

Community investments in environmental improvements in Taranaki 2008 to 2014

Taranaki Regional Council

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Background

Authors: Kel Sanderson & Hugh Dixon

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Executive Summary

The historical achievement

The Taranaki community, as represented by their local government bodies, the agricultural industry players and other productive industries has been investing in ways of improving the environment for many years.

The Taranaki Regional Council recognises these efforts, and first retained BERL to research the value of these investments in 2002. At that time BERL obtained high-level estimates of spending from 1982 to 1996, and detailed estimates from 1997 to 2002. The expenditure has covered the environmental factors of surface water, air, land, energy and the environmental services to support this. Since then, BERL and TRC have completed estimates of investments over the period 2002 to 2007, and the current period 2008 to 2014.

The capital investment over each period is best understood by expressing it as average capital investment per year, because the lengths of the periods differ. Seen in this way the capital investment per year has increased from \$8 million a year for 1982-96, to \$43 million a year for 2002-2007, and has stabilised at that level for 2008-2014.

Table 1.1 Taranaki environmental capital investment, 1982 – 2014

Taranaki environmental investment		1982-1996	1997-2002	2002-2007	2008-2014
Investment over the period	(\$million)	\$123	\$91	\$217	\$261
Investment per year	(\$million)	\$8	\$18	\$43	\$43

Source: BERL

While the capital investment per year has stabilised, there has been a greater call on the community organisations, mainly the District Councils, to increase their annual spending on operating costs, especially on water treatment, pushing this costs to \$74 million.

Table 1.2 Taranaki environmental annual investment, 1982 – 2014

Taranaki environmental investment		1982-1996	1997-2002	2002-2007	2008-2014
Capital investment per year	(\$million)	\$8	\$18	\$43	\$43
Operating cost per year	(\$million)	n.a.	\$29	\$42	\$74
Total investment per year	(\$million)	n.a.	\$47	\$85	\$117

Source: BERL

The annual investment by the Taranaki people in capital costs to protect and improve the environment, and the operating costs to achieve that improvement has increased from \$47 million a year in the period 1997-2002, to \$117 million a year in the period 2008-2014.

Much of the investment needed has now been achieved

Having invested strongly in the environment from 1982 to 2007, there has been less investment needed in some areas between 2008 and 2014.

This reduction does not reflect a declining commitment to protecting and enhancing the environment, but rather reflects that considerable improvement has been achieved with earlier investment, and so there is less additional investment required in some areas.

The profile of per annum capital investment in the main environmental protection areas illustrates this point.

Table 1.3 Taranaki environmental capital investment per annum by category, 1982 – 2014¹

Taranaki environmental capital investment	1982-1996	1997-2002	2002-2007	2008-2014
Investment per year (\$million)				
SURFACE WATER	\$5.6	\$9.6	\$21.4	\$38.4
AIR & NOISE	\$0.1	\$3.6	\$9.7	\$1.6
LAND MANAGEMENT	\$0.3	\$4.4	\$9.8	\$2.9
ENERGY EFFICIENCY	\$2.3	\$0.0	\$1.4	\$0.0
ENVIRONMENT SERVICES	\$0.0	\$0.6	\$1.0	\$0.5
TOTAL	\$8.2	\$18.2	\$43.4	\$43.5

Source: TRC estimates, BERL

Over this historical period the greatest capital investment in each period has been on improvements to the quality of surface water by effluent treatment, riparian planting and water treatment. This continues, although the emphasis in farming has moved from effluent treatment to riparian protection, and for the community, to investment in water quality. With both of these improvements the investments in the current period have been high and once these investments have been made, the environmental improvement is achieved and further investment will not be required in later periods.

This effect on investment profiles is seen for investments to improve air and noise, and also land management. Each of these areas had growing investments per year over the period 1982 to 2007. Particularly in the 2002 to 2007 period there were investments that averaged about \$10 million per year in each area. These were mainly substantial one-off investments related to new oil and gas installations, new transport bases, etc. Now that the investment has been made, only limited further investment has been needed, hence the investment recorded per year in the 2008 to 2014 period has reduced.

The current information for 2008 to 2014

The scope and the method used in this project remains the same as the previous projects. Estimates of expenditure were obtained by an email survey of main industries and district councils, supplemented by information from the Taranaki Regional Council (TRC)'s and the District Councils' annual reports and plans.

Information on agriculture was obtained from the records held at the TRC. Costings were updated from the 2008 report using price indexes published by Statistics New Zealand (SNZ) and Quotable Value (QV). Costings of the 2002 report were from suppliers and cross-referenced to expenditure data from agricultural industry sources.

¹ Due to rounding the individual component may not add to the total.

Table 1.4 summarises capital investment and annual operating cost of community, industry, and agriculture in the Taranaki region over the period 2008 to 2014, in comparison with the two earlier periods.

Over the last six years, the largest capital investments have been on surface water management (\$230.4 million), air quality management and noise reduction (\$9.8 million), and land management (\$17.4 million). While the absolute amount of capital investment for the period 2008 to 2014 is higher than that seen for the previous 2002 to 2007 period, the later period covers six years not five like the earlier period. This means that on an annual basis the level of overall capital investment has been very similar over the last 11 years, at \$43 million a year.

