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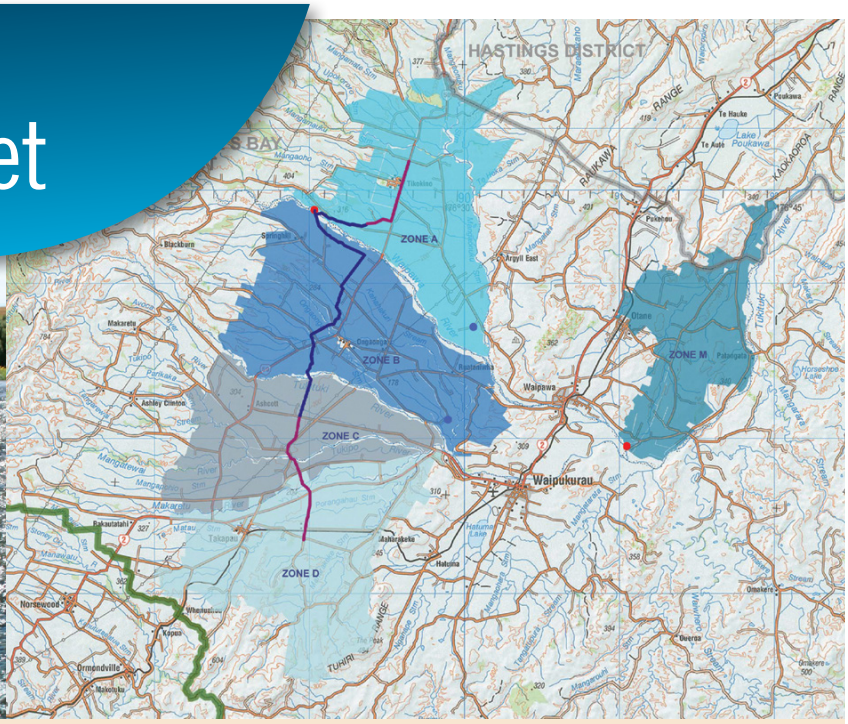

Ruataniwha Water Storage Scheme Overview

The Project

The Ruataniwha Water Storage Scheme (RWSS) is a long-term sustainable water supply solution for Central Hawke's Bay. It is part of a wider programme to better manage water resources in the Tukituki Catchment.

The scheme consists of a 90 million m³ storage reservoir located in the upper Makaroro river, storing water during periods of high flow and over winter. Water can then be released to improve river flows during summer for aquatic life and other river users, while at the same time providing secure water to irrigators. The scheme will be funded by both the public and private sector.

The Need

Hawke's Bay's agricultural advantage lies in its temperate climate, availability of productive land, and potentially abundant water supplies. However, the geography of the region is such that Hawke's Bay is prone to drought. The region experienced four consecutive years of drought from 2006 to 2009, with significant negative economic impacts. Coupled with this, current water allocation exceeds the limits. Consequently, the future is uncertain for consent holders. No new consents have been granted since 2007.

Increased Farm Productivity & Resilience

Farm productivity improves with a reliable water supply, resulting in wider economic benefits for Hawke's Bay. An on-farm feasibility study undertaken by Macfarlane Rural Business concluded that the scheme will enable land use intensification and conversions for a variety of farm types, resulting in more productive and resilient farms in the Ruataniwha Plains. In particular, sheep & beef, arable & process vegetable, dairy, and mixed arable farms with dairy support would benefit from reliable water. It is estimated that the scheme could irrigate 20-30,000ha of farmland, depending on the make-up of farm types.

Environmental Benefits

The use and protection of the Tukituki River has long been a topic of debate in Hawke's Bay.

Since 2008, Hawke's Bay Regional Council has been working on a range of plans and actions in the catchment to provide positive environmental, social, cultural and economic outcomes for the region, now and into the future.

A combination of water storage and higher minimum flows set by HBRC will release the potential for the Lower Tukituki River to be returned to more natural flows in summer, especially if current irrigators can be moved to storage.

A significant amount of work has gone into a wide range of investigations assessing the possibility of large-scale water storage in the Ruataniwha basin. The scheme, coupled with the Proposed Tukituki Plan Change provisions aims to improve water security for farmers, unlock economic potential for Hawke's Bay and improve water quality and quantity in the Tukituki River.

Fast Facts

Dam type:
Concrete-faced rock fill dam

Dam height:
83 metres

Reservoir length:
7 kilometres

Storage volume:
90 million cubic metres

Surface Area:
372 hectares

Irrigation footprint:
20,000 to 30,000 hectares

Area of influence:
Productivity increased for approx 42,000 hectares

Potential electricity generation:
6.5 megawatts

Estimated regional economic benefit:

- 4% GDP increase
- 3.5% increase in employment
- Improved resilience to drought

Estimated cost:
$265 million

RUATANIWHA Water Storage

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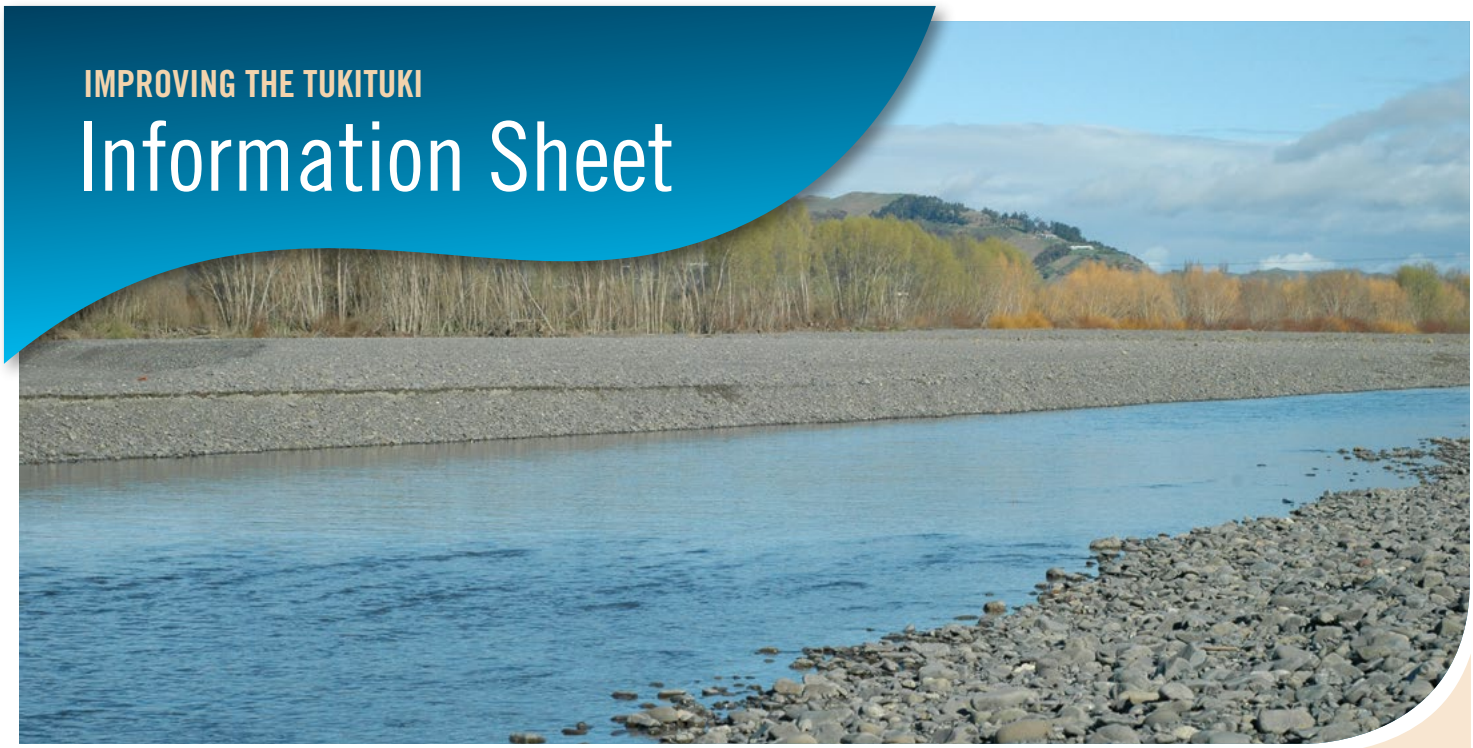

1.0 Improving Summer Flows

The use and protection of the Tukituki River has long been a topic of debate.

