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Making sense of the numbers

Economic value of New Plymouth District infrastructure assets

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Making sense of the numbers

This research and analysis determines the economic value to the New Plymouth economy of the spending on the New Plymouth District Council (NPDC) owned infrastructure assets and services. These include water supply, wastewater collection and disposal, stormwater collection and disposal, solid waste collection and disposal, and road transport.

The high-level findings of the impact of direct infrastructure spending on the value chain spending in the economy are as follows:

For every $1.00 spent by NPDC on infrastructure, there is $1.65 spent in the Taranaki economy.

Separating the capital expenditure (Capex) from the operational expenditure (Opex), the multiplier for the Capex in each of the infrastructure services is $1.76 to $1.79 per $1.00 dollar of NPDC spending. In contrast, for the Opex, the multipliers range from $1.53 to $1.60 per $1.00 of NPDC spending. The multiplier for Capex is expected to be higher than that for Opex. This is because creation and provision of capital goods requires contribution from a broad range of industries and occupations in engineering, construction, material supply etc., whereas the operation of the infrastructure is a more direct process.

The Capex and Opex spending on the three infrastructure types is estimated to directly generate employment of 326 Full Time Equivalents (FTEs) per year. Taking account of the value chain impacts this spending generates an estimated total of 619 FTEs per year.

Findings on potable water, wastewater, and stormwater (Three Waters) include:

For every $1.00 spent by NPDC on Three Waters infrastructure, there is $1.65 spent in the Taranaki economy.

- The replacement cost of the assets total $925 million, which implies for a property with one connection each for potable water, wastewater and stormwater, the replacement cost would average $35,000.
- There is over 1,600 kilometres (kms) of pipeline mains, and their average age is 38 years, 6 years older than for pipelines in 20 comparable Local Authorities.
- The operational spending by NPDC per property per year is $390 per year which is only 59 percent of the average spend in the 20 comparable Local Authorities.
- The money spent on capital renewals per year is one percent of the replacement cost of the $925 million capital which implies an unlikely service life of 100 years for the assets.

There is some indication here that additional Opex and Capex spending on Three Waters may become necessary to maintain effective contribution to the community, the processing businesses, and the whole communities' properties.

Findings on solid waste collection and disposal include:

For every $1.00 spent by NPDC on Solid Waste collection and disposal, there is $1.61 spent in the Taranaki economy.

- The average annual cost of providing the solid waste collection and disposal service is about $10.4 million per year, of which the majority, $9.5 million is Opex.

- The solid waste service is being developed to increase the extent of opportunities for reuse and recycling as well as extending facilities for material recovery by the community, and the commercial and industrial businesses.

Findings on transportation include:

For every $1.00 spent by NPDC on the District roads, there is $1.67 spent in the Taranaki economy.

- The NPDC owns 1,300kms of the total 1,500kms of roads in the District, the rest being Crown and private roads.
- The replacement cost of the road assets total $470 million, and the Capex spending averages $13.3 million per year. This is 2.8 percent of the replacement value.
- Of the 1,300kms of NPDC roads, the smaller access roads and low volume roads total 863kms in length or 66 percent of the length of NPDC roads. They carry only 24 equivalent standard axles (ESAs) and six ESAs per day, compared with 140 to 160 ESAs for arterials roads and secondary collector roads. However, the long length of the access and low volume roads means that they carry nearly one-quarter of the total freight load volume on the NPDC roads.
- The rural roads are estimated to carry an annual freight load of about 5 million ESA kilometres per year which is over half of the nine million ESA kilometres carried on all NPDC roads.
- The industries which generate the most freight in New Plymouth District are the primary industries including dairy, sheep, beef and poultry, and forestry. These primary industries are estimated to generate about six million ESA kilometres per year, of the nine million total.
- The information and estimates available for road usage and the freight tasks allow us to estimate the wider economic benefits enabled by the roads. The total value chain benefits by the primary industry are $740 million Gross Domestic Product (GDP) which is 19 percent of the District's total.
- The three main transport-dependent sectors are primary, road freight and logistics industries, and construction and engineering industries. The value chains including these industries generate an estimated annual GDP in New Plymouth District of $2.6 billion which is about 68 percent of New Plymouth District's annual GDP.

The conclusion is that the wider economic benefits enabled by the NPDC's roads provide a strong justification for spending on maintenance and Capex as needed to provide the main industries with efficient and effective roads across the District.

This conclusion could undoubtedly be applied also to the other infrastructure services if the similar detailed information were available on the wider economic impacts enabled by:

- Secure supply of potable water
- Effective and environmentally efficient wastewater collection and disposal
- Efficient and effective collection of stormwater to protect property as sea levels rise
- Efficient and environmentally effective collection and disposal of solid waste.

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1 Objective approach and scope

1.1 Objective

The objective of this research and analysis is to determine, from a credible research process the economic value to the New Plymouth economy of the spending on the New Plymouth District Council (NPDC) owned infrastructure assets and services including water supply, wastewater collection and disposal, stormwater collection and disposal, solid waste collection and disposal, and road transport.

1.2 Approach

The two pieces of work requested are to firstly estimate the economic impact of the operational programme and the capital investment programme over the next 10 years, and secondly to explore broader approaches and to outline the wider benefits of the services provided.

The first section of work estimates the economic impact of the NPDC operational programme and capital investment programme over the next 10 years as the 'value chain' or 'multiplier' effect in the District economy. This is measured as the annual average direct and indirect contribution to spending in the District, and to District employment and/or the District's GDP (Gross Domestic Product).[1]

The second section will explore measurement of the wider benefits and costs of services provided. For any services where it is possible, estimates are provided of the scale of these benefits and costs.

1.3 Scope

The core scope of the infrastructure services provided has been outlined by the NPDC executives as follows.

Potable water supply:

- Water treatment plants, 4
- Water mains, 840 kilometres (kms)
- Residential water connections, 26,571
- Non-residential water connections, 2,312.

Wastewater collection and disposal:

- Sewage pump stations, 32
- Sewer mains, 480kms
- Residential sewer connections, 24,690
- Non-residential sewer connections, 1,703.