Table 1.4 Summary of total investment on environmental improvements, 1997 – 2014

TARANAKI REGION (\$ Million)	Capital Cost			Annual Operating Cost		
	1997-2002	2002-2007	2008-2014	1997-2002	2002-2007	2008-2014
SURFACE WATER	\$47.9	\$106.8	\$230.4	\$12.6	\$24.5	\$49.3
AIR & NOISE	\$18.2	\$48.7	\$9.8	\$1.6	\$0.8	\$0.9
LAND MANAGEMENT	\$21.9	\$49.1	\$17.4	\$5.7	\$10.2	\$14.9
ENERGY EFFICIENCY	\$0.0	\$7.1	\$0.1	\$0.0	\$0.8	\$0.1
ENVIRONMENT SERVICES	\$3.2	\$5.2	\$3.1	\$8.9	\$5.5	\$8.4
TOTAL	\$91.1	\$216.9	\$260.9	\$28.8	\$41.8	\$73.5

Source: TRC estimates, BERL

The investments on surface water quality have more than doubled compared to the 2002 to 2007 period. At the same time capital investment in all other areas has declined. The expansion of the energy sector has contributed the most to the regional economy in terms of business investment. It has also made the greatest investment in environment mitigations and enhancement. Therefore, we will take a look at this sector specifically in Section 5.6.

There are likely to be costs omitted due to the nature of the survey and, therefore, the estimates derived in this report are conservative. It is possible that a future survey would find significant expenditure in areas where this survey has recorded little. However, as these estimates have been cross-checked with key stakeholders in Taranaki, they are sufficient to indicate the magnitude of investments and expenditures over the six-year period.

This report does not include in the analyses the capital investment or annual operating expenditure in Taranaki on the bio-physical environment made by central government, in particular by Department of Conservation (DoC). Nor does it include spending by the District Councils on community amenities.

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1 Taranaki: people and economy

This section briefly provides a background on the population and economy of Taranaki from Statistics NZ and BERL Database sources.

In 2013 109,600 people live in the Taranaki region. From this, 51,100 Full Time Equivalent (FTEs) were employed in 14,600 businesses in 2013 producing \$6.6 billion in GDP. Taranaki makes up 2.7 percent of national employment and contributes 3.1 percent of national GDP.²

The key industries that drive the Taranaki economy are the oil and gas, and agriculture sectors, and their associated secondary industries such as food processing and engineering. As such, the region employs a far larger proportion of workers in these industries than New Zealand.

Taranaki has achieved strong rises in employment and GDP in the region over the last seven years, while its population growth has matched the New Zealand average. On a GDP per capita basis, Taranaki is well ahead of the national average. Overall growth in employment and GDP in Taranaki has been higher than national growth over the period.

The Taranaki region continues to benefit from shifts in the global economy, as demand expands for energy and commodities (food and raw materials). The aspirations of the developing world, with a new development bank established by the BRICS grouping a recent indication, is likely to see demand for energy, raw materials and food continue to expand. With agriculture, food processing, and energy sectors driving its economic activity, the Taranaki region is well placed to take advantage of the changing global economic environment.

This positive shift cannot rely solely on increases in participation or productivity and will require an increase in employment, which should encourage population growth in the region. Increased population will flow through to the population-based industries (education, health, cultural and personal services). There are glimpses of this in the latest census numbers where the population went from a small increase from the previous five-years and actually increased in-line with the national average, by adding 5,500 people between 2006 and 2013.

² Source: BERL Regional Database and 2013 Census.

2 Scope and methodology

This report aims to quantify the environmental investments and spending made by the broad Taranaki community, in environmental improvements, enhancements or protection over the six year period between 2008 and 2014. The broad Taranaki community is defined as including the agriculture industry, other productive industries (industrial, processing, and energy companies), and the community (the TRC and district councils).

2.1 Scope of the report

This report is an update of the project BERL undertook in 2008 and also in 2002. Both of these previous reports estimated the total amount of investment and annual expenditure of the broad Taranaki community, including the agriculture industry, other productive industries (industrial, processing, and energy), and the community (the TRC and district councils).

The 2002 report looked at investment and spending over a five year period between 1997 and 2002, while the 2008 report looked at investment and spending over the previous five years. The current project focuses on the latest six years of records (i.e. 2008-2014).

The scope of the report is to estimate the investment and expenditure of the Taranaki community on environmental improvements, enhancement or protection. It excludes the expenditure by central government (i.e. DoC). The value of cultural and recreational assets, which the local authorities have created to improve the social conditions in the region are not included in the report.

2.2 Method of estimation

Agriculture

Information on agriculture was provided by the TRC, supplemented by the costing information from the 2002 project. Costings of the previous report were from agricultural suppliers for construction or purchase of effluent treatment systems, riparian protection, various services, and site works. To incorporate price increases over the 12 year time period, we updated the costings using the price indexes published by Statistics New Zealand (SNZ) and Quotable Value (QV). The following list details the sources of the price indexes:

- farm expenses price index (SNZ) - electricity, maintenance cost of hill country plans, weed and pest control, culvert construction, electrical works, earthmoving and site work, irrigation and land drainage, and reclamation and river control
- capital goods price index (SNZ) - fencing, land clearing and establishment
- freehold open market land cost by district (QV) – opportunity costs of effluent systems.