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Improving summer flows

During the last five years Hawke's Bay Regional Council has invested significant time and money to better understand the quality and quantity of the water that flows down the Tukituki River.

Research shows raising the flows in the Tukituki River would have a negative impact on current irrigators, which is why HBRC began looking at water storage. The concept is simple - store winter water to use in the dry summer months, taking the pressure off the Tukituki River.

This research has shown ongoing droughts, drawing of water for irrigation and wastewater discharges have all affected the river. This also highlighted the need to look into new options for water management

What's driving the need to increase minimum flows?

The need to increase the minimum flows in the Tukituki River is driven by a number of factors.

- Current minimum flows are not adequate to protect fish habitat;
- A commitment to review the way we set minimum flows was made following appeals on the Regional Resource Management Plan in 2006;
- The Hawke's Bay community, including environmental interest groups, has expressed continuing concern since 2008 at low flows and water quality in the Tukituki River;
- The National Policy Statement on Freshwater Management requires councils to set water quality and quantity limits.

There are several advantages to having more water flow down the Tukituki River:

- A more attractive river to swim and fish in
- Maintenance and enhancement of the mauri of the river
- More water for the fish to swim in and more room to grow

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2.0 Managing Slime and Algae

The use and protection of the Tukituki River has long been a topic of debate.

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A significant amount of work has gone into a wide range of investigations assessing the possibility of large-scale water storage in the Ruataniwha basin.

The Ruataniwha Water Storage Scheme (RWS), coupled with the Proposed Tukituki Plan Change provisions aims to improve water security for farmers, unlock economic potential for Hawke's Bay and improve water quality and quantity in the Tukituki River.

Less slime and algae caused by Phosphorus

The Tukituki River is different to others around the country because phosphorus is the main cause of the slime and algae seen in the river.

Our research has shown if the amount of phosphorus in the river is reduced, it will limit the ability for slime and algae to grow. This will give us a more attractive river for swimming, fishing and other recreational activities.

We could manage nitrogen to reduce algae and slime, but it would be more costly and take a lot longer.

Other factors causing the slime and algae include the amount of light reaching the streambed, what the bed of the river is like, and the frequency of floods in the river.

Ways to reduce phosphorus in the river:

Stock exclusion rule

- Keeping stock out of the water. New stock exclusion rules will reduce the amount of sediment, bacteria and pathogens entering the water.
- Fonterra also requires stock exclusion from waterways as part of its milk supply agreements

Waipukurau and Waipawa oxidation pond discharges

- A significant reduction in in-river phosphorus will be achieved when these discharges meet the requirements of the current consent, by September 2014.

Farm management plans

- Environmental Farm Plans will be required for all farmers that are signed up to the RWS. This will help farmers to identify and minimise areas of risk for their farm and farming system.
- Any other farmers who intensify farm use will also require farm management plans.

Targetting hot spots

- Through working with farmers and the community in hotspot catchments to identify sources of phosphorus and finding ways to deal with it. HBRC will also be focusing financial incentives in these areas.

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3.0 Nitrogen Management

The use and protection of the Tukituki River has long been a topic of debate.

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Limit effects on aquatic life, by managing Nitrates

Nitrogen is a nutrient that 'leaks' out of all land and often ends up in nearby water bodies. It is usually associated with farming activities but will come from any land, including land that is covered in native forest.

In some parts of New Zealand Regional Councils are looking at using Nitrogen limits to manage the growth of periphyton (slime and algae) in rivers. Over many years the HBRC has conducted investigations and research in the Tukituki. This work tells us that we can control the growth of slime and algae through active management of Phosphorous (see information sheet 2.0).

This is for two reasons:

- Given the specific characteristics of the catchment, it would take a very long time to effectively control peripyhton by limiting Nitrogen. If this method was used, much of the current land use would have to cease and large areas of the catchment would have to be turned into forest. There would be significant adverse economic impacts for individual farmers and the region;
- Managing slime and algae can instead be achieved by limiting Phosphorous through a range of rules and incentives.

However, the setting of limits for a Nitrogen component called "nitrate" is proposed for the Tukituki Catchment.

High levels of the nitrate component of nitrogen in the water can affect the ability of living things in the water, such as fish and insects to grow. So it is important to carefully manage the amount of nitrate leaking out of the land and going into nearby waterbodies.

In late 2011 Hawke's Bay Regional Council asked NIWA to look at what are the maximum level of nitrate in the water that need to be set to protect the important species living in the Tukituki River, like Inanga, insects and trout. This is the first time any Regional Council has looked specifically at what the right levels should be for our native New Zealand species. This information has been used to develop a specific risk management framework for the Tukituki. This framework is a very conservative approach to managing nitrate because it includes very sensitive species that do not occur in the Tukituki or New Zealand.

This research is also being used for limit setting in many other regions and is being incorporated into the revised ANZECC (Australian and New Zealand Guidelines for Fresh and Marine Water Quality) guidelines.

In the Tukituki we are fortunate that our nitrate levels in the water are far lower than NIWA say the maximum limits need to be. This means we can safely add more nitrate to the water without affecting any of the important species living in river. The rules and policies we are proposing for the Tukituki will allow more nitrates to go into the water but will control the levels to ensure we do not breach the limits. This will ensure the protection of our important species.

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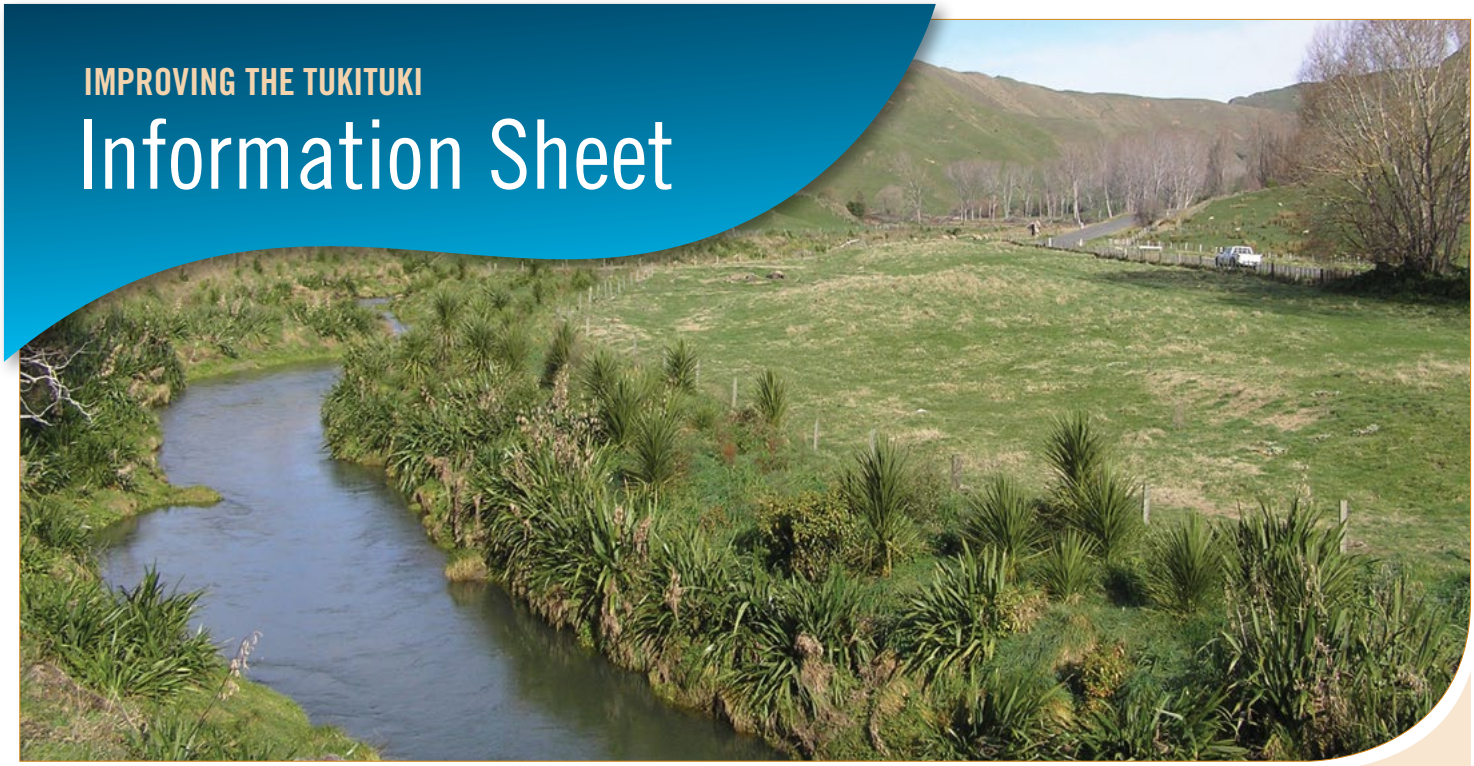

