600,000 is included in the Renewals budget over 6 years i.e. $100,000 per year from 2015/16 to 2020/21, for upgrades to the water network in areas where the fire flows are not being delivered. The areas to be upgraded will be regularly reviewed and identified using the water network model.

2.5.4 Level of Service for Flow Rate

To provide a reticulation network that delivers fire hydrant flows that comply with the New Zealand Fire Service Firefighting Water Supplies Code of Practice 2008. This is generally 25 litres per second in residential areas (12.5 l/s from each of 2 hydrants) and varying flows in Commercial/Industrial areas depending upon the fire hazard (low–medium hazards require 50l/s – 150l/s from a range of operating hydrants).

2.5.5 Performance Measurement and Monitoring

i) Record flows

ii) Determine theoretical flows by use of computer model

2.5.6 Action Plan

i) Target flow correction work so that areas with most consumers and greatest flow problems are corrected first. Develop plan for properties identified in 2011. See A706990.

2.6 EMERGENCY RESPONSE

2.6.1 Headworks

The Maitai and Roding headworks are manned by resident caretakers employed by the Water Treatment Plant contractor. During the caretaker's absence, resident relief caretakers are employed.

2.6.2 Water Treatment Plant

The Tantragee Water Treatment Plant is manned during normal working hours. After hours and on weekends, operators are able to monitor the plant remotely via a computer dial in system.

The operators also carry cell phones that are linked to the plant control system. Outside working hours, alarms are immediately sent to cell phones, so that the operators can respond immediately.

2.6.3 Supervision

The Nelson City Council Utilities operations and maintenance duty staff carry cell phones on a weekly roster so that at all times a Nelson City Council Operations and Maintenance staff member is available to respond to major network faults or faults that have been escalated by the Treatment Contractor or Network Maintenance Contractor.

2.6.4 Contractors Service Response and System Operation

The Utilities Services Maintenance contract requires that the maintenance contractor responds to calls within appropriate times depending on the circumstances as follows.

i) Urgent Works

Urgent works are defined in the first column of the response timetable below in Table 2.5.

Response times apply 24 hours per day every day of the year.

The Contractor must respond to and satisfactorily resolve maintenance works within the maximum response times for the specified percentage of cases.

Table 2.5 Urgent Maximum Response Times

Definition of Urgent Works	Investigation and Appraisal Night and Day	Repair Completed	% of Cases
Burst pipes or major leakages likely to affect the water supply or cause damage to pavements or property.	30 minutes	8 hours	95%
No water or pump station failure.	30 minutes	8 hours	95%
Possible serious health risk (life threatening) water quality problem.	30 minutes	2 hours	100%

i) Non-Urgent Works

Non-Urgent works are as defined in the first column of the response timetable below in Table 2.6.

Response times defined in hours apply 24 hours per day every day of the year.

Response times defined in days are working days (Monday to Friday) excluding public holidays during normal working hours. Such works are programmed by the Contractor on a daily basis.

The Contractor must respond to and satisfactorily resolve maintenance works within the maximum response times in Table 2.6.

Table 2.6 Non Urgent Maximum Response Times

Definition of Non-Urgent Works	Investigation and Appraisal Night and Day	Repair Completed
Minor leaks including from fittings, connections, meters, etc on sensitive hill slopes as identified on drawing 34/78. Missing or damaged service lids.	1 hours	24 hours
Minor leaks including from fittings, connections, meters, etc in areas other than above.	12 hours	3 working days
Water Quality Problems: - Taste and odour - Colour and grit	2 hours	1 working day
Non-serious water quality problems including poor pressure and flow.	N/A	3 working days
Engineers discretionary work	N/A	As agreed

2.7 ENVIRONMENTAL

2.7.1 Statutory Obligations

The Resource Management Act 1991

The Nelson Resource Management Plan

Specific consents issued under the Resource Management Act 1991 control the abstraction of water from the various sources. The conditions include maximum abstraction rates, residual flows which must be maintained in the river, temperature and quality of compensation flows, and biotic monitoring in the rivers.

2.7.2 Level of Service

Comply with resource consents RM025151 and RM975374 conditions for allowable water abstraction rates, revegetation of stream banks and eel and fish passage requirements.

2.7.3 Performance Measurement and Monitoring

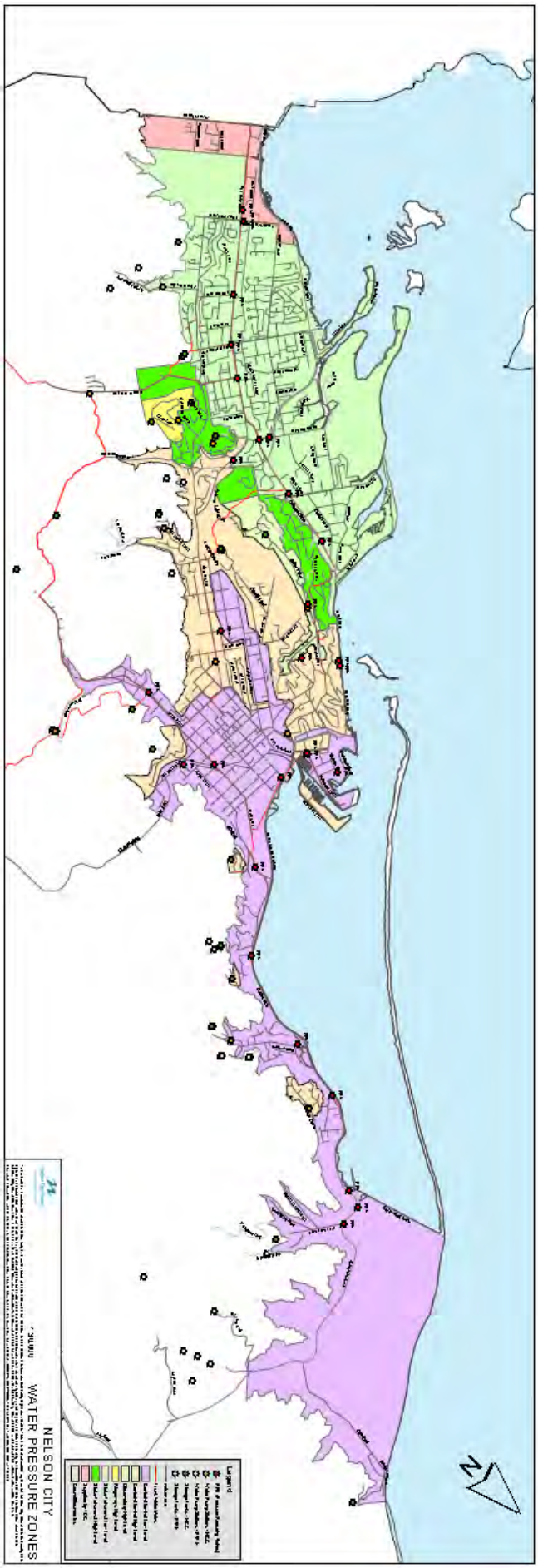
Record natural river flows, abstraction flows, mitigation flows, river temperatures, and water quality and biotic diversity and density.

2.7.4 Action Plan

i) Ongoing monitoring of Resource Consent conditions.

ii) Begin preparations for lodging applications for new resource consents for the Maitai Dam, Roding Dam plus abstraction.

Figure 2.3 Water Pressure Zones



3. FUTURE DEMAND

3.1 EXISTING SITUATION

As noted in Section 2.3.3 the aim is to have the capacity to withstand a 1 in 60 year drought with only sprinkler and hosing restrictions until at least 2035. Outputs in this demand section are therefore calculated on this basis.

Water for the city is extracted directly from both the Maitai and Roding rivers, piped to the treatment plant at the Tantragee saddle and then delivered to the city.

Water from the Maitai river is extracted from a run of river intake on the South Branch of the headwaters or from the Dam reservoir on the North Branch. The dam has been constructed on the North Branch to store water for use in low flow periods and for supplementary water flows to compensate for extraction from the South Branch.

An analysis of the flows in the South Branch of the Maitai river by Tasman District Council hydrologists has indicated that low flows for the 1, 50, 90 and 100 year return periods are as follows:

1 year: 203 litres per second

50 year: 90 litres per second

90 year: 84 litres per second

100 year: 83 litres per second

The Maitai Dam was designed to meet a peak demand of 37,000m3/day through a 75 year return period drought but has the capacity to supply water at the rate of 50,000m3/day through a 60 year return period drought. With the completion of the Water Treatment Plant a further 900,000m3 of water from the bottom of the Maitai Lake can be treated and used for city supply. However, pumping will be required to transport this water to the treatment plant. This additionally available water may need further conditioning prior to use as potable water to address low oxygen levels, elevated organic material levels and heavy metal concentrations.

The existing Maitai pipeline has a maximum capacity of approximately 37,000m3/day.

The Roding Dam has only limited storage and is a run of river intake. Provided there is an adequate flow in the river the Roding pipeline can deliver a maximum of 22,000m3/day. The estimated flow in the Roding River in a 1 in 60 year drought is 11,200m3/day.

However, the Resource Consent for water extraction from the Roding requires that from 1 July 2008 a minimum flow of 100 litres per second be left in the river.

100 litres per second (94 litres per second at the intake) equates to 8,122m3/per day. The available abstraction from the Roding River is therefore 3,100m3/day in a 1 in 60 year drought.

The current dry weather capacity of the water supply system, limited by the capacity of the existing Maitai delivery pipeline, from 1 July 2008 is:

Maitai	37,000m^3/day
Roding	3,100m^3/day
	40,100m^3/day

but with the completion of the duplicate Maitai pipeline the 1 in 60 year drought capacity will be:

Maitai	50,000m^3/day
Roding	3,100m^3/day
	53,100m^3/day

However, the Roding resource consent also requires that if Tasman District Council ceases taking water from Nelson City, the residual flow in the Roding River shall be increased by 10.5 litres/sec which is 907m3/day. It is likely that Tasman District Council will cease this take when the proposed Lee Valley Dam is completed.

The 1 in 60 year drought capacity would then be:

Maitai	50,000m^3/day
Roding	2,193m^3/day
	52,193m^3/day

The current capacity of the Tantragee Water Treatment Plant is approximately 41,000m3/day. Addition of further membranes to commission the fifth train would increase capacity to 50,000m3/day. New technology high capacity membranes are expected to extend the plant capacity even further.

The foothills link from the Roding River (Marsden Valley) to the Water Treatment Plant has a maximum capacity of 22,000m3/day. This allows the Maitai pipeline to be shut down for maintenance other than during the peak summer demand. The normal flow is 16,000m3/day to reduce pumping costs. However, when the Maitai Dam spillway stops flowing i.e. when the lake level is below the crest, and there is still sufficient flow in the Roding, Roding water can be used to supply the City, up to the maximum allowed by the resource consent (residual) thereby minimising draw off of stored water from the Maitai Dam.

The principal trunk link between the Water Treatment Plant and Stoke is the foothills link to Marsden Valley. This has a capacity of 16,000m3/day. Because water in the foothills link is pumped, the use of the Marsden Valley route for treated water is minimised to reduce operating costs.

The other trunk link between the Treatment Plant and Stoke is through the Thompson Terrace reservoirs. The size of the trunk mains and the elevation of the reservoirs restricts the gravity flow through this link to approximately 11,000m3/day. However, a booster pump station in Van Dieman Street increases the peak capacity to 14,500m3/day.

The supply capacity to Stoke and Tahunanui is:

Foothills Link	16,000m^3/day
Cross City Link	14,500m^3/day
	30,500m^3/day

3.2 DEMAND FORECAST

3.2.1 Industrial and Commercial Demand

i) Since the water demand was initially calculated in 1996 there have been significant changes in Industrial and Commercial activities (and therefore water demand) at the Port.

ii) Fin fish quotas are reduced, catches are down, and more processing is carried out at sea or in Asia. The Sanford (South Island) Ltd processing factory at the port has closed and is unlikely to reopen. It is also unlikely that any other similar fish processing factory will be established in Nelson in the forseeable future.

iii) Port Nelson has increased container and log marshalling areas with the demolition of existing buildings, including the Milk Treatment Station. Further expansion of these areas is likely, until ultimately the area bounded by the existing gated area at Graham Street, Wildman Avenue, and the Calwell Slipway becomes port storage.

iv) Current fuel storage areas are likely to decrease. The current BP Oil NZ Ltd tank site is likely to revert to the Port Company in 2025 and become a cargo storage area. Tank storage volume may increase on the other existing site, but the

bunding area will still be required, and the land will not be available for other development.

v) Current engineering activities are likely to remain around the slipway area, and current boating activities are likely to remain around the marina area. These activities are not significant water users.

vi) While total demand from the Port area has steadily fallen from 1999, growth of 0.5% per annum (10.5% over 10 years) has been assumed from 2005 for demand purposes.

vii) Commercial/industrial growth in the remainder of the City/Atawhai area is expected to be restricted by lack of suitable land availability and limited sewer capacity. The Nelson Resource Management Plan limits Trade Waste discharge to the sewer to 0.54 litres per second per hectare. Sites in the Central City and St Vincent/Vanguard Streets area are generally small and a major wet industry is not likely to set up in this area. The recent development of New World and Harvey Norman stores in Vanguard Street, together with their associated car parking, has further reduced commercial/industrial land available for wet uses. Commercial users generally have a low water demand.

viii) Recent Commercial/industrial growth in the Stoke/Tahuna area has utilised most of the existing industrial zoned land.

ix) The Nelson Urban Growth Strategy consultation document suggested that 50 to 80ha of industrial land is required for each 10,000 of population. An average 65ha has been assumed.

x) The Nelson Urban Growth Strategy consultation document suggested that there are limited options for industrial growth within Nelson City. Three options were identified:

- A small additional area on Vanguard Street on flat area up to Northesk Street for service industry (not generating air emissions/noise issues). Area of 2.5 hectares.
- Rationalisation of the Tahunanui industrial area to make more use of the land – currently large areas such as timber yards – where there is potential for more intensive uses. Area of approximately 10 hectares.
- Coordination with Tasman District Council regarding development of new land in Richmond vicinity for industrial uses taking a regional planning approach. i.e. Industrial growth in Nelson will be low water users on small sites.

xi) For the period 2005-2021 it has been assumed that new industrial growth will be located

- 46% Stoke
- 46% Tahunanui
- 8% City
- 0% Port

xii) For the period 2022-2051 it has been assumed that:

- Stoke/Tahunanui will have no land available for industrial growth
- The necessary industrial land will be in the City area (created by further rezoning in the Victory area, further reclamation adjacent to Akersten Street, or by rezoning in the vicinity of the Nelson North Wastewater Treatment Plant).

xiii) It is also assumed that Tasman District Council will continue to supply Alliance Nelson Ltd, Wakatu Industrial Estate, and ENZA Foods Ltd through the Waimea Supply until 2021. Nelson City Council could take over this supply and would be able to meet the reduced demand requirements through a 1 in 60 year drought, with restrictions. However mains would be required in Stoke to provide

sufficient pipe capacity. Further work is required to evaluate actual industrial demand and costs to service this area.

xiv) Some potential for industrial development has also been identified for the Wakapuaka flats adjacent State Highway 6, the Boulder Bank and the Glen Road. Currently a small area is being used for aquaculture research and development. Council would be unable to supply large volumes of water to this area without substantial upgrades of the trunk main.

xv) A review of the industrial demand is expected over the next three years as Council reviews the Nelson Resource Management Plan. The likely impact on the water network will be reflected in future asset management plans.

3.2.2 Residential Demand

i) Residential growth is based on Council's adopted growth forecasts from Statistics New Zealand 2012 population projections.

Tables 3.1, 3.2 and Figure 3.1 show the population figures that would result from the growth projections used.

Table 3.1 Nelson City Population Projections 2011 – 2045. From Statistics New Zealand 2012 (A1114741)

	2011	2015	2025	2045
Population	46,200	47,240	49,400	51,360
Number of households	19,300	20,020	21,640	23,380
Average number of people per household	2.4	2.4	2.3	2.2
Median age (years)	41	42	44	47
Population aged 65 and over	7,450 (16%)	8,480 (18%)	11,610 (23%)	15,130 (30%)
Working age population (aged 15-64)	30,290 (66%)	30,180 (64%)	29,360 (59%)	28,140 (55%)
Population aged under 15 years	8,460 (18%)	8,580 (18%)	8,430 (17%)	8,090 (16%)

Figure 3.1 Nelson City Population Projections

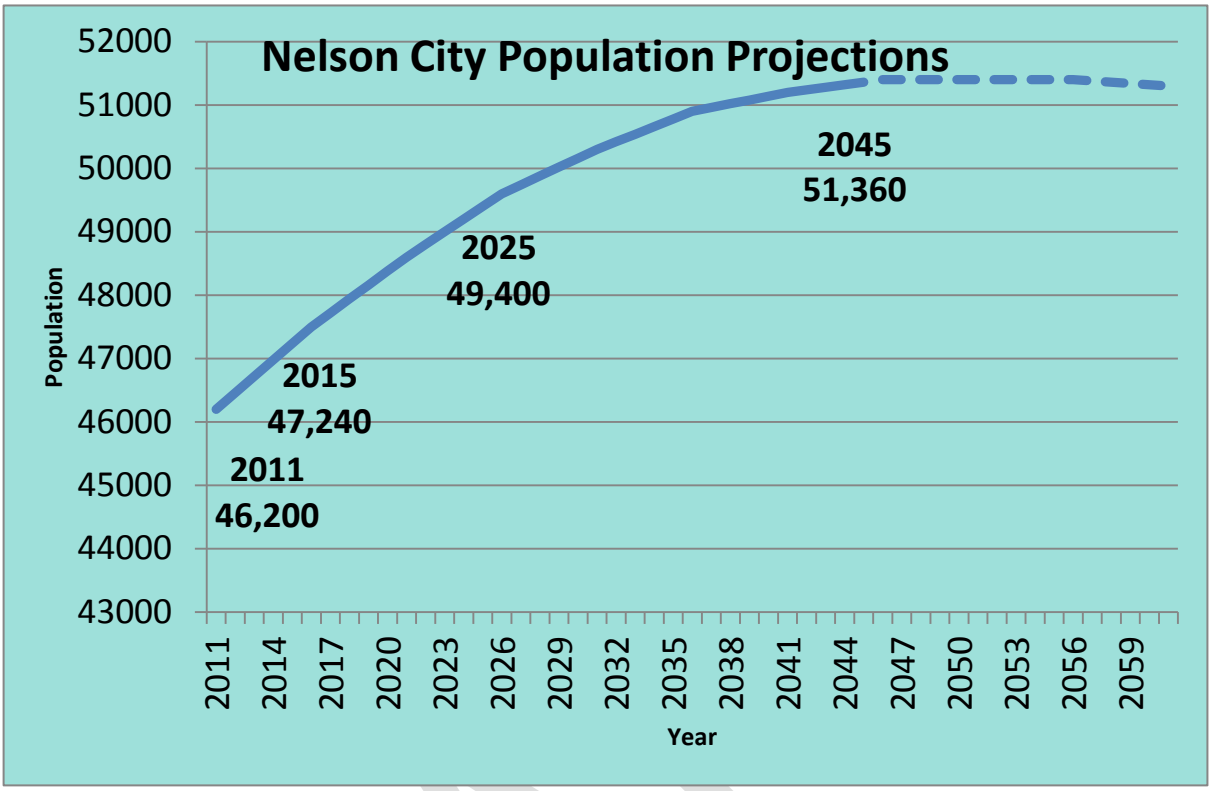


Table 3.2 Nelson City Population Projections 2011 – 2045. From Statistics New Zealand 2012 (A1114741)

Locality	Projected population by locality						
	2015	2020	2025	2030	2035	2040	2045
Stoke							
Ngawhatu	2,340	2,510	2,620	2,730	2,850	2,960	3,110
Saxton	1,960	2,060	2,100	2,110	2,090	2,060	2,030
Nayland	880	900	920	930	930	940	940
Enner Glynn	3,420	3,590	3,790	3,990	4,170	4,340	4,470
Maitlands	2,440	2,480	2,530	2,570	2,610	2,640	2,670
Isel Park	3,100	3,240	3,410	3,590	3,720	3,860	3,960
Langbein	3,310	3,310	3,330	3,340	3,340	3,330	3,330
Sub Total	17,450	18,090	19,140	19,260	19,710	20,130	20,510
Tahunanui							
Tahunanui	2,070	2,070	2,070	2,060	2,040	1,990	1,930
Tahuna Hills	2,440	2,550	2,660	2,750	2,830	2,880	2,920
Nelson Airport	910	900	890	880	870	850	830
Sub Total	5,420	5,520	5,620	5,690	5,740	5,720	5,680

Locality	Projected population by locality						
	2015	2020	2025	2030	2035	2040	2045
Nelson Central							
Port Nelson	110	110	110	110	110	110	110
The Wood	2,810	2,780	2,730	2,680	2,630	2,560	2,500
Britannia	1,380	1,380	1,380	1,370	1,340	1,300	1,230
Washington	3,140	3,230	3,300	3,340	3,370	3,400	3,410
Trafalgar	390	370	360	350	330	310	290
Maitai	580	570	550	530	510	480	450
Kirks	840	850	840	840	820	800	780
Bronte	1,700	1,700	1,690	1,670	1,650	1,620	1,580
Atmore	1,250	1,250	1,250	1,250	1,240	1,220	1,190
Toi Toi	1,640	1,630	1,650	1,640	1,700	1,760	1,780
Broads	1,660	1,680	1,690	1,670	1,650	1,630	1,610
Grampians	2,270	2,340	2,390	2,430	2,480	2,530	2,580
The Brook	1,330	1,350	1,370	1,380	1,400	1,410	1,430
Sub Total	19,100	19,240	19,310	19,260	19,230	19,130	18,940
Nelson North							
Clifton	1,220	1,240	1,240	1,230	1,210	1,190	1,160
Atawhai	2,590	2,720	2,850	2,980	3,050	3,100	3,140
Glenduan	510	540	560	570	580	590	590
Whangamoa	1,010	1,070	1,130	1,180	1,230	1,260	1,290
Sub Total	5,330	5,570	5,780	5,960	6,070	6,140	6,180
City Total	47,300	48,420	49,850	50,170	50,750	51,120	51,310

i) The current peak residential demand for Stoke and Tahunanui is assumed as 0.843m3/head/day and for the City and Atawhai 0.463m3/head/day. This difference occurs because more water is likely to be used in Stoke and Tahunanui for garden and lawn irrigation as the land is more gravel soil, and receives all day sun, whereas in the Central City and Atawhai the sections are generally steeper, have clay soils and often shaded for part of the day.

ii) It is assumed that by 2021 Richmond will not be taking water from Nelson as by then the Waimea Water Augmentation dam currently being investigated for the Lee River is expected to have been built. However the current resource consent requires that if Tasman District Council ceases to take water from Nelson, then the residual flow be increased by 10.5 litres per second = 907m3/day.

iii) Residential demand for 2021 is assumed to be the 2012 demand for houses existing in 2012 as in ii) above and for new houses in Stoke/Tahunanui 0.5m3/head/day and City/Atawhai 0.4m3/head/day for the following reasons:

- Improved plumbing and appliance technology, (particularly being driven by the Australian water shortages), future household use will be reduced e.g. superlow flush 4.5/3 litre toilet flush (compared with 11 litre single flush), low use washing machines, low flow shower heads, aerator taps, reuse of grey water for toilets and irrigation etc.
- Increasing awareness of low water use gardening e.g. drought resistant planting, no mow lawns, or no lawns at all

- With intensification, smaller gardens or no gardens at all for many household units
- Reduced use due to reduced supply pressures
- Consumer education on tap use e.g. turn off while brushing teeth, shorter duration showers, showers instead of baths, rinsing dishes in a partially filled sink rather than under a running tap
- Possible greywater and rainwater storage on site for reuse
- More stringent hosing restrictions
- Pricing incentives
- Central Government Regulation

iv) Residential demand for 2045 is assumed to be the reduced figures for all properties as over the next 30 years a number of currently existing houses are likely to be rebuilt, refurbished or refitted so that all residences will have low water use fittings and appliances. The 2045 peak residential demand for Stoke and Tahunanui is assumed as 0.5m3/head/day (300 litres essential use and 200 litres outside use) and for City and Atawhai 0.4m3/head/day (300 litres essential use and 100 litres outside use) and for Hira 0.5m3/head/day (300 litres essential use and 200 litres outside use).

v) Richmond is entitled to the lesser of 909m3 of water/day or 1/15 of the Roding supply rate. However, the resource consent states that if Tasman District Council ceases taking water from Nelson City the residual flow in the Roding River shall be increased by 10.5 litres/sec which is 907m3/day.

vi) Hira is a possible area of expansion not covered by current supply.

vii) A plan change to the Nelson Resource Management Plan is currently underway to recognise the subdivision activity in the Saxton Creek area North of Champion Road. This area is currently supplied with water by Tasman District Council. If the present supply arrangement with Tasman District Council continues, this portion of the growth will not need to be supplied from Nelson City sources. However the agreement may be revoked on 2 years notice by either Council. The increased population supplied is therefore allowed for in the figures in Table 3.1 above and a project to upgrade reticulation to the area is identified in the capital expenditure budget.

viii) Previous Council Urban Growth Strategy documents also predict that some of the population growth will be by intensification of housing in Atawhai, Central Nelson, Hospital, Tahunanui and Stoke areas. This implies that gardens will be smaller and the peak demand per population will reduce.

ix) Council is concentrating on improving services to developed areas and providing services to areas that are currently being developed (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, Industrial). Servicing of other areas covered by the Services Overlay, because one or more servicing constraints have been identified as needing to be addressed prior to the complete development of that property/area, will be considered as Council develops a policy on prioritising these areas. The specific projects to facilitate future growth, identified in this Asset Management Plan, therefore consist of works required to eliminate servicing constraints on the former.

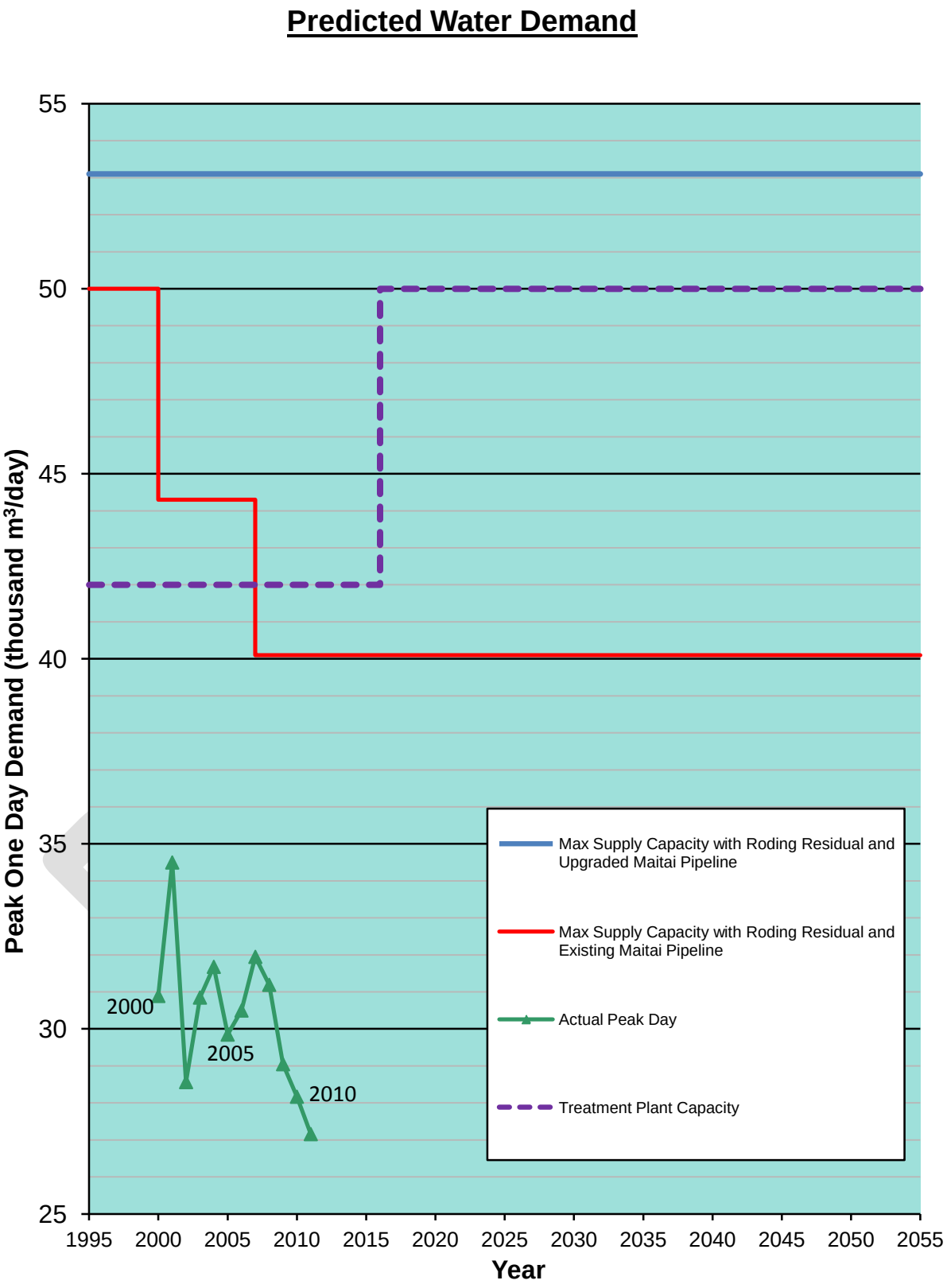
x) A Map of the areas zoned for growth but constrained by lack of services is attached in Appendix I. Construction of services to these areas should be carried out in line with Council's prioritisation policy. Appendix I sets out a draft "INFRASTRUCTURE PLANNING TOOL FOR GROWTH PROJECTS" that reflects infrastructure prioritisation factors. In 2014 Council is expected to consider a proposal to review the Nelson Resource Management Plan and look at wider prioritisation criteria for future development areas. Infrastructure planning will align with any new policy that is developed.

xi) A specific project has been identified to update desktop investigations, carried out in the past, looking at servicing constraints to areas currently zoned for residential development but restricted by a services overlay.

xii) A review of the residential demand is expected over the next three years as Council reviews the Nelson Resource Management Plan. The likely impact on the water network will be reflected in future asset management plans.

xiii) Figure 3.2 compares the capacity of the water sources and water treatment plant with the actual peak day water usage over the last 15 years.

Figure 3.2 Predicted Water Demand



Year	Peak Daily Supply (m3/day)	Year	Peak Daily Supply (m3/day)	Year	Peak Daily Supply (m3/day)
2000	30,900	2007	31,950	2014	27,900
2001	34,500	2008	31,200	2015	
2002	28,570	2009	29,050	2016	
2003	30,850	2010	28,170	2017	
2004	31,680	2011	27,160	2018	
2005	29,850	2012	28,070	2019	
2006	30,500	2013	30,660	2020	

3.2.3 Total Demand

The water demand projections for the next 30 years have been calculated. The results are shown in Table 3.3.

Table 3.3 Water Demand Projections (Peak Day 1 in 60 year Drought)

	TOTAL DEMAND											
	2006			2021			2031			2051		
	res	comm/ind	total	res	comm	total	res	comm	total	res	comm	tot
City /Atawhai/Hira	11018	5104	16122	10772	5550	16322	11308	6210	17518	11212	6870	18082
Stoke/Tahunanui	17450	2893	20343	17084	5327	22411	20959	5327	26286	14105	5327	19432
TDC	910		910									
			21253									
	TOTAL		37375			38733			43804			37514

Note: The projected figures are subject to round off error and may not add exactly to the totals shown.

Based on historical use figures and the supply capacity of the Water sources and treatment plant, Nelson has sufficient water to supply reasonable demands within the city beyond 2050.

As the population increases additional storage reservoirs will be constructed and reticulation upgraded where development requires.

3.2.4 Covered Storage

Currently the Maitai and Roding together are capable of supplying 40,100m3/day. However, demand is more typically spread over a 16-18 hour period. Therefore storage is required to make full use of the night time supply capacity and to meet peaks in demand during the day.

This storage is also needed to ensure continuity of supply in the event of a major problem (e.g. headworks damage, or trunk main failure) and to provide opportunities to carry out planned maintenance.

The Public Heath Grading of Community Water Supplies 2003 Explanatory Notes and Grading Forms imposes distribution grading “demerit points” where there is not covered secure storage of 24 hours average daily demand.

The targeted level of service is 24 hours storage (at average demand) located in the area it is to serve. This standard is met for the smaller hilltop reservoirs and tanks served by pumped systems or night time filling but not for the larger zone reservoirs.

A total of 21,000m3 of covered storage is required to meet the current average demand.

Table 3.3 shows the current reservoirs.

Table 3.3 Current Reservoirs

Name	Location	Year Commissioned	Capacity m3
Thompson Terrace No. 1	Ariesdale Terrace	1961	2,500
Thompson Terrace No. 2	Ariesdale Terrace	1974	5,500
Stoke No. 1	Marsden Valley	1996	2,500
Stoke No. 2	Marsden Valley	2006	2,500
Atawhai No. 1	Walters Bluff	2002	2,500
Clearwater	Tantragee WTP	2004	3,000
Stoke High Level	York Valley Saddle	2011	2,500
Various smaller reservoirs and tanks	Various	Various	1340
Current Total			**22,340m^3**

Table 3.4 shows the reservoirs proposed for the 30 year planning period until 2044/45.

Table 3.4 Proposed Reservoirs

Name	Location	Year Proposed	Capacity
Atawhai No. 2	Bayview Road or Marybank. Yet to be determined.	2014-24	2,500
Future Growth Areas	Nelson- North and South.Yet to be determined.	2034-38	5,000
Proposed Total			**7,500**

In the 2006-2016 Long Term Council Community Plan a high level reservoir was proposed for Marsden Valley in 2015/16 to serve future growth. However development is already proceeding in Marsden Valley and the reservoir has now been completed.

The projected increase in demand caused by development north of Cemetery Point means that Atawhai No. 2 reservoir (2500m3) will be required by about 2021/24. Other reservoirs will be required to serve local growth.

- Malvern Hills to serve the ridge between Botanical Hill and Dodson Valley. This smaller reservoir was shown in the 1998 LTFS for 2001/02 but has been deferred several times until required by development. An options report to identify the best solution for the Atawhai No. 2 reservoir and the upper levels reservoir is currently shown for 2014-2016. It is expected that this report will look at locations and options for servicing the Atawhai area.
- The need for other reservoirs as the city expands has been recognised and allowed for, in general terms, in the capital expenditure tables but not scheduled by exact location as the timing and location of future development is uncertain. Should full residential development proceed at Hira, several large reservoirs supplied by a trunk watermain will be required.