Stormwater collection and removal:

- Stormwater mains, 290kms
- Residential stormwater connections, 28,111
- Non-residential stormwater connections, 2,795.

The potable water, wastewater, and stormwater shall be called collectively the Three Waters, as has been used in this type of analysis by Local Government New Zealand (LGNZ) and others.

[1] The NPDC executives have suggested that a Return on Investment (RoI) could be estimated, however this is a financial parameter which is generally not relevant to provision of public infrastructure services.

Solid waste collection and disposal:

- Refuse transfer station
- Community reuse and recycling centre at the transfer station
- Material recovery facility (MRF).

Solid waste shall be transferred to the Bonny Glen landfill in Marton, Manawatu later in 2019.

NPDC intend constructing an MRF for commercial and industrial waste in 2020-21, and another transfer station.

District roads:

- All of the roads in the District are recorded by NPDC to be 1,500kms in length.

Given the fact that there are three ownership categories, Crown, NPDC and private, and that these road types interact, it is useful to outline where the NPDC owned roads fit in that system.

Business and Economic Research Limited (BERL) has completed an approximate sort analysis of the NPDC database of the separate sections of the roads numbering over 2,300 sections. Our sort indicates that there are about 1,300 total kilometres (kms) of District roads, 160kms of state highways (SH) and 36kms of private roads in the New Plymouth District, giving the total of about 1,500kms of roads in the District.

These roads can be classified in the One Network Road Classification (ONRC) of the New Zealand Transport Agency's (NZTA) Road Efficiency Group. These ONRC classes listed from smaller to larger are:

- Access
- Secondary collectors
- Primary collectors
- Regional
- Arterial
- National.

There is also a generally recognised road classification called low volume roads, with usage below access roads. A very few minor roads were not classified and we included those 'other' roads under 'access'.

The sorted profile of NPDC's rural and urban roads are approximately as follows.

Table 1.1 New Plymouth District road lengths by ONRC class, rural and urban

Road class ONRC	Rural		Urban		Total	
	Length	Share	Length	Share	Length	Share
NPDC Roads: Length Rural and Urban						
	kms	*%*	*kms*	*%*	*kms*	*%*
Arterials	0	0%	16	5%	16	1%
Primary Collectors	42	4%	36	11%	78	6%
Secondary Collectors	255	26%	91	27%	346	27%
Access Roads & Other	428	44%	118	35%	546	42%
Low Volume Roads	242	25%	75	22%	317	24%
TOTAL All Roads	**967**	**100%**	**336**	**100%**	**1,303**	**100%**

The high level indication from this breakdown of the types of NPDC roads is the importance of the lower-density population areas. This is shown by the fact that about two thirds of the length of

NPDC's roads are access and low volume roads. In the rural areas about 70 percent of the length of roads are access and low volume roads.

2 NPDC infrastructure expenditure impacts

This section will take the direct cost components in the operational programmes and capital investment programmes over the next 10 years and estimate the total impact of these on the District economy. The operations of the NPDC in constructing the infrastructure's physical capital buildings, distribution networks and equipment are analysed to show the direct economic activity and the value chain activity in the District generated by NPDC's capital creation and operation of the infrastructure. This will take account of the value chain or multiplier effect on economic activity in the District.

2.1 Summary of the impacts of NPDC infrastructure spending

The NPDC staff have provided itemised tables of the intended expenditure for each of the 10 years 2018-19 to 2027-28 for each of the three main types of infrastructure they provide. These types of infrastructure are the Three Waters (water supply, wastewater and stormwater), solid waste collection and disposal, and transportation infrastructure, mainly roads.

Some of the capital expenditure is 'lumpy', but in general the NPDC executives aim to implement a pipeline of projects so that the engineering and construction industries locally are faced with a relatively steady level of activity. To reflect the level of spending we have estimated the average annual expenditure per year from 2018/19 to 2027/28.

These estimates indicate that the average expenditure per year will be approximately $76.5 million. These figures are in present day prices rather than allowing for inflation over the period. Of this total of $76.5 million, an amount of $40.5 million per year will be spent on the Three Waters, $10.4 million on solid waste, and $25.7 million on transportation.

The $76.5 million is spent paying wages and salaries, buying plant and equipment, construction and other goods and services in the Taranaki economy. This spending stimulates more spending and activity up and down the value chain, and this effect is called the multiplier effect.

2.1.1 Spending and value chain multiplier impacts

The pattern of spending by NPDC on the three types of infrastructure has been shown to average $76.5 million per year. The value chain impact of this spending, spread across a number of items and industries, is estimated to be total spending in the Taranaki economy of over $126 million per year.

For every $1.00 spent by NPDC on infrastructure, there is $1.65 spent in the Taranaki economy.

There is a small variation in the multiplier estimated for each of the three types of infrastructure, depending upon the composition of their spending. However, all three have average multipliers at a similar level, namely between $1.61 and $1.67 for each dollar spent.

Table 2.1: Value chain impacts of annual spending on three infrastructure types

NPDC annual spending on infrastructure: Value chain impact estimates	Annual Average Expenditure	Value Chain Expenditure	Value Chain Dollars per NPDC $1.00 spent
	($ '000)	*($ '000)*	*($s)*
Three Waters Expenditure Annual Average Impact	$40,502	$66,673	$1.65
Solid Waste Expenditure Annual Average Impact	$10,372	$16,700	$1.61
Transportation Expenditure Annual Average Impact	$25,663	$42,785	$1.67
Total NPDC Infrastructures Annual Average Impacts	**$76,537**	**$126,157**	**$1.65**

2.2 NPDC Capex and Opex spending impacts

The expenditures classified as Capex and Opex expenditure in the NPDC accounts are summarised here to show the multiplier impacts in the Taranaki economy. At this stage we note that items classified as Capex include expenditure to renew existing capital infrastructure assets as well as 'new' capital to extend the level and extent of the services provided. Typical and large examples of renewal items are the spending on roads like maintenance metalling, reseals, renewal and rehabilitation of sealed roadways, and footpaths. In most of the infrastructure types there are regular, annual items of expenditure on renewals of plant and equipment.