4.0 Improving Habitat

The use and protection of the Tukituki River has long been a topic of debate.

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Improve river health and habitat - with planting and riverside fencing

Stream side (riparian) planting has a wide range of benefits for the species that live in the rivers and on land. In-stream benefits come from the reduction of contaminants and sediment to rivers.

As well as reducing phosphorus and bacteria coming into the river, planting along riverbanks has a range of benefits for river habitat and the aquatic life that lives there.

Some of our native fish (eels and kokopu) like to hang out under the vegetation which overhangs the stream banks where it is shady and cool. Planting by streams and rivers provides shade, thus keeping the water from getting too hot in summer. Shade and lower temperatures also reduce algal growth and maintain oxygen levels to sustain life in the stream. This is not only good for fish but all life in the water.

Other native fish (bullies and some galaxiids) like to live under the gravels and cobbles in the stream. Riparian planting holds back sediment which otherwise smothers this critical stream habitat and makes the water murky. Roots, branches and leaves in the water provide more habitat and food for the stream invertebrates and are a big factor for ecosystem health and aquatic life.

Stream side planting also has benefits for the species on land. Spiders are able to spin webs in the vegetation to catch flies hatching from the rivers. This has implications as it provides food for birds and other animals further up the food chain, aiding land based biodiversity.

It is likely riparian planting will be encouraged as part of farm management planning.

A $7million mitigation package will be included with the Ruataniwha Water Storage resource consent application, with a key focus on riparian planting and other biodiversity benefits.

Fencing in tandem with planting along river and stream banks not only excludes stock but improves stream habitat.

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5.0 Socio-economic Impact

The use and protection of the Tukituki River has long been a topic of debate.

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Improve the region's employment, wealth and economic wellbeing

The Ruataniwha Water Storage Scheme (RWS) has potential to deliver significant environmental, economic and social benefits for Hawke's Bay. It would provide reliable irrigation water to approximately 25,000 hectares of land, create new job opportunities and give a real boost to the region's economy, especially in Central Hawke's Bay. It is estimated:

- The scheme's construction period is expected to require four thousand job years of work.
- The scheme has the potential to create 2,250 jobs through increased farming activity and its flow-on impacts
- Boost GDP by approximately $235 million a year by full water uptake
- Provide farmers, orchardists and viticulturalists with the water security they need for their operations
- Provide food processors the certainty of supply they require to maintain and grow their businesses
- Such a large project would also fulfil the business community's desire for more inwards investment.

We believe the RWS Scheme has real potential to provide a range of positive results for Hawke's Bay in the next 10 to 15 years; in particular it would drive renewed growth in Central Hawke's Bay.

Over time it is expected the community profile and farm ownership will change. New families will come into the area leading to a subsequent rise in school rolls. There's likely to be great demand on social services and increased participation in sport and recreation.

Hastings District Council and Central Hawke's Bay District Council are considering a social management plan to ensure that community needs, both existing and new, are catered for. This may include migrant assistance programmes for families moving to the region due to extra jobs being created and improved roading infrastructure to cater for the expected increase in rural productivity.

Business Hawke's Bay is coordinating business attraction and growth opportunities. Along with iwi and other groups they are coordinating labour market development initiatives to fill the expected demand for certain skills

The future without water storage

Without the Ruantaniwha Water Storage Scheme to meet the improved environmental parameters in the proposed Tukituki Plan Change there would have to be a reduction in farming in Central Hawke's Bay.

For example to improve the river flows water consent holders would be facing less secure water for irrigation, in turn offering less certainty of supply for processors, therefore potentially affecting future employment opportunities in the region.

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6.0 Existing Irrigators

Irrigation in Ruataniwha Plains

The Ruataniwha Plains benefits from accessible surface and aquifer water resources. There are around 150 consents to irrigate within the boundaries of the command zone of the Ruataniwha Water Storage Scheme, irrigating approximately 6,000ha of farmland. Water allocation currently exceeds limits in the Regional Resource Management Plan and the security of supply is low. No new consents have been granted since 2007, and future long term renewals for water consents remain uncertain.

Tukituki Plan Change:

HBRC is currently updating the Regional Resource Management Plan to implement the Government's National Policy Statement for Freshwater Management. The proposed Tukituki Plan Change is HBRC's first amendment and amongst other changes includes:

- Raising the current minimum flow levels in the Waipawa and Tukituki Rivers to enable a healthier ecosystem. This will affect the reliability of stream depleters with greater probability of water reductions and for potentially longer periods
- Setting revised water allocation limits and new measuring and reporting requirements. This will affect both stream depleters and groundwater abstraction.

The following table summarises the current and proposed changes in reliability and allocation for each consent. For example, in the Upper Tukituki, farmers currently have restrictions 1 in every 3 years.

Plan	Allocation conditions
Current Plan	Rate of take and maximum weekly allocation
Tukituki Plan Change	Rate of take, monthly, and seasonal allocation

Water Consents

Water consents fall into three different categories:

- Surface water takes - these are takes directly from rivers and streams, directly affecting river flows
- Shallow groundwater abstraction - shallow groundwater wells that also directly impact upon surface water resources. Abstraction from these wells have a similar influence on river flows as surface water takes
- Deep groundwater abstraction - deep groundwater wells that also impact upon surface water resources, but do not have an immediate impact on river flows. Rather, there is a lag between when groundwater abstraction occurs, and the influence this has on river flows.

From a water resource management perspective, surface water takes and groundwater abstraction are treated the same and are referred to as stream depleters.

Consent Area		Stream Depleters	Deep Groundwater
Upper Tukituki	Current Reliability	1 in 3 years	Not subject to minimum flows
	Tukituki Plan Change	1 in 2 years	
Waipawa	Current Reliability	1 in 3 years	
	Tukituki Plan Change	1 in 2 years	
Lower Tukituki	Current Reliability	1 in 13 years	
	Tukituki Plan Change (for irrigators below the Red Bridge flow management site)	1 in 7.8 years	
	Tukituki Plan Change (for irrigators above the Red Bridge flow management site)	1 in 3 years	

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7.0 Draft Tukituki Plan Change

Through the draft Tukituki Plan Change the Hawke's Bay Regional Council has some key approaches for improving water quality and quantity in the Tukituki River.

HBRC staff are working on the provisions and aim to present the final Tukituki Plan Change for adoption at Council's meeting on 30 January 2013. The plan change will then be ready for notification and the formal submission process.

What does the Tukituki Plan Change do?

The draft Tukituki Plan Change sets out the environmental bottom lines for all activities in the catchment – taking water, discharging to water and land, and now the use of the land. Diffuse discharges from farmed land must also be measured against the in-stream water quality limits.