3.3 DEMAND MANAGEMENT

3.3.1 Universal Metering

The Council resolved to adopt universal metering in 1996 and a capital programme installed a meter for every property. Universal metering has been in operation since 1 July 1999. The maximum two day average in 1997/98 was 42,300m3/day, whereas the peak since universal metering has been in operation is less than 35,000m3/day.

Although the peak one day water usage prior to universal metering reached 42,000m3/day the typical winter usage is in the order of 21,000m3/day. Given that there is virtually no fluctuation in commercial water usage between winter and summer, the difference of 21,000m3/day must be attributed mainly to residential sprinkler usage, although the summer holiday influx of visitors in late December and early January to Nelson does have an impact.

This means that to meet uncontrolled garden watering demand the water supply system needs up to 100% extra capacity which is only used for approximately 10% of the time.

As noted above the introduction of universal metering has reduced the summer peak by over 37%.

Peak demand is most affected by summer drought and consequent garden watering. The drought of 2000/01 is estimated to have a return period of 1 in 30 years. Other years have been average or wetter than average and this is reflected in the peak demands.

The peak one day flows from 2000 to 2010 are plotted on Figure 3.1.

3.3.2 Other Demand Management

Use of alternative water sources for non-potable water would reduce the demand from the city water supply, particularly under summer conditions. While rainwater tanks and greywater reuse have some appeal, there are further implications with these, such as:

- The Ministry of Health/Department of Building and Housing reservations as to greywater reuse.
- Financial cost to householder.
- Size of tank versus Nelson rainfall (seasonal pattern and total).
- Siting of rainwater tanks on the property.
- Rainwater tanks needs to be considered in the wider concept of sustainability, e.g. environmental cost of producing, transporting and disposing of a tank.
- Plumbing and appliance technology is rapidly advancing, particularly in Australia due to the droughts, and these may actually give better water conservation than tanks/greywater reuse e.g. Very low water usage dual flush toilets 4.5/3 litres per flush compared with 11 litre standard, and normal 11 / 6 dual flush, low water use clothes washers, low flow shower heads.

A full evaluation of alternative non- potable water sources suitable for Nelson, taking into consideration Nelson's current and future weather patterns was proposed in the previous Asset Management Plan. This work still needs to be carried out when resources permit.

3.3.3 Unaccounted for Water

All water reticulation networks are prone to leakage to some extent. Leakage occurs both from the public system and from individual customer's plumbing. International research suggests 60% of losses occur on private property. A slowly dripping tap can leak 40 litres within a 24 hour period, and collectively the total losses from dripping taps can be very significant. The introduction of universal metering has provided consumers with the incentive to promptly repair such leaks.

Networks also have other losses which include:

- Fire fighting and hydrant flow testing

- Overflows at reservoirs and losses during their cleaning
- Mains testing and flushing
- Unknown connections
- Use by contractors

Collectively this total water loss is referred to as Unaccounted for Water (UFW).

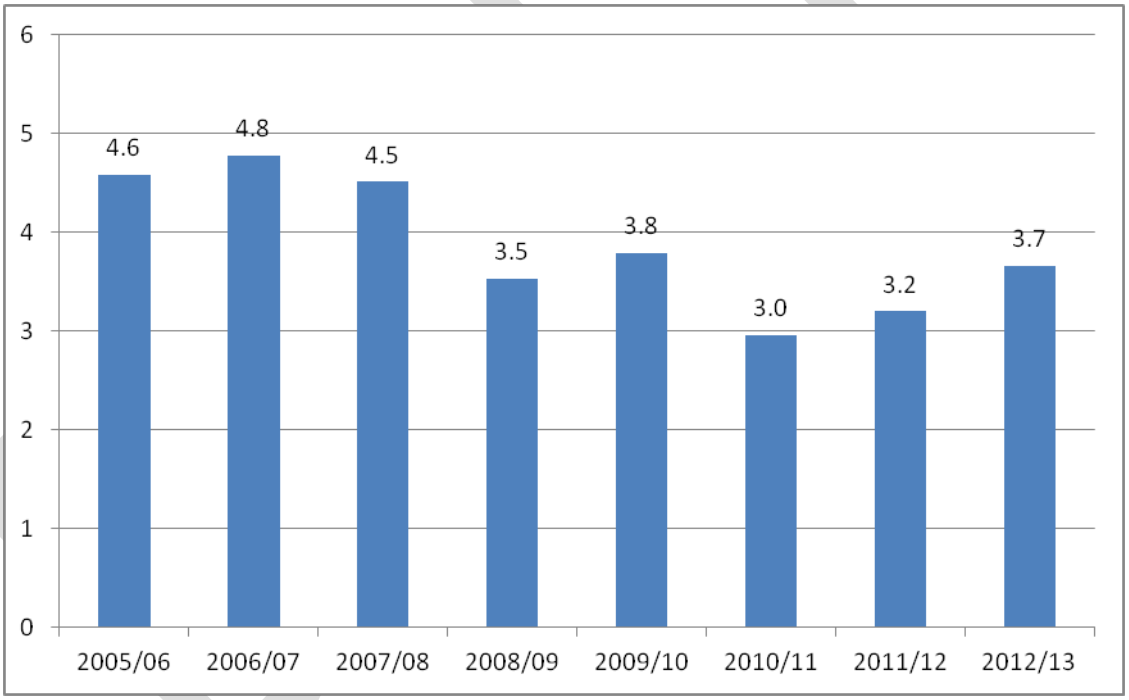
Controlling UFW can significantly reduce demand. UFW control also has environmental benefit as it reduces the quantities of water that are required.

3.3.4 Water Losses

The reporting of annual water losses as a percentage of annual water production is not a satisfactory measure, as losses are nearly constant each year and water sales (and therefore production) is weather dependent. 'Bench Loss' software has been used to calculate the Infrastructure Leakage Index (ILI) which allows year to year comparisons and also benchmarking between water supply authorities.

The infrastructure leakage index has been calculated since 2001/02. The results are shown in Figure 3.2.

Figure 3.3 Infrastructure Leakage Index for Nelson



The Infrastructure Leakage Index has fluctuated over the past with a slight increase apparent over the past two years.

This calculation was made with assumptions regarding un-metered consumption such as flushing of mains, fire fighting, use by contractors etc. Further work is required to refine these assumptions. The viability of providing metered water tank filling points around the city and where possible metered standpipes for flushing, needs to be undertaken. This would allow more accurate measurements to be entered into the calculation.

The World Bank Banding System for interpreting the Infrastructure Leakage Index is shown in Figure 3.4.

Figure 3.4 World Bank Banding System for Infrastructure Leakage Index

	ILI	Performance in real losses management
For Developed Countries	< 2	A
	2 - 4	B
	4 - 8	C
	> 8	D

World Bank suggested strategies for each band are:

- A (0<ILI<2) Further loss reduction may be uneconomic unless there are shortages; careful analysis needed to identify cost-effective improvement.
- B (2<ILI<4) Potential for marked improvements; consider pressure management, better active leakage control practices, and better network maintenance.
- C (4<ILI<8) Poor leakage record; tolerable only if water is plentiful and cheap; even then, analyze level and nature of leakage and intensify leakage reduction efforts.
- D (ILI>8) Very inefficient use of resources; leakage reduction programmes imperative and high priority.

The water loss evaluation for Nelson is shown in Appendix E.

The Council's maintenance contractor has leak detection equipment which is used to search for and pinpoint the location of suspected water leaks. This service is made available free of charge for locating leaks in private property.

Water leaks on hillsides and areas with clay/rock subsoil usually show quickly on the surface, but on flat and gravel subsoil areas the water from leaks may flow away without coming to the surface. Zone meters have been installed at strategic locations in Stoke and Tahunanui to measure the flow into defined areas. Night-time flows (when there is little domestic demand) can be checked for abnormalities and also the inflow into a zone can be compared with the volume of water sold through the water meters. Additional work is required to break the city into District Metering Areas to better monitor water usage by defined zones.

The Leakage Control Plan is shown in Appendix F.

This level of input will be continued until the scale of UFW can be more accurately established and the need for additional effort assessed. One contributing factor to UFW in Nelson is the very high water pressures in some areas of the City (refer Section 2.4.3). The Pressure Reduction Plan is shown in Appendix G.

3.3.5 Water Conservation Strategy

The Regional Policy Statement requires that the Council as a water user must prepare a Water Conservation Plan to limit or restrict the 'non essential' portion of the urban water supply in times of drought.

A "Water Supply Conservation Strategy" was re-adopted by the Council in February 2003 to take account of the reduced abstraction available from the Roding River due to the residual flow required to be left in the river as a condition of the Resource Consent. The water conservation strategy is shown in Appendix B.

3.4 SUPPLY CAPACITY

As discussed in Section 3.1 above, the reliable Roding supply in a 1 in 60 year drought is reduced to 3,100m3/per day after 1 July 2008.

At the abstraction rates currently authorised in the resource consents, Nelson City has sufficient source water to meet predicted demand through a 1 in 60 year drought for

the foreseeable future. Based on current demand projections the capacity of the Maitai pipeline will become the limiting factor in 2023.

It should be noted that these dates will change if the resource consent is varied or demand varies from that predicted.

Possible augmentation options to make up any future deficit were considered by Council in 2007. It should be noted that these do not replace the existing sources but merely bridge the difference between existing supply and future demand. Details are in the following reports prepared by Opus International Consultants:

- Maitai Pipeline and Alternative Water Sources – Options and Costs, Opus International Consultants Ltd, 2006
- Feasibility of Raising the Water Level of Maitai Dam, Opus International Consultants Ltd, and Tonkin and Taylor Ltd, 2007

Options are:

- Roding High Dam. A high dam at the Roding could increase the Roding supply. The estimated cost for 10,000m3/day is $20.9million (2008 dollars) and for 20,000m3/day is $34.0 million (2008 dollars).
- The Waimea Water Augmentation Committee was formed to pursue an additional water source for the Waimea Plains. Nelson City Council is represented on the committee. Currently (February 2014) the site for the proposed dam has been refined down to the upper Lee River. Volumes required for urban supply are small compared with agriculture and horticulture irrigation requirements. Water would be released from the dam and enter the aquifer just above the Brightwater Bridge. It would then be pumped from the aquifer by users on the Waimea Plains. Bores for Richmond and Nelson (should Nelson City Council resolve to commit to the dam) water supplies and a water treatment plant would be sited near the Appleby Bridge. The water would then be pumped to Stoke through a new pipeline. A share in the dam in 2012/13 is estimated to cost $2.5 million (2008 dollars) and the cost of the bores, pumps, treatment and pipeline in the future is estimated to cost $14.7 million (2008 dollars).
- The present capacity of the Nelson Water Treatment Plant at the Tantragee Saddle is 42,000m3/day, however provision has been made in the construction of the Plant for the addition of a further membrane train which will increase the capacity to 50,000m3/day. It is likely that with improved technology the flow rate of new membranes will improve. The addition of the fifth train is programmed for 2014/15 and the present membranes are likely to be renewed from 2015/ 2016.
- Raising the top water level at the Maitai Dam. An adjustable weir could be installed on top of the existing spillway weir so that additional water could be impounded. Obermyer Spillway gates are bottom hinged spillway gates. They are most simply described as a row of steel gate panels supported on their downstream side by inflatable air bladders. By controlling the pressure in the bladders, the lake elevation can be maintained at user-selected points. The standard pneumatic controller provides accurate upstream pond control, and discharges water appropriately to maintain upstream lake elevation through a range of flows. This means that the existing spillway with such a spillway gate can be used to increase the water level, whilst allowing flood flows through as per normal.

  If the lake level is raised by one metre, the storage is increased by 350,000m3. Additional work would be required to alter the auxiliary spillway and to clear an additional one metre band of vegetation around the lake perimeter. A rough order cost for the complete project is $0.7 million (2008 dollars).
- “Dead” Storage. At present the bottom 900,000m3 of water in the dam cannot be accessed. Provision was made at the time that the dam was built to install a pump in the control building pipe work to enable this water to be pumped out and into the existing Maitai pipeline. However, the new pipeline completed up Maitai Valley Road in 2013/14 it will be at a level that will enable the “dead” storage to be used by using the booster pump proposed in the vicinity of the Maitai Motor Camp.

The bottom layer of the Maitai dam lake has high levels of organic material as well as elevated levels of heavy metals from the surrounding hills. The anoxic nature of this layer means that there will likely be additional capital expenditure required to improve the quality of this water should it be required as a source of potable water. There will also be additional operational costs in running the pump when the "dead" storage is utilised.

3.5 EXTENSIONS TO THE AREA SUPPLIED

3.5.1 Eastern Foothills

The Foothills Trunk Main is able to provide water to a large area including Upper Brook Valley, upper Enner Glynn Valley, Marsden Valley, the ridge between the Ngawhatu and Marsden Valleys, and Ngawhatu Valley.

3.5.2 Nelson North / Hira

When the City water supply was extended to the Glen in 1990, high pressure pipework was laid along the State Highway 6 from Allisdair Street to Todds Bush Road, with provision made for a pressure reducing valve at Todds Bush Road. This was to enable increased flow in the pipeline as far as Todds Bush Road.

Provision was also made in the pipework for an extension beyond the Glen turnoff. In 2003 the main was extended by a private subdivider from the Glen turnoff to Hillwood at the foot of Gentle Annie.

Extension over Gentle Annie would provide only a low volume rural restricted supply to existing properties in the Hira Basin.

At its meeting on 24 October 2002, Council resolved that the pipeline not be extended beyond Hillwood subdivision unless a prior change to the Nelson Resource Management Plan allows more intensive development in the Nelson North area and the costs would be met by those being served.

The Nelson Urban Growth Strategy 2006 suggests that Hira could be a residential growth hub around 2026. This study has not been adopted by Council and no changes to the Nelson Resource Management Plan are currently proposed that would provide for increased residential development in this area. Providing a water supply to serve any growth would require a review of supply options. One option is to construct a pipeline from the Water Treatment Plant, down the Maitai Valley to a pump station near Sharlands Creek, a pipeline up Sharlands Creek and over the saddle to Lud Valley. Ultimately three 2,500 cubic metre reservoirs would be required (each similar to the Walters Bluff and Stoke No1 and No2 reservoirs). A trunk main would then extend down the Lud Valley to the vicinity of the present Hira School. This system is roughly estimated to cost $30 million (2007 dollars). Construction of the reservoirs would be staggered to meet development demand, but the pipeline and pump station would have to be constructed as soon as development at Hira proceeds. Other options based on use of local water sources in the Lud, Teal and Wakapuaka streams have not been investigated. Issues with these sources would be the need for sustained available flows in summer drought conditions.

3.6 FUTURE GROWTH

i) As outlined in 3.2.2 Council is concentrating on improving services to developed areas and providing services to areas that are currently being developed (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, Industrial). Servicing of other areas covered by the Services Overlay, because one or more servicing constraints have been identified as needing to be addressed prior to the complete development of that property/area, will be considered as Council develops a policy on prioritising these areas. The specific projects to facilitate future growth, identified in this Asset Management Plan, therefore consist of works required to eliminate servicing constraints on these sites. Further work is currently underway by Council's strategic planning team looking at completing the project prioritisation process in appendix H. A Map of the areas zoned for growth but constrained by lack of services is also attached in Appendix H.

ii) Changes to wet industry demand can also impact on the network and these will be monitored over time.

iii) While the current demand for water is well within the supply capacity, there may be issues with delivery to areas North of the city and the Wakatu industrial estate, where existing network reticulation is not sized for larger flows.

iv) Capital projects in this asset management plan will provide options reports for parts of these areas and construction of storage reservoirs to buffer demand. Long term planning for trunk main upgrades will be re-assessed as Council formulates a policy of future development areas.

3.7 ACTION PLAN

- When future growth projections are available from the 2013 census, the water supply demand for the City will be revised for inclusion in the next Water Supply Asset Management Plan.
- Reports on the Atawhai No 2 reservoir site and the Tasman District – Nelson City link will be commissioned.
- Continue the water loss identification and reduction programme
- Continue the pressure reticulation programme
- Complete District Metering Areas and monitor demand by area in the city.
- Investigate viability of metered contractor filling points and metered standpipes for flushing to improve UFW results.

4. EMERGENCY AND RISK MANAGEMENT

4.1 BACKGROUND

4.1.1 Emergency Management

The key components of Emergency Management are the four "R's":

- Reduction of emergencies;
- Readiness for emergencies;
- Response to emergencies;
- Recovery from emergencies.

Initially risks have to be identified through the Risk Management Process so that advanced planning for the four "R's" can be carried out.

However not all risks are of an emergency nature, for example legal and financial risks.

4.1.2 Risk Management Policy

Risk will be managed in a prudent manner to enable business objectives and strategic goals to be consistently met.

4.1.3 Scope

The scope of risk management is to ensure that:

- Risk is understood and identified;
- Hazards and practices that could cause financial loss, disruption to business goals, injury to people or damage to the environment are controlled as far as practicable; and
- Insurance or other financial arrangements are made to protect the business interests should a loss damaging to the finances of the business occur.

4.1.4 Objectives

The objectives of risk management are to provide:

- Protection and continuity of the core business activities and essential services;
- Fulfilment of legal obligations
- Safeguards for public and employee health
- Environmental protection
- Operation and protection of assets at lowest cost
- Contingency Planning for foreseeable emergency situations
- Protection of ratepayer equity
- Manage borrowings and interest rate risks within Treasury Policy limits
- Manage interest rate risks

4.2 IMPLEMENTATION

4.2.1 Identification of the Risks

To effectively manage risk it is necessary to:

- Identify the nature, extent and likely incidence of risks affecting the operation of the system.
- Measure and evaluate the likely impact which could arise from each type of adverse effect.

- Manage risk to minimise potential effects and be cost effective.
- Monitor and report on the status of each risk on a regular basis.

Potential risks are identified in the tables in Appendix C: Nelson Tasman Engineering Lifelines Project Report 2004. Table 4.4 applies the results of looking at these risks in a quantitative fashion. The Lifelines report should be reviewed and risk schedules updated to reflect network improvements over the past ten years.

The Christchurch Earthquakes of 2010 /2011 lead to significant damage to that city's infrastructure including water storage reservoirs and pipe network from direct shaking and liquefaction. Recognising this, and the results of other natural hazard investigation post the Nelson storm events of December 2011 and April 2013, Nelson City Council is reassessing the risk to the network from earthquakes (including liquefaction, tsunami and direct shaking), flooding, storms and sea level rise.
In particular a series of reports have been compiled, as part of the city's wider hazard planning, as follows:

- *TSUNAMI MODELLING AND EVACUATION ZONE MODELLING FOR TASMAN AND GOLDEN BAY- GNS FEBRUARY 2012 (A261963)*
- *REVIEW OF TSUNAMI HAZARD IN NEW ZEALAND (2013 UPDATE)- GNS AUGUST 2013(A371109)*
- *ASSESSMENT OF THE LOCATION AND PALEOEARTHQUAKE HISTORY OF THE WAIMEA-FLAXMORE FAULT SYSTEM IN THE NELSON-RICHMOND AREA WITH RECOMMENDATIONS TO MITIGATE THE HAZARD ARISING FROM FAULT RUPTURE OF THE GROUND SURFACE- M. R. JOHNSTON A. NICOL GEOLOGICAL CONSULTANT GNS SCIENCE 395 TRAFALGAR STREET PO BOX 30368 NELSON LOWER HUTT GNS SCIENCE CONSULTANCY REPORT 2013/186 AUGUST 2013(A673742)*
- *REVISED PRELIMINARY ASSESSMENT OF THE LIQUEFACTION HAZARD IN TASMAN AND NELSON FEBRUARY 2013 (A597463)*
- *TAHUNANUI AREA LIQUEFACTION ASSESSMENT- TONKIN AND TAYLOR LTD NOVEMBER 2013(A1117884)*
- *MAITAI RIVER FLOOD HAZARD MAPPING MODELLING REPORT TONKIN AND TAYLOR LTD AUGUST 2013(A677152)*

A further report is expected in 2015, to update the 2009 report by the National Institute of Water and Atmospheric studies (NIWA) looking at the latest state of knowledge of the impact of climate change on sea level rise.

The water supply network activity is less impacted by sea level rise than other utilities because the reticulation is kept at a positive pressure, reservoirs are positioned on elevated ground away from direct tidal impact and the city's water source is distant mountain catchments.

Climate change is expected to bring with it more extreme weather in the form of higher intensity and duration rain events (with associated flood damage) and drought periods. The issue will be monitored and future asset management plans will be adjusted to address impacts as they become better understood.

Climate change is an evolving area of research and as such involves significant assumptions with associated uncertainties. Council seeks to limit the impact of those uncertainties by relying on expert guidance from Central Government and programming capital works in a staged fashion. Future upgrades of the water network are based on ensuring the work is designed for demand and conditions anticipated during the service life of the asset.

4.2.2 Analysis of Risks

The risk management framework is consistent with the joint Australian, NZ Standard AS/NZI 4360:1999 Risk Management, to ensure risks are managed on a consistent basis.

Risk is the combination of the likelihood and consequence of an event happening.

Likelihood is a description of the probability or frequency of an event occurring. Likelihood ratings are shown in Table 4.1.

Consequence is the outcome of an event being a loss, injury, disadvantage or gain. Consequence ratings are shown in Table 4.2.

For each event the likelihood score is multiplied by the consequence score for each area of impact. (There will be only one likelihood but several consequences for each event).

These multiples are then totalled to produce the risk score for the event.

The level of risk is determined by utilising the Risk Priority Rating Matrix shown in Table 4.3. This ranks the significance of the various combinations of likelihood and consequence into extreme, high, moderate and low risks.

The risk management process will be further enhanced by the completion of Risk Treatment Schedules and Risk Action Plans.

The Business Continuity Plans prepared in preparation for the potential Y2K (Year 2000) computer event identified in depth potential risks caused by computer failure and associated power supply and communications failures. This existing information is carried into the Risk Treatment Schedule and Risk Action Plans.

Table 4.1 Likelihood Ratings (Semi Qualitative Measure)

Rating		Description	Score
A	Almost Certain	Likely to occur frequently and several times a year.	0.9
B	Likely	Likely to occur more than once during the life of the project.	0.7
C	Moderate	Likely to occur during the life of the project.	0.4
D	Unlikely	May occur once in up to 100 years.	0.2
E	Rare	Might occur once in 100+ years.	0.01

Table 4.2 Semi-Quantitative Measures of Consequence and Areas of Impact

Areas of Impact	Consequence				
	Negligible (10)	**Minor (30)**	**Moderate (50)**	**Major (70)**	**Catastrophic (100)**
Health and Safety	Minor injury possible.	Serious injury to one person.	Serious injury to multiple members of staff, contractor or public.	Single fatality of staff, contractor or public.	Multiple fatalities of staff, contractors or public.
Public Health	Temporary but non-serious health impacts.	Localised serious health impact on one person.	Localised serious health impact on more than 20 people.	Localised or widespread serious health impact on more than 100 people.	Localised or widespread serious health impact on more than 1,000 people.
Asset Performance	Asset failure impacting on one or more persons.	Asset failure impacting on more than four people/d	Asset failure impacting on more than 40 people per	Asset failure impacting on more than 400 people per	Asset failure impacting on more than 4,000 people per
Environment and Legal Compliance	Short term and temporary impact requiring no remedial action.	Medium term environmental impact with immaterial effects on environment or community.	Measurable environmental harm to an internationally or nationally significant site. Loss of public access or conservation value of the site.	Major environmental damage with long-term recovery significant investment. High profile legal challenge. Loss of public access or conservation value of a significant environment.	Permanent environmental damage to an internationally or nationally significant site. Large scale class action.
Historical or Cultural	Loss of important records about a site. Work required restoring them.	Unsympathetic development compromising the integrity of a registered historical, cultural or archaeological site.	Damage to a registered historical, cultural or archaeological site, but capable of restoration.	Loss or permanent damage to a registered historical, cultural or archaeological site.	Permanent loss of national icon.
Financial	Capital cost/ loss <$100k.	Capital cost/loss $100k - $500k.	Capital cost/loss $500k - $1million.	Capital cost/loss $1million- $5million.	Capital cost/loss > $5 million.
Customer Perception	Service Request.	Minor complaint.	Justifiable complaint / information request.	Ministerial questions /third party investigations.	Public or ministerial enquiry.

Table 4.3 Risk Priority Rating (Semi Quantitative)

Risk Score	Level of Risk	Risk Response
> 200	Extreme	Awareness of the event to be highlighted to Council
150-200	High	Risk treatment required. Risk to be eliminated or mitigated as soon as possible
100-150	Moderate	Risk treatment required
0-100	Low	Manage by routine procedures

4.3 RISK IDENTIFICATION, RISK ANALYSIS AND RISK PRIORITY RATING

4.3.1 Vulnerable Assets

Council's headworks, water treatment facilities, trunk mains, and reservoirs are vital assets as without them water supply to the City is not possible.

Water quality is another risk that is City wide.

Reticulation mains are not as critical, as it is generally only the street the main is in or adjoining streets, which are affected by a problem with a reticulation main. Area wide liquefaction events are an exception to this.

Risk events are shown in Table 4.4 following the flow from intakes to consumer.

Table 4.4 Risk Events Ratings (Semi-Quantitative)

General	Event	Likelihood	Score	Rank	Risk
Intakes	Poison or organics accidental spillage or sabotage	0.2	80	10	Low
Treatment Plant	Movement failure caused by, Earthquake, landslide or settlement	0.4	68	11	Low
Maitai Pipeline Dam -WTPlant	Movement failure caused by, Earthquake, landslide or settlement	0.7	130	7	Moderate
Maitai Pipeline WTP-City	Movement failure caused by, Earthquake, landslide or settlement	0.7	210	1	Extreme
Maitai Pipeline	Flood damage	0.7	108	8	Moderate
Roding Pipeline	Movement failure caused by, Earthquake, landslide or settlement	0.4	56	12	Low
Roding Pipeline	Flood damage	0.7	182	3	High
Trunk mains	Movement failure caused by, Earthquake, landslide or settlement	0.2	52	13	Low
Reservoirs	Movement failure caused by, Earthquake, landslide or settlement	0.4	168	4	High
Reticulation	Backflow contamination from private property	0.2	132	6	Moderate
Reticulation	Backflow contamination from industry	0.7	204	2	Extreme
Reticulation	Poison or organics accidental spillage or sabotage	0.2	102	9	Moderate

General	Event	Likelihood	Score	Rank	Risk
Reticulation	Damage from liquefaction (At risk areas Port Nelson, Tahunanui/Stoke)	0.4	140	5	Moderate

4.3.2 Risk Treatment Schedule and Plan

The Risk Treatment Schedule and Plan is shown in Table 4.5.

4.4 RISK SUMMARY

4.4.1 Maitai Water Supply Scheme

Because the Maitai Water Supply Scheme is a vulnerable asset, it was designed to withstand 1 in 100 year seismic and flood events without damage.

Key structures are designed to withstand maximum credible earthquake and probable maximum flood without collapse (but not without some damage, possibly requiring decommissioning and major repair work).

Details of the design parameters of the Maitai Water Supply Scheme are contained in "Nelson City Council Maitai Water Supply Project Design Report", Tonkin & Taylor Limited, 1984.

The Maitai pipeline between the Dam and Brook Street has been identified as an extreme risk from damage due to earthquake displacement or slip.

The pipeline supplies two thirds of Nelson's water, is above ground, on a sidling bench along the hillside. Repair/replacement of 5m of pipe would take 24-48 hours, with town reservoirs holding sufficient water for approximately 8 hours daytime consumption.

Design of a new pipeline between the dam and the Water Treatment Plant has been completed in 2011 with construction completed in 2014/15.

Design and construction of a new pipeline between the Water Treatment Plant and Westbrook Terrace is scheduled for 2014-2018.

Sections of the Maitai pipeline remain close to, or within, the river with some ongoing risk of flood damage. Identification of these sections and regular inspection and maintenance are seen to be the best response.

4.4.2 Roding Water Supply Scheme

The Roding Water Scheme poses low and moderate risks to structures other than a 200m length of pipe between the screenhouse and the chlorinator house. This pipe is suspended on piers along the riverbank. A 30m section was washed out in the large flood of January 1986. Subsequently the pipes were more securely fixed and rock armouring was constructed in front of the piers. There is a possibility that a similar large flood could damage the pipe again. Reinstatement would take 2-3 days, during which time the Maitai river/dam and Tasman District Council would be the only sources supplying the City.

A condition assessment is being carried out in 2013/14 to allow renewal decisions to be made. A risk assessment of any new pipeline route will be undertaken as part of any renewal design.

At a Council workshop in 2014 Councillors expressed the wish for more regular gravel removal behind the dam to improve water storage capacity in light of the increasing risks associated with climate change and summer droughts.

4.4.3 Water Treatment Plant

A portable chlorinator using sodium hypochlorite is held at the Water Treatment Plant. It is a complete stand-alone unit, run by a small petrol generator. This has the capacity of dosing 30l/h of sodium hypochlorite, which is sufficient to treat the full Maitai flow of 37,000m3/day.

A separate Emergency Management Plan has been developed covering Risks and Actions specific to the Water Treatment Plant.

A portable chlorinator alternatively powered by either a petrol motor or an electric motor is held at Princes Drive for emergency chlorination using High Test Hypochlorite (HTH) powder. This has a capacity of dosing 24kg of chlorine per hour. This is sufficient to treat 12,000 cubic metres of water per hour at 2 grams per cubic metre (= 2ppm or 2mg per litre).

A small slip occurred to an excavated bank adjacent the plant during the December 2011 rain event. The plant will remain at risk of small surface slips given the excavations undertaken during construction.

4.4.4 Trunk Mains

Risks posed to the trunk mains range from low to high. The high risk is from earthquake damage where sections of key mains would be damaged. Presently stocks of pipes and fittings are held to allow single repairs to each main.

New trunk mains are typically constructed from more ductile materials.

Mutual aid would be required from other water supply authorities to reinstate trunk mains in the event of multiple major breaks. Refer to section 4.5.2 for details of the Mutual Aid Plan.

4.4.5 Reservoirs

The Clearwater, Stoke, Walters Bluff, and Observatory Hill Reservoirs have been constructed to category 2. The large and small Thompson Terrace Reservoirs have been strengthened to category 2 and category 3 respectively.

Note: Category 2 is a 1 in 1000 year earthquake and category 3 is a 1 in 333 year earthquake.

All large reservoirs have been fitted or retrofitted with automatic seismic shut off valves. When excess flow from the reservoir is detected (such as from a broken outlet trunk main) the outlet valve is automatically shut and an alarm sent to the Duty Officer via the SCADA system.

In 2013/14 a project to review the seismic response and protection features of the reservoirs, intake structures and pipework at the Maitai Dam and the steel siphons on the Maitai Dam to treatment plant pipeline was initiated. This project has been developed as a result of the damage to the Christchurch water network from the February 2011 earthquake in that region.

The project has a number of stages which can be modified as results of each stage are available:

Stage 1- Review the seismicity of the sites and compare with the factors from AS/NZS 1170 Structural Design Actions. This provides a quick view of how design standards might have changed since the reservoirs were constructed.

Stage 2- Review the on-site construction details of the pipework and valving arrangements to ensure seismic valves are correctly positioned and pipework details minimise the risk of water loss in earthquakes. This stage will provide an early benefit by ensuring the reservoirs can contain stored water under less than ultimate design level events.

Stage 3- Review the structural adequacy of the reservoir, dams and pipelines. This stage will look at the structural design and detailing of the major components of the network and may be undertaken in a number of stages.

4.4.6 Liquefaction

Ongoing hazard investigation in 2013 identified the risk of liquefaction to the network in parts of Nelson. The initial study was restricted to the Tahunanui area but similar materials are expected to be part of the Port Nelson reclamation.

The risk to the water network in Tahunanui arises from flotation of chambers and damage to the mains from extension, shortening and translation arising from ground movement.

During the operative period of this plan further work will be carried out to better identify at risk components and current industry response.edit 15mar2014

4.4.7 Water Quality

Risks posed to water quality range from low to extreme. Completion of The Water Treatment Plant in August 2004 has reduced the risk to source water to low.

The extreme risk relates to possible backflow from premises into the water reticulation, thereby putting other consumers in danger. Dual check valves have been fitted to all residential connections as part of the water meter manifold. These will be replaced when the water meters are replaced in 2017-2020. Backflow preventors have been installed at all Nelson City Council drainage pump stations and Council owned buildings and facilities. However, there are fewer protection devices on commercial and industrial premises.

A programme of installing backflow preventors in conjunction with replacing Commercial/Industrial water meters is shown in the Capital Works projections.

4.4.8 Public Health Risk Management Plans

The Nelson Public Health Risk Management Plan 2012 (now referred to as a Water Safety Plan- post the 2013 amendment to the Health Act 1956) outlines a range of issues that are required to be addressed within the network. Budget has been identified for developing the response to these issues. Any further works that arise from the response will be developed in future annual or long term plans.

Table 4.5 Risk Treatment Schedule and Plan - Water Supply

The Risk in Priority Order from Risk Register	Risk Before Treatment	Possible Treatment Options	Preferred Options	Risk After Treatment	Timing
1	E	Maitai Pipeline: WTP-City Damaged by Earthquake, Landslip or Rockfall Regular inspection to look for potential slips and possible rocks or logs that could fall. Cover pipe during logging. Construct “avalanche” shutter in known rockfall areas. Construct alternative main down Brook Valley Road.	New main to be laid down road WTP to Westbrook Terrace via Brook Street	L	Design and Construct 2014/18
2	E	Backflow from Industry	Fit backflow preventors to all commercial and industrial premises.	M	Install 2012/24
3	H	Roding Pipeline Damaged by Floods Maintain rockwork on riverbank. Keep pipeline full to reduce floatation.	Both	M	ongoing
4	H	Reservoirs damaged by Earthquake Major reservoirs are designed for 1 in 1000 or 1 in 333 year earthquakes. Ensure seismic valves properly located, ensure construction details adequate.	Currently being investigated	L	Installation details reviewed 2014 post Christchurch 2011 earthquake. Remedial improvements in LTP 2015-25.
5	M	Damage from liquefaction (At risk areas, Port Nelson, Tahunanui) Anchor chambers	Anchor chambers	L	TBA
6	M	Backflow from Residential Property Replace dual check valves	Replace dual check valves	L	2015/19
7	M	Maitai Pipeline: Dam to WTP- Damaged by Earthquake, Landslip or Rockfall Regular inspection to look for potential slips and possible rocks or logs that could fall. Cover pipe during logging. Construct “avalanche” shutter in known rockfall areas.	Inspection	L	Ongoing
8	M	Maitai Pipeline Damaged by Floods Maintain rockwork on riverbank. Keep pipeline full to reduce floatation.	Both	M	Ongoing

The Risk in Priority Order from Risk Register	Risk Before Treatment	Possible Treatment Options	Preferred Options	Risk After Treatment	Timing
9	M	Accidental Spillage or Sabotage to Reticulation Impossible to prevent. Maintain vigilance	Maintain vigilance	M	Ongoing
10	L	Accidental Spillage or Sabotage to Intakes Impossible to prevent. Maintain Vigilance.	Maintain vigilance	L	Ongoing
11	L	Treatment Plant Damaged by Earthquake Landslide or Settlement Plant has been designed to a high standard. Regular inspection for likely problems.	Regular inspections	L	Ongoing
12	L	Roding Pipeline Damaged by Earthquake, Landslip Regular inspection to look for potential slips and possible rocks or logs that could fall. Construct “avalanche” shutter in known risk areas.	Regular inspections	L	Ongoing
13	L	Trunk mains disrupted by Earthquake Fitting of seismic valves to water reservoirs to turn off water in event of earthquake. Ensure movement joints in network	Seismic valves will not protect pipeline but will retain water in the reservoirs to prevent it draining out through a ruptured trunk main. Water could then be distributed by tanker. Movement considered with new works.	L	Completed 2007/08. Installation details reviewed 2014 post Christchurch 2011 earthquake. Any improvements in LTP 2015-25.