In an economic sense much of this this 'capital' expenditure is really the replacement of physical capital exhausted or depreciated in the 'production' of the current year. Again in an economic sense this expenditure is maintaining the current level of capacity of the capital, However within the 'Capex' there is also spending which is an addition to the level, the amount or the capacity of the physical capital available.

2.2.1 Opex and Capex spending for three types of infrastructure

The total spending on each of the three types of infrastructure, when broken into the Capex and Opex components shows a very similar pattern for both the Three Waters, and the transportation infrastructure. In these two the annual average expenditure on Capex has been relatively similar to the spending on Opex. In fact shares of Capex or Opex all fall between 45 percent and 55 percent of the total spending on that infrastructure.

The solid waste spending is weighted heavily on the Opex spending, as there is much less physical capital involved.

Table 2.2: Value chain impacts of Capex and Opex on infrastructure types

Value chain impacts from Capex and Opex NPDC annual spending on infrastructure	Annual Average Expenditure	Value Chain Expenditure	Value Chain Dollars per NPDC $1.00 spent
	($ '000)	*($ '000)*	*($s)*
Three Waters Capex and Opex Annual Average Impact			
Three Waters Capex	$18,346	$32,754	$1.79
Three Waters Opex	$22,156	$33,919	$1.53
Three Waters Total	**$40,502**	**$66,673**	**$1.65**
Solid Waste Capex and Opex Annual Average Impact			
Solid Waste Capex	$847	$1,491	$1.76
Solid Waste Opex	$9,525	$15,209	$1.60
Solid Waste Total	**$10,372**	**$16,700**	**$1.61**
Transportation Capex and Opex Annual Average Impact			
Transportation Capex	$13,128	$23,500	$1.79
Transportation Opex	$12,535	$19,285	$1.54
Transportation Total	**$25,663**	**$42,785**	**$1.67**
NPDC Three Waters, Solid Waste and Transportation Capex and Opex Annual Average Impacts			
NPDC Infrastructure Capex	$32,322	$57,745	$1.79
NPDC Infrastructure Opex	$44,215	$68,413	$1.55
NPDC Infrastructure Total	**$76,537**	**$126,157**	**$1.65**

The solid waste collection and disposal is very different with only small Capex expenditure being anticipated for coming years. This is presumably because the main disposal is being out-sourced to a facility in another District.

The value chain impacts are relatively consistent with each $1.00 spent on Capex in each of the infrastructure types generating $1.76 to $1.79 across the Taranaki economy. In comparison the spending on Opex in each of the infrastructure types generate from $1.53 to $1.60 across the infrastructure types. The higher generation of activity by the Capex is to be expected as investment in capital requires input from a broader set of industries, including engineering, professional and mechanical or structural as well as construction trades and supply of other goods and services.

2.3 Employment average annual impacts 2018/19 to 2027/28

The spending on infrastructure generates employment in a range of occupations and industries in Taranaki. Using statistical profiles of the types of work necessary to provide the components of the Capex and Opex spending, we have estimated the total direct employment generated. Our estimate is that the spending on the three types of infrastructure directly employs about 326 fulltime equivalent employed people. (FTEs)

Table 2.3: Summary annual employment benefits from NPDC Capex and Opex

NPDC annual spending on infrastructure: Value chain impact estimates	Annual Average Expenditure	Direct Employment	Value Chain Employment
	($ '000)	*(FTEs)*	*(FTEs)*
Three Waters Annual Average Impact	$40,502	164	321
Solid Waste Annual Average Impact	$10,253	40	71
Transportation Annual Average Impact	$25,663	122	227
NPDC Infrastructure Annual Average Impacts	**$66,165**	**326**	**619**

Tracing the backward and forward linkages along the value chain from this spending pattern gives an estimate that 619 FTEs in total are generated by the spending of $66 million each year.

2.4 The roles of infrastructure

A succinct statement of the role(s) of infrastructure in general but as applied to the Three Waters is:

'The infrastructure for urban water (the Three Waters) is a key social and economic enabler: a precursor for any significant residential, commercial or industrial development and a significant input for any agricultural, processing or manufacturing enterprise.' This was the *Overview message* in the document *Evidence base 2015: Urban Water* from the National Infrastructure Unit (NIU) of The Treasury. (Our emphasis added.)

The same can be said for transport access, and increasingly important, for solid waste collection and disposal. This section will outline briefly the generic types of social, economic and potential environmental benefits from infrastructure.

2.4.1 Existence benefits and the benefit of access to a service

The generic benefit the existence of an infrastructure asset can be to provide access to a place as provided by roads, transport modes and other infrastructure which gives the ability to transport. The derived existence benefit is from access to a service provided by an existing infrastructure asset e.g. potable water, wastewater, stormwater. The logic with road access is obvious - in the modern context, if there were no roads, production and sale of most, if not all goods would be impossible. The counter-factual of no roads is not very realistic.

Considering the Three Waters, the water supply, wastewater and stormwater services are perhaps capable of analysis of a counter-factual, presumably implying a lower density of residential development possible with fewer or no services. Certainly for industrial processing and some manufacturing, the ready availability of quantities of (usually potable) water and capacity to dispose of volumes of wastewater is crucial to initial location of some industries. The availability of large volumes of water has enabled major expansion of irrigated primary production in regions with unreliable rainfall. This has created some benefits and also some costs.

2.4.2 Reliability benefits, and resilience to disruption

The continuing, effective benefit from infrastructure assets depends upon the ability of those assets to provide their services reliably, and to be resilient to disruption from natural events. The availability of these flows of benefits depends upon the reliability of the transport assets like roads, rail or air transport, water treatment and supply mains, sewage collection, treatment and disposal, and stormwater collection and disposal including in the form of flood protection and drainage.

This certainty of availability of the services is crucial to allow direct and indirect capital investment in the assets, residences and industries which use the roads, in fixed assets for residential, industrial and commercial production. This aspect is particularly important where the service is a direct production input as in water for irrigation, and for industrial processing. In lower volume uses, reliability may be achieved with storage either of water when services are temporarily unreliable.

2.4.3 Productivity benefits

Productivity benefits in the economic sense can be thought of as the ability to 'produce more for less'. This can apply to assets which apply to transport e.g. stronger roads highways permitting larger trucks, residential infrastructure allowing higher urban density, or water-assisted primary production and processing. The improved provision and more efficient application or utilisation of services can significantly increase the value of business and economic activity in the District. With roads there may well be an example locally where a road upgrade has allowed the operation of larger, heavier truck rigs which could provide a 'static' comparison.