Community and industrial

Information on investment and expenditure in environmental improvements was obtained from a survey of main resource users and district councils, supplemented by information from annual reports and plans of the three district councils³ in the region and the Taranaki Regional Council.

³ New Plymouth District Council, Stratford District Council and South Taranaki District Council.

We have surveyed the entities which have applied for consents over the period 2008-2013. The total number was considerably fewer than those applying in the earlier period. This is understandable as the consents up to 2008 applied to a number of significant capital investments. Once these investments are made, there is no need to repeat them in future periods. However the annual operating expenses will have continued.

Compared to the 111 survey responses received in 2008, we received a total of 17 responses. Some companies and organisations responded that they have no record of investment or expenditure on environmental improvements since 2008, while others had concerns about the issue of confidentiality and were unable to disclose actual figures. Consequently, our calculations were based on the 17 responses received, including district councils, public entities, and companies of various industries.

Given the lower response in 2014 to that seen in the 2008 report, the 2008 survey data for the annual operating expenses for 42 companies who were surveyed but unable to supply data for the 2014 survey was adjusted and included in the 2014 estimation of overall operating expenses. This was done to ensure that any change in the magnitude of annual operating expenses was from changes reported by respondents, rather than due simply to a low response to the survey.

2.3 Assumptions

We made a number of assumptions while examining the survey responses.

- Financing costs (i.e. cost of borrowing to finance a particular project) are excluded;
- Sunk costs are excluded. Ideally, incremental cost will be the best measure here;
- TRC monitoring costs are included.

2.4 Limitations of estimates

Although the survey went to approximately 180 companies and organisations, of which 17 responded, the contact list was not exhaustive. The research predominantly relied upon survey respondents and therefore, depending on their interpretations, there would be gaps and omissions in some areas.

In addition, due to the confidential nature of the information we sought, several organisations and companies did not respond or would not provide estimates of their investment and expenditure.

Consequently, the estimates derived in this report are conservative, although the results of this year's survey show significant changes in some areas of investment and spending compared to our previous report.

The report focuses on capital investment and annual expenditure undertaken on maintenance and improvement of the biophysical environment. Thus, the report does not include in the main analyses any capital investment or annual operating expenditure undertaken by central government, in particular by the Department of Conservation (DoC). Nor does it include spending by the District Councils on community amenities such as parks and libraries.



2.5 Reporting format

The details of investment are now presented in separate chapters for investment by community organisations (Section 3), investment by agriculture (Section 4), and investment by industry (Section 5).

3 Environment investment by the community

The environmental investment by the community sector consists of expenditure by the three district councils in the region and the TRC. The information obtained from the district councils and the TRC indicates that investment by these community organisations was mainly made in regard to:

- maintaining and improving the quality of surface water including fencing riparian margins and planting
- flood and erosion control works
- land sustainability including weed and pest control
- solid waste collection, recycling, and disposal
- maintaining and improving air quality and noise attenuation
- environmental services including policy and planning, environmental monitoring and research, consent processing, compliance monitoring, and staff training.

Table 3.1 summarises the investment and spending by community in the Taranaki region over the last six years from 2008 to 2014 in comparison with the two previous reporting periods since 1997.

Table 3.1 Summary table – community investment 1997 – 2014

COMMUNITY (\$ Million)	Capital Cost			Annual Operating Cost		
	1997-2002	2002-2007	2008-2014	1997-2002	2002-2007	2008-2014
SURFACE WATER						
Water Quality	\$15.5	\$67.0	\$158.4	\$7.9	\$18.4	\$42.1
Riparian Protection	...	...	...	...	...	...
River, flood control	\$0.6	\$16.4	\$11.8	\$2.1	\$3.3	\$4.6
Sub-Total Surface Water	\$16.1	\$83.4	\$170.2	\$10.0	\$21.7	\$46.8
AIR						
Air Quality	...	...	\$1.8	...	...	...
Noise Reduction	...	...	...	...	...	\$0.0
Greenhouse gas	...	...	...	...	...	...
Sub-Total Air	...	...	\$1.8	...	...	\$0.0
LAND						
Land Erosion, Management	\$1.6	...	\$1.4	\$1.1	\$3.0	\$5.5
Solid Waste	\$6.3	\$4.7	\$3.3	\$3.1	\$5.7	\$8.1
Sub-Total Land	\$7.9	\$4.7	\$4.7	\$4.2	\$8.7	\$13.6
ENVIRONMENT SERVICES						
Monitoring, Research, etc	...	\$0.3	\$0.03	\$5.9	\$4.1	\$7.6
Staff	...	...	...	...	\$0.1	\$0.1
Sub-Total Environ't Services	...	\$0.3	\$0.03	\$5.9	\$4.2	\$7.7
TOTAL	\$24.0	\$88.3	\$176.7	\$20.1	\$34.6	\$68.1

Source: Survey, TRC estimates, BERL

The capital investment in Taranaki over the last six years totalled \$176.7 million almost exactly double the \$88.3 million invested from 2002 to 2007. In addition, annual expenditure on maintenance associated with the environmental works, facilities, and processes reached \$68.1 million per year, while the previous report recorded an annual operating spending of \$34.6 million per year from 2002 to 2007. The main increases in capital cost and annual operating cost related to surface water, mainly water quality.

