

# Ruataniwha Water Storage Scheme Review

## Executive summary

The Tukituki River catchment is a large, heavily modified catchment that has been significantly transformed since European settlement for undertaking agriculture, predominantly for sheep and beef production. The River carries rainfall from the headwaters in the Ruahine Ranges, through extensive pastoral landscapes in Central Hawke's Bay, which are commonly dry and drought-prone in summer months, out to the sea near Havelock North, Haumoana and Clive, covering a distance of over 100 km. The middle and lower reaches of the River are particularly valued by the community for recreation and amenity. Owing to the scale (2500 km<sup>2</sup>) and geomorphology of the catchment, predominance of pastoral livestock farming, and the low rainfall and river flows typical in summer months, the Tukituki River presents major challenges to the Hawke's Bay community in achieving substantial improvements to river water quality.

In 2012 the Hawke's Bay Regional Council embarked on new policy development for the catchment aimed at addressing the low summer flows associated levels of algae and slime, or periphyton, via a plan change to the Regional Resource Management Plan, known as Plan Change 6 (PC6). The policy sought to modify the rules governing water allocation to address over-allocation of surface and groundwater, and to regulate land use in order to reduce the phosphorus losses from land to water that stimulate periphyton growth. This policy culminated in a combined strategy to also advance water storage in the catchment to assist with meeting the flow, water security and water quality objectives of the catchment through what has come to be known as the Ruataniwha Water Storage Scheme (RWSS).

The RWSS is a nationally significant proposal involving long-term public and private investment in large-scale infrastructure, with complex hydrology and engineering, and involving land use and water quality implications that will require careful ongoing management. The RWSS is an unprecedented intervention for any regional council in New Zealand. In seeking to generate better environmental outcomes with economic and social benefits via commercial water storage, the Hawke's Bay Regional Council (HBRC) has taken the role of an environmental regulator into the higher risk realm of using its financial balance sheet to more actively enable change.

The proposal to capture the higher winter rainfall from the headwaters of the Makaroro River and use this to reduce pressure on groundwater resources and increase the availability of water for irrigation in dry summers is transformational. To do this all within a commercial framework that enables the concept to be self-financing over time, and turn a profit, is bold. As it is both transformational and bold the RWSS therefore also involves both opportunities and risks.

Over the last 7 years an enormous amount of analytical work has been undertaken to plan and evaluate the many aspects of the scheme. The proposal was scrutinised by a central government-appointed Board of Inquiry, which considered over 26,000 pages of evidence, and has been further evaluated by numerous advisors for the HBRC's development entity, Hawke's Bay Regional Investment Company Ltd (HBRIC Ltd), and other RWSS investors, and then subsequently by the team conducting this Review.

Overall, it can be concluded that the risks associated with the scheme have been extensively assessed and the Council can have confidence that these risks have been identified and, where possible, quantified. How satisfactorily these risks have been mitigated by the proposed financial, engineering and environmental management arrangements for the RWSS, and how reasonable it is for various risks to remain, is a matter of judgement for the Council in determining whether or not to continue with developing the scheme.

Some risks are inherently more manageable than others. In general, this Review concludes that where 'de-risking' can be undertaken, it has been. However, despite this de-risking there are aspects of the scheme proposal that cannot be known definitively in advance. These are the areas of uncertainty and are the areas of principal risk involved in the RWSS proposal.

Of the five major themes of this Review – legal, financial, economic, environmental and engineering – two of these present relatively low levels of uncertainty and therefore low risk to the Council's interests.

The first of these is in the legal area where the Review has confirmed the Council's right to withdraw from pursuing the RWSS as long as due process is followed and the community is consulted in a meaningful way. In the event the Council follows this path then the Review has confirmed that the risks of liabilities to the Council, beyond writing down the \$19.5 million value of the investment to date, are relatively low. The Crown may seek repayment of its approximately \$7m co-investment to date but there is no contractual obligation on the Council to do so.