Excessive growth of algae and slime is the biggest freshwater quality issue in the Tukituki catchment. Science investigations confirm that reducing the phosphorus load in the catchment will deliver the biggest and quickest gains for environmental improvement (see Information Sheet 2.0).

- A significant reduction in in-river phosphorus will be achieved when the discharges from Waipawa and Waipukurau oxidation ponds meet requirements of the current consent, by September 2014.
- The draft plan change includes rules for keeping stock out of the water. This will help reduce algae growth by reducing the amount of phosphorus attached to the soil entering the water. Keeping stock out of the water will also improve stream banks and habitats for native fish and trout.
- The draft plan change proposes increases in minimum flow limits to protect fish habitats. This means some consent holders will need to stop taking water earlier than they currently do.

HBRC recognises that this reduces the reliability of the water supply and so, in parallel, has been investigating harvesting and storage of higher river flows to provide an alternative supply. This plan change and the Ruataniwha Water Storage project are part of the strategic approach to managing the Tukituki catchment.

HBRC also acknowledges that time is essential for these changes to come into force, so the minimum flow restrictions will not take effect until 2018, and stock exclusion until 2017.

Farm Management Plans

The primary production sector is working with HBRC to develop industry good practice guidelines for nutrient, sediment and effluent management. The rules are designed to incentivise farmer to stay in or move into the 'permitted activity' status.

Other areas of the country are also experiencing the impact of plans that set water quality limits as required by the National Policy Statement for Freshwater Management.

The process going forward

HBRC's investment company, Hawke's Bay Regional Investment Company Ltd (HBRIC Ltd) will be lodging the applications for the Ruataniwha water storage project, with a request to 'call in' the proposed plan change to the Environment Protection Authority (EPA) to enable an independent and integrated decision making process to occur through a single Board of Inquiry.

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8.0 Managing the Growth of Blue-Green Algae

The use and protection of the Tukituki River has long been a topic of debate

Hawke's Bay Regional Council has been working on a range of plans for the catchment to provide positive environmental, social, cultural and economic outcomes for the region. A significant amount of work has been done to assess the possibility of large-scale water storage in the Ruataniwha basin.

Water storage, combined with higher minimum flows (set by HBRC) will allow the river to be returned to more natural flows during summer - especially if current irrigators can be moved to storage.

The Ruataniwha Water Scheme (RWSS), coupled with provisions in the proposed Tukituki Plan Change, aims to improve water security for farmers, unlock economic potential for Hawke's Bay and improve water quality and quantity.

Reducing algae and slime

A key water quality issue - particularly in the lower reaches of the Tukituki River - is excessive slime and algae growth, also known as peryphiton. Evidence is clear that reducing phosphorus in the river system will reduce peryphiton. However, there is debate around the relative effects of decreasing phosphorus concentrations at the same time as maintaining or increasing the concentration of nitrogen, and how this might create conditions that favour undesirable algal species, such as Phormidium.

Phormidium mats observed in the Tukituki River are generally very thin and total cover is generally low. Despite this, detached mats are occasionally visible along the river margins.

National Cyanobacterial Recreational Guidelines state that alert levels should be triggered when mats break free and accumulate on the riverside. There may be risks to water users who ingest water containing detached mats or come into direct contact with them. These risks would increase if more mats were present.

The frequency and intensity of flushing flows, caused by significant rainfall events, are key factors influencing Phormidium occurrence. The proposed nutrient management for Tukituki River is unlikely to increase the risk of mats, where proposed flushing flows will remove them before they pose a significant risk.

The incidence of Phormidium does not generally appear to be a major problem in the Tukituki catchment, as it sits well below the draft guideline lower trigger (surveillance) of 20% cover.

There is no relationship between the proportion of bed covered by Phormidium mats and the incidence or concentration of toxins. Cawthron research indicates that it is probably normal to have some Phormidium in all rivers in New Zealand.

The key known drivers of Phormidium growth are:

- flow stability - long accrual period, absence of flushing flow
- substrate size - stability
- velocity (point velocity)

Flushing flows as a management tool

The RWSS offers the potential to release artificial flushing flows to manage Phormidium in the Tukituki River. Up to 40 m^3/s could be released with water storage at full supply level, and up to about 20 m^3/s at lower levels. The release of these flows could be timed to coincide with natural small rainfall events for maximum effect.

Even moderate-size flushing flows could substantially enhance public health risk by removing deposited material, detaching mats, and reducing the potential for subsequent deposits.

The effect of these artificial flushing flows is currently speculative. It is difficult to predict the proportion of Phormidium mats that might be removed. The relationship between flow and mat detachment will be site-specific and has not been established in the Tukituki River. Flushing flows will probably remove a proportion of the biomass, but complete removal of firmly attached mats may not occur.

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9.0 Our Goals for the Tukituki River catchment

What we're striving to achieve in the Tukituki River Catchment

As Hawke's Bay Regional Council develops a plan to set environmental bottom lines for the Tukituki Catchment, other regions around the country are doing the same. Our closest southern neighbour, Horizons Regional Council has developed the One Plan. Some farms in Central Hawke's Bay will be covered by the One Plan, while others just up the road will be managed by Tukituki Plan Change 6.

Both have the same core goals of improving water quality and reducing slime growth, but have taken a different approach to achieving that. The table below gives a good overview of the differences in the two plans.

	What do we want to do?							
Plan	**Control slime in the river**	**Set general water quality limits**	**Set phosphorus limits instream**	**Set dissolved inorganic nitrogen limits instream**	**Set nitrate limits instream**	**Require nutrient budgets**	**Have rules for stock exclusion**	**Set leaching imits for N from the land**
TTPC6	Yes	Yes	Yes, for slime control	No, only for upper catchment	Yes	Yes from 2018	Yes	No
OnePlan	Yes	Yes	Yes, along with DIN for slime control	Yes, along with DRP for slime control	No	Yes for intensive land uses	Yes	Yes - based on LUC units

So what are the key differences between the two plans?

While HBRC and HRC both look to set limits for phosphorus, the management of nitrogen is where they differ.

The One Plan sets limits on the amount of nitrogen that can be leached by intensive land uses, while Tukituki Plan Change 6 does not. The One Plan nitrogen leaching limits are based on the land use capability (or LUC) of each individual farm.

Tukituki Plan Change 6 recognises that in-river nitrate-nitrogen levels are generally within proposed limits and:

- Requires the preparation of nutrient budgets
- Provides time for primary industry to develop and implement good practices, including good practice leaching rates
- Seeks to manage more than minor increases nitrogen losses through a resource consent process
- If exceedances of the in-stream and groundwater nitrogen limits occur, a consent is required for all production land contributing to the exceedance.

Our Goals for the Tukituki catchment

Reduced Phosphorus Levels
Phosphorus is a key contributor to slime and algae growth. Reduced Phosphorus levels will slow down this growth.

Stock Crossings
Stock pollute the stream when they walk through it. Farmers will need to bridge or culvert stream crossings on regularly-used stock races.

Keep Stock from River Edge
Managing stock through temporary or permanent fencing or other means to prevent stock from damaging river banks and polluting the river.

Improved Wastewater Treatment
After September 2014, CHB wastewater discharge will have to be a far higher quality.

Nitrogen Management
Nitrogen levels will be managed to protect fish and other aquatic life.

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10.0 Targeting Phosphorus Priority Catchments

What is a phosphorus priority catchment?

A priority catchment is an area where the in-stream concentration of dissolved reactive phosphorus (DRP) is greater than the target level. These catchments are significant contributors of phosphorus in the Tukituki River, outside of existing point sources such as the Waipawa and Waipukurau sewage schemes. The map above shows the priority sub-catchments in red.

What causes them?

There are a number of contributing sources and, to some degree, each sub-catchment is different. However, farming is a significant contributor through stock contamination of waterways, soil erosion and inappropriate fertiliser use.

Why is phosphorus a problem?

High levels of phosphorus is one of the main causes of excessive slime and algae within the main stem of the Tukituki River *(see Information Sheet 2.0 - Managing Slime and Algae)*.