4.5 RECOVERY

4.5.1 Lifelines

The Civil Defence and Emergency Management Act 2002 requires that every lifeline utility must:

- Ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency.
- Have plans for such a continuity that can be made available to the Director (of Ministry of Civil Defence and Emergency Management) if requested.
- Participate in the development of the National Strategy and Civil Defence Emergency Management Plans (where requested).
- Provide technical advice on Civil Defence Emergency Management issues, where reasonably requested by Civil Defence Emergency Management Groups or the Director.

Lifeline Utilities are: Gas, electricity, water supply, wastewater, telecommunications, road, rail, airports, plants and some broadcast media.

Nelson City Council continues to participate in the Nelson Tasman Engineering Lifelines project. The sections of the final project report relevant to water supply are included in Appendix C of this Asset Management Plan.

4.5.2 Water Supply Mutual Aid Plan

The Nelson City Council is a signatory to the Water Supply Mutual Aid Plan administered by the Water Managers' Group of Water New Zealand (New Zealand Water and Wastes Association).

The purpose of the agreement is to:

- Provide a framework for administration and Water Sector co-ordination;
- Create a central register of contact details of personnel with designated authority;
- Create a central register of approximate resource levels available at each of the Agreement signatories (personnel, equipment, specialist materials);
- Define protocols and principles for requesting and providing assistance during an emergency;
- Set a policy for charging and reimbursement of costs;
- Address liability and indemnity issues.

4.5.3 Local Authority Protection Programme Disaster Fund

Nelson City Council is a member of the Local Authority Protection Programme Disaster Fund. This is a mutual pool created by local authorities in 1993 to cater for the replacement of infrastructure following catastrophic damage by natural disaster.

Central government's Disaster Recovery Plan (currently overseen by the Ministry of Civil Defence and Emergency Management-MCDEM) states that beyond a threshold, central government will pay 60% of restoration costs. Local government are responsible for the remaining 40% thus effectively moving part of the onus from the tax payer to the rate payer. Central government will only provide their 60% following a major catastrophe provided that the local authority can demonstrate it can meet the remaining 40% through:

- Proper maintenance
- The provision of reserve funds
- Effective insurance
- Participation in a mutual assistance scheme with other local authorities e.g. Local Authority Protection Programme Disaster

The Fund is designed to cover local authority owned infrastructural assets which are considered generally uninsurable. These include:

- Water reticulation, treatment and storage
- Sewage reticulation and treatment
- Stormwater drainage
- Dams and canals
- Flood protection schemes including stopbanks
- Floodgates, seawalls and harbour risks such as buoys, beacons and uninsurable foreshore lighthouses

Roads and bridges are not covered by the Fund as local authorities have access to TransFund subsidies.

The Fund is designed as catastrophe protection only, covering serious disruptive loss or damage caused by sudden events or situations which may or may not involve the declaration of a Civil Defence Emergency. Perils include, but are not necessarily limited to, earthquake, storms, floods, cyclones, tornadoes, volcanic eruption, tsunami and other disasters of a catastrophic nature such as a major gas explosion.

The damage resulting from the Canterbury Earthquakes of 2010 and 2011 has severely depleted the reserves of the Local Authority Protection Programme Disaster funds and as a consequence the fund directors have signalled the intention to increase annual levies until the fund recovers. This will increase administration costs in this activity.

4.6 ACTION PLAN

Refer Table 4.5 for Risk Treatment Schedule and Plan.

4.7 REVIEW

The Risk Analysis will be reviewed each year.

In light of the significant seismic activity in Canterbury in 2010/2011 a review of the water reservoirs and sections of the trunk main for damage prevention and post-event response has been undertaken in 2013/14. A separate budget item has been included in the capital works programme for 2015-2017 for any remedial works to the water reservoirs and raw water trunk main sections that are vulnerable to damage. The latter are initially expected to be the steel arch siphons from the Maitai Dam to the water treatment plant.

A more extensive review of the network is required to address the risks identified. This will be undertaken over the duration of this plan and will support the next review of the Nelson- Tasman Lifelines initiative.

4.8 HEALTH AND SAFETY

The Maintenance Contractors carry out monthly inspections of assets, which include identifying any Health and Safety issues.

Internal Audits of Health and Safety practices for construction works on the water supply assets are carried out periodically.

5. LIFE-CYCLE MANAGEMENT PLANS

5.1 BACKGROUND DATA

Assets have a life cycle as they move through from the initial concept to the final disposal. Depending on the type of asset, its lifecycle may vary from 10 years to over 100 years.

5.1.1 Key stages in the asset life cycle are:

- Asset planning; when the new asset is conceived. Decisions made at this time influence the sustainability of the asset, the cost of operating the asset and the lifespan of the asset. Alternative, non asset solutions must also be considered.
- Asset creation or acquisition; when the asset is purchased, constructed or vested (by a subdivider). Sustainability, capital cost, design and construction standards, commissioning the asset, and guarantees by suppliers influence the cost of operating the asset and the lifespan of the asset.
- Asset operations and maintenance; when the asset is operated and maintained. Operation relates to sustainability, efficiency, power costs, throughput etc, and is usually more applicable to mechanical plant rather than static assets such as pipes. Maintenance relates to preventative maintenance where minor work is carried out to prevent more expensive work in the future, and reactive maintenance where a break is fixed.
- Asset condition and performance monitoring; when the asset is examined and checked to ascertain when and how an asset will fail, what corrective action is required and when (i.e. maintenance, rehabilitation or renewal).
- Asset rehabilitation and renewal; when the asset is restored to ensure that the required level of service including sustainability can be delivered.
- Asset disposal and rationalisation. Where a failed or redundant asset is sold off, put to another use, or abandoned.

5.1.2 Sustainability

The Local Government Act 2002 sets out principles that local authorities must act in accordance with. The legislation requires local authorities to ensure prudent stewardship and the efficient and effective use of its resources in the interests of its district or region; and in taking a sustainable development approach, take into account:

- The social, economic, and cultural interests of people and communities; and
- The need to maintain and enhance the quality of the environment; and
- The reasonably foreseeable needs of future generations

In 2011 Council began work on a 50 year vision of what Nelson could become, using sustainability principles. The vision statement was adopted in the Long Term Plan 2012-22 and the full Strategy in 2013. It identified ten goals that the Nelson community said were priorities for action and Council is now working to ensure that these goals and sustainability principles are integrated into all the decisions made about its activities.

Sustainable development actions and approaches are embedded throughout this asset management plan in the sections on: Levels of Service, Demand Management, Lifecycle Management Plans, and Financial. These include the following:

Goal Three

Our natural environment – air, land, rivers and sea – is protected and healthy

- Environmental Level of Service (section 2.7)

  100% compliance with resource Consent Conditions is specified;

- Ongoing investigation of impacts of the operation of the Maitai dam on the ecology of the Maitai river;

  Ongoing revegetation programme for the banks of the Maitai river

Goal Seven

Our economy thrives and contributes to a vibrant and sustainable Nelson

- Funding (section 6.8)

Water metering was implemented in 1999. The overall pricing structure encourages water conservation by recovering 70% of the operating cost from metered water volume charges and 30% by annual fixed charges. Very large consumers (greater than 100,000 m3 per year) are provided with a lower step charge reflecting the importance of these larger industries to the local economy and the funding of the water supply activity;

Goal Nine

Everyone in our community has their essential needs met

- Ensuring a reticulated water supply network is available to the greatest number of residents;

Goal 10

We reduce our consumption so that resources are shared more fairly

- Pressure Level of Service (section 2.4)

  Lowering of pressures reduces losses, increases pipe life, and reduces demand;

- Emergency Response Level of Service (section 2.7)

  Prompt response to broken and leaking pipes and fittings reduces water losses and reduces consequential damage;

- Demand Forecast (section 3.2)

  The demand forecast reflects a decreasing demand into the future due in part to improved plumbing technology, reduced supply pressures, consumer education, and use of alternative (non potable) sources for irrigation;

- Demand Management (section 3.3)

  Demand was significantly reduced by the introduction of universal water metering in 1999. Other demand management methods as outlined in Section 3.3 will be implemented in the future to give effect to community or statutory initiatives to reduce demand. Reduction of unaccounted for water (water losses) is evaluated and an action plan outlined. The Water Supply Conservation Strategy (Appendix B) is to be implemented in times of drought;

- Lifecycle Management (section 5.1)

  Sustainability is most easily implemented during the planning of an asset;

  Sustainability actions already implemented and those that have already been identified are listed. Of significance is the replacement of the existing Maitai pipeline with optimised pipe-size/pumping to manage risk and to provide for growth, but maintaining the existing pipeline as long as it is viable to do so, to reduce pumping costs;

- Capital Expenditure (section 6.5)

  System and pipe improvements are proposed to allow pressures to be reduced, with consequential benefits to reduction of demand and losses;

- Water supply Conservation Strategy (Appendix B)

  This is the approved strategy for the implementation of hosing and other restrictions during a drought;

- Water Loss Evaluation (Appendix E)

  Evaluates the loss components and evaluates their impact on the losses and defines the work required to reduce each aspect;

- Active Leakage Control Plan (Appendix F)

  The proposed methodology to detect and repair leaks to reduce water losses;

- Pressure Reduction Plan (Appendix G)

  The proposed plan to reduce water pressures throughout the city which will lessen pipe failures, reduce water losses, and lower demand.

- Where appropriate, use of longer pipe sections, either coiled polyethylene or uPVC replacing shorter cast iron, concrete and asbestos cement pipes, leading to quicker installation and fewer joints;
- Water pump stations with variable speed drive units for pumps, leading to more economical use of pumps and longer service life;
- Maximising elevated storage reservoirs and gravity reticulation to reduce reliance on pumps;
- Investing in new technologies to rehabilitate existing reticulation, where appropriate, rather than excavate and replace;
- Identification and rectification of losses from the network leading to reduced volumes of water to be treated and pumped;

Growth and demand predictions show that with -

- Implementation of demand and loss reduction measures;
- Construction of an inflatable weir on the Maitai Dam spillway;
- Utilisation of the 900,000 cubic metres of dead storage in the Maitai Dam.

The existing Maitai Dam together with the Roding Intake will be able to meet Nelson's foreseeable future water requirements without the need for pumping water from aquifers on the Waimea Plains to the city.

Community infrastructure is installed and maintained on the understanding that the assets are provided in perpetuity for the benefit of future generations. Longevity of an asset is a prime consideration when design and planning is undertaken for new or replacement components in the network.

Council recognises the benefits that come from formalising asset management plans and better monitoring and modelling of the condition and operation of the network.

Actions for Future Improvements

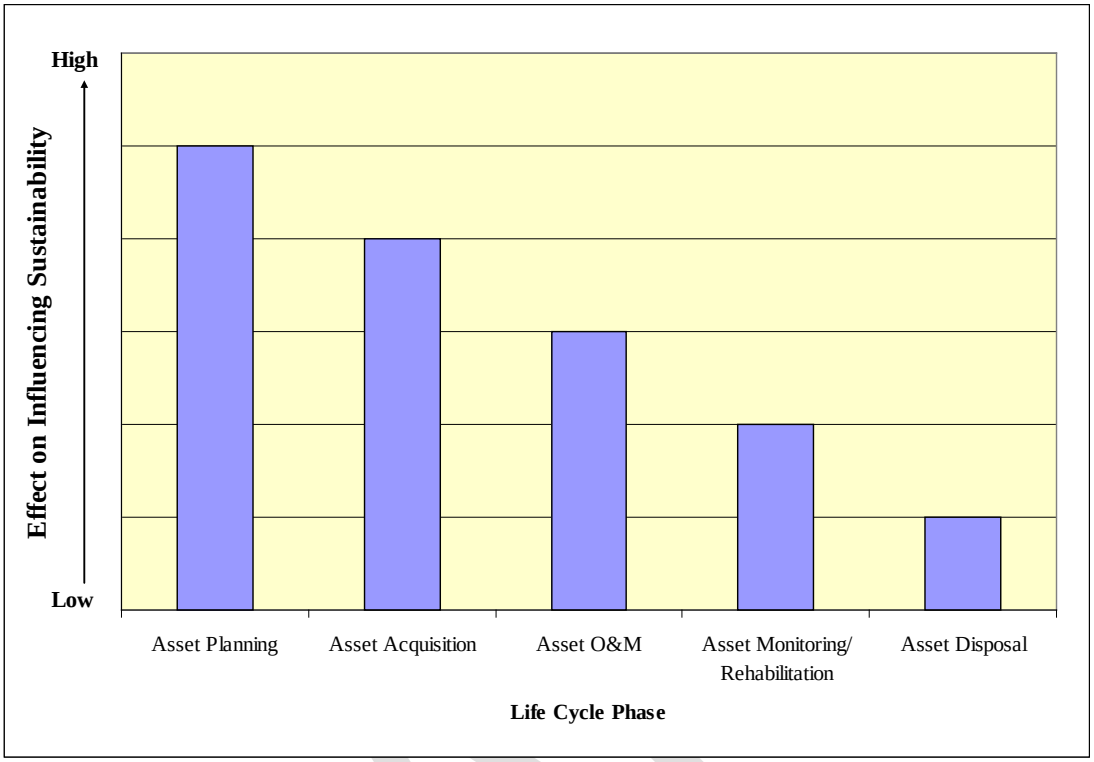
Further action in promoting the sustainability of this activity is considered to centre on the following areas:

- More strategic monitoring of the condition and operation of the asset to identify most appropriate renewal priorities;
- Enhanced network modelling to aid prediction of performance and renewal strategies;
- Additional effort to reduce water losses through renewal of pipelines, reduced water pressures and proactive water loss detection;
- Duplication of the trunk main from the treatment plant to the city centre;
- Renewal of resource consents for the city water supply;
- Ongoing monitoring of water quality in the Maitai and Roding rivers.

Decisions made during the planning of an asset have the greatest influence on the sustainability of the asset and on whole of life costs.

Figure 5.1 shows that the ability to influence sustainability (and costs) is greatest during the Asset Planning phase and declines to the Asset Disposal phase.

Figure 5.1 Sustainability Impact at Various Lifecycle Stages



Retrofitting of "sustainability" is possible for some assets but the best outcomes will be with new assets.

Sustainability Actions Already being Implemented

- Universal Water Metering

  Nelson implemented universal water metering (i.e. a water meter on every residential, commercial and industrial supply) in 1999 and was among the first councils in New Zealand to do so. Charging for water used through the meter has a major impact on demand and reduces water abstraction, pumping and treatment, and defers the need for newer and larger intakes, pipes and other infrastructure.

- Hydro Electric Generation

  The hydro electric generation plant installed at the Water Treatment Plant (WTP) in 2009 will recover energy that would otherwise be dissipated through a Pressure Reducing Valve.

- Use of Abandoned Pipes as Service Ducts

  In the past, water pipes abandoned when replacements were constructed were grouted with concrete. They are now capped to prevent the ingress of water and retained as service ducts for use by other network operators, rather than them having to trench a road and install their own ducts.

- Gravitating Water rather than Pumping

  Treated water can be supplied from the Water Treatment Plant to Stoke by gravity via the City and the Thompson Terrace Reservoirs or by pumping over the foothills. As much water as possible, particularly at times of low demand, is gravitated to reduce the use of electricity for pumping.

  Similarly, while there is sufficient water available from the Maitai, that source is used in preference to the Roding River to reduce the raw water pumped over the foothills to the Water Treatment Plant.

- Pump Timing

  Where possible pumping is carried out in off- peak power times. This not only reduces the country's dependence on fossil fuels to meet peak load, but also reduces Council's electricity costs.

- Water Loss Reduction

  Over time the loss reduction programme currently underway will reduce the loss of water. This will reduce water abstraction, pumping and treatment, and may defer the need for newer and larger intakes, pipes, and other infrastructure.

Sustainability Actions Under Consideration

- Demand Reduction

  Council's Land Development Manual recognises the use of rainwater tanks to supply garden and outdoor use, particularly during summer months. The practicality and cost of installing large tanks on urban sites to make a significant contribution to demand means that it is not considered feasible at this point to rely on these as viable means of reducing demand. This is a topic that will be monitored as the demand and supply curves begin to converge.

  Other methods of reducing demand such as water efficient appliances and fittings will also be monitored as Council is made aware of their use. Currently Council does not actively evaluate water use in new and older homes to compare relative efficiencies of new construction. This is something that is expected to be developed in the future.

- Pipe and other Materials

  Manufacturers of various pipes have started reporting on the sustainability of their products. This work will be reviewed to ensure that appropriate selections are made for future projects. Considerations will include material, manufacture, transport, laying, maintenance, renewal, reuse and disposal ability and cost.

5.1.3 Sustainability Action Plan

- Sustainability will be considered in future decisions.

5.1.4 Asset Failure Modes

Generally it is assumed that physical failure is the critical failure mode for many assets. However the Asset Management process recognises that other modes are relevant and are often critical to effective delivery of services.

The range of failure modes includes:

- Structural; where the physical condition of the asset is the measure of deterioration, service potential and remaining life.
- Capacity; where the level of under or over capacity against the required level of service establishes the remaining life.
- Level of service failure; where reliability of the asset or performance targets are not achieved.
- Obsolescence; where technical change or lack of replacement parts can render assets uneconomic to operate or maintain.

- Cost or economic impact; where the cost to maintain or operate an asset is greater than the economic return.
- Operator error; where the available skill level to operate an asset could impact on asset performance.

5.1.5 Condition Assessment

Historically asset monitoring to determine condition has been subjective, based on local knowledge and experience. Formal procedures now exist to assess asset condition in a qualitative fashion.

The development and continued use of condition assessment data is expected to support the preparation of verifiable predictive decay curves for particular asset types and hence permit prediction of remaining life. Consideration of economic influences and other factors will also be required in the adopted life for the asset type.

By considering the current condition point on an assumed decay curve, the profile can predict the effective life (time) before failure. This failure time can be the physical end of life, minimum level of acceptable service, or limit of capacity of the asset.

Condition assessment ranks assets on a five step scale as follows:

1	Very Good	Very good condition, where only normal maintenance is required.
2	Good	Minor defects only where minor maintenance is required to approximately 5% of the asset.
3	Fair	Maintenance required to return to accepted level of service where significant maintenance is required to 10-20% of the asset.
4	Poor	Requires renewal where significant renewal or upgrade is required to 20-40% of the asset.
5	Very Poor	Asset unserviceable where over 50% of the asset requires replacement.

It is not necessary to assess all assets immediately. It is only necessary to assess those that are going to become unserviceable in the next 20 years.

The extent and repetition of condition assessment will be influenced by:

- The criticality of the asset
- The type of asset
- The relative age of the asset
- The rate of deterioration of the assets
- The economic value of the outcomes to the business
- Unplanned maintenance history

Generally the older the asset the more frequent the assessment of condition is required. It is necessary to know whether failure is imminent and, if previous assessments have shown degradation, at what rate.

5.1.6 Critical Assets

Critical Assets are defined as those assets that are essential to providing a water supply in times of emergency (albeit at a reduced level of service), or have an unacceptable consequence of failure.

Critical assets have been identified as:

- Headworks including dams and intakes
- Raw water trunk mains
- Raw water pump stations

- Water Treatment Plant including Clearwater Reservoir
- Treated water trunk mains
- Treated water pump stations
- Reservoirs

With these assets operating treated water will be available in each suburb for distribution by water tanker or personal collection and by watermain as damaged reticulation is repaired and brought back into service.

5.1.7 Condition and Performance Assessment Process

Condition relates to the physical integrity of the asset.

Performance relates to the capability of the asset to meet defined service criteria, and can address other failure modes such as reliability, capacity, and effect on water quality.

Two complementary approaches to Condition and Performance Assessment will be utilised. The "top down" which provides an overview, and "bottom up" which collects information on each individual asset.

The top down method produces a one off statement of asset condition and performance using a robust statistical methodology. It relies largely on information already available supplemented by targeted studies to improve the quality of the data. It groups pipes of similar size, material, age and operating conditions. The data is then extrapolated to provide estimates of long term expenditure needed to maintain, improve or extend network assets. Information from the "bottom up method" is used to update the data fed into the "top down" method. The top down method should be repeated every three years.

The bottom up method provides a long term database on the condition and performance of assets, which is updated as further information becomes available. A 20 plus year history is considered to be required to build up the base level of information on each specific asset. To obtain a representative assessment of the pipe condition, sampling must be from unfailed pipes as well as failures.

Condition assessment, involving in-situ testing and visual evaluation, is being carried out in 2013/14 on the raw water pipeline from the Roding Dam to Marsden Valley as a means of establishing the renewal timing for this asset.

5.1.8 Current Position on Condition Assessment

Presently the simple approach to condition assessment is being used.

Whenever the maintenance contractor is working on pipe repairs a condition report is made and entered into the Asset Management System. It is anticipated that this database will be used to plot developing problem areas on a city wide basis and allow relationships between pipe types, construction techniques, age and geology to be developed.

Pipe samples will also be recovered, where unexpected failures occur, so that sophisticated condition assessment can be implemented and the data recorded on the Asset Management System.

The Asset Management System will be used as part of an Optimised Decision Making process. The level of sophistication will increase as the condition data base is developed.

5.2 ASSET CONDITION AND PERFORMANCE ASSESSMENTS

5.2.1 Reticulation

Figure 5.1 provides details of the age/material distribution of the Council's water supply network.

Figure 5.2 presents the same information, but showing the likely time of replacement on age, material and criticality.

The Council has implemented the Hansen Asset Management System. It is used to generate works instructions or Service Request Instructions to the utility services maintenance contractor and to link job instructions to the particular section of the network requiring repair, thereby building up a long term maintenance history of the network.

Once a history has been established, maintenance history and age will be used to assist in a deterioration model that will be used to optimise pipe replacements.

With the purchase of Network Analysis software and monitoring equipment, further work, such as area metering, has been carried out to determine areas of excessive water loss.

When considering the condition of the reticulation, the City can be considered as three reasonably distinct areas:

- The Central City and Port Hills was one of the first areas developed in Nelson and was reticulated with cast iron and steel pipe. The 75mm diameter cast iron pipes have largely been replaced with 100mm or 150mm diameter PVC pipes over the last 10 years.

The reticulation is considered to require minor maintenance only i.e. Condition Grade 2 – Good.

- Stoke and Tahunanui came within the City boundaries in the 1950's. Water reticulation was provided at that time. Typically cast iron and asbestos cement pipe was used. Early asbestos cement pipes are softening and starting to fail and needs replacement. The reticulation is considered to be in satisfactory condition, i.e. Condition Grade 2 - Good.
- The Atawhai and Stoke South areas have been developed since the 1970's. Asbestos cement and more recently PVC pipe have been used. The reticulation is considered to be in very good condition, i.e. Condition Grade 1 – Very Good.

5.2.2 Asbestos Cement Watermains

The Water Supply Managers Group of the New Zealand Water and Waste Association has produced a report entitled "Condition Rating of Asbestos Cement Watermains" which includes (on hard copy and diskette) a copy of: the National Specification for Sampling and Testing, the Life Expectancy Model, the Deterioration/Life Curves, and a copy of the current database of results.

This document will be used to assess the condition of asbestos cement pipes in Nelson.

Pipes of larger diameters and pipes of higher pipe pressure classes have thicker walls to provide the necessary hoop strength.

However pipe wall degradation is nearly constant for all pipe sizes and classes, therefore smaller diameter, lower pressure class pipes will fail earlier, and large diameter higher pressure class pipes may never fail from deterioration.

Most asbestos cement pipe laid in Nelson is Class D. The exceptions are where higher pressure classes were required for specific high pressure lines.

It appears that the relationship between ground conditions and deterioration is not completely proven but may be worth investigating for critical pipelines.

By sampling and testing the remaining wall thickness on existing pipes it may be possible to predict the year of first deterioration failures in each asbestos cement pipeline.

Most AC pipelines in Nelson are 100mm and 150mm Class D pipes, laid between the 1950s and 1980s during the subdivision boom in Stoke, Atawhai and the Victory Square area.

These pipelines are of the same size, class, operating pressure, and ground conditions, and can therefore be aggregated to derive the top down deterioration model for Nelson.

Similarly there are some 50mm diameter class D rider mains which can be aggregated. As noted above these pipes are likely to be the first to fail from deterioration. They are

also most likely to fail due to, for example, traffic loading, again due to the relatively thin wall thickness required for the low internal pressure hoop stresses.

A few trunk mains are 200, 300, 375, and 450 mm asbestos cement of varying pressure classes (e.g. the 375mm trunk main from Neale Park to Vickerman Street is C28. A 375mm pressure class C dimension pipe, but with a stronger asbestos cement mix in the wall). As noted above, these pipes are the least likely to fail from deterioration.

Sampling and testing for pipe wall softening will be carried out using the standard methods described in the "Condition Rating of Asbestos Cement Watermains" manual.

The performance of asbestos cement pipes does not generally deteriorate with time.

Asbestos pipe was imported from Britain and Italy in the early 1950s. It is coated with bitumen and is colloquially known as "Black Asbestos" cement pipe.

New Zealand made "Fibrolite" asbestos cement pipe does not appear to be softening. A programme of replacing 50mm diameter "Fibrolite" pipe and 100mm diameter "Black Asbestos" pipe has commenced.

Table 5.3 Best Estimate of Condition of Asbestos Cement Watermains

	Very Good	Good	Fair	Poor	Very Poor	Total
Metres Length	80,434	15,157	12,956	7,762	3,467	119,781
%	67.0	12.6	10.8	6.5	3.0	100

5.2.3 Cast Iron Watermains

Cast iron pipes generally have a long life before deterioration failure.

Their performance however suffers from iron tubercles developing on the inside of the pipes. These restrict the flow, and slough off giving dirty water complaints. However, the strength of the pipe is not affected by the tubercles.

Growths develop on the inside of cast iron pipes caused by iron bacteria. The bacteria are autotrophic and obtain energy from inorganic compounds. They use carbon dioxide as a carbon source. They oxidise soluble ferrous iron to less soluble ferric iron. The bacteria deposit oxidised iron Ferric Hydroxide as a red-brown coloured slime. Iron bacteria thrive in unlined cast iron pipes.

Another source of dissolved iron was from lower levels of the Maitai Lake when this water is used in preference to turbid water from upper levels when the river is in flood. This problem has however been overcome now the water treatment plant has been commissioned.

The deposits form growths or tubercles which restrict the flow in the pipe. With age the growths die and as a result decompose and release foul odours and tastes. The growths slough off the inside of the pipe and can cause orange specks in the water which can stain washing.

There is no simple or inexpensive way of controlling iron bacteria in distribution systems.

The growths can be minimised by using high chlorine residuals, treating the water at source and lining of unlined cast iron pipes.

The failure of cast iron is often at the joints.

Older pipes are lead jointed. These joints sometimes work loose due to internal pressure, earthquake, or traffic vibration. The joints are repaired by re-caulking where possible or by cutting out the joint area and replacing it with a new section of pipe and two gibault couplings.

There is also a possible health hazard with the lead dissolving in the water, particularly near dead ends where there is reduced flow, and the water is in contact with the joint for longer.

There are proprietary processes to scrape and reline cast iron pipes with either cement mortar or epoxy coatings. This eliminates the effects of tubercles and lead joints as noted above.

It is therefore proposed to investigate the feasibility of refurbishment of cast iron reticulation pipes 100mm diameter and larger rather than abandoning them.

Cast iron pipes may be weakened by changes to the chemical composition of the pipe material over time, such as graphitisation.

Cast iron pipes, being brittle are liable to damage due to traffic loadings and point load over or under another service such as stormwater pipe, etc.

In assessing the reason for a cast iron pipe failure the cause of the failure will be carefully ascertained.

Table 5.4 Best Estimate of Condition of Cast Iron Watermains

	Very Good	Good	Fair	Poor	Very Poor	Total
Metres Length	-	-	6,460	37,708	7,007	51,175
%	-	-	12.6	73.7	13.7	100

5.2.4 Trunk mains

Figure 5.1 provides details of the age/material distribution of the Council's water supply pipework.

The Maitai Pipeline was laid in 1963 using 900mm diameter concrete pipe on concrete cradles. 750mm diameter steel pipe was used for the syphons where the pipeline crosses from one side of the valley to the other.

As noted in Section 4.4.1 above the Maitai Pipeline is the highest risk asset.

Cycles of direct sunshine and frosts have resulted in circumferential cracking of the concrete pipes. In areas exposed to the full afternoon sun there are typically three to four cracks per pipe. The flow from the cracks is usually no more than a weep. In the more shady lengths of the line the pipes are in excellent condition. The worst area is immediately downstream of the dam as far as the first syphon.

The pipeline is vulnerable to damage from rock fall which can be caused by either major storms or earthquakes. The leakage that can be caused by a rock fall is far more serious than the weeps from circumferential cracks.

The pipeline is inspected monthly and also following major storms and earthquakes. In November each year an engineering inspection is made.

An inspection in 1998 identified movement in a section of the pipeline near Groom Creek. This was caused by a large earth flow following a period of heavy rain. A 100m long section of affected concrete pipe was replaced by a welded steel pipe, supported on concrete columns, founded on solid ground beneath the earthflow. This work cost $350,000 (1998 dollars).

Tonkin and Taylor Ltd have completed a geotechnical assessment of the existing Maitai Pipeline route. The level of risk is rated from low to extreme and has been based on:

- Identification of hazards (e.g. rockfall, slumping, shallow sides, etc);
- Likelihood of the event or hazard (e.g. almost certain to unlikely rare);
- Consequence of event hazard (e.g. from superficial damage – no leaks or obstructions to catastrophic – multiple or greater than 10m of pipe destroyed, access lost, loss of all flow).

No section of the pipeline was rated extreme (i.e. immediate action required).

The section of pipeline identified with the greatest risk is from the dam down to the Fiddlers Elbow syphon. This section is also the section with the most cracks, as noted above.

Since 1989 maintenance effort has been put into repairing the worst of the cracks and sandblasting and painting the steel syphons. To clear the ground from under the pipe to allow complete painting, it has been necessary to construct additional concrete supports under the pipe. Expenditure is approximately $60,000 pa.

In 2001 and 2002, as a result of increased awareness of possible terrorist, sabotage or vandalism activities, security of the surge towers was improved, rather than maintenance work on the pipes being carried out.

Proactive maintenance of the pipeline was deferred in recent years until the future of the line was determined.

In 2007 Council decided to replace the section of the pipeline from the Maitai Dam to the Water Treatment Plant with a new pipe laid down the Maitai Valley Road. The pipe size may be optimised by providing pumping for peak flows. It was also decided that the existing pipeline should be kept in use for as long as possible to minimise pumping costs. As the break even point is about 20 years, painting of the steel syphons should be continued.

A condition assessment of the steel pipeline section was completed in March 2011. This report has evaluated the condition of the pipeline and provided remediation specifications. The pipeline has significant sections requiring repair and recoating. Provision for the work has been made in the financial section table 6.3 for 2012-2015.

The pipeline passes through a 240m long tunnel near the Tantragee Saddle. The timber shoring in the tunnel was upgraded in 1994 and is considered to be in good condition. The tunnel is inspected annually.

The section of the pipeline from the Water Treatment Plant to the Westbrook Terrace valve chamber was assessed as having the least risk as the geotech and pipe condition was the most favourable. On 30 July 2008 a section of the pipeline approximately half a kilometre downstream of the Treatment Plant was damaged by wind thrown trees. Reinstatement of this section of pipeline (WTP to Westbrook Terrace) with a pipeline laid in Tantragee Road, Brook Street, and Westbrook Terrace is scheduled in the Capital Works programme for 2017/18.

The maintenance schedule to date is shown in Table 5.5.