Conversely, should the Council wish to continue with the development of the scheme the necessary legal framework and principal resource consents are in place for the scheme to proceed. While further resource and building consents, and consent modifications will be required before construction can commence these are judged to not represent substantive risks to the scheme's ability to proceed.

The second area of relatively low uncertainty is in the engineering theme. Gravel management, seismic risk to the dam structure, future costs of decommissioning and catchment hydrology were all reviewed in the course of this exercise. Based on the advice contained in this report and attached appendices these are not considered to present material uncertainty to the Council as an investor.

Alternative dam sites and on-farm storage have also been considered at a high level and while these could spread risk away from a single site project and such a large capital commitment, and could avoid the controversial Department of Conservation land, these alternatives are considerably more expensive on volumetric basis. These alternatives also pose new issues with respect to obtaining water, mitigating the effects of land use and the loss of productive land. The engineering section overall suggests that the RWSS is the most cost effective and efficient method of storing water for Central Hawke's Bay irrigation at scale.

An area that presents a higher level of uncertainty is the RWSS' economics, principally due to the uncertainties about future land use under the scheme. This Review has confirmed that RWSS water is affordable at farm level across a range of possible land uses. Affordability and profitability on-farm are forecast to improve further in time, with productivity growth arising from improved management skills, technology and genetics.

What is less clear is how much land will migrate to what types of use over time in response to the availability of reliable water supply. Different land use profiles have differing economic impacts for the region, including on downstream processing and the number of new jobs created. Agricultural exporters canvassed during the Review were generally positive about the benefits of the RWSS, including for vegetable and arable farming, but also highlighted that despite apples and grapes currently being grown in the RWSS supply zones, new horticulture and viticulture development is likely to be limited in the short to medium term.

Provided the anticipated land profitability is reached, then under all scenarios tested including base case, slower conversion to orchards and vineyards, and smaller final areas in orchards and vineyards, the project generates a net benefit from a financial perspective provided it continues for 70 years. This is the case even if a discount rate as high as 7% is applied.

If the anticipated profitability is not reached (if Earnings Before Interest and Tax, or EBIT, is less than has been predicted), then obviously project financial benefits decline. If the project has a 70 year life, then at a 5%

discount rate all scenarios tested still have a positive Net Present Value, even with a 15% decline in EBIT. However, if the discount rate is increased to 7%, then the highly conservative scenarios, which have slower or zero additional conversion to orchards and vineyards, have a negative NPV.

At full uptake of RWSS water the scheme is forecast to increase annual regional Gross Domestic Product by between \$130 million in a pessimistic scenario and \$380 million in the 'base case', and create between 1130 and 3580 jobs. Increased revenue for the Council-owned Port of Napier in either a low or base case orchard and vineyard conversion scenario is forecast to be between \$2 million and \$2.5 million. More weight should be given to the mid-point of all these ranges given lower levels of horticulture production are anticipated in the short to medium term but more horticultural development is expected in the longer-term.

A key benefit of the RWSS is that it will help manage the impacts of new PC6 'minimum low flow' restrictions for the catchment, without which there will be reduced irrigation security for existing irrigating farmers in 2018, further exacerbated in 2023, when the restrictions on irrigation lifts by 50%. The annual farm earnings (EBIT) impact of this reduced irrigation security, without the RWSS, is estimated to be a reduction of \$900,000 on average and over \$4 million in the driest years.

In assessing the proposed financial arrangements relating to the construction and operation of the RWSS this Review has concluded that these have been thoroughly scrutinised, including by other investing parties, are mostly predictable and (unless they materially change) present relatively low risks to the Council. The detailed design, construction and operation of the scheme are all subject to fixed pricing arrangements.

The 35 year 'take or pay' water contracts with Foundation Water Users provide a solid and secure revenue base for the RWSS. Furthermore, with these Users comprising 61% of irrigable land able to be supplied by the RWSS and owning enough irrigable land to use nearly all of the RWSS water supply, the Council can have confidence that the risk of financial failure by the RWSS is very low.