What can we do about it?

The first step is to identify phosphorus sources in each sub-catchment. This will ensure that any action taken to reduce phosphorus levels is targeted and cost-effective.

As these investigations continue, HBRC will be working with the community (including local landowners, iwi, and primary sector industries) to find the best way of addressing the specific water quality issues of each sub-catchment. Work will begin in Papanui.

Under the proposed Tukituki Plan Change 6, every landowner with holdings greater than four hectares within a priority sub-catchment will be required to implement a phosphorus management plan.

The HBRC land management team will provide assistance to farmers in these areas though a series of field days and workshops. They will also be working with primary industry groups to help land owners develop their individual plans.

For further information call **Warwick Hesketh** or **Kate McKinnon** at HBRC's Waipawa office on **(06) 857 8060** or email **warwick@hbrc.govt.nz** or **kate@hbrc.govt.nz**

RUATANIWHA Water Storage

HAWKE'S BAY REGIONAL INVESTMENT COMPANY LTD

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of part-irrigated mixed livestock and arable farms to irrigated arable and process vegetable farm system

Livestock and Arable Conversion to Irrigated Arable and Process Vegetables

Indicative annual farm budget for mixed livestock and arable and irrigated arable and process vegetable farms

	Part-irrigated livestock & arable ($/ha/year)	Irrigated arable & process vegetables ($/ha/year)
Income - stock		
Sheep sales	1,999	2,364
Cattle sales	861	-
Wool sales	107	61
Income - produce		
Barley	257	-
Feed wheat	-	846
Squash	-	945
Potatoes	-	1,287
Peas	225	589
Beans	-	929
Maize grain	-	1,013
Italian ryegrass	-	612
Miscellaneous	324	530
Total income	**3,773**	**9,175**
Less stock purchases:		
Sheep	1,205	1,820
Cattle	545	-
Total stock purchases	**1,750**	**1,820**
Gross farm income	**2,023**	**7,355**
Less farm expenses:		
Wages (incl. management)	425	506
Fertiliser and lime	250	707
Seeds and treatment	0	596
Weed and pest control	0	682
Other expenses	785	1,793
Total farm expenses	**1,460**	**4,284**
Water charge (@ 25c/m^3)	-	786
Depreciation	83	407
Annual farm surplus	**398**	**1,878**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	389
Annual farm surplus (post finance)	**398**	**1,490**

Farm model assumptions

Mixed livestock & arable farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is comprised of dryland lamb breeding, lamb and bull finishing, dairy cow wintering, and 50 ha of irrigated crops and pasture. Crops grown include spring barley (7 tonne/ha yield, $440/tonne sale price) and peas (7 tonne/ha, $400/tonne), and rape winter feed, on a 12 year rotation. Dryland pasture production is 8 tonne/ha gross, while irrigated pasture is 12.9 tonne/ha gross.

Irrigated arable and process vegetables farming systems are based on a 300 ha farm, also modelled using FARMAX. The intensive farming system is 90% irrigated, and comprised of 270 ha of crop and process vegetable produce production on a five year rotation cycle, and 30 ha of dry lucerne. Produce grown includes wheat (10 tonne/ha, $470/tonne), squash (15 tonne/ha, $700/tonne), potatoes (65 tonne/ha, $220/tonne), peas (8.5 tonne/ha, $400/tonne), beans (12 tonne/ha, $430/tonne), maize grain (12.5 tonne/ha, $450/tonne), and ryegrass seed (2 tonne/ha, $1,700 tonne). Ryegrass straw and lucerne balage is sold. The system also includes intensive lamb finishing, with irrigated pasture production of 12.9 tonne/ha gross.

Other assumptions include:

- Weaner bull - $3.90/kg • Manufacturing beef - $4.25/kg
- Store bull beef - $1.90/kg • Store lamb - $2.70/kg • Lamb - $6.00/kg
- Wool - $4.00/kg • Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 3,492 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	2,689
On farm pumping	172
Associated costs	550
Plant and equipment	1,482
Working capital	1,766
Other costs (savings)	(492)
Total conversion investment	**6,167**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	*5,550
Annual increase in farm surplus	1,480
Annual return on conversion investment	**27%**

*Equivalent cost per ha for 300 ha farm with 270 ha of irrigation

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 5a and 5b)

Detailed budgets can found in appendices to Ruataniwha Water Storage Project – Review of Farm Profitability, 28 August 2012, Macfarlane Rural Business. Available at **www.hbrc.govt.nz**

RUATANIWHA Water Storage

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of part-irrigated mixed livestock and arable farms to irrigated dairy on light soils

Livestock and Arable Conversion to Irrigated Dairy (light soils)

Indicative annual farm budget for mixed livestock and arable and irrigated dairy (light soils) farms

	Part-irrigated livestock & arable ($/ha/year)	Irrigated dairy (light soils) ($/ha/year)
Income - stock		
Sheep sales	1,999	-
Cattle sales	861	458
Wool sales	107	-
Milk	-	10,767
Income - produce		
Barley	257	-
Peas	225	-
Miscellaneous	324	-
Total income	**3,773**	**11,225**
Less stock purchases:		
Sheep	1,205	-
Cattle	545	84
Total stock purchases	**1,750**	**84**
Gross farm income	**2,023**	**11,140**
Less farm expenses:		
Wages (incl. management)	425	1,330
Fertiliser and lime	250	502
Stockfeed purchased	-	2,270
Other expenses	785	1,932
Total farm expenses	**1,460**	**6,034**
Water charge (@ 25c/m^3)	-	1,090
Depreciation	165	287
Annual farm surplus	**398**	**3,730**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	1,975
Annual farm surplus (post finance)	**398**	**1,755**

Farm model assumptions

Mixed livestock and arable farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is comprised of dryland lamb breeding, lamb and bull finishing, dairy cow wintering, and 50 ha of irrigated crops and pasture. Crops grown include spring barley (7 tonne/ha yield, $440/tonne sale price) and peas (7 tonne/ha, $400/tonne), and rape winter feed, on a 12 year rotation. Dryland pasture production is 8 tonne/ha gross, while irrigated pasture is 12.9 tonne/ha gross.

Irrigated dairy (on light soil) farming systems are based on a fully irrigated 300 ha farm modelled using Udder. The farming system comprises of dairy milking (including winter milking) and cattle breeding. The farms are estimated to have 3.7 cows/ha and produce 17.5 tonne/ha of gross pasture (14 tonne/ha consumed), resulting in annual milk production of 1627 kg milk solids/ha.

Other assumptions include:

- Milk price - $6.50/kg milk solids • Weaner bull - $3.90/kg
- Manufacturing beef - $4.25/kg • Store bull beef - $1.90/kg
- Store lamb - $2.70/kg • Lamb - $6.00/kg • Wool - $4.00/kg
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 4,360 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	2,847
On farm pumping	173
Associated costs	367
Livestock	5,479
Fonterra shares ($7.00 / share)	11,389
Dairy shed	3,667
Plant and equipment	1,534
Other costs (savings)	2,764
Total conversion investment	**28,220**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	28,220
Annual increase in farm surplus	3,332
Annual return on conversion investment	**12%**

Dairy payment ($/Kg MS)	$6.00	$6.50	$7.00	$7.50	$8.00
Annual return on conversion investment	**9%**	**12%**	**15%**	**18%**	**20%**

RUATANIWHA Water Storage

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of part-irrigated mixed livestock and arable farms to irrigated mixed arable and dairy support farm system

Livestock & Arable Converted to Mixed Arable & Dairy Support

Indicative annual farm budget for mixed livestock and arable and mixed arable and dairy support farms

	Part-irrigated livestock & arable ($/ha/year)	Irrigated mixed arable & dairy support ($/ha/year)
Income - stock		
Sheep sales	1,999	-
Cattle sales	861	-
Wool sales	107	-
Dairy heifer grazing	-	1,011
Income - produce		
Barley	257	528
Peas	225	436
Maize grain	-	616
Miscellaneous	324	867
Total income	**3,772**	**3,458**
Less stock purchases:		
Sheep	1,205	-
Cattle	545	-
Total stock purchases	**1,750**	**-**
Gross farm income	**2,022**	**3,458**
Less farm expenses:		
Wages (incl. management)	425	400
Fertiliser and lime	250	375
Seeds and treatment	0	199
Weed and pest control	0	141
Feed conservation	101	231
Other expenses	684	556
Total farm expenses	**1,460**	**1,902**
Water charge (@ 25c/m^3)	-	798
Depreciation	165	258
Annual farm surplus	**397**	**500**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	122
Annual farm surplus (post finance)	**397**	**378**

Farm model assumptions

Mixed livestock and arable farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is comprised of dryland lamb breeding, lamb and bull finishing, dairy cow wintering, and 50 ha of irrigated crops and pasture. Crops grown include spring barley (7 tonne/ha yield, $440/tonne sale price) and peas (7 tonne/ha, $400/tonne), and rape winter feed, on a 12 year rotation. Dryland pasture production is 8 tonne/ha gross, while irrigated pasture is 12.9 tonne/ha gross.