Figure 5.2 Water Pipelines: Age / Material Distribution

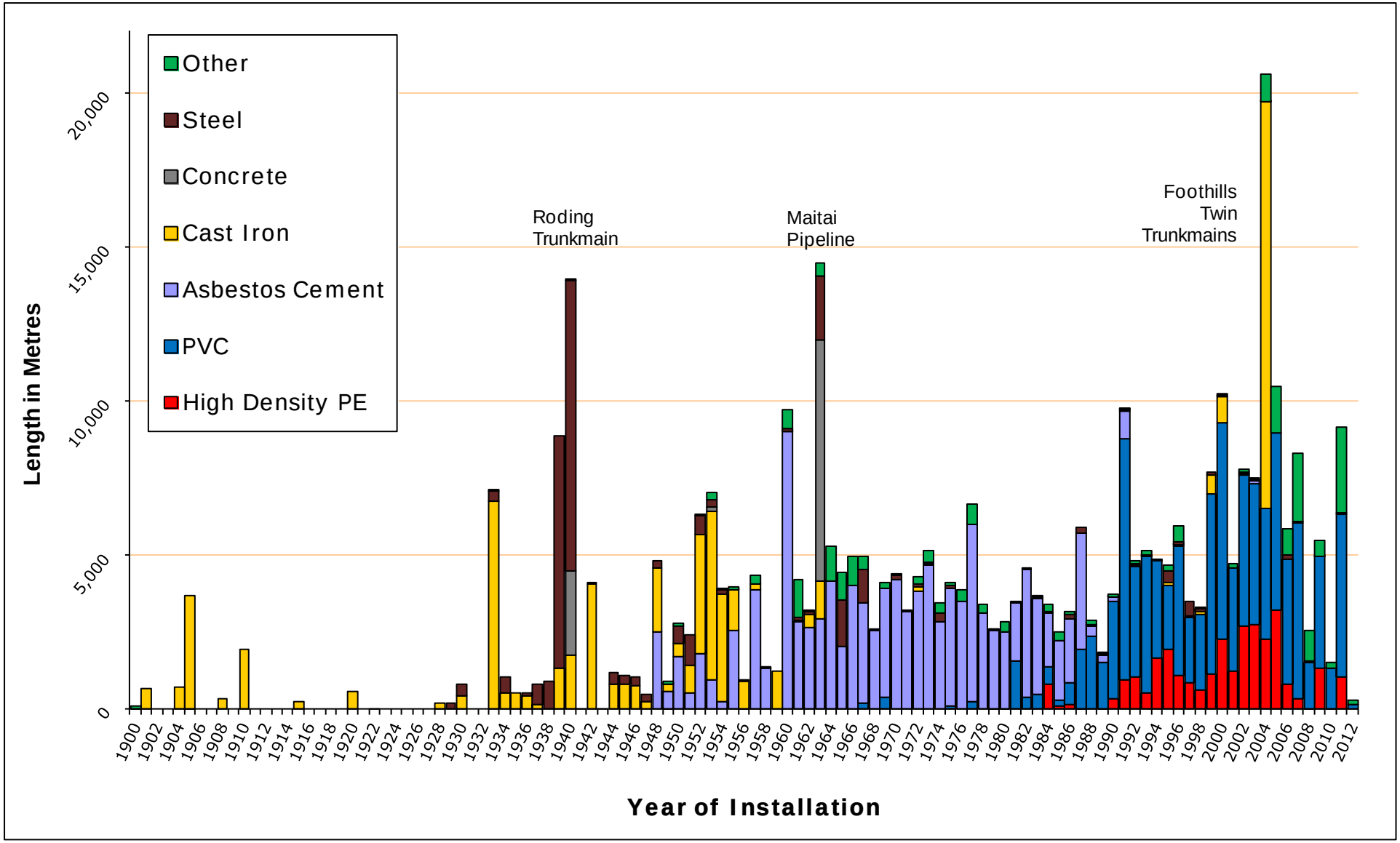


Figure 5.3 Theoretical Life Expectancy / Material Distribution

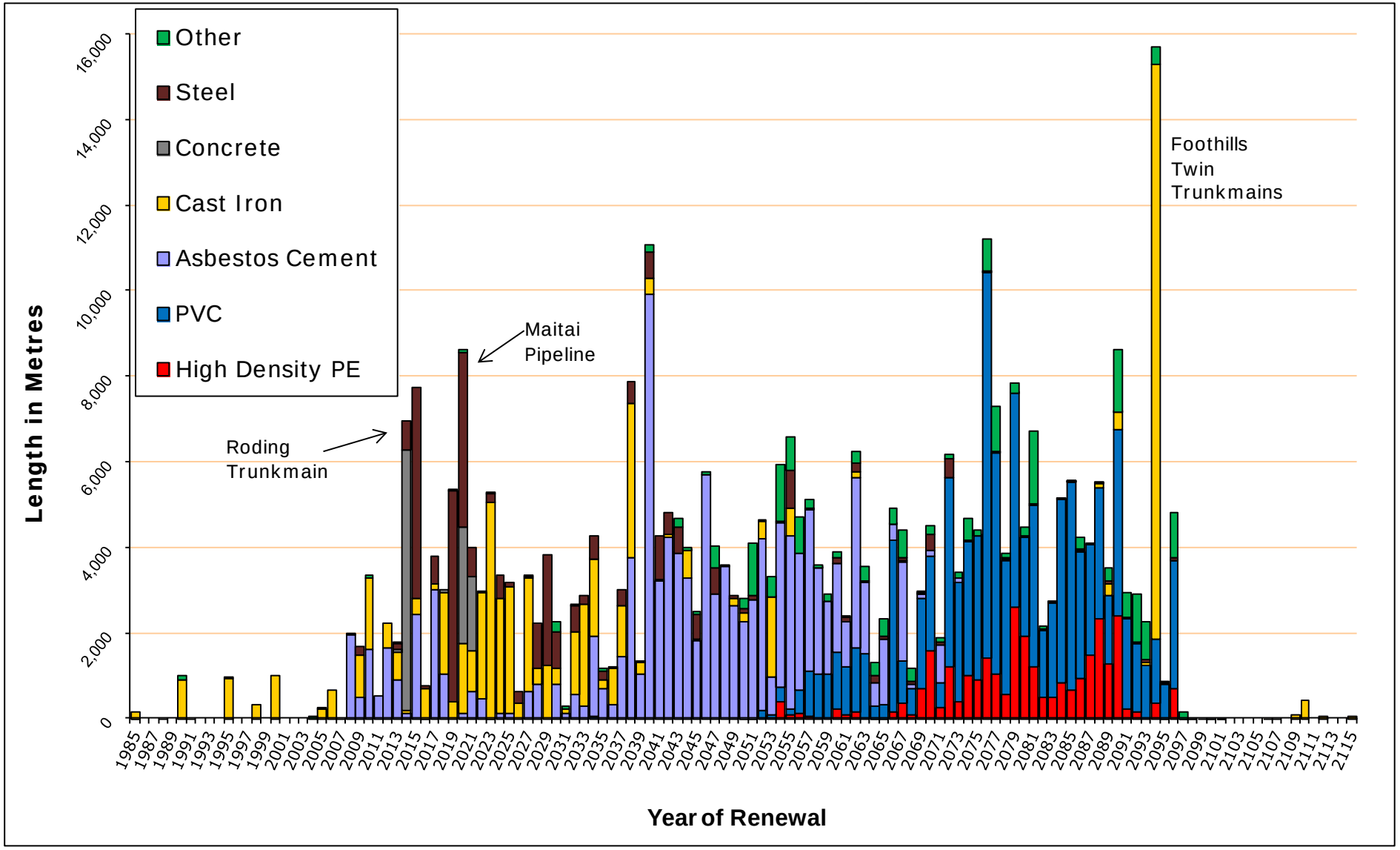


Table 5.5 Maitai Pipeline Maintenance Schedule (over next five years)

Location	Work Done			Work to be Done		
	Support Blocks	Painting	Repairs	Support Blocks	Painting	Repairs
Fiddlers Elbow Syphon					2012/15	
River arch span		1989			2012/15	
West abutment (true right)	1991 2000	1992				
East abutment (true left)						
Motor Camp Syphon				Investigation 2011	2012/15	
River arch span		1980				
West abutment (true left)						
East abutment (true right)	1995	1996				
Andrews Farm Syphon						
East abutment		1993		To be abandoned 2020/21		
West abutment		1993		To be abandoned 2020/21		
Brook Street Falling Main				To be abandoned 2020/21		
Surge Towers and Valve Specials			2001/02			
Tunnel Repairs			1994			
Concrete Pipe Crack Repairs			1996			ongoing
Rockfall Protection						

The Roding pipeline was constructed in the early 1940s at the same time as the Roding weir. The pipeline runs through a 2.7 km long tunnel under the Barnicoat Range, down Marsden Valley and along SH6 to Tahunanui.

The timber shoring in the tunnel was upgraded in 1992 and is considered to be in good condition. The tunnel and the concrete pipeline within it are inspected annually.

The remainder of the pipeline is constructed of steel pipe. Replacement should be programmed within 20 years on an age basis only. Condition inspection was carried out in 2014 and subsequent analysis will be used to determine the actual replacement timing.

Foothills Trunk Mains: The Roding Transfer Pipeline was constructed in 2003/04 using 300mm and 375mm diameter ductile iron pipe. Steel pipe, of the same size, was used where the pipeline crosses two steeply incised creeks.

The pipeline is made up of two pipes buried full length in the same trench.

One pipeline carries raw Roding water from the Marsden Valley (raw water) trunk main to the Water Treatment Plant. The other pipeline carries treated water back to the Marsden Valley (treated water) trunk main.

The pipeline is inspected yearly, but is also continuously monitored by computer for sudden changes in pressure and flow. It is in very good condition.

Water is pumped to a high point (250m) at the saddle between Brook and Enner Glynn valleys. It then falls under gravity the remaining distance. Pressure reducing valves at the Marsden Valley end reduce the pressure to 170m maximum and at the Water Treatment Plant to 7m.

The raw water pipeline is also connected to a hydro electricity generator to capture some of the energy of the water in the pipeline.

Other Trunk Mains: The remainder of the trunk mains in the City have been installed since the 1960s and are in good condition. Refer to section 5.2.1 above regarding Asbestos Cement pipelines, and below for steel trunk mains.

Steel Trunk Mains: Steel pipe is used for trunk mains as they are larger diameter, high pressure mains.

Steel pipe suffers from electrolytic corrosion due to "cell effects" between the steel pipe, other metals, and the soil. Where electrons leave the pipe, the metal is eaten away. Properly coated pipe is insulated from the soil and is therefore protected. The coating can however be incomplete, or have been damaged during pipe laying.

The trunk mains in Brook and Tasman Streets (between Larges Lane and Bridge Street), and under the Maitai River (at QEII Drive) are protected by an impressed current system where electrons enter the steel pipe via the coating defect and exit to the soil in a special anode bed. The Fiddler's Elbow Syphon on the Maitai Pipeline is similarly protected, but with a sacrificial zinc anode.

The systems were installed in 1995 and 1996 and are tested every three months for correct operation, and audited every two years by an independent expert. In 2000 it was found that the ground anode bed in Bronte Street needed replacement. This was carried out in the 2001 financial year.

Above ground pipes are inspected annually to ensure that the pipe coating (epoxy or wrapping) is intact.

Because steel pipes corrode through localised action as described above, sampling is not a reliable means of determining pipe condition.

An assessment of the above ground steel pipe sections was carried out in 2011 by Inspection and Consultancy Services Ltd. This assessment concluded that the condition of the protective coating of the above ground pipework was "poor". A maintenance specification has been developed and budget provision made to allow the pipeline to continue to operate for at least the next 10-20 years.

The overall condition of the mains varies from fair to very good condition i.e. Conditions Grade 1-3.

5.2.5 Headworks (including Dams and Intakes)

Maitai Water Supply Scheme: The Maitai Water Supply Scheme was commissioned in 1987. The Scheme can abstract water from the North Branch Reservoir or the run of river intake on the South Branch. The reservoir has a total live storage of 3.3M m3, and dead storage of 900,000m3.

The Maitai Dam is an earthfill dam with crest height approximately 36m above the North Branch riverbed. The performance of the dam is monitored monthly and following major earthquakes. Tonkin and Taylor Ltd, the designers, carry out an annual inspection of the dam and every five years independent consultants review the original design against current practice.

Maintenance work is programmed in response to their recommendations and those of the Maitai Caretaker.

While these procedures are effective at ensuring year to year reliability of the main supply dams, more work is needed on assessing the longer term requirements for items such as valves, pipework, and electronic equipment.

Assets can fail for reasons other than physical failure. Among other modes are capacity failure, obsolescence, and level of service failure.

Comprehensive Safety Reviews (CSR) of the Maitai Water Supply Dam, which included the Annual Inspection have been commissioned by Nelson City Council. Tonkin & Taylor Ltd undertook the work in 2003 and Riley Consultants Ltd in 2009. The review is to be repeated in 2014.

The 2003 review and inspection found the dam and associated works to be in a very good condition, and to have been operated appropriately since the previous CSR in 1998. Particular attention was paid to reviewing the flood hydrology of the Maitai catchment and the role of the dam in flood attenuation and the seismic risk associated with movement on regional faults: the dam was found to be appropriately designed and constructed in both respects.

Recommendations were made for review of some operational aspects of mechanical equipment and of the linkage of the existing dam emergency procedures with Nelson City Council's overall procedures in terms of an Emergency Action Plan and the associated response procedures. This has been done.

The latest CSR inspection was carried out in November 2008. The final report was received in April 2009.

The report concluded that the dam embankment, spillways, culvert and reservoir are all in good condition.

Recommendations were made to:

- Extend the dam break inundation maps
- Update the Emergency Procedures Manual
- Include level 2 triggers within field inspection sheets
- Develop a procedures document to outline the response procedure to a trigger
- Expand and update procedures to meet the Dam Safety Regulations under the Building Act 2004.

Roding Dam: The Roding Weir was commissioned in 1940. In 1972 the concrete structure was raised by 1.5m to its current height of 11m above the downstream riverbed.

The weir initially created approximately 40,000 cubic metres of storage. Major floods in 1985 severely damaged some of the upper catchment so there are now significant amounts of gravel and sand coming down the catchment that have filled in the storage behind the weir. This material has been removed but every time the storage area was cleaned out nature simply delivered more material to fill it in.

With the need for storage reduced by the presence of the Maitai Dam, the decision was taken to build an intake on the downstream face of the weir in 1988. As the water flows over the weir some of it falls through the intake's screens and into the pipe work which then delivers it into the water supply system. This has proved very effective and has stopped a lot of the silt and sand getting into the water supply system. The volume behind the weir has been allowed to fill in and it now appears to have reached a stable level. The storage volume behind the weir is now no more than 3,000 cubic metres. The diversion tunnel gate was renewed in 2002/03. It is now more readily opened to allow gravel to be flushed through on the falling side of a flood, to prevent gravel build up.

There is a caretaker living on site at the Roding Weir. Routine maintenance work is programmed in response to his recommendations.

The scheme is considered to be in very good condition.

Building Act 2004 - Dam Safety Regulations

The Building Act 2004 requires that dam owners assess their dam against regulatory standards as being high, medium, or low impact in the event of failure, and to provide that information to their regional authority.

For existing dams, this must be done within three months of the dam safety regulations commencing. The Building (Dam Safety) Regulations 2008 were promulgated on 7 July 2008 and were due to commence on 1 July 2010. On 10 June 2010 the Building and Construction Minister confirmed a two year delay in commencement to allow a review of the regulations to be undertaken by Parliament. This review has been completed with final details with cabinet in 2014. The scheme is to come into force on the 31 March 2015.

A dam classified as either medium or high potential impact will require a dam safety assurance programme, to be prepared on a prescribed form, and provide ongoing evidence of compliance. In June 2010 Tonkin & Taylor Ltd completed an assessment of the dams within Nelson City as the first step in the procedure. The work currently carried out for the Maitai Dam probably complies but further assessment work may be necessary for the Roding Dam and York Valley Dam.

5.2.6 Reservoirs

The City has 21,900m3 of covered storage available. The locations of the reservoirs are shown in Figure 2.2.

The two reservoirs at Thompson Terrace were constructed in 1963 and 1974 and provide total storage of 8,000m3. Both reservoirs were strengthened in 1991/92 to improve the seismic performance. The 5,700m3 reservoir now meets Category 2 design requirements and the 2,300m3 reservoir Category 3 design requirements.

Table 5.6 Reservoir Risk Categories

Category	Description
2	Tanks which are intended to remain functional in the emergency period for a major earthquake, for example, fire fighting water.
3	Tanks which should be functional in the restoration period for a major earthquake, for example, potable water.

(From NZS 3106: Code of Practice for Concrete Structures for the Storage of Liquids)

The Stoke Nos.1and 2 Reservoirs, Stoke High Level Reservoir (2,500m3 each), Walters Bluff Reservoir (2,500m3), Clearwater Reservoir (3,000m3) and the Observatory Hill Reservoir (300m3) are of more recent design and are a category 2 risk.

There is both mechanical and electronic equipment at the reservoirs to control and monitor refilling.

Reservoirs are long life above ground structures. Monthly routine maintenance inspections are carried out. Full condition and performance assessment are carried out every five years.

In 2000, an engineering inspection was carried out on the roof structure of the 2,300m3 reservoir at Thompson Terrace. It was found that the roof cladding was perforated and that some of the trusses were badly corroded. The roof was replaced in 2001/02 with fibreglass cladding supported by an external steel structure.

A further engineering inspection was carried out on the rest of the reservoir in 2002 while it was drained for roof construction. It was found that the water seals in the floor were in need of replacement. This has been completed.

In November 2003 engineering inspections were carried out on Thompson Terrace No. 2, Stoke No. 1, Princes Drive and Glen Reservoirs.

Weathering of the concrete dome roof of Thompson Terrace No. 2, corrosion of the internal steel surface of the Glen reservoir, and blistering of the water seals in the Stoke Reservoir were noted. Remedial work of the Glen was completed in 2005/06.

Seals in the Thompson Terrace No 2 reservoir were partly replaced after seepage was noted in the underdrain collector. Anodes were fitted to the internal ladder to prevent further corrosion.

Seismic shut off valves have been retrofitted to the Stoke No.1 and Thompson Terrace Nos.1 and 2 Reservoirs. The newer Atawhai No. 1, Stoke High Level and Stoke No. 2 reservoirs were fitted with seismic valves during construction.

The pipework at the Thompson Terrace reservoirs has been modified to prevent “short circuiting” of the water flow with possible water quality problems.

Work on replacing the seals to Observatory Hill and Panorama Drive reservoirs was completed in 2010.

An additional reservoir at Observatory Hill is under construction in 2014 to provide water storage for the residential subdivisions in the area. This reservoir has a 440 cubic metre storage capacity.

All reservoirs are considered to be in very good condition, i.e. Condition Grade 1 – Very Good.

5.2.7 Pump Stations

Nelson has a gravity fed system. (The Marsden Supply is at 170m City Datum and the Clearwater Reservoir at 155m City Datum). There is therefore low dependency on pumps.

The City has eight pump stations. The locations are shown in Figure 2.2. All have been constructed since 1990 and are in good condition.

At both ends of the Foothills Trunk Main (commissioned 2004) are large inline pump stations. These are critical for the transfer of water to and from the Water Treatment Plant.

The pump stations are inspected weekly, with individual components serviced regularly.

There is a large inline underground pump on the cross town trunk watermain in Van Diemen Street. This was designed to boost the flow from the Treatment Plant to Stoke via the Thompson Terrace Reservoir at times of high demand. It is regularly used to part fill Thompson Terrace to maintain the operation of the pump and reduce the risk of sedimentation in the pipework.

There are five other relatively small above ground pump stations that boost water to higher hillside properties. These are Panorama Drive (two pumps), Princes Drive (two pumps), Austen Ward Heights (one pump), Springlea (two pumps), and Wastney Terrace (three pumps, commissioned in 2008).

Monthly routine maintenance and inspections are carried out. Full performance and condition assessment are carried out every two years.

The pump stations follow a 'rolling' pump overhaul programme. The Van Diemen Street pumps were overhauled in 2010. These works are funded from maintenance budgets, which cannot be exceeded.

The condition of the pumps stations is considered to be very good, i.e. Condition Grade 1 – Very Good.

5.2.8 Pressure Reducing Valves

The City has 32 pressure reducing valves in the reticulation system, (refer to Section 2.4.3). Their locations are shown in Figure 2.2.

Three pressure reducing valves are located at the Marsden Pump Station on the Clearwater Foothills Trunk Main and one is located at the Water Treatment Plant on the raw water foothills trunk main.

These were installed in 2004 as part of the Water Treatment project.

The water maintenance contract has been amended to provide for more preventative maintenance to be carried out on the pressure reducing valves so the potential for malfunction is reduced.

At present, pressure gauges linked to the alarm system monitor the performance of 10 of the pressure reducing valves. These gauges monitor the pressure in the reticulation and generate an alarm if the pressure moves outside set tolerances. The alarm allows maintenance staff to respond to a malfunctioning pressure reducing valve before the excess pressure damages both public and private pipe work.

It is intended to progressively install gauges to monitor the performance of the remaining pressure reducing valves over the next five years.

The condition of the pressure reducing valves is considered to be very good, i.e. Condition Grade 1 – Very Good.

5.2.9 Service Pipes and Meters

Service pipes are the pipes between the watermain and the property street boundary. These pipes are part of the water asset. Pipe materials used are galvanised iron, copper and polyethylene. Galvanised pipes were installed prior to the 1950s. Copper was installed from the 1950s to the 1990s. In recent years polyethylene has been installed.

The quantity of each type of pipe is unknown. Whenever a street is upgraded or a new watermain is laid the water service pipes are relaid if they are galvanised. This procedure has been in force since 1990. The condition of service pipes varies from very good to unserviceable, i.e. Condition Grade 1 to 5.

Supply pipes are the pipes between the property boundary and the building on the site. These pipes may be shared by several properties where there is a Right of Way or Cross Lease access. Supply pipes are privately owned.

All properties connected to the Water Supply are metered. Meters and manifolds are generally situated at the property street boundary. The exception is where one or more properties are served by a common supply pipe. In this case the meter is located in a practical location where the supply pipe branches to serve only one property. The meter and manifold is part of the water asset, although it may be sited on private property on a private supply pipe.

Manifolds were installed as replacements for all residential toby repairs, and on all new subdivisions from 1993. Manifolds were installed on all other residential properties in 1997 and 1998 as part of the Universal Metering Project. Meters were installed into these manifolds in the first six months of 1999.

These manifolds are in very good condition, i.e. Condition Grade 1 – Very Good.

In 2009 a small sample (23) of residential water meters were bench tested for accuracy by Water Meter Services Ltd as part of the water losses investigation. These tests were carried out at flows or 0.38 litres per minute, 15 litres per minute and 50 litres per minute. The results show readings ranging as follows:

Flow 0.38 litres per minute -27.3% to +3.47%

Flow 15 litres per minute -3.31% to +0.77%

Flow 50 litres per minute -31.87% to -1.02%

The variability confirmed a general view that some losses must be attributed to meter performance. The testing was repeated in 2013 to monitor changes and to begin developing a failure curve. Renewal of the simple double check valve assembly in the meter manifold has been identified as a priority, owing to ongoing failure of these units. Budget for this work is shown starting from 2015/16.

The increasing use of automated meter reading technology in the power supply utility field offers real advantages to the water supply activity, principally in reducing costs of meter reading and billing and providing early warning of excess water use that may be an indication of leaks. To investigate the feasibility of adopting this technology it is proposed to develop a trial with a technology supplier in 2014/15.

The future proposed renewal of residential water meters, scheduled over a three year period from 2017/18 at $1,000,000 per year, may make use of new technology if the proposed trial delivers positive results.

Meters on commercial and industrial properties vary in age and size. Most meters have been installed since 1980 in business groups i.e. all schools, all hotels, all hairdressers etc. Meters were installed on parks in 1998, on small users such as offices and small shops as part of the Universal Water Metering project in 1999, and in new subdivisions and developments as they occur.

Trends in each property's water usage are tracked and if a meter appears to be "slowing down", then it is removed for testing or replacement. Worn meters tend to under-read and are therefore in that customer's favour, but true costs are not being recovered from the customer who is therefore subsidised by other consumers.

Renewal of commercial and industrial water meters is scheduled over a 9 year period from 2014/15 at $300,000 per year.

The meters therefore range from near new with a condition assessment of very good to nearly 30 years old i.e. Condition Grade 1 to 5 – Very Good to Very Poor.

5.2.10 Water Treatment Plant

Commissioned in August 2004, the Water Treatment Plant is made up of several hundred components. Each component is maintained regularly on a scheduled maintenance programme in accordance with vendor data.

Operators stationed at the plant regularly inspect, check and calibrate components of the plant to ensure they are performing their design function. The cost of routine maintenance is covered by an operations contract with an external contractor.

Large portions of the plant and the components are computer monitored and alarms are raised if they go outside predetermined performance limits.

The plant and equipment is in Grade 1 – Very Good condition.

In 2012 an S::CAN unit was installed at the treatment plant to measure the following parameters in the raw water:- total organic carbon, dissolved organic carbon and turbidity; and automatically adjust chemical coagulation dosing. Early results are promising with more efficient use of coagulation chemicals possible.

In 2013 Council commenced a trial of dosing the raw water delivery from the Maitai with carbon dioxide as a means of adjusting the pH below 8 which will improve the efficiency of the coagulant chemicals used to remove organic loading in the raw water.

5.2.11 Asset Condition and Performance: Land, Access Roads, Fences, Landscaping and Houses

Land, access roading, fencing and landscaping have now been included in the asset register. These facilities are regularly maintained and are in good condition. The houses at the Maitai and Roding waterworks are listed in Council's fixed asset register.

6. FINANCIAL

6.1 BACKGROUND

The works proposed in the previous sections on Levels of Service, Future Demand, Risk Management and Lifecycle Management all impact on expenditure.

There are cost implications in:

- Meeting levels of service;
- Meeting future demand;
- Managing risk;
- Maintaining/improving asset condition;
- Maintaining/improving asset performance;
- Operating assets;
- Maintaining assets;

which affect the Operations and Maintenance Renewal, and Capital Financial Plans.

Depreciation is an expense which allows for the future replacement of an asset by setting aside its replacement value during its working life.

Operations and Maintenance is an expense to run assets and keep them in good working order.

Renewals are an expense to replace existing assets.

Capital is an expense to create new assets.

6.2 ASSET VALUATION AND DEPRECIATION

6.2.1 Valuation Method

The Maitai Water Supply Scheme, the Maitai Pipeline, the Roding Weir, the Roding Pipeline, the Roding Tunnel, the Thompson Terrace Reservoirs, the Walters Bluff Reservoir, the Ridgeway Reservoir, the Glen Tank and the Observatory Hill Reservoirs have been valued by Opus International Consultants in 2012.

All pipelines have been valued based on optimised replacement costs (ORC), assuming the use of modern techniques and pipe materials. The prices for reticulation pipes are based on recent costs for similar work within Nelson City.

The value of pump stations, pressure reducing valves and the remaining reservoirs was based on recent costs for similar work within Nelson City.

The values were peer reviewed by Opus International Consultants Ltd.

All costs are reported in June 2012 dollars and Goods and Services Tax is not included in the costs.

All assets have been revalued as at 30 June 2012.

In addition to direct purchase/construction costs, professional fees for investigation, resource consent (where applicable), design, construction and 'as built' information have been included.

Valves, hydrants, service pipes, meters, manifolds and boxes have been valued separately.

Financial charges incurred in carrying project costs in the period prior to commissioning have not been included.

Replacement costs have been optimised to represent the lowest cost and most efficient combination of assets providing the same service as the existing assets. Optimisation involves adjustment to deduct any surplus capacity or over design.

Land, access roads, caretakers' houses and fencing are not included on the inventory, as they are recorded in Council's Fixed Asset Register.

Table 6.1 shows the total optimised replacement value of the Nelson City Council water supply system to be $226 million (June 2012 dollars, excluding GST).

Table 6.1 Water Supply Asset Valuation - June 2012

Asset Category	Quantity	Unit	Replacement Value $,000s	Depreciated Replacement Value $,000s	Depreciation $,000s
Reticulation High Pressure	107	km	26,732	13,502	363
Reticulation Low Pressure	213	km	46,678	26,285	562
Trunk Mains	37	km	16,898	9,540	219
Maitai Pipeline	9	km	16,392	1,025	319
Roding Pipeline	6	km	2,995	346	37
Maitai Water Supply Scheme			20,098	14,689	217
Roding Dam			2,767	985	46
Treatment Plant			24,780	14,216	1,198
Tunnels	3	No	11,308	9,527	54
Reservoirs and Tanks	37	No	11,835	9,381	156
Pump Stations	9	No	2,262	1,315	101
Pressure Reducing Valves	33	No	401	229	11
Air & Non Return Valves	123	No	293	170	8
Gate Valves	3,249	No	7,464	4,571	95
Manholes	94	No	343	197	5
Hydrants	2,459	No	5,631	2,846	72
Meters	20,122	No	2,931	746	174
Customer Connections	20,122	No	25,726	15,529	322
Total			**225,535**	**125,098**	**3,957**

6.2.2 Depreciation

The value of the assets has been depreciated on a straight-line basis over their nominal working life. Table 6.2 shows the nominal working life or total life (TL) of each of the classes of assets.

The nominal working life of the reticulation pipework is based on a survival model prepared on the basis of experience of 10 European water supply systems. The results of the model show good agreement with the experience to date in Nelson City.

High pressure reticulation was assigned a slightly shorter life because of the greater working stresses the pipe and fittings will experience.

Trunk mains have been assigned a shorter life again, because of the more serious implications of a pipe failure and the consequent need for a higher standard.

Fixed structures such as dams, tunnels and reservoirs have been assigned a life of expectancy of 100 years.

Pump station structures have been assigned a life expectancy of 100 years, pipes/valves a life of 70 years, and pumps/control equipment 20 years.

The construction year for each individual section of pipe has been researched from field books, plans and other records. This information has been entered into the database to allow the age of the pipes to be calculated.

Sometimes assets have either a positive salvage value or significant disposal cost (that is, a positive or Negative Net Realisable Value (NRV)).

Watermains are generally relaid off line and the existing pipes left in the ground. Thus zero NRV has been assigned to these items.

Sometimes an asset may have a Residual Value (RV) at the end of its economic life, instead of being totally removed or replaced, all (or part) of it continues to be used. It has been assumed that the items have zero residual value.

Table 6.2 Nominal Working Life of Water Assets (Years)

Type	Low Pressure	High Pressure	Trunk Main	Maitai Pipeline	Roding Pipeline
Asbestos Cement (Black)	80	70	65		
Asbestos Cement (Fibrolite)	80	70	65		
Ductile Cast Iron	110	95	90		
Pit Cast Iron	120	105	100		
Spun Cast Iron	100	90	85		
Concrete		65	60	58	75
Copper	90	80	75		
Galvanised Iron	70	55	50		
HDPE	85	70	65		
PVC	85	70	65		65
Concrete Lined Steel	90	80	75		75
Pitch Lined Steel	90	80	75	58	

	Life (Years)
Manholes	
Standard < 1250 dia	84
Standard >= 1250 dia	72
Flow measuring manholes	50
Meter manhole	80
Valves	
Air/NRTN	35
Pressure Reducing	35
Gate valves <250 dia	84
Gate valves >=250 dia	72
Hydrants	
<250 dia	84
>=250 dia	72
Maitai Water Supply Scheme	
Dam and platform	200
Concrete structures (spillway etc)	100
South Supply Intake	50

Roding Dam	100
Other	
Reservoirs	100
Tunnels	100
Stoke reservoir overflow pipe	80
Manifold and meter boxes	80
Service laterals	80
Meters	15

Straight line depreciation is used.

Because the NRV and Residual Value are zero, the Depreciated Replacement Cost (Depreciated Value) is given by

$$DRC = RC * \frac{(TL - age)}{TL}$$

Where

DRC is Depreciated Replacement Cost

RC is Replacement Cost

TL is Total Life

The Depreciated Replacement Cost for each item has been calculated and each class of items has then been aggregated to give the Depreciated Values in Table 6.1.

The depreciated optimised value of the water supply system is assessed at $125 million (June 2012 dollars, excluding GST).

6.3 OPERATIONS AND MAINTENANCE PLAN

6.3.1 Background on Operations and Maintenance

i) Operations

Operations is the running of the water supply system. It includes:

- Management;
- Engineering supervision;
- Electricity and telephones;
- Meter reading and billing.

ii) Forecast Maintenance Programme

Planned maintenance is discussed in Section 5 Lifecycle Management Plan.

As expenditure on condition assessment, planned maintenance, condition modelling and optimised renewals is increased, reactive maintenance should be reduced. However, there may be little overall reduction in maintenance expenditure. The real benefit will be a reduction in unplanned shutdowns and disruption to consumers caused by breaks and failures.

iii) Routine Maintenance

Routine Maintenance is the regular on-going day-to-day work necessary to keep assets functioning including instances where portions of the asset fail and need immediate repair to make the asset operational again. This includes:

- Regular and ongoing annual expenditure necessary to keep the assets at their required service potential;

- Day-to-day and/or general upkeep works designed to keep the assets operating at required levels of service;
- Works which provide for the normal care and attention of the asset including repairs and minor replacements;
- Unplanned (corrective) maintenance, i.e. isolated failures requiring immediate repair to make the asset operational again

iv) Planned Maintenance

Planned Maintenance is carried out in accordance with the requirements of the Utility Services Maintenance Contract.

Additional planned maintenance work is carried out on the reticulation to address faults identified by the leak detection work.

v) Unplanned (Reactive) Maintenance

Reactive maintenance is carried out in accordance with the requirements of the Utility Services Maintenance Contract.

vi) Maintenance Standards

The work performed and material to be used complies with the Nelson City Council Land Development Manual 2010 (and subsequent amendments) and all relevant New Zealand Standards, in particular those listed in the Utility Services Maintenance Contract.

6.3.2 Assumptions

It is assumed that operations and maintenance will be carried out at the same levels as at present. Where there are specific one off or periodic items (such as the three yearly review of the Water Treatment Plant contract) these have been allowed for in the financial plan.

6.3.3 Level of Service Implications

The key levels of service are pressure, flow, quality and reliability.

For the water supply system to deliver the levels of service it must be intact and functioning. Reactive maintenance must be carried out promptly. Planned maintenance must be carried out to ensure that downtime is minimised by carrying out maintenance before it becomes reactive.

6.3.4 Demand Implications

With increasing demand there will be an increase in total variable costs particularly as more water is treated and pumped.

6.3.5 Risk Implications

Intakes, raw water trunk mains, the Water Treatment Plant, treated water trunk mains and reservoirs must all be maintained, kept secure and protected from natural hazards so that they can continue to function through an emergency albeit at a reduced level of service.

6.3.6 Lifecycle Implications

Operations and maintenance is the longest period of the asset lifecycle and ongoing maintenance is necessary to ensure that the design life of the asset is achieved.

6.3.7 12 Year Operations

Table 6.3 shows the planned 12 year operation and maintenance financial plan.

6.3.8 Sensitivity

Treatment and pumping are dependant on demand. In dry summers the demand by domestic irrigation is high and so total costs of treating and pumping water are higher however revenue is also increased.

Routine Planned Maintenance is essential so that assets do not fail unexpectedly, leading to other failures. For example regular maintenance of a pressure reducing valve ensures that it works correctly and does not fail, introducing high pressures into the system that cause pipes to fail.

Table 6.3 Water Supply Operation and Maintenance Projections

Water Supply Operation and Maintenance Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**		
O&M Expense	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Administration	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760
Depreciation	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326
Electricity	458	458	456	456	456	456	456	456	456	456	456	456	456
Water Treatment	1,479	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Physical Works – Programmed	204	200	200	200	200	200	200	200	200	200	200	200	200
Physical Works – Reactive	2,080	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300
Engineering Services	343	343	343	343	343	343	343	343	343	343	343	343	343
Headworks	310	216	179	179	204	179	179	179	179	204	400	179	179
Roding Dam Gravel		50	50	50	250								
Scada		60	70										
Fish Passage		20											
PHRMP		50											
Total [(a)] ($,000s)	**11,960**	**12,315**	**12,184**	**12,114**	**12,371**	**12,064**	**12,064**	**12,121**	**12,064**	**12,089**	**12,317**	**12,064**	**12,064**

Notes:

(a) Projections are in 2015 dollars. Figures in the Long Term Plan are adjusted for inflation

6.4 RENEWAL STRATEGY

6.4.1 Background on Renewals

i) Definition

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original capacity.