However, while the RWSS is forecast to 'break even' from Year 1, there remains a degree of uncertainty about the timing and therefore quantum of the financial returns to HBRIC Ltd. Over the scenarios used for financial modelling in this Review, and even in a 'severe downside' case of water sales never exceeding 82% of full uptake, the scheme returns at least a 7.1% return to HBRIC Ltd over the first 35 years. The cash returns are forecast to fall well short of the 6% required by the Council in the first 22 years however, and therefore HBRIC Ltd will be required to undertake substantial borrowing against its equity and future earnings in the scheme, or require greater dividends from the Port of Napier, if it is to pay the 6% required by the Council during the early years of the scheme's operation.

The key financial question the Council needs to resolve is whether it believes the rates of return on the Council's capital, including the risks around the timing and quantum of these returns, are acceptable in light of the Council's broader strategic economic and environmental objectives. The Council also needs to determine whether it requires a higher level of initial uptake to manage the risks to its financial returns, and whether it wishes HBRIC Ltd to borrow against its equity to maintain distributions to the Council.

Achieving the construction of such major infrastructure to address significant environmental and regional economic objectives at not only no additional cost to the ratepayer, but also at a commercial return commensurate with other infrastructure assets, is an ambitious goal. The Council needs to clarify which of its objectives are paramount and which ones it is comfortable can be put at risk.

The area of greatest uncertainty and risk for the Council relates to the environmental management challenges for water quality arising from land use in the Tukituki catchment. A key finding of this Review is that substantial environmental risks and uncertainty exist for the Council in this catchment with or without the RWSS. However, the RWSS was developed as a complementary element of a dual management strategy

with Plan Change 6 and the risk profile for the Council is markedly different depending on whether or not the RWSS proceeds.

The environmental management risks are the most difficult to definitively quantify due to the scale of the catchment and the scheme, the inherent uncertainties, complexities and knowledge gaps with natural and biological systems, and the imperfect planning and policy framework of Plan Change 6. Environmental management is rarely a perfect science and usually requires decisions with imperfect information and judgements about how to treat risk. When faced with uncertainty environmental regulators can often manage risk by adopting 'adaptive management' approaches that allow methods to be tested and modified over time. This presents the Council with a particular challenge when confronting such a binary decision with long-term consequences such as is the case with the RWSS.

Possibly the most readily quantifiable aspect of the Review's environmental considerations is in the area of river flows. In addition to the increased river flows for conveyance of irrigation water to down-stream abstraction points, and expected additional irrigation 'losses' through groundwater to surface water, the RWSS is required to assist with low summer flows as conditions of its consents. These conditions require the scheme to contribute an additional 1.9 million m<sup>3</sup> of water, on average each year, to the low summer flows in the Makaroro, Waipawa and Tukituki rivers. Much more is provided in dry years, and to demonstrate, the 2013 drought year would have required 6.77 million m<sup>3</sup> in flow augmentation. These flows will bring environmental, social and cultural benefits at times of high water stress in the catchment.

In addition the RWSS is required to provide four 'flushing flows' each summer each of 1 million m<sup>3</sup> over 9 hours to remove periphyton. These flows were reviewed as part of this Review, and were concluded to be likely to provide effective flushing in the Makaroro and Waipawa rivers, but there is less certainty about effectiveness in the Tukituki River. The RWSS therefore plans to 'piggyback' on rainfall events to enhance flushing in the Tukituki. The opportunity exists to increase capacity in the dam for rates of flushing by 60% at a cost of up to \$2.95 million.