Mixed arable & dairy support farming systems are based on a 300 ha farm, also modelled using FARMAX. The intensive farming system is 80% irrigated, comprising of 120 ha of irrigated crops on an eight year rotation cycle, and 60 ha of dry lucerne. The system has extensive dairy support, including dairy cow wintering and dairy heifer grazing. Crops grown includes Barley (8 tonne/ha, $440/tonne), vining peas (7 tonne/ha, $400/tonne), and maize silage (19 tonne/ha, $210/tonne). Some barley straw and lucerne balage is sold. Irrigated pasture production is 11.9 tonne/ha gross.

Other assumptions include:

- Weaner bull - $3.90/kg • Manufacturing beef - $4.25/kg
- Store bull beef - $1.90/kg • Store lamb - $2.70/kg
- Lamb - $6.00/kg • Wool - $4.00/kg • Dairy heifer grazing $9/hd/week
- Winter grazing $23/hd/week
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 3,988 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	2491
On farm pumping	144
Associated costs	771
Other costs (savings)	(1,225)
Total conversion investment	**2181**

Financial summary for investment in farm intensification

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	*1,745
Annual increase in farm surplus	103
Annual return on conversion investment	**6%**

*Equivalent cost per ha for 300 ha farm with 240 ha of irrigation

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 5a and 4b)

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of part-irrigated mixed livestock and arable farms to an orchard

Livestock and Arable Conversion to Orchard

Indicative annual farm budget for mixed livestock and arable farms and orchards

	Part-irrigated livestock & arable ($/ha/year)	Irrigated orchard ($/ha/year)
Income - stock		
Sheep sales	1,999	-
Cattle sales	861	-
Wool sales	107	-
Income - produce		
Pacific Rose / Fuji apples	-	57,200
Barley	257	-
Peas	225	-
Miscellaneous	324	-
Total income	**3,772**	**57,200**
Less stock purchases:		
Sheep	1,205	-
Cattle	545	-
Total stock purchases	**1,750**	**-**
Gross farm income	**2,022**	**57,200**
Less farm expenses:		
Wages (incl. management)	425	3,400
Fertiliser and lime	250	400
Cartage	20	22,594
Weed and pest control	69	2,700
Contracting	48	10,960
Other expenses	648	4,500
Total farm expenses	**1,460**	**44,554**
Water charge (@ 25c/m^3)	-	625
Depreciation	165	1,600
Annual farm surplus	**397**	**10,421**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	7,203
Annual farm surplus (post finance)	**397**	**3,218**

Farm model assumptions

Mixed livestock and arable farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is comprised of dryland lamb breeding, lamb and bull finishing, dairy cow wintering, and 50 ha of irrigated crops and pasture. Crops grown include spring barley (7 tonne/ha yield, $440/tonne sale price) and peas (7 tonne/ha, $400/tonne), and rape winter feed, on a 12 year rotation. Dryland pasture production is 8 tonne/ha gross, while irrigated pasture is 12.9 tonne/ha gross.

Orchards are based on a fully irrigated 50 ha apple orchard. Apple varieties grown include Fuji, Pacific Rose, and Pacific Queen, yielding 2,200 packed tce/ha.

Other assumptions include:

- Apples - $26/tce • Weaner bull - $3.90/kg
- Manufacturing beef - $4.25/kg • Store bull beef - $1.90/kg
- Store lamb - $2.70/kg • Lamb - $6.00/kg • Wool - $4.00/kg
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 2,500 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	12,277
On farm pumping	166
Trees and structures	30,400
Working capital	32,653
Frost protection	12,500
Plant and equipment	7,667
Buildings	5,000
Other costs (savings)	2,234
Total conversion investment	**102,897**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	102,897
Annual increase in farm surplus	10,024
Annual return on conversion investment	**10%**

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 5a and 8b)

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of part-irrigated mixed livestock and arable farms to a vineyard

Livestock and Arable Conversion to Vineyard

Indicative annual farm budget for mixed livestock and arable farm and vineyard

	Part-irrigated livestock & arable ($/ha/year)	Irrigated vineyard ($/ha/year)
Income - stock		
Sheep sales	1,999	-
Cattle sales	861	-
Wool sales	107	-
Income - produce		
White grape varieties	-	14,438
Pinot Noir grape	-	2,600
Barley	257	-
Peas	225	-
Miscellaneous	324	-
Total income	**3,772**	**17,038**
Less stock purchases:		
Sheep	1,205	-
Cattle	545	-
Total stock purchases	**1,750**	**-**
Gross farm income	**2,022**	**17,038**
Less farm expenses:		
Wages (incl. management)	425	2,800
Fertiliser and lime	250	167
Weed and pest control	0	733
Contracting	48	4,750
Other expenses	737	1,957
Total farm expenses	**1,460**	**10,407**
Water charge (@ 25c/m^3)	-	250
Depreciation	165	1,600
Annual farm surplus	**397**	**4,781**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	3,886
Annual farm surplus (post finance)	**397**	**895**

Farm model assumptions

Mixed livestock and arable farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is comprised of dryland lamb breeding, lamb and bull finishing, dairy cow wintering, and 50 ha of irrigated crops and pasture. Crops grown include spring barley (7 tonne/ha yield, $440/tonne sale price) and peas (7 tonne/ha, $400/tonne), and rape winter feed, on a 12 year rotation. Dryland pasture production is 8 tonne/ha gross, while irrigated pasture is 12.9 tonne/ha gross.

Vineyards are based on a fully irrigated 30 ha farming system. Grape varieties grown include 25 ha of white varietals yielding 10.5 tonne/ha, and 5 ha of Pinot Noir yielding 6 tonne/ha.

Other assumptions include:

- White grape varietals - $1,650/tonne
- Pinot Noir grapes - $2,600/tonne • Weaner bull - $3.90/kg
- Manufacturing beef - $4.25/kg • Store bull beef - $1.90/kg
- Store lamb - $2.70/kg • Lamb - $6.00/kg • Wool - $4.00/kg
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 1000 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	8,177
On farm pumping	159
Vineyard costs	33,367
Plant and equipment	5,667
Working capital	7,075
Other costs (savings)	1,064
Total conversion investment	**55,509**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	55,509
Annual increase in farm surplus	4,384
Annual return on conversion investment	**8%**

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 5a and 9b)

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Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from unlocking dairy farm intensification through irrigation

Dairy Intensification (heavy soils)

Indicative annual farm budget for dairy farms with and without irrigation

	Dairy (heavy soils) ($/ha/year)	Irrigated dairy (heavy soils) ($/ha/year)
Income		
Milk	5,653	9,972
Cattle sales	432	404
Total income	**6,084**	**10,376**
Less stock purchases:		
Cattle	85	107
Total stock purchases	**85**	**107**
Gross farm income	**5,999**	**10,269**
Less farm expenses:		
Wages (incl. management)	1,100	1,340
Fertiliser and lime	448	510
Stockfeed purchased	1,505	2,378
Other expenses	1,270	1,732
Total farm expenses	**4,323***	**5,960****
Water charge (@ 25c/m^3)	-	998
Depreciation	167	287
Annual farm surplus	**1,509**	**3,025**

*$5.05/kgMS **$3.89/kgMS

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	Unirrigated ($/ha/year)	Part-irrigated ($/ha/year)
Less conversion financing costs (Interest @ 7%):	0	933
Annual farm surplus (post finance)	**1,509**	**2,092**

Farm model assumptions

Dairy farming systems are based on a 300 ha farm, modelled using Udder. The farming system comprises dairy milking and cattle breeding on heavy soils with good moisture retention properties.