Work displaying one or more of the following attributes, can be classified as rehabilitation or renewal expenditure:

- Works which do not increase the capacity of the asset, i.e. works which upgrade and enhance the assets restoring them to their original size, condition, capacity, etc;
- The replacement component of augmentation works which increase the capacity of the asset, i.e. that portion of the work which restores the assets to their original size, condition, capacity etc;
- Reconstruction or rehabilitation works involving improvements, realignment and regrading;
- Renewal and/or renovation of existing assets, i.e. restoring the assets to a new or fresh condition.

Work over and above restoring an asset to original capacity is capital expenditure. However if the additional cost is within 10% of the renewal cost then the total cost will be treated as renewal expenditure.

ii) Renewal Decisions

Assets can fail from various modes other than the normally recognised physical, failure or breakage.

The range of failure modes includes:

- Structural: where the physical condition of the asset is the measure of deterioration, service potential and remaining life, for example a steel watermain may suffer from corrosion.
- Capacity/utilisation: where it is necessary to understand the level of under or over-capacity against the required level of service to establish remaining life or timing for renewal, for example a watermain may be too small to carry the required flow.
- Level of service failures: e.g. reliability, image, where performance targets are not achieved, for example iron tubercles in a cast iron main may lead to complaints of orange specks in the water.
- Obsolescence: technical change or lack of replacement parts can render assets uneconomic to operate or maintain, for example electronic equipment may no longer be serviceable as components may no longer be available.
- Cost or economic impact: where the cost to maintain and operate an asset is likely to exceed the economic return expected, or the customer's willingness to pay to retain an asset.

Each of these modes has distinct attributes that require evaluation to allow an understanding of the effect on the assets. Assessment of the performance related to the type of failure is important.

Condition assessment is a typical failure mode assessment activity.

To evaluate cost and obsolescence as failure modes it is necessary to capture the asset's operating and maintenance cost information, and to compare this with the lifecycle cost expectations.

Renewals of assets will be assessed and reviewed annually when this can be achieved through the following processes or decision making steps:

- What is the cost of rehabilitation versus replacement?
- What are the possible increases in effective life following the different treatment options?
- What is the probability and consequences of failure if rehabilitation / renewal do not take place?
- What are the customer benefits that are derived from the different levels of service that each option offers?
- What are the funding requirements and options?
- What are the future annual and periodic maintenance and operating costs following rehabilitation or replacement?
- What is the justification for any premium being paid for increased level of service?

As condition assessment and maintenance histories are built up, these will be used in determining renewal priorities.

iii) Renewal Standards

The work performed and materials to be used shall comply with the Nelson City Council Land Development Manual (and subsequent amendments) and all relevant New Zealand Standards (complete with amendments).

6.4.2 Assumptions

It is assumed that renewals will be continued as necessary whilst still at a rate that is attainable both from resource and financial aspects.

6.4.3 Level of Service Implications

It is necessary to renew pipes and equipment before they impact on levels of service. For example renewal or relining of cast iron pipe to improve water quality, renewal of softening asbestos cement pipe to maintain reliability.

6.4.4 Demand Implications

Renewals will be sized to allow for future demand. Where the increase is greater than 10% then the difference will be funded from capital (for example, ridermains being laid in conjunction with cast iron and asbestos cement renewals).

6.4.5 Risk Implications

There is a risk to water quality, financial income, and consumer parity by not undertaking renewals of pipes, meters and dual check valves.

6.4.6 Lifecycle Implications

Pipes and equipment must be renewed before maintenance costs become excessive. Decisions made at the time of renewal have impact on the whole lifecycle costs of the asset.

6.4.7 Renewal Plan

- Relining of selected 100mm diameter and larger cast iron pipes will be considered in the future
- Asbestos Cement Pipe - 50mm diameter Fibrolite pipes and 100mm diameter “Black Asbestos” pipes which are identified as being near the end of their economic life are scheduled for renewal from 2007/08 to 2020/21
- Steel Pipe - Steel pipes tend to corrode randomly. Individual sections of steel pipe which fail will be replaced as maintenance expenditure

- Water Treatment Plant Filters – Installation of the fifth train is proposed to begin 2014/15 in order to provide greater flexibility with the filter renewal programme and possibly extend the life of the existing filters. Renewal of the existing filters is shown in the renewal projections for 2016/17. As the Water Treatment Plant has been in operation for ten years and the filters are guaranteed for 10 years advice from the manufacturer will guide the replacement timetable.
- Water Meters - Residential water meters were installed in 1999, and have a life of 12-15 years. It is cheaper to replace these sizes rather than test and refurbish them. These are expected to be replaced under renewal budgets over 3 years from 2017/18. As part of the renewal process consideration will be given to the installation of "smart meters" that allow 24 hour real time monitoring of water use. This type of information would be valuable in the leak detection programme.
- Residential Backflow Prevention – The dual check valves in the water meter manifold are spring operated and lose effectiveness with time. An increasing number of the valves are also disintegrating in the manifolds and a programme to replace these will commence in 2015/16. As the dual check valve is fitted immediately underneath the meter it was initially considered to be appropriate for them to be replaced at the same time as the meter. The number of failures and risk of pieces of the valves impacting the water meters and household water fittings has lead to the need to begin the replacement in advance of the meters.

Water Meters – Commercial and Industrial water meters were installed from 1980 to 1999. Larger sizes can be refurbished but spare parts for early models are not now available. Renewal of commercial and industrial water meters is scheduled over a 9 year period from 2014/15 at $300,000 per year.

Water Supply Renewal Projections are shown in Table 6.4.

6.4.8 Sensitivity on Renewal Plan

The Renewal Plan assumes that pipework and other water assets will be renewed using optimised decision making and condition/failing modelling. As these techniques are still being developed for the water assets, a fixed but realistic sum each year is shown in the Renewal Plan.

Table 6.4 Water Supply Renewals Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**		
Project Area	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Pipeline	838	794	794	794	850	850	850	900	900	900	950	950	950
Pump Stations - Renewals		0	528	70	3	21	0	13	137	495	498	0	3
Headworks - renewals	60	60	60	60	60	60	60	60	60	60	60	60	60
Reservoir Refurbishment Programme					50	50	50						
Residential Meters	50	100	100	1,000	1,000	1,000							
Commercial Meters	301	300	300	300	300	300	300	300	300	300			
Backflow Prevention Renewals												350	350
Water Treatment Plant Renewals	0	0	1,000	1,030	1,135	1,000	4	0	0	4,375	0	1,000	1,000
Total ($,000s)	**1,249**	**1,254**	**2,782**	**3,254**	**3,398**	**3,281**	**1,264**	**1,273**	**1,397**	**6,130**	**1,508**	**2,360**	**2,363**

Note: Projections are in 2015 dollars. Figures in the Long Term Plan are adjusted for inflation

6.5 CAPITAL PROGRAMME

6.5.1 Background on Capital

New works are those works that create a new asset that did not previously exist or works which upgrade or improve an existing capacity. They may result from growth, social or environmental needs.

Capital expenditure projects display one or more of the following characteristics:

- Construction works which create a new asset that did not previously exist in any shape or form;
- Expenditure which purchases or creates a new asset (not a replacement) or in any way improves an asset beyond its original design capacity;
- Upgrading works which increase the capacity of the asset;
- Construction works designed to produce an improvement in the standard and operation of the asset beyond its present capacity.

Capital Work Standards

The work performed and materials to be used shall comply with the Nelson City Council Land Development Manual (and subsequent amendments) and all relevant New Zealand Standards, (complete with amendments).

Table 6.5 shows the Capital Work program and projections.

6.5.2 Assumptions on Capital

The major items of capital expenditure are the duplication of the Maitai Pipeline construction of a second storage reservoir for the Atawhai area, a fifth filtration train and new filters at the treatment plant and installation of backflow prevention devices as noted in 6.5.7 below.

6.5.3 Level of Service Implication on Capital

The capital works for system improvements and ridermains are to address problems with pressure, flow, and continuity of supply to the levels of service required.

6.5.4 Demand Implications on Capital

The capital works proposed will address the need for more storage and trunk mains to meet growth requirements. Failure to meet growth requirements will then impact on Levels of Service.

6.5.5 Risk Implications on Capital

The capital works proposed address the need for decreasing the risk on the Maitai Pipeline and preventing backflow from commercial and industrial promises.

6.5.6 Lifecycle Implications on Capital

Decisions made to construct a capital project will have implications for the life of the asset, as will subsequent design decisions. Optimised decision making will therefore be used to identify and prioritise all potential solutions for water supply projects over $0.5million value.

6.5.7 Capital Financial Plan

i) Maitai Pipeline (Water Treatment Plant – Westbrook Terrace Valve Chamber)

The section of the existing Maitai pipeline below the Treatment Plant is of less risk from geotechnical and pipeline condition hazards. However it was damaged by falling trees in the storm of 30 July 2008. A replacement pipe would be laid down the Treatment Plant access road, down Brook Street and Westbrook Terrace to the existing valve chamber at the corner of Westbrook Terrace and

Silverbirch Grove where it would connect to the existing trunk main system. This work is scheduled for 2017/18.

ii) System Improvements

Minor works to achieve and maintain the levels of service. Minor issues are identified through modelling, service technician comments and staff knowledge each year. Initially it is proposed to concentrate on water loss correction work to reduce the losses.

iii) Atawhai Hills Reservoir and Pump Station

To improve supply capacity and facilitate green field development to the upper levels of the Atawhai foothills, one option considered was a pump station alongside the Walters Bluff reservoir, pumping up to a small storage reservoir (300-500m^3) on the ridgeline above. In this plan a detailed options report will be developed from 2015- 2016/17 to identify preferred location(s) for the Atawhai No 2 reservoir and upper level reticulation options.

iv) Atawhai No. 2 Reservoir

Modelling work by Opus International Consultants Ltd for the Walters Bluff Reservoir in 2000 identified that a second reservoir between Walters Bluff and Dodson Valley would be required in the future as a result of growth. Final timeframes will be established by either demand through developer interest and subdivision consent applications or the need to establish a water source for emergencies. Currently the reservoir is shown in the CAPEX tables for 2020-2024.

v) Atawhai Trunk Main

An additional trunk main will be required to link the Atawhai No. 2 Reservoir to the existing trunk main system. This is proposed for 2021/22.

vi) Ridermains

The renewal budgets allow for the replacement of 50mm and 100mm asbestos cement watermains. However, the Land Development Manual requires a watermain on one side of the street and a ridermain on the other. To accommodate this a separate budget is identified for new ridermain installations.

vii) System Improvements/ Miscellaneous Pipe and Fittings

There is an ongoing need for small improvements to the water network to address localised issues that arise with flow, pressure, taste and turbidity. A budget for these is included in the CAPEX tables. Larger issues are addressed as specific CAPEX projects.

viii) Lee Valley Dam

Nelson City Council is currently a stakeholder in the investigations for the dam in the Lee Valley proposed by the Waimea Water Augmentation Committee. To secure a share in the dam (for water required at the turn of the century) a payment of $4.4 million (10% of the expected construction cost of $44M) would have to be made at the time of construction.

As discussed above in section 3 other options are expected to provide sufficient water for the city and a share in the Lee Valley Dam is not required for the water supply activity. No funding is therefore shown in the Capital Works Projections.

ix) Backflow Prevention.

Backflow prevention is one of the factors considered in the Ministry of Health water gradings. The water supply does not currently meet Ministry of Health requirements as not all premises have backflow prevention. Backflow is identified as the second highest risk to the water supply (refer section 4.4.6).

Reduced pressure backflow preventors have been installed on all connections to sewage treatment plants and pump stations and new connections to Reserve facilities.

The meter manifolds installed on domestic and some commercial connections (refer Section 5.2.7) incorporate a spring loaded dual check valve. While not providing an absolute guarantee, these valves significantly reduce the possibility of accidental contamination of the water supply from a residential property, which is also considered to be a low level risk of contamination source.

A survey has begun of all commercial and industrial premises to determine the exact backflow prevention needs, so that a programme for installation of backflow preventors can be established. Installation of backflow preventors has been established as an important means of protecting the network from contamination.

The sum of $3.8 million over 11 years ($350,000 per year) has been shown in the Capital Works Projections from 2014/15 for the fitting of backflow preventors to Commercial and Industrial premises in conjunction with meter renewals.

x) Fire Flows

Budget allowance of $100,000 per year for seven years from 2014/15 has been made for works required to improve the fire flow issues in the city. These issues have largely been created by the change in the requirement for fire flows to be available within specified “as measured along the road” distances from fire hydrants, rather than as a straight line measure direct from the hydrant.

Table 6.5 Water Supply Capital Expenditure Projections Note: Projections are in 2015 dollars. Figures in the Long Term Plan are adjusted for inflation

Year		1	2	3	4	5	6	7	8	9	10	11	12		
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**				
Project	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	**Growth**	**LOS**
Malvern Hills - Atawhai Pump & Ridge Resvr	21	67	150												
Atawhai #2 Reservoir					100	285	500	1,000	1,250	1,250					
Atawhai Trunk Main					50	95		3,300							
Backflow Prevention	375	350	350	350	350	350	350	350	350	350	350				
Maitai Pipeline (WTP-Westbk Tce)	100	100	100	4,000											
Observatory Hill Reservoir & Pump															
Maitai Planting	10	10	10	10	10	10	10	10	10	10	10	10	10		
Maitai Resource Consent Renewal	80	150	60												
Roding Resource Consent Renewal	80	150	60												
Roding Pipeline		100							1,000	1,500	1,500	1500			
Telemetry / control upgrades															
Pressure Enhancement											100				
NCC - TDC Link		100	100	1,000	1,000	1,000									
DMA establishment		50	100	100											
Water Loss Reduction Programme		100	100	100	100	100	100								
Hira extension											100	150	1,000		
Future Growth Additional Storage															
Seismic Risk Upgrades		100	100	100											
Water Treatment Plant Membranes	1,200	1,000													
Natural Hazards Risk Assessment		50	50		100	100	100								
Network Capacity Confirmation for Growth Areas		50	100						100	100	100	1,250			
Network Upgrades Nelson North															
Network Upgrades Nelson Central															

Network Upgrades Nelson South															
Fire Flow Upgrades	100	100	100	100	100	100	100								
Pipe Improvements/Pressure Reduction	50	50	50	50	50	50	50	50	50	50	50	50	50		
Ridermains	155	155	155	155	155	155	155	55	55	55	55	55	55		
System Improvements & Misc Pipes & Fittings	60	60	60	60	60	60	60	50	50	50	50	50	50		
Water Treatment Plant Upgrades										150	500	500	500		
Dam Upgrades		0	0	0	100	100	100	0	0	0	100	0	100		
Total ($,000s)	**2,231**	**2,742**	**1,645**	**6,025**	**2,175**	**2,405**	**1,525**	**4,815**	**2,865**	**3,515**	**2,915**	**3,565**	**1,765**		

6.5.8 Sensitivity on Capital Plan

Most of the Capital projects are growth related, therefore if growth is slower (or faster) than predicted then projects may need to be put back (or brought forward).

6.6 ASSET DISPOSAL PLAN

Water mains are generally relaid off line. If pipes are left in the ground they are usually sealed at the connections and retained as a possible duct for cables.

Mechanical equipment that has been replaced is cannibalised for parts or sold as scrap metal unless it is considered to have genuine resale value. In this case, the piece of surplus equipment will be sold with income directed to the water supply account.

6.7 LONG TERM PLAN

The Council adopted a 10 year Long Term Plan in 2012 which outlined the major activities and projects the Council expected to be involved in during the next 10 years, and the resources needed for these. These have been reviewed, as above, and this Plan proposes changes which will be carried into the Long Term Plan 2015-25.

6.8 FUNDING

6.8.1 Contributions

The Resource Management Plan has set a financial contribution so that subdividers, developers and new industry pay their share of the capital expenditure for reserves purposes each year as part of the costs of growth.

From 1 July 2006 Development Contributions have been collected under the Local Government Act 2002 as detailed in the Long Term Plan.

The remaining costs of collecting, treating and delivering water are funded from user charges.

6.8.2 Water by Meter User Charges

From 1 July 1999 universal metering has been in operation and there is no charge in the general rates for the supply of water.

The Water Pricing Structure Working Party was convened in 2003 and made its recommendation to the Infrastructure Committee which in turn recommended the pricing structure to the full Council meeting on 18 December 2003.

The objective of the pricing structure is to:

- Encourage water conservation
- Be fair to residential and commercial water users
- Be simple to administer and readily understood by the public
- Recognise the opportunity value and fire fighting value of the water supply system and the benefits this provides to empty sections and houses
- Provide regular cash flow while avoiding excessive reading and invoicing costs

The key points in the pricing structure are:

- A house or section without a water connection not be charged a fee
- All properties on water by meter (including empty sections) should pay a minimum annual charge.
- The fixed costs are approximately 90% and variable costs approximately 10% of the total costs of operating the water supply. If the minimum annual charge was set to recover 90% of costs there would be little incentive to conserve water. Therefore the minimum annual charge was set to recover only 30% of the total costs. This encourages water conservation, but still means that low (or no)

volume users do pay a share of the opportunity and fire fighting value of the supply.

- There being no “entitlement to free water for low usage” associated with the minimum annual charge.
- The minimum annual charge (collected as a daily charge) be set to recover 30% of the estimated water by meter revenue requirement, and that the remaining 70% be recovered as user charges
- The revenue required from Major Water Users with Even Demand (including financial and operating costs) be calculated based on the value of water supply assets used by those users and allocated as a percentage of peak summer demand for assets sized for peak demand (part of the treatment plant), and as a percentage of water used for assets sized for water volume
- The charges for Bulk Water Users over 10,000m^3 per year, where there is predominantly summer irrigation, be at the average of the 0-10,000m3 and the 10,000-100,000m^3 rates. This recognises that these Users contribute to the summer peak, but do not use a large part of the reticulation
- The charges for usage in the 10,000-100,000m^3 band and 100,000+m^3 band be set to recover the revenue calculated above and in the same ratios as used in previous years.
- A revenue issue may arise in the future, if the water reuse project involving treated water from Bells Island is developed. This project would supply irrigation water to the Tahunanui / Stoke area and impact on water sales currently made for this purpose.

7. ASSET MANAGEMENT PRACTICES

7.1 ASSET MANAGEMENT

Council adopted an Asset / Activity Management Plan Policy in 2010. This policy confirms that the Water Asset Management Plan should be developed to a "Core Plus " level as best reflects the needs for a city of Nelson's size.

A gap analysis between "Core" and "Advanced" Asset Management has been undertaken for each asset group. The analysis is shown in Appendix D.

7.2 INFORMATION SYSTEMS

All asset information is stored on Arcinfo, a computer based Geographical Information System and Hansen Asset Management System. The accounting system used is integrated computer software supplied by Napier Computer Systems. The various systems are linked.

7.3 ACCOUNTING/FINANCIAL SYSTEMS

7.3.1 Background

Accounting is carried out to International Financial Reporting Standards (IFRS) to comply with the Local Government Amendment Act Number 3 (the No. 3 Act). The Nelson City Council uses integrated computer software supplied by Napier Computer Systems.

The General Ledger is linked to packages that run Debtors, Creditors, Banking, Rates, Fixed Assets, Invoicing, Water Billing, Job Costing, and Payroll.

Internal monthly financial reports are generated by activity and sub-activity.

External financial reports by significant activity are published in the annual report. Monthly summaries are presented to the Finance Committee of Council.

7.3.2 Definition of Expenditure Categories

Expenditure can be divided into two broad categories;

i) Ongoing day to day operations and maintenance works;

ii) Programmed works that upgrade or renew the asset to provide the required level of service.

All expenditure on infrastructure assets will therefore fall into one of three categories:

iii) Maintenance Expenditure

iv) Capital Expenditure – renewals/replacements

v) Capital Expenditure – creation/enhancement

7.3.3 Maintenance Expenditure

Maintenance may be planned or unplanned, and is the regular ongoing day to day work necessary to keep assets operating, including instances where portions of the asset fail and need immediate repair to make the asset operational again. This includes:

- Regular and ongoing annual expenditure necessary to operate and keep the assets at their required service potential;
- Day to day and/or general upkeep works designed to keep the assets operating at required levels of service;
- Works which provide for the normal care and attention of the asset including programmed repairs and minor replacements;
- Unplanned (reactive) maintenance i.e. isolated failures requiring immediate repair to make the asset operational again.

7.3.4 Capital Renewal/Replacement Expenditure

Renewal expenditure is major work which does not increase the asset's design capacity but restores, rehabilitates, replaces or renews an existing asset to its original capacity. This includes:

- Works which do not increase the capacity of the asset, but restores them to their original size, condition capacity, etc.
- The replacement component of augmentation works which restores the assets to their original size, condition, capacity, etc.
- Reconstruction or rehabilitation works involving improvements, realignment and regrading;
- Renewal and/or renovation of existing assets, restoring the assets to a new or fresh condition consistent with the original asset.

7.3.5 Capital Creation/Enhancement Expenditure

Capital works create a new asset that did not previously exist, or upgrade or improve an existing capacity. They may result from growth, social or environmental needs. This includes:

- Construction works which create a new asset that did not previously exist in any shape or form;
- Expenditure which purchases or creates a new asset (not a replacement) or in any way improves an asset beyond its original design capacity;
- Upgrading works which increase the capacity of the asset;
- Construction works designed to produce an improvement in the standard and operation of the asset beyond its present capacity.

7.3.6 Depreciation and Loss of Service Potential

- Depreciation and Loss of Service are calculated in Hansen.

7.4 GEOGRAPHICAL INFORMATION SYSTEM

7.4.1 Background

When the decision was made to implement the Geographical Information System in 1993 it was recognised that the existing asset information was not of a suitable standard to be entered directly into the system. A contract was let for the capture and delivery of data in digital format suitable for entry into the Geographical Information System system.

The data capture included contours, building outlines, road markings, kerb and channel, manholes, sumps, valves, hydrants etc. To ensure that underground services were captured as accurately as possible, students were employed to identify and mark every surface access point (e.g. manholes, valves).

The data was captured, using photogrammetry, from March 1994 and progressively delivered over the following three years. Nelson City Council staff carried out accuracy checks on the co-ordinate data supplied, searched all the engineering plans and field books for information on pipe alignment, material and age and entered this information into the Geographical Information System.

7.4.2 Accuracy Limitations

There is a high degree of confidence in the accuracy of the data.

- Spatial Data

  Data captured by photogrammetry is required to be accurate to within a tolerance of ± 0.3m. In streets where surface openings could not be seen from the air (e.g. under verandas or trees) the points were picked up by the contractor's field survey team. In other less accessible areas, it was not considered economic to

search for buried fittings. Instead the best estimated position was entered and the accuracy limitation flagged.

- New assets are recorded from the surveyed coordinates and levels shown on the "as built" plans supplied by the subdivider (for vested assts) or Council's project section (for new capital work).
- Pipe Size, Material, and Age Data

There is high confidence in the accuracy of pipe age, material and size data in Hansen.

Before historic data was entered into the Geographical Information System system considerable research through existing "as built" and "field book" records was carried out.

For early pipes where an exact date of construction was not known, the best estimate was used based on the type of pipe, the age of surrounding pipes and the period the area was developed.

Cross reference was also made to Council's schematic water supply operational plans - "the water plans". These plans have existed in transparency and latterly in electronic format for over 40 years and are used daily by the maintenance contractor. Whenever the contractor excavates onto a pipe and discovers an error in size or material in the plans, this is reported and the master plan updated.

- New assets are recorded from the "as built" plans supplied by the subdivider (for vested assets) or Council's engineering project section (for new capital work).
- Toby Location
- As outlined in Section 5.2.7, each property has been provided with a meter manifold in a plastic meter box. This manifold also serves as the toby for the property.
- As part of the project, a description of the meter box location has been entered into the Napier Computer Systems Water Billing System. The location of each meter box and toby is recorded by dimensions from boundaries.
- The meter box location is only recorded on Geographical Information System for new subdivisions.

7.4.3 Maintenance of Geographical Information System Data

New data is updated into the Geographical Information System system on a monthly basis.

7.5 INFORMATION FLOW REQUIREMENTS AND PROCESSES

7.5.1 Existing Information Flow and Business Processes

In June 2000, Opus International Consultants Ltd completed a report entitled "The Development of Business Process Mapping for Asset Management Systems" preparatory to Nelson City Council purchasing and implementing a computer based Asset Management System.

The report details the existing business processes used by the Nelson City Council in its Asset Management planning.

The report identified a preferred process for the management of Council assets and identified gaps in the current process for each asset group and recommended actions required to correct the gaps and implement the transition to the preferred management process.

The report concluded that the majority of data required for Asset Management is already collected and stored. However the data is stored in a myriad of systems and files and is therefore not extensively used to support the Asset Management planning decision making processes.

7.6 ASSET MANAGEMENT SYSTEM

7.6.1 Background

In 2000 the Hansen Asset Management System was selected as best suited to meet the future Asset Management planning requirements of Council. In 2014 a decision was made to continue with the Hansen Asset Management System version 8.

7.6.2 Implementation

The water asset group was chosen to pilot the implementation of the new system.

The data collection and management for water was improved as noted above, and once the new procedure was approved, was developed over other asset groups within the Nelson City Council.

7.6.3 Accuracy Limitations

Pipe data in Hansen is populated from the Geographical Information System system and the comments above regarding accuracy limitations applies also.

Non pipe data is entered into Hansen manually from “as-built” drawings therefore is considered to be accurate.

7.7 NETWORK MODEL

7.7.1 Background

In 2001 the Infoworks water network modelling package was purchased and installed. The Network Model is used to calculate fire hydrant flows, verify design pipe sizes for new works and check the capacity of the system to cope with future development.

7.7.2 Accuracy Limitations

In 2002 extensive monitoring of flow and pressure was carried out to enable the model to be more accurately calibrated. Further extensive flow and pressure monitoring was carried out in February 2006 and was used to further refine the model. Model calibration is carried out regularly with re-calibration undertaken in 2014/15.

Infoworks is populated from the Geographical Information System system and the comments above regarding accuracy limitations apply also.

7.8 CONDITION MODEL

Condition models will be developed for the various Water Supply Assets. This has commenced with condition models for steel and cast iron pipe. The utility services maintenance contractor is collecting ratings on corrosion, pitting, coating and tuberculation when pipe is exposed for maintenance. These ratings are combined within the Hansen system to give an overall pipe condition. When sufficient data has been collected the condition and hence expected useful life left, of lengths of pipe of similar age and laid under similar conditions will be able to be predicted.

The system needs to be extended to Asbestos Cement pipe condition prediction using data collected by the Utility Services Maintenance contractor and information from the “New Zealand Asbestos Cement Watermain Manual” produced by the New Zealand Water and Waste Association.

7.9 SCADA TELEMETRY

Council has a “Kingfisher” SCADA (Supervisory Control and Data Acquisition) system and an “Intouch” system at the base station. The system is used to monitor and control critical aspects of the network such as the dams, treatment plant, reservoirs, pumps and control valves.

The need for constant monitoring of the water network by the SCADA system has grown to the point that without it, maintaining the current Levels of Service would be difficult. SCADA has given Council the ability to ascertain faults and instigate remedial actions by remote control without affecting the service to consumers.

8. PLAN IMPROVEMENT AND MONITORING

8.1 PREVIOUS ACTION PLANS

The 2001, 2004, 2006, 2009 and 2012 Water Supply Asset Management Plans contained action plans for Monitoring and Improvement. Table 8.1 Reviews these plans and reports on progress.

Table 8.1 Previous Action Plans Report Needs to be updated.

Action	WAMP Ref	Year Due	Completed Y/N	Comments
Health and Safety Practices Internal Audit	8.3.6 2006	Six monthly	Yes	Done every six months
Maintain Backflow Register	2.2.4 2006	Annually	Yes	
Compare average peak two day demand with projected demand	2.3.4 2006	Annually	Yes	
Target pressure correction work	2.4.4 2006	Annually	Yes	
Target flow correction work	2.5.6 2006	Annually	Yes	
Review risk analysis	4.7 2006	Annually	Yes	
Review and update costs by 30 August each year	8.4.5 2006	Annually	Yes	
Maitai Dam Annual Engineering Inspection	5.2.3 2006	Annually	Yes	
Revise water supply demand growth	3.7 2006	2006	Yes	This document updates peak annual use compared to supply capacity.
Establish a backflow prevention policy	2.2.4 2006	2006	No	Policy now superseded by programme. Council approved funding 2013/14.
Develop Contamination Response Plan	4.4.6 2006	2006	No	Deferred pending completion of PHRMP.
Establish Condition Model for asbestos cement pipe	7.8 2006	2006	No	Longer term project resource dependent.
Achieve “Ab” water grading from Ministry of Health	2.2 2006	2007	Yes	Achieved May 2011.
Investigate options for mitigating risk to Maitai pipeline	4.4.1 and 5.2.2 2006	2007	Yes	Council decision to duplicate pipeline made in 2007.
Fit seismic shutoffs to major water reservoirs	4.3.2 2006	2008	Yes	Completed October 2007
Commence duplication of Maitai pipeline	4.3.2 2006	Dam to WTP 2011/14 Construction	Yes	Construction due to complete 2013/14.
Maitai Dam comprehensive Safety Review	4.2.3 2006	2014	No	Due 2014
Revise Asset Management Plan	8.4.4 2006	2014	Yes	This document
Routinely calibrate the accuracy of the Network Analysis	2.4.4 2006	2014/15	No	Due 2014/15

Action	WAMP Ref	Year Due	Completed Y/N	Comments
Pump Stations 5 year engineering inspections	5.2.5 2006	2009/14	No	Carried out on a rolling basis as resources allow
Reservoirs 5 year engineering inspections	5.2.4	2009/14	No	Carried out on a rolling basis. Panorama Drive done 2009, Observatory Hill done 2010.
Have backflow preventors on all commercial /residential premises	4.3.2 2006	2024	No	Not due
Replace double check valves on residential properties	4.3.2 2006	2015	No	Not due

8.2 PERFORMANCE MONITORING AND MANAGEMENT

The effectiveness of the Water Asset Management Plan will be monitored in various ways and the results used in the updating and revision of the Plan as described in Section 8.4.

8.2.1 Current Level of Service Objectives

This Water Asset Management Plan contains levels of service in Section 2.0. Compliance with the current level of service objectives will be monitored by internal audit.

8.2.2 Capital and Renewal Works Programme

The carrying out of the annual capital and renewal works programme will be monitored to ensure that the works are completed on time and within budget.

8.2.3 Maintenance Works Programme

The carrying out of the maintenance works will be monitored to ensure that the works are carried out within the required response times, to the required standard, and at the least cost.

8.3 IMPROVEMENT PROGRAMME

8.3.1 Improving Accuracy and Confidence in Asset Management Plan

Asset management improvements and associated objectives are noted throughout the Asset Management Plan.

These improvements will improve the accuracy of, and confidence in, the Water Asset Management Plan. These improvements are shown in Table 8.2.

A risk assessment is an essential element of any Asset Management Plan. This involves identification of critical assets, risk analysis and development of risk reduction and contingency planning to suit the business situation.

8.3.2 Core to Advanced Gap Analysis

Asset Management Planning is a constantly evolving process, with underpinning Asset Management systems constantly providing better information. Previous Water Supply Asset Management Plans were adopted by Council in 1999, 2001, 2006, 2009 and 2012. These reviews have each created an updated plan and have been timed to link with Council's strategic planning cycle, i.e. the Community Plan and Long Term Plan.

The Infrastructural Assets Business Unit held an in-house Asset Management workshop in January 2006 in preparation for the 2009 rewrite of the Unit's three year business plan, the Water Supply Asset Management Plan, and Transportation Asset Management Plan.

At that workshop a gap analysis between "Core" and "Advanced" Asset Management was undertaken for each asset group. The Water Supply Asset Management Plan was

considered to be midway between “core” and “advanced”. The detailed assessment is included in Appendix D.

Based on the definitions in the recently published International Asset Management Manual 2006 the Water Supply Asset Management Plan 2004 is considered between core and advanced in that the areas in Table 8.2 are not covered.

In recent years it has been recognised that a new rating level of “Core Plus” is the most appropriate rating for cities of Nelson’s size. This rating reflects that parts of the asset can be managed at a Core level and parts at an Advanced level. The resultant provides an effective asset management tool without becoming un-necessarily expensive. The development of “core plus” asset management practices will be reviewed prior to the completion of the 2018 Asset Management Plan.

8.4 MONITORING AND REVIEW PROCEDURES

The plan will be reviewed annually and revised every three years to incorporate, amongst other things, improved decision making techniques, updated asset information, and Council policy changes which impact on targeted levels of service.

The effectiveness of the Asset Management Plan will be monitored in various ways.

8.4.1 Statutory Audit

The Local Government Act requires that an annual, financial audit of the operations of the Council be carried out. Audits may include all significant activities such as Asset Management planning.

Previous Water Asset Management Plans were examined by Audit New Zealand in the course of audits of the Nelson City Council.

8.4.2 Internal Audit

An internal audit will be taken to assess the effectiveness with which the plan meets its objectives prior to the development of the 2018-28 Asset Management Plan.

8.4.3 Benchmarking

Benchmarking of service quality and cost efficiency against similar organisations will be carried out at some future date, most likely once an Asset Management System is operational, and a history has been established.

Local Government NZ is embarking on a benchmarking exercise for Council utilities in 2014. Nelson City Council is a contributor to this exercise.

8.4.4 Review and Updates

The Water Asset Management Plan programmes and costs will be reviewed and updated annually by 30 August each year for incorporation into the Annual Plan.

9. ACTION PLAN

9.1 EXPLANATION

Throughout this Water Asset Management Plan, Objectives, Targets, Capital Works, Major maintenance and Plan improvements are referred to. Table 9.1 brings all these items together in chronological order to show the work required and the targeted time for the actions for each section of the Water Asset Management Plan.