While the relationship between flows and periphyton can be quite direct, the relationship with nutrients is far more complex. The levels of Dissolved Inorganic Nitrogen (DIN) in the Ruataniwha sub-catchments including from winter-based, intensive stock trading and finishing production systems, already exceed water quality limits in PC6 now. As a result more than 100 farms currently planning to join the RWSS (and come under the RWSS' global consent for all supplied farms) are likely to have to be regulated by resource consent on a property by property basis if the RWSS does not proceed. The Council will need to actively regulate land use on these properties and others in the exceeding sub-catchments, through uncertain mechanisms, while it is working with the wider catchment on improving other priority issues such as sediment, erosion and Dissolved Reactive Phosphorus (DRP).

The Review has highlighted that the 'Land Use Capability' (LUC) nitrogen leaching rates in PC6 actually allow for *increased* nitrogen losses on many farms and do not provide an effective mechanism to control land use to meet the Plan's limits for in-stream DIN. The Board of Inquiry accepted some increase in nitrogen losses occurring at catchment scale but set in-stream DIN limits that work against this notion on the Ruataniwha Plains. This places additional risk and uncertainty on the extent to which increased irrigation enabled by the RWSS can be compatible with achieving the limits in PC6.

The Review has also highlighted the lack of any clear case for the DIN limits being set at their current level relative to the objectives in the Plan, other than being a trigger for more intensive management effort. However, the Plan provides no guidance on what actions should or can be taken once the DIN limits are triggered other than farms must apply for resource consents and meet LUC leaching rates. Furthermore, the Review has highlighted that meeting the DIN limits in all Tukituki sub-catchments by 2030 is highly

improbable and may even be physically impossible. It appears the Board of Inquiry may have misunderstood the requirements of the National Policy Statement on Freshwater Management in setting the DIN limit timetable of achievement by 2030. The discontinuities in Plan Change, as well as emerging national requirements, highlight that elements of the Plan will need to be reviewed in time, with or without the RWSS.

The RWSS proposal includes a mitigation package of environmental enhancement – fencing, planting, pest control – as well as the supplementary summer flows and flushing flows, mentioned above, to remove periphyton. The scheme is required to manage environmental compliance of all its supplied farms through nutrient allocations and Farm Environmental Management Plans, establish research farms and to monitor a wider range of environmental parameters than the Council. Overall, Council staff believe that without the RWSS the Council's implementation of PC6 will be more costly and some of the objectives harder to achieve.

Taken together, the environmental issues canvassed by the Review present a difficult choice for the Council because there are risks and uncertainties whether the RWSS proceeds or not. This choice is essentially to either: 1. principally rely on regulation of land use, based on uncertain science and law (and currently deficient policy), to reduce intensive livestock farming on the Ruataniwha Plains with little or no economic upside; or 2. to complement PC6 regulation, with all of its limitations, by using the Council's investment in the RWSS as a driver of land use change on the Ruataniwha Plains from winter to summer-based production systems, and with less livestock and more arable and horticultural production over time. The full extent to which the Council can use its investment in the RWSS in this way, and how quickly and effectively it can be done, requires significantly more analysis than has been available for this Review but the opportunity is genuinely apparent. Both options will involve years of effort with no guarantee of success.

A third approach, which has been beyond the scope of this review, could be to supplement the regulatory approach required by PC6 without the RWSS and deploy the Council's financial resources in a less commercial model, possibly with little or no financial return, to facilitate land management and land use change without large-scale irrigation development.

Given the ability of the RWSS to manage land use collectively and to require more actions on-farm than the Council under PC6, the RWSS option presents more flexibility with more economic upside. Equally, it is not possible to rule-out land use from RWSS-enabled irrigation exacerbating the current nitrogen management challenge. The theoretical ability to require the RWSS to drive down the nitrogen losses of its supplied farms is already in the Council's hands via PC6 and the RWSS consents. The question will be one of the practicalities of regulating based on as yet unknown legal and scientific tests.

Put simply, the Council has the principal levers to ensure the RWSS operates in a manner consistent with achieving the PC6 water quality targets and the RWSS has the levers to ensure its farmers comply. Quantifying what this will involve on any given farming operation cannot be determined without considerably more analysis and farmer engagement than has been available to this Review.