3.1 Surface water

Surface water quality

The measures to protect and improve surface water quality mainly related to stormwater handling, wastewater, and sewage collection, treatment and discharge. From 2008 to 2014 capital investment recorded was about \$170.2 million, considerably higher than the \$83.4 million reported for the period 2002 to 2007.

For example, New Plymouth District Council (NPDC) has invested more than \$48 million on wastewater collection, treatment, and disposal. In addition to this investment NPDC also spent around \$12 million in improvements in water abstraction, treatment and distribution.

Other examples include more than \$7 million invested on water quality in Stratford District Council; and around \$65 million from South Taranaki District Council. The investment was solely on maintaining and improving water quality, and includes no capital investment for riparian protection. This is consistent with the estimation in the 2008 report.

There are also contributions to the activities of the Taranaki Tree Trust on riparian work, which is reflected in the spending of the agriculture sector. Repairs, pipe upgrades, and water treatment projects undertaken by the district councils were also substantial.

Rivers and flood control and stormwater

The TRC's responsibility for river and flood control includes advising and assisting landholders on matters relating to the control of rivers and flooding in order to minimise and prevent damage by floods and erosions, as required by the Soil Conservation and Rivers Control Act 1941.

The information from the past three surveys indicates that from a very low level of \$0.6 million invested from 1997 to 2002, a strong investment programme was pursued, investing \$16.4 million between 2002 and 2007. This investment has continued, but at a lower level, investing \$11.8 million, in river and flood control over the 2008 to 2014 period.

As to be expected with the expanded capital involved, the operating costs have increased to \$4.6 million annually, compared to \$3.3 million annually over the previous period. The TRC alone spent around \$3.8 million (which averaged around \$0.6 million annually) on river control and flood control. The main areas of expenditure were on the Lower Waitara and Lower Waiwhakaiho River Flood Control Schemes.

3.2 Air quality and noise control

Spending in the areas of air quality and noise control by the community sector was minimal. The majority of the investments in these areas were from industry, which is detailed in Section 5.

3.3 Land erosion and management

Land management and erosion control

The TRC provides property planning services to landowners, including comprehensive, agroforestry, and conservation farm plans, as well as riparian management plans. It also provides environmental

enhancement grants for protection of wetlands and other aspects of the environment identified as regionally significant. Annual spending by the community of \$5.5 million was estimated for the last six years, this is up from the \$3 million spent previously between 2002 and 2007.

Solid waste

The measures by community organisations to collect solid waste and to operate landfills, recycling, and transfer stations are significant parts of their environmental protection operation. They made significant investments in transfer stations in the earlier periods to facilitate amalgamating the solid waste handling at Colson Road as the main centralised landfill in the region. Consequently the subsequent investment has been able to be reduced from \$6.3 million in 1997-2002, to \$4.7 million in 2002-2007, and down to \$3.3 million from 2008 to 2014.

The average annual cost of operating the waste collection, recycling, and disposal was \$8.1 million per annum over the period 2008 to 2014, up from \$5.7 million per annum over the period 2002 to 2007.

3.4 Environment services

The category 'environmental services' includes environment planning and policy, monitoring and research, consent processing, and monitoring. The basis for recording this investment appears to have changed a little over the latest period, however the comparable costs of three district councils and the TRC spent annually monitoring, research and staff appear to have increased from \$4.2 million a year from 2002-2007, to \$7.7 million a year from 2008-2014.

4 Environment investment by agriculture

The agricultural sector in Taranaki is predominantly pastoral, relying on the year-round growing conditions for vegetative production as a base for dairying on the ring plain and other lower areas. In the hill country, there is sheep and beef production, dry stock grazing, and expanding forestry production. This sector has always been the largest employer, with around 7,000 FTEs employed in both 2007 and 2013.

The main environmental attribute requiring protection under dairying is surface water quality, and control of pests and weeds. The sheep and beef production in the hill country requires protection measures to reduce soil erosion, and also pest and weed control, especially in gullies and bush remnants.

Therefore, categories examined include:

- effluent systems - oxidation ponds, tertiary ponds etc
- riparian planting
- land management – hill country protection
- pest control
- bridge construction
- culvert installation
- underpass construction.

Note that not all bridge and culvert installations are required to obtain resource consents due to small size etc and, of the others, not all are consented. Similarly not all underpass constructions are consented. This contributes to underestimations of the actual investment presented in this report.

Table 4.1 details the capital investment and expenditure for the reporting periods for the last three environmental investment reports.