Table 9.1 Action Plan Needs updating

	WAMP Ref	Year
Water Quality		
Over the next three years the following are considered important to complete:		
• Progress Backflow Prevention Programme		2015/18
• Renewal of WTP membranes		2015-2018
Review of FACE, Microbiological compliance and Chemical compliance with the aim of identifying ways of reducing demerit points accumulated through the Drinking Water Grading process.		2015-18
Develop Contamination Response Plan.		2015-18
Pressure		
Routinely calibrate the accuracy of the Network Analysis model so that reliable predictions are provided.	2.4.6	3 year cycle
Target pressure correction work so that areas of the network with most consumers and greatest pressure problems are corrected first.		Annually
Flow		
Target flow correction work so that areas with most consumers and greatest flow problems are corrected first.	2.5.6	Annually
Environmental		
Ongoing monitoring or Resource Consent conditions.	2.7.4	Annually
Future demand		
• When future growth projections are available, the water supply demand for the city will be revised for inclusion in the next Water Supply Asset Management Plan.	3.7	Annually
• Continue the water loss identification and reduction programme		
Emergency and Risk Management		
Refer Table 4.5 for Risk Treatment Schedule and Plan.	4.6	Annually
Review the lifelines risk assessment and response		2015-2018
Growth		
When the final results of the revised Nelson Resource Management Plan are available, the water supply demand for the City will be revised for inclusion in the next Water Supply Asset Management Plan.	3.7	2015-18

Risk Develop Contamination Response Plan.	4.4.6	2006
Condition Model Establish Condition Model for Asbestos Cement Pipe.	7.8	2015
Water Supply Grading Maintain “Ab” water grading from Ministry of Health.	2.2	Annually
Risk Commence duplication of Maitai Pipeline.	4.3.2	Construction due to start 2011/12
Maitai Dam Comprehensive safety Review (Last completed 2008)	4.2.3	Due 2013
Asset Management Plan Revise by 30 November.	8.4.4	2014
Network Model Routinely calibrate the accuracy of the Network Analysis model so that reliable predictions are provided.	2.4.4	2014
Pump Stations Rolling programme of inspections and upgrade where required.	5.2.6	Following programme
Reservoirs Rolling programme of inspections and upgrade where required.	5.2.5	Following programme
Risk Have backflow preventors on all commercial premises.	4.4.6	Completion deferred in this document until 2024
Risk Replace double check valves on residential properties (in conjunction with water meter renewals).	4.4.6	2016 Not due yet

9.2 ANNUAL PERFORMANCE MONITORING

Throughout this Water Supply Asset Management Plan annual performance and monitoring measures are noted. Table 9.2 brings all these items together.

Table 9.2 Annual Performance Monitoring and Reporting

	WAMP Reference
Water Quality (i) Measure quality in accordance with the current Drinking Water Standards for New Zealand as set out in the Health Act 1956. (ii) Record compliance with Ministry of Health grading. (iii) Record compliance with backflow prevention requirements.	2.2.4
Reliability (i) Record daily headworks supply and treatment plant supply. (ii) Record the actual time the water supply is interrupted and restored, and number of properties affected. (iii) Record all complaints regarding “out of water”. (iv) Record time and type of notice shutdown given to consumers. (v) Project peak daily demands for a 30 year planning period every 5 years.	2.3.4
Pressure Identify the number of properties with unacceptable: (i) Pressure fluctuations; (ii) Minimum pressure; (iii) Maximum pressure.	2.4.4
Flow (i) Record flows (ii) Determine theoretical flows by use of a computer model.	2.5.5
Environment Sustainability (i) Record natural river flows, abstraction flows, mitigation flows, river temperatures, and water quality and biotic diversity and density.	2.7.3

APPENDIX A: GLOSSARY OF TERMS

GLOSSARY OF TERMS

The following terms and acronyms (in brackets) are used in this Plan.

Advanced Asset Management	Asset management which employs predictive modelling, risk management and optimised decision-making techniques to establish asset lifecycle treatment options and related long term cash flow predictions. (See Basic Asset Management).
Annual Plan	An Annual Plan is published in years two and three, alternating with the three-yearly Long Term Plan, that sets out Council's updated financial situation, intended activities and work programme for the following three financial years.
Asset	A physical component of a facility which has value, enables services to be provided and has an economic life of greater than 12 months. Dynamic assets have some moving parts, while passive assets have none.
Asset Management	The combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of providing the required level of service in the most cost-effective manner.
Asset Management System	An Asset Management system is a combination of processes, data and software applied to provide the essential outputs for effective Asset Management planning such as reduced risk and optimum infrastructure investment.
Asset Management Plan	A plan developed for the management of an infrastructure asset that combines multi-disciplinary management techniques (including technical and financial) over the lifecycle of the asset in the most cost effective manner to provide a specified level of service. A significant component of the plan is a long-term cash flow projection for the activities.
Asset Register	A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, construction, technical and financial information about each.
Backflow Prevention Device	A mechanical device required by the Drinking Water Protection Regulations to prevent water from private plumbing flowing back into the water supply system and possibly contaminating the public supply. May be a column 10.7m high, a double check valve system or a reduced pressure principle device.
Benefit-Cost Ratio (B/C)	The sum of the present values of all benefits (including residual value, if any) over a specified period, or the lifecycle, of the asset or facility, divided by the sum of the present value of all costs.
Business Plan	A plan produced by an organisation (or business units within it) which translates the objectives contained in an Annual Plan into detailed work plans for a particular, or range of, business activities. Activities may include marketing, development, operations, management, personnel, technology and financial planning.
Capital Expenditure	Expenditure used to create new assets or to increase the capacity of existing assets beyond their original design capacity or service potential. Capital expenditure increases the value of asset stock.
Cash Flow	The stream of costs and/or benefits over time resulting from a project investment or ownership of an asset.
City Datum	The baseline from which heights in the City are measured. It is approximately 12m below mean sea level (so that all numbers are positive).

Closed Circuit Television	A method of inspecting pipes by sending a mobile camera along the length of the pipe to visually record the interior.
Community Plan	See Long Term Council Community Plan.
Components	Specific parts of an asset having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality.
Condition-Based Preventive Maintenance	Preventive maintenance initiated as a result of knowledge of an items condition from routine or continuous monitoring.
Condition Monitoring	Continuous or periodic inspection, assessment, measurement and interpretation of the resultant data, to indicate the condition of a specific component so as to determine the need for some preventive or remedial action.
Core Asset Management	Asset management which relies primarily on the use of an asset register, maintenance management systems, job/resource management, inventory control, condition assessment and defined levels of service, in order to establish alternative treatment options and long-term cash flow predictions. Priorities are usually established on the basis of financial return gained by carrying out the work (rather than risk analysis and optimised decision-making).
Corrective Maintenance	The remedial actions performed as a result of failure, to restore an item to a specified condition. Corrective maintenance may or may not be programmed.
Critical Assets	Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets.
Current Replacement Cost	The cost of replacing the service potential of an existing asset, by reference to some measure of capacity, with an appropriate modern equivalent asset.
Data Warehouse	A system that is used to centralise a group of disparate databases in an organisation to facilitate access into each of those databases.
Deferred Maintenance	The shortfall in rehabilitation work required to maintain the service potential of an asset.
Demand Management	The active intervention in the market to influence demand for services and assets with forecast consequences, usually to avoid or defer capital expenditure. Demand management is based on the notion that as needs are satisfied expectations rise automatically and almost every action taken to satisfy demand will stimulate further demand.
Depreciated Replacement Cost	The replacement cost of an existing asset less an allowance for wear or consumption having regard for the remaining economic life of the existing asset.
Depreciation	The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted for by the allocation of the cost (or revalued amount) of the asset less its residual value over its useful life.
Deterioration Rate	The rate at which an asset approaches failure.
Economic Life	The period from the acquisition of the asset to the time when the asset, while physically able to provide a service, ceases to be the lowest cost alternative to satisfy a particular level of service. The economic life is at the maximum when equal to the physical life; however obsolescence will often ensure that the economic life is less than the physical life.
Failure Modes, Effects and Criticality	A technique for analysing and evaluating a design to ensure that the application has the desired reliability characteristics by obviating those

Analysis	critical failure modes through employment of redundancy, providing alternate modes of operation, derating, or any other means.
Gap Analysis	A method of assessing the gap between a business's current Asset Management practices and targeted future objectives/practices. Also called needs analysis or improvement planning.
Geographic Information System	Software which provides a means or spatially viewing, searching, manipulating, and analysing an electronic database.
Infrastructure Assets	Stationary systems forming a network and serving whole communities, where the system as a whole is intended to be maintained indefinitely at a particular level of service potential by the continuing replacement and refurbishment of its components. The network may include normally recognised ordinary assets as components.
l/sec	Litres per second. A measure of flow.
Level of Service	The defined service quality for a particular activity (i.e. water) or service area (i.e. water quality) against which service performance may be measured. Service levels usually relate to quality, quantity, reliability, responsiveness, environmental, acceptability and cost.
Life	A measure of the anticipated life of an asset or component; such as time, number of cycles, distance intervals etc.
Lifecycle	The cycle of activities that an asset (or facility) goes through while it retains an identity as a particular asset i.e. from planning and design to decommissioning or disposal.
Lifecycle Cost	The total cost of an asset throughout its life including planning, design, construction, acquisition, operation, maintenance, rehabilitation and disposal costs.
Likelihood	Used as a qualitative description of probability or frequency.
Long Term Council Community Plan	Prepared as a requirement of the Local Government Act 2002, with the purpose of describing Council's activities, describing the 'community outcomes' (goals) of the Council area, providing integrated decision-making and coordinating the resources of Council. It provides a long-term focus for the decisions and activities of the Nelson City Council, and is an important basis for the accountability of the Council to the Nelson community. It provides an opportunity for the public to participate in decisions on activities to be carried out by Council. It covers ten years planned financial expenditure in detail.
m3/day	Cubic metres per day. A measure of flow.
Main	The pipework system that conveys water from the intakes to each street. Trunk mains bring water from the intakes to the City secondary mains water to suburbs. Reticulation mains (or distribution) mains supply water into each street and are fitted with fire hydrants. Rider mains are smaller pipes supplying one side of a street.
Maintenance	All actions necessary for retaining an asset as near as practicable to its original condition, but excluding rehabilitation or renewal. Fixed interval maintenance is used to express the maximum interval between maintenance tasks. On-condition maintenance is where the maintenance action depends upon the item reaching some predetermined condition.
Maintenance Standards	The standards set for the maintenance service, usually contained in preventive maintenance schedules, operation and maintenance manuals, codes of practices, estimating criteria, statutory regulations and mandatory requirements, in accordance with maintenance of quality objectives.
Monitor	To check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify change.

Non-asset Solution	A non-asset solution is one where demand for an asset's service is dealt with in a way other than by additional investment in new resources and infrastructure. This might be by regulation (restricting time of use and type of use), economic incentives (such as pricing structures and subsidies), educational campaigns and provision of alternative ways of meeting customers' needs. Non-asset solutions are usually included in a demand management strategy.
Non-return Valve (NRV)	A mechanical device that allows water to flow in one direction only.
NZ IFRS	International Financial Reporting Standard
Optimised Decision Making (ODM)	An optimisation process for considering and prioritising all options to rectify existing or potential performance failures of assets. The process encompasses NPV analysis and risk assessment.
Optimised Depreciated Replacement Cost (ODRC)	The optimised replacement cost after deducting an allowance for wear or consumption to reflect the remaining economic or service life of an existing asset. ODRC is the surrogate for valuing assets in use where there are no competitive markets for assets, or for their services or outputs.
Optimised Replacement Cost (ORC)	The minimum cost of replacing an existing asset with modern equivalent assets offering the same level of service. The optimisation process adjusts the value for technical and functional obsolescence, surplus assets or over-design.
Payback Period	The time it takes for the cumulative benefits or savings of an investment to pay back the original investment and other accrued costs.
Performance Measure (PM)	A qualitative or quantitative measure of a service or activity used to compare actual performance against a standard or other target. Performance measures commonly relate to statutory limits, safety, responsiveness, cost, comfort, asset performance, reliability, efficiency, environmental protection and customer satisfaction.
Performance Monitoring	Continuous or periodic quantitative and qualitative assessments of the actual performance compared with specific objectives, targets or standards.
Planned Maintenance	Planned maintenance activities fall into three categories: Periodic – necessary to ensure the reliability or to sustain the design life of an asset. Predictive – condition monitoring activities used to predict failure. Preventive – maintenance that can be initiated without routine or continuous checking (e.g. using information contained in maintenance manuals or manufacturers' recommendations) and is not condition- based.
Pressure Reducing Valve (PRV)	A mechanical device that modulates to maintain a constant lower pressure downstream irrespective of flow.
Rehabilitation	Works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification. Generally involves repairing the asset to deliver its original level of service (i.e. heavy patching of roads, sliplining of sewer mains, etc) without resorting to significant upgrading or renewal, using available techniques and standards.
Renewal	Works to upgrade, refurbish or replace existing facilities with facilities of equivalent capacity or performance capability.
Remaining Economic Life	The time remaining until an asset ceases to provide the required service level or economic usefulness.
Renewal/Replacement	The complete replacement of an asset that has reached the end of its life, so as to provide a similar or agreed alternative, level of service.
Repair	Action to restore an item to its previous condition after failure or damage.

Replacement Cost	The cost of replacing an existing asset with a substantially identical new asset.
Reservoir	A large storage area for water. May be uncovered, e.g. Maitai Lake or covered, e.g. stressed concrete reservoirs at Thompson Terrace.
Residual Value	The net market or recoverable value which would be realised from disposal of an asset or facility at the end of its life.
Rider Main	A small diameter watermain on the opposite side of the road from the principal watermain.
Risk Management	The application of a formal process to the range of possible values relating to key factors associated with a risk in order to determine the resultant ranges of outcomes and their probability of occurrence.
Risk Management Process	The systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, evaluating, treating, monitoring and communicating risk.
Routine Corrective Maintenance	Corrective maintenance, excluding emergency corrective and programmed corrective maintenance.
Routine Maintenance	Day to day operational activities to keep the asset operating (replacement of light bulbs, cleaning of drains, repairing of leaks, etc) and which form part of the annual operating budget, including preventive maintenance.
Sensitivity Analysis	Testing of the variations in the outcome of an evaluation by altering the values of key factors about which there might be uncertainty.
Service	A service refers to the provisioning of or the actual system of supplying a public need, A water service (pipe) is that section of the reticulation between the main in the street and the property boundary.
Stakeholders	Those people and organisations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity.
Strategic Plan	A plan containing the long-term goals and strategies of the Council. Strategic plans have a strong external focus, cover major portions of the Council's operations and identify major targets, actions and resource allocations relating to the long-term survival, value and growth of the Council.
Tank	A small covered storage area for water. Usually made of concrete and of 23m3 capacity.
Universal Metering	Having water meters fitted to all properties, i.e. ordinary (residential) and extraordinary (commercial, industrial and other non-residential) users.
Unplanned Maintenance	Corrective work required in the short-term to restore an asset to working conditions so it can continue to deliver the required service or to maintain its level of security and integrity.
Useful Life	May be expressed as either: The period over which a depreciable asset is expected to be used, or The number of production or similar units (i.e. intervals, cycles) that is expected to be obtained from the asset.
Valuation	Assessed asset value which may depend on the purpose for which the valuation is required i.e. replacement value for determining maintenance levels, market value for lifecycle costing and optimised deprival value for tariff setting.

APPENDIX B: WATER SUPPLY CONSERVATION STRATEGY

MAITAI

Refer to Figure A. Please note that the letters below correspond with the same letters in circles in the Figure.

A. Publicity will be run with the theme "Use Water Wisely" between 1 January and 30 April each year.

B. When the water level is in this range water will be released from the reservoir into the Maitai River as required by the 'Surplus Water' requirement of Resource Consent 960567.

   The arrangement that was established with the Nelson Catchment Board in 1987 is that surplus water is released at a steady rate from the reservoir whenever the flow at the forks drop below 300 litres per second and the lake level is above the acceptable draw down line. The rate of release is reviewed weekly.

C. When the water level is in this range sprinkler restrictions will be put in place. As a minimum restriction odd numbered properties would be able to water on odd-numbered days and even numbered properties on even numbered days. Advertising will be run to remind the public of these restrictions. Flushing of mains will be reduced.

D. When the water level is in this range a sprinkler ban will be put in place. The only exception will be high value areas such as bowling greens, golf course greens, cricket pitches and high profile public gardens. Advertising will be run to remind the public of this ban.

E. When the water level is in this range hosing restrictions will be introduced. Depending on the severity of the situation these measures could include:

   - A complete ban on residential hosing
   - Restrictions on industrial and commercial use of water e.g. close down automatic car washes, stop washing of cars in Sale Yards
   - Approaches to major industries to explain the severity of the situation and request co-operation through minimal water use.
   - Increased advertising
   - Establishment of a 'Hot Line' for residents to report non-compliance with Water Restrictions.
   - Water mains only flushed in response to water quality complaints.

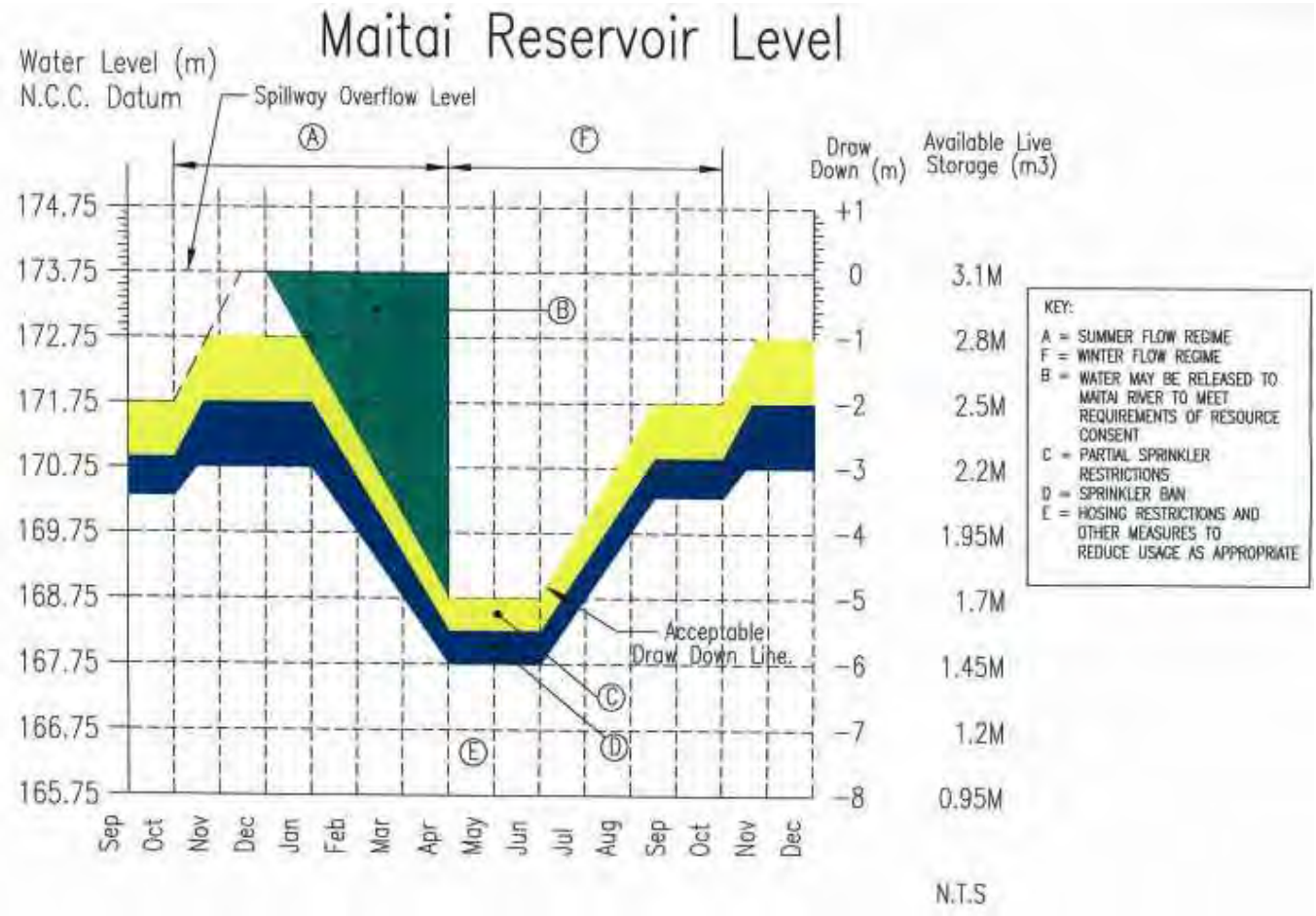
F. If during the period 1 May to 30 October the minimum river flow is reduced in accordance with Resource Consent 960567 the response shall be the same as for Item E.

   NOTE:

   i) This strategy outlines the minimum response to falling water levels in the Maitai Reservoir. Response may be more severe depending on long range weather forecasts.

   ii) Water restrictions may be put in place for other reasons such as fluctuating water pressures in the reticulation caused by excessive demand.

Figure A Maitai Reservoir Level



RODING

i) When the natural flow of the Roding River above the weir is 196 litres per second or less for two consecutive days (5 year return period low flow), restrictions as in Section C will be put in place.

ii) When the natural flow of the Roding River above the weir is 160 litres per second or less (10 year return period low flow), restrictions as in Section D will be put in place.

iii) When the natural flow of the Roding River above the weir is 140 litres per second or less for two consecutive days (20 year return period low flow), restrictions as in Section E will be put in place.

Note: These measures are in accordance with the requirements of Resource Consent No. 975374

APPENDIX C: LIFELINES

Extract from Civil Defence Emergency Management Act 2002

s60. Duties of Lifeline Utilities

Every lifeline utility must:

a) Ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency;

b) Make available to the Director in writing, on request, its plan for functioning during and after an emergency;

c) Participate in the development of the national civil defence emergency management plans;

d) Provide, free of charge, any technical advise to any Civil Defence Emergency Management Group or the Director that may be reasonably required by that Group or the Director;

e) Ensure that any information that is disclosed to the lifeline utility is used by the lifeline utility, or disclosed to another person, only for the purposes of this Act.

s64. Duties of Local Authorities

1. A local authority must plan and provide for Civil Defence Emergency Management within its district.

2. A local authority must ensure that it is able to function to the fullest possible extent, even though this may be at a reduced level, during and after an emergency.

Extract from Nelson Tasman Engineering Lifelines Project Report 2004

Civil Water Supply

Nelson City water supply is sourced from Maitai and Roding river catchments. The water supply network includes dams, intake structures, water treatment plant, tunnels, approximately 320km of pipework, 4 pump stations and reservoir storage of approximately 13,300m^3.

The Maitai Water supply scheme, including the Maitai earthfill Dam, was commissioned in 1987 and is considered to be in good condition except for the trunk main between the dam and Upper Brook Street. The Roding Weir was commissioned in 1940 and is still in good operating condition. Gravel tends to build up behind the weir and requires regular removal.

The Brook Dam, constructed in 1904 as Nelson's original water supply scheme, was decommissioned in 2000. The Maitai trunk pipeline, constructed in 1963, is largely exposed and is vulnerable to landslip with some sections positioned on benched platforms on steep geologically unstable slopes and some sections passing through a tunnel. The pipe is identified as at extreme risk from movement failure caused by earthquake, landslide or settlement. This segment of the network is marked as highest priority for mitigation measures to ensure ongoing water supply is secure. The main is nominated for future replacement in the next five years.

The 65 year old Roding pipeline, which is rated at high risk due to flooding potential, passes through a 2.7km tunnel under the Barnicoat range, and the pipe is programmed to be replaced in 20 years. The Central City and Port Hills Cast Iron mains are all at the end of their life and are all predominantly due to be replaced by 2006/07. Atawhai and Stoke suburbs have more recent pipe systems constructed of AC or PVC and are in good condition.

Reservoirs in Thompson Terrace have been seismically strengthened in 1992/93 and re-roofed in 2001/02. Stoke, Atawhai, and Observatory Hill reservoirs are recent and all are in good condition. Pump stations in Princes Drive, Austen Ward Heights, Van Diemen Street and Panorama Drive have been constructed since 1990 and are considered to be in good condition.

The recently constructed water treatment plant at the Tantragee Saddle is situated close to slopes potentially prone to landslip, however the facility is rated to be at low risk and risks to

its operation are assessed in detail in site specific geotechnical reports associated with construction design.

Walters Bluff (Atawhai) reservoir although sited on a splinter fault has been specifically designed and constructed to mitigate risks from fault rupture and earthquake shaking and is rated at low risk to these hazards.

Other mitigation measures identified for Nelson's water network include installation of seismic control valves on reservoirs to secure water reserves in existing storage facilities and prevent loss through failed service lines.

Since this report was completed the Stoke High Level Reservoir has been completed in 2010/11. The reservoir is located on the York/Brook saddle above the land fill site and has a storage volume of 2500 cubic metres. An additional 440m^3 reinforced concrete reservoir has been constructed at Observatory Hill in 2014. This takes Nelson's storage to 22,340m^3.
The Christchurch Earthquakes of 2010 /2011 lead to significant damage to that city's infrastructure including water storage reservoirs and pipe network from direct shaking and liquifaction.
Recognising this, and the results of other natural hazard investigation post the Nelson storm events of December 2011 and April 2013, Nelson City Council is reassessing the risk to the network from earthquakes (including liquefaction, tsunami and direct shaking), flooding, storms and sea level rise.

NELSON TA...MAN LIFELINES

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:

Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Earthquake **Impact** **Risk**

Component/Segment	From	To	Length	Importance	Vulnerability		Immediately After	Period Following	Return to Normality		Risk Rating 1	Risk Rating 2	Risk Rating 3	Comment
Stoke #1 Reservoir				5	1		3	3	3		3	3	3	Have been designed to catergory 2 of NZS 3106
Walters Bluff Reservoir				5	1		3	3	3		3	3	3	ie intended to remain functional in the emergency
Clear Water Reservoir				5	1		3	3	3		3	3	3	period for a major earthquake of 1 in 1000 year return
Tompson Tce #2 Reservoir				5	1		3	3	3		3	3	3	Has been strenghtened to catergory 3
Tompson Tce #1 Reservoir				5	1		3	3	3		3	3	3	Has been strenghtened to catergory 2
														(1in 333 year return period)
														However the fitting of seismic valves is necessary
														to retain water from being lost through broken
														distribution lines
														Walters Bluff and Clearwater have been fitted during
														Construction

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Flooding / Storm Surge / Erosion **Impact** **Risk**

Component/Segment	From	To	Length	Importance	Vulnerability	Immediately After	Period Following	Return to Normality	Risk Rating 1	Risk Rating 2	Risk Rating 3	Comment
Roading Headworks	Screens	Tunnel		4	2	1	3	3	2	6	6	Erosion of pipe bench - Alternative use Maitai Supply
Roading Trunkmain	Tunnel	P.S.		4	2	1	3	3	2	6	6	Erosion of gravels pipe lain in
Maitai Headworks	Screens	Mixing Box		5	2	1	1	1	2	2	2	Erosion of banks pipe laid in - Alternative use Dam Supply
Maitai Pipeline	Mixing Box	Camp		1	3	3	3	3	9	9	9	Localised Erosion / Slipping of pipe bench
Atawhai Trunk Main	Cemetery Point	Marybank		3	1	1	2	3	1	2	3	Storm surge: Protected by Haven, rock protection, Atawhai Rising Main.
												Note: Water Assets not suceptible to flooding damage. Erosion caused by flooding may (refer above)

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Ground Shaking (Earthquake) Amplification

Component/Segment	From	To	Length	Importance	Vulnerability	Impact: Immediately After	Impact: Period Following	Impact: Return to Normality	Risk Rating 1	Risk Rating 2	Risk Rating 3	Comment
City Trunk Main	Tasman St	Scotland St		5	2	1	3	3	2	6	6	
	Scotland St	Ngatitama St		5	1	1	3	3	1	3	3	
	Ngatitama St	Hampden St		5	2	1	3	3	2	6	6	
	Hampden St	Boundary Rd		5	1	1	3	3	1	3	3	
	Waimea Rd	TT Reservoir		5	1	1	3	3	1	3	3	
Roading Trunk Main	Surge Chbr	Marsden Vly		4	1	1	3	3	1	3	3	
	Tunnel Portel	Ridgeway		4	2	1	3	3	2	6	6	
	Ridgeway	Main Road		4	2	1	2	3	2	4	6	
Stoke Reservoir Trunk Main	Marsden Rd	Reservoir		3	1	1	2	3	1	2	3	
Richmond Trunk Main	Marsden Rd	Champion Rd		2	2	1	2	3	2	4	6	
Tahuna Trunk Main	Marsden Rd	Marie St		4	2	1	2	3	2	4	6	
	Marie St	KFC		1	2	1	2	2	2	4	4	
TTR Trunk Main	Annesbrook Dr	TTR		4	1	1	2	3	2	4	6	

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Landslip

Component/Segment	From	To	Length	Importance	Vulnerability	Impact: Immediately After	Impact: Period Following	Impact: Return to Normality	Risk Rating 1	Risk Rating 2	Risk Rating 3	Comment
Maitai Pipeline	Dam	WTP		5	3	1	3	3	3	9	9	Pipe laid on bench on steep hillside
	WTP	Brook St		5	3	1	3	3	3	9	9	Pipe laid on bench on steep hillside
Thompon Tce Reservoir Pipline	Boundary Road	TTR		4	2	1	3	3	2	6	6	
	TTR	Annesbrook Dr		5	2	1	2	3	2	4	4	
Stoke Reservoir				5	1	1	2	3	1	2	3	) Partially backfilled to support hillside behind
Walters Bluff Reservoir				5	1	1	2	3	1	2	3	) Slopes design by Geotech.
Thompson Tce #1 Reservoir				5	1	1	2	3	1	2	3	) on Spur, set back from slope below
Thompson Tce #2 Reservoir				5	1	1	2	3	1	2	3	)
Clearwater Reservoir				5	1	1	2	3	1	2	3	Slopes designed by Geotech

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Landslip damaging: Stoke, Thompson Tce, Walters Bluff and Clearwater Reservoirs have been considered not vulnerable similarly Water Treatment Plant and Maitai Dam

Utility: NCC WATER

Completed By: Dave Plant Date: 17/03/2004

Note:
Importance 1-5 (5 most important)
Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

Vulnerability to Hazard Ground Shaking (Earthquake) Amplification

							Impact			Risk			
Component/Segment	**From**	**To**	**Length**	**Importance**	**Vulnerability**		**Immediately After**	**Period Following**	**Return to Normality**	**Risk Rating 1**	**Risk Rating 2**	**Risk Rating 3**	**Comment**
Brook Street Trunk Main	WTP	Hillside		5	1		1	3	3	1	3	3	
	Hillside	Hillside Lane		5	1		1	3	3	1	3	3	
	Hillside Lane	Bronte St		5	2		1	3	3	2	6	6	
Atawhai Trunk Main	Bronte St	Bridge St		4	2		1	2	3	2	4	6	
	Bridge St	North Rd		4	2		1	2	3	2	4	6	
	North Rd	Whakatu Marae		4	2		1	2	3	2	4	6	
	Whakatu Marae	Cemetery Point		3	1		1	2	3	1	2	3	
	Cemetery Point	Bayview Rd		3	2		1	2	3	2	4	6	
	Bayview Rd	Tui Glen Rd		2	1		1	2	2	1	2	2	
	Tui Glen Rd	Marybank		1	2		1	2	2	2	4	4	
Walters Bluff Trunk Main	Whakatu Marae	Reservoir		4	1		1	2	3	1	2	3	
Port Trunk Main	North Road	Sealords		2	2		1	2	3	2	4	6	
Maitai Trunk Main	Dam	Fiddlers Arch		5	3		1	3	3	3	9	9	
	Fiddles Arch			5	3		1	3	3	3	9	9	
	Fiddlers	Camp		5	3		1	3	3	3	9	9	
	Camp	WTP		5	3		1	3	3	3	9	9	

Vulnerability 1-3 (3 most vulnerable)
Impact 1-3 (3 most impact)

APPENDIX D: NELSON CITY COUNCIL ADVANCED ASSET MANAGEMENT GAP ANALYSIS - WATER

Table A: Gap Analysis - Water

A – Advanced asset management criteria met
C – Core asset management criteria only met

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
1. Description of Assets	An adequate description of the asset, both physically and in financial terms, with the ability to aggregate and disaggregate information. State the remaining useful lives of assets. A financial description of the assets that is linked to the physical description and meets the requirements of: • Financial Reporting • Valuation Standards, augmented by the NZ Depreciation and Valuation Guidelines	As for 'Core' plus • A reliable physical inventory of assets at both an individual asset level and at a network level. This would include: - Physical attributes such as location, material, age etc. - Systematic monitoring and analysis of physical condition - Systematic measurement of asset performance (including utilisation/capacity)	A A A		• Need to identify all critical assets clearly in Asset Management Plan	
2. Levels of Service	Asset Management Planning should define the level of service or performance required of the asset, linked to the strategic/community outcomes of the organisation. The significant services (for which service levels should be subject to consultation and agreement) should be stated. Define the length of time for which the asset network must deliver the required service.	As for 'Core', plus • For each significant service; - Evaluating level of service options - undertaking consultation on level of service options with the community and other relevant stakeholders (using consultation processes which meet industry recognised standards) - adoption by the Council or governing body, of the service level and standards after consultation - public communication of the service level & standards in a 'Customer Charter' or equivalent public document - regular monitoring & public reporting of the organisation's adherence to agreed service levels and standards. • Ensuring the Asset Management plans of each significant service reflect and are based on the agreed levels of services, including technical performance measures which underpin the customer-agreed levels of service and standards	C C C C A A	A A A A	• Identify gaps and actions required • Identify resources • Determine a time frame – next version of asset mgt plan • Review targets, resources and timeframe • Ensure adequate time for Asset Management Plan writing • Set up timetable for asset mgt plan re-writes	
3. Managing Growth	Demand for forecasts for each network or facility for a 10 year period are based on latest growth forecasts. Demand management strategies and demand drivers are understood	• Demand forecasts include analysis of the different factors that comprise demand. • The sensitivity of asset development (capital works) programmes to demand changes is understood.	A C	A	• Undertake a sensitivity analysis of programmes (especially Capex) to demand changes	

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
	and documented.					
4. Risk Management	Risk management to identify critical assets and associated risks and risk management strategies	• Management of assets must include recognition and application of the principles of integrated risk management, specifically • Risk management should be consistent with AU/NZS4360, and industry good practice such as the NZ Local Government Handbook for risk management • Asset risk management should be integrated with other corporate risk management processes • Asset risk management should encompass: - Identification and risk management strategies for critical assets - Engineering lifelines based risk assessments and mitigation plans, including reference to the organisation's disaster recovery and business continuity plans - The link to maintenance and replacement strategies	A A A A/C C	A A		
5. Lifecycle (Optimised) Decision-Making	Identify gaps between current service capability and the required service capability to meet future demand and target service levels and reflect these gaps in an asset development programme. Evaluation and ranking, based on suitable criteria, of options for significant capital investment decisions.	• The ability to predict robust and defensible options for asset treatments that can assist in achieving optimal costs over the life cycle of the asset or asset network, including: - Applying appropriate economic evaluation tools (or other Council endorsed prioritisation systems) in developing short-term project lists, and - Using predictive modelling techniques to provide defensible long-term financial forecasts. First grade for critical assets, Second grade for non-critical assets (to be identified in Asset Management Plans)	CC CC	AC AC	• Restrict to critical assets only	
6. Financial Forecasts	Asset Management Planning should translate the physical aspects of planned maintenance, renewal and new work into financial terms for at least the ensuing 10 years and in a manner that is fair, consistent and transparent. The forecasts should include sufficient information to enable decline in service potential (depreciation) of an asset to be measured. Guidance on depreciation is included in the NZ Valuation and Depreciation Guidelines.	• Asset Management Planning should translate the physical aspects of planned operational, maintenance, renewal and new works into financial terms: - Generally over the timeframe in which the asset network must deliver services - In more specific terms, over the period for which the organisation has a strategic plan. - The compilation of financial forecasts should be consistent, reliable and provable. - The sensitivity of the forecasts to potential significant changes in assumptions should be analysed and discussed in the Asset Management plan.	C A A C	A A	• Document the thinking behind strategic decisions and link all previous chapters into financials • Identify form of sensitivity analysis to be undertaken • Identify basic assumptions and likely impact on programme for financial forecast from change	
7. Planning Assumptions and Confidence Levels	Asset Management Planning should List all assumptions and provisos under which the plan and financial	As for 'Core', plus • Asset Management Planning should: - List all the assumptions and	A		• Determination of data requirements • Action plan to	