The Council needs to decide which set of risks it prefers, and which set of levers presents the best prospects of achieving the highly durable *objectives* of Plan Change 6. Both courses are fraught with uncertainty and the Hawke's Bay Regional Council does not have the luxury of 'doing nothing'.

In addition to deciding whether or not to continue with the RWSS, this Review concludes that the Council needs to clarify or re-state its objectives for the catchment, including and particularly timetables for achievement. In time, it will need to ensure the policy and planning framework is fit-for-purpose for achieving the objectives in the desired timeframes.

Given the RWSS's ability to influence land management and land use in the Ruataniwha Basin within the existing PC6 construct, this Review concludes that should the scheme proceed it would be appropriate to continue to work through the DIN-limit implementation issues in PC6 over the next four years during the

construction phase. The development of the Irrigation Operational Management Plan, required by the RWSS consents before water is delivered, is the key opportunity to plan the approach to reducing nitrogen losses under the RWSS.

However, should the RWSS not proceed this Review concludes that it will be necessary to revisit and review Plan Change 6 with some urgency. This will involve significant science and planning resources that will need to be allocated within the upcoming 2018-2028 Long Term Plan.

## Summary of Key Conclusions

### Legal Key Conclusions

The Council is entitled to withdraw from further development of the RWSS.

It will likely be necessary to consult the Hawke's Bay community on a decision to abandon or shelve the RWSS project, either through the 2018-2028 Long Term Plan or through the Special Consultative Procedures of the Local Government Act.

Any decision the Council takes could be subject to legal challenge by any entity or member of the public but the likelihood of successful appeal, or award of compensation, is judged to be low as long as the Council follows due process in decision-making.

HBRIC has no contractual obligations that would create liabilities for the Company in the event it is directed to cease the development of the scheme. The primary cost to HBRIC and the Council would be the write down of the investment to date of approximately \$19.5 million. There is a risk that the Crown will seek the refund of its approximately \$7 million investment to date.

There are expectations in the Central Hawke's Bay community that PC6 and the RWSS are a 'package deal' and the Council will need to address this should the Council decide to abandon the RWSS.

If the Council determines that HBRIC should continue with the development of the RWSS then technically no further resolutions are required. However, it would be beneficial for the Council to formally resolve to continue.

There are substantive merits to the land exchange case and a reasonable prospect that the Supreme Court will uphold the ability of the Minister of Conservation to approve the reclassification of the 22 hectares of land in question. The Council's legal advisors have noted that it would be imprudent to proceed with the RWSS until the land swap matter is resolved.

There are a number of further consents and consent variations that the RWSS will need in finalising the detailed design and operation of the scheme. These are not considered to present material uncertainty to whether the scheme can proceed.

## **Key Financial Conclusions**

The financial model built for the RWSS can be considered to be fit-for-purpose based on the assumptions made through expert input. The Council can take comfort that these processes have been thorough, and the financial risks have been identified and where appropriate mitigated.

Either conservative assumptions, or conservative modelling scenarios (where ranges of outcomes have been forecast), are used throughout the financial analysis of this Review.

The drivers for investment in the RWSS differ for different investing parties, which is reflected in their differing investment horizons and required returns.

The construction phase and the possibility of cost overruns do not represent significant risks to the Council. The greatest risk of this phase is with constructor's financial strength to undertake the project, which is being appropriately managed.

The generally predictable nature of the operating assets mean there is a low risk of operating costs varying significantly and having a material impact on HBRC's returns.

Forecast water uptake is a critical driver of scheme revenue and is the key risk variable around the economic viability of the scheme and the performance of the Council's investment capital.

Based on the contracted level of initial uptake the scheme will 'break even', or meet sufficient revenue to meet its operating costs, including servicing bank debt, in the first year.

The financial risk of low uptake is principally borne by HBRIC, and in turn HBRC, in the form of returns potentially being at the lower end of the range modelled. However, this risk apportionment may arguably be offset, at least in part, by the ownership of the RWSS and associated revenues substantially reverting to the Council and the Hawke's Bay's community from Year 70 as well as the broader regional economic and environmental benefits on which the Council's investment has been predicated.