The unirrigated farm is assumed to have 2.5 cows/ha, and 11.1 tonne/ha gross pasture production (8.9 tonne/ha consumed), producing 855 kg of milk solids/ha.

The fully irrigated dairy farm is assumed to have 3.3 cows/ha, and 17.3 tonne/ha gross pasture production (13.8 tonne/ha consumed), producing 1,530 kg of milk solids/ha.

Commodity price assumptions:

- Milk price - $6.50/kg milk solids • Store bull beef - $1.90/kg Manufacturing beef - $4.25/kg • Store lamb - $2.70/kg

Assumptions specific to the part-irrigated farm model include:

- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 3,990 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	4,249
On farm pumping	148
Associated costs	550
Livestock	1,888
Fonterra shares ($7.00 / share)	4,746
Other costs (savings)	1,743
Total conversion investment	**13,324**

Financial summary for investment in farm intensification

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	13,324
Annual increase in farm surplus	1,515
Annual return on conversion investment	**11%**

Dairy payment ($/Kg MS)	$6.00	$6.50	$7.00	$7.50	$8.00
Annual return on conversion investment	**9%**	**11%**	**14%**	**16%**	**19%**

RUATANIWHA Water Storage

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Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from unlocking dairy farm intensification through irrigation

Dairy Intensification (light soils)

Indicative annual farm budget for dairy farms part-irrigated and fully irrigated

	Part-irrigated dairy (light soils) ($/ha/year)	Irrigated dairy (light soils) ($/ha/year)
Income		
Milk	8,441	10,767
Cattle sales	377	458
Total income	**8,818**	**11,225**
Less stock purchases:		
Cattle	96	84
Total stock purchases	**96**	**84**
Gross farm income	**8,722**	**11,140**
Less farm expenses:		
Wages (incl. management)	1,110	1,330
Fertiliser and lime	470	502
Stockfeed purchased	1,766	2,270
Other expenses	1,601	1,932
Total farm expenses	**4,946***	**6,034****
Water charge (@ 25c/m^3)	-	1,090
Depreciation	257	287
Annual farm surplus	**3,519**	**3,730**

*$3.89/kgMS **$3.70/kgMS

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	Unirrigated ($/ha/year)	Part-irrigated ($/ha/yYear)
Less conversion financing costs (Interest @ 7%):	-	373
Annual farm surplus (post finance)	**3,519**	**3,357**

Farm model assumptions

Dairy farming systems are based on a 300 ha farm, modelled using Udder. The farming system comprises dairy milking and cattle breeding on light soils.

The part-irrigated farm is assumed to have 225 ha of irrigation before intensification. The farm has 3.1 cows/ha, and 15 tonne/ha gross pasture production (12 tonne/ha consumed), producing 1,270 kg of milk solids/ha,

The fully irrigated dairy farm is assumed to have 3.7 cows/ha, and 17.5 tonne/ha gross pasture production (14 tonne/ha consumed), producing 1,630 kg of milk solids/ha. The system also includes winter milking.

Commodity price assumptions:

- Milk Price - $6.50/kg milk solids • Store bull beef - $1.90/kg Manufacturing beef - $4.25/kg • Store lamb - $2.70/kg

Assumptions specific to the part-irrigated farm model include:

- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 4,360 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	1,082
On farm pumping	173
Associated costs	137
Livestock	1,104
Fonterra shares ($7.00 / share)	2,485
Other costs (savings)	348
Total conversion investment	**5,329**

Financial summary for investment in farm intensification

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	5,329
Annual increase in farm surplus	210
Annual return on conversion investment	**4%**

Dairy payment ($/Kg MS)	$6.00	$6.50	$7.00	$7.50	$8.00
Annual return on conversion investment	**1%**	**4%**	**7%**	**11%**	**14%**

RUATANIWHA Water Storage

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of dryland finishing farms to irrigated arable and process vegetable farm system

Dryland Finishing Conversion to Irrigated Arable and Process Vegetables

Indicative annual farm budget for dryland finishing and irrigated arable and process vegetable farms

	Dryland finishing ($/ha/year)	Irrigated arable & process vegetables ($/ha/year)
Income - stock		
Sheep sales	743	2,364
Cattle sales	2,300	-
Wool sales	13	61
Income - produce		
Barley	92	-
Feed wheat	-	846
Squash	-	945
Potatoes	-	1,287
Peas	-	589
Beans	-	929
Maize grain	-	1,013
Italian ryegrass	-	612
Miscellaneous	-	530
Total income	**3,148**	**9,175**
Less stock purchases:		
Sheep	560	1,820
Cattle	1,330	-
Total stock purchases	**1,890**	**1,820**
Gross farm income	**1,258**	**7,355**
Less farm expenses:		
Wages (incl. management)	213	506
Fertiliser and lime	102	707
Animal health	17	43
Seeds and treatment	0	596
Weed and pest control	0	682
Other expenses	353	1,750
Total farm expenses	**686**	**4,284**
Water charge (@ 25c/m^3)	-	786
Depreciation	83	407
Annual farm surplus	**490**	**1,878**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	568
Annual farm surplus (post finance)	**490**	**1,310**

Farm model assumptions

Dryland finishing farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is an unirrigated system comprising of lamb and beef finishing, rape-fed summer and winter. The farms are estimated to have 12 stock units/ha and 8.2 tonne/ha gross pasture production. The system also includes production of 25ha of feed barley (5 tonne/ha yield, $440/tonne sale price).

Irrigated arable and process vegetables farming systems are based on a 300 ha farm, also modelled using FARMAX. The intensive farming system is 90% irrigated, and comprised of 270 ha of crop and process vegetable produce production on a five year rotation cycle, and 30 ha of dry lucerne. Produce grown includes wheat (10 tonne/ha, $470/tonne), squash (15 tonne/ha, $700/tonne), potatoes (65 tonne/ha, $220/tonne), peas (8.5 tonne/ha, $400/tonne), beans (12 tonne/ha, $430/tonne), maize grain (12.5 tonne/ha, $450/tonne), and ryegrass seed (2 tonne/ha, $1,700 tonne). Ryegrass straw and lucerne balage is sold. The system also includes intensive lamb finishing, with irrigated pasture production of 12.9 tonne/ha gross.

Other assumptions include:

- Store lamb - $2.70/kg • Lamb - $6.00/kg • Wool - $4.00/kg
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 3,492 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	4,270
On farm pumping	172
Associated costs	550
Plant and equipment	2,038
Working capital	2,159
Other costs (savings)	(174)
Total conversion investment	**9,014**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	*8,113
Annual increase in farm surplus	1,389
Annual return on conversion investment	**17%**

*Equivalent cost per ha for 300 ha farm with 270 ha of irrigation

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 3a and 5b)

Detailed budgets can found in appendices to Ruataniwha Water Storage Project - Review of Farm Profitability, 24 August 2012, Macfarlane Rural Business. Available at **www.hbrc.govt.nz**

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from unlocking finishing farm intensification through irrigation

Dryland Finishing Intensification

Indicative annual farm budget for dryland and irrigated finishing

	Dryland finishing ($/ha/year)	Irrigated finishing ($/ha/year)
Income - stock		
Sheep sales	743	2,020
Cattle sales	2,300	1,957
Wool sales	13	16
Income - produce		
Barley	92	257
Total income	**3,148**	**4,249**
Less stock purchases:		
Sheep	560	1,422
Cattle	1,330	585
Total stock purchases	**1,890**	**2,007**
Gross farm income	**1,258**	**2,242**
Less farm expenses:		
Wages (incl. management)	213	348
Fertiliser and lime	102	168
Contracting	50	100
Other expenses	321	472
Total farm expenses	**686**	**1,088**
Water charge (@ 25c/m^3)	-	1,008
Depreciation	83	83
Annual farm surplus	**490**	**63**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	Dryland finishing ($/ha/year)	Irrigated finishing ($/ha/year)
Less conversion financing costs (Interest @ 7%)	-	266
Annual farm surplus (post finance)	**490**	**(203)**

Farm model assumptions

Finishing farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system comprises of bull and lamb finishing, along with the production of spring barley.