<table>
<tr><th>Asset Management Attribute</th><th>'Core' Asset Management Planning Criteria</th><th>'Advanced' Asset Management Planning Criteria</th><th>Current</th><th>Desired</th><th>Comment</th><th>Time</th></tr>
<tr><td></td><td>forecasts are prepared.
Indicate the degree of confidence of data reliability underpinning the Asset Management plan; particularly
• data on asset condition;
• data on asset performance;
• accuracy of asset inventory; and
• demand/growth forecasts.
On the basis of the preceding assumptions and confidence of underlying data, provide a level of precision, or confidence, on the expenditure forecasts for the asset network.</td><td>provisos in the Asset Management plans, and note key assumptions regarding Asset Management planning in the organisation's strategic plans.
- Have degrees of confidence on the data as follows:
<table><tr><td></td><td>Critical Assets</td><td>Non Critical Assets</td></tr><tr><td>Inventory data</td><td>Grade 1</td><td>Grade 2</td></tr><tr><td>Condition data</td><td>Grades 1 or 2</td><td>Grades 1, 2 or 3</td></tr><tr><td>Performance data</td><td>Grades 1 or 2</td><td>Grades 1, 2 or 3</td></tr><tr><td colspan="3">(Grades are contained in Appendix C of the Manual)</td></tr></table>
Note:
First Grade is critical assets, second is non-critical as identified in Asset Management Plans
Condition relates to availability of useful data not the quality of data already obtained.</td><td>AA
CC
AA</td><td></td><td>collect data
• Analyse data</td><td></td></tr>
<tr><td>8. Outline Improvement Programmes</td><td>Asset Management planning should state what needs to be done to improve Asset Management processes and techniques.
Improvement programmes should outline:
• the weak areas
• how weak areas will be addressed
• the timeframe over which the improvements will occur; and
• the resources (human and financial) needed</td><td>As for 'Core', plus
• Improvement programmes should outline key performance indicators for monitoring Asset Management improvement.
• The improvement plan should comment generally on achievements against the previous plan, and formally report against key performance indicators.</td><td>C
C</td><td>A
A</td><td>• Words are in document but need to be collated in the improvement plan section</td><td></td></tr>
<tr><td>9. Planning by qualified persons</td><td>Asset Management planning must be undertaken by a suitably qualified person, for example an engineer specialising in the relevant activity, or a Level 6 (Tactical) or Level 7 (Strategic) National Diploma in Asset Management or equivalent skill level.
If plans are prepared by persons not suitably qualified, the plans should be independently assessed by a qualified person.
The planning process should be peer reviewed.</td><td>As for 'Core Asset Management Plan Criteria'.</td><td>A</td><td></td><td></td><td></td></tr>
<tr><td>10. Commitment</td><td>The Asset Asset Management Plan must be approved and</td><td>As for 'Core', plus
• The organisation must demonstrate that Asset</td><td>A</td><td></td><td></td><td></td></tr>
</table>

Asset Management Attribute	'Core' Asset Management Planning Criteria	'Advanced' Asset Management Planning Criteria	Current	Desired	Comment	Time
	adopted by the governing body, Board or Council. This includes approval of the improvement element of the plan. Asset Management plans must be seen as the key planning tool for infrastructure assets and/or significant physical assets which provide the inputs for Council's strategic plans (Long Term Council Community Plan). Asset Management Plans must be regularly updated to reflect the most current future plans for the assets (it is expected the "Core" Asset Management planning will be significantly revised in the light of action under improvement programme. In the first few years annual revisions of Asset Management Plans are likely).	Management plan requirements are being implemented through operational plans, and formally report discrepancies. • Asset Management planning is seen as a constantly evolving process, with underpinning Asset Management systems constantly providing better information. • It is expected that formal Asset Management plans, and overarching Asset Management strategies will be formally revised every three years, with the timing of revisions linked to the organisation's strategic planning cycles.	A A			

	Year	Completed Y/N
Levels of Service		
Evaluating Service Options	2015	N
Undertaking Consultation on Levels of Service Options	2015	N
Adoption by the Council of Levels of Service after Consultation (note 1)	2015	N
Public Communication of Levels of Service in a "Customer Charter"		N
Managing Growth		
Sensitivity of Asset Capital Works to demand changes	2015	N
Risk Management		
Engineering Lifelines based risk assessments including reference to disaster recovery and business continuity plans	2015	N
Link to maintenance and replacement strategies	2015	N
Lifecycle Optimised Decision Making		
Ability to predict robust and defensible options for asset treatments that achieve optimal lifecycle costs including:		
Applying appropriate economic evaluation tools, and	2015	N
Using predictive modelling techniques to provide defensible long term financial forecasts.	2015	N
Financial Forecasts		
Asset Management Plan translates physical aspects of Operations and Maintenance, Renewal and Capital Works in financial terms:		

	Year	Completed Y/N
Over the timeframe the Network must deliver services, and	2015	N
The sensitivity of Forecasts to potential significant changes in assumptions are discussed and analysed in the Asset Management Plan	2015	N
Planning Assumptions and Confidence Levels		
Have confidence levels on condition data	2015	N
Outline Improvement Programmes		
Improvement programmes outline key performance indicators for monitoring Asset Management improvement	2015	N
Improvement plan should comment on achievement against the previous plan and formally report against key performance indicators	2015	N

Note 1: Consultation on levels of Service is carried out via the Community Plan and Annual Plan consultation processes.

APPENDIX E: WATER LOSSES EVALUATION

Background

This section examines the components and evaluates their impact on the Nelson City water supply losses, and defines the work required to reduce each aspect of the losses.

The components of water loss are well documented in the New Zealand Water and Wastes Association "Benchloss" manual which is based on the International Water Association Water Loss Task Force "Guidance Notes", and the definitions are therefore not repeated here.

Figure D1 show the components and their numerical magnitude. Note the boxes are not to scale.

The following work is being carried out as priorities allow to determine (improve the accuracy of) the numbers

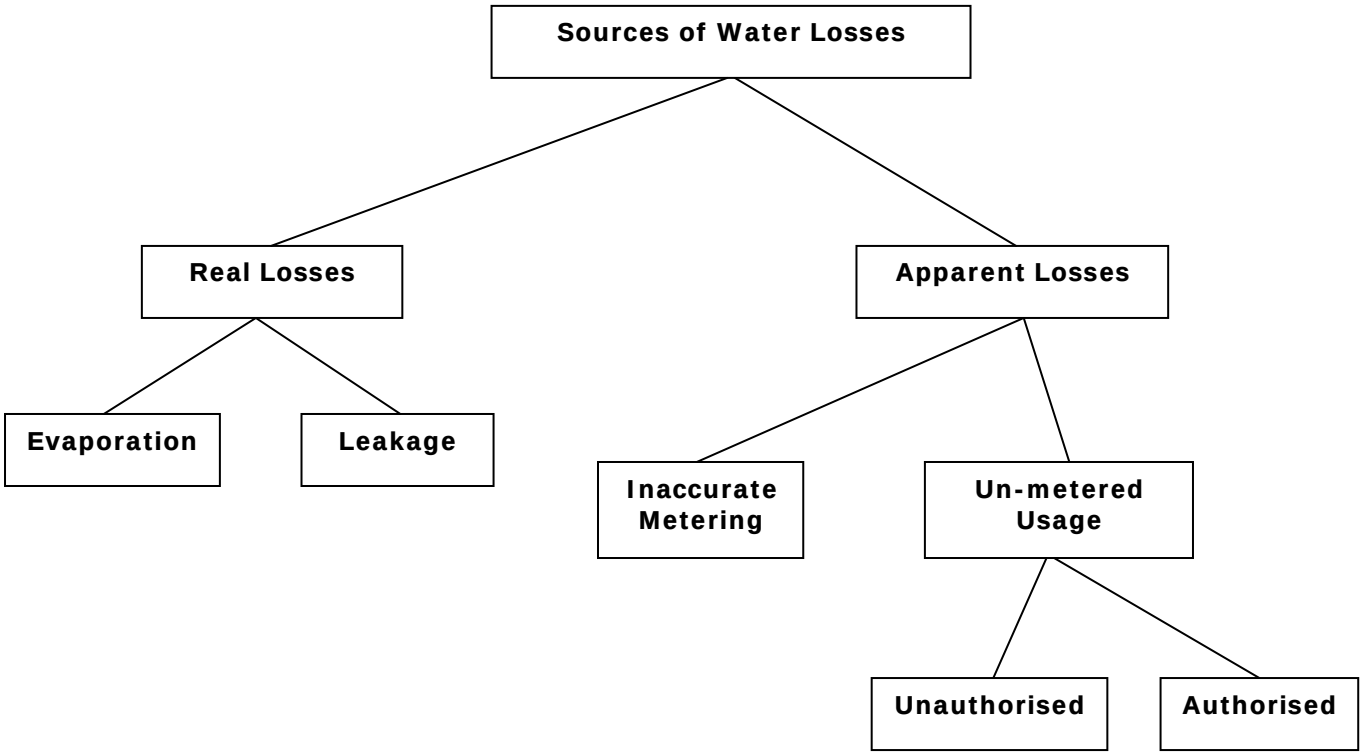
- Collect Water Supply Data
- Test Source Meter for Accuracy
- Collect and assess metered water use data
- Test customer meters for accuracy
- Collect data to quantify unmeasured authorized uses e.g. mains flushing, fire fighting etc
- Review water accounting and data handling procedures
- Measure water losses including field inspection of reservoirs, tanks, control valves

Figure B The Water Balance Data for 2012/13 Financial Year (latest available)

<table>
<tr><td rowspan="2">Own Sources
7391.0 m^3x10^3
434.5 l/cap/d
+/- 2.0%</td><td rowspan="8">System Input
7391.0 m^3x10^3
434.5 l/cap/d
+/- 2.0%</td><td rowspan="2">Billed Water Exported to other systems</td><td></td><td></td><td>Billed Water Exported to other systems
3.4 m^3x10^3 +/- 2.0%
0.2 l/cap/d</td><td rowspan="3">Revenue Water
4914.4 m^3x10^3
288.9 l/cap/d
+/- 1.7%</td></tr>
<tr><td rowspan="3">Authorised Consumption
5008.4 m^3x10^3
294.5 l/cap/d
+/- 1.7%</td><td rowspan="2">Billed Authorised Consumption
4914.4 m^3x10^3
288.9 l/cap/d
+/- 1.7%</td><td>Billed Metered Consumption by Registered Customers
4911.0 m^3x10^3 +/- 1.7%
288.7 l/cap/d</td></tr>
<tr><td rowspan="2">Water Imported
0.0 m^3x10^3
0.0 l/cap/d
+/- 0.0%</td><td rowspan="5">Water Supplied
7387.6 m^3x10^3
434.3 l/cap/d
+/- 2.0%</td><td>Billed Unmetered Consumption by Registered Customers
0.0 m^3x10^3 +/- 0.0%
0.0 l/cap/d</td></tr>
<tr><td>Unbilled Authorised Consumption
94.0 m^3x10^3
5.5 l/cap/d
+/- 8.8%</td><td>Unbilled Metered Consumption
0.0 m^3x10^3 +/- 0.0%
0.0 l/cap/d</td><td rowspan="5">Non-Revenue Water
2476.6 m^3x10^3
145.6 l/cap/d
+/- 6.9%</td></tr>
<tr><td rowspan="3">Water Losses
2382.6 m^3x10^3
140.1 l/cap/d
+/- 7.1%</td><td>Unbilled Unmetered Consumption
94.0 m^3x10^3 +/- 8.8%
5.5 l/cap/d</td></tr>
<tr><td rowspan="2">Apparent Losses
209.2 m^3x10^3
12.3 l/cap/d
+/- 25.2%</td><td>Unauthorised Consumption
5.0 m^3x10^3 +/- 13.3%
0.3 l/cap/d</td></tr>
<tr><td>Customer Meter Under-registration
204.2 m^3x10^3 +/- 25.8%
12.0 l/cap/d</td></tr>
<tr><td>Real Losses
2173.4 m^3x10^3
127.8 l/cap/d
+/- 8.2%</td><td>Real Losses
2173.4 m^3x10^3 +/- 8.2%
127.8 l/cap/d</td></tr>
</table>

Figure D2 shows the sources of Real and Apparent Water Losses diagrammatically

Figure C Sources of Water Losses



Note re Authorised Un-metered Usage
Strictly speaking, authorised un-metered usage is not an apparent loss, if it is identified and correctly quantified in the water balance. Refer Fig D1.

Real Losses

Refer figures B and C

Evaporation

All of Nelson's treated water storage is covered.

Evaporation is not considered to be a factor in the water losses.

Leakage

Leakage from trunk mains

The trunk mains are operated at high pressure. Trunk mains are laid under roads or in otherwise visible areas, therefore leaks will show on the surface quickly.

Leakage from trunk mains is not considered to be a factor in the water losses.

Leakage from reticulation pipes

Leakage from reticulation pipes is unquantified. While pipe bursts show at the surface, smaller leaks may go undetected for some time and infiltrate into the ground, particularly in Stoke, Tahunanui and The Wood which are on gravel and sand.

Reticulation pipe leaks are considered to be a major factor in the water losses

Leakage from service pipes

Leakage from reticulation pipes is unquantified. While pipe bursts show at the surface, smaller leaks may go undetected for some time and infiltrate into the ground, particularly in Stoke, Tahunanui and The Wood which are on gravel and sand.

Service pipe leaks are considered to be a major factor in the water losses.

Leakage through Scour Valves

Scour valves are situated in low spots near creeks or storm water mains to facilitate draining of trunk and large diameter reticulation mains. Leaks from scours could go un-noticed for some time. A system has been set up for Nelmac to regularly check scour valves by inspecting the outlets and electronically listening on the valve for water passing.

Leakage through scour valves is not considered to be a major factor in the water losses.

Leaking Hydrants

Hydrants usually only leak after use and the fire service (and others) usually report if they are unable to fully shut off the hydrant. Due to the design of fire hydrants, the shaft glands do not leak when the hydrant is turned off.

Fire Hydrants are situated in the road or other accessible places and are visible therefore leaks quickly fill the hydrant box and show on the surface unless the ground is particularly porous.

Hydrant leaks are not considered to be a major factor in the water losses.

Leakage from Valves

Unlike hydrants, glands on valves can leak at any position of the valve gate. Valves used to be checked and “exercised” by Nelmac on a 3 yearly basis. However this procedure was ceased when it was found that the process actually initiated many valve gland leaks. Leakage normally fills the valve box and shows on the surface. Valve gland leaks are now repaired on a reactive basis.

Leaks through “shut” valves allow water into an adjacent zone – normally from a high pressure zone into a low pressure zone, but water is not lost from the system.

Leakage through reservoir filling valves is discussed in “reservoir overflows” below

Leakage from valves is not considered to be a significant factor in the water losses.

Bursts

Nelson City Council has quick response times in its level of service. Nelmac’s contract requires them to respond to bursts within 30 minutes. Leakage from bursts is allowed for in the water balance, but is not significant.

Bursts are not considered to be a major factor in the water losses.

Leakage from reservoirs

All reservoirs and tanks are above ground and inspected monthly by Nelmac. No leakage from the walls has been noted.

All major reservoirs have underdrains leading to inspection manholes. Nelmac checks these monthly and any leakage is investigated and repairs made. The only seepage in recent years has been at the Thompson Terrace #2 reservoir where (in 2007) there was a slight seepage, and the internal water seals on a sector of the reservoir were renewed.

Reservoir leakage is not considered a factor in the water losses.

Reservoir overflows

All major reservoirs have level recorders, are connected to the SCADA system, and alarmed.

Minor reservoirs and tanks are inspected monthly by Nelmac.

Reservoir overflows are not considered to be a factor in the water losses.

Apparent Losses

Refer figures B and C

Inaccurate Metering

Misreading of meters

Meters are read manually and the reading is keyed into a handheld data logger on site. The data is then downloaded electronically to the computer system, where the bills are generated. Reports of exceptionally high or low usage are generated, and the meters are re-read in case there are reading or data entry errors. This process would also identify if the reading for the previous period (i.e. start reading for the current period) held in the archive is incorrect.

Misreading of meters, Data Transfer errors, and Data Analysis errors are not considered to be factors in the water losses.

Residential Meters out of calibration

A sample of 89 manifold water meters has been tested for accuracy over three flow volumes; 0.38lpm, 15lpm and 50lpm (Refer A754715). All were installed as part of the 1999 Universal metering programme and have been in operation for approximately 15 years. A significant number of meters under-recorded flows in the 0.38lpm flow range. It is possible that a component of the water losses may result from under recording flows to consumers.
The water meters will be checked again within the next three years to see if a trend can be shown.

Residential meter accuracy is considered to be a factor in the water loss.

Commercial/Industrial Meters out of Calibration

As at June 2008, commercial/industrial water meters have not been tested for calibration. Installation of water meters commenced prior to 1980 and was completed in 1999 at the same time as residential meeting. Therefore some meters are up to 30 years old.

Commercial/industrial meter accuracy is also considered to be a factor in the water losses.

Meters not recording low flows

Large diameter meters do not accurately record low flows. Until recently meters were sized the same as pipe size, i.e. for maximum flow. Large commercial/industrial water meters will therefore be under reading normal and low flows. New installations now have combination (low and high flow) meters installed.

Meters not recording low flows is considered to be a factor in the water losses.

Meters not in System

Occasionally meters are found that have been installed, but have not been entered into Napier Computer Systems water billing system, and are therefore not being read or charged. One recent example was where the connection was approved and completion signed off, but not entered into Napier Computer Systems. A system has been implemented (May 2008) to correlate the 3 steps - connection applications, meter data returns from approved water connection contractors (AWCCs), and water meter records in Napier Computer Systems.

Meters not in the system are not considered to be a significant factor in the water losses.

Un-metered Usage

Unauthorised Un-metered Usage

Illegal hydrant use

The use of water from fire hydrants other than for fire fighting, testing or mains flushing is contrary to the Water Supply Bylaw. However this has not been enforced to date.
Illegal hydrant use is not considered to be a significant factor in the water losses.

Illegal connections

It is difficult to make illegal connections directly to mains, ridermains and service connections (within legal road) due to their depth and high pressures. However on cross lease or Right of Way sections it is possible to turn off the isolating valve at the street boundary and make an illegal connection on private property before the meter. Most residents would not have the technical ability to make such a connection. Water would still have to be used through the meter to avoid suspicion. Illegal use would most likely be used for garden watering or swimming pool filling. In recent years only one such case was reported by a concerned neighbour.

Illegal connections are therefore not considered to be a significant factor in the water losses.

Authorised Un-metered Usage

Strictly speaking, authorised un-metered usage is not an apparent loss, if it is identified and correctly quantified in the water balance. Assumptions have been made on the following uses.

Firefighting

Water suppliers with a reticulated system are required to provide fire fighting water to the NZ Fire Service and to not charge for it. The normal fire demand is 25 L/sec (90 m3/hr) Allowing two full hours use of water per week, the fire demand is less than 10,000 m3/yr. (e.g. compare with a single leak of 1 L/sec running for 1 year at 32,000 m3/yr).

Fire fighting use is therefore not considered to be a significant factor in the water losses.

Other approved use of Fire hydrants

When the fire service receives a request for assistance in supplying water for non- fire purposes they refer their applicant to the Council's Technical Services section for approval. Similarly contractors requiring large volumes of water for subdivision or roading purposes apply for permission to take the water. In both cases the parties are asked to advise the council of the volume used.

Therefore it is only small users of water from hydrants that are not recorded.

Other approved use of fire hydrants is therefore not considered to be a factor in the water losses.

Mains flushing

Dead end mains are regularly flushed by Nelmac to prevent any debris build where the water velocity is low. Mains are also flushed after repair to remove any debris that has settled. Nelmac have used metered standpipes for this and the volume of water flushed each year has been estimated and included in the water balance.

Mains flushing is therefore not considered to be a significant factor in the water losses.

Mains testing

The volume of water used in the testing, chlorination, and flushing of new mains both on subdivisions and council renewals and capex has been estimated and included in the water balance.

Mains testing is therefore not considered to be a significant factor in the water losses.

Draining mains

The volume of water used to drain mains for repair has been estimated and included in the water balance.

Draining mains is therefore not considered to be a significant factor in the water losses.

Draining reservoirs

The volume of water used in draining reservoirs and tanks for repair and to maintain chlorine residual has been estimated and included in the water balance.
Draining reservoirs is therefore not considered to be a significant factor in the water losses.

Central Business District amenities

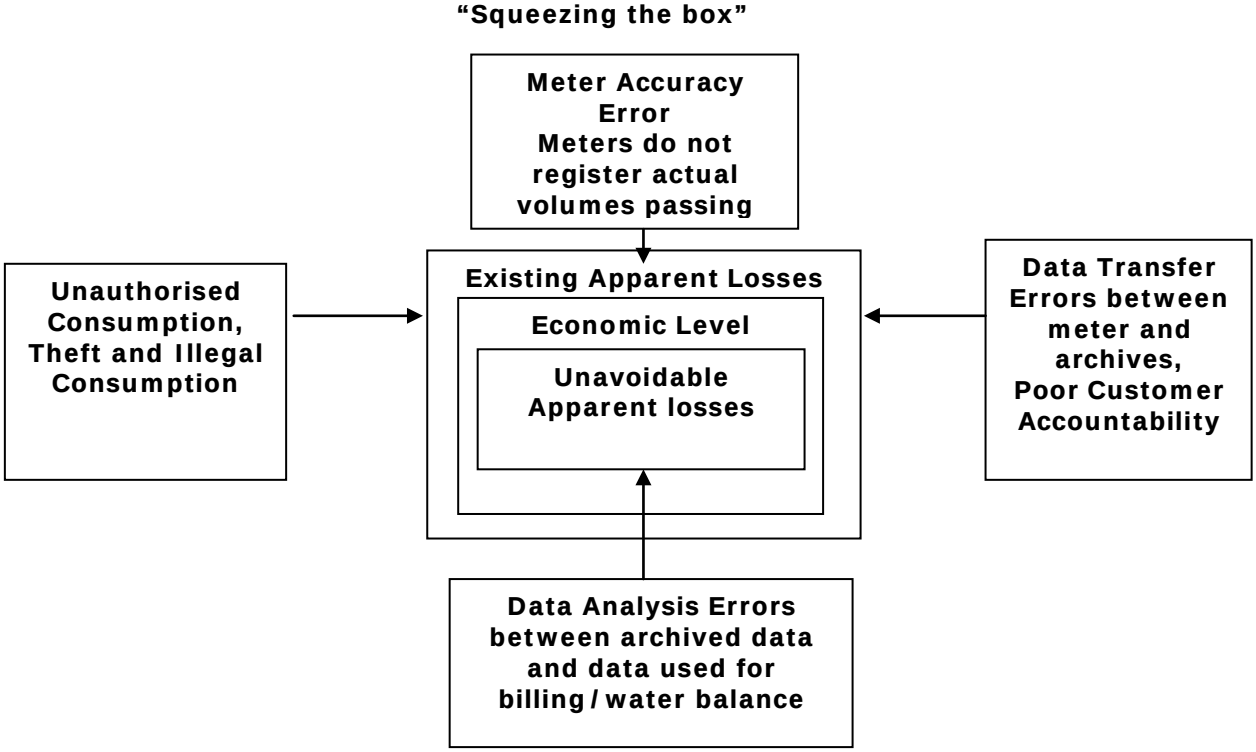
Hanging baskets irrigation, Bird scaring tree sprays, Symonds Gas Lamp (in Trafalgar Street outside the Victorian Rose), and drinking fountains at Church steps and Bridge / Trafalgar corner are metered.

Central Business District amenities are therefore not considered to be a significant factor in the water losses.

Reducing Apparent Losses

Figure D shows the components for managing apparent losses by "squeezing the box". Taking each corrective action will reduce the apparent losses.

Figure D The Four Components of Managing Apparent Losses



Considering the four factors in Apparent Losses

- Meter Accuracy
- Data Transfer
- Unauthorised Consumption
- Data analysis

As discussed above, only Meter Accuracy is considered to be a significant factor in the losses and needing priority attention at this time.

Action Plan

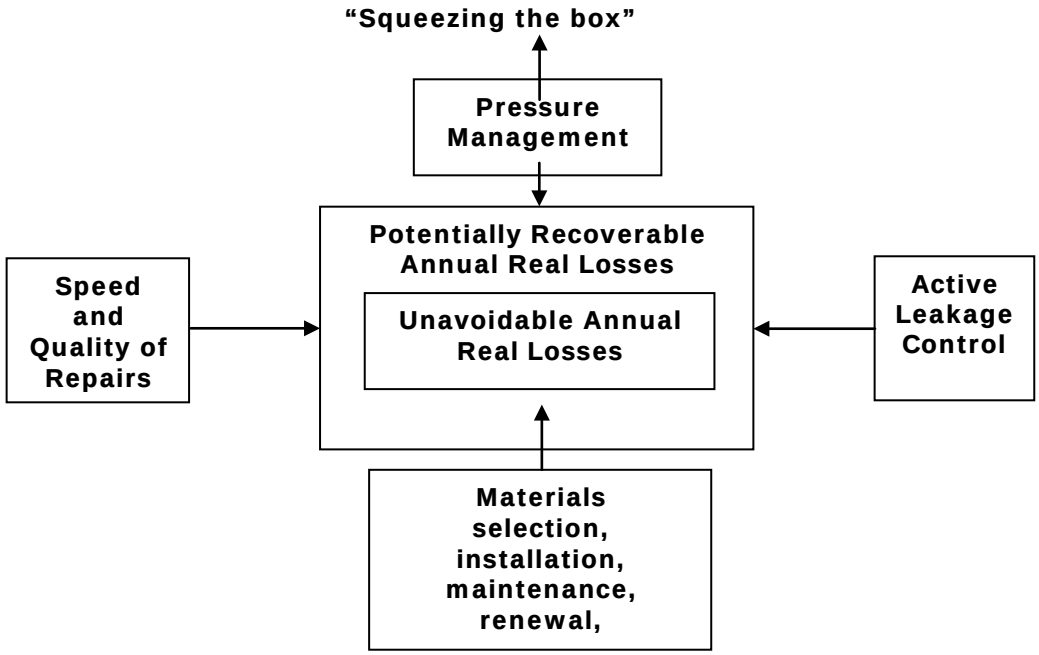
- Complete residential meter accuracy testing programme to allow 95% confidence.
- Schedule replacement of residential meters

- Test all commercial/industrial water meters 100mm dia. and over, and repair or replace as necessary.
- Test all commercial water meters 50 mm dia and over but less than 100mm dia. and replace as necessary.
- If water meters 50 mm dia. and over are to be replaced, consider whether a combination meter (low flow/high flow) should be installed.

Reducing Real Losses

Figure E shows the components for managing real losses by "squeezing the box". Taking each corrective action will reduce the real losses.

Figure E The Four Components of Managing Real Losses



Considering the four factors in Real Losses

- **Speed and Quality of Repairs**. The Nelmac utilities maintenance contract has short response times that are recorded in Hansen and are met. Repairs are made to a high standard. Little "squeeze" is therefore available from Speed and Quality of Repairs.
- **Materials Selection**. The Nelson City Council Engineering Standards specifies the materials to be used in repairs, maintenance, renewals, capital expenditure and assets to be vested. These are of a high and appropriate standard. Little "squeeze" is therefore available from Materials Selection.
- **Active Leakage Control**. Leakage is identified above as a major factor in the losses. Significant "squeeze" is available from Active Leakage Control and it is a matter of priority. The active leakage control action plan is shown in Appendix F.
- **Pressure Management**. Pressure reduction is identified as a major factor in the losses. Significant "squeeze" is available from Pressure reduction and it is a matter of priority. The pressure reduction action plan is shown in Appendix G.

APPENDIX F: ACTIVE LEAKAGE CONTROL PLAN

Proposed Methodology

- Divide the water supply system into discrete reservoir/pressure reducing valve supply zones.
- Designated District metering areas
- Test and repair isolation valves for District Metering Areas
- Install district flow meters and data loggers
- Night time low flow tests including reading customer meters at beginning and end to quantify demand
- Acoustic leak detection survey to identify leak locations
- Repair located leaks
- Repeat night time low flow tests to confirm repair and quantify “background” losses
- Consider more proactive maintenance program.
- Reduce time between leak reports and repairs
- Implement pressure management (refer Appendix G)
- Continue main replacement program (currently 50 and 100mm dia. asbestos cement)

APPENDIX G: PRESSURE REDUCTION PLAN Needs to be upgraded.

Background

1. Many areas of the city receive pressures in excess of the Levels of Service specified in the Water Supply Asset Management Plan.

   High pressures result in

   - More pipe failures (particularly Asbestos Cement pipes)
   - More water losses from undetected leaks
   - Higher customer usage
   - Demerit points in the water supply distribution grading

   Reduction in pressure will therefore have long term benefits to the water asset.

2. Parts of the Stoke area (particularly) have Asbestos Cement pipes that were laid in the 1950's and are starting to fail. Lowering the pressure in these pipes will extend their useful life. However some pipes are under capacity for fire flows when the pressure is reduced so will have to be renewed with a larger diameter pipe.

3. The renewal and new ridermain projects seek to strategically combine Capex and Renewal funding such that pressures can be lowered in the future.

4. A ridermain in Tosswill Road laid in conjunction with road upgrading will allow houses on the downhill side of the road to be put on low pressure in the future. Houses on the uphill side will remain on the existing high pressure main, as will the fire hydrants. This area is not high priority for pressure reduction, but the opportunity is being taken lay the ridermain at this time. Additional works yet to be scheduled will include a low pressure pipe from the bottom of Tamaki Street down the steps to the low pressure main on the opposite side of Tahunanui Dve., and a new main in Tosswill Road from Tahunanui Dve to the Chamberlain Street intersection. A similar riderman will also be laid in Chamberlain Street from Tosswill Road to Maire Street in the future.

5. Recent work in the Enner Glynn/Wakatu area (Beatson Road to Torlesse St) has allowed this area to be transferred to low pressure (107m City Datum). The new pipes have been sized to meet the Fire flow Levels of Service at the reduced pressure. The pressure reducing valve currently at Cawthron Crescent will have to be relocated to the top of Beatson Road near Waimea Road.

6. The Maitland/Ridgeway area is currently on Marsden Valley High Pressure (170 m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to Treatment Plant/Thompson Terrace. Reservoir High Pressure (155m City Datum). A new pressure reducing valve will be required on the Ridgeway near Marsden Road, and the Austen Ward Heights booster pump station will have to be upgraded to sustain pressures to Leach Place, and the top of Austen Ward Heights / Calamaras Street.

7. The additional works noted in 5 and 6 above are proposed for "System Improvements" funding.

8. The lower Port Hills (including Haven Road / Wakefield Quay), Washington Valley, Toi Toi Valley (including Emano / Murphy), Hospital, and Mount Street areas are also on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum), but should be on low pressure (107 m City Datum). No synergies with renewals are possible in this area and additional funding for Capex is proposed in the Water Supply Asset Management Plan 2009/19.

9. The City/Atawhai low pressure zone has been split into three zones – Atawhai, The Wood and the Central City. This has enabled the Wood zone to be put on 83m City Datum while the other two zones remain on 107m City Datum. This split also allows for smaller District Metering Areas.

10. Lowering of night-time pressure in all pressure reducing valve zones will achieve the benefits listed in 1 above. Additional funding for System Improvements is proposed in the Water Supply Asset Management Plan 2009/19 for the fitting of a variable controller to one pressure

reducing valve in each zone, and the resetting of other pressure reducing valves to a lower pressure.

Network Modelling Results

Network Modelling of The Wood Pressure Reduction

Background

The City/Atawhai low pressure zone has been split into three zones – Atawhai, The Wood and the Central City. This has enabled the Wood zone to be put on 83m City Datum while the other two zones remain on 107m City Datum. This split also allows for smaller District Metering Areas.

This was achieved by modelling different scenarios and carrying out the following works:

Completed works as at 2011
Modelling results
The Trafalgar Street pressure reducing valve was reduced from a setting of 107m to 83m.
A new pressure reducing valve was inserted at the corner of Nile and Tory Streets, set to 83m.
Valves were shut at Trafalgar Street bridge (just north of Ajax Avenue), Hardy Street bridge, Bridge Street bridge and in Atawhai Drive just south of Iwa Road to enclose the new lower pressure zone.
It was found that fire flows were no longer achievable in Iwa Road and Walters Bluff. A new pressure reducing valve at the bottom of Walters Bluff (set to 107m) was required to remedy this.
New pressure reducing valves that have been installed.
At the bottom of Walters Bluff set to 107m
In Tory Street at the intersection with Nile Street, set to 83m
Other Misc New Works that have been completed
New valve in Atawhai Drive just south of Iwa Road
Change setting of Trafalgar Street pressure reducing valve to 83m

Network Modelling of Port Hills / Washington / Victory / Toi Toi Pressure Reduction

Background

Currently the Port Hills / Washington Valley / Victory Square / Toi Toi Valley areas are supplied directly at Water Treatment Plant / Thompson Terrace Reservoir pressure, but much of the land is at low level and is therefore receiving excess pressure.

The objective was to model scenarios giving pressures within the Targeted Level of Service in the Water Supply Asset Management Plan (30 m to 90 m head at each property).

The initial attempt to design alterations to the reticulation to achieve lower pressures was hampered by the need to maintain high pressure in the cross city links in the reticulation (Wellington St, Gloucester St, Washington Road, Hampden Street, Alfred Street, Toi Toi Street etc.).

The second attempt put all the areas onto low pressure and then devised means of providing high pressure to those areas needing it. This was successful.