At the time in the late 1980s when a range of activities were being de-regulated, analyses were done which showed that infrastructure capacity was essential for businesses in de-regulated industries to expand and prosper. The seminal paper on this phenomenon was that by Aschauer. An obvious example was in civil aviation where a proliferation of airlines in the US, and even to a lesser extent in New Zealand, required increased capacity in the FAA in US, and CAA in New Zealand. The additional airlines in New Zealand at that time included Newmans Air / Ansett New Zealand, Origin Pacific, and Air Albatross. Now there is Air Chathams and Sounds Air operating multiple routes, among others.

From time to time operation of competing airlines on domestic routes in New Zealand has increased productivity and access to higher levels of service.

2.4.4 Reporting top-down benefits

There is not a large amount of information and empirical data measuring the extent and value of these benefits, however where possible in the following sections we shall refer to them. In a District like New Plymouth where a large part of the District economy is based on the primary sector with production units geographically spread around the District, the road network is a critical part of the infrastructure. In this case we are able to provide estimates of the broad impacts which roads have on the NPDC economy.

3 Provision of Three Waters services

This description of the benefits and costs of the services provided by the NPDC will initially describe the status of New Zealand estimation of the benefits of the Three Waters. We then describe the scope of NPDC provision of the Three Waters and the capital value and the age of key assets compared with those in other New Zealand medium-sized Territorial Local Authorities (TLAs). We describe the rate of NPDC annual Capex on these assets. We then compare NPDC performance in some parameters with that of other New Zealand medium-sized TLAs.

3.1 The social and economic importance of Three Waters

'The infrastructure for urban water (the 3 waters) is a key social and economic enabler: a precursor for any significant residential, commercial or industrial development and a significant input for any agricultural, processing or manufacturing enterprise,' was the *Overview message* in the document *Evidence base 2015: Urban Water* from the National Infrastructure Unit (NIU) of The Treasury. (Our emphasis added.)

3.1.1 Awareness of an issue for Three Waters

There has been concern since 2011-2013 in New Zealand and some action from players in local government and central government to obtain better information on the status of assets and quality performance in provision of services to the Three Waters. Water New Zealand began its National Performance Review (NPR) in 2007 and recruited more organisations into its survey, reaching 16 in 2011, 29 in 2012 and 48 to 50 in recent years. Not all have provided fully comprehensive information, but most datasets contain information from over 40 participants.

As well LGNZ established the '3 Waters project' in 2013 to respond to an information gap in The Treasury's 2011 National Infrastructure Plan. More survey work and issues analysis was completed in 2013 and 2014, and the concentration was on the quality of the service, resilience, capital costs of maintaining the network etc.

3.1.2 Empirical evidence of Three Waters' benefits is lacking

Despite this acceptance of the importance of the Three Waters as a social and economic enabler of residential, commercial and industrial development, and the effective delivery of their services, we are not aware of any fundamental or comprehensive analysis of the economic (and/or social) benefits of the Three Waters. Nor is there yet comprehensive inclusion of quantified social, economic and environmental benefits and costs in estimates of the fundamental resource rentals which should accrue to uses and users of water.

We understand from LGNZ staff who worked on the 'LGNZ 3 Waters project' for some years that although they were able to obtain some information from most councils, they were unable to complete estimates of the benefits attributable to the Three Waters.

Nevertheless it is clear that there is a need to maintain the quality and quantity of the water resource and to maintain in a sound condition the assets delivering the Three Water services.

3.2 Scope of NPDC Three Waters provision

We have outlined the scope of the assets providing the Three Waters services in section 1.3 above. These assets are listed in the table below, which shows that the Three Waters have 36 pump stations and treatment plants, the water and wastewater is distributed and collected in over 1,600

kilometres of pipeline mains. These service approximately 26,000 residential properties and 2,300 non-residential properties.

Table 3.1: Three Waters scope: main assets and consumers

Three Waters Capital	Pump stations / Treatment plants	Length of Pipe mains	Total Consumer Connections		
			Residential	Non-Residential	Total
	(No)	*(Km)*	*(No)*	*(No)*	*(No)*
Potable water	4	840	26,571	2,312	28,883
Wastewater	32	480	24,690	1,703	26,393
Storm water	-	290	28,111	2,795	30,906
Total / Average 3 Waters	**36**	**1,610**	**26,500**	**2,300**	**28,700**

3.3 NPDC Three Waters capital and operations

The total capital replacement cost is shown as the Gross Current Replacement Cost (GCRC) of the assets and the total is estimated at $925 million for the Three Waters assets.

3.3.1 Capital assets per consumer

The estimates on the table indicate that for each connection of potable water the GCRC is about $11,000, for wastewater is about $15,600 and for stormwater is about $9,000.

Table 3.2: Three Waters asset replacement cost and connections

Three Waters Capital	Total Consumer Connections			Replacement Cost Value GCRC	
	Residential	Non-Residential	Total	Total	Per Connection
	(No)	*(No)*	*(No)*	*($ Mn)*	*($)*
Potable water	26,571	2,312	28,883	$285	$10,700
Wastewater	24,690	1,703	26,393	$386	$15,600
Storm water	28,111	2,795	30,906	$253	$9,000
Total / Average 3 Waters	**26,500**	**2,300**	**28,700**	**$925**	**$34,900**

This implies that for a property with one connection each for potable water, wastewater and stormwater, the NPDC asset replacement cost would be an average of about $35,000.

3.3.2 Age of NPDC Three Waters assets

The data in the Water New Zealand National Performance review indicates that the NPDC pipelines are generally somewhat older than the average for other similar-sized TLAs in New Zealand. The pipelines relatively oldest are the wastewater ones which average 43 years old in NPDC, and 32 years old in comparable TLAs.