Table 4.1 Summary table – agriculture investment 1997 – 2014

AGRICULTURE (\$ Million)	Capital Cost			Annual Operating Cost		
	1997 - 2002	2002-2007	2008-2014	1997 - 2002	2002-2007	2008-2014
SURFACE WATER						
Dairy Effluent Treatment	\$4.0	\$3.6	\$5.6	\$0.9	\$1.5	\$1.9
Riparian Protection	\$1.1	\$3.6	\$19.5	...	...	...
Sub-Total Surface Water	\$5.1	\$7.2	\$25.1	\$0.9	\$1.5	\$1.9
LAND						
Hill Country Erosion	...	...	...	\$2.9	\$3.9	\$1.8
Pest & Weed Control	...	...	...	\$3.3	\$3.7	\$2.9
Sub-Total Land	...	...	...	\$6.2	\$7.7	\$4.6
SITE WORK						
Bridge	...	\$2.1	\$2.3	...	...	...
Culvert	...	\$1.5	\$2.0	...	...	...
Underpass	...	\$8.7	\$7.2	...	...	...
Sub-Total Site Work	...	\$12.3	\$11.6	...	...	...
TOTAL	\$5.1	\$19.5	\$36.7	\$7.1	\$9.2	\$6.5

Source: TRC estimates, BERL

4.1 Surface water

In 2003, the Dairying and Clean Streams Accord was signed by the Minister of Agriculture, Minister for the Environment, Fonterra and Local Government New Zealand (on behalf of regional councils). The Accord is a voluntary programme to promote sustainable dairy farming in New Zealand. It focuses on the quality of New Zealand's streams, rivers, lakes groundwater and wetlands. In 2004, the Taranaki Regional Council prepared a Regional Action Plan to implement the Accord in Taranaki. Important measures to protect and improve the quality of surface water on farms are treatment of dairy effluent; riparian management (the fencing and protection of the margins of streams and rivers to reduce the effects of pasture runoff into the surface water); and the construction of bridges or culverts to exclude direct access by cattle to watercourses.

Farm dairy effluent treatment

Initially, simple oxidation ponds treated the effluent, then discharged into watercourses, streams, and rivers. Farm dairy effluent treatment by discharge to land is also an option and many farmers have invested in effluent irrigation systems to do this. Tertiary oxidation ponds and tertiary treatment systems, such as constructed wetlands, are further options that have been developed.

Over the period 2008 - 2014 there were approximately 60 new dairy effluent treatments installed in Taranaki and, over the same period, 269 were upgraded. Among the 60 newly installed treatments, 23 of them were oxidation pond systems, and 37 were effluent irrigation systems.

Total installation and upgrade costs reached \$5.6 million over the last six years; and annual cost of running and maintaining all systems was estimated to be around \$1.9 million.

Riparian protection and enhancement

Water quality is protected by treating farm dairy effluent, by protecting rivers and streams by fencing their riparian strips, and by on-farm bridging or culvert construction and underpasses for cattle crossings.

The very strong commitment to riparian planting and fencing over the reporting periods is as follows:

1997 to 2002:	139 kms of fencing,	280,000 plants;
2002 to 2007	412 kms of fencing,	872,000 plants;
2008 to 2014	3,021 kms of fencing,	2,480,000 plants.

The estimated cost of this fencing and planting from 2008 to 2014 was approximately \$19.5 million investment on riparian protection, compared with the \$3.6 million from 2002 to 2007. The cost of fencing has been adjusted using the Capital Goods Price Index from Statistics New Zealand.

The calculation of riparian planting excludes the opportunity cost of production lost from the land in the riparian margins retired, following the method we used for the 2002 report. It is likely that, in the absence of the fencing retirement, not all of this land would be available for grazing.

The TRC has been working with landowners to develop property (riparian) plans and implement them.

4.2 Land erosion and management

In the agriculture sector in Taranaki there is a need for soil erosion prevention measures in the hill country, as well as pest and weed control on both dairy farms and sheep and beef farms. These costs are generally covered from the operating budgets on the farms.

Hill country erosion

Over the period 2008-2014, there were 114 new hill country farm management plans, of which 84 were comprehensive farm plans and 30 were agroforestry plans. The average farmer expenditure is over \$15,400 per year on implementation of sustainable land management practices such as environmental planting, forestry/agroforestry development, or fencing and retirement of erosion-prone land. The annual cost was adjusted according to the Farm Expenses Price Index published by Statistics New Zealand. The total annual farmer expenditure under this programme is thus \$1.8 million per annum.

Dairy farm pest and weed control

The TRC carries out initial control for a three-year self-help possum control programme. Therefore, the first year cost is not charged to farmers (these costs are included in the community investment and spending in the previous section). Farmers subsequently undertake their own maintenance or employ a contractor to carry out the maintenance. The total cost in the next two years to the farmers is estimated at about \$1.6 million for the second year and \$1.3 million for the third year.

Site work

According to the TRC's "Dairying and Clean Streams Accord, Regional Action Plan for Taranaki, Annual Report for 2011/2012", 98 percent of regular stream crossing points are adequately bridged and/or culverted. This keeps dairy cows out of streams, reducing soil erosion and stream pollution.

The TRC monitors the progress and provides resource consent advice and information in terms of the construction of bridges and culverts. The dairy farming community have managed to achieve the year 2007 target set by Taranaki's Regional Action Plan under the Dairying and Clean Streams Accord.

A number of road underpasses have also been installed in the region. The underpasses keep solid waste from the public roads and contribute to preventing disease transfer by vehicles.