The forecast cash return on investment for the first 35 years to HBRIC ranges from 7.3% (Extreme Downside) to 10.8% (Base Case.) The Internal Rate of Return (IRR) for the life of the project in all demand scenarios is estimated to be within a range of 5.8% (Extreme Downside) to 7.1% (Base Case). Mr John Palaret considers that the "the return to HBRC as an investor is an acceptable infrastructure return at all levels."

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## **Key Financial Conclusions (continued)**

The Council should anticipate substantial borrowing by HBRIC if it is to deliver the 6% annual cash return on the RWSS investment currently required. This borrowing is forecast to represent between 6% and 13% of HBRIC's assets, which Mr Palairet considers is "not at an unacceptable level of gearing" but "will impose a constraint on HBRIC Ltd. on investment in other capital projects."

At present it is assumed that the RWSS operator will be required to repay their bank debt in full by year 30 at the expiry of resource consents, which provides some upside potential for the Council as this may not be eventually be required and thereby enhancing returns. The future value of water and ability for the RWSS to generate higher than forecast revenues also represents upside potential.

Forecasting uptake involves inherent uncertainties, however the 186 contracted Foundation Water Users represent a significant proportion (61%) of the ownership of the irrigable land in RWSS command area and yet on average these contracted farmers have committed to purchasing sufficient water to irrigate only a minority of their irrigable land at this point. This is expected and gives confidence in significantly greater uptake by farmers already committed to the scheme.

Lewis Tucker consider the achievement by HBRIC in securing 40% contracted water materially reduces the uptake risk for investors. In the view of both Mr Palairet and Lewis Tucker Ltd the forecast uptake scenarios used in the financial modelling can be considered conservative.

The Council had previously set a Condition Precedent uptake for financial close of 40 million m<sup>3</sup>. The RWSS' commercial bankers have set 45 million m<sup>3</sup> as a minimum requirement for their lending. Mr Palairet has recommended a revised Condition Precedent of 48 million m<sup>3</sup> pre-financial close.

The Council needs to determine whether, based on changes to the proposed scheme and the analysis contained in this Review, including the costs and benefits and risks and opportunities, a different Condition Precedent uptake figure is warranted before the Council commits its capital to the scheme.

The Council needs to determine whether it considers the role of its capital within the overall capital structure appropriately reflects its interests in the scheme, including the strategic regional economic and environmental objectives on which the Council's development of the scheme has been based.

It is important that the Council clearly identifies its objectives for the RWSS and can therefore determine under what circumstance these will be achieved and when they will not.

## Key Economic Conclusions

Lewis Tucker conclude “that RWSS water is affordable from the outset but becomes more affordable in the outer years due to the impact of on-farm productivity gains.” They further consider that affordability is not the primary impediment to uptake, but instead management skill and understanding, as well as access to expertise, will be the limiting factor.

Discounted cash flow modelling by Lewis Tucker suggest RWSS water is affordable for sheep and beef, arable, dairy and pipfruit production.

Determining the likely future land uses under the RWSS involves inherently high levels of uncertainty, and drivers external to the economics of the scheme. However, the overwhelming majority of agribusiness leaders interviewed believe that modelled land uses represent realistic profitable land use options.

Agribusiness leaders interviewed place equal (if not greater) value on the reliability of production compared with increased productivity arising from irrigation.

There is strong interest from processors in expanded irrigated vegetable production and for high value small seed production in the region.

Meat processors also see benefits for more consistent and stable supply of livestock from irrigated pasture, although recognise that expanded irrigation will generate more competition for land use away from livestock production.

Existing large-scale horticulture operators expressed strong reservations about the likelihood of significant pipfruit or viticulture development on the Ruataniwha Plains in the short to medium term.