Table 3.3: NPDC pipelines' age in perspective

Three Waters Capital	Pump stations / Treatment plants	Pipeline mains		
			NPDC	NZ Medium size TLAs
	(No)	*(Km)*	*(Age, Years)*	*(Age, Years)*
Potable water	4	840	36	34
Wastewater	32	480	43	32
Storm water	-	290	35	31
Total / Average 3 Waters	**36**	**1,610**	**38**	**32**

3.3.3 Rate of capital replacement of Three Waters' assets

The total connections of each of the Three Waters in NPDC number about 28,000, and the GCRC of capital providing these three services is estimated at about $925 million. The average intended expenditure on Capex per year for the next 10 Years is estimated at about $18.3 million per year.

This rate of Capex would perhaps seem reasonable if the assets had been maintained well in the past. The Capex spending on capital renewals average per year is about 1 percent of the GCRC which implies that the physical assets are expected to have an average life of 100 years.

Table 3.4: Capital values and Capex renewal spending on the Three Waters

Three Waters	Total Connections	Replacement Cost GCRC	Capital Renewals per year	Share of Replacement Cost
	(No)	*($ Mn)*	*($ Mn)*	(%)
Potable water	28,883	$285.4	$4.5	1.6%
Wastewater	26,393	$385.7	$4.1	1.1%
Storm water	30,906	$253.4	$0.2	0.1%
Total 3 Waters	**28,800**	**$924.5**	**$8.9**	**1.0%**

However, there are two factors which indicate that current capital spending on renewals is likely to be less than will be needed.

These two factors are:

1. The current condition of the assets, shown above to have an average pipeline age for the three waters given as 35 to 43 years, when the median for medium-sized TLAs in New Zealand is given as 31 to 34 years. There is an indication that 28 percent of the potable water assets are in poor condition as recorded in WaterNZ *National Performance Review 2016-17*, *Volume 2: Participant Comparisons.* (The NPR)
2. The second factor is the rate of renewal spending compared with the expected service life of the assets. The rate of spending implies the need for a service life of 100 years. However the WaterNZ NPR indicates that the pipeline mains average an age of 38 years, and at that age some of the assets are already in poor condition. In fact a lot of the networks (perhaps 25 to 30 percent according to the NPR) are assessed to be in poor or very poor condition, being aged from about 35 to 45 years. The stormwater system appears to have very different characteristics from the potable water and wastewater.

3.3.4 Three Waters operations spending

The NPR allows us to compare the NPDC expenditure per connection for each water, with the national average as well as with the other 19 or 20 medium-sized TLAs. As a comparison with the medium TLAs, the value shown is for the median (mid-point) TLA.

This comparison showed that the average expenditure on operations per property for Three Waters for NPDC was $390 per property per year. For the median of the 19 or 20 medium-sized TLAs, the average expenditure on Three Waters operation was $660 per property per year. For the expenditure on all Three Waters, NPDC spent about 59 percent of the amount spent by the median of the medium-sized TLAs.

Table 3.5: Three Waters average expenditure per property NPDC and NZ

Three Waters Opex	Expenditure per Property		
	NPDC	NZ Medium size TLAs	NPDC Share
	($/Yr)	*($/Yr)*	*(%)*
Potable water	$180	$280	64%
Wastewater	$190	$320	59%
Storm water	$20	$60	33%
Total / Average 3 Waters	**$390**	**$660**	**59%**

The level of NPDC expenditure on each of these waters was between 33 and 64 percent of the level of expenditure per property in the median of the medium-sized TLAs. There could be a number of reasons for these differences, but there would seem to be some indication that with older pipelines than average, and lower expenditure per property, there may be some need to increase operations expenditure in future. Any increase will be accompanied by increased activity in the economy, along the value chain.

4 Scope and costs of solid waste collection and disposal

An infrastructure service provided by NPDFC is the collection and disposal of solid waste. This service is provided to households as well as commercial and industrial ratepayers. The NPDC is in the process of increasing the opportunity to reuse and recycle as well as providing material recovery facilities for households, and in future for commercial and industrial ratepayers in a policy to reduce overall waste.

4.1 Solid waste collection and disposal

The main current NPDC assets applied to solid waste collection and disposal include:

- The Colson Road landfill, due for closure shortly, and de-commissioning
- Refuse transfer station
- Community reuse and recycling centre at the transfer station
- Material recovery facility (MRF).

Solid waste shall be transferred to the Bonny Glen landfill in Marton, Manawatu later in 2019. NPDC intend constructing an MRF for commercial and industrial waste in 2020-21, and another transfer station.

The previous operation of the landfill at Colson Road has ceased about now and the three Taranaki District Councils have undertaken contracts to send their solid wastes to the private Bonny Glen landfill near Marton in the Manawatu.

Henceforth the NPDC responsibility shall be mainly to encourage reuse and recycling, and material recovery facilities for the community, the commercial and the industrial ratepayers.

4.2 Solid waste collection and disposal Opex and Capex

The costs of supplying the solid waste collection and disposal service has a significant annual average cost of approximately $10 million. The bulk of this cost is the operational expenditure of $9.5 million with average capex of only $0.8 million per year. This annual figure of $10 million compares with an annual figure for transportation of $25 million, and for the Three Waters of $40 million.

As from later in 2019 onwards the NPDC activity in this area shall be concentrated on community reuse and recycling, and material recovery from community waste, commercial waste and industrial waste. The remaining solid waste shall be collected and transferred by NPDC to Bonny Glen landfill.

For every $1.00 spent by NPDC on solid waste collection and disposal, there is $1.61 spent in the Taranaki economy.

Table 4.1: Solid Waste Capex and Opex spending and value chain impacts

Value chain impacts from Capex and Opex NPDC annual spending on Solid Waste	Annual Average Expenditure	Value Chain Expenditure	Value Chain Dollars per NPDC $1.00 spent
	($ '000)	*($ '000)*	*($s)*
Solid Waste Capex and Opex Annual Average Impact			
Solid Waste Capex	$847	$1,491	$1.76
Solid Waste Opex	$9,525	$15,209	$1.60
Solid Waste Total	**$10,372**	**$16,700**	**$1.61**

5 Functions and benefits of District roads

The total length of all District roads is recorded by NPDC as being about 1,500 kilometres (kms) in length. Given the fact that there are three ownership categories, Crown, NPDC and private, and that these road types interact, it is useful to outline the total road profile, and where the NPDC owned roads fit in that system.