The dryland finishing system has 12 stock units/ha, 8.2 tonne/ha gross pasture production, and rape-fed summer and winter. The system also includes production of feed barley (5 tonne/ha yield, $440/tonne sale price).

The irrigated finishing system has 18 stock units/ha (less bulls but over twice as many lambs), 13 tonne/ha gross pasture production, supplemented by rape feeding in early winter. Similarly, the system includes production of 25ha feed barley, but increased to 7 tonne/ha yield.

Commodity price assumptions:

- Weaner Bull - $3.90/kg
- Manufacturing beef - $4.25/kg
- Store bull beef - $1.90/kg
- Store lamb - $2.70/kg
- Lamb - $6.00/kg
- Wool - $4.00/kg

Assumptions specific to the irrigated farm model include:

- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 4,031 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	2,847
On farm pumping	109
Associated costs	667
Other costs (savings)	172
Total conversion investment	**3,795**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	3,795
Annual increase in farm surplus	(427)
Annual return on conversion investment	**-11%**

Farm budgets based on information from Macfarlane Rural Business Limited (budget reference 3a and 3b)

Detailed budgets can found in appendices to Ruataniwha Water Storage Project – Review of Farm Profitability, 28 August 2012, Macfarlane Rural Business. Available at **www.hbrc.govt.nz**

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from conversion of dryland finishing farms to irrigated dairy on light soils

Dryland Finishing Conversion to Irrigated Dairy (light soils)

Indicative annual farm budget for dryland finishing and irrigated dairy (light soils) farms

	Dryland finishing ($/ha/year)	Irrigated dairy (light soils) ($/ha/year)
Income - stock		
Sheep sales	743	-
Cattle sales	2,300	458
Wool sales	13	-
Milk	-	10,767
Income - produce		
Barley	92	-
Total income	**3,148**	**11,225**
Less stock purchases:		
Sheep	560	-
Cattle	1,330	84
Total stock purchases	**1,890**	**84**
Gross farm income	**1,258**	**11,140**
Less farm expenses:		
Wages (incl. management)	213	1,330
Fertiliser and lime	102	502
Stockfeed purchased	-	2,270
Other expenses	371	1,932
Total farm expenses	**686**	**6,034***
Water charge (@ 25c/m^3)	-	1,090
Depreciation	83	287
Annual farm surplus	**490**	**3,730**

*$3.70/kgMS

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	($/ha/year)	($/ha/year)
Less conversion financing costs (Interest @ 7%):	0	2,155
Annual farm surplus (post finance)	**490**	**1,575**

Farm model assumptions

Dryland finishing farming systems are based on a 300 ha farm, modelled using FARMAX. The farming system is an unirrigated system comprising of lamb and beef finishing, rape-fed summer and winter. The farms are estimated to have 12 stock units/ha and 8.2 tonne/ha gross pasture production. The system also includes production of 25ha of feed barley (5 tonne/ha yield, $440/tonne sale price).

Irrigated dairy (on light soil) farming systems are based on a fully irrigated 300 ha farm modelled using Udder. The farming system comprises of dairy milking (including winter milking) and cattle breeding. The farms are estimated to have 3.7 cows/ha and produce 17.5 tonne/ha of gross pasture (14 tonne/ha consumed), resulting in annual milk production of 1627 kg milk solids/ha.

Other assumptions include:

- Milk price - $6.50/kg milk solids • Weaner bull - $3.90/kg
- Manufacturing beef - $4.25/kg • Store bull beef - $1.90/kg
- Store lamb - $2.70/kg • Lamb - $6.00/kg • Wool - $4.00/kg
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 4,360 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	4,270
On farm pumping	173
Associated costs	550
Livestock	5,299
Fonterra shares ($7.00 / share)	11,389
Dairy shed	3,667
Plant and equipment	2,034
Other costs (savings)	3,401
Total conversion investment	**30,783**

Financial summary for investment in farm conversion

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	30,783
Annual increase in farm surplus	3,240
Annual return on conversion investment	**11%**

Dairy payment ($/Kg MS)	$6.00	$6.50	$7.00	$7.50	$8.00
Annual return on conversion investment	**8%**	**11%**	**13%**	**16%**	**18%**

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RUATANIWHA WATER STORAGE SCHEME

Farming Financials

Indicative farm financial information for assessing returns in Hawke's Bay from unlocking sheep and beef intensification through irrigation

Sheep and Beef Intensification

Indicative annual farm budget for a sheep and beef farm with and without irrigation

	Unirrigated ($/ha/year)	Part-irrigated ($/ha/year)
Income		
Sheep sales	684	1,452
Cattle sales	650	679
Wool sales	162	167
Total income	**1,496**	**2,298**
Less stock purchases:		
Sheep	12	304
Cattle	399	399
Total stock purchases	**411**	**703**
Gross farm income	**1,085**	**1,595**
Less farm expenses:		
Wages (incl. management)	258	270
Fertiliser and lime	122	152
Animal health	37	37
Other expenses	179	195
Total farm expenses	**596**	**653**
Water charge (@ 25c/m^3)	0	224
Depreciation	56	72
Annual farm surplus	**433**	**646**

Indicative financing costs assuming investment 100% funded through bank loan

Finance costs represent interest payments if the conversion was funded entirely through a bank loan. However, taking out a loan for conversions will depend on individual farmer circumstances and farmers are advised to seek advice from their bank.

	Unirrigated ($/ha/year)	Part-Irrigated ($/ha/year)
Less conversion financing costs (Interest @ 7%):	0	86
Annual farm surplus (post finance)	**433**	**560**

Farm model assumptions

Sheep and beef farming systems are based on a 900 ha farm, modelled using FARMAX. The farming system comprises sheep and beef breeding and finishing (with part-irrigated farm model including extra lamb trading account). The farms are estimated to have 10 stock units/ha and 7.6 tonne of dry matter/ha gross pasture production.

Commodity price assumptions:

- Weaner bull - $3.90/kg • Manufacturing beef - $4.25/kg
- Store bull beef - $1.90/kg • Store lamb - $2.70/kg
- Lamb - $6.00/kg • Wool - $4.00/kg

Assumptions specific to the part-irrigated farm model include:

- 200 ha of land irrigated producing 12.9 tonne of pasture dry matter per ha
- Water price of 25c per m^3 (mid-range estimate)
- Annual irrigation requirement of 4,031 m^3 per ha

Indicative irrigation conversion costs for farm intensification

	($/ha)
Conversion investment	
On farm irrigation	4271
On farm pumping	162
Associated costs	1598
Other costs (savings)	(522)
Total conversion investment	**5509**

Financial summary for investment in farm intensification

The financial summary details annual return on conversion investment, which will be equal to return on equity if the conversion investment is 100% equity funded.

	($/ha)
Conversion investment required	*1,224
Annual increase in farm surplus	213
Annual return on conversion investment	**17%**

*Equivalent cost per ha for 900 ha farm with 200 ha of irrigation

Sheep & beef farm budgets based on information from Macfarlane Rural Business Limited (budget reference 1a and 1b)

Detailed budgets can found in appendices to Ruataniwha Water Storage Project - Review of Farm Profitability, 28 August 2012, Macfarlane Rural Business. Available at **www.hbrc.govt.nz**

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