Land use change to greater horticulture and viticulture can be considered to be likely in the medium to long term, given the lower cost of land combined with the adaptive land management practices.

Significant expansion of horticultural production is expected to be less likely in the short-term, and in the medium-term may be at the lower end of production scenarios, and therefore weight should be given to the lower production scenario when evaluating economic impacts.

Under all scenarios tested including the base case, slower conversion to orchards and vineyards, and smaller final areas in orchards and vineyards, the RWSS project is predicted to generate a net benefit from a financial perspective provided it continues for 70 years and is assessed using a 5% discount rate.

Butcher Partners forecast the RWSS at full uptake will increase Regional Gross Domestic Product by \$130m - \$380m and create between 1,130 and 3,580 jobs. The bottom of these ranges are based on the exceptionally conservative assumption that the RWSS results in no increase in orchards or vineyards and instead this land is used arable farming.

The Community Reference Group has highlighted that the analysis undertaken in this section has not quantified the impacts on the community more broadly in terms of wider business confidence and opportunities, and social and cultural outcomes.

The financial and economic analysis collectively suggests that the on-farm production benefits, particularly in terms of flexibility and predictability, are sufficient to offset financial and economic risks, especially when considered over the longer-term.

## Environment key conclusions

Plan Change 6 and the RWSS were developed as a dual strategy for managing low summer river flows and associated levels of periphyton, with stored water from the RWSS intended to replace ground and surface water, provide low flow augmentation and flushing flows, and to complement nutrient management aspects of PC6.

If the RWSS does not proceed irrigation security for existing irrigators impacted by PC6 increases in minimum flows will reduce on-farm cash surpluses by an estimated 35% and earnings by \$900,000 on average, although in the very driest years farm earnings are estimated to reduce to be \$4.7 million.

If the RWSS does not proceed there are farm systems modelling approaches to sheep, beef and dairy production without irrigation and using fodder crops that can reduce nitrogen and phosphorus losses while still optimizing financial returns from available inputs.

If the RWSS is not to proceed it will be necessary for the Council to reconsider the implementation plan for PC6, including the level and nature of resources committed, which should be expected to increase.

Construction of the RWSS will have detrimental impacts on biodiversity, which were reviewed by the Board of Inquiry. The Board determined that an appropriate mitigation and offset package was included in the RWSS consents that would achieve no net reduction in biodiversity.

Under Plan Change 6 water quality limits there is “no headroom” for further deterioration in periphyton levels and Macro Invertebrate Community Index scores and improvements of both are primary imperatives of PC6 for water quality.

The flushing flows to move periphyton can be expected to be effective in the Makaroro and Waipawa Rivers but there is uncertainty of their efficacy in the Tukituki River.

There is no scope to increase Dissolved Reactive Phosphorus (DRP) losses in the catchment and in many sub-catchments substantial reductions are required, which is the largest PC6 management challenge for the Council.

The RWSS is required to either reduce or not increase phosphorus losses and the RWSS consent provides more prescriptive and intensive management of phosphorus than permitted activity rules for the wider catchment.

The PC6 Dissolved Inorganic Nitrogen (DIN) limit of 0.8 mg/L is currently exceeded by between 130% and the 420% at 6 monitoring sites, all within the Ruataniwha Plains area.

Achieving the DIN limit in all Tukituki sub-catchments, particularly those in the Ruataniwha Plains area, will require land use restrictions – probably severe in some areas - and likely land use change.

The RWSS is required to operate and manage nitrogen loss from RWSS farms “in a manner consistent with” achieving the PC6 DIN limits and targets by 2030 but its consents don’t require absolute compliance with the DIN limit.

The Land Use Capability leaching rates mechanism in PC6 to control nitrogen gives considerable headroom (30-50%) for further nitrogen losses across the catchment and is not considered an effective means to manage nitrogen where the levels need to be significantly reduced.

PC6 gives no particular mechanisms to the Council with which to manage land use in the event of DIN limits being exceeded in a tributary catchment beyond requiring LUC leaching rates be met.