5.1 Profile of all District roads

These roads can be classified in the One Network Road Classification (ONRC) of the NZTA's Road Efficiency Group. These ONRC classes and general characteristics are as follows.

- Access, small roads facilitating daily activities (can include daily tanker collections)
- Secondary collectors, provide secondary routes, and may be only access route
- Primary collectors, link significant local populations and industries
- Regional, major connectors between and within regions, including public transport
- Arterial, link regionally significant places and industries
- National, link major population centres and transport hubs.

There is also a generally recognised road classification called low volume roads. From their vehicle use characteristics they appear to be a lower sub-class of access roads. Also there were a very few roads not specifically classified which we recorded as 'other' and included them in those under 'access'.

5.1.1 ONRC class of roads in New Plymouth District

BERL has completed an approximate sort analysis of the NPDC database of the separate sections of the roads numbering over 2,300 sections. Our sort indicates that there are about 1,300 total kilometres (kms) of District roads, 160kms of state highways and 36kms of private roads in the New Plymouth District, giving a total of about 1,500kms of roads in the District.

The classes and lengths of roads shown in the table as owned by the Crown, privately, and by NPDC show clearly the pattern of road provision.

Table 5.1: New Plymouth District roads' owners and ONRC classes

Road class ONRC	Crown	Private	NPDC	Total
	kms	*kms*	*kms*	*kms*
Regional	121	0	0	**121**
Arterials	16	0	16	**31**
Primary Collectors	23	0	78	**101**
Secondary Collectors	0	0	346	**346**
Access & Other	0	36	546	**582**
Low Volume Roads	0	0	317	**317**
TOTAL All Roads	**160**	**36**	**1,303**	**1,499**

It is rather surprising that none of the state highways (SH) in New Plymouth District including SH3 are classed as national roads linking major population centres and transport hubs. This may be reflected in the quality parameters applied to any changes made in SH3.

The table shows that over 850kms of the 1,500 total is the NPDC owned access and low volume roads. This indicates the large role of the NPDC roads in the provision of transport in the District.

Work completed by BERL in 2012 for Local Government New Zealand showed that of the total 6,600 million tonne kilometres transport task for commodity exports, an estimated 57 to 64 percent of the transport task was on local and regional roads, and the remaining 43 to 36 percent was on state highways.

In other words for commodity exports, local roads carry 1.3 to 1.8 times the transport task of state highways. This indicates the need to ensure the effective operation of the local roads in order to maintain the country's efficient export industries. The following sections describe the rural/urban profile, the functions and tasks on the NPDC owned roads.

5.1.2 Profile of roads owned by NPDC

The sorted profile of NPDC rural and urban roads are approximately as follows.

Table 5.2 New Plymouth District road lengths by ONRC class

Road class ONRC	Rural		Urban		Total	
	Length	Share	Length	Share	Length	Share
NPDC Roads: Length Rural and Urban						
	kms	*%*	*kms*	*%*	*kms*	*%*
Arterials	0	0%	16	5%	16	1%
Primary Collectors	42	4%	36	11%	78	6%
Secondary Collectors	255	26%	91	27%	346	27%
Access Roads & Other	428	44%	118	35%	546	42%
Low Volume Roads	242	25%	75	22%	317	24%
TOTAL All Roads	**967**	**100%**	**336**	**100%**	**1,303**	**100%**

The high level indication from this breakdown of the types of NPDC roads is the importance of the lower-density population areas. This is shown by the fact that about two thirds of the length of NPDC's roads are access and low volume roads. In the rural areas about 70 percent of the length of roads are access and low volume roads.

5.2 District roads Capex and Opex

The expenditure by NPDC on transportation is very largely spent on the substantial road network. As well there is spending on assets of great benefit to the community such as the Coastal Walkway, however that spending is small compared with that on the communities' roads.

The direct spending on the Capex and Opex of the roads over the next ten years is an average of $25.66 million per year. Of that total, the shares spent directly on Capex and Opex are quite similar, with $13.1 million per year spent on Capex, and $12.5 million per year spent on Opex.

This direct spending on Capex and Opex stimulates spending up and down the value chains from the specific Capex and Opex activities. To enable the annual spend of $13.1 million on Capex activities, the total value chain spending is estimated at $23.5 million a year. This implies that the $13.1 million direct spend has a multiplier of 1.79 applied to it to generate the total value chain spending.

Table 5.3: Transportation Capex and Opex spending and Value Chain impacts

Value chain impacts from Capex and Opex NPDC annual spending on Transportation	Annual Average Expenditure	Value Chain Expenditure	Value Chain Dollars per NPDC $1.00 spent
	($ '000)	*($ '000)*	*($s)*
Transportation Capex and Opex Annual Average Impact			
Transportation Capex	$13,128	$23,500	$1.79
Transportation Opex	$12,535	$19,285	$1.54
Transportation Total	**$25,663**	**$42,785**	**$1.67**

The similar estimate for the Opex shows that with the $12.5 million annual spend, the total value chain spending is estimated at $19.3 million a year. This implies that the $12.5 million direct spend has a multiplier of 1.54 applied to it to generate the total value chain spending.

The multiplier for Capex is expected to be higher than that for Opex because creation and provision of capital goods requires contribution from a broad range of industries and occupations in engineering, construction, material supply etc., whereas the operation of the infrastructure is a more direct process.

The finding is that expenditure by NPDC on transportation, especially on roads provides a strong stimulation to the District's economy.

For every $1.00 spent by NPDC on the District Roads, there is $1.67 spent in the Taranaki economy.

5.2.1 Rate of renewal by annual Capex

The roads in New Plymouth District are shown below to have considerable, wide benefits to the District's economy. As the District has important economic activities spread widely, there is a very considerable body of capital tied up in the District's roads. In fact the Annual Management Plan indicates that the Gross Current Replacement Cost (GCRC) of these roads would be over $470 million.

Seen in that context the annual Capex of about $13 million per year is under 3 percent of the GCRC. The wider impacts estimated in section 5.6 below show that the roads enable an annual value added contribution to the District economy's GDP of over $1,200 million. This is over twice the capital value of the roads.