Results

- A 200 pipe is required in Princes Drive (Day's Track to Richardson Street) to provide continuity of supply to the Port Hills / Port area (including Sealord) if the trunkmain from North Road to Vickerman Street is out of action. Note this pipe is not needed for normal operation.
- There are a few houses at the top of the southern end of Montreal Road which are above the 67 m contour and will not receive adequate pressure.

- Can't achieve a fire flow to a couple of houses at the end of Konini Street (numbers 5A and 7). Can get 12.5 litres per second out of the hydrants outside 16 Konini and 87 Mount Street but these are both over 135m away.
- Fireflows were not adequate at the top of Emano Street without upgrading the main in Orsman Crescent. Once this is upgraded to a 150 then we can get 12.5 litres per second at the end of Emano and 12.5 litres per second at the corner of Emano and Orsman which is sufficient.
- Cannot achieve 25 litres per second in Mount Street without the non-return valve which brings water from the low pressure system when there is a fire flow.

New pressure reducing valves

- At the corner Russell Street and Stanley Crescent supplying into the new low pressure zone in Washington Valley and into the new 150 main supplying the Port/Queens Road area.
- Toi Toi below Abraham
- Laval Heights to replace shut valve – set to 140m – could be lower
- Quebec Road to replace shut valve – reduces from Observatory Hill pressure to Maitai High Level – set to 155m
- At the corner of Princes / Richardson supplying into the top of Richardson Street and into Washington Road
- Outside 7 Orsman Crescent

New Links

- 150 to link the new low level system either side of the newly shut valves in Hampden Street at the corner of Kawai Street
- 150 - Corner of St Vincent and Toi Toi to link the 150 on the southern side of Toi Toi to the 200 in Toi Toi
- Need to link the Fountain Place main to the 100 low pressure in Haven Road
- 100 link between the 100 and 150 in Haven Road south of Vickerman Street

New Mains

- 370m of 150 main up Russell Street from Haven to Queens
- 385m of 50 ridermain up Russell Street from Haven Road to Stanley Crescent
- 235m of 100 main from Russell Street to end of Mt Pleasant Avenue
- 1070m of 200 main along Princes Drive from Princes/Toi Toi to Princes/Richardson
- 70m of 150 from new 200 in Princes Dve down to the end of The Cliffs via the reserve.
- Upgrade Orsman Cr from 100 to 150 – length 330m

Other Miscellaneous New Works

- New non-return valve outside 36 Mount Street – required so that upper Mount Street can achieve fire flows
- Small booster Pump (and tank?) Montreal Road / Hutson Street.
- New valve outside 41 Wolfe St
- New valve outside 17 Mt Pleasant Avenue
- New valve outside 16 Albert Road
- New valve in Haven Road just north of Russell Street in the 200
- New valve by 121 Queens Road
- New valve in Haven Road just south of Vickerman Street in the 150 CIPT

Completed works as at 2011
New pressure reducing valve in Laval Heights to replace shut valve – set to 140m – could be lower
New non-return valve outside 36 Mount Street – required so that upper Mount Street can achieve fire flows
New valve outside 41 Wolfe Street.

Network Modelling of Pressure Reduction Wakatu / Enner Glynn / Ridgeway

Background

The Wakatu area (Beatson Road to Torlesse Street) is currently on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to low pressure (107 m City Datum). The new pipes have been sized to meet the Fire Flow Levels of Service at the reduced pressure. The pressure reducing valve currently at Cawthon Crescent will have to be relocated to the top of Beatson Road near Waimea Road.

The Maitland/Ridgeway area is currently on Marsden Valley High Pressure (170 m City Datum). The proposed works in 2008/09 and 2009/10 will allow this area to be transferred to Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). A new pressure reducing valve will be required on the Ridgeway near Marsden Road, and the Austen Ward Heights booster pumpstation will have to be upgraded to sustain pressures to Leach Place, and the top of Austen Ward Heights / Calamaras Street.

Results

A pressure reducing valve was inserted in the Ridgeway just north of Marsden Road. This needs to be set to 'Thompson Terrace Reservoir' pressure, but sufficiently low so that water does not flow north along the new 200 main above. A setting of 142m was sufficient to supply 30m to the top of Arapiki Road and still have the water flowing south along the new main. This setting will have to be established through experimentation and possibly varied seasonally.

A pressure reducing valve was inserted in Beatson Road just below the (eastern) intersection with Scotia Street to achieve fire flows at Beatson / Waimea.

To achieve fire flows in Anglia Street requires upgrading the 100 AC main in Beatson Road to 150 PVC, the 100 AC main in Scotia Street from Beatson to Anglia to 150 PVC and the 100 AC in Anglia to 100 PVC.

To achieve fire flows in Burrough Place requires upgrading the 100 AC in Waimea, Chings, Enner Glynn from Beatson to Burrough to 150 PVC

To obtain fire flows in Cherry Avenue requires a connection into the new 200 main at Baigent / The Ridgeway, upgrading the 100 AC in Baigent from The Ridgeway to Cherry to 150 PVC and upgrading the 100 AC in Cherry to 100 PVC.

Other fire flows which were tested and were adequate are as follows:

- Can get 12.5 litres per second in Newman Drive at Boyes Place (and 12.5 litres per second from above non-return valve)
- Last hydrant on Enner Glynn Road providing Baigent upgraded as above
- Panorama, Arapiki, View Mount, Coster
- To achieve the residential pressure level of service in Leach Place, Sophies Way, and the top of Austen Ward Heights and Calamaras Street, a booster pumpstation is required. (The existing small pump and 2x25 cu m tanks do not provide a permanent solution).
- If the booster pump is sited at the intersection of Torlesse and Jerningham Streets a link between Torlesse Street and the intersection of Waterhouse and Austen Ward Heights, (or a pressure reducing valve at the intersection of Waterhouse and Austen Ward Heights) is required to maintain fire flows to Coster Street and Calamaras Street.

New Pressure Reducing Valves

- In The Ridgeway just north of Marsden Road
- In Beatson Road

New Mains

- 500m of 200 main from Waimea Road/The Ridgeway to The Ridgeway/Torlesse (abandon AC 100). Connection at Baigent Road.
- Upgrade 535m of 100 AC to 150 PVC main in Waimea Road, Chings Road, Enner Glynn Road (from Chings Road to Burrough Place) Note : Continue renewal in 100 PVC to Newman Dve.
- Upgrade 71m of 100 AC to 150 PVC in Baigent Road from The Ridgeway to Cherry Avenue. Note : Continue renewal in 150 PVC to high point of Baigent Road (start of existing 100 PVC
- Renew 220m of 100 AC to 100 PVC in Cherry.
- A new 150 PVC (or PE) link between Torlesse Street and Waterhouse Street, Austen Ward Heights intersection via the walkway is needed to maintain fire flows if the pump station is built on the intersection of Torlesse and Jerningham Streets.

Other Misc New Works

- New valve in Enner Glynn Road just north of Newman Drive
- New valve in Waterhouse just north of Torlesse
- Remove the pressure reducing valve in Cawthron Crescent
- Future new ridermain at the top end of Scotia Street to Ulster to keep the top houses on high pressure and reduce the others to low pressure
- The initial modelling did not include the Austen Ward Heights area above the NRV.
- Subsequently a new PS on the intersection of Torlesse and Jerningham Streets was modelled.

Completed works as at 2011
200 main laid from Waimea Road/Beatson Road to The Ridgeway intersection (abandon AC 100). Connected at Ulster Street
Upgrade 338m of 100 AC to 150 PVC in Beatson Road
Upgrade 188m of 100AC to 150 PVC in Scotia Street from Beatson to Anglia
Renew 262m of 100 AC to 100 PVC in Anglia Street
New valve in Scotia Street just south of Ulster

Network Modelling of Pressure Reduction East side of Waimea Road (Motueka Street to Boundary Road)

Background

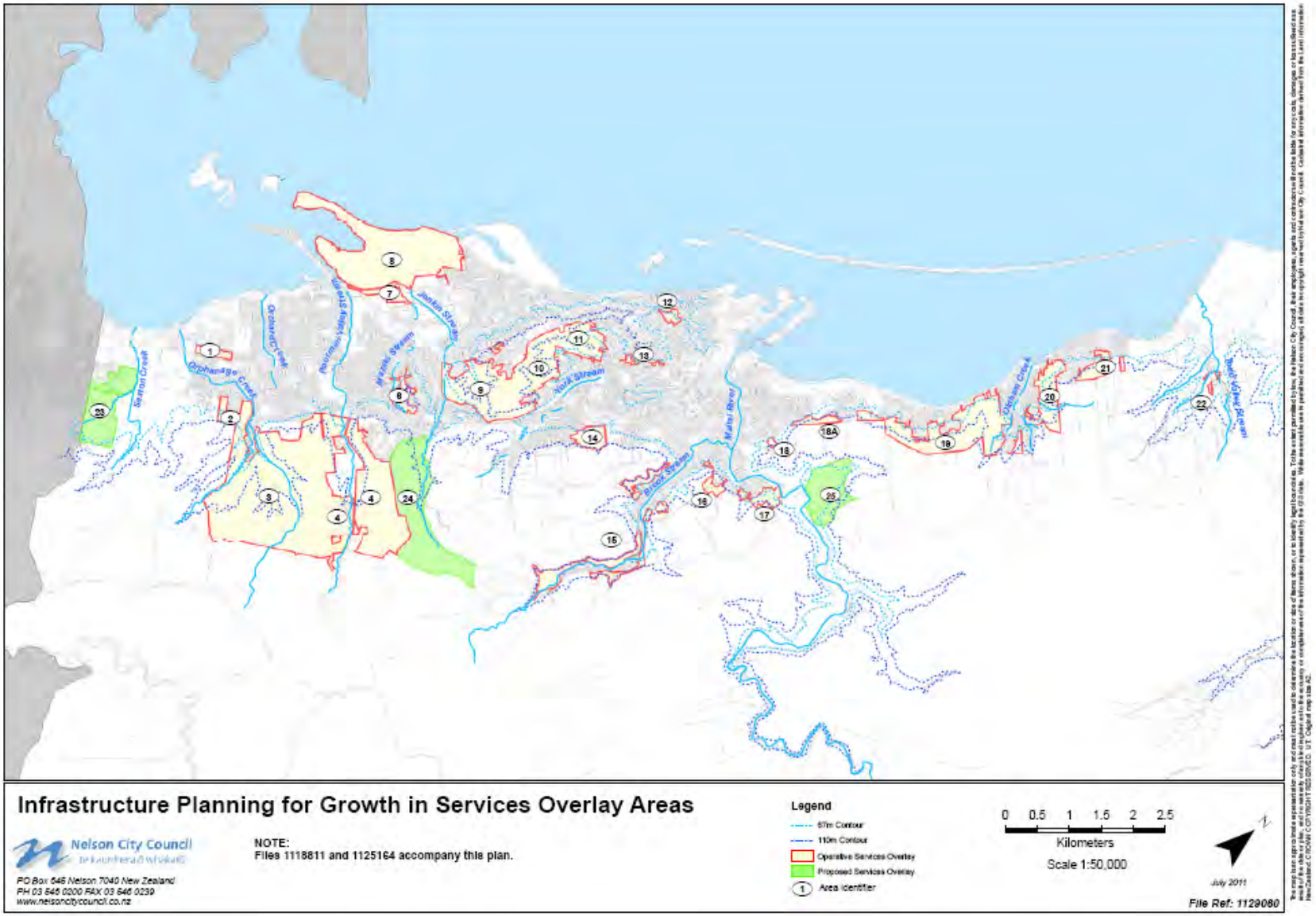
The East side of Waimea Road between Motueka Street and Market Road is currently on Treatment Plant/Thompson Terrace Reservoir High Pressure (155m City Datum). The proposed works will allow this area to be transferred to low pressure (107m City Datum). The pipe capacities have been checked to ensure that the Fire Flow Levels of Service can be maintained at the reduced pressure.

New Links

- 100 link from the 100 AC to the 150 CI in Waimea Road just south of the valve to be shut at Motueka Street
- 100 link from the 100 AC to the 150 CI in Waimea Road, south of Tukuka Street
- 100 link from the 100 AC to the 150 CI in Waimea Road, north of Boundary Road

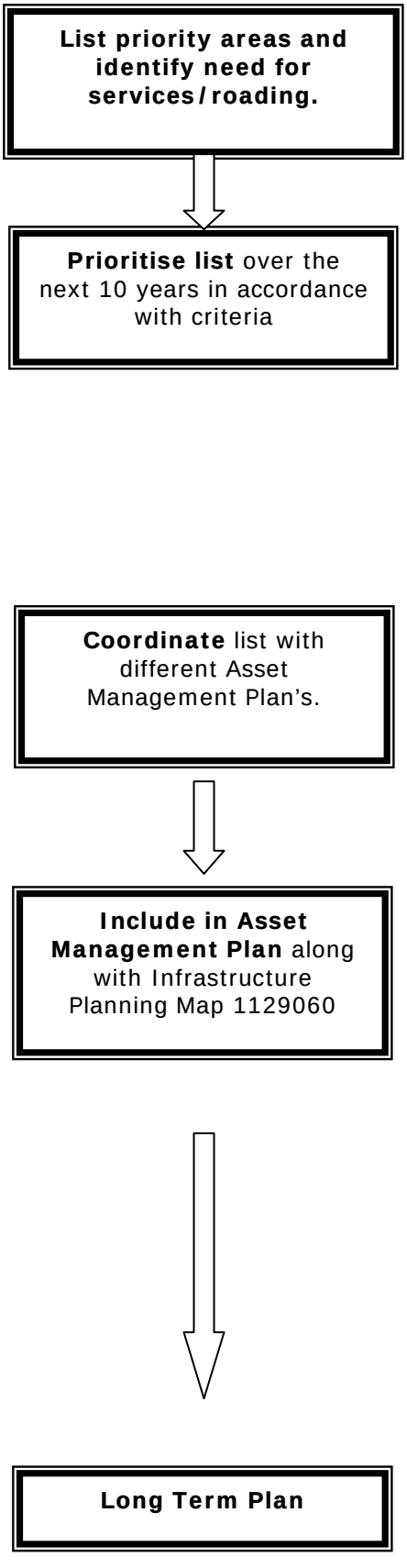
APPENDIX H: INFRASTRUCTURE PLANNING PROCESS FOR GROWTH PROJECTS

Figure F Plan of Infrastructure Planning for Growth in Services Overlay Areas



Infrastructure Planning Process for Growth Projects in Asset Management Plan's which inform the Long Term Plan

This document outlines the strategic planning process with respect to the prioritisation of projects going into Councils core Asset Management Plans (roading, wastewater, water and stormwater) to facilitate growth and therefore support their inclusion in the Long Term Plan.



These are areas zoned for development but located within the Services Overlay (including PC 13, 14, 17 & 18)
Refer Map 1129060 and Document 1139245

Criteria (Weight for objectivity):

- Cost to service versus estimated Household Unit of Demand (HUD) or HUD equivalent yield (i.e. maximise development potential/$, including any extraordinary ongoing maintenance costs of future assets vested in Council)
- Risk and Hazards for utility development
- Appropriateness of onsite mitigation for utilities
- Indication of development timing and other Council projects in the same vicinity that can be brought together at the same time.
- Capital expenditure already identified in previous Annual Plan or Long Term Council Community Plan/Long Term Plan

Coordinate

- Ensure projects identified and prioritised for inclusion in the Asset Management Plan's are coordinated with each other across Asset Management Plan's (i.e. funding servicing to eliminate constraints to areas in the Services Overlay one by one in an integrated manner – not in a piecemeal fashion).

Include in Asset Management Plan's
Include map and standard paragraph in Asset Management Plan's as follows:
Council is concentrating on providing services to areas that are zoned for development (Residential, Rural Zone High Density Small Holdings, Suburban Commercial, Industrial) but are covered by the Services Overlay because one or more servicing constraints have been identified as needing to be addressed prior to the development of that property/area. The projects to facilitate future growth identified in this Asset Management Plan therefore only consist of works required to eliminate servicing constraints on sites zoned for development and these have been prioritised in accordance with Council's strategic planning process. A Map of the areas zoned for growth but constrained by lack of services is attached in Appendix ##.

Inform Development Contributions policy and figures
Alignment with the Sustainability Strategy– i.e. if supports intensification or development adjacent to services/reticulation as a priority.
Assist Council to assess merits or otherwise of proposals coming in as submissions to the Long Term Plan that seek to

Table B: Prioritisation Analysis of areas within the Services Overlay for scheduling of expenditure on addressing servicing constraints through the Asset Management Plan's and Long Term Plan

Area No.	Description	Reasons located in Services Overlay[1]	Criteria Rating [2]			Indication of development timing[3]	Prior approval through Annual Plan or Long Term Plan[4]
			Costs to Service versus anticipated Development HUD Yield[5]	Degree of risk / hazards[6]	Appropriateness of onsite mitigation for utilities[7]		
1	Main Road Stoke/Saxton Road/Railway Reserve	SW1					
2	Ballard Drive/Ashdonleigh	W4 W5 T3					
3	Solitaire /Ngawhatu Valley	SW1 WW1 W1 W4 W5 T3					
4	Marsden Valley	SW1 WW1 W3 W5 T1 T3					
5	Enner Glynn	SW1 WW1 W3 W5 T1 T3					
6	Coster Street	SW3 W4					
7	Lower Quarantine	WW3 W2 T2					
8	Airport Land	D					
9	Tasman Heights	SW1 W3					

[1] Evaluated for each area and will change as utility services are installed
[2] Ratings are applied on a scale to be determined
[3] This reflects owners plans for development and other Council projects in the same vicinity that can be brought together at the same time. This criteria is likely to be subject to change.
[4] Approval for capital expenditure through an earlier Annual Plan or Long Term Plan is expected to have the highest priority for expenditure
[5] This is assessed on a case by case basis and reflects the permitted activity requirements of the NRMP
[6] Based on hazards identified in the NRMP planning maps
[7] Relates to the suitability of the area for onsite utility servicing

Area No.	Description	Reasons located in Services Overlay[1]	Criteria Rating [2]			Indication of development timing[3]	Prior approval through Annual Plan or Long Term Plan[4]
			Costs to Service versus anticipated Development HUD Yield[5]	Degree of risk / hazards[6]	Appropriateness of onsite mitigation for utilities[7]		
		W4 T1 T3					
10	Emano/Murphy	SW1 WW1 W3 T3					
11	Toi Toi Street	W3 T3					
12	Washington Valley	T3					
13	St Vincent Street	Infrastructure constraints addressed, only in Services overlay now for roading connection purposes.					
14	Campbell/Braemar	SW1					
15	Upper Brook	W3					
16	Atmore/Cleveland	SW1					
17	Upper Nile Street	SW1 W2 W4					
18	Upper Halifax Street	SW1					
19	Davies Drive – Dodson Valley	SW1 WW2 WW5 W4 W5 T2 T3					
20	Werneth	SW1 W3 W4 T2 T3					
21	Wastney Terrace	SW1 W3 WW4					
22	Todd Valley	SW1					
23	Plan Change 18 Nelson South	SW1 SW2 SW6 WW1 WW2 WW5					
24	Plan Change 17 Enner Glynn	SW1 WW1 W3					

Area No.	Description	Reasons located in Services Overlay[1]	Criteria Rating [2]			Indication of development timing[3]	Prior approval through Annual Plan or Long Term Plan[4]
			Costs to Service versus anticipated Development HUD Yield[5]	Degree of risk / hazards[6]	Appropriateness of onsite mitigation for utilities[7]		
		W5 T1 T3					
25	Plan Change 14 Ralphine Way						

Table C: Services Overlay Infrastructure Upgrade Codes

Stormwater	
SW1	Adequacy of downstream system – capacity constraint
SW2	Upgrade of Saxton Creek
SW3	Upgrade of Arapiki Stream
SW4	Upgrade of Jenkins Stream
SW5	York Stream Pressure System
SW6	Provision of Services to adjoining land
Wastewater	
WW1	Adequacy of downstream system – capacity constraint
WW2	System not available
WW3	Provision of Pump Station
WW4	Adequacy of Pump Station
WW5	Provision of Services to adjoining land
Water	
W1	Adequacy of downstream system– capacity constraint
W2	System not available
W3	Source of supply dictated by elevation
W4	Above the water contour or landlocked if below
W5	Provision of Services to adjoining land
W6	Supplied by Tasman District Council
Transport	
T1	Adequacy of downstream system– capacity constraint
T2	System not available - landlocked
T3	Provision of Roads to adjoining land
Other	
D	Provision of integrated services will be necessary. Distance from existing services will need to be addressed

APPENDIX I: 30 YEAR INFRASTRUCTURE STRATEGY

The requirement for an infrastructure strategy arose from advice provided by Better Local Government programme advisory groups. The strategy is intended to improve local authorities' delivery of core infrastructure and management of physical assets. It should identify strategic issues facing the council and the future implications and is intended to add transparency for residents and ratepayers about these issues and their consequences.
The strategy is included in the LGA 2002 Amendment Bill (No 3) which is expected to be passed in current form in June 2014.

This Asset Management Plan contains the information that would form the basis of the water utility section of an integrated strategy, in particular the following are addressed in the sub sections of the plan either directly or as areas that will require future work:

a) What level of infrastructure investment, if any, is necessary to provide for growth in the community. See section 3.2 -Demand Forecast and section 6.5- Capital Programme;

b) Managing the timing of investment for growth, to avoid constraints on growth from limited infrastructure capacity while minimising the costs to the community of underutilised infrastructure capacity. See section 3.2 -Demand Forecast and section 6.5- Capital Programme;

c) What level of investment is needed to maintain, renew and replace existing assets.

See section 6.4-Renewal Strategy;

d) Balancing service level expectations with affordability in the context of demographic changes such as depopulation and aging. See section 2- Levels of Service;

e) What level of investment, if any, is needed to improve the level of service provided by those assets. See section 2- Levels of Service;

f) Planning for maintenance, growth and possible increases or decreases in levels of service provided. See section 2- Levels of Service, section 3- Future Demand, section 6.3 - Operations and Maintenance Plan;

g) Managing or improving public health and environmental outcomes, or mitigating adverse effects on them. See section 2 -Levels of Service;

h) Managing the risks to and resilience of, infrastructure assets from natural disasters. See section 4- Emergency and Risk Management;

i) Managing the financial provision for risks to infrastructure assets from natural disasters. See section 4- Emergency and Risk Management ;

j) Indicative estimates of the projected operating expenditure and capital requirements for each year. See section 6.3- Operations and Maintenance Plan, section 6.4- Renewal Strategy, section 6.5 -Capital Programme;

k) Assumptions about service levels and asset lives on which the projections are based.

See section 2- Levels of Service and section 6.2- Asset Valuation and Depreciation;

l) Assumptions involving significant uncertainty- the nature of that uncertainty and its potential impacts. See section 4- Emergency and Risk Management .

Water Supply Operation and Maintenance Projections Figures are in 2015 dollars and will be adjusted for inflation in each Annual Plan.

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**			**2027/37 LTP**			**2030/40 LTP**			**2033/43 LTP**			**2036/46 LTP**			**2039/49 LTP**			**2042/52 LTP**		
O&M Expense	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Administration	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760	2,760
Depreciation	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326	4,326
Electricity	458	458	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456	456
Water Treatment	1,479	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Physical Works – Programmed	204	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Physical Works – Reactive	2,080	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300	2,332	2,300	2,300
Engineering Services	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343	343
Headworks	310	216	179	179	204	179	179	179	179	204	400	179	179	179	204	179	179	179	179	204	400	179	179	179	204	179	179	179	179	204	400
Roding Dam Gravel		50	50	50	250											50	50	50	250								50	50	50	250	
Scada		60	70																												
Fish Passage		20																													
PHRMP		50																													
Total [(a)] ($,000s)	**11,960**	**12,115**	**12,184**	**12,114**	**12,371**	**12,064**	**12,064**	**12,096**	**12,064**	**12,089**	**12,317**	**12,064**	**12,064**	**12,096**	**12,089**	**12,114**	**12,146**	**12,114**	**12,314**	**12,121**	**12,285**	**12,064**	**12,096**	**12,064**	**12,089**	**12,096**	**12,114**	**12,114**	**12,146**	**12,339**	**12,285**

Water Supply Renewals Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**			**2027/37 LTP**			**2030/40 LTP**			**2033/43 LTP**			**2036/46 LTP**			**2039/49 LTP**			**2042/52 LTP**		
Renewals Project Area	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Pipeline	838	794	794	794	850	850	850	900	900	900	950	950	950	1000	1000	1000	1050	1050	1050	1100	1100	1100	1150	1150	1150	1200	1200	1200	1250	1250	1250
Pump Stations - Renewals		0	528	70	3	21	0	13	137	495	498	0	3	28	0	3	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0
Headworks - renewals	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Reservoir Refurbishment Programme					50	50	50																								
Residential Meters	50	100	100	1,000	1,000	1,000													1500	1500											
Commercial Meters	301	300	300	300	300	300	300	300	300	300										300	300	300	300	300	300	300	300	300	300	300	300
Backflow Prevention Renewals												350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350	350
Water Treatment Plant Renewals	0	0	1,000	1,030	1,135	1,000	4	0	0	4,375	0	1,000	1,000	1,000	1,015	1,000	0	0	0	0	0	1,000	1,000	1,000	1,000	1,000	0	0	0	0	0
Total (a) ($,000s)	1,249	1,254	2,782	3,254	3,398	3,281	1,264	1,273	1,397	6,130	1,508	2,360	2,363	2,438	2,425	2,413	1,460	1,460	2,960	3,310	1,810	2,810	2,860	2,860	2,860	2,925	1,910	1,910	1,960	1,960	1,960

Water Supply Capital Expenditure Projections

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Long Term Plan		**2015/25 LTP**			**2018/28 LTP**			**2021/31 LTP**			**2024/34 LTP**			**2027/37 LTP**			**2030/40 LTP**			**2033/43 LTP**			**2036/46 LTP**			**2039/49 LTP**			**2042/52 LTP**		
Capital Projects	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45
Malvern Hills - Atawhai Pump & Ridge Resvr	21	67	150																												
Atawhai #2 Reservoir					100	285	500	1,000	1,250	1,250																					
Atawhai Trunk Main					50	95		3,300																							
Backflow Prevention	375	350	350	350	350	350	350	350	350	350	350																				
Maitai Pipeline (Dam-WTP)																															
Maitai Pipeline (WTP-Westbk Tce)	100	100	100	4,000																											
Maitai Planting	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Maitai Resource Consent Renewal	80	150	60																												
Roding Resource Consent Renewal	80	150	60																												
Roding Pipeline		100							1,000	1,500	1,500	1500																			
Telemetry / control upgrades															100										100						
Pressure Enhancement											100																				
NCC - TDC Link		100	100	1,000	1,000	1,000																									
DMA establishment		50	100	100																											
Water Loss Reduction Programme		100	100	100	100	100	100																								
Hira extension											100	150	1,000	1,000																	
Future Growth Additional Storage																					100	100	500	2500	500	500	2,000				
Seismic Risk Upgrades		100	100	100																											
Water Treatment Plant Membranes	1,200	1,000																													
Natural Hazards Risk Assessment		50	50		100	100	100																100	250	250	250		1,000	1,000	1,000	1,000
Network Capacity Confirmation for Growth Areas		50	100						100	100	100	1,250						100	100	100	1,250						100	100	100	1,250	
Network Upgrades Nelson North															100	100	150	50	1,000	1,000	1,000										
Network Upgrades Nelson Central														100	100	100	1,500														
Network Upgrades Nelson South																						100	100	100	1,500						
Fire Flow Upgrades	100	100	100	100	100	100	100																								
Pipe Improvements/Pressure Reduction	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	
Ridermains	155	155	155	155	155	155	155	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	
System	60	60	60	60	60	60	60	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	

Improvements & Misc Pipes & Fittings																														
Water Treatment Plant Upgrades										150	500	500	500	500																
Dam Upgrades		0	0	0	100	100	100	0	0	0	100	0	100	0	500	500	500	500	150	500	500	500	500	0	0	0	0	0	0	0	
Total (a) ($,000s)	**2,231**	**2,742**	**1,645**	**6,025**	**2,175**	**2,405**	**1,525**	**4,815**	**2,865**	**3,515**	**2,915**	**3,565**	**1,765**	**1,765**	**965**	**865**	**2,315**	**815**	**1,415**	**1,765**	**3,015**	**865**	**1,365**	**3,015**	**2,515**	**915**	**2,265**	**1,265**	**1,265**	**2,415**	**1,010**

APPENDIX J: NELSON WATER TREATMENT PLANT ASSET MANAGEMENT PLAN (A1111654) (A717945)

Fulton Hogan

121 Bolt Road
Tahunanui
Nelson

Alan Tolland
Nelson City Council
PO Box 645
Nelson 7040

29th March 2012

Dear Alan,

I have drawn up a draft renewals schedule for the process equipment at the Nelson Water Treatment plant for your consideration. The values are based on a 5% per annum compounded price based on the values at the commencement of the O&M contract in August 2004.

The membrane cassettes are not included as this is currently being discussed. GEZenon have been asked to provide a schedule and pricing and options for improved cassette models.

Some electrical components have also been omitted at this stage due to the lack of cost detail; however the detail will be furnished once I have feedback from you regarding the final format of this schedule.

Also not included in this schedule is any building renewals

Please review this draft schedule and let me know what changes if any, need to be made

Sincerely

Richard Kennedy

Fulton Hogan
NWTP Dept. Manager

Draft Summary March 2012

NWTP 10 year renewals schedule ($x1000)

Finacial year	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Analysers	-	-	15	40	41	34	46	12	12	-	-
Blowers	-	-	-	9	10	7	10	54	180	56	180
CIP Dosing	-	-	-	19	16	3	4	-	-	-	-
CIP System	-	-	-	7	15	4	2	17	15	25	11
Ferric Dosing	-	-	-	-	-	-	-	10	11	2	2
Lower Level	-	-	2	2	2	2	1	49	3	5	3
Rej & Sup	-	-	9	6	10	2	6	2	7	31	25
CW PH	-	-	58	56	11	-	62	13	11	15	66
RW PH	-	-	32	39	39	31	36	-	-	10	-
Soda Ash	-	-	21	4	3	2	2	8	7	-	-
Cl_2	-	-	10	5	9	20	17	13	16	-	-
Switch Room	-	26	28	21	18	27	9	-	-	25	-
Tanks	-	-	13	13	12	8	11	7	7	-	-
Total	0	26	188	221	186	140	206	185	269	169	287

Note: This does not include:
Replacement of membrane cassettes, chedule and model to be determined - GEZenon will supply details
Some electrical and electronic components - see 'Switchboard' sheet attached.

Cost based on 5% inflation compounding on 2004 values (indicated in the 'Total' column of the attached sheets)

Nelson City Council

Contract EC 2617
Tantragee Water Treatment Plant
& Transfer Pipeline Asset Mgt Plan

July 2004

Fulton Hogan Ltd MWH
Fulton Hogan MWH Joint Venture

Contract EC 2617
Tantragee Water Treatment Plant and Transfer Pipeline
Asset Management Plan

Contents

Status—AM Plan
Job Number—801/007700

Date—July 2004
Our Ref—amplan

Fulton Hogan Ltd MWH
Fulton Hogan MWH Joint Venture

1. Summary

This document presents the Asset Management Plan for the Tantragee Water Treatment Plant and Roding transfer pipeline system.

The purpose of the plan is to ensure optimal life-cycle use and cost of plant and equipment.

The Plan contains:

- Current and projected service standards to be met by the water treatment plant and Roding pump stations and pipelines.
- Asset Register
- Details of asset condition and performance
- Estimates of useful remaining life of the components of the plant and transfer pipeline system based on condition assessment.
- A maintenance management plan based on the concepts of reliability-centred maintenance.
- A prioritised 5-year component renewals programme based on asset condition and performance.

Fulton Hogan Ltd MWH
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2. General

The Tantragee Water Treatment Plant and Roding Transfer Pipeline system are newly constructed assets of the Nelson City Council.

Details of these assets are described in the As-Built drawings, and the Operations & Maintenance Manual.

3. Asset Register

Roding Transfer Pipeline:

- Roding Break tank (downstream of tunnel)
- Roding raw water pump station
- Roding raw water pipeline
- Roding raw water saddle tank
- Roding clear water pump station
- Roding clear water pipeline
- Roding clear water saddle tank

Tantragee Water Treatment Plant:

- Building
- CWS tank
- Exterior pipework
- Landscape and road surfaces within fenced enclosure
- Water treatment system within building
- Lagoons, pipes and pump station
- Maitai clear water return pipe

For details of each component reference should be made to the Operations and Maintenance (O&M) manual.

4. Asset Condition and Performance Standard

All assets are new at end of Construction 2nd August 2004.

Performances standards are:

CONDITION	Roding to Tantragee Pump Station/Pipeline Ml/d	Minimum Plant Capacity Ml/d	Tantragee to Roding Pump Station/Pipeline
Initial (to 2008)			
1) Normal Maximum	16 (net through plant)	42	16
2) Emergency	22 (gross)	N/A	N/A
Future (to 2030)			
1) Normal Maximum	16 (net through plant)	52	16
2) Emergency	22 (gross)	N/A	N/A

The initial standards are met by the current assets.
The Future standards require the purchase and installation of equipment for the 5th membrane "train".
Other assets have been sized to provide the required future performance.

4.1 Service Standards

4.1.1 Buildings and structures

Buildings and structures will generally provide service for 50 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.2 Pipelines and Mechanical Plant

Pipelines and pumps will generally provide service for 20 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.3 Electrical Equipment

Electrical equipment will generally provide service for 15 years. This will be achieved following on-going inspection and periodic maintenance.

4.1.4 Controls

Controls will generally provide service for 10 years. This will be achieved by observation during use and prompt attendance to any issues that arise.

5. Remaining Useful Life

The assets are made up of a large number of components.
For details of each component reference should be made to the Operations and Maintenance (O&M) manual.

An Excel spreadsheet of all items of equipment is held electronically at the Water Treatment Plant and in hard copy within the O&M manual.

During the operations phase of the Water Treatment Plant by the Joint Venture, the operator will enter an estimate of the remaining life of each component onto the equipment list spreadsheet.

6. Maintenance Management Plan

The maintenance of the assets will be focussed on ensuring that performance standards are reliably met. Components critical to achieving the required performance are to be maintained as a priority.

During the Operations phase of the WTP by the Joint Venture, the operator will update and manage a maintenance plan.

The maintenance plan will form part of the O&M manual, and be drawn from vendor data on each item.

7. 5-year Renewals Programme

During the Operations phase of the WTP by the Joint Venture, the operator will identify a prioritised 5-year component renewals programme.

This will be entered as a column on the Equipment List.

The operator will use the above mentioned estimate of the remaining life of each component to predict required renewals.