Bridges, culverts & underpasses

The numbers presented below indicate the minimum amount of investment as not all bridges and culvert installations are required to obtain resource consent due to small size etc and not all installations are consented. Similarly, not all underpass constructions are consented.

Bridges

There were 57 bridges built during the period 2002 and 2007, and a further 51 from 2008 to 2014. Using construction cost estimates for bridges of different length, and updated according to the relevant SNZ Capital Goods Price Index, we estimate that these 51 bridges cost \$2.3 million to build, compared with the \$2.1 million cost of constructing the 57 bridges built between 2002 and 2007.

Culverts

Over the period 2008-2014 there were 196 new culverts installed in the Taranaki region this is up from the 171 new culverts installed between 2002 and 2007. Taking account of the difference in size, we estimate the average cost of installation averages at around \$3,600 per culvert, and materials cost of around \$6,600 for each culvert. Therefore, we report a total of \$2.0 million capital investment in culverts from 2008 to 2014.

Underpasses

Information on the number of underpasses installed between 2008 and 2014 was obtained from the three District councils. The estimate is that a total of \$7.2 million was spent to install 83 new underpasses in Taranaki. Costs of material and installation vary depending on the size (width and length) of the underpasses, ranging from \$50,000 to \$95,000.

The total capital investment in site work to improve environmental outcomes in 2008 to 2014 was \$11.6 million from 2008 to 2014, which is slightly less than the \$12.3 million estimated for 2002 to 2007. As with other areas of capital investment, now that these improvements have been made, it could well be that future investment in these areas will decline.

5 Environment investment by industry

There is a broad range of investments made by industry in environmental improvements to mitigate any effects on the environment.

With substantial industrial plants, the environmental measures are designed into the equipment and supplied as elements in the overall plant configuration and/or construction. In each of the three periods since 1997, there have been significant lumpy investments of the order of \$20 million to \$35 million by Taranaki industry in water quality, air quality, greenhouse gas mitigation, and land erosion reduction.

Being lumpy investments these have not increased steadily over time, and so the total capital investment by industry has fluctuated from \$62 million in 1997-2002, up to \$109 million in 2002-2007, and a reduction to an estimated \$47 million in 2008-2014.

The largest class of investment in the 2008-2014 period is in water quality, with some follow-up investment in greenhouse gas emissions.

Table 5.1 compares the total capital investment, annual operating costs, and total environmental services costs for the periods 1997-2002, 2002-2007 and 2008-2014.

Table 5.1 Summary table – industry investment 1997 – 2014

Industry (\$ Million)	Capital Cost			Annual Operating Cost			Environmental Services	
	1997 - 2002	2002-2007	2008-2014	1997 - 2002	2002-2007	2008-2014	2002-2007	2008-2014
SURFACE WATER								
Water Quality	\$25.4	\$12.4	\$34.6	\$1.6	\$1.2	\$0.4	\$1.7	\$0.5
Riparian Protection	\$1.3	\$3.9	\$0.2	\$0.1	\$0.0	\$0.1	\$0.0	\$0.1
River, flood control			\$0.3			\$0.1		\$0.0
Sub-Total Surface Water	\$26.7	\$16.3	\$35.1	\$1.7	\$1.3	\$0.6	\$1.7	\$0.6
AIR								
Air Quality	\$14.0	\$27.5	\$0.0	\$1.4	\$0.1	\$0.1	\$0.0	\$0.4
Noise Reduction	\$4.2	\$4.0	\$1.5	\$0.2	\$0.0	\$0.1	\$0.0	\$0.9
Greenhouse gas	...	\$17.2	\$6.4	...	\$0.6	\$0.7	\$0.0	\$0.0
Sub-Total Air	\$18.2	\$48.7	\$8.0	\$1.6	\$0.8	\$0.9	\$0.0	\$1.3
LAND								
Land Erosion, Management	\$0.2	\$28.6	\$0.2	...	\$0.1	\$0.1	\$0.0	\$0.0
Solid Waste	\$13.7	\$3.5	\$1.0	\$1.5	\$1.4	\$1.1	\$0.1	\$0.1
Sub-Total Land	\$14.0	\$32.0	\$1.1	\$1.5	\$1.5	\$1.3	\$0.1	\$0.1
Energy								
Energy Efficiency	...	\$7.1	\$0.1	...	\$0.8	\$0.1	\$0.0	\$0.3
Sub-Total Energy	...	\$7.1	\$0.1	...	\$0.8	\$0.1	\$0.0	\$0.3
ENVIRONMENT SERVICES								
Monitoring, Research, etc	\$3.2	\$4.9	\$3.0	\$0.5	\$1.2	\$0.5	\$6.1	\$9.9
Staff	...	\$0.0	\$0.1	\$2.5	\$0.1	\$0.1	\$0.0	\$0.1
Sub-Total Environ't Services	\$3.2	\$4.9	\$3.1	\$3.0	\$1.3	\$0.6	\$6.1	\$9.9
TOTAL	\$62.0	\$109.1	\$47.5	\$7.8	\$5.7	\$3.5	\$7.9	\$12.2

Source: TRC estimates, BERL

The capital investments in previous periods in solid waste, monitoring measures and water quality have all resulted in reduced annual operating costs in those areas. The total annual operating costs

of environmental measures for industry in Taranaki decreased further from \$5.7 million per year in 2002-2007, to \$3.5 million per year from 2008-2014.