Table 5.4: Transportation annual Capex and replacement value

Transportation 'Capex' expenditure 2018 to 2027	District road length	Replacement Cost GCRC	Capex per year	Annual 'Capex' share of GCRC
	(Kms)	($ '000)	($'000)	(%)
District roads	1,278	$470,357.9	$13,331.3	2.8%
Value per kilometre ($'000)		$368.04	$10.43	

Source: 2018-2028 Transportation AMP

This indicates that there is a need to ensure that the capital renewals and maintenance spending is sufficient to maintain a high level of efficiency of the roads so that they can continue to enable the substantial wider economic benefits.

5.3 The functions of District roads

District roads perform the fundamental function of providing geographic surface access around New Plymouth District and Taranaki.

For NPDC residents the main purposes of their use of the roads are:

- Travel to and from work
- Travel to and from schools and tertiary education
- Travel to have access to retail and social and recreational services
- Travel for recreation using a range of modes: four and two wheel motorised, cycles, horses.

For businesses in New Plymouth District, Taranaki (and outside) the main purposes are:

- Transport of their primary products from farm and forest to processing plant/market
- Transport of raw materials, components and machinery to manufacturing and construction businesses, and transporting finished products to markets
- Travel and transport of their (urban-based) services and goods to residents, farms, forests
- Access for their rural clients to their urban businesses providing goods, services, recreation.

Generally travel by the residents will be covered by car trips, and transport for most of the urban based retail and services will be covered by cars and light commercial vehicles (LCVs).

The primary products from farm and forest, and the transport of raw materials, components and machinery to manufacturers and construction businesses as well as final products to market, are likely to be transported mainly by medium commercial vehicles (MCVs), and heavy commercial vehicles (both HCV I and HCV II).

This pattern of function is reflected in the profile of vehicle use on the different roads. On the rural roads the heavily-used primary collectors have cars as 90 percent of the vehicles, LCVs as four percent, and heavy vehicles six percent. On the lower-volume access roads cars are a lower 84 percent, LCVs seven percent, and heavy vehicles nine percent.

There is less differentiation on the urban roads with cars generally comprising 92 percent to 94 percent of traffic, LCVs three to four percent of traffic, and heavy vehicles two percent to 4.5 percent of traffic.

All roads have a large numerical majority of vehicles being cars carrying residents, and cars and LCVs carrying services to residents and businesses. In the rural area, as the roads become more remote, the percent of heavy vehicles, namely MCVs and the HCVs increases from two to 4.5 percent in the urban areas, to six percent on the main collector roads in rural areas and eight to 10 percent of the traffic on the access and low volume roads.

5.3.1 NPDC road benefits to residents businesses and services

There is strong benefit to the residents and the businesses from the access around the District, and this shows itself in the number of daily movements of cars and LCVs. These movements total 2,600 in the rural areas and 26,000 per day in the urban areas.

The main cause of wear and need for ongoing maintenance is the freight-carrying HCVs, and to a lesser extent MCVs. This aspect is now researched in detail.

5.4 Main freight tasks on the District roads

Classified by the ONRC Classification the main types of District roads in NPDC are:

- Arterials
- Primary collectors
- Secondary collectors
- Access.

The arterial function in the District and Region is shared by the state highways (SH), SH3 and SH45 and the main District arterial roads. The data provided by NPDC indicates that the length of state highways in the District is over 120kms, and they carry a significant arterial load. As well there are approximately 36kms of private roads, generally local roads to reserves, cemeteries and the like.

These state highways and private roads are omitted from our analyses as they are not provided by, or maintained by NPDC.

5.4.1 Profile of freight loads on District roads

In this description we use the ONRC classification for the rural and urban roads. The objective is to ascertain the freight task carried out by the lengths of road of each ONRC class in the rural and urban areas.

The accepted method of measuring the freight task of a road is to obtain estimates of the daily number of Equivalent Standard Axles (ESAs) which pass over the road in a day. The ESAs exerted by each vehicle type are assessed as follows:

1 MCV = 0.37 ESAs 1 HCV I = 0.9 ESAs 1 HCV II = 1.84 ESAs.

Using these coefficients and the estimated average daily traffic counts (ADTs) we can estimate the approximate average daily ESAs on each road.

For each class of road we have taken a simple average of the ADTs on the roads for which these and the ESAs are measured. We can thus give an indication of the scale of the average number ESA movements per day. Assuming that the ADTs are estimated for a 365-day year we can estimate the number of ESA movements annually. Finally, by multiplying by the kilometre (kms) length of the road we can estimate the number of "ESA kms" per year for each road class.

Table 5.5: NPDC road classes' freight loads per day and per year

Road class ONRC	Total	Share	Average Load	Total Freight Load	
	kms	*%*	*Est. ESA / day*	*ESA kms / year ('000)*	
Arterials	16	1%	160	930	10%
Primary Collectors	78	6%	440	3,330	37%
Secondary Collectors	346	27%	140	2,680	30%
Access Roads & Other	546	42%	24	1,820	20%
Low Volume Roads	317	24%	6	300	3%
TOTAL All Roads	**1,303**	**100%**	**770**	**9,060**	**100%**

Rather surprisingly although the access roads only carry a small number of estimated ESAs per day, their longer length means that they carry a significant total load. For example the access roads have an estimated average freight load of 24 ESAs per day compared with 440 ESAs per day for primary collectors, the latter being 18 times as much. However, the fact that the access roads are

546kms or seven times longer than the primary collectors 78kms means that the access roads carry over half as much total freight load as the much busier primary collectors.

The total freight load for each road class is shown here as thousands of ESA kms per year. These parameters are more easily thought of as million ESA kms per year. Hence the main freight loads are the 3.3 million ESA kms carried by the primary collectors, the 2.7 million ESA kms carried by the secondary collectors, and the 1.8 million ESA kms carried by the access roads. These make up in total 7.8 million ESA kms, which is 86 percent of the total of 9.06 million ESA kms on all roads.

5.4.2 Rural freight loads and tasks

The indications from our estimates above are that the NPDC roads carry a total annual freight load of about nine million ESA kms per year. One of the key freight tasks for the economy of the Region is the freight associated with carrying the primary produce from the farms and forests, the livestock to and from the farms, and carrying the inputs like fertiliser and seedlings to the farms and forests. The bulk of this load is carried on the rural roads and we can obtain an approximate estimate of this.