Expert scientific advice concludes that the 0.8 mg/L DIN concentration is not a defensible threshold between healthy and unhealthy ecosystems but represents a point on a risk continuum.

The 0.8 DIN Limit should be seen as a management trigger in the context of the whole resource management effort and not an objective in its own right, nor seen as an appropriate long-term management target around which all else must be ordered. The objectives of the Plan, including better periphyton and MCI outcomes, should be the long-term outcome focus.

Achieving the 0.8 mg/l DIN limit by 2030 in all sub-catchments with or without the RWSS is considered by Council staff to be highly improbable and likely to be physically impossible.

The Board of Inquiry may have mistakenly interpreted the NPSFM as requiring PC6 objectives to be met by 2030, not that limits must be in place by 2030 with achievement able to be set on a more achievable timeline.

A better way to approach the PC6 DIN limits might be to require both the RWSS farmers and non-RWSS farmers, by the year 2030, to be achieving sustained reductions in nitrogen losses and be operating in a manner consistent with achieving the 0.8 DIN *over time*.

Should the RWSS proceed the operators should work on the basis that RWSS-supplied farms will be at risk of being deemed material contributors to DIN limit exceedances in time and develop the Irrigation Environmental Management Plan with an objective of operating in a manner consistent with achieving the DIN limits in time.

Managed well and held to account, the RWSS can be considered to be an enabling part of the approach to achieving PC6's objectives.

In addition to deciding whether or not to continue with the RWSS, the Council should also clarify its objectives for the catchment, including and particularly timetables for achievement. In time, it will need to ensure the policy and planning framework is fit for purpose for achieving the objectives in the desired timeframes.

Given that the principal catchment nitrogen management challenge lies within the Ruataniwha Basin, and in light of the RWSS's ability to influence land management and land use in the Basin, it would be appropriate to continue to work through the DIN-limit implementation issues in PC6 over the next four years. Once the Irrigation Operational Management Plan has been developed, an assessment can then be made of what residual planning issues need reconsideration in order to achieve the Plan's objectives.

However, should the RWSS not proceed this Review concludes that it will be necessary to revisit and review PC6 with some urgency. This will involve significant science and planning resources that will need to be allocated within the upcoming 2018-2028 Long Term Plan.

## **Engineering Key Conclusions**

Reducing the height or relocating the dam to avoid inundating the DoC land can be expected to have sufficiently negative impacts on the costs and capacity of the dam to make it uneconomic to construct.

Achieving equivalent water storage in medium sized dams would cost around \$100m more than the RWSS.

On farm storage is estimated to cost around \$5 per m<sup>3</sup> (including land costs) in contrast to \$1.45 per m<sup>3</sup> for the RWSS, would require on-farm pressurisation and be more challenging to collect comparable water inflows. For RWSS equivalent storage volume on-farm storage would inundate 1800 hectares of higher productivity land in contrast to the RWSS using 400 hectares of low productivity land.

Gravel is expected to accumulate at a manageable rate in upper parts of the reservoir and be economically extractible for the life of the RWSS, posing no safety risk or materially adverse impact on scheme reliability.

Detailed dam structure design will be for Maximum Design Earthquake based on GNS assessments. The current design is capable of accommodating a 0.5 m vertical displacement without failure.

Decommissioning costs for the dam are estimated to be in the order of \$26-30m. Given the long expected life of the dam, including the fact that the asset would transfer to HBRC ownership in 70 years along with sizeable annual revenues, it appears reasonable that no provision for funding decommissioning has been made at this time and can be addressed in the future.

Recent river flow monitoring of the Makaroro has increased confidence of catchment water balance estimates and gives a mean annual inflow volume of 184 million m<sup>3</sup>, about 4% lower than the estimate from the Feasibility Study. However, this reduction is not predicted to translate to a similar reduction in flow yield and its profile gives a slight improvement in the drought performance of the scheme.