The main environmental attributes which industry overall invests in are air quality and noise control, land management (in particular, land erosion), and surface water quality including riparian protection. To manage this process, industry spends on monitoring and research.

Taranaki is home to almost all New Zealand's oil and gas production. Indeed, it accounted for 75 percent of the oil and gas sector's GDP in New Zealand in 2013. The demand for domestic oil and gas will continue to increase in the next 20 years, according to the Energy Outlook published by the Ministry of Economic Development⁴, which expects continuing investment and sustainable growth in Taranaki in the next few years.

We discuss the energy sector in more detail in Section 5.6.

5.1 Surface water

Surface water quality

The main types of investment undertaken by industry in surface water quality are in waste water and effluent treatment. These include bio-filters, effluent irrigation, water re-use, truck wash systems, and stormwater management including ponds. There is also considerable investment in bunding around tank-farms to protect against pollution

The total investment by surveyed industries in Taranaki in surface water quality measures in the last six years was \$34.6 million, nearly three times the investment in the previous 2002-2007 period. The annual operating costs for industry associated with these environmental measures totals was just \$0.4 million per annum, which is a significant reduction on the \$1.2 million spent on annual operating costs between 2002 and 2008. The significant new investment in this area is likely to have resulted in lower annual operating costs in this area.

Riparian protection and planting

While there had been riparian protection investment by industry in the previous periods, there appears to have been little investment in this area in the current period with just \$0.2 million spent.

5.2 Air quality and noise control

Measures taken to improve air quality include various processes to reduce plant emissions and dust control. Very significant investments were made in chemical and related industries in the ten years between 1997 and 2007. Consequently there were no consents for additional investments in this area between 2008 and 2014.

In total \$66.9 million was spent on improvements to air quality, noise reduction and reduction in greenhouse gasses in the ten years between 1997 and 2007. While there was no additional investments in air quality for the latest period, \$8 million was invested in noise reduction and reduction in greenhouse gases.

⁴ Ministry of Economic Development, *New Zealand's Energy Outlook to 2040*, July 2013.
Community investments in environmental improvements in Taranaki 2008 to 2014

Annual operating cost for air quality, noise reduction and reduction in greenhouse gases was recorded at \$900,000 per annum over the last six years. This is up on the \$800,000 per annum spent between 2002 and 2007.

5.3 Land erosion and management

Land erosion

Having invested a total of \$28.6 million in landscaping, weed control and other land management measures in the previous period, there was very little recorded further expenditure in this area between 2008 and 2014.

Solid waste

As in the previous period there was little investment in solid waste disposal. Also because most of this is handled by the district councils, there was little annual expenditure either.

5.4 Energy efficiency

The significant energy efficiency investment made in the previous period was not repeated in the current period.

5.5 Environmental monitoring, research, and staff

Apart from regular expenditure on monitoring services (\$3 million capital investment and \$0.5 million annual operating cost), industry also increased their capability to undertake their own environmental research and monitoring. This is evidenced by an impressive amount of \$9.9 spent million on environmental services, hiring environmental, technical, and professional staff or consultant services.

The energy sector spent a significant amount on research and monitoring. These costs are capitalised due to the direct impact of the research and monitoring on production.

Furthermore, we noticed that there were a few companies investing to improve the environmental awareness of their staff. Full time staff members are also being hired to manage environmental matters.

5.6 The energy sector

Table 5.2 highlights the significant capital investments and annual operating expenditures over the period 2008-2014 by the energy sector.

The energy sector's capital investment totalled \$40 million over the last six years out of the \$47.2 million invested by all industry. This is about 84 percent of the total investment in environmental protection and enhancement by all industry. This happened to be the same share as in the previous period. The majority of the spending this period was in water quality, greenhouse gas reduction, and environmental monitoring services.

Table 5.2 Summary table – the energy sector 2008 – 2014

Energy (\$ Million)	Capital Cost		Annual Operating Cost	
	Energy	Total Industry	Energy	Total Industry
SURFACE WATER				
Water Quality	\$31.8	\$34.6	\$0.1	\$0.4
Riparian Protection	\$0.2	\$0.2	\$0.0	\$0.1
River, flood control	\$0.1	\$0.3	\$0.0	\$0.1
Sub-Total Surface Water	\$32.0	\$35.1	\$0.2	\$0.6
AIR				
Air Quality	\$0.0	\$0.0	\$0.0	\$0.1
Noise Reduction	\$1.5	\$1.5	\$0.1	\$0.1
Greenhouse gas	\$3.2	\$6.4	\$0.1	\$0.7
Sub-Total Air	\$4.7	\$8.0	\$0.2	\$0.9
LAND				
Land Erosion, Management	\$0.0	\$0.2	\$0.0	\$0.1
Solid Waste	\$0.4	\$1.0	\$0.1	\$1.1
Sub-Total Land	\$0.4	\$1.1	\$0.1	\$1.3
Energy				
Energy Efficiency	\$0.1	\$0.1	\$0.1	\$0.1
Sub-Total Energy	\$0.1	\$0.1	\$0.1	\$0.1
ENVIRONMENT SERVICES				
Monitoring, Research, etc	\$2.6	\$3.0	\$0.4	\$0.5
Staff	\$0.1	\$0.1	\$0.0	\$0.1
Sub-Total Environ't Services	\$2.7	\$3.1	\$0.4	\$0.6
TOTAL	\$40.0	\$47.5	\$1.0	\$3.5

Source: TRC estimates, BERL

In contrast, annual operating costs were only about one-third of the total by all industry.