Table 5.6: NPDC rural roads' freight load daily and annual totals

Rural Road class	ESA per Day	ESA per Year	ESA Kms per Year (Mn)
Rural Access Roads	10	3,160	1.4
Rural Secondary Collectors	40	14,030	1.7
Rural Primary Collectors	120	44,400	1.9
Total Rural major roads	**170**	**61,590**	**4.9**

This indication is that the rural roads carry a total annual freight load of about five million ESA kms per year. This is a little over one half of the estimated total of about nine million ESA kms carried on all of the NPDC roads.

5.5 Primary sector freight tasks for NPDC roads

The previous sections analysed high-level estimates of the freight load carried in on all of the District-owned roads, and the approximate component carried on rural NPDC roads. We have also quoted earlier work by BERL for LGNZ which showed that for commodity exports, local roads carry 1.3 to 1.8 times the transport task of state highways.

The current section aims to complete a bottom-up analysis of freight tasks for the primary sector based upon broad estimates of the areas of the land uses in the District. These freights tasks are those associated with carrying the primary produce from the farms and forests, the livestock to and from the farms, and carrying the inputs like fertiliser and seedlings to the farms and forests.

Data on the areas in the District under each land use comes from a CoreLogic land use database held by BERL, for land titles recorded for each Census Area Unit (CAU). Some of these numbers can be cross-checked at the regional level with the DairyNZ database, Beef & Lamb NZ database, and the MPI forest database.

The profile of the land use areas must be combined with data for the transport tasks per hectare for each land use. The latter data on the transport task per hectare of each land use (measured as the ESAs per 1,000 hectares of land use) comes from a study by Transport Engineering Research

New Zealand Limited (TERNZ) on behalf of the RCA Forum and New Zealand Forest Owners Association (FOA).[2]

Table 5.7: Primary industry freight loads on NPDC roads yearly

Primary Industry	NPDC Land Use Area	Taranaki ESA/1000 hectares	Land Use ESAs p.a.	Average distance kms	ESA Kms per year (Mn)
	('000 ha)	*(ESA p.a.)*	*(ESA p.a.)*	*(kms)*	*(ESA Kms)*
Dairy	62	1,300	81,150	40	3.2
Rural mainly Sheep, Beef, Poultry	73	120	8,760	50	0.4
Forestry	41	920	37,600	60	2.3
Sub-total main Primary land uses	**176**	**720**	**127,510**	**47**	**5.9**

The TERNZ study takes account of freight movements of inputs and outputs of the primary sector enterprises.

The freight load from these three main primary industries totals about 5.9 million ESA kms, which is about two thirds of the total freight loads of nine million ESA kms from all industries and users on all roads in NPDC area. It is greater than the total 4.9 million ESA kms estimated to be carried on the rural roads. This indicates that the primary sector could be responsible for two thirds of the overall freight task on NPDC roads. Taken with the information on the previous table this indicates that the primary sector has a high share of the freight task on rural primary collectors, secondary collectors, and access roads.

The remaining main freight tasks are those serving the construction, wholesale and retail sectors.

5.6 Wider economic benefits from transport on NPDC roads

The Taranaki economy is based mainly on the primary production industries, of pastoral farming, other food production (e.g. meat and chickens), forests and processing. While oil and gas makes a major contribution to Regional and District GDP, it does not make major use of the NPDC infrastructure especially roads, nor does it generate a large share of District employment.

All of these require access, but by far the dominant ones are the primary industries.

5.6.1 Primary industry District economy benefits

The primary industries produce annually about $420 million of value added which comprises 11 percent of the District's GDP. The largest sector is the meat production, then dairy and forest and wood.

Once the value chain activity is added the total contribution is a value added of $740 million per year, which comprises 19 percent of New Plymouth District Council's annual GDP.

[2] De Pont, John, TERNZ, *The impact of land use on pavement wear*. Auckland March 2017.

Table 5.8: Primary industries' direct and value chain benefits

Primary Industry	Value added / GDP		Employment / FTES	
	Direct	Total	Direct	Total
	($Mn)	*($Mn)*	*(FTEs)*	*(FTEs)*
Dairy	130	200	1,150	1,740
Meats	200	380	1,780	3,440
Forest and wood	90	160	660	1,160
Sub-total large Primary	**420**	**740**	**3,590**	**6,340**
Share District	11%	19%	10%	18%

The value chains of these primary industries employ over 6,300 fulltime equivalent employees, which is 18 percent of the employment in the District.

However the employment in the primary industries, and their value chains is only a part of the story of the economic activity generated by the primary industries being the main users of the District roads. The industries involved with the primary industries in the broader picture are the road freight and logistics, construction and engineering industries. We outline the extent of these.

5.6.2 Primary, road freight, logistics, construction and engineering industries

The main production industries directly dependent upon District wide transport infrastructure are the primary industries; the main industries providing transportation service efficiently on this transportation infrastructure are the road freight and logistics industries, and the main industries creating and providing the physical capital assets of the transportation infrastructure are the construction and engineering industries.

The extent of activity in these industries and along their value chains are shown in the table. According to the economic measure used, their share of the District economy are from 52 to 68 percent of the District's economy.

Table 5.9: Three transport-dependent sectors' direct and value chain benefits

Industry Sector	Value added / GDP		Employment / FTES	
	Direct	Total	Direct	Total
	($Mn)	*($Mn)*	*(FTEs)*	*(FTEs)*
Primary	420	740	1,150	1,740
Road freight, logistics	260	460	1,770	2,640
Construction, engineering	580	1,420	5,660	14,280
Sub-total Three Sectors	**1,260**	**2,620**	**8,580**	**18,660**
Share District	33%	68%	24%	52%

5.7 Conclusion

It is almost impossible to imagine the current level of production and economic activity in New Plymouth District without an effective and efficient road network. For this reason it could be claimed that the road network directly enables or contributes to one third of the District's GDP. The total value chain of these large transport-dependent industries enabled by the roads accounts for over two-thirds of the District's economic activity or GDP.