6 Total investment in the environment

The analyses in the previous sections give conservative order-of-magnitude estimates of the investment and annual spending on the environment by the Taranaki community in the last six years, as well as comparing it with the previous two five year periods. This section draws together the information to show the overall pattern of investment and the annual operating costs spent on the environment in Taranaki.

6.1 Summary table

The total pattern of community investment in the environment is shown in Table 6.1

Table 6.1 Summary table – total investment and spending 1997 – 2014

(\$ Million)	Capital Cost			Annual Operating Cost		
	1997-2002	2002-2007	2008-2014	1997-2002	2002-2007	2008-2014
SURFACE WATER						
Community	\$16.1	\$83.4	\$170.2	\$10.0	\$21.7	\$46.8
Agriculture	\$5.1	\$7.2	\$25.1	\$0.9	\$1.5	\$1.9
Industry	\$26.7	\$16.3	\$35.1	\$1.7	\$1.3	\$0.6
Sub-Total Surface Water	\$47.9	\$106.8	\$230.4	\$12.6	\$24.5	\$49.3
AIR						
Community	...	...	\$1.8	...	...	...
Agriculture	...	...	...	...	...	...
Industry	\$18.2	\$48.7	\$8.0	\$1.6	\$0.8	\$0.9
Sub-Total Air	\$18.2	\$48.7	\$9.8	\$1.6	\$0.8	\$0.9
LAND						
Community	\$7.9	\$4.7	\$4.7	\$4.2	\$8.7	\$13.6
Agriculture	...	\$12.3	\$11.6	...	...	...
Industry	\$14.0	\$32.0	\$1.1	\$1.5	\$1.5	\$1.3
Sub-Total Land	\$21.9	\$49.1	\$17.4	\$5.7	\$10.2	\$14.9
ENERGY						
Community	...	...	...	...	...	...
Agriculture	...	...	...	...	...	...
Industry	...	\$7.1	\$0.1	...	\$0.8	\$0.1
Sub-Total Energy	\$0.0	\$7.1	\$0.1	\$0.0	\$0.8	\$0.1
ENVIRONMENT SERVICES						
Community	...	\$0.3	\$0.03	\$5.9	\$4.2	\$7.7
Agriculture	...	...	...	...	...	...
Industry	\$3.2	\$4.9	\$3.1	\$3.0	\$1.3	\$0.6
Sub-Total Environ't Services	\$3.2	\$5.2	\$3.1	\$8.9	\$5.5	\$8.4
Total Community	\$24.0	\$88.3	\$176.7	\$20.1	\$34.6	\$68.1
Total Agriculture	\$5.1	\$19.5	\$36.7	\$0.9	\$1.5	\$1.9
Total Industry	\$62.0	\$109.1	\$47.5	\$7.8	\$5.7	\$3.5
TOTAL	\$91.1	\$216.9	\$260.9	\$28.8	\$41.8	\$73.5

Source: TRC estimates, BERL

In total, the Taranaki region spent in total \$260.9 million in capital investment and \$73.5 million per annum in annual operating costs over the period 2008-2014. By comparison, the preceding five year period saw a total of \$216.9 million capital investment and \$41.8 million per annum in annual operating costs.

The pattern of investment in the environment changed dramatically in the last period from 2008 to 2014. Total investment by the community organisations doubled from \$88 million to \$176 million. This was an increase from 40 percent of the region's total capital investment to 68 percent. The

dominant part of this was an investment of \$170 million in surface water. This investment alone accounted for 65 percent of the region's total investment in the environment.

In contrast, the Industry sector had been the largest investor in the two previous periods, having contributed more than half of the Region's total investment in each period. In the period under review from 2008 to 2014, the industry sector has been able to benefit from this earlier investment and reduce its investment to \$47.5 million from the \$109 million in the previous period.

The agriculture sector again increased investment especially in surface water, as it fulfils the aims of the Clean Streams Accord and other objectives.

The capital cost figure of \$260.9 million for the period 2008-2014 shown in Table 6.1 is the total investment by the different sectors over the 6 year period. This equates to an average annual capital expenditure of \$43.5 million for all sectors, which happens to be exactly the same as the annual figure in the 2002-2007 period. Adding to this figure the annual operating cost of \$73.5 from Table 6.1 gives an estimate of the total spending on the environment per annum.

Total spending on the environment per annum by the Taranaki community over the period 2008 to 2014 is therefore conservatively estimated at \$117 million per annum. This compares to a figure of \$85 million for the 2002-2007 period and \$47 million per annum for the 1997-2002 period.

